State of Hawaii
Department of Transportation
Highways Division

Bridge Management Bridge Inspection Manual

State of Hawaii
Department of Transportation
Highways Division

Bridge Management Bridge Inspection Manual

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Chapter 1 Introduction

1.1 Purpose

The AASHTO Manual for Bridge Element Inspection provides the information needed to perform bridge inspection using the National Bridge Elements (NBE). Federal regulations will soon require all bridges to be inspected using NBE's. The purpose of this manual is to supplement the AASHTO manual with Hawaii-specific information.

1.2 How to use this Manual

The manual was designed as a top down approach when inspecting the bridge. This basically refers to the inspector starting the inspection on the top of the bridge and then proceeding down to the bridge substructure.

To use this manual for new element inspections:

1. Chapter 2 describes filling out the new inspection form and final report.
2. Chapter 3 describes using AASHTOWare Bridge Management (BrM) software.
3. Chapter 4 describes new deck elements.
4. Chapter 5 describes new superstructure elements.
5. Chapter 6 describes new substructure elements.
6. Chapter 7 describes new culvert elements.
7. Chapter 8 describes new wearing surface and protective system elements.
8. Chapter 9 includes the NBI ratings.
9. Chapter 10 describes using BrM to input new inspections.

Because of the nature of our implementation of our bridge inspection program, this manual will continually be revised. If you are not already on the HDOT Bridge inspection email address list and would like updates to this manual, or if you have suggestions to improve this manual, please contact James Fu, State Highways Division, Bridge Design Section; email: james.fu@hawaii.gov or phone (808) 692-7613.

1.3 Acronym Definitions

BrM AASHTOWare Bridge Management software

CoRe ***Co***mmonly ***Re***cognized elements

NBE National Bridge Element

NBI National Bridge Inventory

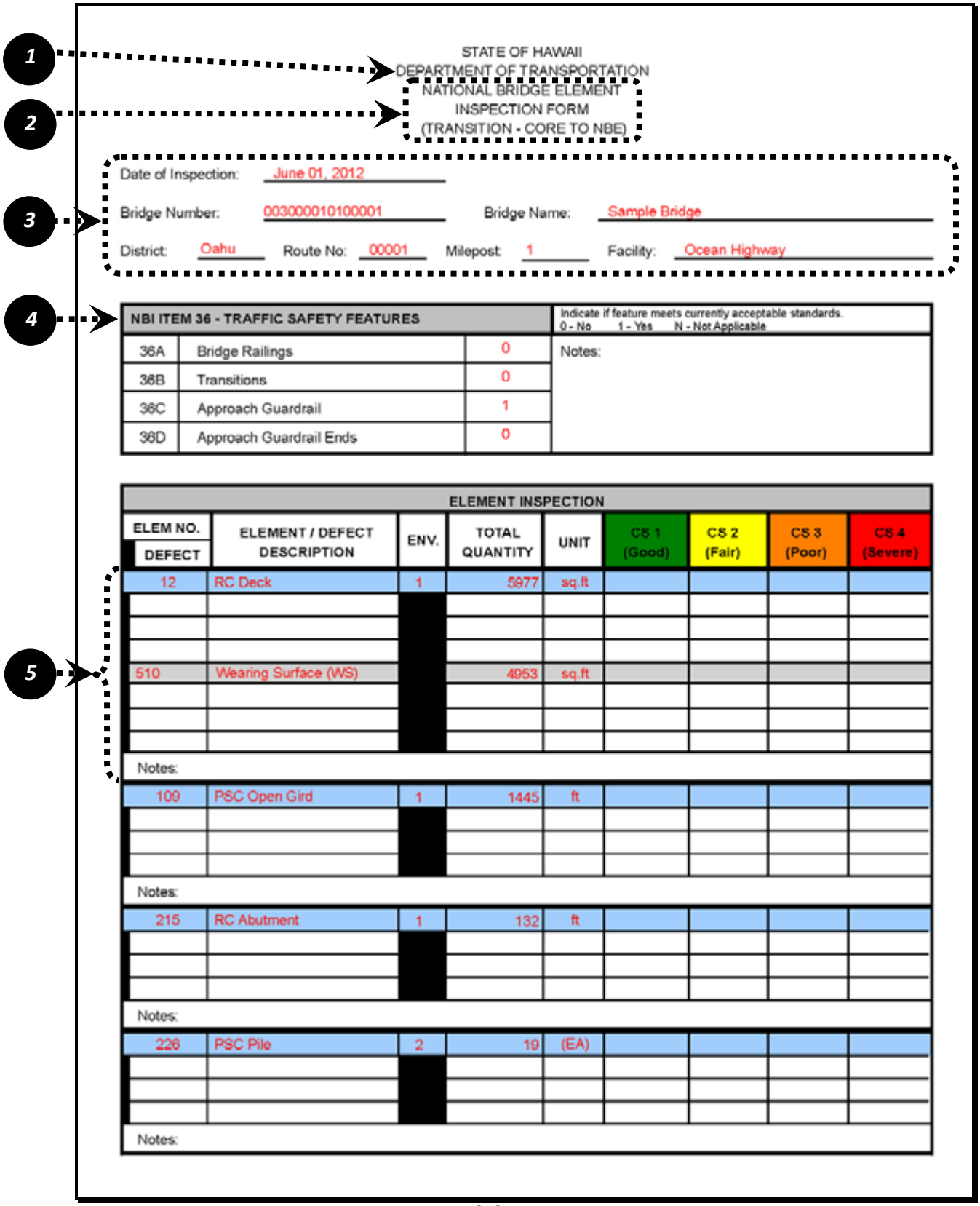
Chapter 2 National Bridge Element (NBE) – Form and Report

