3-EI.1 GENERAL

The Moving Ahead for Progress in the 21st Century Act (MAP-21) required each state and appropriate Federal agencies to report bridge element level data to the US Department of Transportation Secretary. The Federal Highway Administration (FHWA) will use the data to review condition of bridges on the National Highway System (NHS) for evaluation of state transportation agency results as part of MAP-21 required National Highway Performance Program.

More importantly, gathering Element Inspection (EI) data provides Bridge Owners with a more detailed picture of the health of their bridges than the broad Nattional Bridge Inventory (NBI) Condition ratings (superstructure, substructure, deck and culvert) that have been collected for all bridges, both on and off the NHS since the National Bridge Inspection Standards (NBIS) were established in the 1970s. Condition ratings and other functional and geometric data for bridges allowed FHWA to use the Sufficiency Rating for funding prioritization.

The overall condition ratings have not allowed Owners to identify localized problems (i.e. issues with protective systems such as paint, or failure of bridge joints and the resultant damage to major elements), identify repairs, or develop actions needed to preserve their assets.

Detailed data from EI allows Owners to manage their bridge inventory more effectively, allowing them to:

- Quantify and describe element condition observed during inspection and the extent of deterioration.
- Identify candidates for preservation, maintenance, rehabilitation, improvement (i.e. widening, raising, strengthening) and replacement practices/strategies.
- Predict future deterioration of bridge elements for schedule purposes.
- Manage their budgets for bridge preservation.

FHWA is working with state agencies nationwide to help them improve their Bridge Management Systems "to do the right activity, to the right bridge, at the right time and at the right cost."

Bridge EI has been in use by other state transportation agencies since the 1990s. NDOT will begin use of EI beginning in 2014. Local Bridge Owners are encouraged, but not required to use EI to help them manage and preserve their bridges.

3-EI.2 REFERENCES

The information in the NDOT's Bridge Inspection Program Manual supplements requirements, procedures, and information in documents by:

- The American Association of State Highway and Transportation Officials (AASHTO)
- The U.S. Department of Transportation, Federal Highway Administration (FHWA)
- The National Cooperative Highway Research Program (NCHRP)

The References list of documents applicable to bridge inspection is included in the Manual Appendix. The current National Bridge Inspection Standards (NBIS) are also included in the Appendix. FHWA anticipates these will be revised.

Persons involved with the Nebraska Bridge Inspection Program and the bridge inventory must be knowledgeable of the requirements in National Bridge Inspection Standards, the AASHTO *Manual for Bridge Element Inspection*, the AASHTO *Manual for Bridge Evaluation*, and FHWA publications, technical advisories and publications related to the NBIS.

The NBIS takes precedence over any material contained in the reference manuals i.e. AASHTO Manual. Where there may be implied or conflicting language between the documents, the nationwide direction provided by the NBIS will always govern.

3-EI.2.1 Element Inspection

Element Inspection in this Chapter is based on The AASHTO *Manual for Bridge Element Inspection*, First Edition, 2013, and current interims. The condition reporting is based on standard National Bridge Elements (NBEs), standard Bridge Management Elements (BMEs) and Agency Defined Elements (ADEs). AASHTO has also defined standard defects for four condition states (Good, Fair, Poor, Severe). An agency can also define Agency Defined Defects (ADDs) using the four condition states. ADEs may also be sub-elements of NBEs or BMEs.

The following publications are the background and early information on Element Inspection:

- 1985 – NCHRP Project 12-28: Bridge and Pontis Management software
- 1987 – NCHRP Report 300: Element based Bridge Management Systems (BMS)
- 1993 – FHWA CoRe Element Report recommendations
- 1996 – AASHTO CoRe Element Guidelines adopted (2002 & 2010 Interim Revisions)
- 2011 – AASHTO Guide Manual for Bridge Element Inspection, First Edition

3-EI.2.2 NBI and Other Inspection Data

The FHWA National Bridge Inventory includes Item 1 through Item 116. The definitions, descriptions and guidance for use are in a separate chapter of the BIP Manual, Chapter 3-NBI, these items print on a structure's Structural Inventory and Appraisal (SI&A) report.

The 200 series and 300 series NE custom data fields used by NDOT are not submitted to the FHWA. The NE items do not print on a structure's Structural Inventory and Appraisal (SI&A) report.

These were developed by the NDOT Bridge Division and are used for bridge maintenance and bridge management purposes. The assignment of a particular rating or code to any item will only indicate that action is required or desired, but will not imply that action will be taken or is pending.

The following list is a summary of NE items related to hydraulic waterway evaluation for bridges that still need to be recorded with element inspection.

NE Item No.	Description	EI Inspection
344	Abutment Walls Undermined	Defect Flag (6000)
344A	Approach Settles/Washes Out	Deleted
345	Crossing a Canal	See Ch 3-NE
346	Stream Bed Degradation	See Ch 3-NE
347	Noticeable Contraction of Stream	See Ch 3-NE
348	Local Scour at Piers/Abutments	Defect Flag (6000)
349	Banks Eroding/Unstable	Deleted – covered by Item 61
350	Stream Shifted from Center	See Ch 3-NE
351	Floodwater Reaches Low Superstructure	Deleted – covered by Item 71
351A	Low Road Elevation Above Low Superstructure	Deleted - covered by Item 71
352	Floodwater Over Bridge Deck or Roadway	Deleted – covered by Item 71
353	Potential Debris Upstream	See Ch 3-NE
354	Bents/Piers in Channel	See Ch 3-NE
355	Alignment with Flow	See Ch 3-NE
356	Debris Blocking Channel at Bridge	NDOT BME 9552
357	Drop from Upstream Deck to Flowline	See Ch 3-NE
357A	Drop from Upstream Deck to Ground at Abutment 1	See Ch 3-NE
357B	Drop from Upstream Deck to Ground at Abutment 2	See Ch 3-NE
358	Is there a Scour Problem	Defect Flag (6000)
358A	Significant Flood in Last Two Years	Deleted
358B	Scour Increased in Last Two Years	Defect Flag (6000)
358C	Scour Plan of Action Effective Date	See Ch 3-NE

The following list is a summary of NE items related to culverts that still need to be recorded with element inspection.

NE Item No.	Description	EI Inspection
323	Culvert Barrel	Deleted – covered by Item 62
324	Culvert Ends	EI Element Wingwall & Headwall
325	Debris at Inlet	NDOT BME 9552
326	Embankment Erosion	See Ch. 3-NE.
327	Alignment with Structure	Deleted – utilize Item 355 for both Bridges & Culverts
328	Flowline Drop at Culvert Inlet	See Ch. 3-NE
329	Flowline Drop at Culvert Outlet	See Ch. 3-NE
330	Culvert Silt in Barrel	NDOT BME - 9553
335	Inspectors Opinion on Culvert Adequacy	Defect Flag (6000)

3-EI.3 ELEMENT INSPECTION BASICS

NDOT uses AASHTOWare BrM Software for recording all bridge inspection data, both element inspections and non-element inspections.

There are approximately 3,600 bridges in Nebraska that are State owned or on the National Highway System (NHS). The majority of NHS bridges are owned by the State.

3-EI.3.1 Structural Span Units – Basics

Structure Units are used to group and organize elements. A bridge may have one or more structure span units, and these may correspond to spans, or groups of spans.

The superstructure material, design, and construction affect reporting of element inspection data. NBI Items 43 A & B report material/design/construction (MDC) for a bridge; Items 44 A & B report the MDC for approach spans, if different from the main span.

Generally, bridges with a single material/design/construction will be reported as a single structural span unit in BrM and recorded with the total quantity of each element on the bridge. For example, a 200-foot, three-span, prestressed concrete continuous beam bridge with four girder lines will have 800 linear feet of the element Prestressed Concrete Girder/Beam, NBE 109.

If an inspector has questions concerning how to determine the structure span unit for major highway bridges with joints or interchange bridges with ramps/gores, they should contact the Bridge Division and review bridge plans for direction.

3-EI.3.2 Elements – Basics

Elements are quantified from the plans prior to the inspection. If plans are not available, field measurements will be the source of the information to develop the elements and their quantities. There are some elements that can only be identified correctly from plans, such as pier pile that are surrounded by concrete for protection.

A typical bridge is composed of a deck, substructure and a superstructure. The substructure is the portion of the bridge that supports the superstructure and distributes all bridge loads to the ground. It includes spread footings, piles, pile caps, pier columns, pier walls, and abutments or beam seats. The superstructure is the portion of the bridge that supports the deck and connects one substructure element to another. It includes bearings, girders, diaphragms and bracing, decks, deck overlays, and railing/parapets. The deck is the surface on which vehicles drive and/or pedestrians walk and transferes the loads to the superstructure.

NBEs are the primary load-carrying components of bridges needed to determine the overall condition and safety of the structure. BMEs are secondary features that owners typically monitor and manage because they can affect the long-term durability of the primary load-carrying elements. These BMEs include protective systems such as paint, deck overlays, and deck joints.

Element quantities are reported in set units of measure (SF, LF, EA). A simple average bridge made of the same MDC may have three to ten elements. A more complex bridge may have up to 20 elements.

The total quantity of the element is reported, as well as the quantity of the element in each of the four condition states.

3-EI.3.3 Environment – Basics

Elements are assigned an environment which indicates the likelihood that the element may deteriorate. AASHTO has defined four environments: Benign, Low, Moderate, and Severe. NDOT has defined a fifth environment: Hidden.

Environment states are for:

1) Capturing environmental conditions that an element must function.
2) The likelihood of failure during service.

3-EI.3.4 Defects and Condition States – Basics

The AASHTO standard defects are included in this Chapter for the convenience of the inspector.

NDOT has also defined defects for state use that are in addition to the standard defects. For each defect, the four condition states are described in detail.

All elements shall have associated defects (unless element determined to be in condition state 1). Defects are unique to the element and element material (i.e. concrete, steel, timber, etc.). It is the inspector's responsibility to determine the appropriate defects per unit of measure of the element to be listed under the element on the report.

Given that all elements are three diminsional, where multiple condition states exist within a unit of measure only the predominant defect in severity and extent is recorded. Given multiple defects of the same condition state within a unit of measure, the inspector will determine the defect that is controlling the deterioration and shall be the only defect reported for that unit of measure. The other overlapping defects located within the unit of measure shall be captured by the inspector under the element note or appropriate defect notes. The sum of all of the reported quantities in each condition state must equal the total quantity of the element. This will quantify the element's condition state.

Additional element condition language is referenced in Section 3-EI.6 Element Condition Language.

3-EI.4 ELEMENT INSPECTION INPUT INTO BRM

EI data is input by the Program Management (PM) Staff and TLs.

The PM Staff inputs those types that are typically static type items (total quantities for each element).

The TL inputs quantities of each element in the condition state noted during inspection.

TL also must provide notes related to their inspection.

Element Inspection comments are required for any element rated in Condition State (CS)-3 or CS-4. These comments shall be recorded as element level comments on the elements grid of the BrM.

Inspection level notes shall be recorded on the notes summary tab.

When a condition state is deemed to be a CS-4 it is a Critical Finding and NDOT requires that the structure be closed. The intent is that if the Owner wishes to open the bridge, then a bridge engineer will review the structure (typically, an inspector is not a bridge engineer). After the review, the bridge can be opened if the structural review and analysis allows or the engineer's opinion is that the bridge can be opened. A Critical Finding Report must show and document the decisions. See Chapter 4 Bridge Inspection for instructions on notifications and filing this report.

3-EI.5 SPAN UNITS/ENVIRONMENTAL STATES

3-EI.5.1 Span Units

The inventory of elements and conditions will need to be completed, identified and grouped by spans. Currently there are two acceptable methods for grouping bridge elements:

By each physical span of the bridge (i.e. span-by-span) or,

By elements grouped by common design and material superstructure combinations.

Based on the following information, the NDOT decided to group their bridge elements by common design and material superstructure combinations and not by each physical span of the bridge.

For each grouping method, element records were created from the information contained in the NDOT bridge asset management database. After analyzing the results for each grouping method, the following conclusions were derived:

- Regardless of the grouping method selected, the number of records that will be required for describing a bridge increases exponentially as the number of span groups increases.
- The span-by-span data set had a significant increase in the number of base elements by a factor of nearly 4-to-1 over the design and material superstructure combination data sets. Please note that the increased number of elements did not provide enough additional information in order to allow project development and maintenance activities to pinpoint future project needs based on element data alone.
- Notes on defects and/or future project needs would not be reduced by collecting the additional data required by the span-by-span method.
- Regardless of the grouping method utilized, picture and defect locations are still required as part of the inspection and the number of notations would still be the same.
- By utilizing a smaller dataset, data accuracy would be increased.
- By utilizing a smaller dataset, the amount of effort required to perform data management would be reduced.

The span unit code and sequence number will have a specific designation and is based on the following:

- Units and elements will be numbered increasing from the south to the north or from the west to the east (see following examples).
- Elements will be assigned a span unit type based on the span hierarchy that is defined in NBI Items 43 and 44. In addition, an NDOT span type has been defined to account for the paving section that leads to the beginning of the bridge. The span unit hierarchy types are:
  - Main Span – This span is defined in NBI Item 43, is the highest within the hierarchy and will have a span starting sequence number of “1” with a span unit code of “M”.
  - Approach Spans – These spans are defined in NBI Item 44 or as additional spans that were not defined in either NBI Items 43 or 44 and will be assigned the next sequence number after the main span with a span unit code of “A”. Each additional approach span will be assigned the next sequence number but retain the same span unit code of “A”.
  - Paving Spans – These spans are defined as the spans that approach the bridge and are comprised of grade beams, grade beam piles and/or paving slabs. Paving spans will be assigned the next sequence number after the main span and/or approach spans in conjunction with a span unit code of “P”. Each additional paving span will be assigned the next sequence number but retain the same span unit code of “P”.

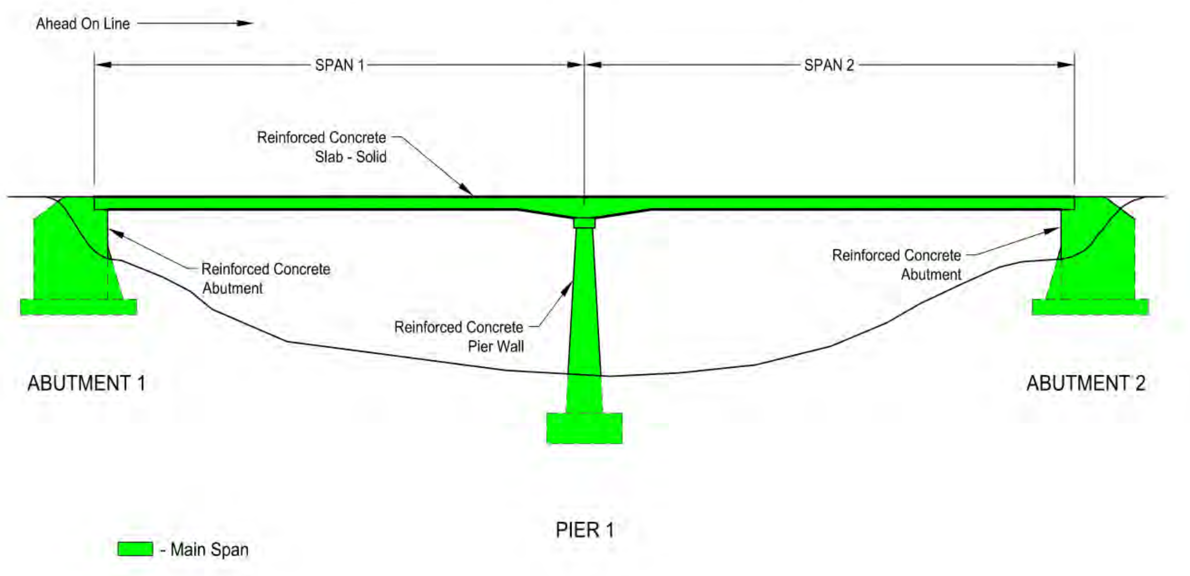
- Elements that share multiple spans with the same span unit type will be assigned to the span that has the lower span sequence (i.e. if two main spans share a pier cap, the pier cap will be assigned to the first main span unit).
- Elements that share multiple spans that have different span unit types will be assigned as follows:
  - Main Span/Approach Span element will be assigned to the Main Span.
  - Approach Span/Paving Span element will be assigned to the Approach Span.
  - Main Span/Paving Span element will be assigned to the Main Span.

Group designations for the various span unit types are as follows:

Code	Description
M	Main Units – This section will contain all of the elements that are part of the major bridge but are not part of the Paving Units or the Approach Units.
A	Approach Units – This section will contain all of the elements that are a part of the designated approach, are a part of the major structure and are leading to the main span.
P	Paving Units – This section will contain all of the elements that are not part of the major structure but are an integral part of the structure: • Paving Slabs • Grade Beams • Grade Beam Piles

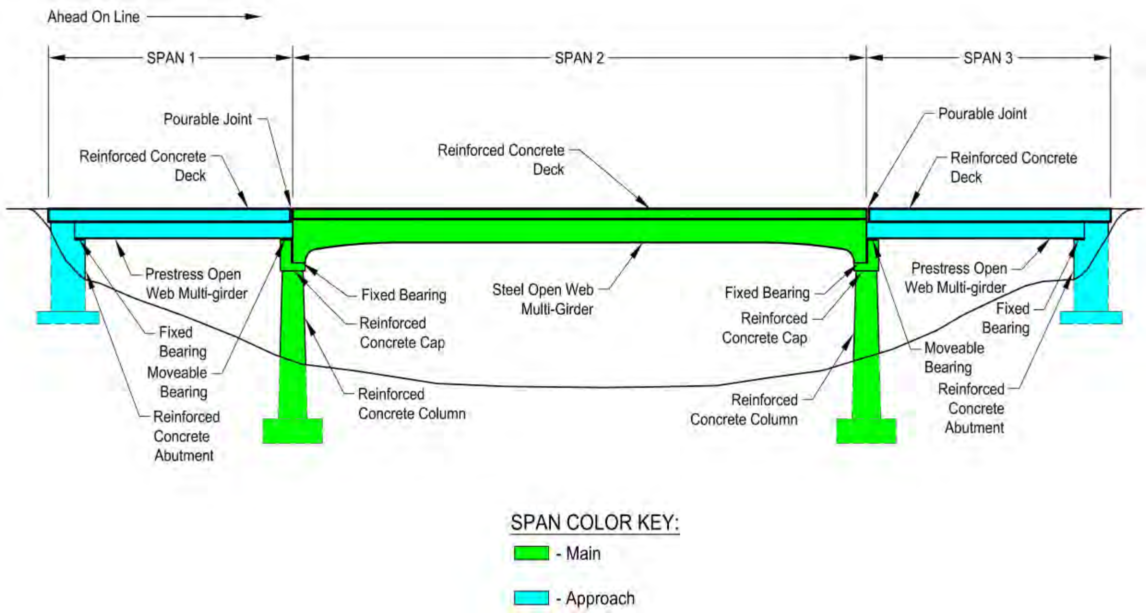
The following are general examples of how elements will be assigned based on bridge configuration:

Two Span Slab



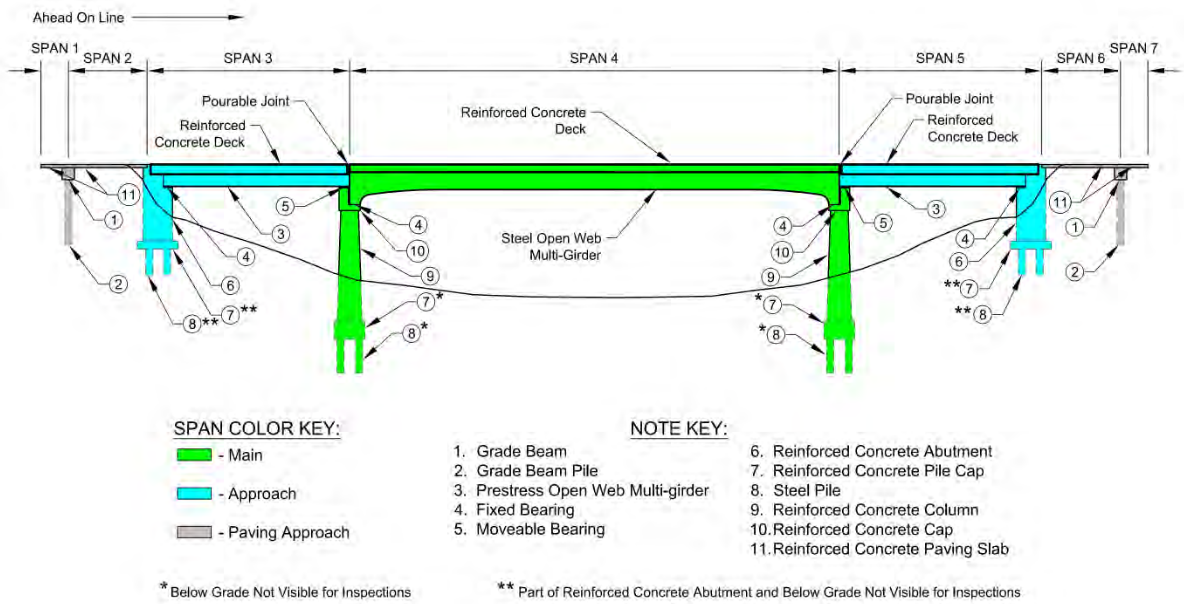
Span Unit Type	Span Unit Number	Element Number
Main	1	38 - R/C Slab - Solid (x2) (Span 1 and Span 2)
Main	1	210 - R/C Pier Wall (Between Span 1 and Span 2)
Main	1	215 - R/C Abutment (x2) (Span 1 and Span 2)

Approach & Main Spans



Span Unit Type	Span Unit Number	Element Number
Main	1	12 - R/C Deck (Span 2)
Main	1	301 - Pourable Joint Seal (x2) (Span 2)
Main	1	107 - Steel Open Girder/Beam (Span 2)
Main	1	9304 - Fix Plate Bearing (x2) (Span 2)
Main	1	205 - R/C Column (x2) (Span 2)
Main	1	234 - R/C Pier Cap (x2) (Span 2)
Approach	2	12 - R/C Deck (x2) (Span 1 and 3)
Approach	2	109 - Prestressed Concrete Open Girder/Beam (x2) (Span 1 and 3)
Approach	2	9304 - Fix Plate Bearing (x2) (Span 1 and 3)
Approach	2	9228 - Roller Bearing (x2) (Span 1 and 3)
Approach	2	215 - R/C Abutment (x2) (Span 1 and 3)

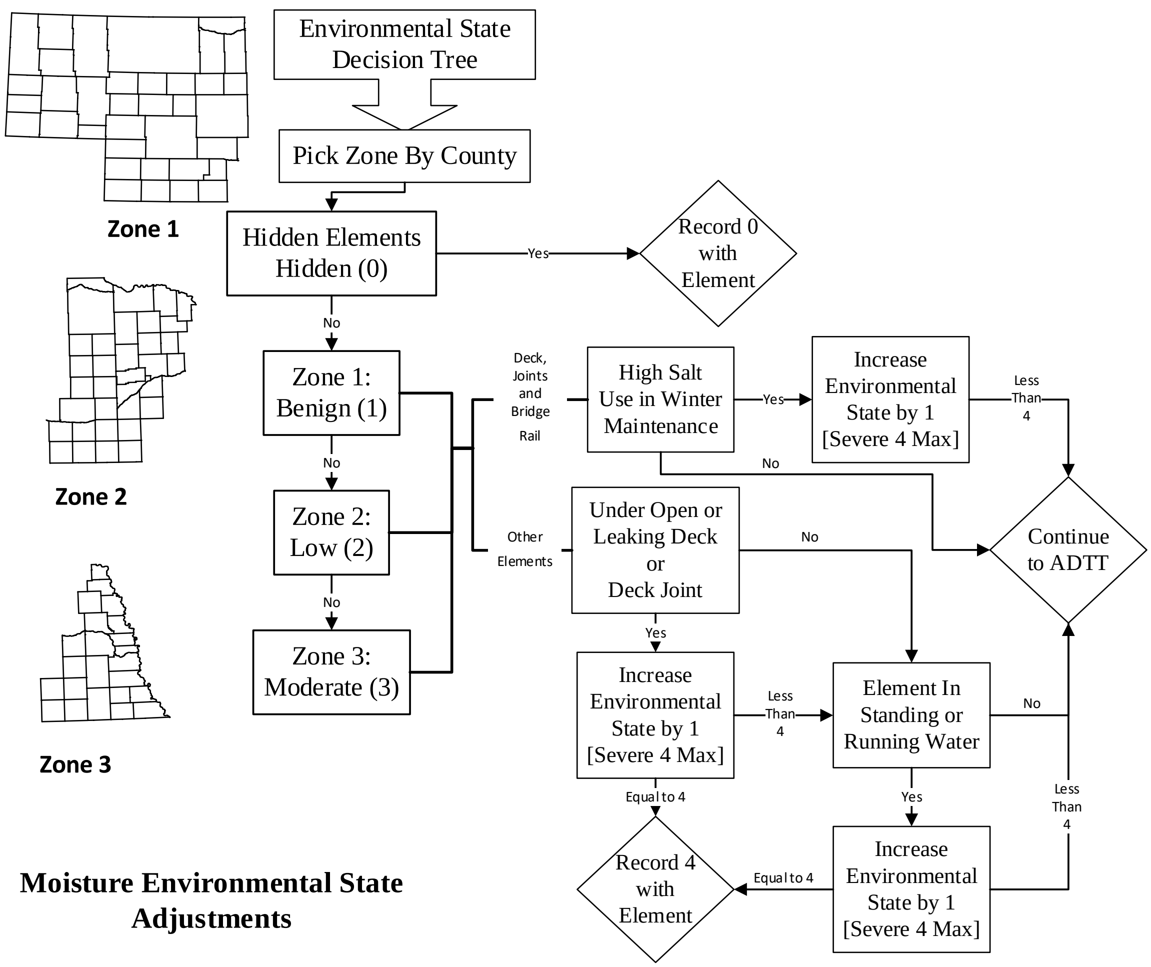
Paving, Approach & Main Spans



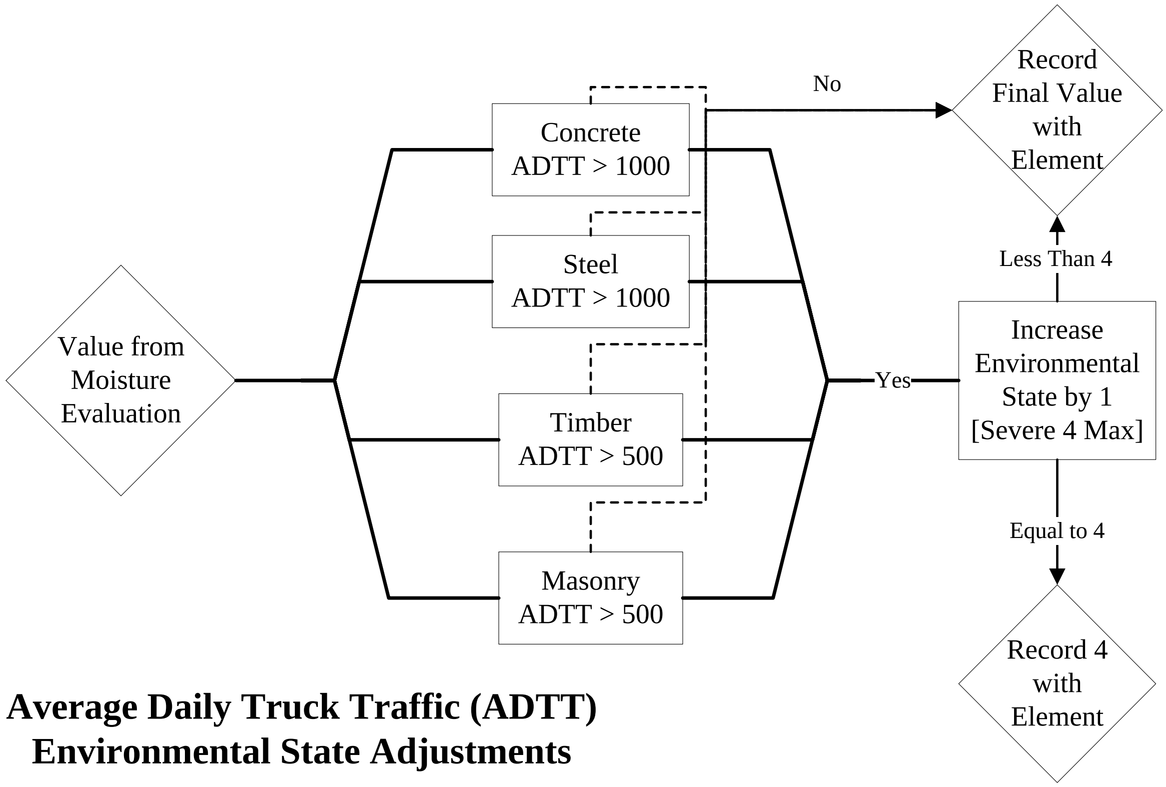
Span Unit Type	Span Unit Number	Element Number
Main	1	12 - R/C Deck (Span 4)
Main	1	301 - Pourable Joint Seal (x2) (Span 4)
Main	1	107 - Steel Open Girder/Beam (Span 4)
Main	1	9304 - Fix Plate Bearing (x2) (Span 4)
Main	1	205 - R/C Column (x2) (Span 4)
Main	1	234 - R/C Pier Cap (x2) (Span 4)
Approach	2	12 - R/C Deck (x2) (Span 3 & 5)
Approach	2	109 - Prestressed Concrete Open Girder/Beam (x2) (Span 3 & 5)
Approach	2	9304 - Fix Plate Bearing (x2) (Span 3 & 5)
Approach	2	9228 - Roller Bearing (x2) (Span 3 & 5)
Approach	2	215 - R/C Abutment (x2) (Span 3 & 5)
Paving	3	321 - R/C Paving Slab (x4) (Span 1, 2, 6 & 7)
Paving	3	9230 - Grade Beam Cap (x2) (Span 1, 2, 6 & 7)
Paving	3	9234 - R/C Grade Beam Pile (x2) (Span 1, 2, 6 & 7)
		**R/C Pile Cap and Steel Pile not included from Span 4 because the elements are not visible for inspection.* ***R/C Pile Cap and Steel Pile not included from Span 3 and 5 because the elements are included in the abutment quantity and the elements are not visible for inspection.* ****Grade Beam Cap and R/C Grade Beam Pile are included in the element list for Span Unit 3 for Bridge Management purposes even though they are not visible for inspection. These elements will be identified as an Environment State "0".*

3-EI.5.2 Environmental States

Environmental states will be utilized for both project development and deterioration modeling. Regardless, if an element possesses one environmental state or if an element possesses multiple environmental states, the element will need to be divided into the appropriate environmental state, quantity and quantity condition states. Based on the “Environmental States Development Flowcharts”, the appropriate environmental state will need to be assessed based on the conditions outlined below:



Moisture Environmental State Adjustments



Average Daily Truck Traffic (ADTT)
Environmental State Adjustments

3-EI.6 ELEMENT CONDITION LANGUAGE

Element numbers above 9000 are defined as NDOT specific elements. Element classification indicates whether the specific element is:

- NBE – AASHTO National Bridge Element.
- NDOT NBE – AASHTO National Bridge Element with NDOT Name and Number (element to be rolled into the parent NBE).
- BME – AASHTO Bridge Management Element.
- NDOT BME – NDOT Bridge Management Element (element to be rolled into the parent AASHTO BME if applicable).

As a direct result of the October 3, 2013 release of the FHWA publication "Specification for the National Bridge Inventory Bridge Elements", specific AASHTO Elements are required to be submitted to FHWA as part of their annual update. NDOT NBE and NDOT BME elements will be denoted under the "Element Classification" category below each appropriate element description throughout Chapter 3 – EI. These elements are Agency Defined Elements (ADEs) unique only to the NDOT Bridge Inspection Program. In addition, NDOT specific NBEs and BMEs that are associated with this FHWA specification will be required to be combined together into the specific AASHTO Elements. Those ADEs that are to be rolled into a parent element will be denoted as such under the "NBE Parent" or "BME Parent" category located under each appropriate element description throughout Chapter 3-EI Element Inspection Coding. Those NBEs and BMEs that are to be submitted to the FHWA include:

- NBE (elements that are designated as NBEs in the AASHTO *Bridge Element Inspection Manual*, First Edition 2013).
- Joints (Elements 300 through 306).
- Wearing Surfaces (Element 510).
- Steel Protective Coatings (Element 515).
- Concrete Protective Coatings (Element 521).

Please note that the remaining NDOT BME elements will not be reported to FHWA but will be used to manage the NDOT bridge inventory.

3-EI.7 DECKS AND SLABS

3-EI.7.1 General

The deck/top flange/slab evaluation is captured using the defined condition states and is three-dimensional in nature with the defects observed on the top surface, the bottom surface, or both. Deck/top flange/slab top or bottom surfaces that are not visible for inspection shall be assessed based on the available visible surface. If both the top and bottom surfaces are not visible, the condition shall be assessed based on destructive testing, nondestructive testing, or indicators in the materials covering the surfaces.

Quantity Calculation:
The quantity for this element includes the area of the deck/top flange/slab from the end of floor to end of floor length by the out to out deck width, including any median areas and accounting for any flares or ramps present.

Unit of Measure: Square Feet

3-EI.7.2 Reinforced Concrete

All elements are constructed of mild reinforced concrete regardless of the wearing surface or protective system used.

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.
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)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of 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.
Abrasion/Wear (PSC/RC) (1190)	No abrasion or wearing.	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.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

12 Reinforced Concrete Deck

Description:
This element defines all bridge decks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

16 Reinforced Concrete Top Flange

Description:
This element defines all bridge girder top flanges where traffic rides directly on the structural element. These bridge types include tee-beams, box girders, and girders that require traffic to ride on the top flange.

Element Classification: NBE

NBE Parent: N/A

Commentary:
This quantity is for the top flange riding surface only. Girder web and bottom flange are to be evaluated by the appropriate girder element.

38 Reinforced Concrete Slab – Solid

Description:
This element defines all bridge slabs that have a solid cross section.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9038 Reinforced Concrete Slab – Voided

Description:
This element defines all bridge slabs that have a voided cross section.

Element Classification: NDOT NBE

NBE Parent: 38 Reinforced Concrete Slab – Solid

Commentary:
None.

3-EI.7.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned concrete regardless of the wearing surface or protective system used.

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.
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)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
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.	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.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

13 Prestressed Concrete Deck

Description:
This element defines all bridge decks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

15 Prestressed Concrete Top Flange

Description:
This element defines all bridge girder top flanges where traffic rides directly on the structural element. These bridge types include bulb-tees, box girders and girders that require traffic to ride on the top flange.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.7.4 Steel

All elements are constructed of steel regardless of the wearing surface or protective system used.

When the steel grid deck has concrete fill in the wheel tracks only, use Element 29 for the concrete filled portion and Element 28 for the unfilled portion of the deck.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td rowspan="2">Corrosion (1000)</td><td>None.</td><td>Freckled rust. Corrosion of the steel has initiated.</td><td>Section loss is evident or pack rust is present but does not warrant structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Cracking (1010)</td><td>None.</td><td>Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.</td><td>Identified crack that is not arrested but does not warrant structural review.</td></tr>
<tr><td rowspan="2">Connection (1020)</td><td>Connection is in place and functioning as intended.</td><td>Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.</td><td>Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>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.</td><td>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.</td><td>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.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

28 Steel Deck with Open Grid

Description:
This element defines all open grid bridge decks with no fill.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

29 Steel Deck with Concrete Filled Grid

Description:
This element defines bridge decks with concrete fill either in all of the openings or within the wheel tracks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

30 Steel Deck Corrugated/Orthotropic/Etc.

Description:
This element defines those bridge decks constructed of corrugated metal filled with Portland cement, asphaltic concrete or other riding surfaces. Orthotropic steel decks are also included.

Element Classification: NBE

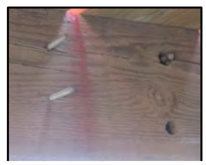
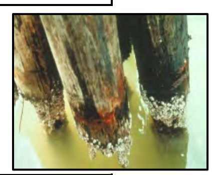
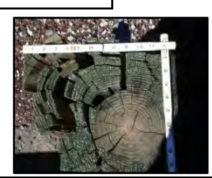
NBE Parent: N/A

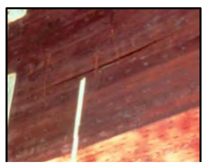
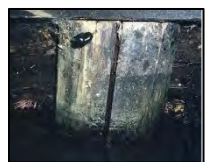
Commentary:
None.

3-EI.7.5 Timber

All elements are constructed of timber regardless of the wearing surface or protective system used. Timber running planks shall be included under the wearing surface assessment.

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, broken welds, fasteners, 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% to 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.	
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
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.	
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

31 Timber Deck

Description:
This element defines all bridge decks.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

54 Timber Slab

Description:
This element defines all bridge slabs.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.7.6 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types and regardless of the wearing surface or protective system used.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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, broken welds, fasteners, 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.	
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

60 Other Deck

Description:
This element defines all bridge decks not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

65 Other Slab

Description:
This element defines all slabs not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.8 RAILINGS

3-EI.8.1 General

Consider only the condition of the bridge, transition, approach and terminal section. The evaluations of the rails that are to crash or design standard shall be coded with NBI Items 36 A through D, Traffic Safety Features.

Record the predominant rail element at the rail location. For example, if the:

- Concrete rail is 2 feet 6 inches tall and the metal rail is 1 foot tall, code only the concrete rail element and record the cumulative rail height in inches in the element's scale attribute (i.e. 3 feet 6 inches).
- Concrete rail is 1 foot tall and the metal rail is 2 feet 6 inches tall, code only the metal rail element and record the cumulative rail height in inches in the element's scale attribute (i.e. 3 feet 6 inches).

Bridge Rail
A bridge commonly has only two rows of rail, one on each side of the traveled way. But in some cases, a bridge may have more than two rows of rail when it has a center median or protected pedestrian/bicycle lanes.

Approach Rail
When the approach rail extends beyond 100 feet from the end of the bridge, consider only the first 100 feet.

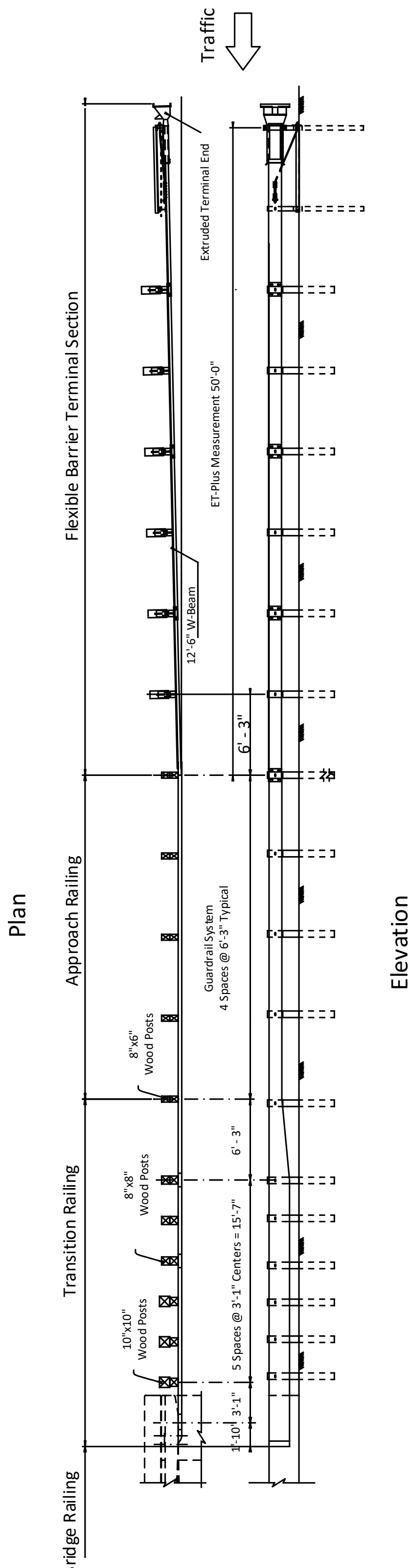
Quantity Calculation:

Bridge Rail
The quantity for this element is the sum of the number of rows of bridge rail times the length of the bridge and only includes the rail on the bridge. (See Sketch)

Approach Rail
The quantity for this element is the length of the rail approaching the bridge within the clear zone that is not a part of the transition rail or the end section attenuators. (See Sketch)

Transition Rail
The quantity for this element is the length of the transition rail between the bridge rail and the approach rail or end section attenuators that is within the clear zone that is not a part of the bridge rail or the end section attenuators. (See Sketch)

Unit of Measure: Feet

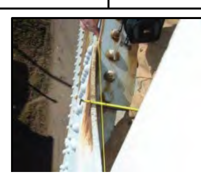


Element	Quantity
9343 Flexible Barrier Terminal Section	50 ft
9333 Metal Approach Railing	25 ft
9338 Metal Transition Railing	25 ft

3-EI.8.2 Metal Rail

All elements pertain to metal rail that is associated with the bridge. Refer to the other bridge rail material elements (concrete, timber, masonry, other) for specific defects for assessing the condition of posts, blocking and curbs that may be constructed of materials other than metal.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td rowspan="2">Corrosion (1000)</td><td>None.</td><td>Freckled rust. Corrosion of the steel has initiated.</td><td>Section loss is evident or pack rust is present but does not warrant structural review.</td><td></td></tr>
<tr><td>*</td><td></td><td></td><td></td></tr>
<tr><td>Cracking (1010)</td><td>None.</td><td>Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.</td><td>Identified crack that is not arrested but does not warrant structural review.</td><td>The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td rowspan="2">Connection (1020)</td><td>Connection is in place and functioning as intended.</td><td>Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.</td><td>Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.</td><td></td></tr>
<tr><td>*</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Distortion (1900)</td><td>None.</td><td>Distortion not requiring mitigation or mitigated distortion.</td><td>Distortion that requires mitigation that has not been addressed but does not warrant structural review.</td><td></td></tr>
<tr><td>*</td><td></td><td></td><td></td></tr>
</table>

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

330 Metal Bridge Railing

Description:
This element defines all types and shapes of metal bridge railing which includes steel, aluminum, metal beam, rolled shapes, etc. Also included in this element are the posts (i.e. metal, timber or concrete), blocking and curb.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9333 Metal Approach Railing

Description:
This element defines all types and shapes of metal approach railing which includes steel, aluminum, metal beam, rolled shapes, etc. Also included in this element are the posts (i.e. metal, timber or concrete), blocking and curb.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9338 Metal Transition Railing

Description:
This element defines all types and shapes of metal transition railing which includes steel, aluminum, metal beam, rolled shapes, etc. Also included in this element are the posts (i.e. metal, timber or concrete), blocking and curb.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9343 Flexible Barrier Terminal Section

Description:
This element defines flexible barrier terminal sections located on the shoulder of a roadway or in the median and its condition evaluation includes the terminal end, posts, guardrail and connection hardware. These types of terminal sections (i.e. ET-2000, ET-Plus, SKT-350 and similar products) absorb energy by coiling the attached guardrail.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
Quantity is the number of rows of end treatment that is connected to the approach or transition rail times the length. Typical lengths are 50 feet or 75 feet depending on the offset from the roadway. End sections that have one foot or less offset have a 75 foot length while offsets of 4 or more feet have a 50 foot length.

Terminal Types	**Standard Lengths**
BCT (Breakaway Cable Terminal)	37’ – 6”
MELT (Modified Eccentric Loader Terminal)	37’ – 6”
SRT (Slotted Rail Terminal) - Rural	37’ – 6”
SRT (Slotted Rail Terminal) - Urban	25’
BEST (Beam Eating Steal Terminal)	50’
ET-2000	50’ or 62’ – 6”
SKT-350 (Sequential Kinking Terminal)	50’

Breakaway Cable Terminal

Modified Eccentric Loader Terminal

Slotted Rail Terminal

Beam Eating Steel Terminal

ET-2000 Family

SKT-350

9344 Crash Cushions Terminal Section

Description:
This element defines terminal sections for blunt ends of rigid barriers and fixed objects located in the median or on the shoulder and utilizes internal self-contained energy absorption systems. Examples include “TRACC”, “CAT-350”, “ADIEM”, and “Universal TAU-II”.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity is the total length of the crash cushion and includes the transition plus the cushion. Typical lengths are 14, 21, 25 and 30 feet.

Commentary:
None.

TRACC Family

CAT-350

ADIEM

Universal TAU-II

3-EI.8.3 Reinforced Concrete Rail

All elements of the railing must be constructed of reinforced concrete regardless of the protective system used.

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.
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)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

331 Reinforced Concrete Bridge Railing – Closed

Description:
This element defines all closed types and shapes of bridge railing.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9331 Reinforced Concrete Bridge Railing – Open

Description:
This element defines all open types and shapes of bridge railing.

Element Classification: NDOT NBE

NBE Parent: 331 Reinforced Concrete Bridge Railing

Commentary:
None.

9334 Reinforced Concrete Approach Railing – Closed

Description:
This element defines all closed types and shapes of approach railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9335 Reinforced Concrete Approach Railing – Open

Description:
This element defines all open types and shapes of approach railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9336 Reinforced Concrete Approach Rail On Wingwall

Description:
This element defines all approach railing that is mounted directly to a wingwall.

Element Classification: NDOT NBE

NBE Parent: N/A

Commentary:
None.

9339 Reinforced Concrete Transition Railing – Closed

Description:
This element defines all closed types and shapes of transition railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9340 Reinforced Concrete Transition Railing – Open

Description:
This element defines all open types and shapes of transition railing.

Element Classification: NDOT BME

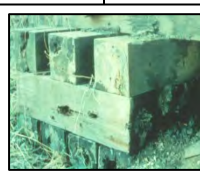
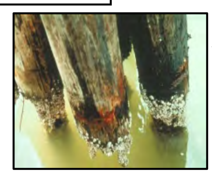
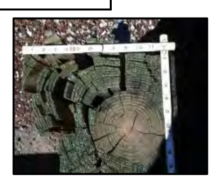
BME Parent: N/A

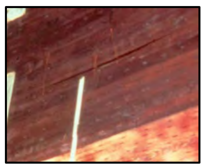
Commentary:
None.

3-EI.8.4 Timber Rail

All elements are for timber rail that is associated with the bridge. Refer to the other bridge rail material elements (concrete, timber, masonry, other) for specific defects for assessing the condition of posts, blocking and curbs that may be constructed of materials other than timber.

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, broken welds, fasteners, 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% to 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.	
	* 			

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td rowspan="2">Crack (Timber) (1160)</td><td>None.</td><td>Crack that has been arrested through effective Measures.</td><td>Identified crack that is not arrested but does not require structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>*</td><td></td><td>
</td></tr>
<tr><td rowspan="2">Split/ Delamination (Timber) (1170)</td><td>None.</td><td>Length less than the member depth or arrested with effective actions taken to mitigate.</td><td>Length equal to or greater than the member depth but does not require structural review.</td></tr>
<tr><td>*</td><td></td><td>
</td></tr>
<tr><td>Abrasion/ Wear (Timber) (1180)</td><td>None or no measurable section loss.</td><td>Section loss less than 10% of the member thickness.</td><td>Section loss 10% or more of the member thickness but does not warrant structural review.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>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.</td><td>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.</td><td>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.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

332 Timber Bridge Railing

Description:
This element defines all bridge railing.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9332 Timber Approach Railing

Description:
This element defines all approach railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9341 Timber Transition Railing

Description:
This element defines all transition railing.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.8.5 Masonry Rail

All elements of the railing must be constructed of masonry block or stone and are for all types and shapes of rail that is associated with the bridge.

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 voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
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.	
	* 			

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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

334 Masonry Bridge Railing

Description:
This element defines all bridge railing.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9345 Masonry Approach Railing

Description:
This element defines all approach railing.

Element Classification: NDOT BME

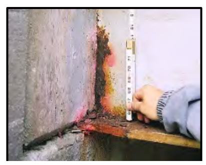
BME Parent: N/A

Commentary:
None.

3-EI.8.6 Other

All elements pertain to types and shapes of railing that are constructed of composite materials, or other materials, that cannot be classified using any other defined rail elements of other material types (i.e. metal, concrete, timber, or masonry).

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	**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, broken welds, or fasteners, 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.	

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)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

333 Other Bridge Railing

Description:
This element defines all bridge railing not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9337 Other Approach Railing

Description:
This element defines all approach railing not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9342 Other Transition Railing

Description:
This element defines all transition railing not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.9 SUPERSTRUCTURE

3-EI.9.1 General

Condition evaluation of girder elements includes the web face along with the top and bottom faces of the flange. In addition, the box girder evaluation is three-dimensional in nature with the observed defects on both the interior and exterior surfaces being used to capture the condition states.

Observed distress pertaining to trusses and arches are located in the panel diagonals and vertical members (including spandrel columns) and are reported as measured length along the panel. These elements do not include the condition of the panel cross frame (Element 9152), floor beams (spandrel caps), and gusset plates (Element 162). But for filled arches, the arch quantity shall be measured from spring line to spring line with the length below the spring line being considered the substructure.

Record the web or panel height in the scale factor for the element.

The length of beams, girders, stringers and floor beams that are under a deck joint or a deck drain that outlets storm water onto these features is at the discretion of the inspector to determine the length that is being influenced by the Environment. These elements should follow the flowchart for Environment.

Quantity Calculation:

Girder/Stringer
Quantity for this element is the number of girders multiplied by the span length.

Box Sections
Quantity for this element is the number of visible web faces divided by two and multiplied by the appropriate length.

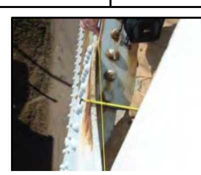
Truss and Arches
Quantity for this element is the sum of all of the lengths of each truss or arch panel measured longitudinally along the travel way.

Unit of Measure: Feet

3-EI.9.2 Steel

All elements are constructed of steel regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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 exists 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, broken welds, fasteners or pack rust with distortion but do 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.	
	*			
Load Capacity (5000)	No reduction.	No reduction.	No reduction.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

102 Steel Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
Does not include girders that are constructed of high performance steel.

9102 High Performance Steel Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders that were constructed with high performance steel or a combination of high performance and non-high performance steel.

Element Classification: NDOT NBE

NBE Parent: 102 Steel Closed Web/Box Girder

Commentary:
Record the strength of the high performance steel in the element description.

107 Steel Open Girder/Beam

Description:
This element defines all open girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
Does not include girders that have cover plates or are constructed of high performance steel.

9101 Steel Open Girder/Beam With Cover Plate

Description:
This element defines all open girders with cover plates.

Element Classification: NDOT NBE

NBE Parent: 107 Steel Open Girder/Beam

Commentary:
None.

9107 High Performance Steel Open Girder/Beam

Description:
This element defines all open girders that were constructed with high performance steel or a combination of high performance and non-high performance steel.

Element Classification: NDOT NBE

NBE Parent: 107 Steel Open Girder/Beam

Commentary:
Record the strength of the high performance steel in the element description.

113 Steel Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

120 Steel Truss

Description:
This element defines all truss elements including all tension and compression members for through and deck trusses.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

141 Steel Arch

Description:
This element defines all steel arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

152 Steel Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9152 Cross Frame

Description:
This element defines all single member (floor beam) or built-up members (truss panel) such as sway frames on trusses, two girder systems that are not floor beams and diaphragms on multi-girder curve steel structures.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
For two girder systems and deck trusses, when the deck and/or the stringers are attached to the cross frame, floor beams should be used.

147 Steel Main Cables

Description:
This element defines all cable stay or main suspension cables not embedded in concrete.

Element Classification: NBE

NBE Parent: N/A

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each main cable measured longitudinally along the travel way.

Commentary:
Use for main cables in suspension bridges or main cable stays in cable stayed bridges. Suspender cables or other smaller cables shall be captured using the secondary cable element.

148 Secondary Steel Cables

Description:
This element defines all suspender cables not embedded in concrete.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the individual cable or cable groups carrying the load from the superstructure to the main cable/arch elements.

Commentary:
Use for suspender cables, other smaller cables or groups of cables in one location acting as a system to carry loads from the superstructure to the main cable/arch. Suspension bridge main cables or cable stays shall be captured using the steel main cable element.

161 Steel Pin and Pin & Hanger Assembly or Both

Description:
This element defines all pins and pin & hanger assemblies.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of pins, pin & hanger assemblies or both.

Commentary:
Distress observed on either the hanger assembly or plate should be considered in the condition assessment.

162 Steel Gusset Plate

Description:
This element defines only those gusset plate(s) connections that are on truss/arch panel(s). These connections can be constructed with one or more plates that may be bolted, riveted or welded.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
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.

Commentary:
Gusset plates that are part of secondary elements such as cross frames are not considered.

For built-up gusset plates, distress observed on any plate should be considered in the condition assessment.

3-EI.9.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Where traffic rides directly on the structural element regardless of the wearing surface, evaluation of the top flange above the fillet is considered with Element 15.

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.
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)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

104 Prestressed Concrete Closed Web/Box Girder

Description:
This element defines all closed web girders or box girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

109 Prestressed Concrete Open Girder/Beam

Description:
This element defines all open web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
Code this element for all open web girders except for Inverted T (9104), NU (9106) and Double T (9109).

9104 Prestressed Concrete Inverted T Girder

Description:
This element defines all open web Inverted T Beams.

Element Classification: NDOT NBE

NBE Parent: 109 Presetrssed Concrete Open Girder/Beam

Commentary:
These elements do not have a top flange.

9106 Prestressed Concrete NU Girder

Description:
This element defines all open web NU Girders.

Element Classification: NDOT NBE

NBE Parent: 109 Presetrssed Concrete Open Girder/Beam

Commentary:
None.

9109 Prestressed Concrete Double T Beam

Description:
This element defines all open web Double T Beams.

Element Classification: NDOT NBE

NBE Parent: 109 Presetrssed Concrete Open Girder/Beam

Commentary:
If traffic rides directly on the top flange or on a non-structural wearing surface over the top flange, this element would be used to assess the girder web only of each Double T Beam. If a structural deck has been placed over the top flange, the girder web and top flange will be assessed as one unit. The girder count is both stems from longitudinal joint to longitudinal joint of each, not the individual stems.

115 Prestressed Concrete Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

143 Prestressed Concrete Arch

Description:
This element defines all prestressed concrete arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

154 Prestressed Concrete Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.9.4 Reinforced Concrete

All elements are constructed of mild steel reinforced concrete regardless of the protective system.

Where traffic rides directly on the structural element regardless of the wearing surface, evaluation of the top flange above the fillet is considered with Element 16.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td>Delamination/ Spall/ Patched Area (1080)</td><td>None.</td><td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched Area that is sound.</td><td>Spall greater than 1 in. deep or greater than6 in. diameter. Patched Area that is unsound or showing distress. Does not warrant structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td>Exposed Rebar (1090)</td><td>None.</td><td>Present without measurable section loss.</td><td>Present with measurable section loss but does not warrant structural review.</td></tr>
<tr><td rowspan="2">Efflorescence /Rust Staining (1120)</td><td>None.</td><td>Surface white without build-up or leaching without rust staining.</td><td>Heavy build-up with rust staining.</td></tr>
<tr><td>* </td><td></td><td></td></tr>
<tr><td>Cracking (RC and Other) (1130)</td><td>Width less than 0.012 in. or spacing greater than 3.0 ft.</td><td>Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.</td><td>Width greater than 0.05 in. or spacing of less than 1 ft.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>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.</td><td>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.</td><td>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.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

105 Reinforced Concrete Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

110 Reinforced Concrete Open Girder/Beam

Description:
This element defines all open web girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

116 Reinforced Concrete Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

144 Reinforced Concrete Arch

Description:
This element defines all reinforced concrete arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

155 Reinforced Concrete Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

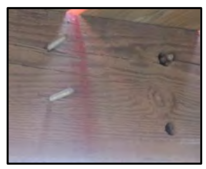
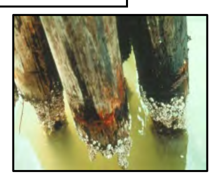
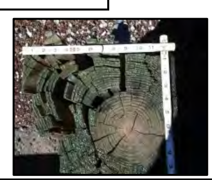
NBE Parent: N/A

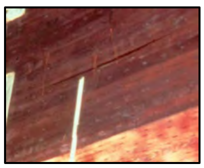
Commentary:
None.

3-EI.9.5 Timber

All elements are constructed of timber regardless of the protective system and condition evaluation includes all of the timber surfaces.

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, broken welds, fasteners, 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% to 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.	
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
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.	
	*			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

111 Timber Open Girder/Beam

Description:
This element defines all open girders.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

117 Timber Stringer

Description:
This element defines all members that support the deck in a stringer floor beam system.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

135 Timber Truss

Description:
This element defines all truss elements including all tension and compression members for through and deck trusses.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

146 Timber Arch

Description:
This element defines all timber arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

156 Timber Floor Beam

Description:
This element defines all floor beams that typically support stringers.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.9.6 Masonry

All elements are constructed of block or stone and may be placed with or without mortar regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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 voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

145 Masonry Arch

Description:
This element defines all masonry arches.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

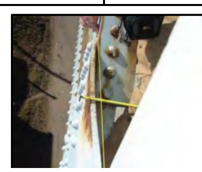
3-EI.9.7 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types regardless of the protective system.

Where traffic rides directly on the structural element regardless of the wearing surface, evaluation of the top flange above the fillet is considered with Element 15 or 16.

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, broken welds, fasteners, 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.	

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)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

106 Other Closed Web/Box Girder

Description:
This element defines all box girders or closed web girders not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

112 Other Open Girder/Beam

Description:
This element defines all open girders not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

118 Other Stringer

Description:
This element defines all stringers not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

136 Other Truss

Description:
This element defines all truss elements including all tension and compression members and through and deck trusses not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

142 Other Arch

Description:
This element defines all arches not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
For filled arches, the arch quantity shall be measured from spring line to spring line. The length below the spring line is considered substructure.

157 Other Floor Beam

Description:
This element defines all floor beams that typically support stringers not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

149 Other Secondary Cable

Description:
This element defines all suspender cables not embedded in concrete not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the individual cable or cable groups carrying the load from the superstructure to the main cable/arch elements.

Commentary:
Use for suspender cables, other smaller cables or groups of cables in one location acting as a system to carry loads from the superstructure to the main cable/arch. Suspension bridge main cables or cable stays shall be captured using the steel main cable element.

3-EI.10 BEARINGS

3-EI.10.1 General

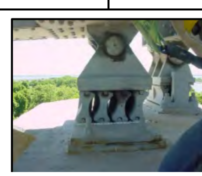
Bearings that cannot be visibly inspected should not be collected.

Quantity Calculation:
Quantity for this element is the sum of each bearing.

Unit of Measure: Each

3-EI.10.2 Elastomeric Bearings

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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, broken welds, fasteners, 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.	
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.	
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

310 Elastomeric Bearing

Description:
This element defines only those bridge bearings that are constructed primarily of elastomers with or without fabric or metal reinforcement.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.10.3 Movable Bearings

All elements define only those bridge bearings which provide for both rotation and longitudinal movement.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 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, broken welds, fasteners, 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.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.	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.	
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

311 Movable Bearing

Description:
This element defines only those bridge bearings that provide movement by other mechanisms that are not covered in Rocker with Pin (9311), Roller (9312), or Sliding Plate (9313) bearings.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9311 Rocker With Pin Bearing

Description:
This element defines only those bridge bearings which provide movement by means of a rocker with pin mechanism.

Element Classification: NDOT NBE

NBE Parent: 311 Moveable Bearing

Commentary:
None.

9312 Roller Bearing

Description:
This element defines only those bridge bearings which provide movement by means of a roller mechanism.

Element Classification: NDOT NBE

NBE Parent: 311 Moveable Bearing

Commentary:
None.

9313 Sliding Plate Bearing

Description:
This element defines only those bridge bearings which provide movement by means of a sliding plate mechanism.

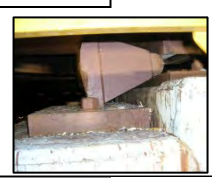
Element Classification: NDOT NBE

NBE Parent: 311 Moveable Bearing

Commentary:
None.

3-EI.10.4 Enclosed/Concealed Bearings

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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, broken welds, fasteners, 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.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

312 Enclosed/Concealed Bearing

Description:
This element defines only those bridge bearings that are enclosed (i.e. not open for detailed inspection).

Element Classification: NBE

NBE Parent: N/A

Commentary:
Should be used for box girder hinges and in cases where the bearing material is not visible. The inspector shall assess the condition based on alignment, grade across the joint, persistence of debris or other indirect indicators of the condition.

3-EI.10.5 Fixed Bearings

All elements define only those bridge bearings which provide for rotation movement only (no longitudinal movement).

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, broken welds, fasteners, 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.	
	* 			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
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.	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.	
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

313 Fixed Bearing

Description:
This element defines only those bridge bearings that are not covered in the Fixed Pinned (9303) or Fixed Plate (9304) bearings.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9303 Fixed Pinned Bearing

Description:
This element defines only those bridge bearings that are pinned.

Element Classification: NDOT NBE

NBE Parent: 313 Fixed Bearings

Commentary:
None.

9304 Fixed Plate Bearing

Description:
This element defines only those bridge bearings that have a plate and bolt connection.

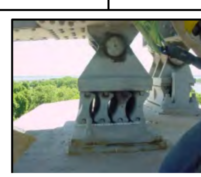
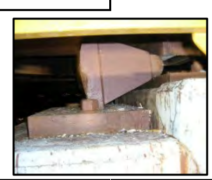
Element Classification: NDOT NBE

NBE Parent: 313 Fixed Bearings

Commentary:
None.

3-EI.10.6 Pot Bearings

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	**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, broken welds, fasteners, 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.	
	*			

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
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.	
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

314 Pot Bearing

Description:
This element defines all high load bearings with confined elastomer. This bearing may be fixed against horizontal movement, guided to allow sliding in one direction or floating to allow sliding in any direction.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.10.7 Disk Bearings

Condition State Definitions:

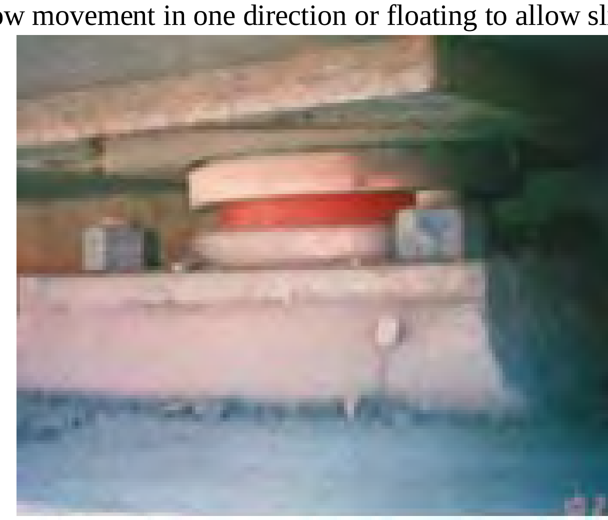
Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Corrosion (1000)	None.	Freckled rust. Corrosion of the steel has initiated.	Section loss is evident or pack rust is present but does not warrant structural review.	The condition warrants a structural review to determine the effect on strength 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, broken welds, fasteners, 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.	
	*			

Defects	Condition States			
	1	**2**	**3**	**4**
	GOOD	**FAIR**	**POOR**	**SEVERE**
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.	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.	
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

315 Disk Bearing

Description:
This element defines all high load bearings with a hard plastic disk. This bearing may be fixed against horizontal movement, guided to allow movement in one direction or floating to allow sliding in any direction.



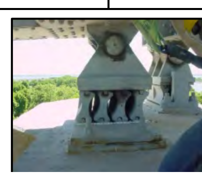
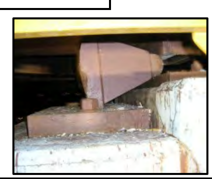
Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.10.8 Other Bearings

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, broken welds, fasteners, 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.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

316 Other Bearing

Description:
This element defines all other material bridge bearings regardless of translation or rotation constraints.

Element Classification: NBE

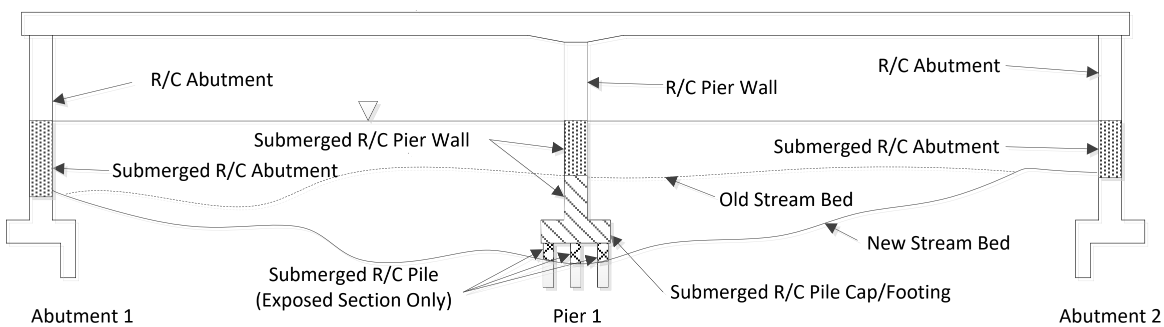
NBE Parent: N/A

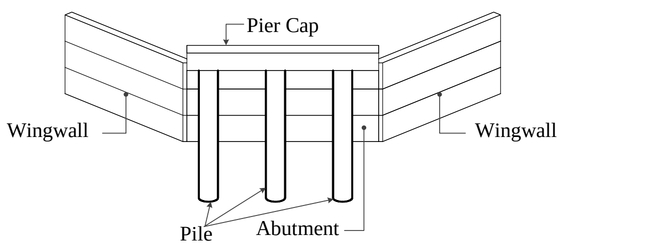
Commentary:
Intended for bearings constructed of materials that cannot be classified using any other defined bearing element.

3-EI.11 SUBSTRUCTURE

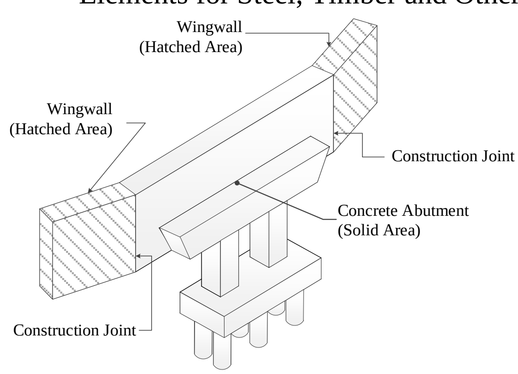
3-EI.11.1 General

Substructure elements are divided into two groups. The first group is the elements that are collected by the inspectors that are not associated with underwater or diving inspections and will be collected through the normal inspection process. The second group is the submerged elements which are to be collected during the underwater inspection process by divers or inspectors. The element condition reported will be comprised of both the above waterline and below waterline conditions.





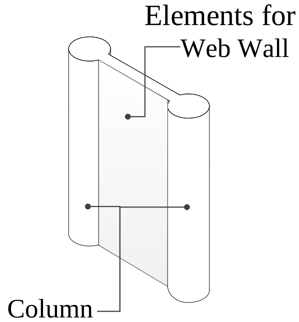
Elements for Steel, Timber and Other Abutments

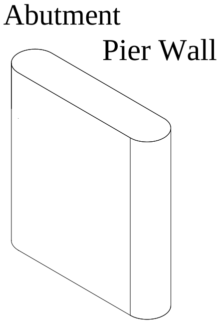


Elements for Concrete Abutment

Abutment assessment has two different groupings dependent on the type of material:

- Steel, timber, and other materials abutments shall be divided into abutment, wingwall (if appropriate), pile and pier cap elements.
- Concrete abutments will have only the abutment element and wingwall element (if appropriate).





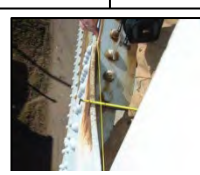
Pier walls have a consistent size from the beginning to the end of the wall. When reviewing the substructure, columns that have an enclosed area that is smaller in size than the supporting columns consider the enclosed area a web wall and assess the columns only.

Columns and Web Wall Pier Wall

Steel

All elements are constructed of steel regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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.	
	*			
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, broken welds, fasteners, 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.	
	*			

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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

202 Steel Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9202 Submerged Steel Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 202 Steel Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

207 Steel Tower

Description:
This element defines all built-up or framed tower supports.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports.

Commentary:
Intended to be used for truss framed tower supports or built-up steel towers in order to capture large supports and towers associated with suspension bridges, cable stayed bridges, moveable bridges or similar structural configurations.

9207 Submerged Steel Tower

Description:
This element defines all built-up or framed tower supports and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 207 Steel Tower

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports below the waterline.

Commentary:
Intended to be used for truss framed tower supports or built-up steel towers in order to capture large supports and towers associated with suspension bridges, cable stayed bridges, moveable bridges or similar structural configurations.

219 Steel Abutment

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9219 Submerged Steel Abutment

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 219 Steel Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9248 Steel Grade Beam Cap

Description:
This element defines all grade beam caps.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of the grade beam caps.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

225 Steel Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9225 Submerged Steel Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 225 Steel Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9231 Steel Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

231 Steel Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9237 Steel Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (sheet pile joint, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9243 Steel Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.11.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 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.
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)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
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.	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.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

204 Prestressed Concrete Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9204 Submerged Prestressed Concrete Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 204 Prestressed Concrete Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

226 Prestressed Concrete Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9226 Submerged Prestressed Concrete Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 226 Prestressed Concrete Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9232 Prestressed Concrete Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state "0".

233 Prestressed Concrete Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

3-EI.11.4 Reinforced Concrete

All elements are constructed of mild reinforcing steel and concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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.
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)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	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.	
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.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

205 Reinforced Concrete Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9205 Submerged Reinforced Concrete Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 205 Reinforced Concrete Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

210 Reinforced Concrete Pier Wall

Description:
This element defines all pier walls.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9210 Submerged Reinforced Concrete Pier Wall

Description:
This element defines all submerged pier walls and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 210 Reinforced Concrete Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

215 Reinforced Concrete Abutment

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9215 Submerged Reinforced Concrete Abutment

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 215 Reinforced Concrete Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

220 Reinforced Concrete Pile Cap/Footing

Description:
This element defines all pile caps/footings that are visible for inspection. Pile caps/footings exposed from erosion or scour are included and the exposure may be intentional or caused by erosion or scour.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of the footings or pile caps along the skew angle.

Commentary:
None.

9220 Submerged Reinforced Concrete Pile Cap/Footing

Description:
This element defines all pile caps/footings that are visible for inspection and is used for underwater inspections. Pile caps/footings exposed from erosion or scour are included and the exposure may be intentional or caused by erosion or scour.

Element Classification: NDOT NBE

NBE Parent: 220 Reinforced Concrete Pile Cap/Footing

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of footings or pile caps along the skew angle below the waterline.

Commentary:
None.

9230 Reinforced Concrete Grade Beam Cap

Description:
This element defines all grade beam caps.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the length of the grade beam caps.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

227 Reinforced Concrete Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9227 Submerged Reinforced Concrete Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 227 Reinforced Concrete Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9234 Reinforced Concrete Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

234 Reinforced Concrete Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9238 Reinforced Concrete Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (cold joint, water stop, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9244 Reinforced Concrete Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

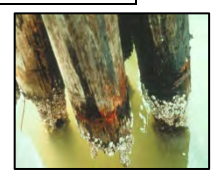
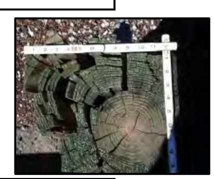
Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

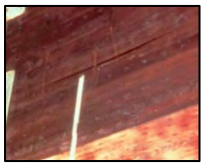
Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.11.5 Timber

All elements are constructed of timber regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
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% to 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.	
	* 			

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td rowspan="2">Split/ Delamination (Timber) (1170)</td><td>None.</td><td>Length less than the member depth or arrested with effective actions taken to mitigate.</td><td>Length equal to or greater than the member depth but does not require structural review.</td><td rowspan="5">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td colspan="3">*   </td></tr>
<tr><td>Abrasion/ Wear (Timber) (1180)</td><td>None or no measurable section loss.</td><td>Section loss less than 10% of the member thickness.</td><td>Section loss 10% or more of the member thickness but does not warrant structural review.</td></tr>
<tr><td>Settlement (4000)</td><td>None.</td><td>Exists within tolerable limits or arrested with no observed structural distress.</td><td>Exceeds tolerable limits but does not warrant structural review.</td></tr>
<tr><td>Scour (6000)</td><td>None.</td><td>Exists within tolerable limits or has been arrested with effective countermeasures.</td><td>Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.</td></tr>
<tr><td>Damage (7000)</td><td>Not applicable.</td><td>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.</td><td>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.</td><td>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.</td></tr>
</table>

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

206 Timber Column

Description:
This element defines all visable columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9206 Submerged Timber Column

Description:
This element defines all submerged columns and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 206 Timber Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

208 Timber Trestle

Description:
This element defines all built-up or framed tower supports.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports.

Commentary:
Intended to be used for truss framed trestle or tower supports in order to capture large supports and towers associated with large deck truss bridges.

9208 Submerged Timber Trestle

Description:
This element defines all built-up or framed tower supports and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 208 Timber Trestle

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the heights of the built-up or framed tower supports below the waterline.

Commentary:
Intended to be used for truss framed trestle or tower supports in order to capture large supports and towers associated with large deck truss bridges.

212 Timber Pier Wall

Description:
This element defines all pier walls that include pile, sheet material and filler.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9212 Submerged Timber Pier Wall

Description:
This element defines all submerged pier walls that include pile, sheet material and filler and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 212 Timber Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

216 Timber Abutment

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet material joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9216 Submerged Timber Abutment

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions but does not include the supporting piles and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 216 Timber Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet material joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

228 Timber Pile

Description:
This element defines all piles that are visible for inspection. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9228 Submerged Timber Pile

Description:
This element defines all piles that are visible for inspection and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 228 Timber Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9235 Timber Grade Beam Pile

Description:
This element defines all grade beam piles. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

235 Timber Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9240 Timber Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (sheet material joint, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9245 Timber Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.11.6 Masonry

All elements are constructed of block or stone and may be placed with or without mortar regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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 voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
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.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

213 Masonry Pier Wall

Description:
This element defines all pier walls.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9213 Submerged Masonry Pier Wall

Description:
This element defines all submerged pier walls and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 213 Masonry Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

217 Masonry Abutment

Description:
This element defines all abutments and includes the material retaining the embankment, monolithic wingwalls and abutment extensions.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9217 Submerged Masonry Abutment

Description:
This element defines all abutments, includes the material retaining the embankment, monolithic wingwalls and abutment extensions and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9261 Rectangular Mechanically Stabilized Earth Abutment

Description:
This element defines all abutments constructed of mechanically stabilized earth systems that are rectangular concrete panels including integral wingwalls and abutment extensions.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with integral wingwalls and abutment extensions measured along the skew angle.

Commentary:
Integral wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not integral to the abutment shall not be included in the quantity or assessment of the abutment element.

9262 Cruciform Mechanically Stabilized Earth Abutment

Description:
This element defines all abutments constructed of mechanically stabilized earth systems that are cruciform concrete panels including integral wingwalls and abutment extensions.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with integral wingwalls and abutment extensions measured along the skew angle.

Commentary:
Integral wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not integral to the abutment shall not be included in the quantity or assessment of the abutment element.

9263 Block Mechanically Stabilized Earth Abutment

Description:
This element defines all abutments constructed of mechanically stabilized earth systems that are modular block units including integral wingwalls and abutment extensions.

Element Classification: NDOT NBE

NBE Parent: 217 Masonry Abutment

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with integral wingwalls and abutment extensions measured along the skew angle.

Commentary:
Integral wingwalls, up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not integral to the abutment shall not be included in the quantity or assessment of the abutment element.

9241 Masonry Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (cold joint, water stop, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:
For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9246 Masonry Headwall

Description:
This element defines all headwalls and includes the material retaining the embankment.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without wingwalls.

Commentary:
Used with culverts only. Integral headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.11.7 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types regardless of the protective system.

Condition State Definitions:

<table>
<tr><th rowspan="3">Defects</th><th colspan="4">Condition States</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><th>GOOD</th><th>FAIR</th><th>POOR</th><th>SEVERE</th></tr>
<tr><td>Corrosion (1000)</td><td>None.</td><td>Freckled rust. Corrosion of the steel has initiated.</td><td>Section loss is evident or pack rust is present but does not warrant structural review.</td><td rowspan="9">The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.</td></tr>
<tr><td></td><td>* </td><td></td><td></td></tr>
<tr><td>Cracking (1010)</td><td>None.</td><td>Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.</td><td>Identified crack that is not arrested but does not warrant structural review.</td></tr>
<tr><td>Connection (1020)</td><td>Connection is in place and functioning as intended.</td><td>Loose fasteners or pack rust without distortion is present but the connection is in place and functioning as intended.</td><td>Missing bolts, rivets, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.</td></tr>
<tr><td></td><td>* </td><td></td><td></td></tr>
<tr><td>Delamination/ Spall/ Patched Area (1080)</td><td>None.</td><td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.</td><td>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.</td></tr>
<tr><td>Efflorescence /Rust Staining (1120)</td><td>None.</td><td>Surface white without build-up or leaching without rust staining.</td><td>Heavy build-up with rust staining.</td></tr>
<tr><td></td><td>* </td><td></td><td></td></tr>
</table>

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. 3.0 ft.	Width greater than 0.05 in. or spacing of 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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

203 Other Column

Description:
This element defines all visable columns not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns.

Commentary:
None.

9203 Submerged Other Column

Description:
This element defines all submerged columns not otherwise defined and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 203 Other Column

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of columns below the waterline.

Commentary:
None.

211 Other Pier Wall

Description:
This element defines all pier walls not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

9211 Submerged Other Pier Wall

Description:
This element defines all submerged pier walls not otherwise defined and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 211 Other Pier Wall

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the lengths of the pier walls measured along the skew angle below the waterline.

Commentary:
Extends from edge of deck to edge of deck along the skew angle and web walls are not included.

218 Other Abutments

Description:
This element defines all abutments and includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions not otherwise defined but does not include the supporting piles.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

9218 Submerged Other Abutments

Description:
This element defines all abutments, includes the sheet material retaining the embankment, monolithic wingwalls and abutment extensions not otherwise defined but does not include the supporting piles and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 218 Other Abutments

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the width of the abutment with monolithic wingwalls and abutment extensions measured along the skew angle below the waterline.

Commentary:
Monolithic wingwalls, up to the first construction joint (sheet pile joint, etc.), shall be considered in the quantity and assessment of the abutment element. Wingwalls that are not monolithic to the abutment shall not be included in the quantity or assessment of the abutment element.

229 Other Pile

Description:
This element defines all piles that are visible for inspection not otherwise defined. Piles exposed from erosion or scour are included.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection.

Commentary:
None.

9229 Submerged Other Pile

Description:
This element defines all piles that are visible for inspection not otherwise defined and is used for underwater inspections.

Element Classification: NDOT NBE

NBE Parent: 229 Other Pile

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles visible for inspection below the waterline.

Commentary:
None.

9236 Other Grade Beam Pile

Description:
This element defines all grade beam piles not otherwise defined. Piles exposed from erosion or scour are included and will require evaluation.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is the sum of the number of piles.

Commentary:
This element shall be inventoried for each bridge (if applicable) whether visible or buried. If buried, code the environmental state “0”.

236 Other Pier Cap

Description:
This element defines all pier caps that support girders and transfer load into piles or columns not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the cap lengths measured along the skew angle.

Commentary:
None.

9242 Other Wingwall

Description:
This element defines all wingwalls inclusive of all pile and earth retaining systems not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is dependent upon whether it is:

- Abutment – the sum of the length of wingwalls measured from the abutment at the first construction joint (sheet pile joint, etc.) to the end of the wingwall.
- Culvert – the sum of the length of the wingwalls starting at the construction joint or the angle connecting the wingwall to the headwall.

Commentary:

For continuous wingwalls, record the length of the wingwall to the appropriate construction joint where the fill retained will not influence the bridge or approach roadway and the recorded length is the longer of the bridge paving unit length or 50 feet per wingwall.

9247 Other Headwall

Description:
This element defines all headwalls and includes the sheet material retaining the embankment not otherwise defined.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of all of the lengths of each headwall measured longitudinally along the travel way without win walls.

Commentary:
Used with culverts only. Monolithic headwalls, the angle connecting the wingwall to the headwall or up to the first construction joint (cold joint, water stop, etc.), shall be considered in the quantity and assessment.

3-EI.12 CULVERTS

3-EI.12.1 General

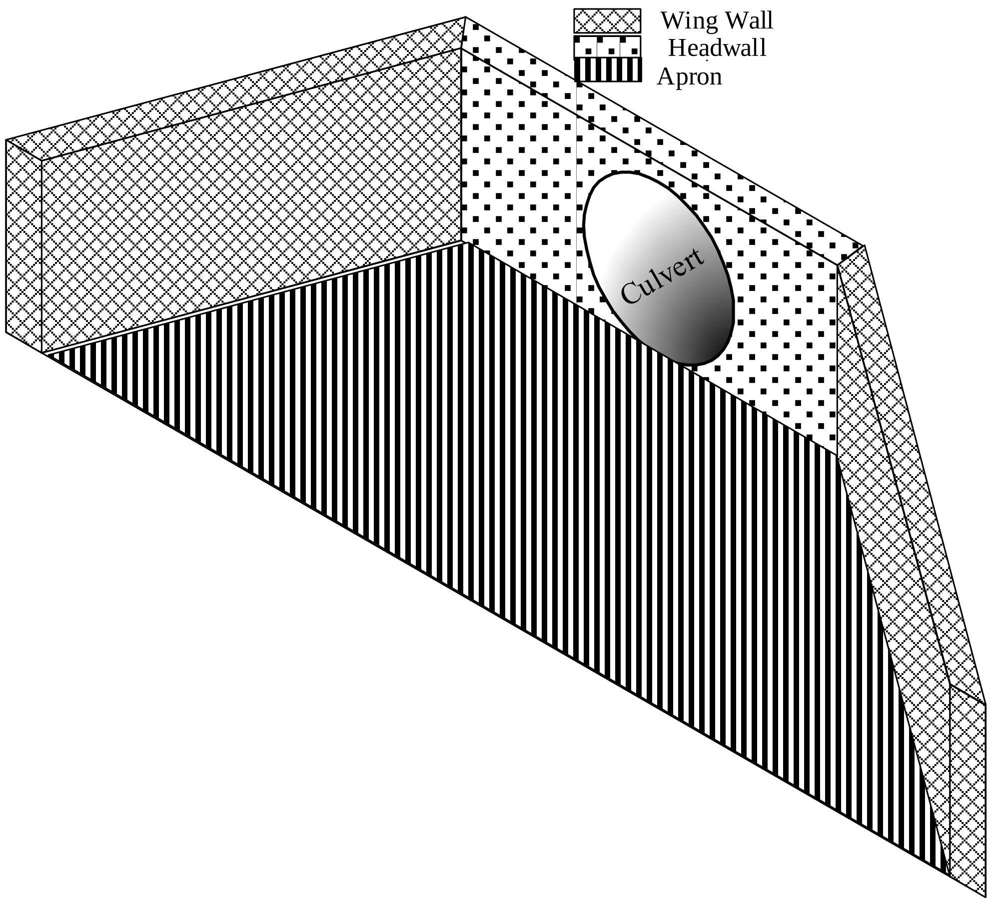
The distortion defect is contingent on a number of factors such as site, wall thickness, fill depth, etc. The inspector shall use such factors to assess the proper condition state.

Record the culvert size in the element description.

Record the number of culvert barrels in the scale field.

If the culvert has a headwall and associated wingwall(s), record the appropriate element. Types and descriptions are listed in the Substructure Element Section of this chapter.

Inspectors should also review guidance in Chapter 6 Scour. If there are further questions, consult the Owner's Hydraulic Engineer or NDOT BIP Bridge Hydraulics Manager.



Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the sum of the barrel flow line lengths.

3-EI.12.2 Steel

All elements are constructed of steel regardless of the protective system.

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.	
	*			
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, broken welds, fasteners, 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.	
	*			

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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

240 Steel Culvert

Description:
This element defines all culverts that are arched, round or elliptical shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9270 Steel Arpon

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.3 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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.
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)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
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.	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.	
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.	

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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

245 Prestressed Concrete Culvert

Description:
This element defines all culverts that are primarily box shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

3-EI.12.4 Reinforced Concrete

All elements are constructed of mild steel reinforced concrete regardless of the protective system.

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.
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)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	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.	
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.	

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

241 Reinforced Concrete Culvert

Description:
This element defines all culverts that are box, arched, round or elliptical shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9271 Reinforced Concrete Apron

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

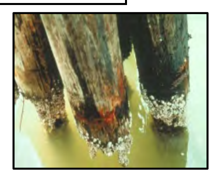
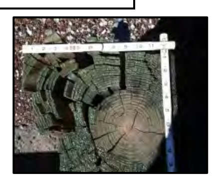
Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.5 Timber

All elements are constructed of timber regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 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, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	
	* 			
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% to 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.	
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
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.
	* 			
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.	
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

242 Timber Culvert

Description:
This element defines all culverts that are primarily box shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9272 Timber Arpon

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.6 Masonry

All elements are constructed of block or stone and may be placed with or without mortar regardless of the protective system.

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	**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 voids in less than 10% of joints.	Cracking or voids in 10% or more of the joints.	
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.	

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

244 Masonry Culvert

Description:
This element defines all culverts that are primarily box and arched shaped.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9273 Masonry Apron

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.12.7 Other

All elements are constructed of composite materials, or other materials, that cannot be classified using any other defined elements of other material types regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 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, broken welds, fasteners, 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.	
	*			

Defects	Condition States 1 GOOD	Condition States 2 FAIR	Condition States 3 POOR	Condition States 4 SEVERE
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of 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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

243 Other Culvert

Description:
This element defines all culverts that are box, arched, round or elliptical shaped not otherwise defined.

Element Classification: NBE

NBE Parent: N/A

Commentary:
None.

9274 Other Apron

Description:
This element defines all aprons that are hardened surface placed at the invert of the culvert at either inlet or outlet to protect structure from scour/erosion damage and improve flow capacity not otherwise defined.