2.1 General

The **National Bridge Element (NBE) Inspection Form (Transition – CoRe to NBE)** shall be printed prior to bridge inspection and shall be used as a guide during the field visit. This form is a transitional form that has been created to assist inspectors in switching from the old Commonly Recognized (CoRe) Structural Elements inspection to the new National Bridge Element (NBE) inspection. The old CoRe elements in past inspections have been migrated to NBE elements; however, defects are not provided since there was no past data. *(Note: Once this transition phase has been completed (i.e., 24 months for routine inspections), a new routine inspection form will be made available. This revised form will contain all past NBE elements and defects.)* To access BrM, and view and print the NBE inspection form, refer to Chapter 3 Getting Started Using BrM Software.

The **National Bridge Element (NBE) Final Inspection Report** shall be printed after the field inspection has been completed and the new bridge inspection data has been input into BrM. The report shall be signed and submitted to the bridge owner along with other pertinent information (i.e., photos, sketches, etc.). To create a new inspection in BrM, input bridge inspection data, and view and print the NBE final inspection report, refer to Chapter 10 Inspection Data Management Using BrM Software.

2.2 NBE Inspection Form (Transition – CoRe to NBE) with Descriptions



1

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

2

NATIONAL BRIDGE ELEMENT
INSPECTION FORM
(TRANSITION - CORE TO NBE)

3

Date of Inspection: June 01, 2012

Bridge Number: 003000010100001 Bridge Name: Sample Bridge

District: Oahu Route No: 00001 Milepost: 1 Facility: Ocean Highway

4

NBI ITEM 36 - TRAFFIC SAFETY FEATURES			Indicate if feature meets currently acceptable standards. 0 - No 1 - Yes N - Not Applicable
36A	Bridge Railings	0	Notes:
36B	Transitions	0	
36C	Approach Guardrail	1	
36D	Approach Guardrail Ends	0	