Element Classification: NDOT BME

NBE Parent: N/A

Unit of Measure: Feet

Quantity Calculation:
Quantity for this element is the length of hardened suface along the flow line.

Commentary:
Used with culverts only. Aprons monolithic to head walls, the angle connecting the apron to the head wall or up to the first construction joint (cold joint, water stop, etc.) shall be considered in the quantity and assessment.

3-EI.13 JOINTS

3-EI.13.1 General

Joint configurations consist of expansion, pourable, compression and assembly joints.

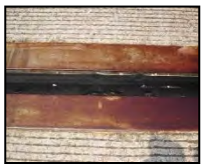
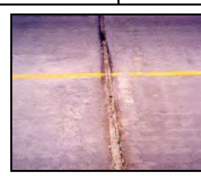
Unit of Measure: Feet

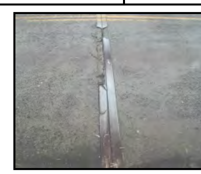
Quantity Calculation:
Quantity for these elements is the sum of the lengths of the joint measured along the skew angle.

3-EI.13.2 Strip Seal Joints

These elements define all expansion joint devices which utilize a waterproof gland with some type of metal extrusion or other system to anchor the gland.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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)	No debris to a 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.
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

300 Strip Seal Expansion Joint

Description:
This element defines all joint devices which utilize a neoprene type waterproof gland.

Element Classification: BME

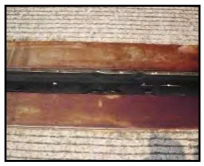
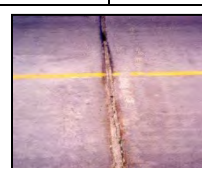
BME Parent: N/A

Commentary:
None.

3-EI.13.3 Pourable Seal Joints

These elements define all joints that have a pourable sealer.

Condition State Definitions:

	Condition States			
	1	2	3	4
Defects	**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)	No debris to a 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.
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

301 Pourable Seal Joint

Description:
This element defines all joints with or without a backer.

Element Classification: BME

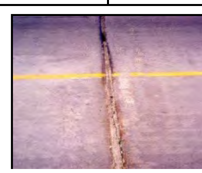
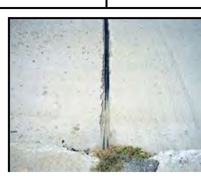
BME Parent: N/A

Commentary:
None.

3-EI.13.4 Compression Seal Joints

These elements define all joints filled with a preformed compression type seal and may or may not have an anchored system to confine the 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)	No debris to a 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.
	*			

Defects	**Condition States**			
	1	**2**	**3**	**4**
	GOOD	**FAIR**	**POOR**	**SEVERE**
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.
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

302 Compression Seal Joint

Description:
This element defines all joints filled with a preformed compression type seal that are not preformed silicone.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

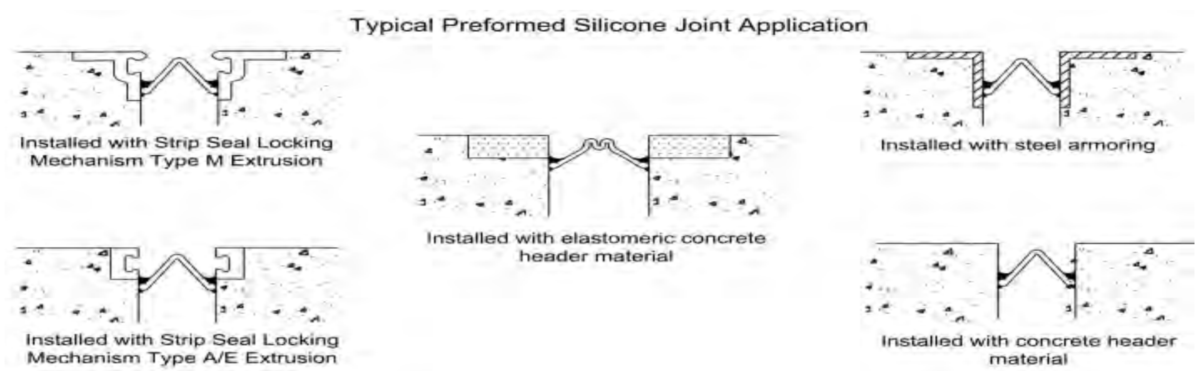
9401 Preformed Silicone Joint

Description:
This element defines all joints that consist of a preformed silicone joint gland and will not have an anchored system to confine the seal.

Element Classification: NDOT BME

BME Parent: 302 Compression Seal Joint

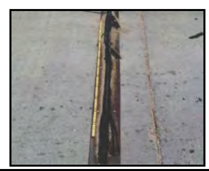
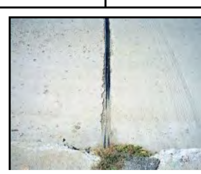
Commentary:
None.



3-EI.13.5 Assembly Joints

These elements define all joints that have an assembly mechanism that may or may not have a 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)	No debris to a 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.
	*			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

303 Assembly Joint With Seal

Description:
This element defines all joints that have a seal.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

305 Assembly Joint Without Seal

Description:
This element defines all joints that are open, not sealed and include finger and sliding plate joints.

Element Classification: BME

BME Parent: N/A

Commentary:
Include open joints with or without a drainage trough below the joint.

3-EI.13.6 Open Joints

These elements define all joints that are designed as open joints but not those joints that were designed to have a seal that is currently missing.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	**FAIR**	**POOR**	**SEVERE**
Debris Impaction (2350)	No debris to a 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.
	* 			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

304 Open Expansion Joint

Description:
This element defines all joints that are open but not sealed.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.13.7 Other Joints

These elements define all joints constructed of materials that cannot be classified using any other defined joint element.

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)	No debris to a 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.
	*			
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

306 Other Joint

Description:
This element defines all joints that cannot be described by any other joint element category.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.14 PAVING SLABS

3-EI.14.1 General

Bridge paving slabs are structural sections between the abutment and the roadway pavement that are constructed with mild, prestressed or post-tensioned steel reinforcement and concrete. The presence of the paving slab will require the Grade Beam Caps and Grade Beam Piles elements to be coded but may not be visible for inspection. Types and descriptions are listed in the Substructure Element Section of this chapter.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for this element is the area of the paving slab(s) from edge to edge including any median areas and accounting for any flares or ramps that are present.

3-EI.14.2 Prestressed Concrete

All elements are constructed of prestressed or post-tensioned steel reinforced concrete regardless of the protective system.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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.
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)	Width less than 0.004 in. or spacing greater than 3 ft.	Width 0.004 in. to 0.009 in. or spacing 1.0 ft. to 3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	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.	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.	
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.

320 Prestressed Concrete Paving Slab

Description:
This element defines all structural paving slab sections.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.14.3 Reinforced Concrete

All elements are constructed of mild steel reinforced concrete regardless of the protective system.

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.
Exposed Rebar (1090)	None.	Present without measurable section loss.	Present with measurable section loss but does not warrant structural review.	
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width greater than 0.05 in. or spacing of less than 1 ft.	
Abrasion/ Wear (PSC/RC) (1190)	No abrasion or wearing.	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.	
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.

321 Reinforced Concrete Paving Slab

Description:
This element defines all structural paving slab sections.

Element Classification: BME

BME Parent: N/A

Commentary:
None.

3-EI.15 WEARING SURFACES

3-EI.15.1 General

Deck and slab wearing surfaces consist of asphalt, epoxy/polyester or cementitious materials.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements is the area of the deck/slab that is protected by the wearing surface.

3-EI.15.2 Asphalt Overlays

All elements define the wearing surfaces that consist of flexible asphaltic concrete.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Raveling (9905)	The aggregate and/or binder has started to wear away but has not progressed significantly. The pavement only appears slightly aged and slightly rough.	The aggregate and/or binder have worn away and the surface texture is moderately rough and pitted. Loose particles may be present, and fine aggregate is partially missing from the surface.	The aggregate and/or binder have worn away significantly, and the surface texture is deeply pitted and very rough. Fine aggregate is essentially missing from the surface, and pitting extends to a depth approaching one half the coarse aggregate size.	The wearing surface is no longer effective.
	* 			
Rutting (9906)	No rutting.	Rutting depth 0.25 in to 0.50 in.	Rutting depth 0.50 in. to 0.75 in.	
	* 			
Cracking (AC) (9907)	No Cracking of Asphalt Surface.	The cracks have very little or no spalling along the edges and are less than 0.25 in. in width, Spacing 1 to 4 cracks per 100 ft.	The cracks have little or no spalling but they are greater than 0.25 in. in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks, Spacing 5 to 9 cracks per 100 ft.	The wearing surface is no longer effective.
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate 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

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9511 Asphalt Overlay

Description:
This element defines all decks/slabs that have a flexible material overlay but without a waterproof membrane.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9512 Asphalt Overlay with Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with an unkown type of waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9513 Asphalt Overlay with Preformed Fabric Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with a preformed fabric waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9514 Asphalt Overlay with Cold Liquid Applied Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with cold liquid applied polyuria waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9515 Asphalt Overlay with Hot Liquid Applied Membrane

Description:
This element defines all decks/slabs that have a flexible material overlay with hot liquid applied asphaltic waterproof membrane but may or may not have drain tubes.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

3-EI.15.3 Thin Lift Overlays

All elements define the wearing surfaces that consist of epoxy/polyester material.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 SEVERE
Delamination / Spall / Patched Area / Pothole (Wearing Surfaces) (3210)	None.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched Area that is sound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Patched Area that is unsound or showing distress. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate 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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9514 Multilayer-Polymer Overlay (Epoxy and/or Polyester)

Description:
This element defines all decks/slabs that have a multilayer epoxy and/or polyester material overlay with broadcast aggregate.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

3-EI.15.4 Thick Lift Overlays

All elements define the wearing surfaces that consist of cementitious material.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination / Spall / Patched Area / Pothole (Wearing Surfaces) (3210)	None.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched Area that is sound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Patched Area that is unsound or showing distress. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate 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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9516 Concrete Overlay (HDLS)

Description:
This element defines all Portland cement low slump and cements without additives.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9517 Latex Modified Overlay

Description:
This element defines all Portland cement overlays that contain latex additives.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

9518 Silica Fume Overlay

Description:
This element defines all Portland cement overlays that contain silica fume additives.

Element Classification: NDOT BME

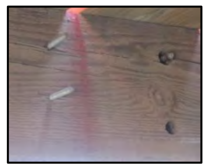
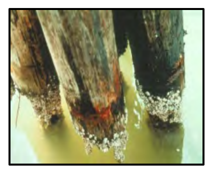
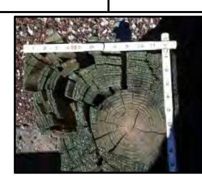
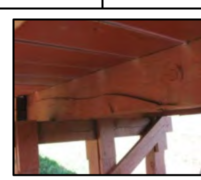
BME Parent: 510 Wearing Surfaces

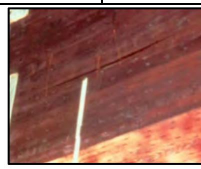
Commentary:
None.

3-EI.15.5 Timber Planks

All elements define the wearing surfaces that consist of timber material.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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, broken welds, fasteners, or pack rust with distortion but does not warrant a structural review.	The wearing surface is no longer effective.
	* 			
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 wearing surface is no longer effective.
	* 			
Check/Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5% to 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 wearing surface is no longer effective.
	* 			
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 wearing surface is no longer effective.
	* 			

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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 wearing surface is no longer effective.
	* 			
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 wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate 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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9519 Timber Running Planks

Description:
This element defines all decks/slabs that have timber running planks.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surfaces

Commentary:
None.

3-EI.15.6 Other Overlays

All elements define the wearing surfaces that consist of other overlays that are not covered in asphalt, epoxy/polyester or cementitious materials.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Delamination/ Spall/ Patched Area/Pothole (Wearing Surfaces) (3210)	None.	Delaminated. Spall less than 1 in. deep or less than 6 in. diameter. Patched area that is sound. Partial depth pothole.	Spall 1 in. deep or greater or 6 in. diameter or greater. Patched area that is unsound or showing distress. Full depth pothole.	The wearing surface is no longer effective.
Crack (Wearing Surface) (3220)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012 in. to 0.05 in. or spacing of 1.0 ft. to 3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	The wearing surface is no longer effective.
Effectiveness (Wearing Surface) (3230)	Fully effective. No evidence of leachate 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.

Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9515 Other Overlay

Description:
This element defines all other overlays not otherwise defined.

Element Classification: NDOT BME

BME Parent: 510 Wearing Surface

Commentary:
None.

3-EI.15.7 Stay-in-Place Form

All elements define the forms that remain-in-place after the deck has been placed and the bridge is open for service.

Condition State Definitions:

Defects	Condition States 1 GOOD	2 FAIR	3 POOR	4 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 review to determine the effect on serviceability of the element or bridge. The condition is beyond the limits established in Condition State 3.
				
Cracking (1010)	None.	Crack that has self-arrested or has been arrested with effective arrest holes, doubling plates, or similar.	Identified crack exists 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, broken welds, fasteners or pack rust with distortion but do 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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9530 Steel Stay-in-Place Forms (SIP)

Description:
This element defines all soffit stay-in-place forms and does include the protective system of paint or galvanization.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity for this element includes the area between the girder lines only.

Commentary:
None.

3-EI.16 PROTECTIVE SYSTEMS

3-EI.16.1 General

Protective systems consist of materials that protect the parent element.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements is the area of the entire protected parent element surface.

3-EI.16.2 Sealers / Water Proofers

All elements define the sealers/water proofers that are applied to concrete surfaces but the application is not limited to just the decks.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Textured Surface (9900)	Friction course intact.	Less than 10% has been worn off.	10% to 25% has been worn off.	More than 25% has been worn off.
Wear (Concrete Protective Coatings) (3510)	None.	Underlying concrete not exposed, coating shows 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.

9521 Healer/Sealers

Description:
This element defines all concrete elements that have a crack healer/sealer applied to them such as High Molecular Weight Methacrylate (HMWM).

Element Classification: NDOT BME

BME Parent: 521 Concrete Protective Coating

Commentary:
None.

9522 Silane/Siloxane Water Proofers

Description:
This element defines all concrete elements that have a water proofer applied to them such as silane/siloxane.

Element Classification: NDOT BME

BME Parent: 521 Concrete Protective Coating

Commentary:
None.

3-EI.16.3 Steel Protective Coatings

All elements define steel protective coatings.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements is the area of the entire protected steel element surface. The element quantity can be estimated utilizing the following methodology:

- Steel beams that are rolled or built-up sections: length (feet) X web height (feet) X 2.9.
- Trusses and arches: length (feet) X panel height (feet) X 0.6.
- Round culverts: length (feet) X 3.14 X diameter (feet).
- Oval culverts: length (feet) X 6.28 X $\sqrt{\frac{\left(\frac{\text{Diameter 1}}{2}\right)^2+\left(\frac{\text{Diameter 2}}{2}\right)^2}{2}}$.

Commentary:
Used on structural elements only such as deck, girders, trusses, columns, abutments and culverts but not applicable to traffic rails or other non-structural elements.

3-EI.16.4 Weathering Patina

All elements define the weathering steel protective coating.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
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 0.50 in. diameter.	Dark black color. Large flakes, 0.50 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.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9541 Weathering Steel Protective Coating

Description:
This element defines all steel elements that have a patina protective coating.

Element Classification: NDOT BME

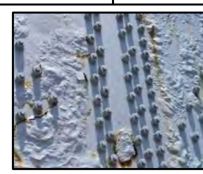
BME Parent: 515 Steel Protective Coating

Commentary:
None.

3-EI.16.5 Other Steel Coatings

All elements define the protective paint systems that consist of single and multi-coat systems as well as organic and inorganic systems.

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.
	* 			
Effectiveness (Steel Protective Coatings) (3440)	Fully effective.	Substantially effective.	Limited effectiveness.	Failed, no protection of the underlying metal.
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.

*Note: Photos approximate the boundary condition between Good/Fair, Fair/Poor and Poor/Severe.

9540 Steel Paint Protective Coating

Description:
This element defines all steel elements that have a paint protective coating.

Element Classification: NDOT BME

BME Parent: 515 Steel Protective Coating

Commentary:
None.

9542 Galvanized Steel Protective Coating

Description:
This element defines all steel elements that have a galvanized protective coating.

Element Classification: NDOT BME

BME Parent: 515 Steel Protective Coating

Commentary:
None.

9543 Other Steel Protective Coating

Description:
This element defines all steel elements that have other top coat steel corrosion inhibitors that are not paint or galvanized.

Element Classification: NDOT BME

BME Parent: 515 Steel Protective Coating

Commentary:
None.

3-EI.16.6 Concrete Reinforcing Steel Protective Systems

All elements define situations where the concrete element may be expected to deteriorate at a rate that is slower than an unprotected situation. Protective systems include rebar coatings, cathodic protection or other similar protective methods.

Condition State Definitions:

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.

520 Concrete Reinforcing Steel Protective System

Description:
This element defines all concrete reinforcing steel corrosion protective systems.

Element Classification: BME

BME Parent: N/A

Commentary:
Do not use if a wearing surface but address the wearing surface utilizing the appropriate wearing surface element.

3-EI.17 COUNTERMEASURES

3-EI.17.1 General

Countermeasures consist of various types of slope protection that includes riprap, A-Jack, spur dikes, gabions, articulating blocks and concrete slope protection and need to be assessed based on their effectiveness.

Unit of Measure: Feet

Quantity Calculation:
Quantity for these elements is the sum of the length along the channel.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Effectiveness (Countermeasures) (9901)	Countermeasure shows no signs of deterioration. There are signs of scour repair and installation of the countermeasure. Scour has been stabilized.	Countermeasure has some signs of deterioration, minor shifting, and/or movement of the countermeasure, but there are no signs of additional scour at the countermeasure location. Scour is stabilized.	The countermeasure shows signs of deterioration. The installed countermeasure has been compromised and there are signs of new or recurring scour.	The countermeasure is no longer effective. There is little or no sign of the countermeasure. There are signs that scour is affecting the substructure elements of the bridge. Damage is significant enough to warrant analysis of the 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.

9250 Riprap

Description:
This element defines all placed material of broken stone/concrete to protect the foundations and/or revetments of embankments.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9251 A-Jack

Description:
This element defines all precast geometric shapes that are interlocked with each other to protect the substructure element.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9252 Spur Dikes

Description:
This element defines all placed material in a jetty for guiding overbank flow through the adjacent structure.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity for this element is the sum of the length along the jetty.

Commentary:
None.

9253 Gabions

Description:
This element defines all wire baskets filled with non-erosive material.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9254 Articulating Blocks

Description:
This element defines all tied and/or interlocking precast blocks.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

9255 Concrete Slope Protection

Description:
This element defines all poured concrete placed armoring around substructure elements.

Element Classification: NDOT BME

BME Parent: N/A

Quantity Calculation:
Quantity for this element is the sum of the length along the abutment.

Commentary:
None.

9256 Other Slope Protection

Description:
This element defines all other slope protection that is not covered in other countermeasure elements.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.18 OTHER CONDITION ASSESSMENT MARKERS

3-EI.18.1 General

The purpose of "Other Condition Assessment Markers" is to enhance the assessment of the parent element and can be utilized in other project level activities but not within the deterioration models.

3-EI.18.2 Chloride Contamination

All elements define the chloride contamination data that will be populated based on a deck survey. As part of the element notes, record the date and concentration of the in-depth deck evaluation.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for this element is the area of the deck from edge to edge including any median areas and accounting for any flares or ramps present.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Chloride Concentration (9902)	0 to 0.5 lbs./cu.yd.	0.5 to 1 lbs./cu.yd.	1 to 2 lbs./cu.yd.	Greater than 2 lbs./cu.yd.

9550 Deck Chlorides at Reinforcement Level

Description:
This element defines all deck chloride concentrations at the rebar level from in-depth deck testing and investigation. The supporting data for this element shall be documented in the deck survey results.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.18.3 Electrical Potentiality

All elements define the electrical potential data that will be populated based on a deck survey. As part of the element notes, record the date and electrical potential of the in-depth deck evaluation.

Unit of Measure: Square Feet

Quantity Calculation:
Quantity for these elements include the area of the deck from edge to edge including any median areas and accounting for any flares or ramps present.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Half-Cell Potential (CSE - Copper-Copper Sulfate Electrode) (9903)	-0.00 to -0.20 V CSE.	-0.20 to -0.35 V CSE.	-0.35 to -0.40 V CSE.	Greater than -0.40 V CSE.

9551 Electrical Potential at Reinforcement Level

Description:
This element defines all deck electrical potential at the rebar level from in-depth deck testing and investigation. The supporting data for this element shall be documented in the deck survey results.

Element Classification: NDOT BME

BME Parent: N/A

Commentary:
None.

3-EI.18.4 Flow Restrictions

All elements define the flow restrictions applicable to both bridges and culverts.

Condition State Definitions:

Defects	Condition States			
	1	2	3	4
	GOOD	FAIR	POOR	SEVERE
Debris/Silt Blocking Flow on Hydraulic Structure (9904)	No significant debris/silt lodged against structure.	Debris/silt has started building but has not restricted flow <10%.	Debris/silt has built-up and has started to restrict flow <50%.	Debris/silt has blocked flow through the structure ≥50%.

9552 Debris Blocking Flow

Description:
This element defines the aproximate amount of debris that is accumulating in the stream at a structure.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Quantity Calculation:
Quantity for this element is “Each” and only one element per span group is allowed.

Commentary:
Do not code until debris level has reached Condition State 2 (Fair).

9553 Silt in Culvert Barrel

Description:
This element defines the aproximate amount of silt that is accumulating in the culvert barrel.

Element Classification: NDOT BME

BME Parent: N/A

Unit of Measure: Each

Calculation:
Quantity for this element is “Each” and only one element per span group is allowed.

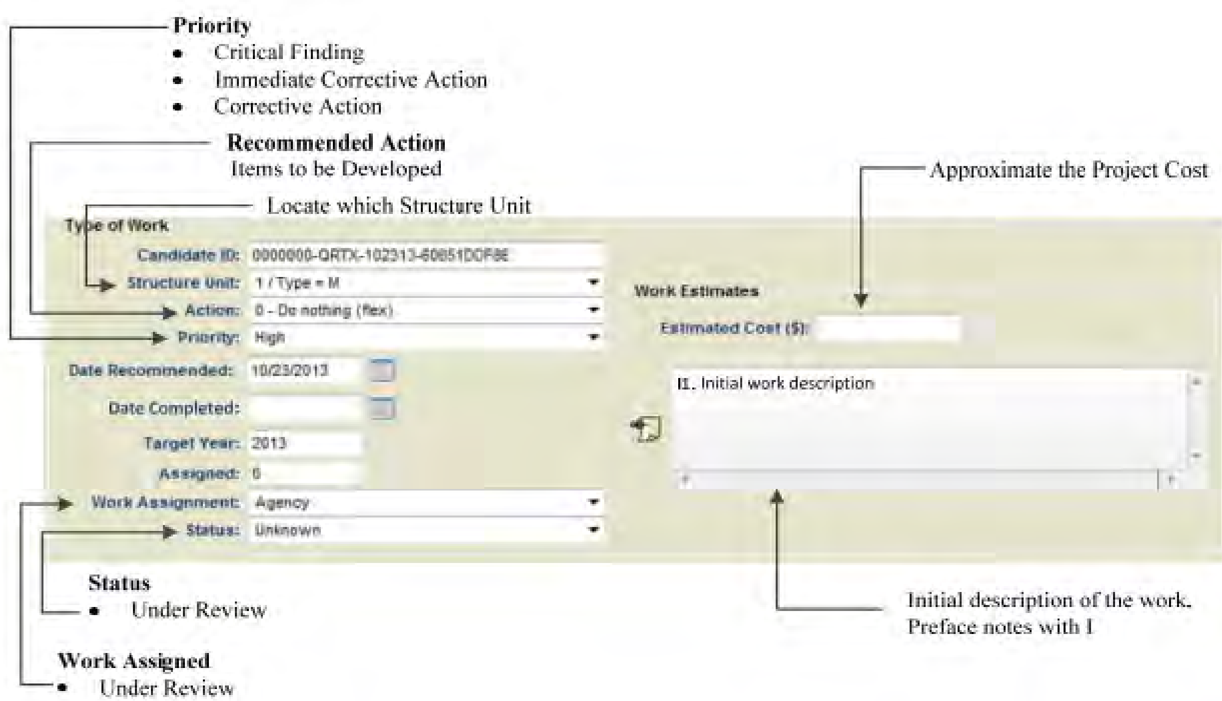
Commentary:
Do not code until silt level has reached Condition State 2 (Fair).

3-EI.19 INSPECTOR WORK FINDINGS/STRUCTURE REPAIR/CRITICAL FINDING REPORTS

The work flow developed to document the process pertaining to the initial findings, progress update and closeout action is as follows:

Inspector Initiates Work:
The inspector initiates the work from the inspection and also records the following:

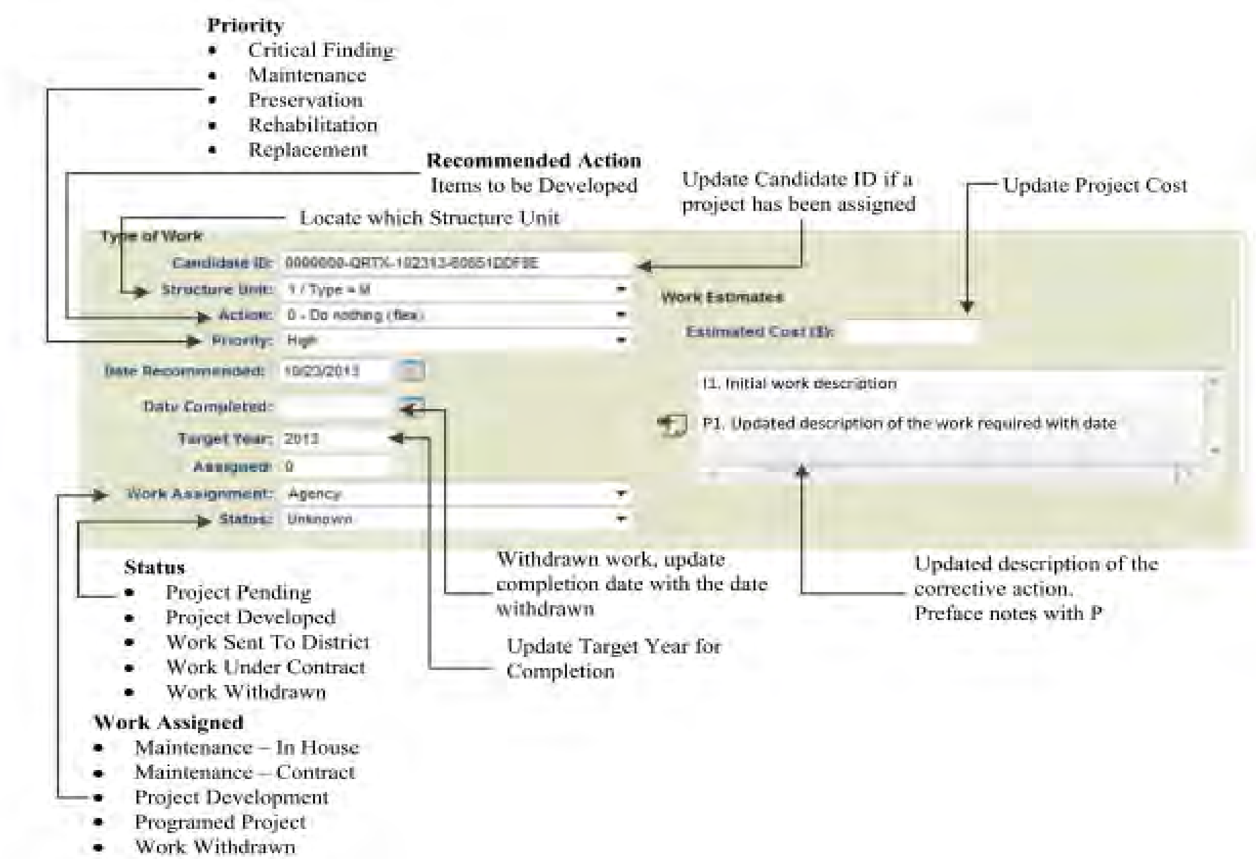
- Structure Unit were the defect was located.
- Recommended action.
- Priority – Critical Finding or Structure Repair.
- Status – "Under Review" will be the only option for this stage.
- Action type.
- Approximate cost of the action.
- Description of the corrective action. Notes will be prefixed with an "I".
- Work Assigned will be "Under Review".



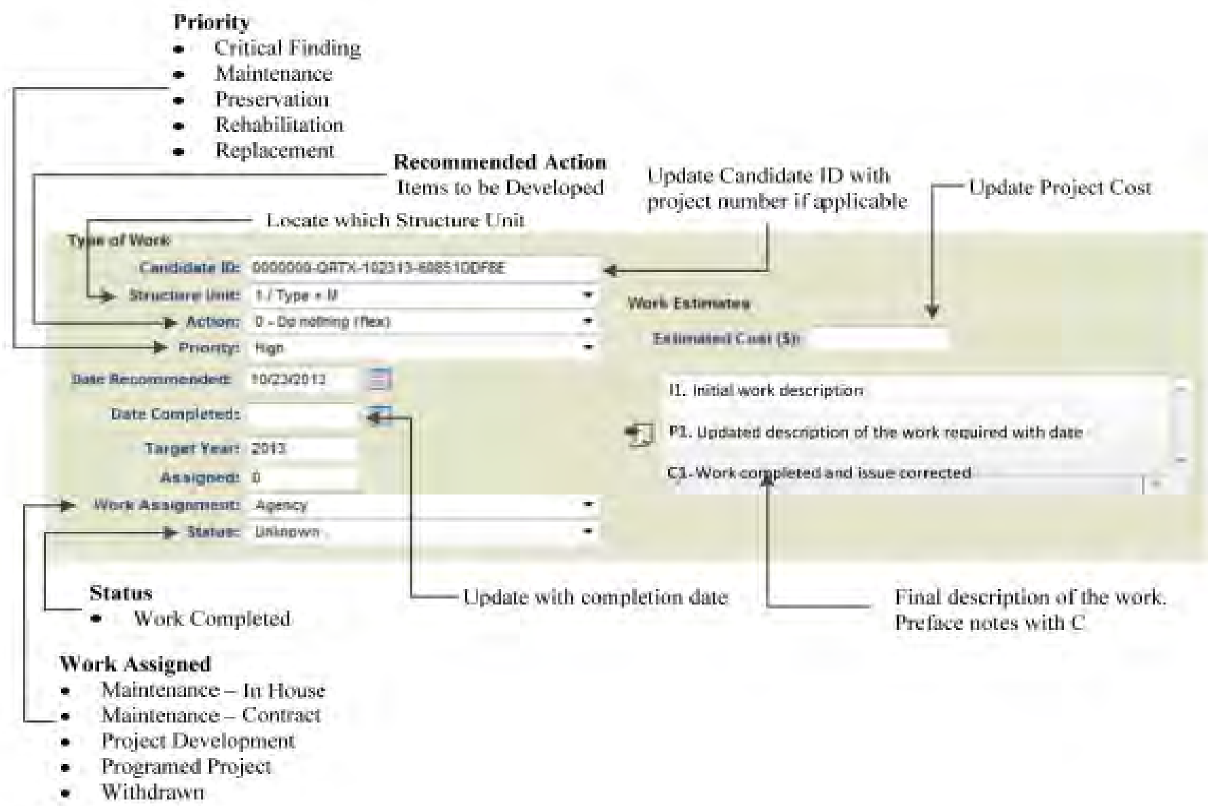
Work Under Review and Assignment (Progress):
The work candidate will be reviewed by the appropriate oversight committee for action and assigned as either a District Maintenance action or a Project Development action which will also require an update to its status in the work flow process. It should be noted that if a proposed project already exists that will address the assigned corrective action, the corresponding project identification will be required to be placed in the “Candidate ID” field.

In addition, the work candidate’s Priority, Action, Estimated Cost, Target Completion Year and Action Description will have to be updated accordingly and any information added to the Action Description Field will be prefaced with a “P”.

Work candidates that were reviewed and deemed not feasible or were withdrawn, will be marked as such in the Status and Work Assigned fields along with updating the Date Completed with the date that the action was withdrawn.



Project Completed:
When a project has been completed and the improvement has been confirmed by inspection, the Bridge Owner or their representative will update the status, insert the date the action was completed, insert the final cost of the project and insert any additional relevant comments. All comments added at this step will be prefaced with a "C".



3-EI.20 QUALITY CONTROL

The NBIS defines Quality Control (QC) as "procedures that are intended to maintain the quality of a bridge inspection and load rating at or above a specified level."

Quality Control is defined for NDOT's program as a system of routine technical activities, to measure and control the quality of the bridge inventory data or report as it is being developed. The QC system is designed to include general methods such as accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for measurement, calculation, recording information and reporting. QC activities include:

- Documents, data, or calculations signed by a PE, must have QC completed by an individual of equivalent or better qualifications than the originator (this is typically documented when the QC individual signs or initials the documents).
- See that the technical activity has followed procedures set by NDOT.
- Providing routine and consistent checks for data integrity, correctness and completeness.
- Identifying and addressing errors and/or omissions.
- Documenting inventory data.
- Recording all QC activities.

Quality Control for this program is the responsibility of the consultant or agency actually conducting the activity. Quality Control checks are conducted on every product of a program operation, and thus at a much higher frequency than quality assurance checks. When the QC on a program product is complete, it is finished and deliverable to the Bridge Owner for their records.

Consultants providing professional services to Bridge Owners must submit a Quality Control plan to the Bridge Owner for review and approval. QC must be done on the deliverables prior to submittal to the Bridge Owner.

NDOT completes QC on data that has been entered into the BrM database on a continual basis.

3-EI.21 QUALITY ASSURANCE

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

3-EI.22 REVISION HISTORY

Rev	Date	Description
0	2014 May 16	Initial Issue of Chapter
1		
2		
3	2015 March 15	Revision 3
4	2016 March 11	Revision 4
5	2017 March 16	Revision 5
6	2018 March	Revision 6
7	2020 March	Revision 7

3-EI.23 FORMS

Forms used in completing inspections that are mentioned in this Chapter are listed below. Participants and contributors to the Nebraska Bridge Inspection Program are advised to go to the NDOT Bridge Inspection Program website http://dot.nebraska.gov/business-center/bridge/forms/ for the current list of applicable forms and the most recent versions of each form.

Name	DR Form
Structural Inventory and Appraisal	N/A

3-EI.24 APPENDIX A: INSPECTION EXAMPLES

3-EI.24.1 General

Memos and other guidance that may have been issued after the issuance of the current revision of this Chapter can be found at the NDOT Bridge Inspection Program website at http://dot.nebraska.gov/business-center/bridge/inspection/

Participants are urged to check this site to ensure they have all the most current information and forms.

The element level inspection allows for a more acute evaluation of bridge components by breaking out the standard NBI Structural Categories (i.e. deck, superstructure, substructure, etc.) into the specific components, or elements that comprise those categories.

While this may appear cumbersome at first, the element level inspection allows the inspector to view the structure more intently and may provide the inspector with more information to determine the most appropriate NBI coding.

Included with all elements is an Environmental State. This state is used for project development and deterioration modeling. Those elements exposed to deicing agents, located at or under deck joints, or exposed to standing or running water are subjected to harsher conditions. Referring to Section 3-EI.5.2 Element Inspection Coding of Chapter 3, the inspector will notice a flow chart that determines the Environmental State that shall be applied to all elements. The inspector will also note that there is a “hidden elements” branch in the flow chart which equates to an element that has never been exposed, or was exposed and then covered. These elements should be coded “0” under the environmental state. Grade beam piling and grade beams are the only “hidden” elements. Once the grade beam caps or piling become exposed they shall be evaluated and recorded under the appropriate environmental state.

This Appendix is intended to provide the reader with several examples that detail the element break down of typical bridge structures seen throughout the Nebraska roadway system. The examples provide an appropriate amount of information for an inspector to assemble the primary elements for each structure. After a total quantity is determined, it is the inspector’s responsibility to evaluate each element by its assigned unit of measure and determine and record the appropriate defects within each unit of measure.

Please note, that while the Appendix is an aid, no two structures are the same. Consequently, this Appendix does not include every possible element listed within Chapter 3-EI Element Inspection Coding. It is the inspector’s responsibility to accurately determine the appropriate elements and defects that make up a particular structure.

Refer to the AASHTO *Manual for Bridge Element Inspection*, 1st Edition 2013, Appendix B for specific examples of determining defects and the appropriate Condition State on bridge elements.

3-EI.24.2 Simple Span Concrete Slab

Superstructure: 30’-0 simple span concrete slab

Structure located in Environmental Zone 2

ADTT = 10 and low salt use

Substructure: Steel sheet piling supported by wide flange walers and H-piles

Traffic Appurtenances: W-beam rail supported by steel wide flange posts

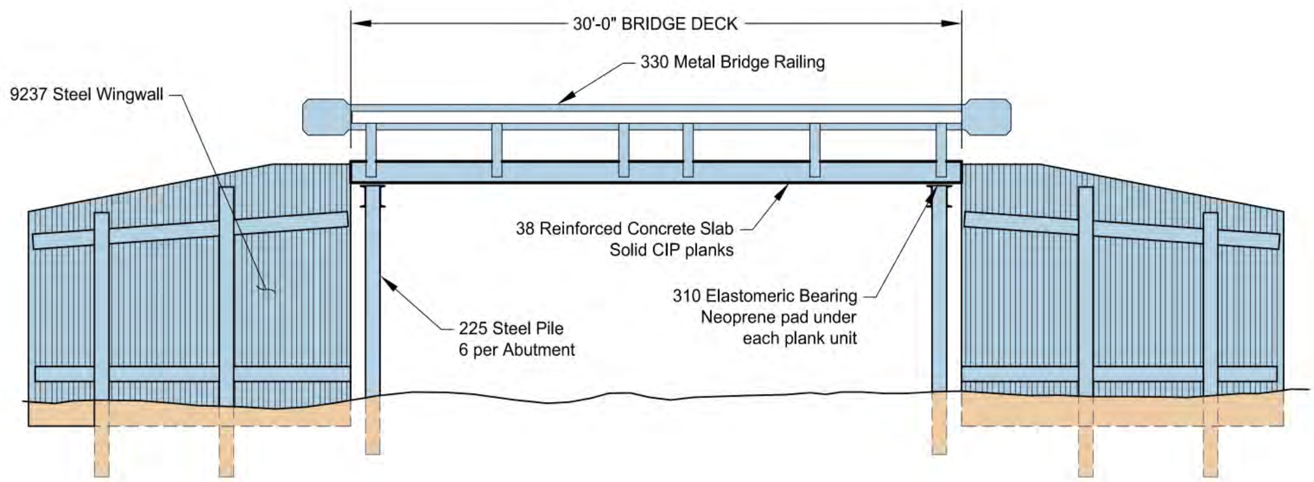


Figure 3-EI.24.2-1: Elevation view of simple concrete slab bridge

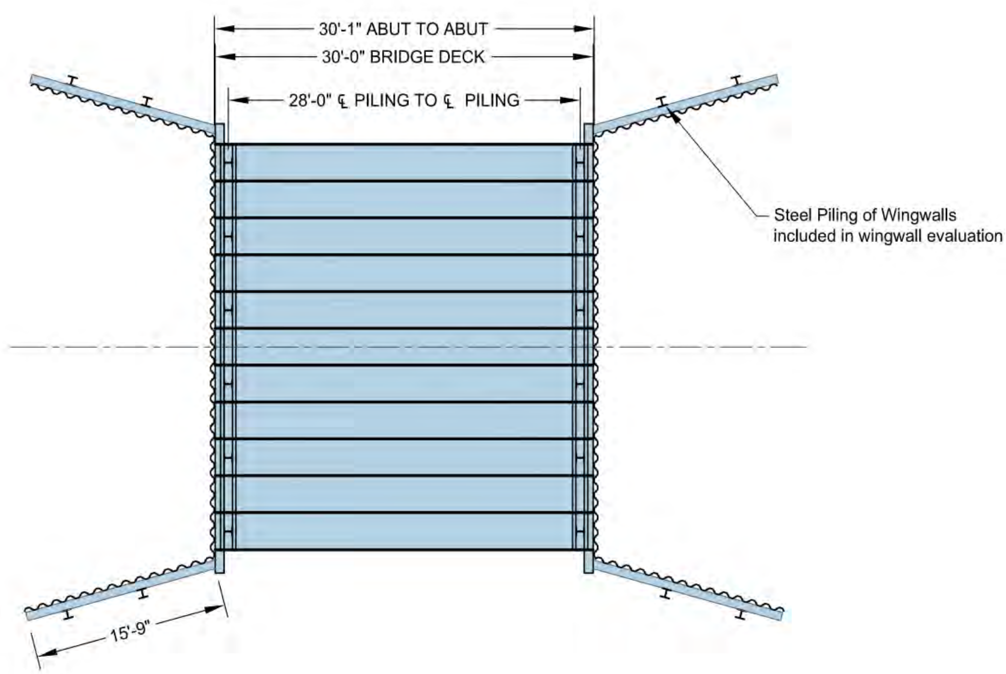


Figure 3-EI.24.2-2: Plan view of simple concrete slab bridge

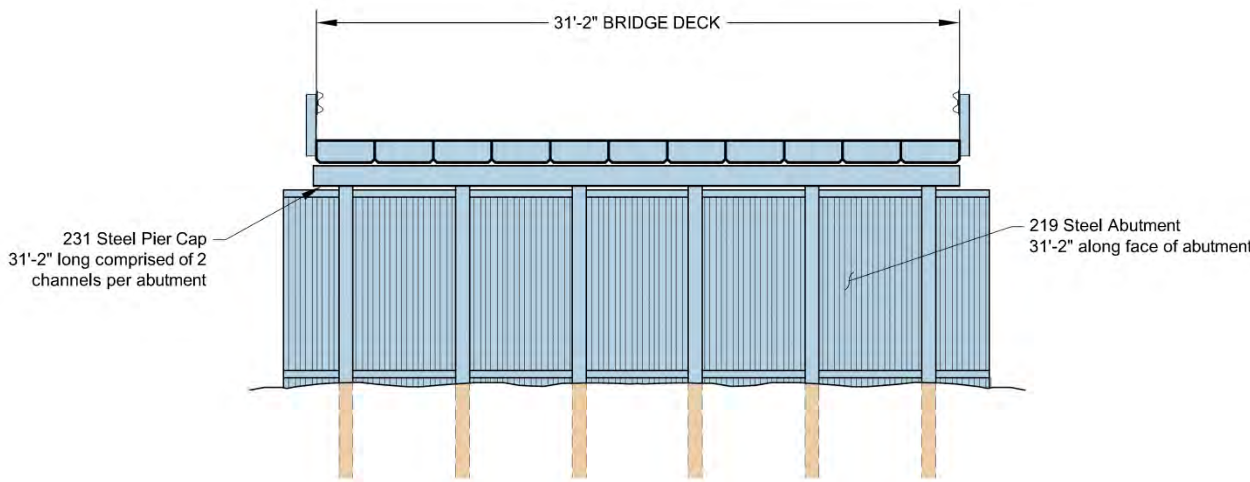


Figure 3-EI.24.2-3: Cross section half-view of simple concrete slab bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume Deck joints are not leaking.

Deck and elements under joints: Environmental State = 2 (for zone 2) + 0 (for low salt use) + 0(for ADTT < 1000) = 2

Super and substructure elements not under joints: Environmental State = 2 (for zone 2) + 0(for salt use) + 0(for ADTT< 1000) = 2

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	38	Reinforced Conc. Slab		SF	936	2
Quantity Calculation		*Span 1*	*30.0' x 31.2' = 936*			
M	310	Elastomeric Bearing		EA	22	2
Quantity Calculation		*Span 1*	*11 x 2 = 22*			
M	330	Metal Bridge Railing		FT	60	2
Quantity Calculation		*Span 1*	*30.0 x 2 = 60*			

Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	219	Steel Abutment	FT	63	2
Quantity Calculation	*Span 1*	*31.2 x 2 = 63*			
M	225	Steel Pile	EA	12	2
Quantity Calculation	*Span 1*	*6 x 2 = 12*			
M	231	Steel Pier Cap	FT	63	2
Quantity Calculation	*Span 1*	*31.2' x 2 = 63*			
M	9237	Steel Wingwall	FT	63	2
Quantity Calculation	*Span 1*	*15.75' x 4 = 63*			

Element Commentary – Simple Span Concrete Slab

38 Reinforced Concrete Slab – Solid

Use slab element when girder elements are not present. This slab bridge was constructed using precast concrete units. The units act as one which is most similar to a slab.

Rate each square foot of the slab using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes the top, bottom, and edges of the slab when visible.

Assess overlays and forms using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or stay-in-place forms to assess the slab when no surfaces of the slab are visible. Do not include the condition of the rail or curb in the assessment of the slab.

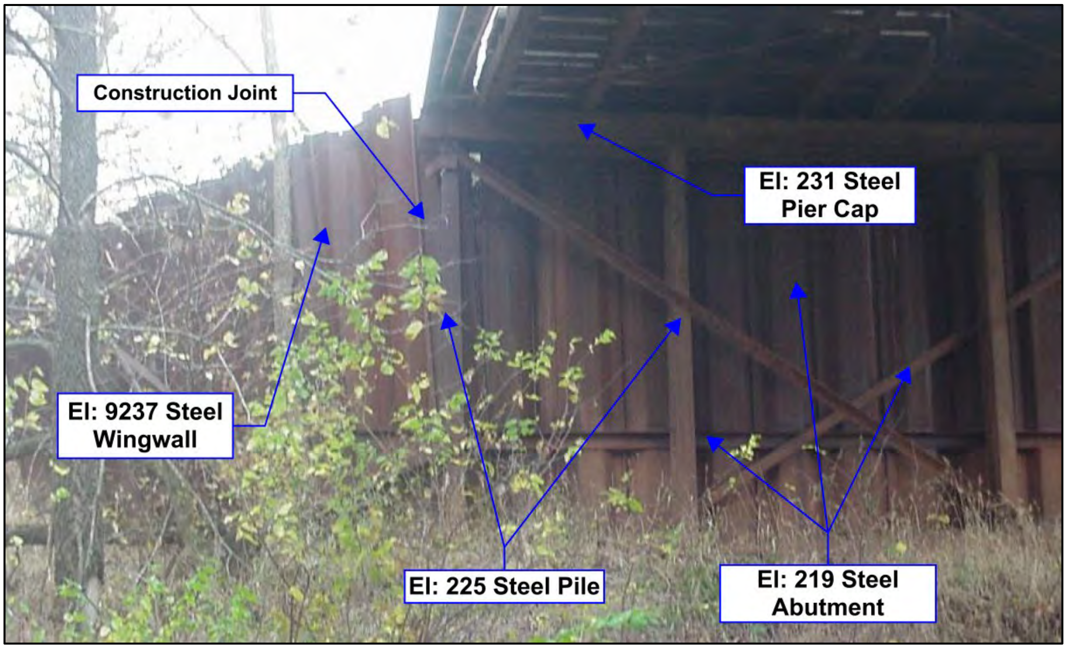
219 Steel Abutment

Use when the piling is comprised of steel and/or when steel sheet piling is used as the primary component to retain roadway fill. Wingwalls are included in the abutment element when they are integral or if they are not independent of one another. Steel sheet piling, for example, that continues beyond the limits of the superstructure is assessed under the abutment element so long as the sheet piling is interlocked continuously.

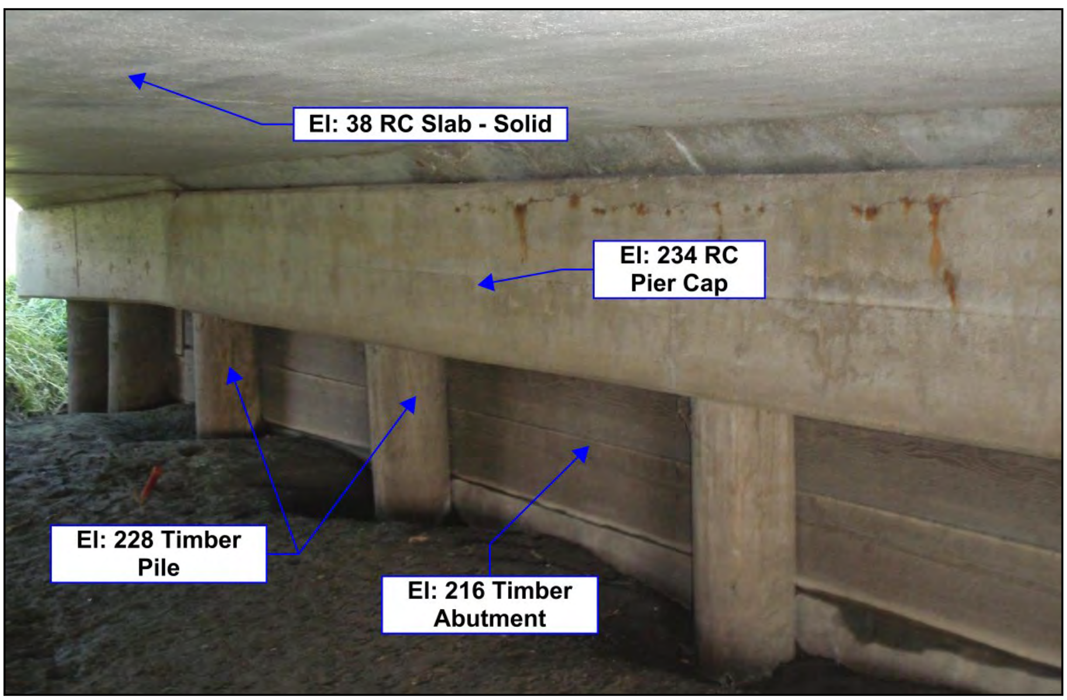
Rate each linear foot of the abutment using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes the full height of the abutment.

Wingwalls parallel to the abutment should be included in the length of the abutment. Wingwalls that are flared or perpendicular to the abutment are assessed under another NDOT BME. Element 9237 Steel Wingwall would be used when steel sheeting is used.

Steel Abutment Example



Timber Abutment Example (for Comparison)



225 Steel Pile

Assess each exposed steel pile supporting the abutment quantity using condition state definitions. Assign the overall condition state per exposed pile.

Include wingwall piles if the wing is included in the abutment quantity. Do not include piling for wingwall elements, as they are included in the wingwall assessment.

Only those piles that are exposed and visible shall be inspected and quantified and assigned the appropriate Environmental State. Hidden piles are not quantified on the inspection report and thus will not have an Environmental State associated with them. The only exceptions to this rule are the Grade Beam Pile elements. These piling shall be quantified, regardless if exposed or not. Hidden grade beam piling will have an Environmental State of "0" assigned to them. Exposed grade beam piling shall be evaluated using the appropriate Environmental State.

Piles may be exposed due to scour, erosion, settlement, etc. and then filled back in or repaired. If piling originally exposed had been inspected and subsequently buried, the inspector shall keep the piling quantity on the inspection report and note the piling has been buried, whether by natural or manmade countermeasures.

231 Steel Pier Cap

Use when the superstructure bears along a cap on a pile bent, regardless if an abutment or pier.

Rate each linear foot of the steel cap using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes all sides of the cap element. In this example the cap is constructed of two steel channels separated between the piling. Both channels are assessed as one element. The inspector should record the worst condition of either channel along each foot.

310 Elastomeric Bearing

Use when the slab bears on a pad of elastomeric material (a simple pad or reinforced with steel plate).

Rate each bearing using the condition state definitions. The assessment represents the worst condition found on each bearing.

330 Metal Bridge Railing

Use when metal rail beam and posts are used as the traffic appurtenances on the bridge structure. The element does not include the portions of the rail that extend beyond the limits of the bridge or abutment onto the roadway approaches.

Rate each linear foot of the metal rail using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes all sides of the bridge railing, posts, and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

Remaining portions of rail off the bridge are assessed under an NDOT BME in element level inspection. For this example all railing components are to be assessed under element 330. There is no approach rail.

9237 Steel Wingwall

Use when steel sheet piling and piling are used to retain roadway fill beyond the extents of the steel abutment sheeting under the superstructure. While steel sheeting is typically “locked” together, the joint created acts more as a hinge, thus making steel sheet piling in essence not integral.

Rate each linear foot of the steel wingwall using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes the full height of the steel sheeting, steel piling, and steel waling, if present. Since piling condition is included with this element, do not include wing piling within the piling element.

3-EI.24.3 Continuous Concrete Slab

Superstructure: 92'-0 continuous concrete slab

Structure located in Environmental Zone 3

ADTT = 500 and low salt use

Substructure: Semi-integral concrete abutment supported by steel piling

Traffic Appurtenances: Concrete open rail supported by concrete posts

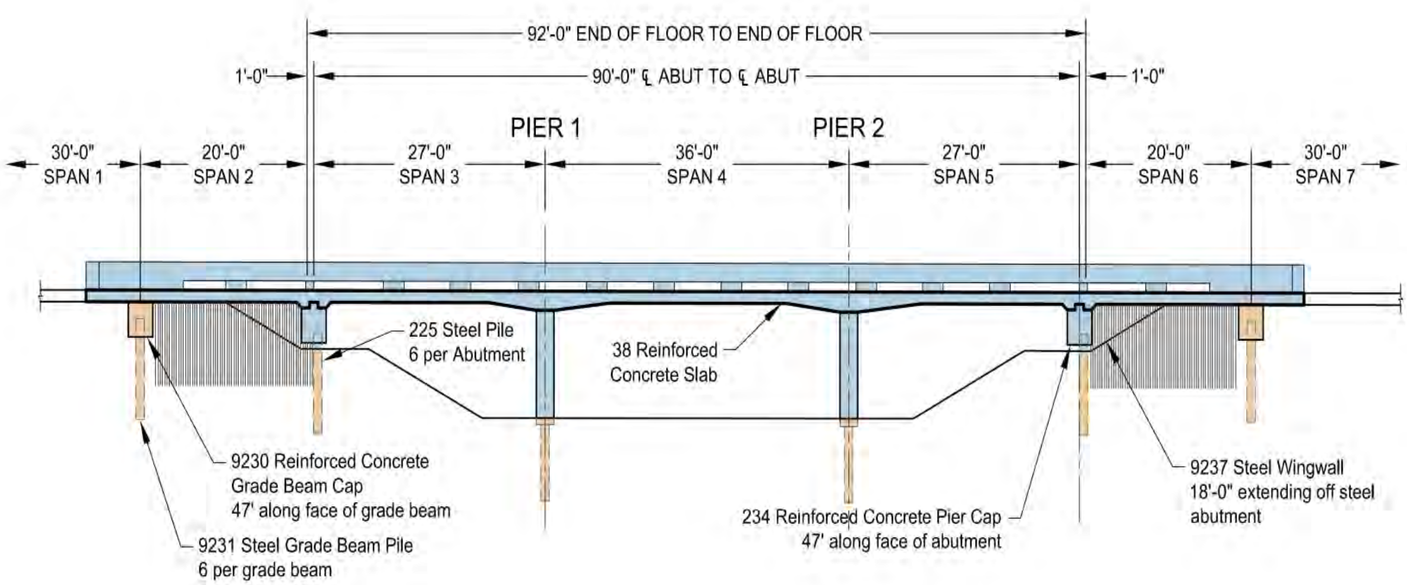


Figure 3-EI.24.3-1: Elevation view of continuous concrete slab bridge

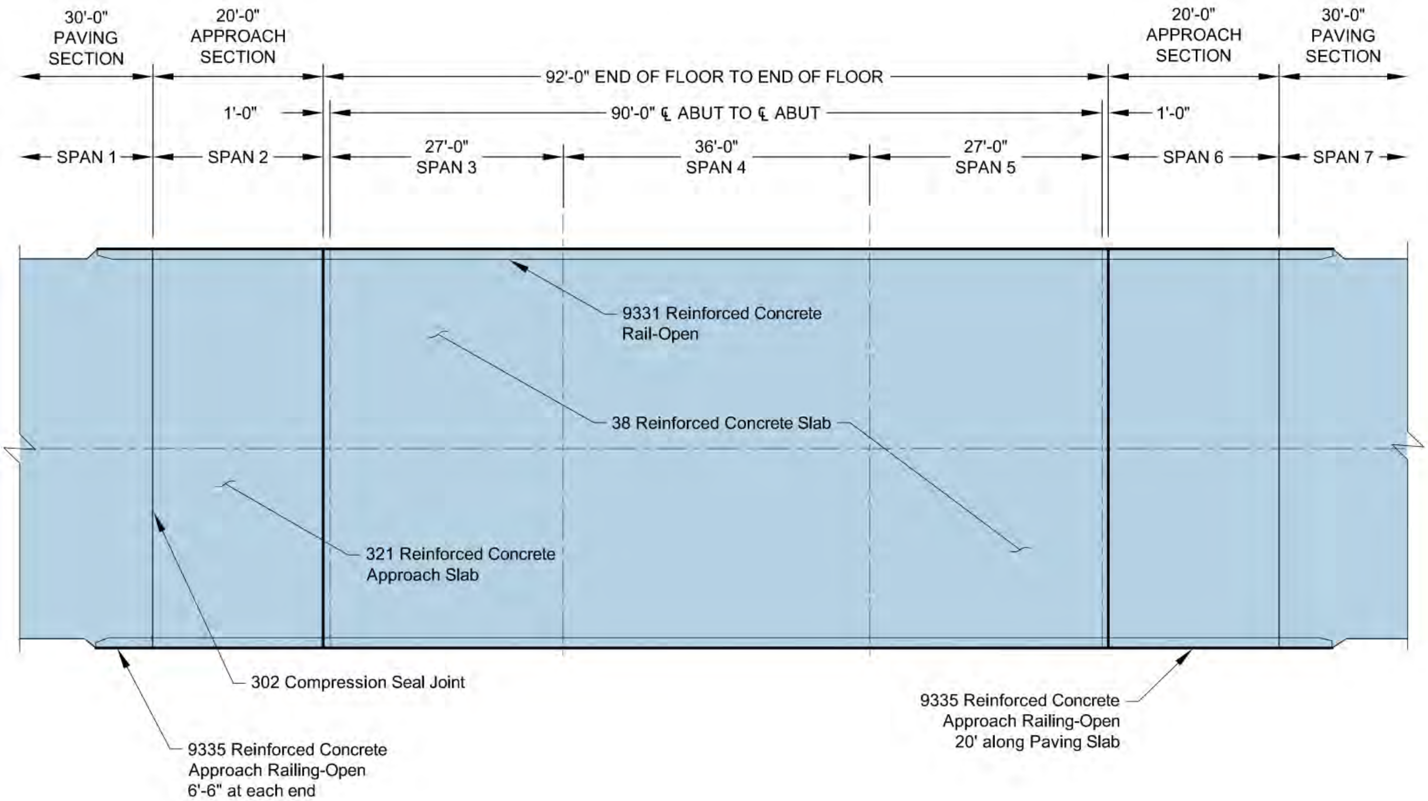


Figure 3-EI.24.3-2: Plan view of continuous concrete slab bridge

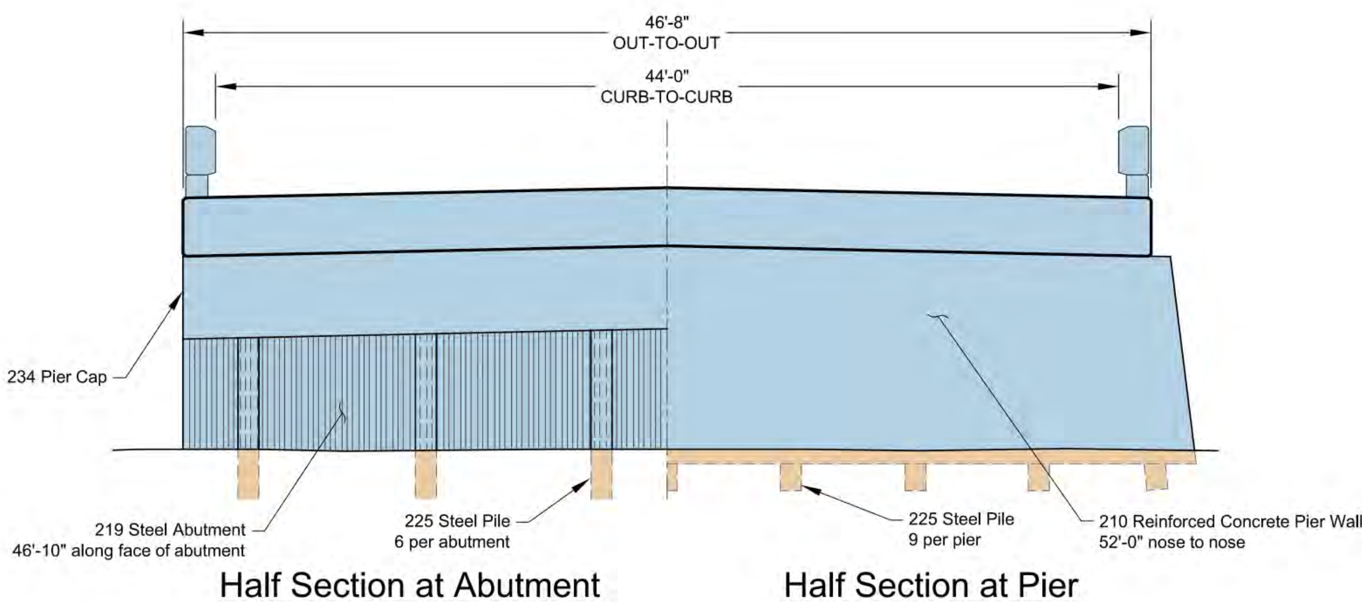


Figure 3-EI.24.3-3: Cross section view of continuous concrete slab superstructure

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 3 (for zone 3) + 0 (for low salt use) + 0(for ADTT < 1000) = 3

Super and substructure elements not under joints: Environmental State = 3 (for zone 3) + 0 (for no leakage) + 0 (for ADTT < 1000) = 3

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	38	RC Slab - Solid		SF	4,294	3
Quantity Calculation		*Span 3*	*28' x 46.67' = 1,307*			
		Span 4	*36' x 46.67' = 1,680*			
		Span 5	*28' x 46.67' = 1,307*			
M	9331	RC Bridge Railing - Open		FT	184	3
Quantity Calculation		*Span 3*	*28' x 2 = 56*			
		Span 4	*36' x 2 = 72*			
		Span 5	*28' x 2 = 56*			

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	210	RC Pier Wall		FT	104	3
Quantity Calculation		*Span 3*	*52'*			
		Span 4	*52'*			
M	219	Steel Abutment		FT	94	3
Quantity Calculation		*Span 3*	*46.83'*			
		Span 5	*46.83'*			
M	225	Steel Pile		EA	12	3
Quantity Calculation		*Span 3*	*6*			
		Span 3	*9 (unexposed)*			
		Span 4	*9 (unexposed)*			
		Span 5	*6*			
M	234	RC Pier Cap		FT	94	3
Quantity Calculation		*Span 3*	*47'*			
		Span 5	*47'*			

Approach						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
P	302	Compression Seal Joint		FT	93	3
Quantity Calculation		*Span 2*	*46.7'*			
		Span 6	*46.7'*			
P	321	RC Paving Slab		SF	4,320	3
Quantity Calculation		*Span 1*	*30' x 44' = 1320*			
		Span 2	*20' x 44' = 840*			
		Span 6	*20' x 44' = 840*			
		Span 7	*30' x 44' = 1320*			
P	9230	RC Grade Beam Cap		FT	94	0
Quantity Calculation		*Span 2*	*47' (unexposed)*			
		Span 6	*47' (unexposed)*			
P	9231	Steel Grade Beam Pile		EA	12	0
Quantity Calculation		*Span 2*	*6 (unexposed)*			
		Span 6	*6 (unexposed)*			
P	9237	Steel Wingwall		FT	72	3
Quantity Calculation		*Span 2*	*18' X 2 = 36*			
		Span 6	*18' X 2 = 36*			
P	9335	RC Approach Railing - Open		FT	106	3
Quantity Calculation		*Span 2*	*(20' + 6.5') x 2 = 53*			
		Span 6	*(20' + 6.5') x 2 = 53*			

Element Commentary – Continuous Concrete Slab

38 Reinforced Concrete Slab – Solid

Use solid slab element when no voids are present within the superstructure. The slab element is used when girder elements are not present.

Rate each square foot of the slab using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes the top, bottom, and edges of the slab when visible.

Assess overlays using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or stay-in-place forms to assess the slab when no surfaces of the slab are visible.

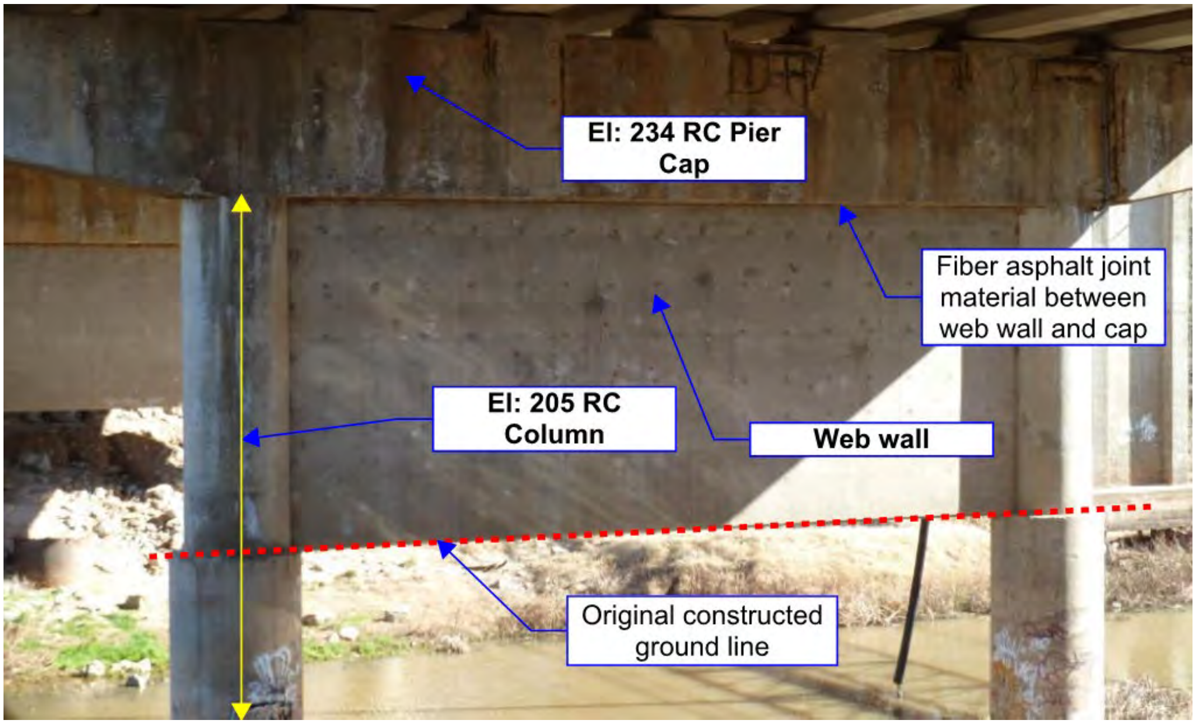
210 Reinforced Concrete Pier Wall

Use when the substructure unit is not comprised of piling or columns and directly supports the superstructure (a cap may also be part of a pier wall).

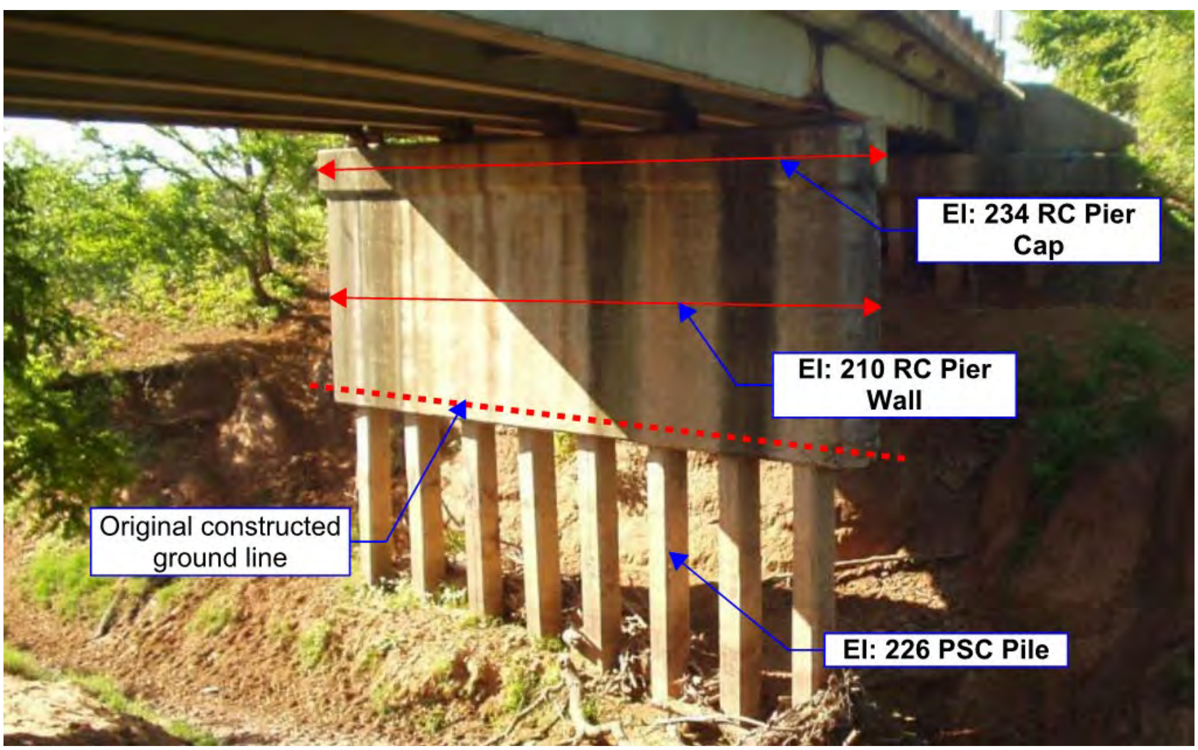
Rate each linear foot of the pier wall using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes the full height of the pier wall, both sides, and top when there is no cap.

Piers with columns and intermediate web walls, or diaphragms may look like pier walls. These components are commonly seen on solid piers; however web walls are noticeably thinner than the columns within the pier. While these components may extend the same height as the columns, their main purpose is to support the columns. The web walls or diaphragms are not intended to support the superstructure loading and are secondary members. See examples below:

Pier Web Wall Example



Pier Cap and Pier Wall Example



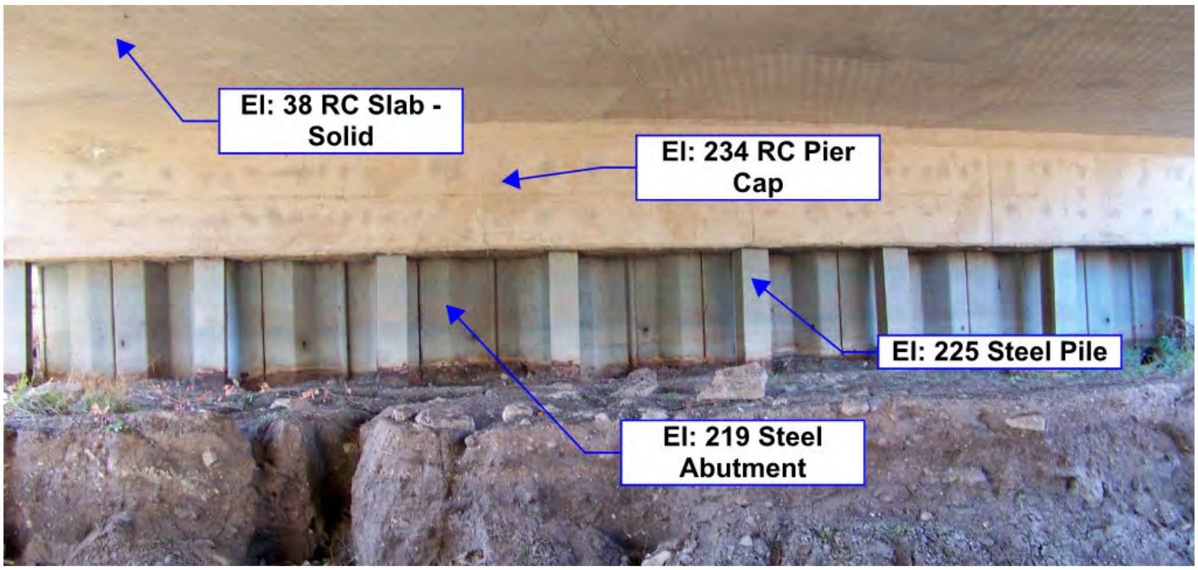
219 Steel Abutment

Refer to example 3-EI.24.2 Simple Concrete Slab for further discussion on this element.

Use element 219 for the steel sheet piling retaining the fill in this example where steel sheet piling is used under the concrete cap at the abutment.

If the sheet piling was concrete, then element 215 Reinforced Concrete Abutment would be used to assess sheet pile and abutment cap.

Steel Abutment Example



225 Steel Pile

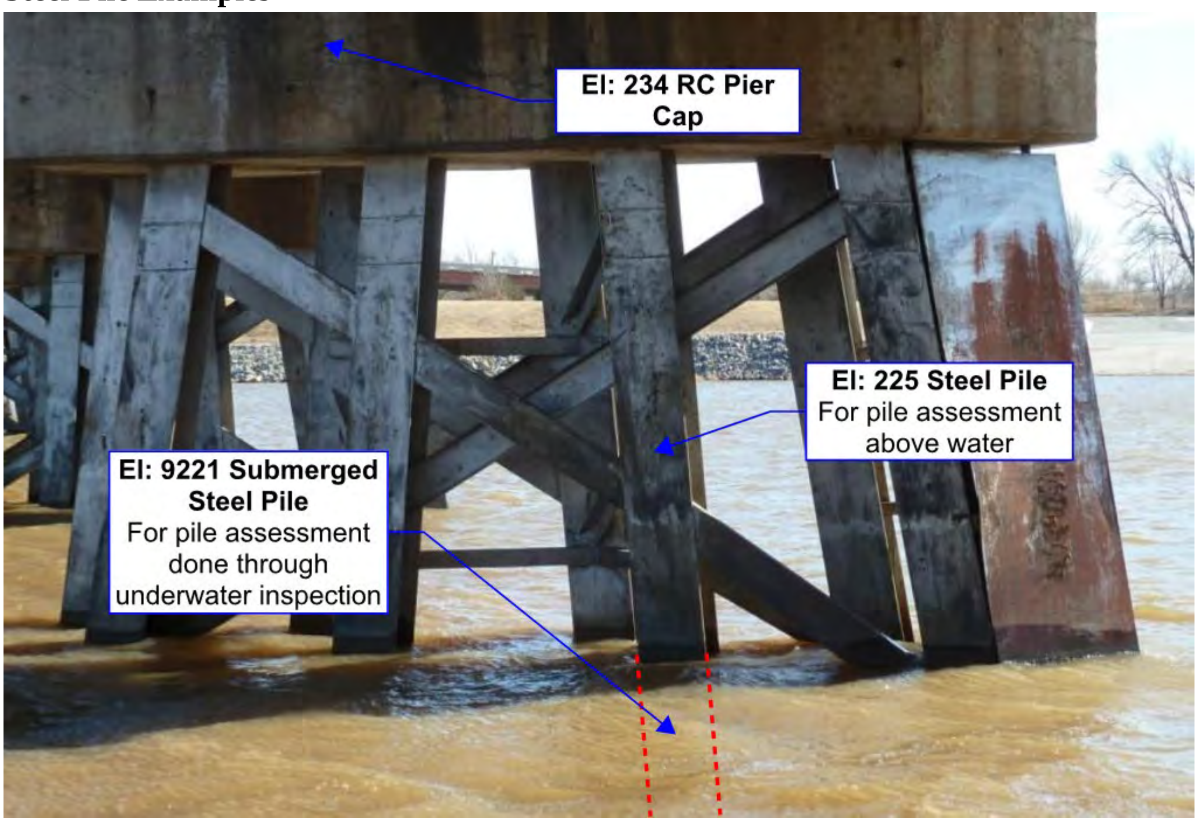
Refer to example 3-EI.24.2 Simple span Concrete Slab for further discussion on this element.

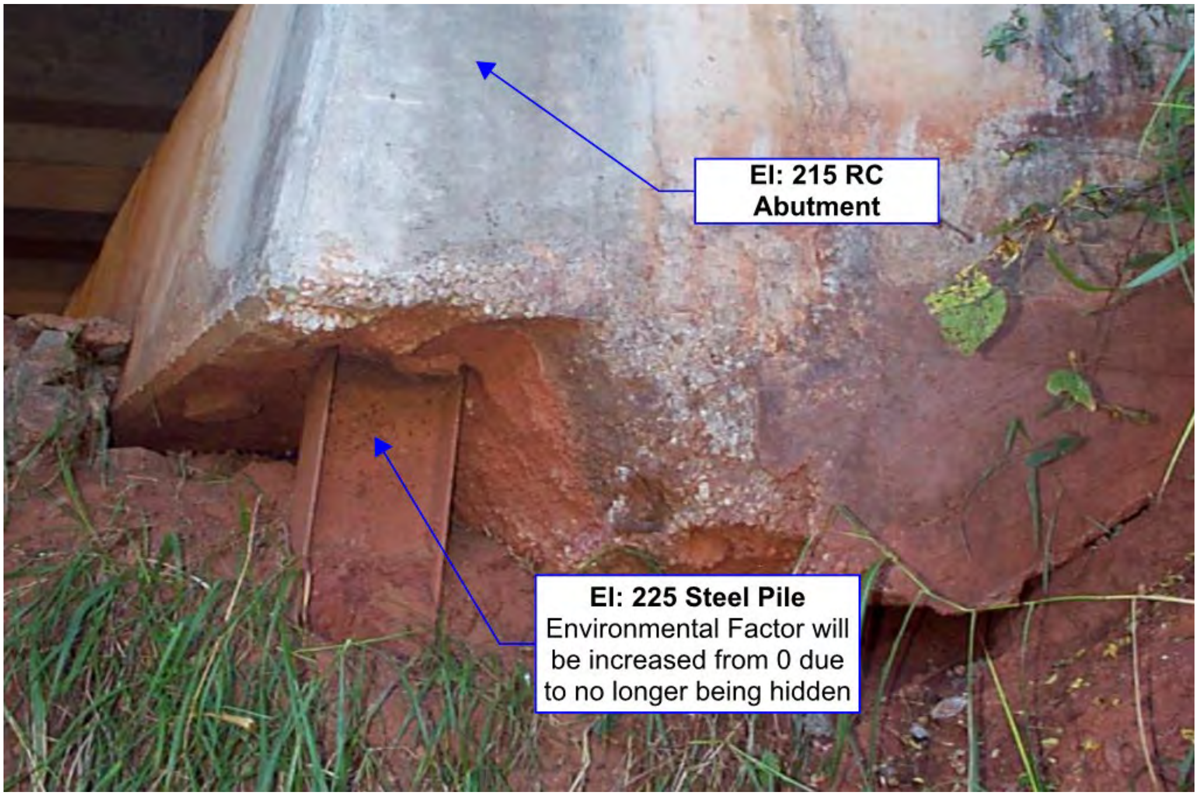
In this example, the steel piling at the abutment are exposed while the pier wall piling is hidden. Only those piles that are exposed and visible shall be inspected and quantified and assigned the appropriate Environmental State. Hidden piles are not quantified on the inspection report and thus will not have an Environmental State associated with them. The only exceptions to this rule are the Grade Beam Pile elements. These piling shall be quantified, regardless if exposed or not. Hidden grade beam piling will have an Environmental State of "0" assigned to them. Exposed grade beam piling shall be evaluated using the appropriate Environmental State.

Piles may be exposed due to scour, erosion, settlement, etc. and subsequently filled back in or repaired. If piling originally exposed had been inspected and subsequently buried, the inspector shall remove the piling quantity that was buried from the inspection report. If the exposed piling (prior to being buried) is in poor condition, the inspector shall fill out a work candidate form. If buried, the appropriate piling quantity will be removed from the inspection report, however the work candidate form will ensure that the Department is aware of the piling in poor condition.

Divers will use element 9225 Submerged Steel Pile to rate steel piles below the normal pool elevation. Other inspectors will use element 225 Steel Pile to rate steel piles above the normal pool elevation and for steel piles submerged in water but not inspected by divers. Some piles may be completely submerged. In this instance only use element 9225. Partially submerged piles that undergo underwater inspection will use elements 9225 and 225 for each pile. The purpose for this is to assure that piles above the waterline are inspected and rated on the proper frequency. See example below:

Steel Pile Examples





When element 225 becomes exposed:

1) Rate the condition of the exposed pile.
2) Assign the appropriate Environtmental State to the exposed pile.
3) For grade beam piling, quantify the piling and assign an Environmental State of "0"

If the pile becomes hidden/buried:

1) Remove the unexposed piling quantity from the inspection report.

234 Reinforced Concrete Pier Cap

Use when abutment is comprised of a pile bent and cap, with sheeting or lagging located within the cap and exposed to retain roadway fill. In this example the abutment is comprised of exposed steel sheeting, steel piling and a concrete cap. The steel sheeting is considered the abutment as it retains the fill qualifying the abutment cap as element 234.

Rate each linear foot of the cap at the abutment using the condition state definitions. The assessment represents the worst condition state of each linear foot, which includes all exposed sides of the cap element.

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

321 Reinforced Concrete Paving Slab

Use when roadway approaches immediately adjacent to bridge structure are composed of reinforced concrete. When the approach slab spans between the bridge abutment and a grade beam, the paving slab beyond the approach slab shall also be included within the evaluation of this element. If no grade beam is present, only the paving slab immediately adjacent to the bridge shall be evaluated.

Rate each square foot of the approach using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes only the top of the approach.

Assess overlays using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface to assess the approach when the top surface is not visible.

9230 Reinforced Concrete Grade Beam Cap

Use this element when a grade beam is supported by piling and supports the approach slabs adjacent to the bridge structure.

For hidden grade beams code the Environment State “0” and the Condition State 1. For exposed grade beams change the environment to the appropriate 1 to 4 rating and assess the condition of each exposed linear foot of the concrete grade beam using the condition state definitions. If the grade beam is hidden in future inspections change the environment back to “0”, but maintain the exposed condition state unless repairs were made. The assessment is three dimensional in nature. Each linear foot shall be represented by the worst condition state defect.

9231 Steel Grade Beam Pile

Use this element for the approach grade beam.

For hidden grade beams piles code the Environment State “0” and the Condition State 1. For exposed grade beams change the environment to the appropriate rating and rate the condition of each exposed pile using the condition state definitions. If the grade beam pile is hidden in future inspections change the environment back to “0”, but maintain the exposed condition state unless repairs were made. The assessment should represent the worst condition state of each pile.

9237 Steel Wingwall

Use this element for the exposed steel sheet pile wingwalls. If the soil of the embankment covers this element, it should not be recorded during an inspection and the wingwall would then be considered the cap located on top of the sheet piling (most likely comprised on reinforced concrete).

Rate the worst condition found in the exposed height of each linear foot of wingwall using the condition state definitions.

9331 Reinforced Concrete Bridge Railing – Open

Use when reinforced concrete rail beam and posts are used as the traffic appurtenances on the bridge structure. The element does not include the portions of the rail that extend beyond the abutments.

Rate the worst condition found for each linear foot of the concrete rail using the condition state definitions. Each linear foot includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

Element 331 – Reinforced Concrete Bridge Railing Example

Typical Approach:

*Use Element 9336 when concrete rail is attached to the wingwall.

**Use Element 9334 when concrete rail is attached to the approach slab

9335 Reinforced Concrete Approach Railing – Open

Use this element for the portions of element reinforced concrete railing attached to the approach slab that has openings and extends from the end of the bridge (edge of paving notch) or beyond the abutment. This element should not be used for portions of rail on top of wingwall.

Use element 9336 Reinforced Concrete Approach Rail on Wingwall, if the rail is integral with the wingwalls rather than the approach slab.

Use element 9339 and 9340 Reinforced Concrete Transition Railing – Closed and Open, respectively when the rail (not on the bridge) tapers down to the roadway. The transition rail element would be most likely encountered in urban bridge structures.

Rate each linear foot of the concrete rail using the condition state definitions. Measure transition rail from the joint at the abutment to the joint that separates the transition portion of rail from the approach rail, unless element 9336 is used. The assessment should represent the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects. For example a timber curb located in front of a reinforced concrete bridge rail would be assessed under the bridge railing element, however the material defects for timber would be incorporated under the element.

3-EI.24.4 Concrete Frame (Not Box Culvert)

Superstructure: 180’-10 concrete rigid frame

Structure located in Environmental Zone 2

ADTT = 1200 with high salt use in winter

Substructure: Stub and full height concrete abutments. The pier legs are concrete columns rigidly connected to the superstructure beams.

Traffic Appurtenances: Metal railing supported by metal posts

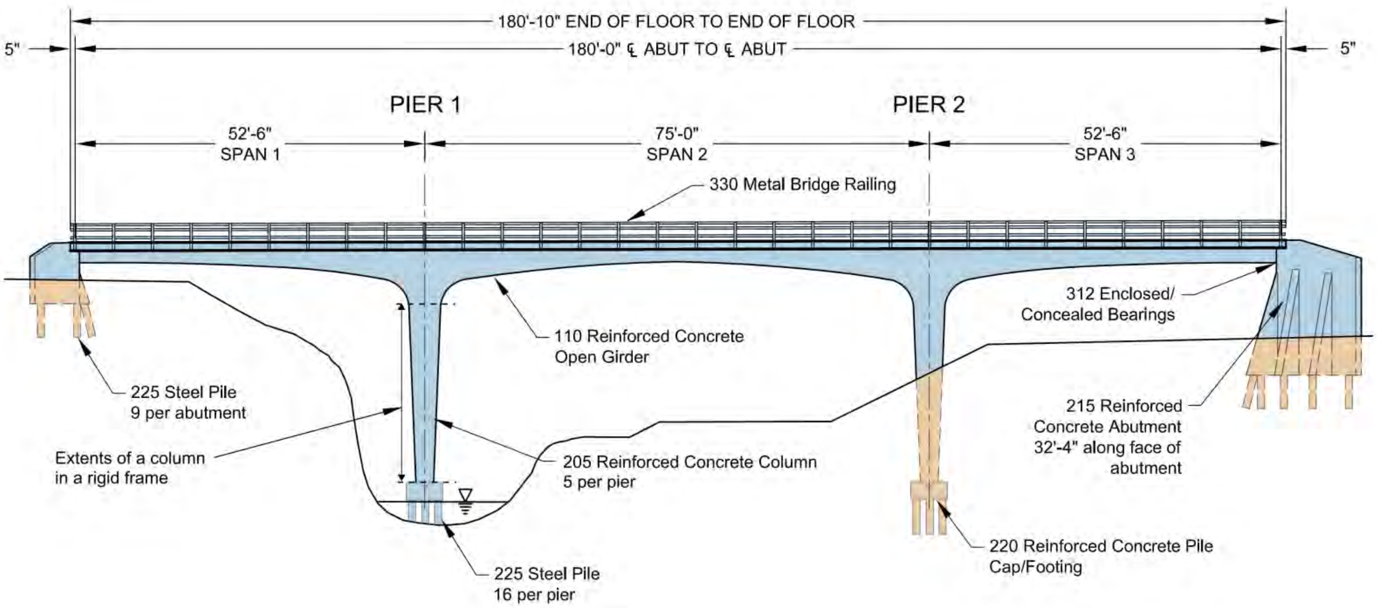


Figure 3-EI.24.4- 1: Elevation view of concrete rigid frame

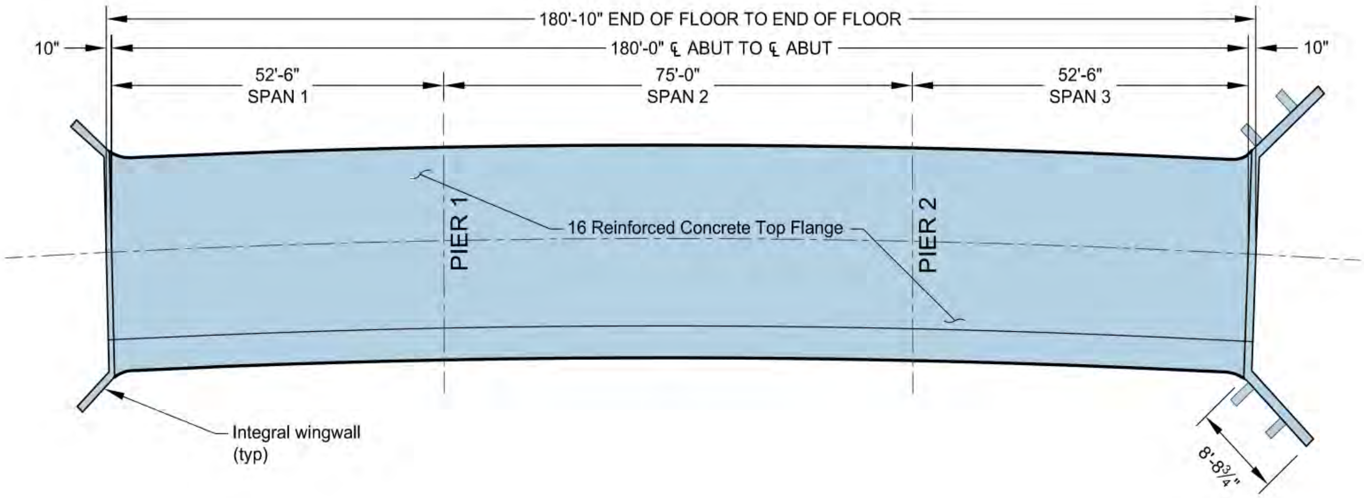


Figure 3-EI.24.4- 2: Plan view of concrete rigid frame

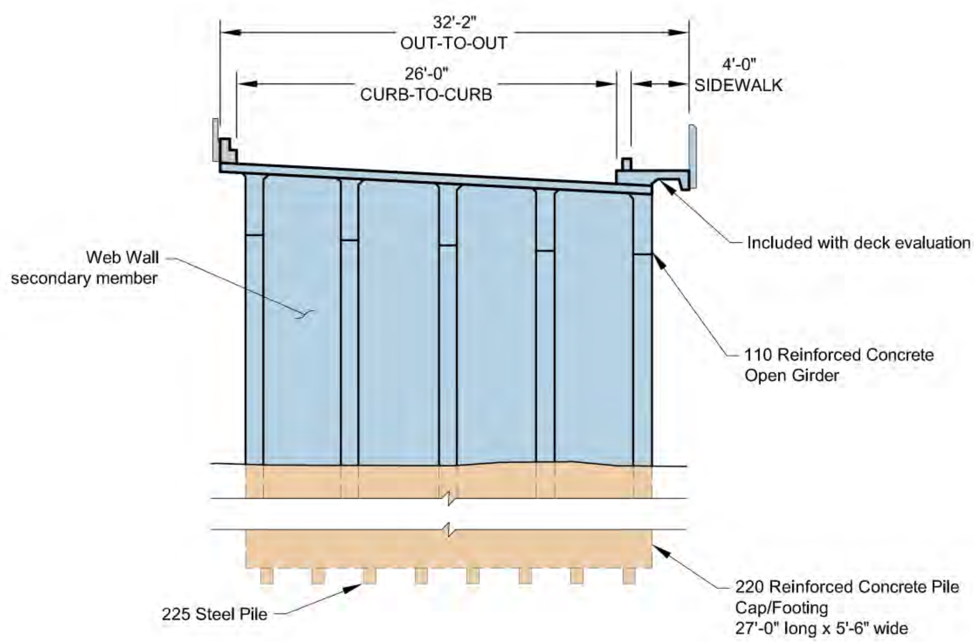


Figure 3-EI.24.4- 3: Cross section of superstructure near centerline pier

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each Deck joint in not leaking.

Deck and elements under joints: Environmental State = 2 (for zone 2) + 1 (for high salt use) + 1(for ADTT > 1000) = 4

Super and substructure elements not under joints: Environmental State = 2 (for zone 2) + 0 (for no joint leakage) + 1(for ADTT> 1000) = 3

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	16	RC Top Flange		SF	5,822	4
Quantity Calculation		*Span 1*	*52.9' x 32.2' = 1703.38*			
		Span 2	*75' x 32.2' = 2415*			
		Span 3	*52.9' x 32.2' = 1703.38*			
M	110	RC Open Girder		FT	904	3
Quantity Calculation		*Span 1*	*52.9' x 5 = 264.5*			
		Span 2	*75' x 5 = 375*			
		Span 3	*52.9' x 5 = 264.5*			
M	312	Enclosed/Concealed Bearing		EA	10	3
Quantity Calculation		*Span 1*	*5*			
		Span 3	*5*			
M	330	Metal Bridge Railing		FT	362	4
Quantity Calculation		*Span 1*	*52.9' x 2 = 105.8'*			
		Span 2	*75' x 2 = 150'*			
		Span 3	*52.9' x 2 = 105.8'*			

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	205	RC Column		EA	10	3
Quantity Calculation		*Span 2*	*5 x 2 = 10*			
M	215	RC Abutment		FT	99	3
Quantity Calculation		*Span 1*	*32.3' +(8.7' x 2) = 49.7'*			
		Span 3	*32.3' +(8.7' x 2) = 49.7'*			
M	220	RC Pile Cap/Footing		FT	27	3
Quantity Calculation		*Span 2*	*27'*			
		Span 2	*27 (unexposed)*			
M	225	Steel Pile		EA	16	3
Quantity Calculation		*Span 1*	*9 (unexposed)*			
		Span 2	*16*			
		Span 2	*16 (unexposed)*			
		Span 3	*9 (unexposed)*			

Element Commentary – Concrete Rigid Frame Bridge

Rigid frames in general are unique structures in relation to element level inspection. The superstructure and legs act as one unit. The bearings are at the base of the legs. Therefore, anything above the bearing is rated with the superstructure.

16 Reinforced Concrete Top Flange

Use the top flange element when the top flange acts as the driving surface for vehicles (even if overlay is present). The superstructure in this example can be viewed as a reinforced concrete tee beam. The top flange, while integral with the girder, also acts as the deck. For this type of superstructure (similar prestressed concrete layouts included) is essentially broken into two components where the top flange is separated from the web and assessed as a deck component and the leg or stem of the beam is assessed as a beam component. Therefore top flange defects will have no bearing on the condition of the beam component.

Rate each square foot of the top flange using the condition state definitions. The assessment represents the worst condition stated of each square foot, which includes the top, bottom, and edges of the flange when visible.

Assess overlays or wearing surfaces using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or wearing surface to assess the top surface of the top flange when the top surfaces of the top flange are not visible.

110 Reinforced Concrete Open Girder

Use when beam component of superstructure is composed of reinforced concrete. For this example, this element is used for assessing the webs and bottom flange of the tee-beams. The top flange is assessed under element 16 Reinforced Concrete Top Flange as the flange acts as both the beam flange and the driving surface.

Rate each linear foot of the beam using the condition state definitions. The assessment represents the worst condition stated of each linear foot, which include the web and bottom flange for this particular example.

Rigid frames consist of components that split where a portion (leg) turns down from the deck to a pier bearing while the remaining portion continues to an abutment or other bearing. In this situation the component above the fillet from the legs shall be evaluated under a superstructure component while the portion below shall be evaluated as a column element. Note that girder portions are evaluated per linear foot while the leg (column) portion is evaluated as an each measurement.

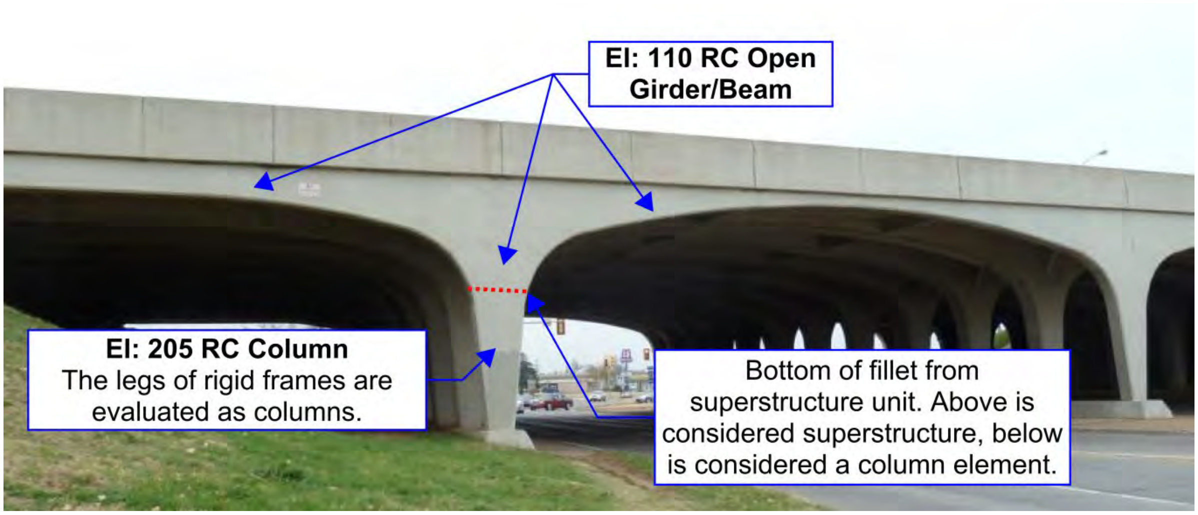
205 Reinforced Concrete Column

Use this element for those legs of a rigid frame. The legs of a steel rigid frame shall be evaluated similarly using element 202 Steel Column.

Rate each column using the condition state definitions. The assessment should represent the worst condition stated on the column. For a rigid frame, the column extents are from the bearing on the substructure to the bottom of the fillet from the superstructure element.

Assess piles under the appropriate elements. Piles, in contrast to columns, are driven to bearing.

Element 210 reinforced concrete pier wall would not be an applicable element for the piers in this example. While web walls are present between the columns, these act as diaphragms providing lateral resistance for the columns. Furthermore, a pier wall would not have isolated rectangular pile footings as foundations.



*Legs of Rigid Frames should be assessed under the appropriate column element. This is valid for any construction material.

215 Reinforced Concrete Abutment

Use when concrete abutment is the primary component supporting superstructure load and retaining roadway fill. Stub abutment and full height concrete abutments fall under this element.

Rate each linear foot of the abutment along the skew using the condition state definitions. Include wingwall lengths in the abutment quantity when there are no construction joints between the abutment and wingwalls to the first joint in the wing. The assessment represents the worst condition state of each linear foot, which includes the full height of the abutment and wingwalls (if present).

220 Reinforced Concrete Pile Cap/Footing

Use when pile cap or footings are exposed and capable of being inspected. Spread footings will fall under this element. Commonly, columns may be placed on a pile cap or footing as the foundation. Typically these elements are intentionally buried, however they may become exposed.

Divers will use element 9220 Submerged RC Cap/Footing to rate concrete cap/footing foundations underwater. Other inspectors will use element 220 RC Cap/Footing to rate concrete cap/footing foundations and for concrete caps/footing foundations submerged in water but not inspected by divers. The purpose for this is to assure that concrete cap/footing foundations are inspected and rated on the proper frequency.

Only Pile Cap/Footings that are exposed and visible shall be inspected and quantified and assigned the appropriate Environmental State. Hidden elements are not quantified on the inspection report and thus will not have an Environmental State associated with them (with the exception of Grade Beam Caps and Piling).

Pile Caps and Footings may be exposed due to scour, erosion, settlement, etc. and then filled back in or repaired. If a cap or footing, originally exposed, has been inspected and subsequently buried, the inspector shall keep the quantity on the inspection report and note the cap or footing has been buried, whether by natural or manmade countermeasures. If it is exposed or becomes exposed rate the element with the appropriate 1 to 4 environment state and condition state.

225 Steel Pile

Refer to example on 3-EI.24.2 Simple Span Concrete Slab for discussion on this element.

312 Enclosed/Concealed Bearing

Use when bearings are hidden, concealed or unknown. Concrete structures will commonly have full height abutments or pier diaphragms that make it difficult to distinguish bearing material or type.

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Assess the bearing by looking for evidence around the bearing for signs of bearing deterioration such as cracking, spalling, rust staining or leaching of the surrounding material. For this example the bearings are concealed by the concrete abutment and therefore fall under this element.

330 Metal Railing

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

Note that the curbs are also assessed under this element even when comprised of different construction material. In this instance, the defects associated with concrete should be used under the metal bridge railing element when assessing the curb.

3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder

Superstructure: 122’-0 7/8 single span prestressed concrete girder

Structure located in Environmental Zone 2

ADTT = 900 with high salt use

Substructure: Concrete pile bent abutments. The lower portions of the abutments are comprised of steel piling to retain approach roadway fill.

Traffic Appurtenances: Reinforced concrete open railing with approach and transition sections.

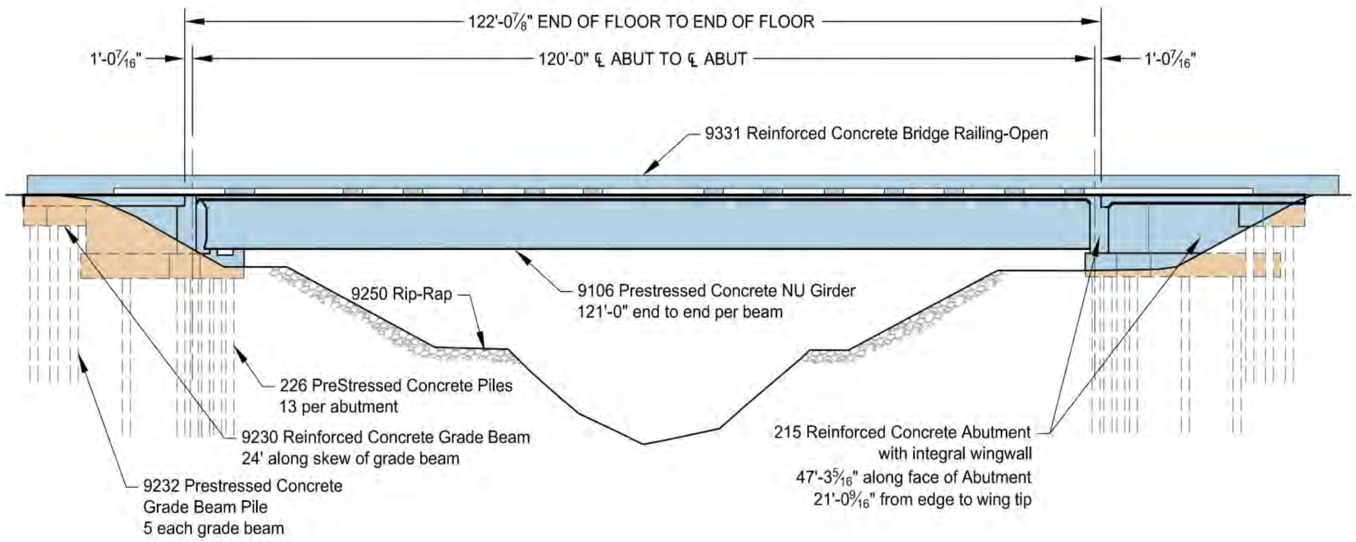


Figure 3-EI.24.5- 1: Elevation view of simple prestressed concrete beam bridge

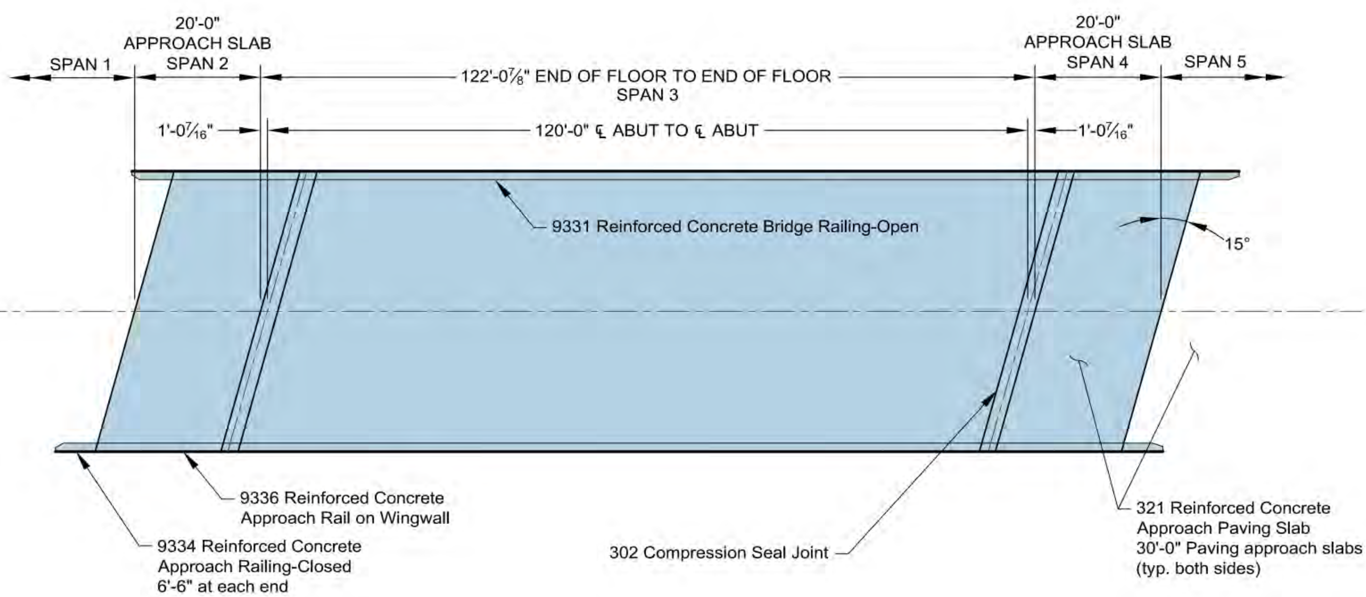


Figure 3-EI.24.5- 2: Plan view of simple prestressed concrete beam bridge

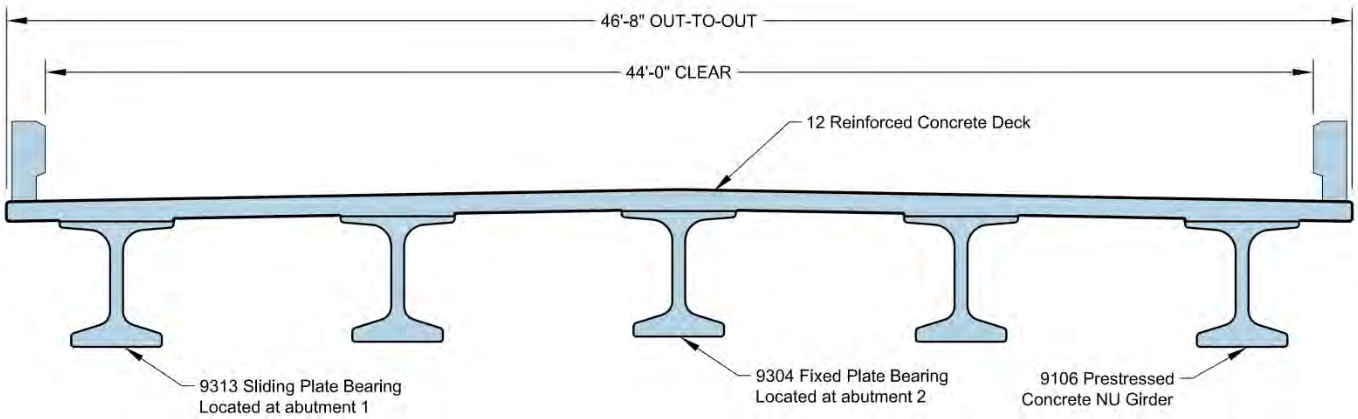


Figure 3-EI.24.5- 3: Cross section view of prestressed concrete beam bridge superstructure

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each Deck joint is not leaking.

Deck and elements under joints: Environmental State = 2 (for zone 2) + 1 (for high salt use) + 0 (for ADTT < 1000) = 3

Super and substructure elements not under joints: Environmental State = 2 (for zone 2) + 0 (for no leakage) + 0 (for ADTT < 1000) = 2

Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	12	RC Deck	SF	5,702	3
Quantity Calculations	*Span 3*	*122.1' x 46.7' = 5702.1*			
P	302	Compression Seal Joint	FT	97	3
Quantity Calculation	*Span 2*	*46.7' / cos(15 deg) = 48.3'*			
	Span 5	*46.7' / cos(15 deg) = 48.3'*			
M	9106	PSC NU Girder	FT	605	2
Quantity Calculations	*Span 3*	*121' x 5 = 605*			
M	9304	Fixed Plate Bearing	EA	5	2
Quantity Calculations	*Span 3*	*5*			
M	9313	Sliding Plate Bearing	EA	5	2
Quantity Calculations	*Span 3*	*5*			
M	9331	RC Concrete Bridge Railing - Open	FT	244	3
Quantity Calculations	*Span 3*	*122.1' x 2 = 244.2'*			

Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	215	RC Abutment	FT	179	2
Quantity Calculations	*Span 3*	*[47.3' +(21.0' x 2)] x 2 = 178.6'*			
M	226	PSC Pile	EA	Not Reported	-
Quantity Calculations	*Span 3*	*13 x 2 = 26 (unexposed)*			
M	9250	Riprap	FT	Field Measurement	2
Quantity Calculations	*Span 3*	*Field Measurement*			

Paving Approach					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
P	321	RC Paving Slab	SF	4,508	3
Quantity Calculation	*Span 1*	*30' x 44' = 1320*			
	Span 2	*20' x 46.7' = 934*			
	Span 4	*20' x 46.7' = 934*			
	Span 5	*30' x 44' = 1320*			
P	9230	RC Grade Beam Cap	FT	97	0
Quantity Calculation	*Span 2*	*46.76' / cos(15 deg) = 48.3' (unexposed)*			
	Span 5	*46.76' / cos(15 deg) = 48.3' (unexposed)*			
P	9232	PSC Grade Beam Pile	EA	10	0
Quantity Calculation	*Span*	*5 (unexposed)*			
	Span	*5 (unexposed)*			
P	9334	RC Approach Railing - Closed	FT	26	3
Quantity Calculations	*Span 1*	*6.5' x 2 = 13*			
	Span 5	*6.5' x 2 = 13*			
P	9336	RC Approach Rail on Wingwall	LF	80	3
Quantity Calculations	*Span 2*	*20' x 2 = 40*			
	Span 4	*20' x 2 = 40*			

Element Commentary Simple Span Prestressed Concrete Beam Bridge

12 Reinforced Concrete Deck

Use deck element when bridge superstructure component is supported by beams.

Rate each square foot of the deck using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which includes the top, bottom, and edges of the deck when visible.

Assess overlays and steel stay-in-place forms using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or stay-in-place forms to assess the slab when no surfaces of the slab are visible.

215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion of this element.

In this example, element 215 should be used because the concrete sill abutment is the intended member used to retain fill. Even though steel sheet piling is located under the concrete abutment, the berm elevation is above the bottom of the concrete abutment indicating the concrete abutment is retaining the embankment fill. If in the future, an event exposes the steel sheeting below the concrete abutment an argument could be made to include element 219 Steel Abutment. However, in its current state the sheeting shall not be recorded on the inspection report.

The integral wingwalls shown in this example would also be evaluated under the Reinforced Concrete Abutment element.

226 Prestressed Concrete Pile

Use when prestressed concrete piling supports the abutment cap, pier cap or footing.

Rate each exposed pile using the condition state definitions. The assessment should represent the worst condition found on each pile. In this example none of the piling is exposed, therefore the piling element would not be found on the inspection report.

PSC piling is typically square. While reinforced concrete piling does exist, prestressed piling is much more common and should be assumed unless found to be otherwise (existing plans, etc.).

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

321 Reinforced Concrete Paving Slab

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9106 Prestressed Concrete NU Girder

Use when prestressed concrete beam used as superstructure component. This element should not be used for prestressed box beams or other superstructure components that contain enclosed spaces. The NU girder is unique in design and resembles a bulb-tee girder. These girders were originally designed for Nebraska use. The inspector may need to refer to the bridge plans to verify the type of prestressed concrete girder encountered in the field.

Rate each linear foot of the beam using the condition state definitions. The assessment should represent the worst condition stated of each linear foot.

9230 Reinforced Concrete Grade Beam Cap

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9232 Prestressed Concrete Grade Beam Pile

Use this element for the approach grade beam.

For hidden concrete grade beams piles code the Environment State “0” and the Condition State 1. For exposed grade beams change the environment to the appropriate 1 to 4 rating and rate the condition of each exposed pile using the condition state definitions. If the grade beam pile is hidden in future inspections change the environment back to “0”, but maintain the exposed rating unless repairs were made. The assessment should represent the worst condition state of each pile.

9250 Riprap

Use for slope protection along banks in immediate vicinity of bridge.

Rate each linear foot of the riprap along the abutment length to its extents using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

It is not practical to measure the length of riprap for situations where the protection continues up and downstream. Measure the quantity along the channel from edge to edge of rip rap, edge to edge of deck plus the distance that would be affected by deck drainage, or to Right-of-Way lines. Capture the distance that maintenance would be responsible for.

9304 Fixed Plate Bearing

Use when bearing assembly allows for only rotational movement and is comprised of simply a metal plate(s). This is commonly achieved through an anchor bolt through the assembly into the substructure.

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Often in concrete bridges the bearings are concealed or difficult to inspect due to full height concrete diaphragms. When this is the case, the inspector should inspect as much of the exposed portion of the bearing as possible and look for evidence of other deterioration such as cracking, spalling, rust staining or leaching around the bearing.

9313 Sliding Plate Bearing

Use when bearing assembly allows for translational and rotational movement and is comprised of a metal plate(s).

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Often in concrete bridges the bearings are concealed or difficult to inspect due to full height concrete diaphragms. When this is the case, the inspector should inspect as much of the exposed portion of the bearing as possible and look for evidence of other deterioration such as cracking, spalling, rust staining or leaching around the bearing.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9334 Reinforced Concrete Approach Railing – Closed

Use this element for the portions of reinforced concrete railing attached to the slab that has no openings and extend off the length of the bridge or beyond the abutment. This railing is not attached to the wingwall. Use element 9336 Reinforced Concrete Approach Rail on Wing, if it is constructed on the wingwalls rather than the slab or its own foundation.

Rate each linear foot of the concrete rail using the condition state definitions. Measure approach rail from the joint at the abutment to the joint that separates the transition portion of rail from the approach rail unless element 9336 is used. In this case the measurement is taken from the end of element 9336 to the end of the concrete rail away from the bridge. The assessment represents the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

This element is typically used in conjunction with elements 9335 Reinforced Concrete Approach Railing – Open and 9331 Reinforced Concrete Bridge Rail – Open.

9336 Reinforced Concrete Approach Rail on Wingwall

Use this element for the portions of reinforced concrete approach railing attached directly to the wingwalls. The approach rail extends from the end of the bridge rail (typically the joint in the paving notch).

Rate each linear foot of the concrete rail using the condition state definitions. Measure length of approach rail on the wingwalls from the joint over the abutment. The assessment represents the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. When the curb is not the same material as the rail, assess the curb based on its appropriate material defects.

This element is typically used in conjunction with elements 9335 Reinforced Concrete Approach Railing – Open and 9331 Reinforced Concrete Bridge Rail – Open.

3-EI.24.6 Prestressed Concrete Double T Beam

Superstructure: 33'-10 prestressed concrete double T Beam bridge

Structure located in Environmental Zone 1

ADTT = 100 and low salt use

Substructure: Concrete pile bent abutments with integral concrete wingwalls

Traffic Appurtenances: Open concrete bridge railing

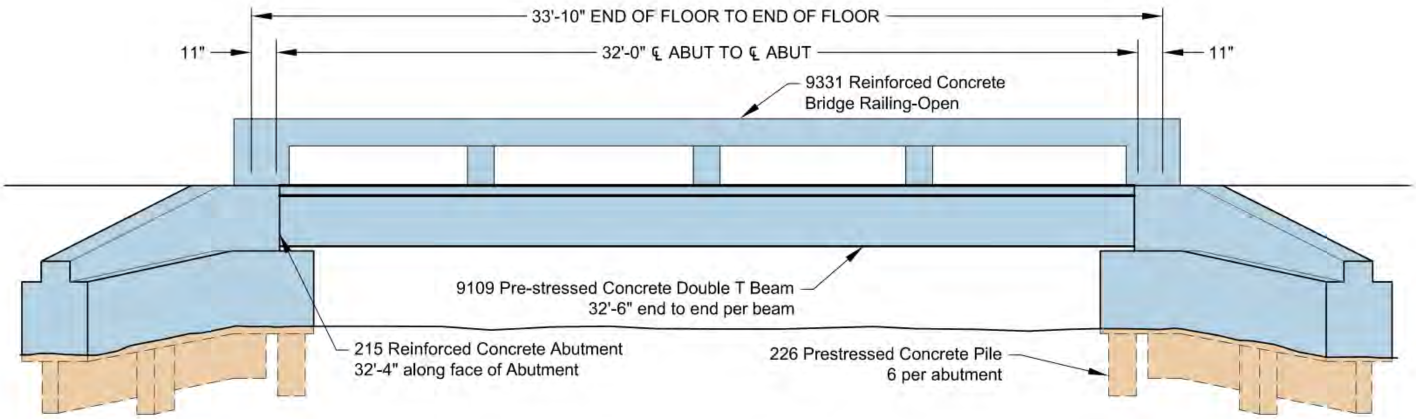


Figure 3-EI.24.6- 1: Elevation view of prestressed concrete double T Beam bridge

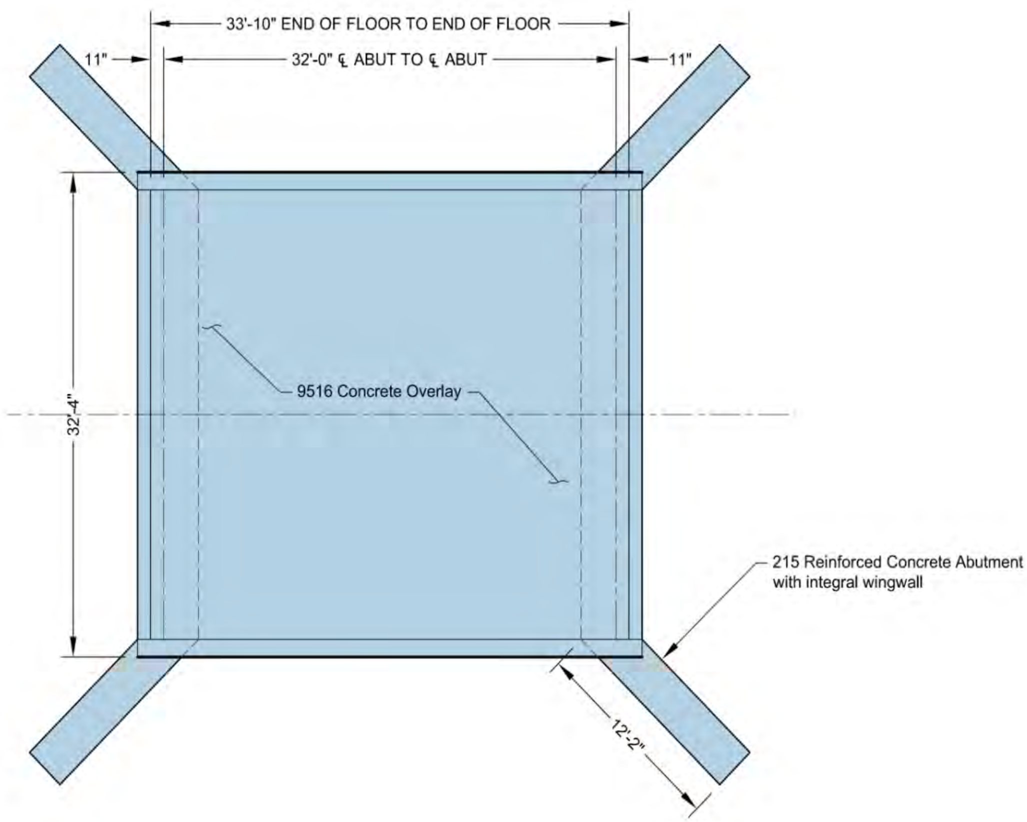


Figure 3-EI.24.6- 2: Plan view of prestressed concrete double T Beam bridge

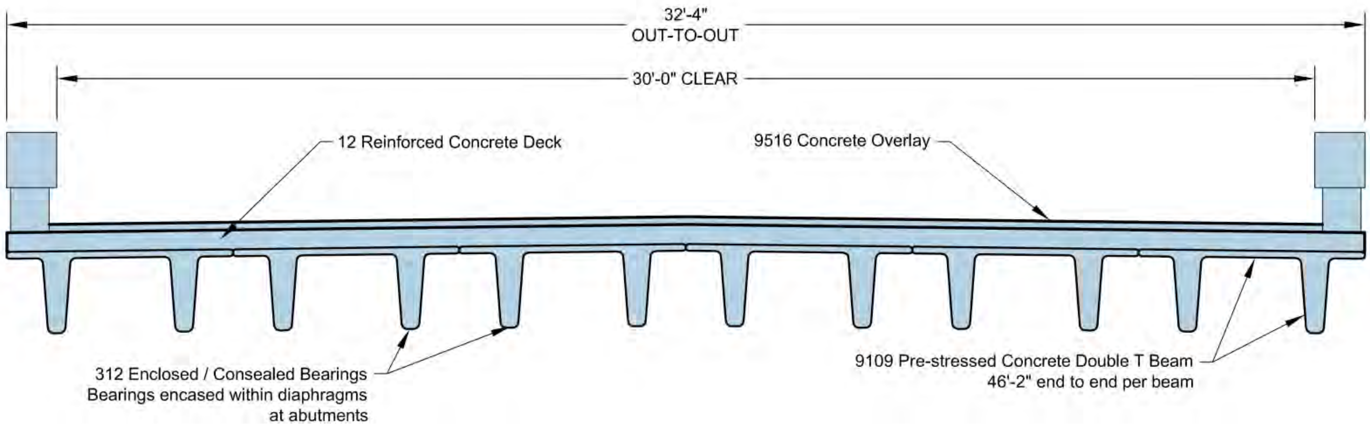


Figure 3-EI.24.6- 3: Cross section view of prestressed concrete double T Beam bridge superstructure

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each Deck joint is not leaking.

Deck and elements under joints: Environmental State = 1 (for zone 1) + 0 (for low salt use) + 0 (for ADTT < 1000) = 1

Super and substructure elements not under joints: Environmental State = 1 (for zone 1) + 0 (for leakage) + 0 (for ADTT< 1000) = 1

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	12	RC Deck		SF	1,092	1
Quantity Calculations		*Span 1*	*33.8' x 32.3' = 1091.74*			
M	312	Enclosed/Concealed Bearing		EA	24	1
Quantity Calculations		*Span 1*	*12 x 2 = 24*			
M	9109	PC Double T Beam		FT	195	1
Quantity Calculations		*Span 1*	*32.5' x 6 = 195'*			
M	9331	RC Concrete Bridge Railing - Open		FT	68	1
Quantity Calculations		*Span 1*	*33.8' x 2 = 67.6'*			
M	9516	Concrete Overlay		SF	1,014	1
Quantity Calculations		*Span 1*	*33.8' x 30' = 1014*			

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	215	RC Abutment		FT	113	1
Quantity Calculations		Span 1	(32.3' + 12.2' x 2) X 2 = 113.4'			

Element Commentary – Simple Span Prestressed Concrete Double T Beam Bridge

12 Reinforced Concrete Deck

In this case the deck is hidden by a concrete overlay on top and the T Beam top flanges on the bottom. Therefore, the assessment of the deck would include reviewing past ratings, assessment of the elements covering the top and bottom for indications of the condition of the deck, and/or destructive or nondestructive tests of the deck.

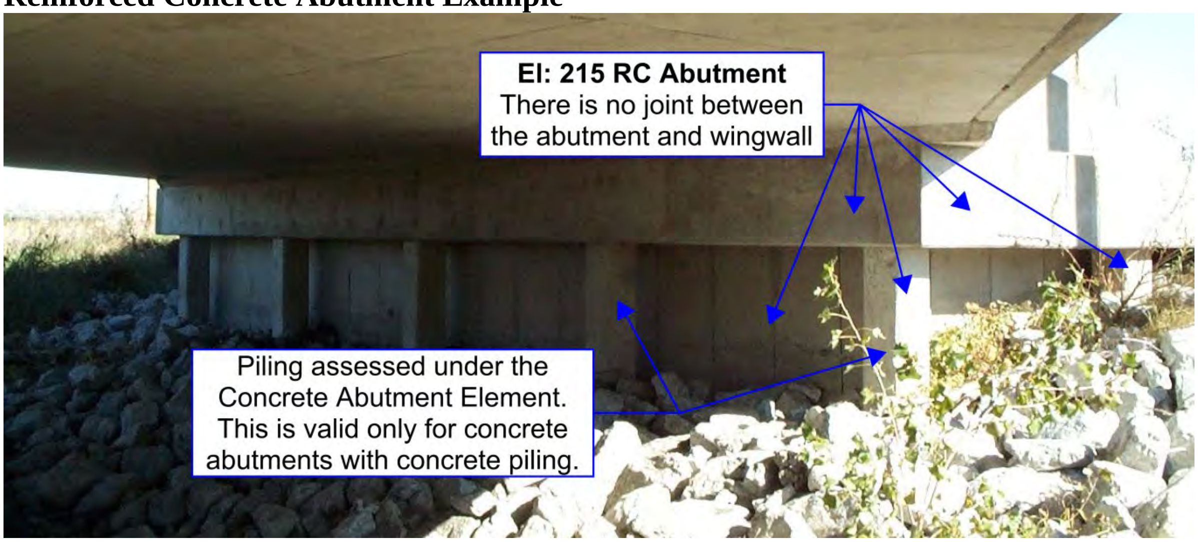
215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion on this element.

Concrete abutments are all inclusive. That is, the concrete sheet piling behind the concrete piles and the concrete piles should be included in the assessment of the abutment element. Include wingwalls in the abutment quantity since there are no joints between the wingwalls and abutment. These wingwalls are integral.

Rate each linear foot of the abutment along the skew using the condition state definitions. The length should also take into account those wings that are integral (not separated by a joint) with the abutment. The assessment should represent the worst condition state of each linear foot, which includes the full height of the abutment and sheet piling.

Reinforced Concrete Abutment Example



Since there is no joint between the abutment and the wingwall, the wingwall length is included in the abutment quantity and the PSC pile in the wing is included under the 215 Reinforced Concrete Abutment.

312 Enclosed/Concealed Bearing

Use when bearings are hidden, concealed or unknown. Concrete structures will commonly have full height abutment or pier diaphragms that make it difficult to distinguish bearing material or type.

Rate each bearing using the condition state definitions. The assessment should represent the worst condition found on each bearing.

Assess the bearing by looking for evidence around the bearing for signs of bearing deterioration such as cracking, spalling, rust staining or leaching of the surrounding material. For this example the bearings are concealed by the concrete diaphragms and therefore fall under this element.

9109 Prestressed Concrete Double T Beam

Use the top flange element 15 Prestressed Concrete Top Flange when the top flange acts as driving surface for vehicles or includes an asphalt or thin concrete overlay. In this example, there is a concrete deck over the T Beams, so Element 12 is used instead of element 15 and the entire Double T Beam is assessed as one unit (legs and top flange).

When the Double T Beams have a structural deck placed over them, use element 9109 prestressed concrete Double T Beam to assess the legs and top flange of the T Beams. If the top flange is the riding surface, or only an overlay (~2" thick) or other wearing surface covers the top surface, the top flange is assessed separately from the beam component using element 16 Reinforced Concrete Top Flange or 15 Prestressed Concrete Top Flange, depending on the beam material. Only the legs of the Double T Beam would be assessed under element 9109 when a top flange element is used. Moreover, regardless of the number of legs per girder unit, that is the number of legs between longitudinal joint to longitudinal joint, the legs are evaluated as one girder, not each leg as an individual girder.

Rate each linear foot of the tee beam using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top flange for T Beams.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9516 Concrete Overlay (HDLS)

Used when the overlay is comprised of concrete. An overlay or wearing surface is typically placed over the top surface of T Beam top flanges. However, in this case the bridge already had a concrete deck and a concrete overlay was placed on top of it.

Rate each square foot of the wearing surface using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which only includes the top surface.

3-EI.24.7 Continuous Prestressed Concrete Double T Beam

Superstructure: 141'-0 continuous prestressed concrete double T Beam bridge

Structure located in Environmental Zone 1

ADTT = 2000 and high salt use

Substructure: Full height concrete abutments. Concrete pile pier bents.

Traffic Appurtenances: Open concrete bridge railing

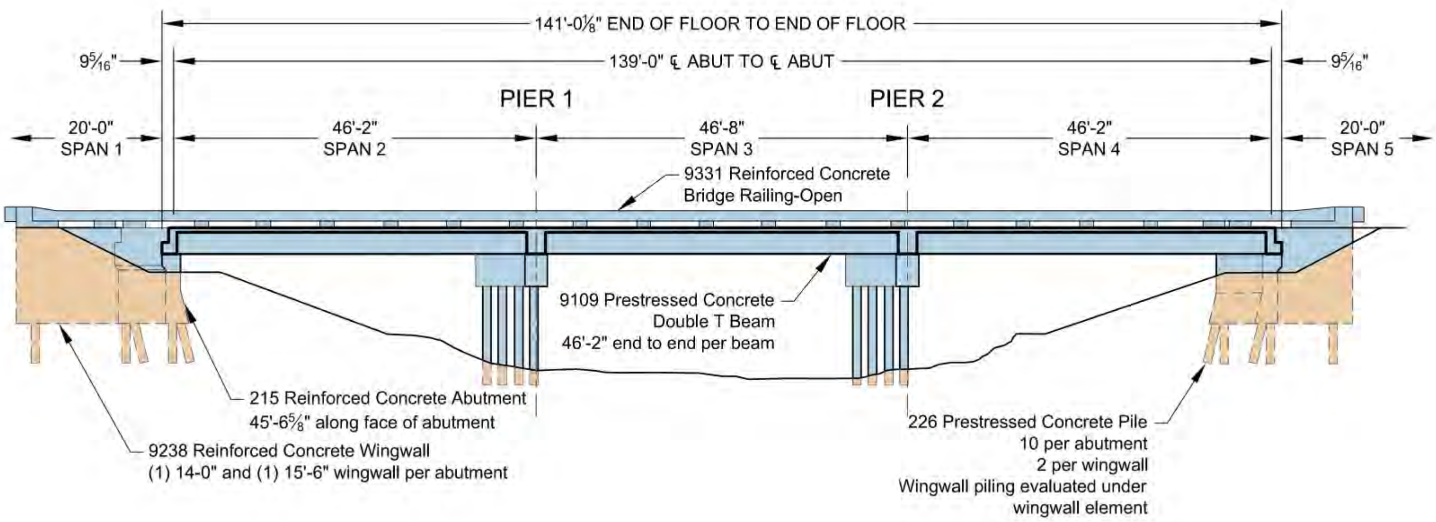


Figure 3-EI.24.7- 1: Elevation view of continuous prestressed concrete Double T Beam bridge

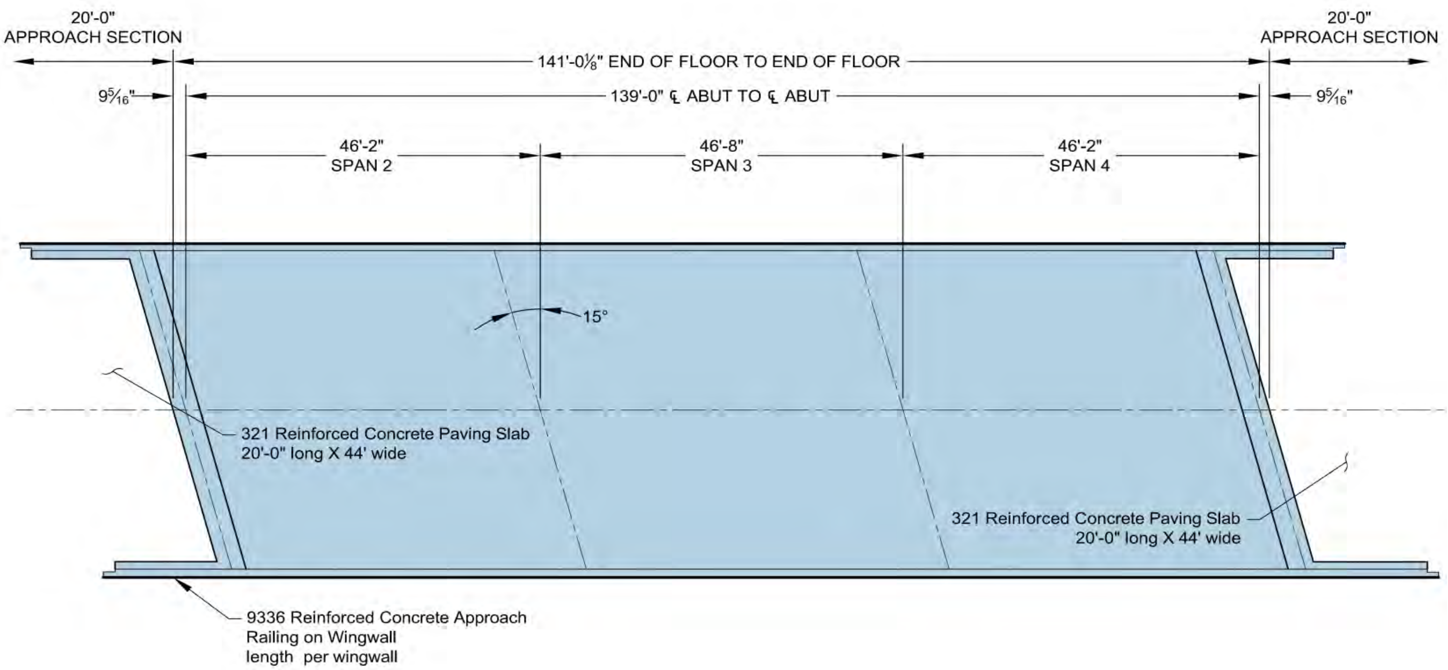


Figure 3-EI.24.7- 2: Plan view of continuous prestressed concrete Double T Beam bridge

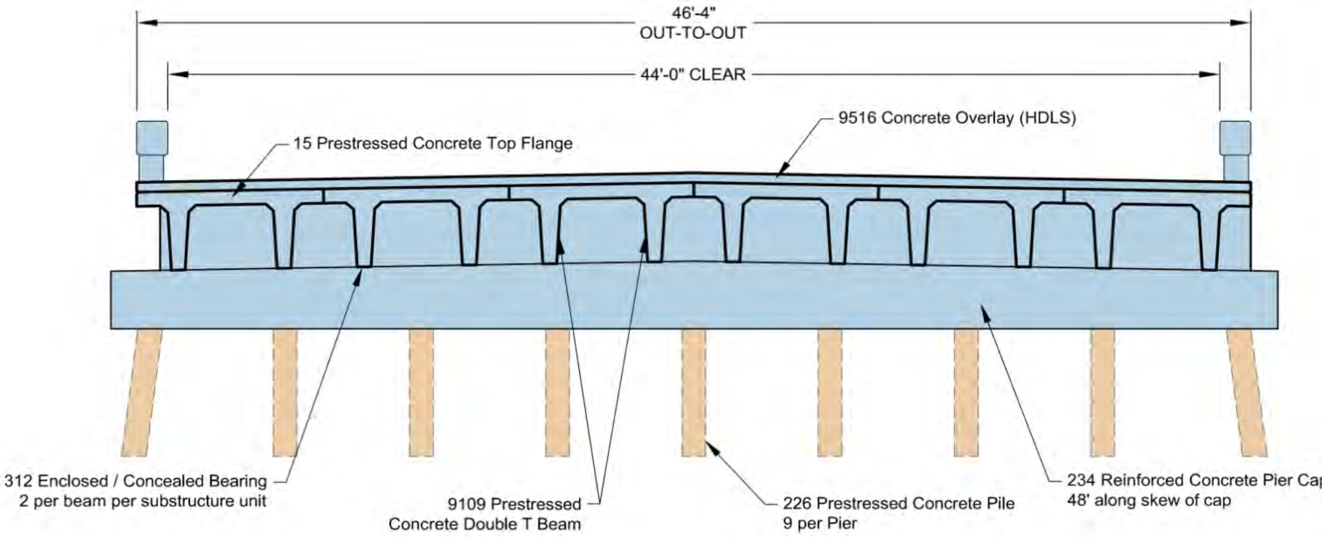


Figure 3-EI.24.7- 3: Cross section view of superstructure for continuous prestressed concrete Double T Beam bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 1 (for zone 1) + 1 (for high salt use) + 1(for ADTT > 1000) = 3

Super and substructure elements not under joints: Environmental State = 1 (for zone 1) + 0(for no leakage) + 1(for ADTT > 1000) = 2

Superstructure						
Group	EI No.	Element Description		Unit	Element Quantity	Environ. State
M	15	PSC Top Flange		SF	6,514	3
Quantity Calculations		*Span 2*	*(46.2' + 0.8') x 46.3' = 2176.1*			
		Span 3	*46.7' x 46.3' = 2162.2*			
		Span 4	*(46.2' + 0.8') x 46.3' = 2176.1*			
M	312	Enclosed/Concealed Bearing		EA	96	2
Quantity Calculations		*Span 2*	*12 x 2 = 24*			
		Span 3	*12 x 2 = 24*			
		Span 4	*12 x 2 = 24*			
		Span 4	*12 x 2 = 24*			
M	9109	PSC Double T Beam		FT	832	2
Quantity Calculations		*Span 2*	*46.2' x 6 = 277.2'*			
		Span 3	*46.2' x 6 = 277.2'*			
		Span 4	*46.2' x 6 = 277.2'*			
M	9331	RC Concrete Bridge Railing - Open		FT	281	3
Quantity Calculations		*Span 2*	*(46.2' + 0.8') x 2 = 94'*			
		Span 3	*46.7' x 2 = 93.4'*			
		Span 4	*(46.2' + 0.8') x 2 = 94'*			
M	9336	RC Approach Rail on Wingwall		FT	59	3
Quantity Calculations		*Span 1*	*14'*			
		Span 1	*15.5'*			
		Span 3	*14'*			
		Span 3	*15.5'*			

Substructure					
Group	EI No.	Element Description	Unit	Element Quantity	Environ. State
M	215	RC Abutment	FT	91	2
Quantity Calculations	*Span 2*	*45.6'*			
	Span 4	*45.6'*			
M	226	PSC Pile	EA	18	2
Quantity Calculations	*Span 2*	*14 (unexposed)*			
	Span 3	*9*			
	Span 4	*9*			
	Span 4	*14 (unexposed)*			
M	234	RC Pier Cap	FT	96	2
Quantity Calculations	*Span 3*	*48'*			
	Span 4	*48'*			
M	9238	RC Wingwall	FT	59	2
Quantity Calculations	*Span 2*	*14' x 2 = 28*			
	Span 4	*15.5' x 2 = 31*			

Approach					
Group	EI No.	Element Description	Unit	Element Quantity	Environ. State
P	321	RC Paving Slab	SF	1760	3
Quantity Calculations	*Span 1*	*20' x 44' = 880*			
	Span 5	*20' x 44' = 880*			

Element Commentary – Continuous Prestressed Concrete Double T Beam

15 Prestressed Concrete Top Flange

Use the top flange element when the top flange acts as the driving surface for vehicles. The top flange, while integral with the legs of the girder unit, acts as the deck, even when covered with an overlay. Overlays are simply protective coatings for a deck or slab. The girder unit is essentially broken into two components where the top flange is separated from the web and assessed as a deck component and the legs or stems of the beam are assessed as the beam or superstructure component. Therefore top flange defects will have no bearing on the condition of the beam component.

Rate each square foot of the top flange using the condition state definitions. The assessment represents the worst condition stated of each square foot, which include the top, bottom, and edges of the flange when visible.

Assess overlays or wearing surfaces using other appropriate elements. Use destructive or nondestructive testing or indicators in the overlay surface or wearing surface to assess the top surface of the top flange when the top surfaces of the top flange are not visible.

215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion of this element.

For this example, the wingwalls are not integral and are therefore not included within the assessment of the abutment element. The wingwall shall be assessed as element 9238 Reinforced Concrete Wingwall.

226 Prestressed Concrete Pile

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

Wingwall piling, regardless of whether if integral or not, is assessed with the wingwall and therefore should not be included within the piling quantity.

Element 9226 Submerged Prestressed Concrete Pile should only be used for Underwater Inspections and inspected by Divers. During Routine Inspections, the inspector may be able to visually observe piling below the water line. In this case, element 226 Prestressed Concrete Pile should still be used.

312 Enclosed/Concealed Bearings

Refer to example 3-EI.24.6 Prestressed Concrete Double T Beam for further discussion on this element.

321 Reinforced Concrete Paving Slab

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

In this example, no grade beam is present, therefore only the paving slab immediately adjacent to the bridge on either side is evaluated under this element.

9109 Prestressed Concrete Double T Beam

Refer to example 3-EI.24.6 Prestressed Concrete Double T Beam for further discussion of this element.

For this example, a concrete overlay tops the Double T Beams. Where traffic rides directly on the top flange or a wearing surface (not a structural deck with reinforcing steel) over the top flange, element 15 Prestressed Concrete Top Flange is used to assess the top flange and element 9109 Prestressed Concrete Double T Beam is used to assess only the legs of the Double T Beam. In this case, the legs of each unit, that is the number of legs located between longitudinal joint to longitudinal joint, are evaluated as one girder. Therefore the worst condition state from only one leg per linear foot shall be recorded on the inspection report.

9238 Reinforced Concrete Wingwall

Use when a non-integral reinforced concrete wingwall is used to retain roadway fill beyond the extents of the abutment. In this example the concrete wingwalls are supported by two piles and a joint between the wing and abutment can be observed.

Rate each linear foot of the reinforced concrete wingwall using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes the full height of the wingwall and any exposed wingwall piling.

If piling were to be exposed under the wingwalls, the piling would be assessed under the wingwall element.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9335 Reinforced Concrete Approach Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9336 Reinforced Concrete Approach Rail on Wingwall

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion of this element.

9516 Concrete Overlay (HDLS)

Use when the overlay or wearing surface is comprised of concrete. An overlay or wearing surface is typically placed over the top surface of T Beam top flanges, as is the case in this example.

Rate each square foot of the wearing surface using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which only includes the top surface.

The wearing surface or overlay measurements should be from the extents of the surface. Typically, an overlay is placed only between the inside faces of the parapets and thus will have a total measurement less than the deck, slab, or top flange total area. In this example, however, the overlay was placed from out to out of the top flange limits and appropriately has the same total area as the top flange quantity.

3-EI.24.8 Simple Span Steel Stringer/Multi-beam or Girder

Superstructure: 46’-10 simple steel girder bridge. The girders are painted.

Structure located in Environmental Zone 3

ADTT = 10 and low salt use

Substructure: Full height steel pile bent abutments

Traffic Appurtenances: Metal bridge railing

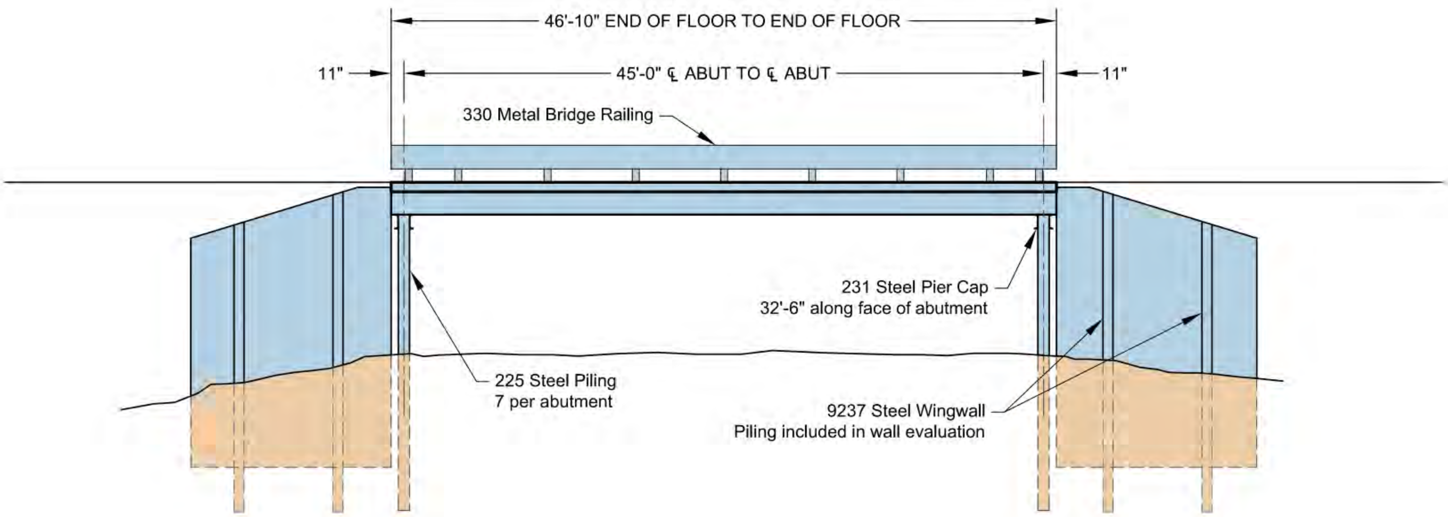
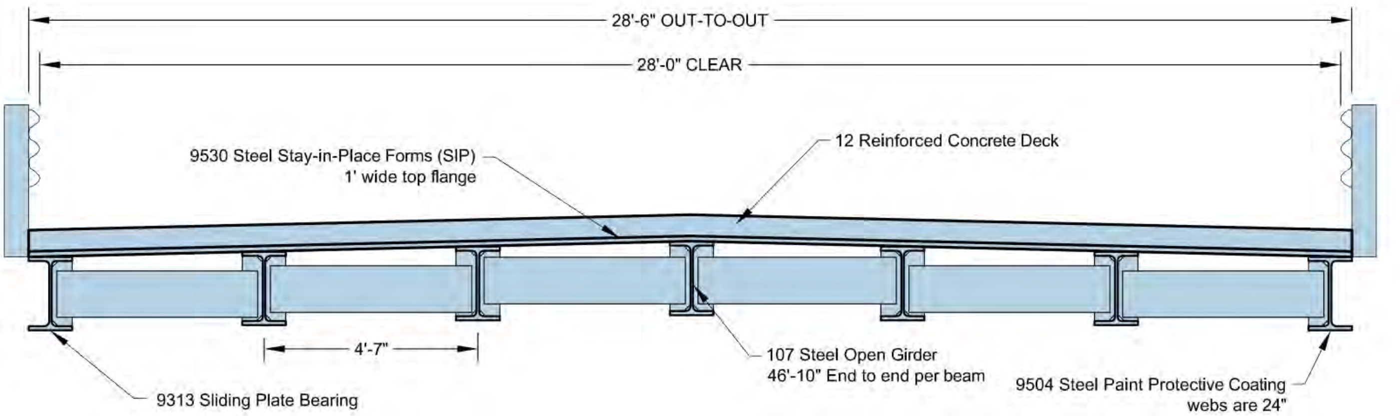


Figure 3-EI-24.8- 1: Elevation view of simple span steel girder bridge



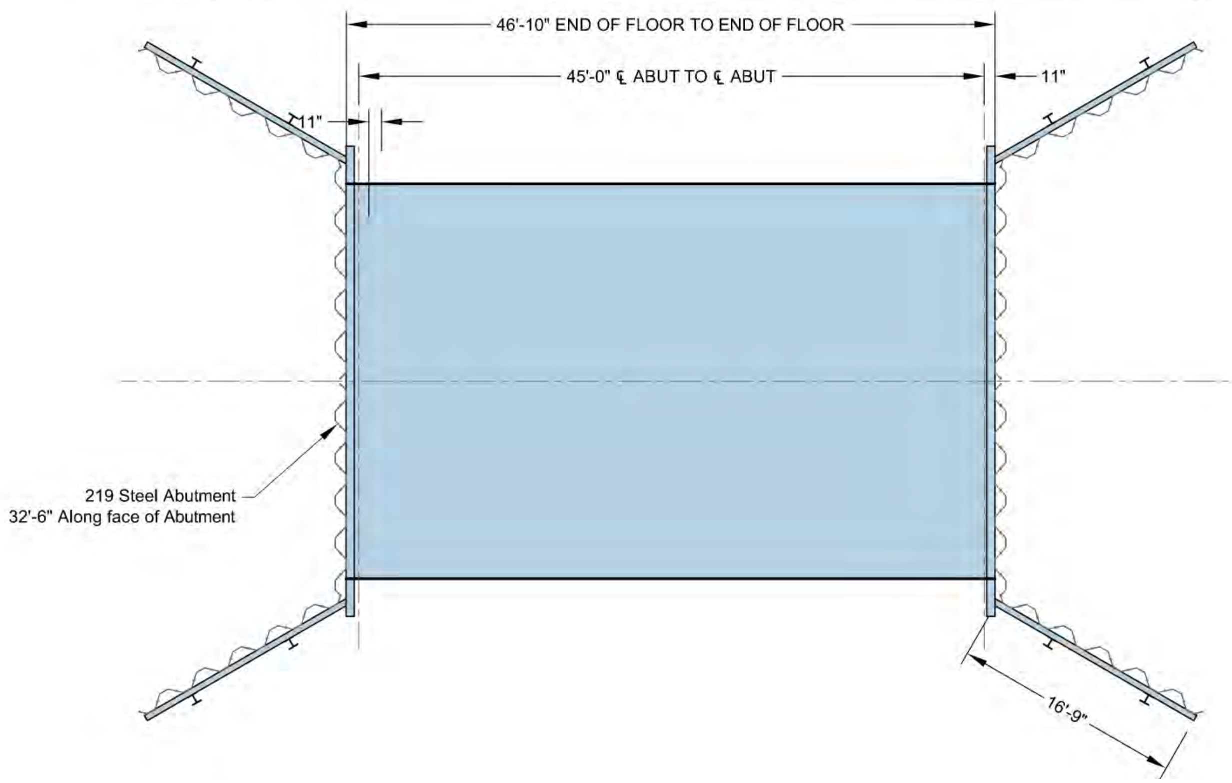


Figure 3-EI-24.8- 2: Plan view of simple span steel girder bridge

Figure 3-EI-24.8- 3: Cross section view of superstructure of simple steel girder bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 3 (for zone 3) + 0 (for low salt use) + 0 (for ADTT < 1000) = 3

Super and substructure elements not under joints: Environmental State = 3 (for zone 3) + 0 (for no leakage) + 0 (for ADTT < 1000) = 3

Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	12	RC Deck	SF	1,334	3
Quantity Calculations	*Span 1*	*46.8' x 28.5' = 1333.8*			
M	107	Steel Open Girder	FT	328	3
Quantity Calculations	*Span 1*	*46.8' x 7 = 327.6'*			
M	9540	Steel Paint Protective Coating	SF	1,900	3
Quantity Calculations	*Span 1*	*7 x 2'* x 46.8' x 2.9 = 1900.1*			
M	330	Metal Bridge Railing	FT	94	3
Quantity Calculations	*Span 1*	*46.8' x 2 = 93.6'*			
M	9313	Sliding Plate Bearing	EA	14	3
Quantity Calculations	*Span 1*	*7 x 2 = 14*			
M	9530	Stay-in-Place Form	SF	1,006	3
Quantity Calculations	*Span 1*	*46.8' x (28.5' – 7 x 1'**) = 1006*			
M	9542	Galvanized Steel Protective Coating	SF	1,006	3
Quantity Calculations	*Span 1*	*46.8' x (28.5' – 7 x 1'**) = 1006*			

*W24 (2 ft tall beam height).

**1 ft wide top flange.

Substructure					
Group	EI No.	Element Description	Unit	Element Quantity	Environ. State
M	219	Steel Abutment	FT	65	3
Quantity Calculations	*Span 1*	*32.5' x 2 = 65'*			
M	225	Steel Pile	EA	14	3
Quantity Calculations	*Span 1*	*7 x 2 = 14*			
M	231	Steel Pier Cap	FT	65	3
Quantity Calculations	*Span 1*	*32.5' x 2 = 65'*			
M	9237	Steel Wingwall	FT	67	3
Quantity Calculations	*Span 1*	*16.8' x 4 = 67.2'*			

Element Commentary – Simple Span Steel Girder

12 Reinforced Concrete Deck

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

107 Steel Open Girder/Beam

Use when deck is structurally supported by steel beam components oriented longitudinally along roadway. In a floor system these are the primary structural components, and the beam components bear directly on the substructure.

Rate each linear foot of the open girder using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

219 Steel Abutment

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

225 Steel Pile

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

231 Steel Pier Cap

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

330 Metal Bridge Railing

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

Note that the curbs are also assessed under this element even when comprised of different construction material. In this instance, the defects associated with concrete should be used under the metal bridge railing element when assessing the curb.

9237 Steel Wingwall

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

9313 Sliding Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9530 Steel Stay-in-Place Forms (SIP)

Use when steel forms remain in place under structural concrete decks.

Rate each square foot of stay-in-place formwork using the condition state definitions. The area of assessment is only from flange to flange between girders.

This element should not be used in the instance when steel supports only gravel. In this case element 30 Steel Deck Corrugated/Orthotropic/Etc. should be used. Stay-in-Place forms are not structural once the concrete deck has cured. The forms can be a method by which to assess the underside of the deck through indirect means. If heavy corrosion is evident in the center of a span, this may be an indication that water has been allowed to seep through the concrete deck. Other methods of testing should be used if heavy deck deterioration is suspected.

9540 Steel Paint Protective Coating

Use on all steel primary structural members that are coated in paint or other similar coating.

Rate each square foot of the protective coating using the condition state definitions. The area of assessment is all exposed surfaces.

This element is evaluated separately from the actual bridge member it protects. That is the protective coating should not be evaluate with the member but evaluated by its own defect condition states. For example, the protective coating may be in Condition State 4 (no effectiveness, failed and exposing bare steel beneath) while the exposed steel underneath is in Condition State 1 (no corrosion).

9542 Galvanized Steel Protective Coating

Use when the protective coating on a structural steel member is comprised of galvanization. In this example the Stay-in-Place forms are protected with a galvanized coating.

Rate each square foot of the protective coating using the condition state definitions. The area of assessment is all exposed surfaces.

This element is evaluated separately from the actual bridge member it protects. That is the protective coating should not be evaluate with the member but evaluated by its own defect condition states. For example, the protective coating may be in Condition State 4 (no effectiveness, failed and exposing bare steel beneath) while the exposed steel underneath is in Condition State 1 (no corrosion).

3-EI.24.9 Continuous Steel Stringer/Multi-beam or Girder

Superstructure: 253'-2 continuous steel girder bridge. Girders are comprised of weathering steel.

Structure located in Environmental Zone 3

ADTT = 5000 and high salt use

Substructure: Full height concrete abutments with hammerhead piers

Traffic Appurtenances: Reinforced concrete open bridge railing

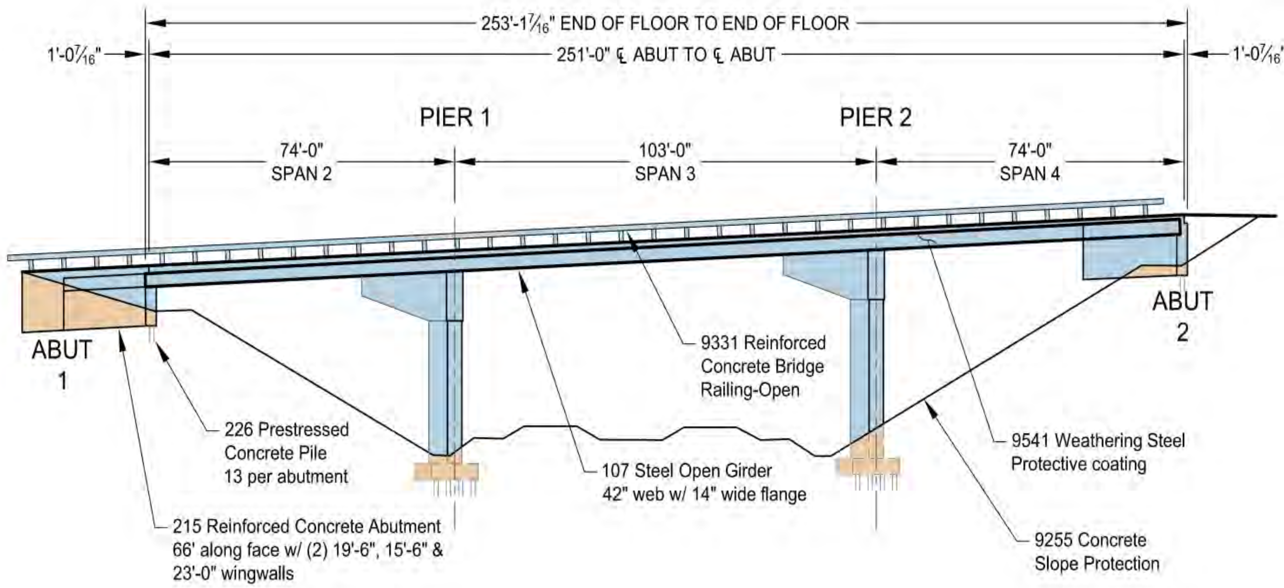


Figure 3-EI.24.9- 1: Elevation view of continuous steel girder bridge

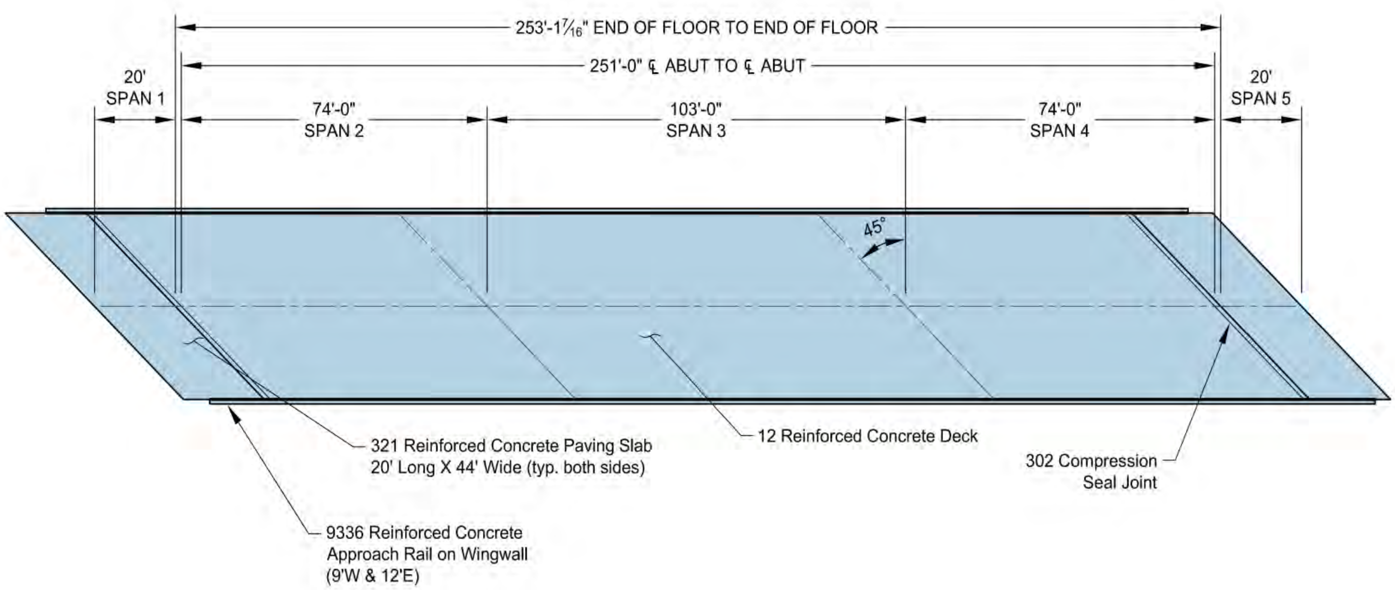


Figure 3-EI.24.9- 2: Plan view of continuous steel girder bridge

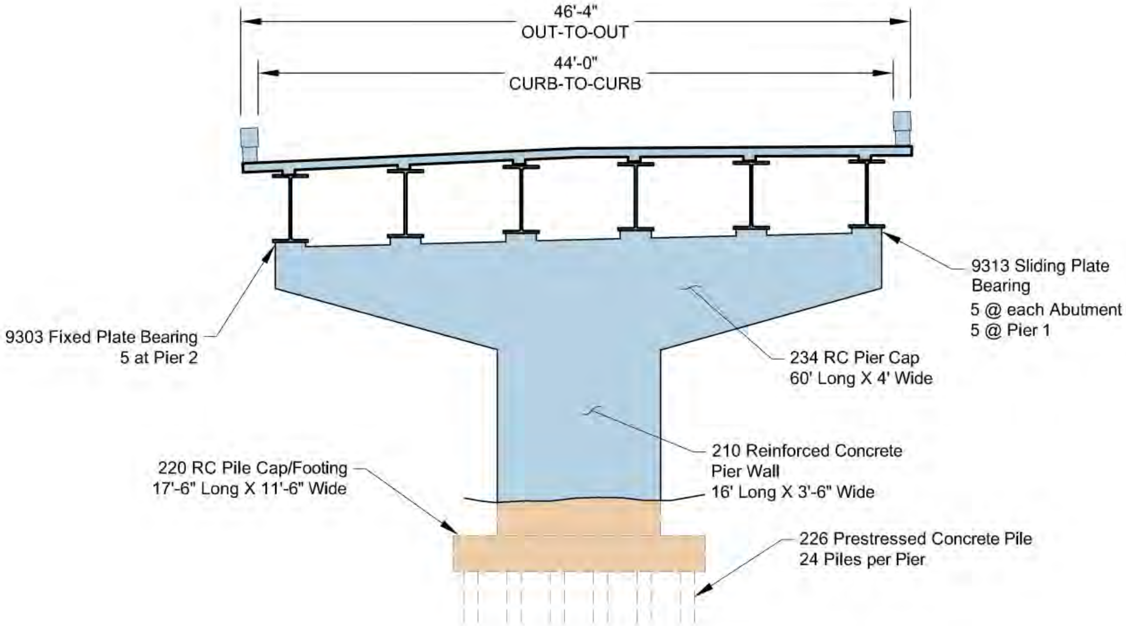


Figure 3-EI.24.9- 3: Cross section view of superstructure of continuous steel girder bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 3 (for zone 3) + 1 (for high salt use) + 1 (for ADTT > 1000) = 4

Super and substructure elements not under joints: Environmental State = 3 (for zone 3) + 0 (for no leakage) + 1 (for ADTT > 1000) = 4

Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	12	RC Deck		SF	11,719	4
Quantity Calculations		*Span 2*	*75.0' x 46.3' = 3474.8*			
		Span 3	*103' x 46.3' = 4768.9*			
		Span 4	*75.0' x 46.3' = 3474.8*			
M	107	Steel Open Girder/Beam		FT	1,510	4
Quantity Calculations		*Span 2*	*74.3'* x 6 = 445.8'*			
		Span 3	*103' x 6 = 618*			
		Span 4	*74.3'* x 6 = 445.8'*			
M	9313	Sliding Plate Bearing		EA	18	4
Quantity Calculations		*Span 2*	*5*			
		Span 2	*5 x 2 = 10*			
M	9304	Fixed Plate Bearing		EA	6	4
Quantity Calculations		*Span 2*	*5*			
M	9331	RC Concrete Bridge Railing - Open		FT	506	4
Quantity Calculations		*Span 2*	*75.0' x 2 = 150'*			
		Span 3	*103' x 2 = 206'*			
		Span 4	*75.0' x 2 = 150'*			
M	9336	RC Approach Rail on Wingwall		FT	42	4
Quantity Calculations		*Span 2*	*9' +9' = 18'*			
		Span 4	*12' + 12' = 24'*			
M	9541	Weathering Steel Protective Coating		SF	15,323	4
Quantity Calculations		*Span 4*	*6 x 42"/12 x 74.3' x 2.9 = 4524.9*			
		Span 4	*6 x 42"/12 x 103' x 2.9 = 6272.7*			
		Span 4	*6 x 42"/12 x 74.3' x 2.9 = 4524.9*			

*When no lengths for a girder can be located, it is safe to assume (for quantity calculation purposes) the girder extends 4"-6" beyond the centerline of bearing.

Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
M	210	RC Pier Wall		EA	32	4
Quantity Calculations		*Span 3*	*16'*			
		Span 4	*16'*			
M	215	RC Abutment		FT	210	4
Quantity Calculations		*Span 2*	*66' + 19.5' + 15.5' = 101'*			
		Span 4	*66' + 19.5' + 23' = 108.5'*			
M	220	RC Pile Cap/ Footing		FT	Not Reported	-
Quantity Calculations		*Span 3*	*17.5' (unexposed)*			
		Span 4	*17.5' (unexposed)*			
M	226	PSC Pile		EA	Not Reported	-
Quantity Calculations		*Span 2*	*13 (unexposed)*			
		Span 3	*24 (unexposed)*			
		Span 4	*24 (unexposed)*			
		Span 4	*13 (unexposed)*			
M	234	RC Pier Cap		FT	120	4
Quantity Calculations		*Span 3*	*60'*			
		Span 4	*60'*			
M	9255	Concrete Slope Protection		FT	Field Measurement	4
Quantity Calculations		*Span 2*	*Field Measurement*			
		Span 4	*Field Measurement*			

Approach						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
P	321	RC Paving Slab		SF	1760	4
Quantity Calculations		*Span 1*	*20' x 44' = 880*			
		Span 5	*20' x 44' = 880*			
P	302	Compression Seal Joint		FT	124	4
Quantity Calculations		*Span 1*	*44' / cos (45 deg) = 62.2'*			
		Span 5	*44' / cos (45 deg) = 62.2'*			

Element Commentary – Continuous Steel Stringer / Multi-beam or Girder Bridge

12 Reinforced Concrete Deck

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

107 Steel Open Girder/Beam

Use when deck is structurally supported by steel beam components oriented longitudinally along roadway. In a floor system these are the primary structural components, and the beam component bear directly on the substructure.

Rate each linear foot of the open girder using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

When a built-up or rolled girder contains a cover plate, the member should be assessed under element 9101 Steel Open Girder/Beam with Cover Plate.

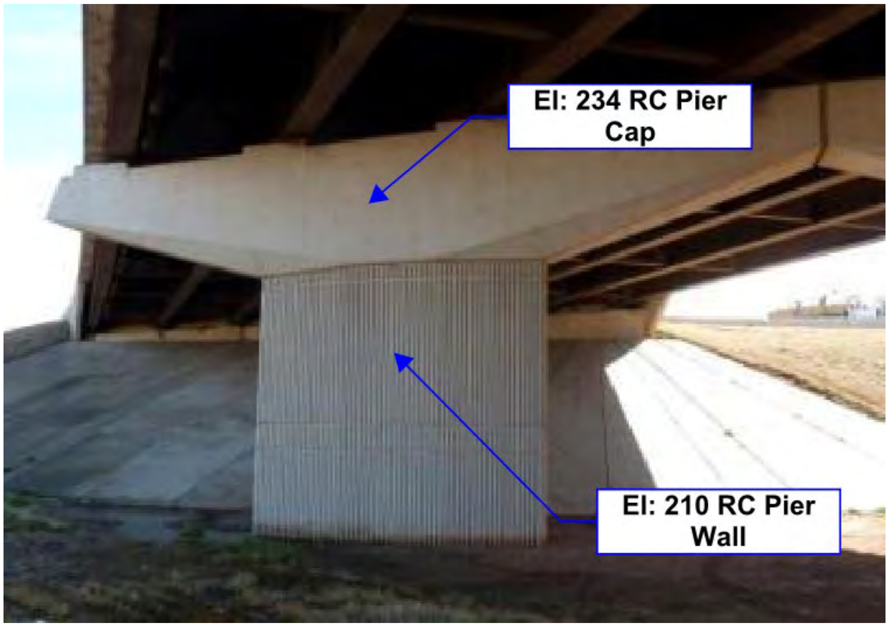
210 Reinforced Concrete Pier Wall

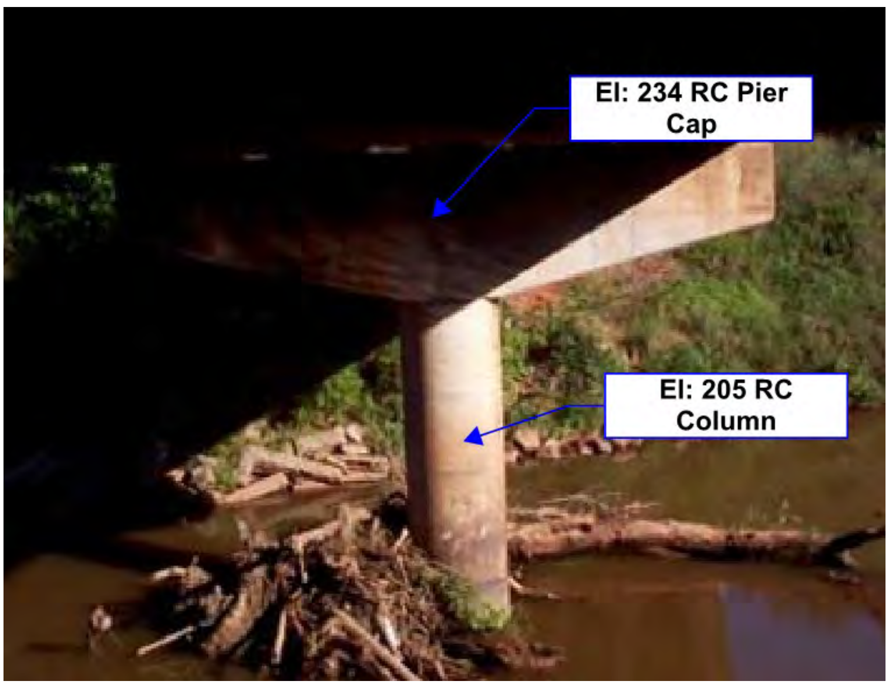
Use for substructure elements that are stems or shafts and shaped longer than wide. For this example, a column is not used as the stem below the pier cap is longer than it is wide.

Rate each linear foot of the wall using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes both sides and the full height of the wall.

Had the stem been a round or square shape, element 205 Reinforced Concrete Column would be applicable for this example.

Hammerhead Pier Element Identification Example





Use element 210 – Reinforced Concrete Pier Wall when the base is rectangular.

Use element 205 – Reinforced Concrete Column when the base is round or square.

215 Reinforced Concrete Abutment

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion of this element.

220 Reinforced Concrete Pile Cap/Footing

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion on this element.

226 Prestressed Concrete Pile

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

234 Reinforced Concrete Pier Cap

Use when substructure unit, abutment or pier, is comprised of a pile bent with superstructure bearing on cap, or when component length is greater than length of a pier. For this example, hammerhead piers consist of a pier cap with a stem/shaft support.

Rate each linear foot of the cap using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the cap element.

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

9230 Reinforced Concrete Grade Beam Cap

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9255 Concrete Slope Protection

Use for slope protection along banks in immediate vicinity of bridge.

Rate each linear foot of the concrete slope protection taken along the abutment using the condition state definitions. The assessment should represent the worst condition state of each linear foot.

It is not practical to measure the length of riprap for situations where the protection continues up and downstream. The inspector should measure the riprap to a maximum length of the bridge length along either bank under the structure.

9304 Fixed Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9313 Sliding Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9331 Reinforced Concrete Bridge Railing – Open

Refer to example 3-EI.24.3 Continuous Concrete Slab for further discussion of this element.

9336 Reinforced Concrete Approach Rail on Wingwall

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion of this element.

9541 Weathering Steel Protective Coating

Use when the steel member is comprised of weathering steel and has a protective patina across the surface.

Rate each square foot of the protective system using the condition state definitions. The assessment should represent the worst condition state of each square foot of the protective coating.

When portions of the weathering steel member are painted, i.e. the patina has been effectively removed and the bare steel painted, element 9540 Steel Paint Protective Coating should be used for the area of painted protective coating and the remaining of the coating as element 9541.

This element is evaluated separately from the actual bridge member it protects. That is the protective coating should not be evaluate with the member but evaluated by its own defect condition states. For example, the protective coating may be in Condition State 4 (no effectiveness, failed and exposing bare steel beneath) while the exposed steel underneath is in Condition State 1 (no corrosion).

3-EI.24.10 Steel Truss

Superstructure: 253'-2 steel truss with steel girder approach spans

Structure located in Environmental Zone 1

ADTT = 10 and low salt use

Substructure: Full height concrete abutments with RC column piers

Traffic Appurtenances: Reinforced concrete and metal bridge railing

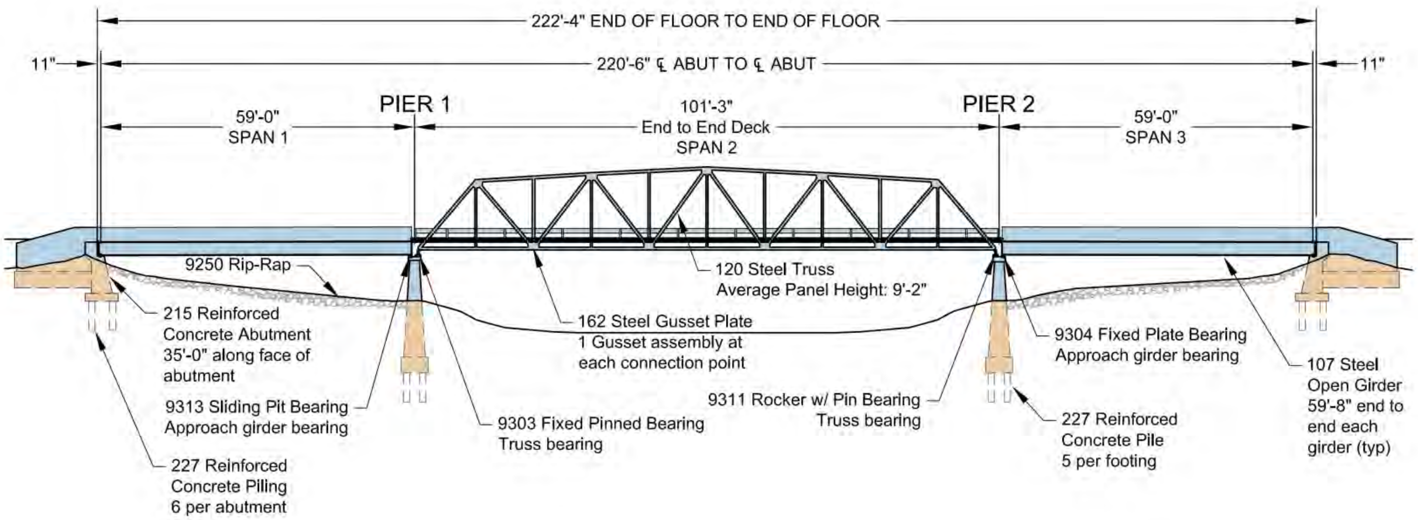


Figure 3-EI.24.10- 1: Elevation view of steel truss bridge

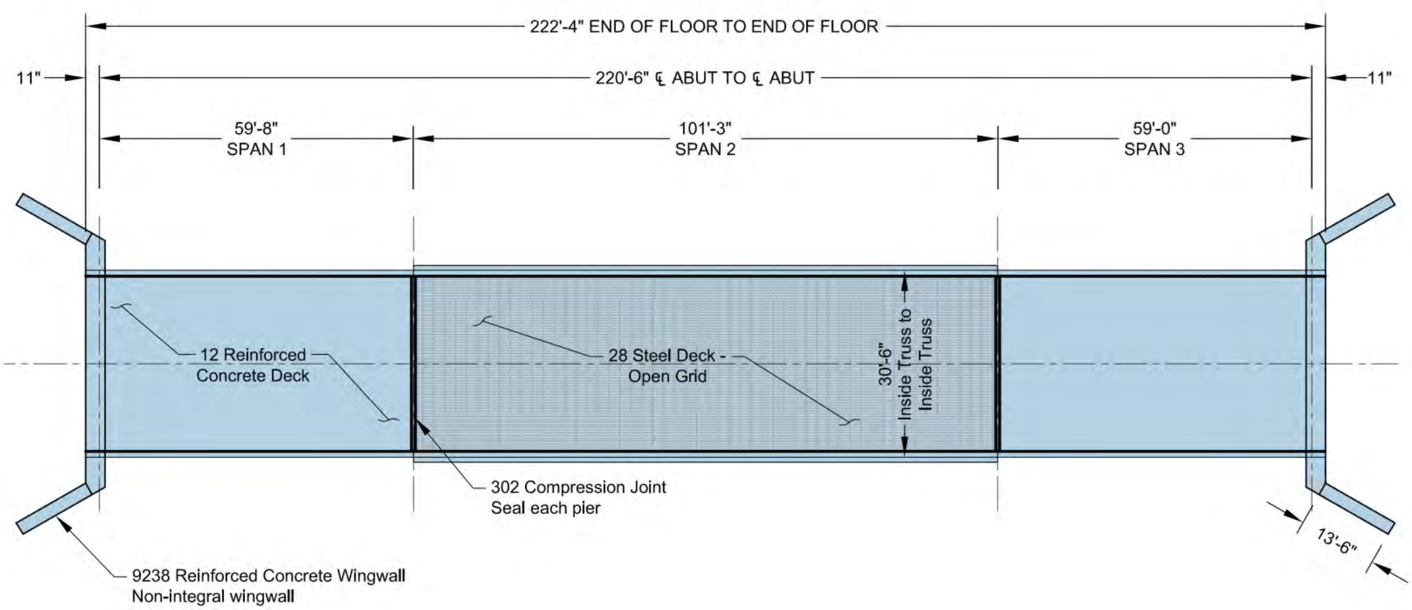


Figure 3-EI.24.10- 2: Plan view of steel truss bridge

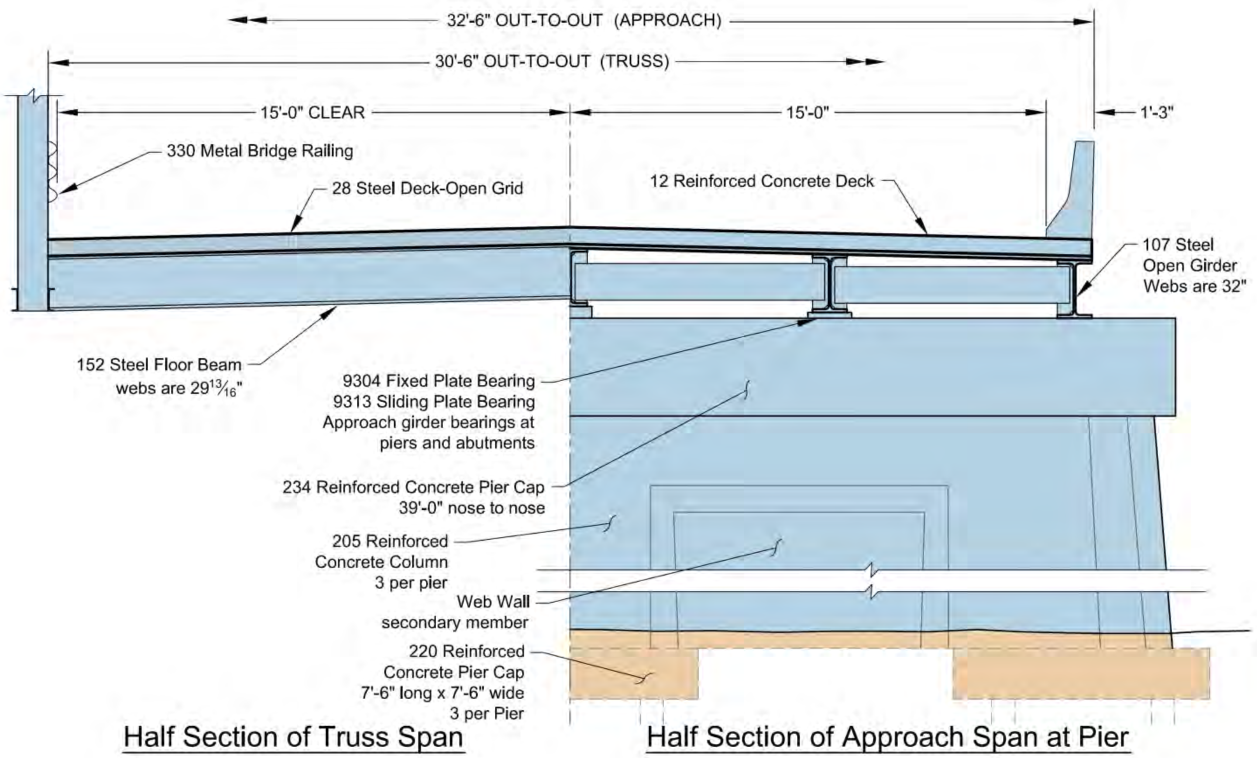


Figure 3-EI.24.10- 3: Cross section view of superstructure of steel truss bridge

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Assume each deck joint is not leaking.

Deck and elements under joints: Environmental State = 1 (for zone 1) + 0 (for low salt use) + 0 (for ADTT < 1000) = 1

Super and substructure elements not under joints: Environmental State = 1 (for zone 1) + 0 (for no leakage) + 0 (for ADTT < 1000) = 1

Main - Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	28	Steel Deck with Open Grid	SF	3,090	1
Quantity Calculations		*Span 2*	*101.3' x 30.5' = 3089.7*		
M	120	Steel Truss	FT	203	1
Quantity Calculations		*Span 2*	*101.3' x 2 = 202.6'*		
M	9540	Steel Paint Protective Coating	SF	1121	1
Quantity Calculations		*Span 2*	*203' x 9.2' x 0.6 = 1120.6*		
M	152	Steel Floor Beam	FT	336	1
Quantity Calculations		*Span 2*	*30.5' x 11 = 335.5'*		
M	9540	Steel Paint Protective Coating	SF	1855	1
Quantity Calculations		*Span 2*	*257.4' x (29 $^{13}/_{16}$")/ 12 x 2.9 = 1854.5*		
M	162	Gusset Plate	EA	40	1
Quantity Calculations		*Span 2*	*20 x 2 = 40*		
M	302	Compression Seal Joint	FT	60	1
Quantity Calculations		*Span 1*	*30' x 2 = 60'*		
M	330	Metal Bridge Railing	FT	203	1
Quantity Calculations		*Span 2*	*101.3' x 2 = 202.6'*		

Main - Substructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	205	RC Column	EA	6	1
Quantity Calculations		*Span 2*	*3 x 2 = 6*		
M	220	RC Pile Cap/Footing	FT	Not Reported	-
Quantity Calculations		*Span 2*	*7.5' x 3 x 2 = 45' (unexposed)*		
M	227	RC Pile	EA	Not Reported	-
Quantity Calculations		*Span 2*	*5 x 3 x 2 = 30 (unexposed)*		
M	234	RC Pier Cap	FT	78	1
Quantity Calculations		*Span 2*	*39' x 2 = 78'*		
M	9303	Fixed Pinned Bearing	EA	2	1
Quantity Calculations		*Span 2*	*2*		
M	9311	Rocker with Pin Bearing	EA	2	1
Quantity Calculations		*Span 2*	*2*		

Approach - Superstructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
A	12	RC Deck		SF	3,887	1
Quantity Calculations		*Span 1*	*59.8' x 32.5' = 1943.5*			
		Span 3	*59.8' x 32.5' = 1943.5*			
A	107	Steel Open Girder		FT	590	1
Quantity Calculations		*Span 1*	*59' x 5 = 295*			
		Span 3	*59' x 5 = 295*			
A	9540	Steel Paint Protective Coating		SF	4,563	1
Quantity Calculations		*Span 1*	*295' x 32"/12 x 2.9 = 2,281.3*			
		Span 3	*295' x 32"/12 x 2.9 = 2,281.3*			
A	331	RC Concrete Bridge Railing - Closed		FT	239	1
Quantity Calculations		*Span 1*	*59.8' x 2 = 119.6'*			
		Span 3	*59.8' x 2 = 119.6'*			
A	9304	Fixed Plate Bearing		EA	10	1
Quantity Calculations		*Span 1*	*5*			
		Span 3	*5*			
A	9313	Sliding Plate Bearing		EA	10	1
Quantity Calculations		*Span 1*	*5*			
		Span 3	*5*			

Approach - Substructure						
Group	El No.	Element Description		Unit	Element Quantity	Environ. State
A	215	RC Abutment		FT	70	1
Quantity Calculations		*Span 1*	*35'*			
		Span 3	*35'*			
A	227	RC Pile		EA	Not Reported	-
Quantity Calculations		*Span 1*	*6 (unexposed)*			
		Span 3	*6 (unexposed)*			
A	9238	RC Wingwall		FT	54	1
Quantity Calculations		*Span 1*	*13.5' x 2 = 27'*			
		Span 3	*13.5' x 2 = 27'*			
A	9250	Riprap		FT	Field Measurement	1
Quantity Calculations		*Span 1*	*Field Measurement*			
		Span 3	*Field Measurement*			

Element Commentary – Steel Thru Truss

12 Reinforced Concrete Deck

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

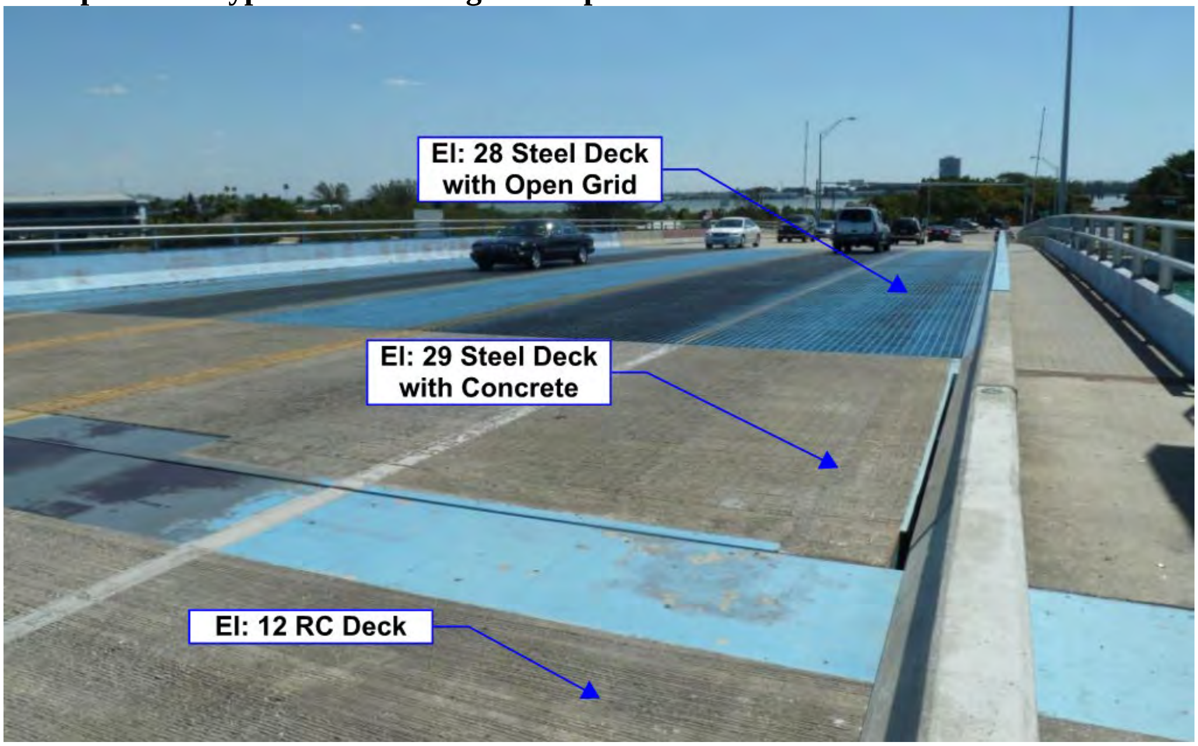
28 Steel Deck with Open Grid

Use for grid decks constructed of steel that are not filled allowing the passage of deck runoff and smaller debris down to the superstructure members below the deck.

Rate each square foot of the deck using the condition state definitions. The assessment should represent the worst condition stated of each square foot, which includes the top, bottom, and edges of the deck when visible.

Assess filled grids under element 29.

Multiple Deck Types on One Bridge Example



Record and assess each deck type under the appropriate element:

107 Steel Open Girder/Beam

Use when deck is structurally supported by beam components oriented longitudinally along roadway. In a floor system these are the primary structural components, that is the beam component that directly bears on the substructure.

Rate each linear foot of the open girder using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

Element 113 Steel Stringer would not be used to assess these beams. Stringers are smaller flexural members oriented longitudinal to the roadway and found in superstructure floor systems. A floor system is an assembly of girders/trusses, floor beams and stringers, where the stringers run parallel to the girders/trusses and tie into the floor beams.

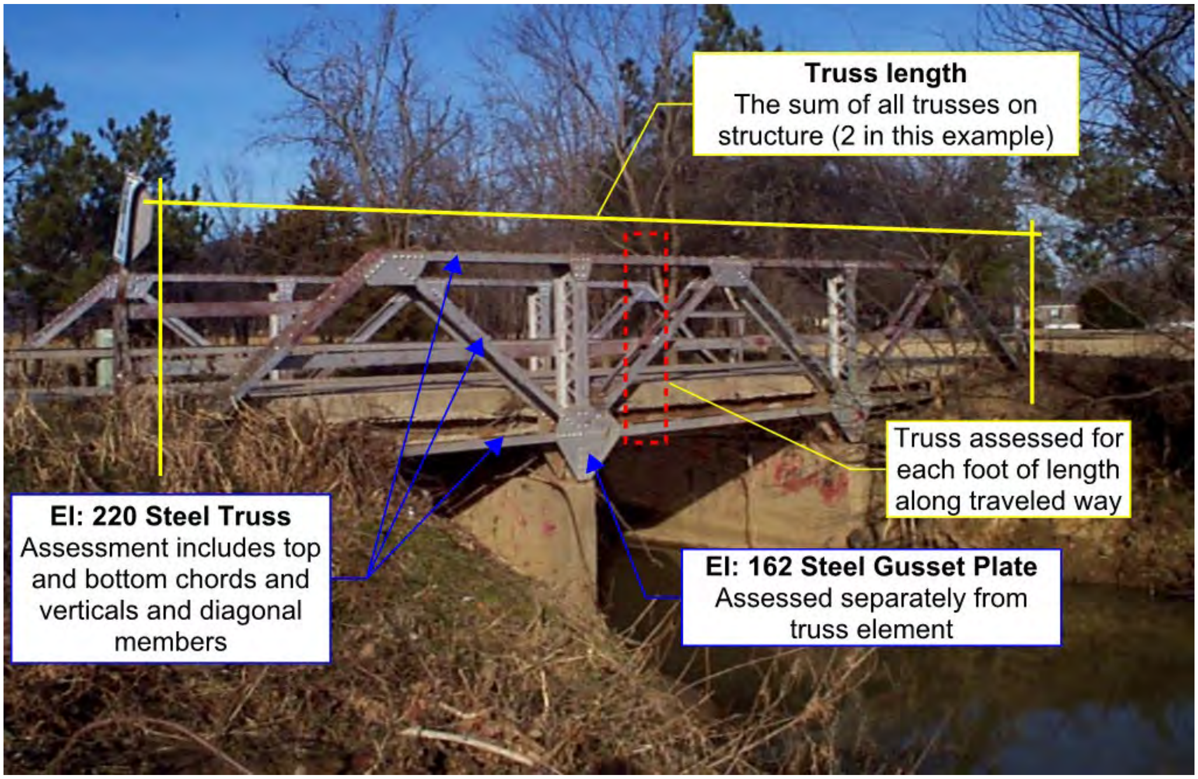
120 Steel Truss

Use to assess all primary truss elements. This includes all vertical, diagonal, upper and bottom chord members. This element is inclusive of all steel trusses. The truss in this example is relatively shallow and does not require vertical sway bracing. On taller trusses where vertical sway bracing is present, these secondary members shall not be evaluated under the truss element but under element 9152 Cross Frame.

Rate each linear foot of the truss using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the horizontal projected length of all diagonal and vertical members along the length of the truss.

Assess gusset plates under element 162 Steel Gusset Plate. Lower lateral bracing is not assessed in element inspection. Lower lateral bracing are secondary members. Deficiencies may be noted under the truss element; however there is no element to track their condition state.

Steel Truss Example



152 Steel Floor Beam

Use for beams that run transverse to the roadway and transfer loading to girders/trusses running perpendicular to the floor beams.

Rate each linear foot of the floor beam using the condition state definitions. The assessment should represent the worst condition stated of each linear foot, which includes the web and top and bottom flanges.

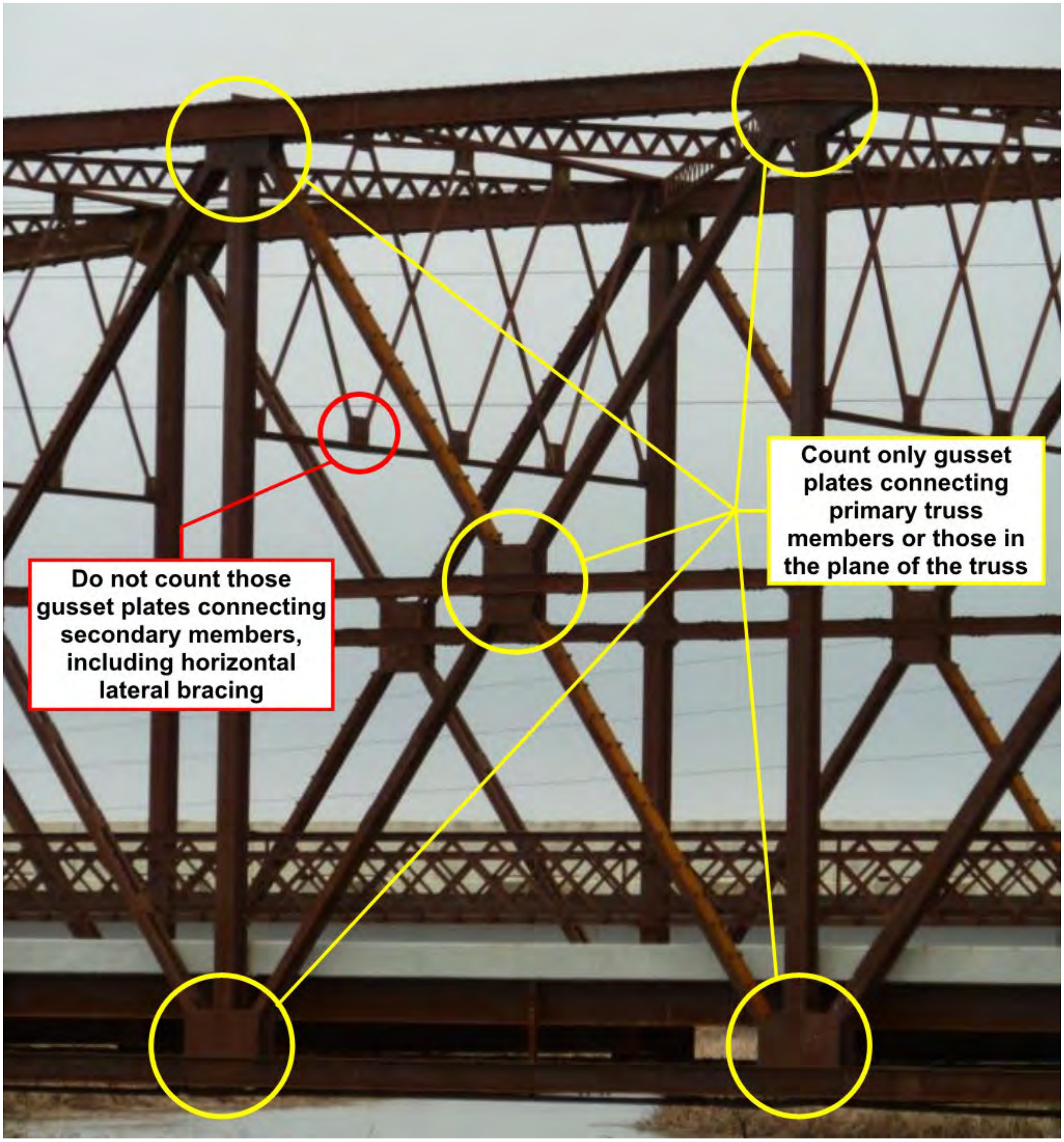
162 Steel Gusset Plate

Use for steel gusset plates that join primary truss members together.

Rate each gusset plate assembly using the condition state definitions. The assessment should represent the worst condition found on each gusset plate assembly. An assembly is comprised of all the gusset plates located at one panel point connection.

Lateral bracing gussets, or other gussets not in the plane of the truss are not assessed under element 162 Steel Gusset Plate.

Steel Gusset Plate Connections Example



Assess each gusset plate in primary load path member connections. Look for plate distortion, corrosion (pack rust) distorting plates, or causing section loss, and loose or missing rivets or bolts.

Count 1 EA at each connection point. Regardless if the gusset plates are built up sections, the quantity to assess would be 1 EA at that point.

Rate the worst condition per connection.

205 Reinforced Concrete Column

Use for those substructure elements that are drilled or placed and support either a cap or the superstructure itself.

Rate each column using the condition state definitions. The assessment should represent the worst condition stated on the column, which includes the full height and length of the column.

Assess piles under the appropriate elements. Piles, in contrast to columns, are driven to bearing.

Element 210 reinforced concrete pier wall would not be an applicable element for the piers in this example. While web walls are present between the columns, they essentially act as diaphragms providing lateral resistance for the pier. A pier wall would not have isolated rectangular pile footings as foundations.

215 Reinforced Concrete Abutment

Use when a stub or full height abutment is used or when concrete sheet piling is used as the primary component to retain roadway fill. Wingwalls are included in the abutment element when they are integral, which is they are not independent of one another. In this example there is a joint between the abutment and wingwall. Therefore they are not integral.

Rate each linear foot of the abutment along the skew using the condition state definitions.

220 Reinforced Concrete Pile Cap/Footing

Refer to example 3-EI.24.4 Concrete Frame (Not Box Culvert) for further discussion on this element.

227 Reinforced Concrete Pile

Use when reinforced concrete piling supports a cap or footing.

Rate each exposed pile using the condition state definitions. The assessment should represent the worst condition found on each pile.

Reinforced Concrete piling is typically square. Prestressed piling is much more common and should be assumed unless found to be otherwise (existing plans, etc.). In this case the plans indicate concrete piling.

234 Reinforced Concrete Pier Cap

Use when substructure unit, abutment or pier, is comprised of a pile bent with superstructure bearing on cap, or when top portion of pier supporting the superstructure is greater than the length of the pier bent.

Rate each linear foot of the cap using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the cap element.

Element 220 Reinforced Concrete Pile Cap/Footing is not used in this instance as the bridge component is located at the pier and directly supports the superstructure.

302 Compression Seal Joint

Use when a preformed polyurethane or other similar material is located within a deck or approach slab joint. Typically steel headers will be located on either side of the seal to keep the material protected and secure.

Rate each linear foot of the joint using the condition state definitions. The assessment should represent the worst condition found along each foot of the joint.

Compression seal joints are not to be confused with a strip seal joint. Strip seal joints are typically composed of steel extrusion anchors located on either side of the joint that firmly hold a simple neoprene seal.

330 Metal Bridge Railing

Refer to example 3-EI.24.2 Simple Span Concrete Slab for further discussion on this element.

331 Reinforced Concrete Bridge Railing – Closed

Use when solid reinforced concrete rail is used as the traffic appurtenances on the bridge structure. The element does not include the portions of the rail that extend beyond the limits of the bridge onto the roadway approaches.

Rate each linear foot of the concrete rail using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. The curb condition should be assessed based on the defects appropriate for its material type.

Remaining portions of rail not on the bridge are assessed under an NDOT BME in element level inspection.

9238 Reinforced Concrete Wingwall

Use when a non-integral reinforced concrete wingwall is used to retain roadway fill beyond the extents of the abutment. In this example the concrete wingwalls are supported by two piles and a joint between the wing and abutment can be observed.

Rate each linear foot of the reinforced concrete wingwall using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes the full height of the wingwall and any exposed wingwall piling.

If piling were to be exposed under the wingwalls, the piling would be assessed under the wingwall element.

9250 Riprap

Use for slope protection along banks in immediate vicinity of bridge.

Rate each linear foot of the riprap using the condition state definitions. The assessment should represent the worst condition stated of each linear foot.

It is not practical to measure the length of riprap for situations where the protection continues up and downstream. The inspector should measure the riprap to a maximum length of the bridge length along either bank under the structure.

9303 Fixed Pinned Bearing

Use on bearings that allow rotational movement by utilizing a pin. In this example the truss bears on a pinned bearing. The assembly is anchored to the concrete pier cap however the truss is able to rotate about the bearing at the pin connection.

Rate each pinned bearing using the condition state definitions. The assessment should represent the worst condition found on each fixed pinned bearing.

9304 Fixed Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

9311 Rocker with Pin Bearing

Use on bearings that allow rotational and translational movement by utilizing a pin. In this example the truss bears on a pinned bearing. The assembly bears on the concrete pier cap however the truss is able to rotate about the bearing at the pin and translate through the rocker.

Rate each pinned bearing using the condition state definitions. The assessment should represent the worst condition found on each rocker with pinned bearing.

9313 Sliding Plate Bearing

Refer to example 3-EI.24.5 Prestressed Concrete Stringer/Multi-beam or Girder for further discussion on this element.

3-EI.24.11 Reinforced Concrete Box Culvert

Superstructure: 6 - 10’-0 span reinforced concrete box culvert

Structure located in Environmental Zone 3

ADTT = 10 and low salt use

Substructure: N/A

Traffic Appurtenances: Closed reinforced concrete bridge railing.

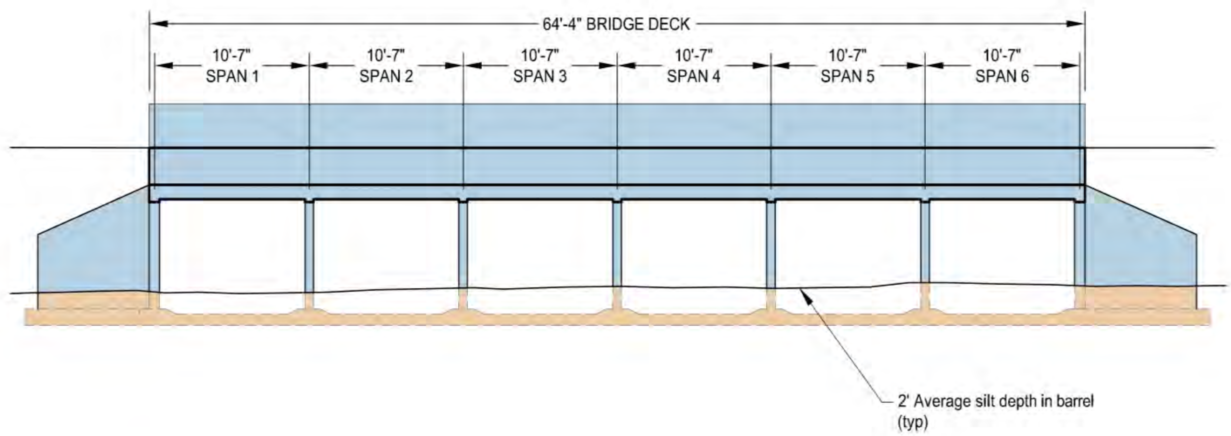


Figure 3-EI.24.11- 1: Elevation view of a multi-cell reinforced concrete culvert.

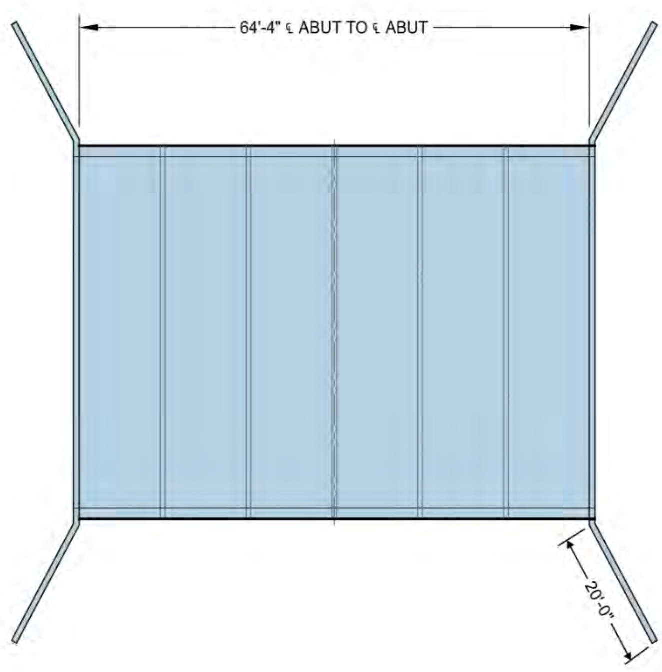


Figure 3-EI.24.11- 2: Plan view of a multi-cell reinforced concrete culvert.

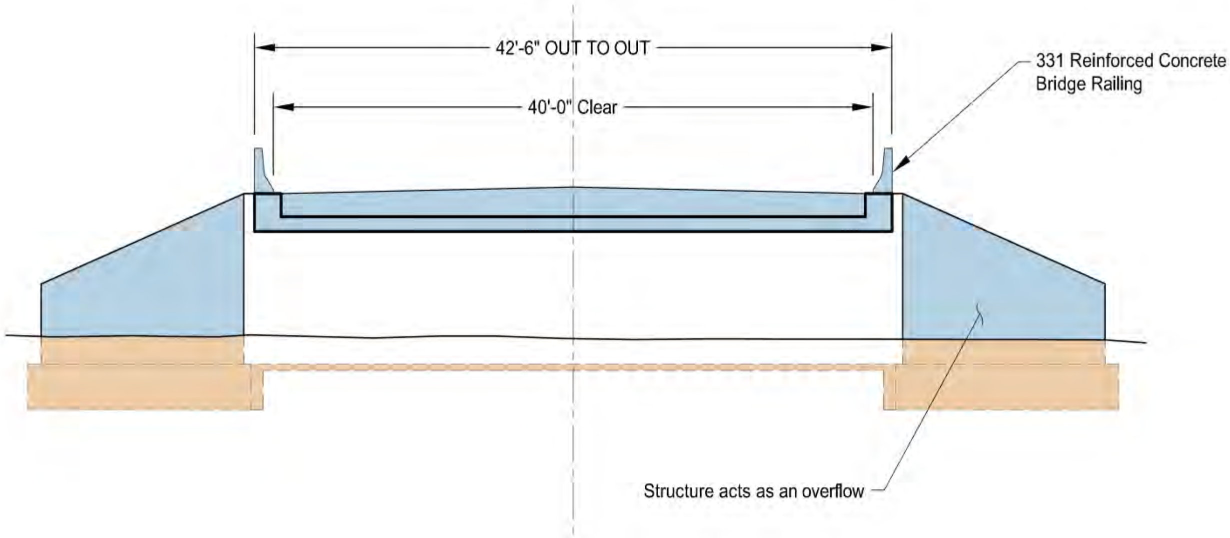


Figure 3-EI.24.11- 3: Roadway view of a multi-cell reinforced concrete culvert.

Whenever applicable, element quantities should be calculated from existing As-Built plans. Field measurements are typically used when plans do not exist or for verification purposes.

The quantities calculated in the table below are calculated using the above figures for reference.

The formulas below follow the flowchart from the NDOT Bridge Inspection Manual for the determination of each element Environmental State.

Culvert elements: Environmental State = 3 (for zone 3) + 0 (for low salt use) + 0 (for ADTT < 1000) = 3

Superstructure					
Group	El No.	Element Description	Unit	Element Quantity	Environ. State
M	241	RC Culvert	FT	255	3
Quantity Calculations	*Span 1*	*42.5' x 6 = 255'*			
M	9238	RC Wingwall	FT	80	3
Quantity Calculations	*Span 1*	*20.0' x 4 = 80'*			
M	331	RC Bridge Railing - Closed	LF	129	3
Quantity Calculations	*Span 1*	*64.3' x 2 = 129'*			
M	9553	Silt in Culvert Barrel	EA	1	-
Quantity Calculations	*Span 1*	*1*			

Element Commentary – Reinforced Concrete Box Culvert

241 Reinforced Concrete Culvert

Use this element for standard culvert structures comprised of reinforced concrete or those larger structures that contain a structural floor between abutments. A structural floor ties into the walls of the structure essentially creating a rigid frame along the bottom of the structure. A concrete lined channel through the underside of a bridge does not constitute a structural floor.

Rate this element per linear foot along each barrel. The assessment should represent the worst condition state of each linear foot, which includes both walls, the ceiling and the floor of each barrel. The linear foot is taken circumferentially around the barrel.

331 Reinforced Concrete Bridge Railing – Closed

Use when solid reinforced concrete rail is used as the traffic appurtenances on the structure. The element does not include the portions of the rail that extend beyond the limits of the structure onto the roadway approaches. In this example a closed concrete bridge rail is located and tied into the culvert parapet wall. To capture any deficiencies with this wall, the bridge railing element shall be used. If the bridge railing were free standing or part of the roadway over structure, this element would not be associated with the culvert.

Rate each linear foot of the concrete rail using the condition state definitions. The assessment should represent the worst condition state of each linear foot, which includes all sides of the bridge railing, posts and curb if present. The curb condition should be assessed based on the defects appropriate for its material type.

Remaining portions of rail not on the bridge are assessed under an NDOT BME in element level inspection.

9238 Reinforced Concrete Wingwall

Use this element for concrete wingwalls of culverts whether integral or otherwise.

Rate this element per linear foot along each wing. The assessment should represent the worst condition state of each linear foot, which takes into account the full height of the each linear foot.

9244 Reinforced Concrete Headwall

Use this element for concrete headwalls of culverts. A culvert headwall will typically be found at the ends of steel culverts. In this example the wall above the barrels is considered a parapet wall, not a headwall. Parapet walls are evaluated with each appropriate culvert barrel.

Rate this element per linear foot along each headwall. The assessment should represent the worst condition state of each linear foot. This includes taking into account the full height of each linear foot.

9553 Silt in Culvert Barrel

Use this element to capture silt within culvert barrels. Only 1 EA may be used per span group. In this example all 6 barrels constitute the main span group.

Rate this element as an each item for every span group with accumulated silt. The assessment should represent the worst condition state found within each span group. For example, there may be some silt deposits at the inverts of the culvert however walking through the barrel, the silt depth rises which impedes flow. The condition state would be based on the area restricting flow.

This element should not be confused with element 9552 Debris Blocking Flow. Element 9552 should be used when large objects (logs, branches, trash, etc.) become lodged at the invert of a culvert.

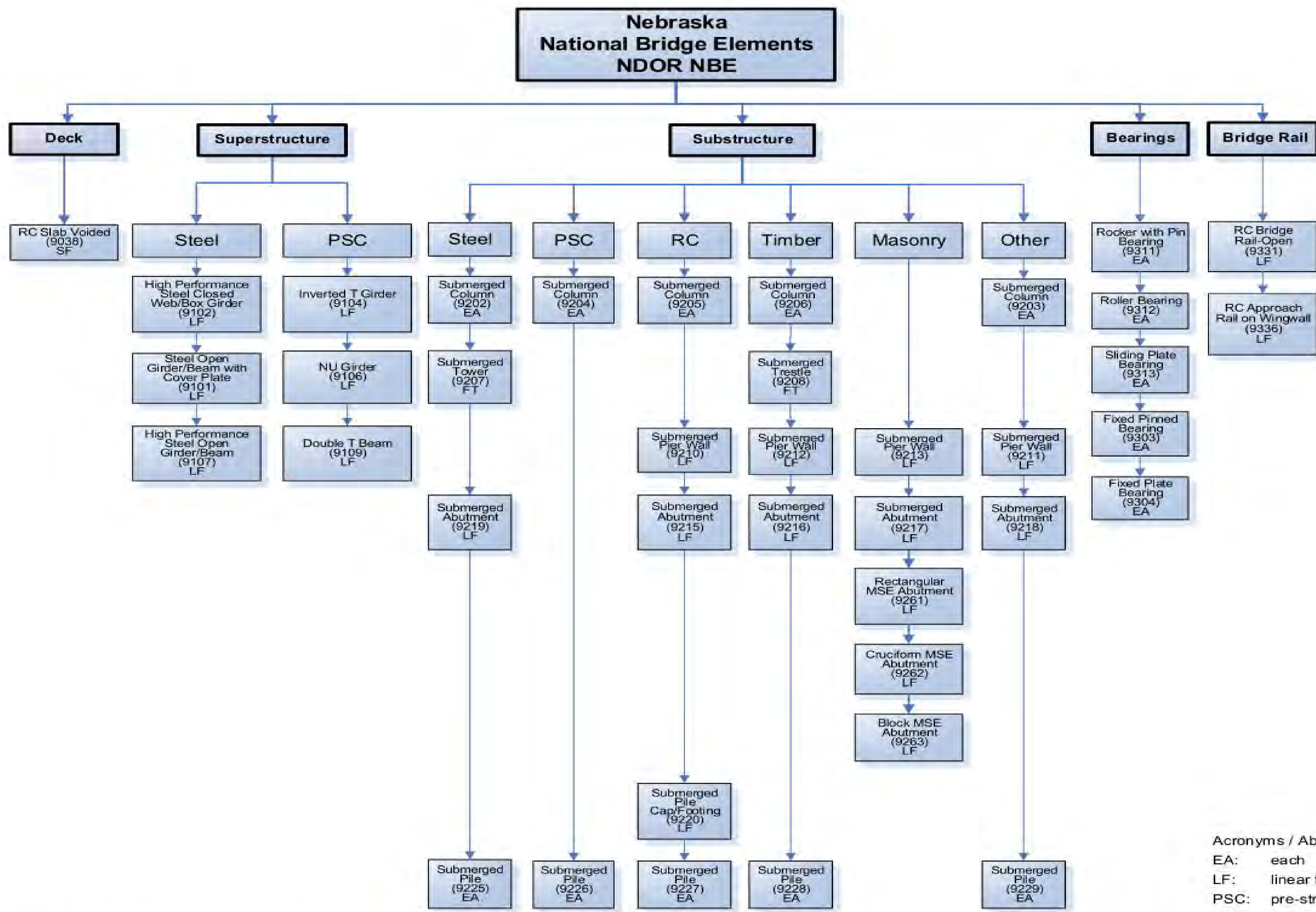
3-EI.25 APPENDIX B: NDOT NBE AND NDOT BME GROUPINGS

3-EI.25.1 General

The charts on the following pages organize the Nebraska Elements defined in Chapter 3-EI Element Inspection Coding into the NDOT NBEs and the NDOT MBEs. For each element, the name, identifier, and units of measure are shown and elements are grouped by major bridge assembly and material type.

Charts for National Bridge Elements (NBEs) and Bridge Management Elements (BMEs) as defined in the AASHTO Manual for Bridge Element Inspection, First Edition 2013, can be referenced in Appendix C of said manual.

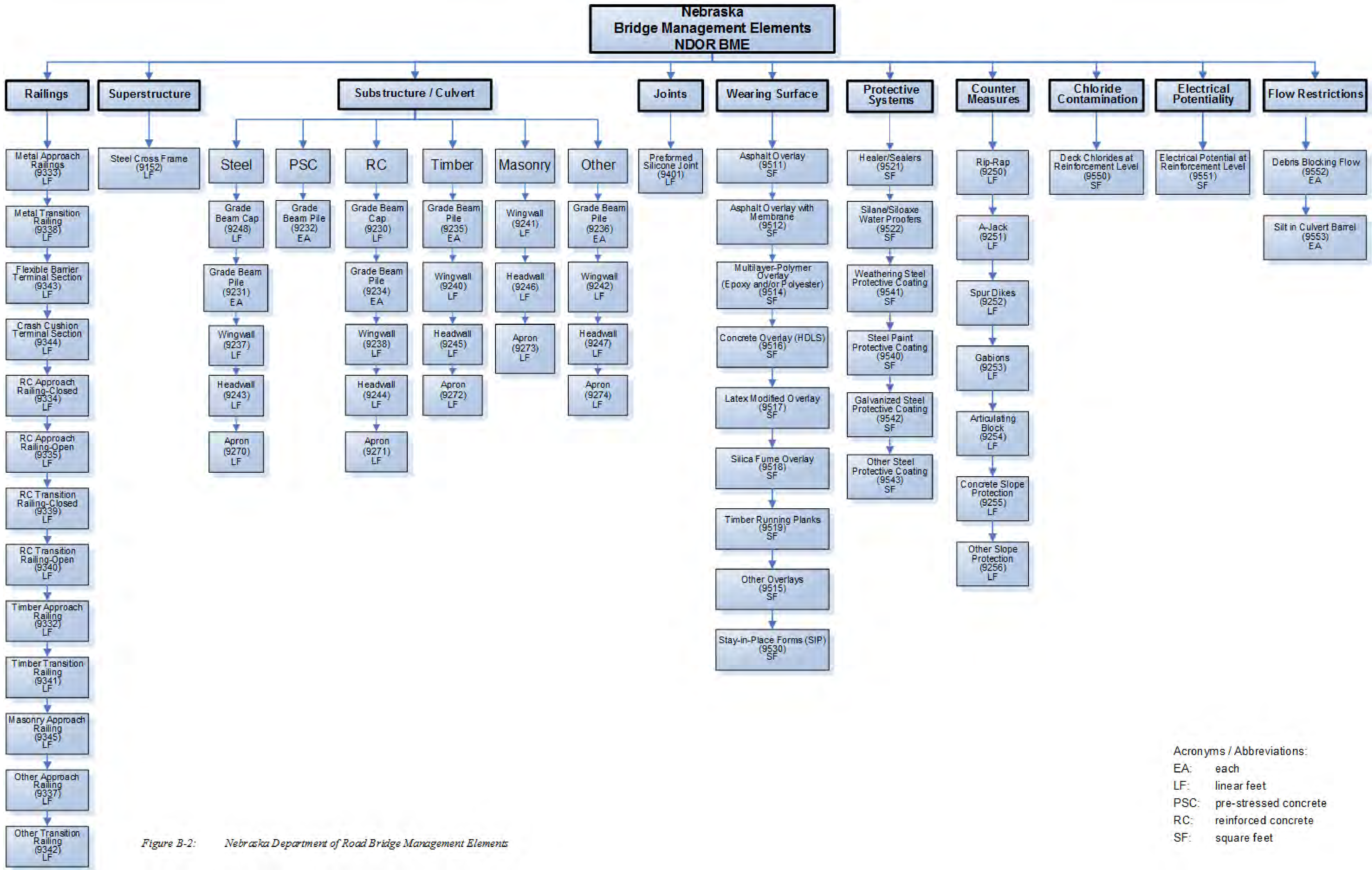
3-EI.25.2 NDOT NBE Groupings Chart



Acronyms / Abbreviations:
EA: each
LF: linear feet
PSC: pre-stressed concrete
RC: reinforced concrete
SF: square feet

Figure B-1: Nebraska Department of Road National Bridge Elements

3-EI.25.3 NDOT BME Groupings Chart



Acronyms / Abbreviations:
EA: each
LF: linear feet
PSC: pre-stressed concrete
RC: reinforced concrete
SF: square feet

Figure B-2: Nebraska Department of Road Bridge Management Elements

3-EI.26 APPENDIX C: NEBRASKA MATERIAL DEFECT GROUPINGS

3-EI.26.1 General

The chart on the following page organizes the Nebraska Material Defects defined in Chapter 3-EI Element Inspection Coding. For each defect, the name, and identifier are shown and defects are grouped by material type.

A chart for AASHTO Material Defects as defined in the AASHTO Manual for Bridge Element Inspection, First Edition 2013, can be referenced in Appendix D of said manual.

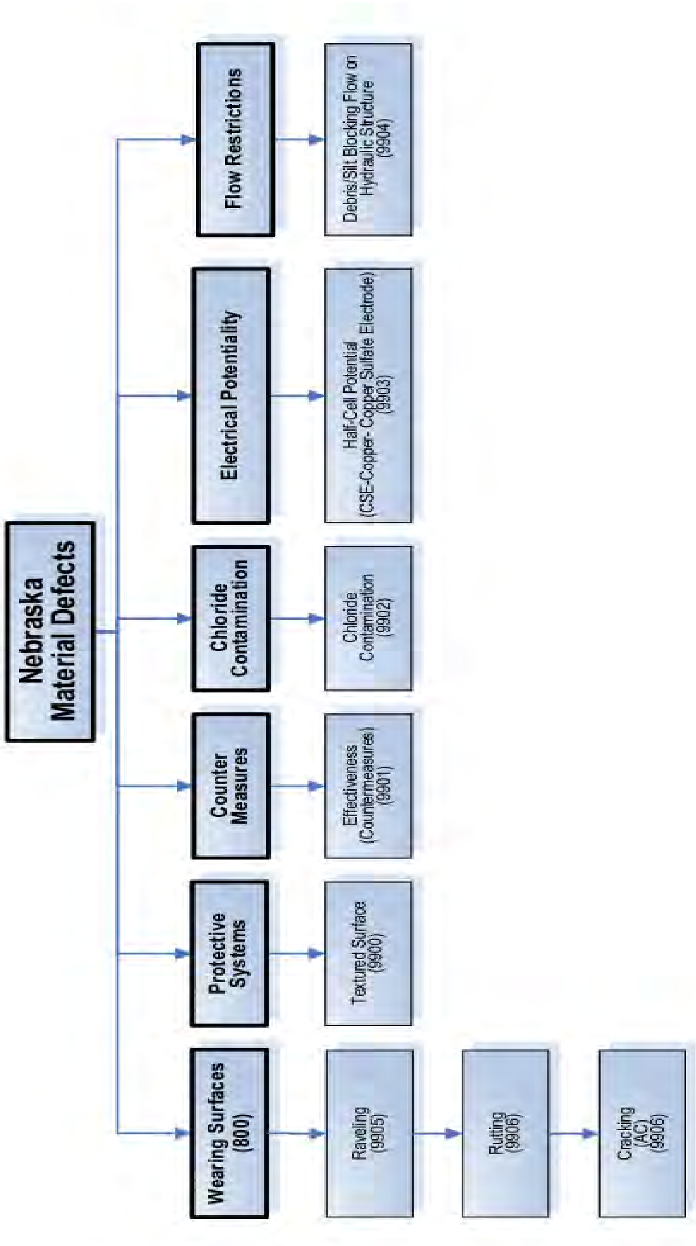


Figure C-1: Nebraska Department of Road Material Defects

3-EI.26.2 Nebraska Material Defect Groupings Chart

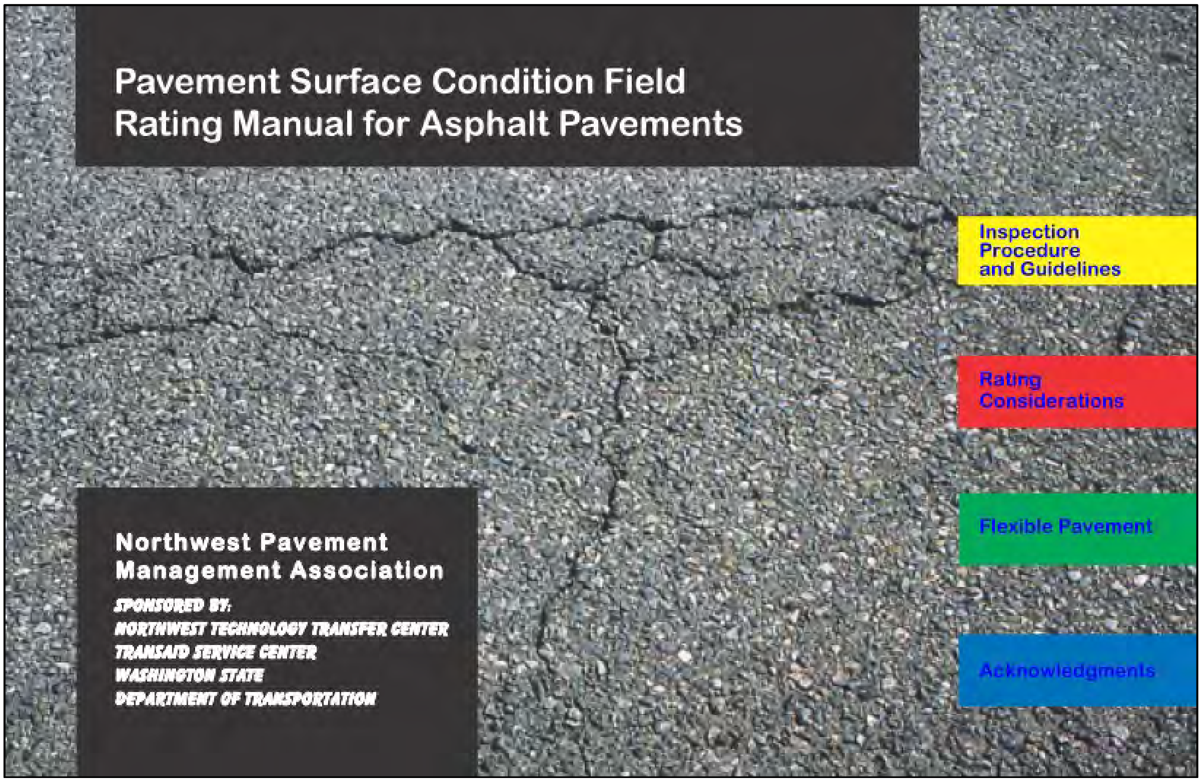
3-EI.27 APPENDIX D: ASPHALT PAVEMENT FIELD RATING MANUAL

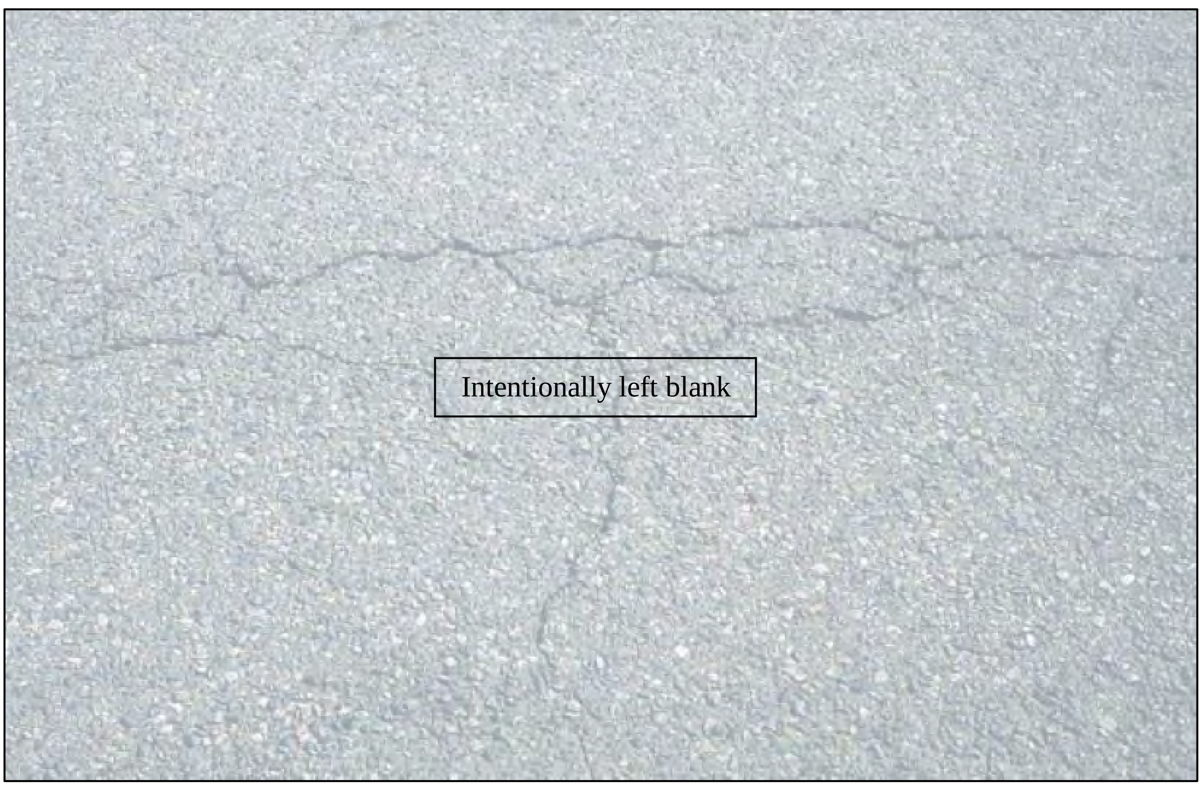
3-EI.27.1 General

The field rating manual for asphalt pavements in Appendix D is to be used as a reference guide for assessing the condition state of NDOT BME 9511 – Asphalt Overlay and NDOT BME 9512 – Asphalt Overlay with Membrane as defined in Chapter 3-EI Element Inspection Coding.

The Pavement Surface Condition Field Rating Manual for Asphalt Pavements was published by the Northwest Pavement Management Association.

3-EI.27.2 Field Rating Manual





Pavement Surface Condition Field Rating Manual for Asphalt Pavements

Northwest Pavement Management Association

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CONTENTS

Inspection Procedure and Guidelines

These inspection procedures offer a method of determining pavement condition through observing and recording the presence of specific types and severities of defects or distresses in the pavement surface.

The elements of pavement condition rating are as follows:

1. The type of defect.
2. The severity of the defect.
3. The extent to which the road surface is affected by the defect.

There are several types of defects and several possible severities and extents for each defect. These are described and illustrated for flexible pavements in the following pages of this manual.

8

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Rating Considerations

Listed below are important factors to consider when you collect pavement condition data.

- Each agency must decide whether to record the extent of the **predominant severity** of each defect type or to record the extent of **each severity** of each defect type. The agency must also decide whether to estimate/measure and record these extents using finite values or standardized ranges of values.

  *If the **predominate severity** procedure is used for each type of defect observed*, you should record only one severity, the **predominant severity**. Always record the higher rated severity if approximately equal proportions of more than one severity exist. The purpose is to establish a severity that represents the typical condition of the roadway segment. The extent you record is always the overall extent associated with all levels of severity for a given distress type. *This extent may be a range of values or it may be a finite value*. Your individual agency may wish to note (in the comments section of the form) the occurrence of any level of severity that is significantly higher than what you have recorded in the rating.

10

*If you are recording the extent associated with **each severity** of each distress type*, then instead of recording the total extent and the **predominant severity**, you will record the extent of **each severity** of each type of defect. It is recommended that a finite value (the actual percentage or count) of the extent is recorded for each of the severity categories as use of ranges will probably result in too large an extent for the total of the severities.

- Roads can be rated on foot or by vehicle. In urban areas, rating is frequently done on foot. The best driving speeds for observing the defects range from 2 to 5 miles per hour. A single lane is generally used, but if time and funds allow, an agency can measure more than one lane.

  ***Note:** Different values will likely be obtained in walking vs. driving and the agency needs to be aware of possible problems in comparing results obtained by using more than one technique.*

- The relative sun angle and direction of viewing the roadway surface will greatly affect your visual observation. Be sure to view the pavement from more than one direction occasionally during the survey to assure the true nature of the pavement surface is being observed.

11

- The time of year and weather (moisture and temperature) conditions over a given time period can also affect the severity and visibility of certain distresses. If at all possible, rate the roadway network at a similar time of the year and only while the pavement is dry.
- When rating a roadway, you must observe the entire area of the traveled roadway segment or sample and determine the defect severities and extents over this full pavement surface area.
- When rating composite pavements (such as asphalt over rigid pavement), classify cracks that may correspond with the concrete joints as distresses and rate these, and other cracks, as the type of crack they represent (transverse or longitudinal).
- When rating the width of cracks, use the average width, not the extremes. Cracks often vary in width and the intent is to rate the overall severity of the crack.

12

- Condition ratings apply only to the traveled surface of a road. Do not include the conditions of shoulders or other adjacent areas. Shoulder condition, drainage information, or other items may be accounted for and collected separately from or with the pavement rating data.
- Areas within the curb returns are considered a part of the intersection for rating purposes. Intersections are generally rated with a higher functional class street or in a given direction. Intersections may also be separately rated and recorded. Each agency needs to develop its own policy.
- If opposite sides of the roadway or individual lanes are rated separately, use separate forms and enter the data into the database as separate multilane segments.
- When any type of defect is not observed, write an "N" in the first space on the field form for that defect. The "N" indicates clearly that a defect was not present and reduces the potential for confusion when the data are entered into the database.
- Your PMS manager may wish you to observe and collect additional information during the survey. This might include such things as historical and physical information, documenting new segments, or noting items needing repair.
- It is important that you receive clear direction from the PMS manager on all details related to data collection prior to beginning the survey project.

13

Flexible Pavement Distresses

1. *Rutting and Wear*

Rutting is a surface depression within the wheel path. Rutting results from a permanent deformation in any of the pavement layers or subgrades, usually caused by consolidation or lateral movement of the materials due to traffic loads. When the upper pavement layers are severely rutted, the pavement along the edges of the rutted area may be raised. Usually, the rutting occurs gradually across the wheel path, reaching a maximum depth in the center of the wheel path. Ruts are most obvious after rainfall when they are full of water.

Wear is surface depression in the wheel path resulting from tire abrasion.

14

Measurement for Rutting

Severity: The average rut depth in the wheel path for the segment or sample.

Recommended ranges for estimated severity.

Low — 1/4-inch to 1/2-inch

Medium — 1/2-inch to 3/4-inch

High — over 3/4-inch

Extent: The extent of rutting is assumed to be the full length of the segment in the wheel path.

Measure: Take measurements in as many locations as is practical and average them.

Rutting

2. *Alligator Cracking*

Alligator fatigue cracking is associated with loads and is usually limited to areas of repeated traffic loading. The cracks surface initially as a series of parallel longitudinal cracks within the wheel path that progresses with time and loads to a more branched pattern that begins to interconnect. The stage at which several discontinuous longitudinal cracks begin to interconnect, is defined as alligator cracking. Eventually the cracks interconnect sufficiently to form many pieces, resembling the pattern of an alligator.

On narrow, two-lane roads, alligator cracking may form along the center line rather than in the customary wheel paths.

Almost always, the pattern of the cracking (the longer dimension of the connected cracks) is parallel to the roadway or direction of vehicle travel. However, alligator cracking occasionally occurs in a pattern transverse to the roadway direction because of poor trench compaction, settlement, or frost action.

Pot holes and other occurrences of destroyed or missing pavement are accumulated as high severity alligator cracking and may also be noted in the comments area of the field form.

Severity:

Low — Branched, longitudinal, discontinuous thin cracks are beginning to interconnect and form the typical alligator pattern with no spalling.

Medium — Cracking is completely interconnected and has fully developed an alligator pattern. Some spalling may appear at the edges of cracks. The cracks may be greater than 1/4-inch wide, but the pavement pieces are still in place.

High — The pattern of cracking is well developed. Spalling is very apparent at the crack. Individual pieces may be loosened and may rock under traffic. Pieces may be missing. Pumping of fines up through the cracks may be evident.

Low

Medium

High

Option A — Measurement for Alligator Cracking

Extent: The extent of alligator cracking is related to the length of wheel paths. There are two wheel paths in every lane. Therefore, a 100-foot lane has 200 feet of wheel paths. Accurate measurement and recording as a percentage of wheel path length is preferable.

Recommended ranges for estimated extent.

1 percent to 9 percent of both wheel paths
10 percent to 24 percent of both wheel paths
25 percent to 49 percent of both wheel paths
50 percent to 100 percent of both wheel paths

Measure: Accumulate the lengths along the surveyed lane of each severity of the alligator cracking as it occurs in both wheel paths. Divide the accumulated lengths by twice the length of the segment (two wheel paths per lane). Multiply by 100 to get percent, and round to a whole number.

18

Option B — Measurement for Alligator Cracking

Extent: The extent of alligator cracking is related to the entire survey area.

Measure: Alligator Cracking is measured in square feet. The major difficulty in measuring this type of distress is that two or three levels of severity often exist within one distressed area. If these portions can be easily distinguished from each other, they should be measured and recorded separately. However, if the different levels of severity cannot be divided easily, the entire area should be rated at the highest severity level present.

19

3. *Longitudinal Cracking*

Longitudinal cracks run roughly parallel to the roadway center line. Longitudinal cracks associated with the beginning of alligator cracking are generally discontinuous, broken, and occur in the wheel path. However, any longitudinal crack that is clearly within the wheel path should be rated.

Note: Do not include cracks which reside only within 6 inches of a lane edge. These cracks are assumed to be caused by, or related to, a paving construction joint and should be rated as nonwheel path longitudinal cracking. If your survey includes an item for joint or crack seal condition, you should include the seal condition of these lane edge construction joints in that survey item.

Severity:

Low — The cracks have very little or no spalling along the edges and are less than 1/4-inch in width. If the cracks are sealed and the width of the crack prior to sealing is invisible, they should be classified as Low Severity.

Medium — The cracks have little or no spalling but they are greater than 1/4-inch in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks.

High — Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack. At some point, this longitudinal cracking becomes alligator cracking.

Low

Medium

High

Option A — Measurement for Longitudinal Cracking

Extent: The extent of longitudinal cracking is recorded as a percent of the length of the surveyed segment.

Recommended ranges for estimated extent.

1 percent to 99 percent of length of segment
100 percent to 199 percent of length of segment
200 percent or more of length of segment

Measure: Accumulate the lengths along the surveyed lane of each severity of the longitudinal cracking as it occurs. Divide the accumulated lengths by the length of the segment. Multiply by 100 to get percent, and round to a whole number.

22

Option B — Measurement for Longitudinal Cracking

Extent: The extent of longitudinal cracking is related to the entire survey area.

Measure: Longitudinal cracks are measured in linear feet. The length and severity of each crack should be recorded after identification.

23

4. *Nonwheel Path Longitudinal Cracking*

Nonwheel path longitudinal cracks run roughly parallel to the roadway center line. They may be caused by a poorly constructed paving joint, a reflective crack caused by joints and cracks beneath the surface course, including joints and cracks near the edge of the pavement. These types of cracks are not load-associated.

Low severity nonwheel path longitudinal cracking looks very similar to low severity alligator cracking; however, low severity alligator cracking always occurs in the wheel path and should be rated as alligator cracking.

Severity:

Low — The cracks have very little or no spalling along the edges and are less than 1/4-inch in width. If the cracks are sealed and the width of the crack prior to sealing is invisible, they should be classified as Low Severity.

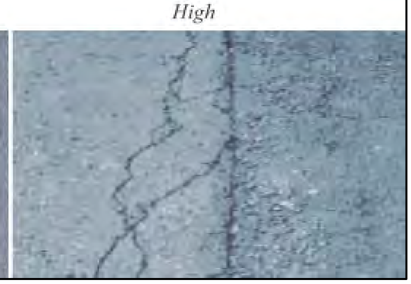
Medium — The cracks have little or no spalling but they are greater than 1/4-inch in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks.

High — Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack.

Low

Medium

High



Option A — Measurement for Nonwheel Path Longitudinal Cracking

Extent: The extent of nonwheel path longitudinal cracking is recorded as a percent of the length of the surveyed segment.

Recommended ranges for estimated extent.

1 percent to 99 percent of length of segment
100 percent to 199 percent of length of segment
200 percent or more of length of segment

Measure: Accumulate the lengths along the surveyed lane of each severity of the nonwheel path longitudinal cracking as it occurs. Divide the accumulated lengths by the length of the segment. Multiply by 100 to get percent, and round to a whole number.

26

Option B — Measurement for Nonwheel Path Longitudinal Cracking

Extent: The extent of nonwheel path longitudinal cracking is related to the entire survey area.

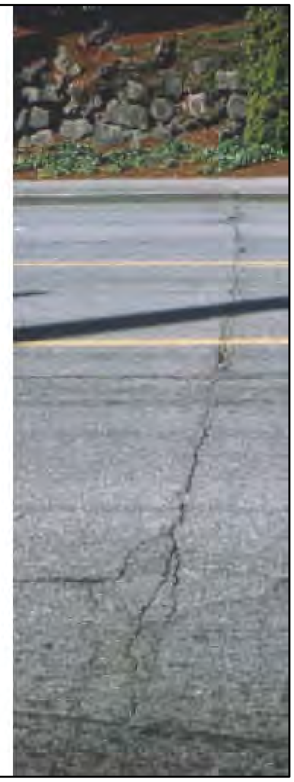
Measure: Nonwheel path longitudinal cracks are measured in linear feet. The length and severity of each crack should be recorded after identification.

27

5. *Transverse Cracking*

Transverse cracks run roughly perpendicular to the roadway center line. They may be caused by surface shrinkage due to low temperatures, hardening of the asphalt, or cracks in underlying pavement layers such as PCCP slabs. They may extend partially or fully across the roadway.

Consider only those transverse cracks that are a minimum of two feet in length.



Severity:

Low — The cracks have very little or no spalling along the edges and are less than 1/4-inch in width. If the cracks are sealed and the width of the crack prior to sealing is invisible, they should be classified as Low Severity.

Medium — The cracks have little or no spalling but they are greater than 1/4-inch in width. There may be a few randomly spaced low severity connecting cracks near the main crack or at the corners of intersecting cracks.

High — Cracks are spalled and there may be several randomly spaced cracks near the main crack or at the corners of intersecting cracks. Pieces are visibly missing along the crack.

Low

Medium

High

Option A — Measurement for Transverse Cracking

Extent: The extent of transverse cracking is quantified as a frequency of occurrence expressed as a count per 100 feet of lane length.

Recommended ranges for estimated extent.

1 to 4 cracks per 100 feet
5 to 9 cracks per 100 feet
10 or more cracks per 100 feet

Measure: Accumulate the count along the surveyed lane of each severity of transverse crack as it occurs. Divide the accumulated counts by the length of the segment. Multiply by 100 to get the frequency, and round to a whole number.

30

Option B — Measurement of Transverse Cracking

Extent: The extent of transverse cracking is related to the entire survey area.

Measure: Transverse cracks are measured in linear feet. The length and severity of each crack should be recorded after identification.

31

6. Raveling and Aging

Raveling and aging are pavement surface deterioration that occurs when aggregate particles are dislodged (raveling) or oxidation causes loss of the asphalt binder (aging). An ACP loses its smooth surface and begins to appear very open and rough.

The severity is rated by the degree of aggregate and binder loss. Rate the overall severity within the segment as the most predominate observed level.

This distress is measured or observed differently depending on whether the road surface is BST or ACP. Care should be exercised when rating chip sealed pavements, as they tend to look raveled because of the inherent nature of the chip seal surface. However, raveling in chip sealed pavements (loss of aggregate) actually results in a condition of excess asphalt, and should be rated as flushing (see next distress, Flushing/Bleeding).

Severity:

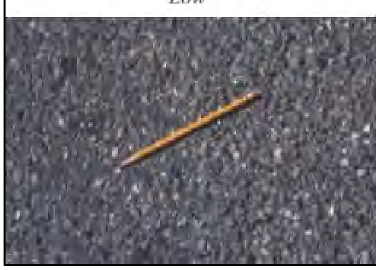
Low — The aggregate and/or binder has started to wear away but has not progressed significantly. The pavement only appears slightly aged and slightly rough.

Medium — The aggregate and/or binder has worn away and the surface texture is moderately rough and pitted. Loose particles may be present, and fine aggregate is partially missing from the surface.

High — The aggregate and/or binder have worn away significantly, and the surface texture is deeply pitted and very rough. Fine aggregate is essentially missing from the surface, and pitting extends to a depth approaching one half the coarse aggregate size.

High

Low



Medium

High

Extent: The extent of raveling is estimated and expressed relative to the surface area of the surveyed lane.

Recommended ranges for estimated extent.

Localized — Patchy areas, usually in the wheel paths.

Wheel Path — Majority of wheel tracks are affected, but little or none elsewhere in the lane.

Entire Lane — Most of the lane is affected.

Measure: Estimate the severity and extent.

34

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35

7. *Flushing/Bleeding*

Flushing and bleeding is indicated by an excess of bituminous material on the pavement surface which presents a shiny, glass-like reflective surface that may become sticky in hot temperatures.

At the lower severity levels, the extents "localized" and "wheel path" may be difficult to differentiate; however, as the severity increases, "wheel path" becomes more well defined. Wheel path refers to tire tracking area and may be used to represent the condition of only one wheel track being heavily involved.

This distress is measured or observed differently depending on whether the road surface is BST or ACP. In BST pavements, loss of aggregate (raveling), commonly referred to as "chip loss", leaves the binder exposed. This condition looks like flushing, and should be rated as flushing.

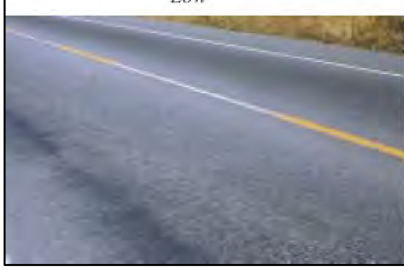
Severity:

Low — Minor amounts of the aggregate have been covered by excess asphalt but the condition has not progressed significantly.

Medium — Significant quantities of the surface aggregate have been covered with excessive asphalt. However, much of the coarse surface aggregate is exposed, even in those areas showing flushing.

High — Most of the aggregate is covered by excessive asphalt in the affected area. The area appears wet and is sticky in hot weather.

Low



Medium

High

Extent: The extent of flushing is estimated and expressed relative to the surface area of the surveyed lane.

Recommended ranges for estimated extent.

Localized — Patchy areas, usually in the wheel paths.

Wheel Path — Majority of wheel tracks are affected, but little or none elsewhere in the lane.

Entire Lane — Most of the lane is affected.

Measure: Estimate the severity and extent.

38

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39

8. Patching

A patch is an area of pavement which has been replaced with new material to repair the existing pavement or access the utility.

A patch is considered a defect no matter how well it is performing (a patched area or adjacent area usually does not perform as well as an original pavement section). Generally, some roughness is associated with this distress. In general, a patch is less than a typical rehabilitation in size and scope. They are less than full roadway width and/or are less than project length. Some agencies may have patches as long as the work defined by another agency as a rehabilitation.

Temporary patches, as well as localized permanent repairs (dig-out repair), are included in this distress category. Utility cut patches are also included as part of the patching values.

40

Low — Patch has at most low severity distress of any type.

Medium — Patch has medium severity distress of any type.

High — Patch has high severity distress of any type.

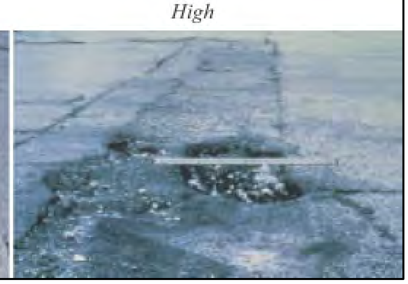
low

Medium

Low

Medium

High



Option A — Measurement for Patching

Extent: The extent of patching is related to the length of wheel paths. Each half of the lane is considered one wheel path.

Recommended ranges for estimated extent.

1 percent to 9 percent of both wheel paths
10 percent to 24 percent of both wheel paths
25 percent or more of both wheel paths.

Option B — Measurement for Patching

Extent: The extent of patching is related to the entire survey area.

Measure: Patching is measured in square feet of entire inspection area. No other distresses (e.g., rutting or cracking) are recorded within a patch. Other distresses in the patch area are used to determine the severity level of the patch.

42

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43

9. *Original WSDOT Patching*

In general, a patch is less than a typical rehabilitation in size and scope. They are less than full roadway width and/or are of less than project length. Some agencies may have patches as long as the work defined by another agency as a rehabilitation. WSDOT defines a lane with "new surfacing" as a patch if it is less than about half a mile in length. Definition of minimum rehabilitation vs. maximum patch length is a matter of agency policy.

Temporary patches, as well as localized permanent repairs (dig-out repair), are included in this distress category. The patches or repairs which are obviously the result of utility work are the exception, and are not included as part of the patching values.

While appropriately done repairs are an asset rather than a liability to the life of a segment of pavement, the fact that they were required (other than for utility work) generally indicates some failure in the pavement structure.

If any patch (including a utility patch) shows surface defects, such as alligator cracking, accumulate those defects also, and include them in the overall segment rating.

44

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Patching

Severity: Severity of patching is defined in three categories which are most easily recognized by the method of construction.

Low — The lowest severity is BST patching or chip seal patching. It is constructed by spraying hot asphalt onto the roadway (usually using a truck with a spray bar) and then spreading and rolling crushed stone onto the surface. It is identified by its nearly straight edges, rough texture, and surface contours which mimic the surface below. This is assumed to cover low severity cracking or raveling.

Medium — Blade patching is the medium severity patching. It has edges shaped to the contours of the surrounding pavement and is of variable thickness with feathered edges. This type is assumed to cover (or replace) medium to severe alligator cracking, pot holes, rutting, or other significant pavement defects. Cold patches are of this type.

High — Dig-Out or Full Depth patching is the most severe of the types rated. A patch (or repair) of this type is constructed by neatly cutting out a full depth portion of the pavement, removing all disturbed materials, and refilling the void with an appropriate pavement section. This appropriately reconstructed section should be as strong as the original pavement section, perhaps even stronger. This type of patch is assumed to replace severe alligator cracking.

46

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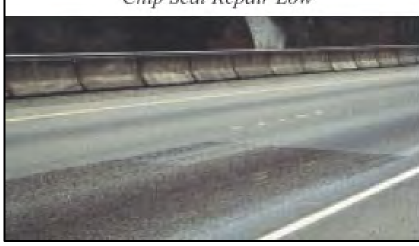
Chip Seal Repair Low


Blade Repair Medium


Dig Out High

Extent: The extent of patching is related to the length of wheel paths. Accurate measurement expressed as a percentage of wheel path length is preferable. Each half of the lane is considered one wheel path. This form of measurement is identical to that of alligator cracking because the general assumption is that patching replaces alligator cracking.

Recommended ranges for estimated extent.

1 percent to 9 percent of both wheel paths
10 percent to 24 percent of both wheel paths
25 percent or more of both wheel paths

Note: Patching was included in the WSPMS because without a deduction for patching, a roadway which is virtually made of patches would appear to be a "perfect" segment or project. This would result in the segment or project never being included in a prioritized list of pavements needing rehabilitation.

If an agency has separate maintenance districts, or crews assigned to specific areas, the more efficient crew/district can be penalized by the pavement management system for doing a better job. If its roadways rate higher as a result of better maintenance operations, those roadways might not receive repair and rehabilitation funds as a result.

The way in which the PMS uses these distress severities can vary, and the desired effect can be accommodated by using different deduct values to reflect the needs of the agency. If patching and/or repairs are

48

not deemed a serious issue within your agency, then reduce or remove the optional local deducts associated with the patching severities.

Measure: Accumulate the lengths along the surveyed lane of each severity (type) of patching as it occurs in both wheel paths. Divide the accumulated lengths by twice the length of the segment (two wheel paths per lane). Multiply by 100 to get percent, and round to a whole number.

49

10. Corrugation and Waves

This distress category covers a general form of surface distress which is not limited to the wheel path, although they may occur in the wheel path. The distress may occur in isolated areas, such as at intersections, or it may occur over a large part of the roadway surface.

Corrugations and waves are regularly occurring transverse undulations in the pavement surface. Corrugations occur as closely spaced ripples, while waves are undulations whose distance from peak to valley is more than 3 feet.

Severity: The severity of corrugation is defined as the maximum vertical deviation from a 10-foot straightedge placed on the pavement parallel to the center line of the roadway.

Low — 1/8-inch to 2 inches per 10 feet.

Medium — 2 inches to 4 inches per 10 feet.

High — Over 4 inches per 10 feet.

Option A — Measurement of Corrugation and Waves

Extent: The extent of corrugations is expressed in percent of the lane area affected.

1 percent to 9 percent of the area of the segment
10 percent to 24 percent of the area of the segment
25 percent or more of the area of the segment

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

Option B — Measurement of Corrugation and Waves

Extent: The extent of corrugations is expressed in square feet of the entire survey area.

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

51

11. Sags and Humps

This distress category also covers forms of surface distress that are not limited to the wheel path, although they generally include the wheel paths. The distress usually occurs in isolated areas of the roadway surface.

Sags and humps are localized depressions or elevated areas of the pavement that result from settlement, pavement shoving, displacement due to subgrade swelling, or displacement due to tree roots.

Severity: The severity of sags or humps, like corrugation, is defined as the maximum vertical deviation from a 10-foot straightedge placed on the pavement parallel to the center line of the roadway.

Low — $^{1}/_{8}$-inch to 2 inches per 10 feet.

Medium — 2 inches to 4 inches per 10 feet.

High — Over 4 inches per 10 feet.

Option A — Measurement for Sags and Humps

Extent: The extent of sags and humps is expressed in percent of the lane area affected.

1 percent to 9 percent of the area of the segment
10 percent to 24 percent of the area of the segment
25 percent or more of the area of the segment

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

Option B — Measurement for Sags and Humps

Extent: The extent of sags and humps is expressed in square feet of the entire survey area.

Measure: Determine severity by measuring the maximum difference in elevation that occurs within a 10-foot straightedge length centered over the area of displacement. Rate the overall distress by using the highest observed level.

53

12. Block Cracking

Block cracks divide the pavement surface into nearly rectangular pieces with cracks that intersect at about 90 degrees. This type of distress differs from alligator cracking in that alligator cracks form smaller, irregular shaped pieces with sharp angles. Also, alligator cracks are caused by repeated traffic loadings and are, therefore, generally located in traffic areas (i.e., the wheel paths).

Block cracking is caused principally by shrinkage of the asphalt concrete and daily temperature cycling. It is not load-associated, although load can increase the severity of individual cracks. The occurrence of block cracking usually indicates that the asphalt has hardened significantly through aging. Block cracking normally occurs over a large portion of the pavement area including nontraffic areas. However, various fatigue related defects may occur in the same segment.

54

Severity: The severity of block cracking is defined by the average size of the blocks and the average width of the cracks that separate them.

Block Size

Low — 9 × 9 feet or greater.

Medium — 5 × 5 feet to 8 × 8 feet blocks.

High — 4 × 4 feet blocks or less.

Crack Size

Low — Less than 1/4 inch.

Medium — Over 1/4 inch.

High — Spalled.

Option A — Measurement of Block Cracking

Extent: The extent of block cracking is assumed to be the full surveyed segment. If the block cracking does not extend throughout the segment, then rate the segment using longitudinal and transverse cracking.

Measure: Estimate the typical size of the blocks and select the appropriate standard block size and crack size.

Option B — Measurement of Block Cracking

Extent: The extent of block cracking is assumed to be square feet or percent of length. If the block cracking does not extend throughout the segment, then rate the segment using longitudinal and transverse cracking.

Measure: Measure the typical size of the blocks and select the appropriate standard block size and crack size.

56

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57

13. Pavement Edge Condition

Edge raveling occurs when the pavement edge breaks away from roadways without curbs or paved shoulders. However, edge conditions can still occur with paved shoulders. Edge patching is the repair of this condition. The "lane less than 10 feet" distress indicates that the edge raveling has progressed to the point where the pavement width from the center line to the outer edge of roadway has been reduced to less than 10 feet.

Severity: The severity of Pavement Edge Condition is defined as follows.

Low — Edge Raveling

Medium — Edge Patching

High — Edge lane less than 10 feet.

Measure: Accumulate the lengths along the surveyed lane of each type edge defect as it occurs. Divide the accumulated lengths by the length of the segment. Multiply by 100 to get percent, and round to a whole number.

58

Extent: The extent of pavement edge conditions is recorded as a percentage of the length of the surveyed segment. Recommended ranges for estimated extent.

1 percent to 9 percent of the length of the segment
10 percent to 24 percent of the length of the segment
25 percent or more of the length of the segment

Edge Raveling

Edge Patching

14. Crack Seal Condition

Rate the condition of any existing crack (or joint) sealant. There may be separate information fields available for recording the amount (total length) of seal and the year it was installed or recording the absence of any sealant on the entire section.

60

Severity:

None — There are no sealed cracks.

Low — Sealant in good to excellent condition.

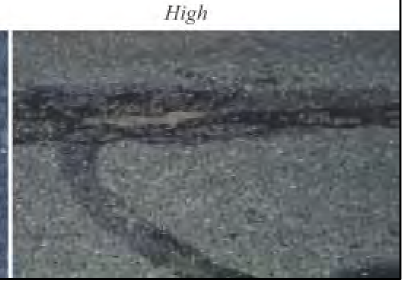
Medium — Hairline failure in the sealant allows a minimal amount of water to pass.

High — The sealant is severely cracked and may allow significant quantities of water to pass. The sealant is wide open (or nonexistent) and will allow water to pass freely.

Low

Medium

High



Extent: The extent of crack sealing is quantified as the percent of the total length of the cracks (or joints) in the segment which exhibit the seal condition.

1 percent to 9 percent of the total length of cracks or joints
10 percent to 24 percent of the total length of cracks or joints
25 percent or more of the total length of cracks or joints

Measure: Count (or estimate) and accumulate the length of cracks and joints that exhibit each severity of seal condition. Count (or estimate) the total length of cracks and joints in the segment. Divide each of the accumulated lengths of condition by the total length of cracks and joints, multiply by 100, and round to a whole number.

62

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63

Acknowledgments to the First Revision

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Tacoma	Steve Pope Dan Soderlind
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64

Counties

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Measurement Research Corporation	Derald Christensen
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65

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Cities

- Airway Heights
- Bellevue
- Bellingham
- Bonney Lake
- Bremerton
- Edmonds
- Ellensburg
- Forks
- Gig Harbor
- Lacey
- Lynden
- Moses Lake
- Normandy Park
- Olympia
- Port Angeles
- Seattle
- Shelton
- Spokane
- Sunnyside

Counties

- Ada (Idaho)
- Adams
- Asotin
- Benton
- Clallam
- Columbia
- Franklin
- Klamath (Oregon)
- Okanogan
- Pend Oreille
- San Juan
- Walla Walla
- Whatcom
- Whitman
- Yakima

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66

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67

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68

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69