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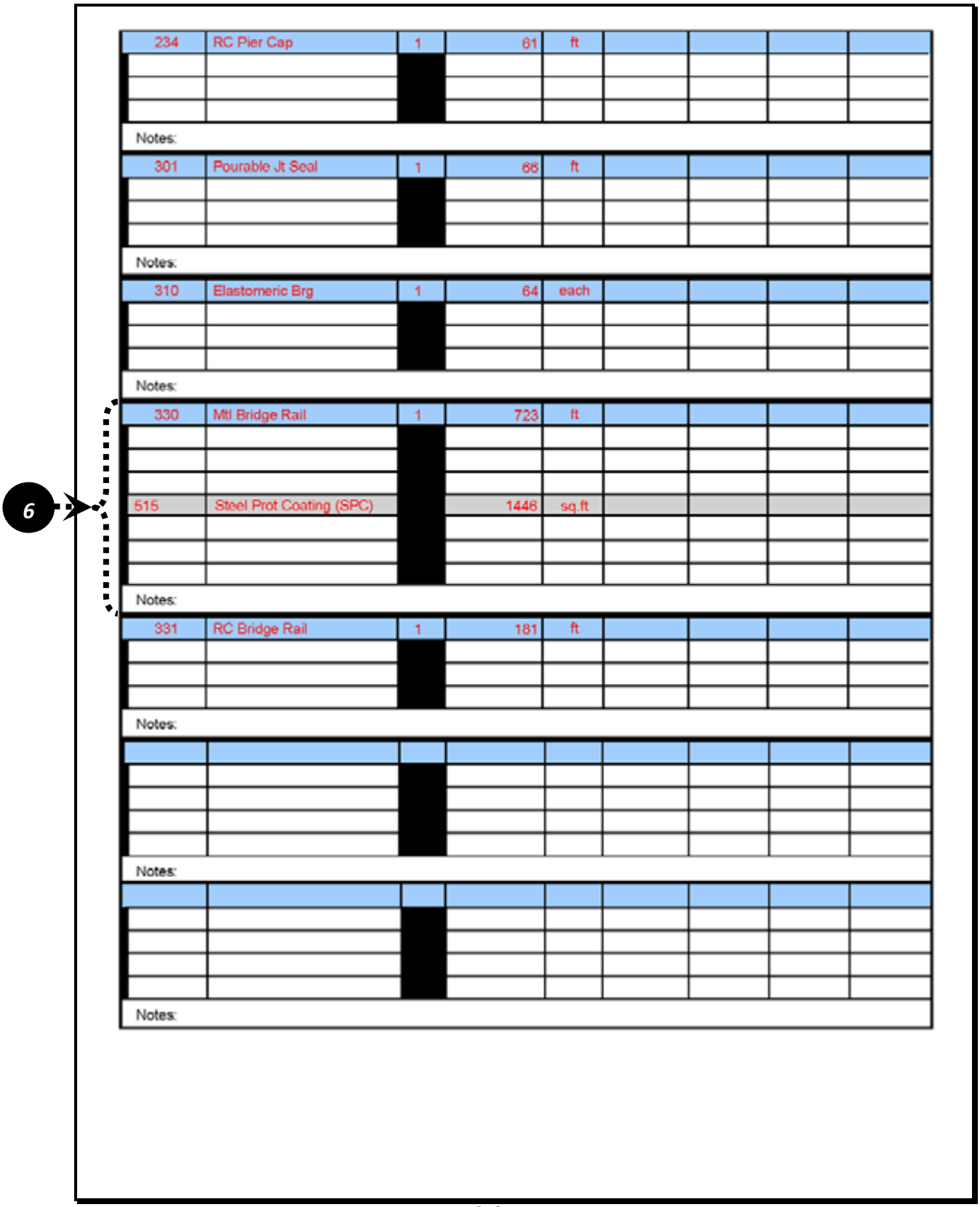
ELEMENT INSPECTION

ELEM NO. / DEFECT	ELEMENT / DEFECT DESCRIPTION	ENV.	TOTAL QUANTITY	UNIT	CS 1 (Good)	CS 2 (Fair)	CS 3 (Poor)	CS 4 (Severe)
12	RC Deck	1	5977	sq.ft				
510	Wearing Surface (WS)		4953	sq.ft				
Notes:								
109	PSC Open Gird	1	1445	ft				
Notes:								
215	RC Abutment	1	132	ft				
Notes:								
226	PSC Pile	2	19	(EA)				
Notes:								


234 RC Pier Cap 1 61 ft
Notes:
301 Pourable Jt Seal 1 66 ft
Notes:
310 Elastomeric Brg 1 64 each
Notes:
330 Mtl Bridge Rail 1 723 ft
515 Steel Prot Coating (SPC) 1446 sq.ft
Notes:
331 RC Bridge Rail 1 181 ft
Notes:
Notes:
Notes:
6

Notes:

7

NBI ITEM CONDITION RATINGS			Describe defects noted during bridge inspection. Provide sketches, diagrams, and photographs where possible.
58	Deck	5	Notes:
59	Superstructure	4	
60	Substructure	5	
61	Channel and Channel Protection	7	
62	Culvert	N	

8

NBI ITEM 93 - CRITICAL FEATURE INSPECTION		REQUIRED	FREQUENCY	LAST	DATE
93A	Fracture Critical Details	N			
93B	Underwater Inspection	Y	60	6/1/12	
93C	Other Special Inspection	N			

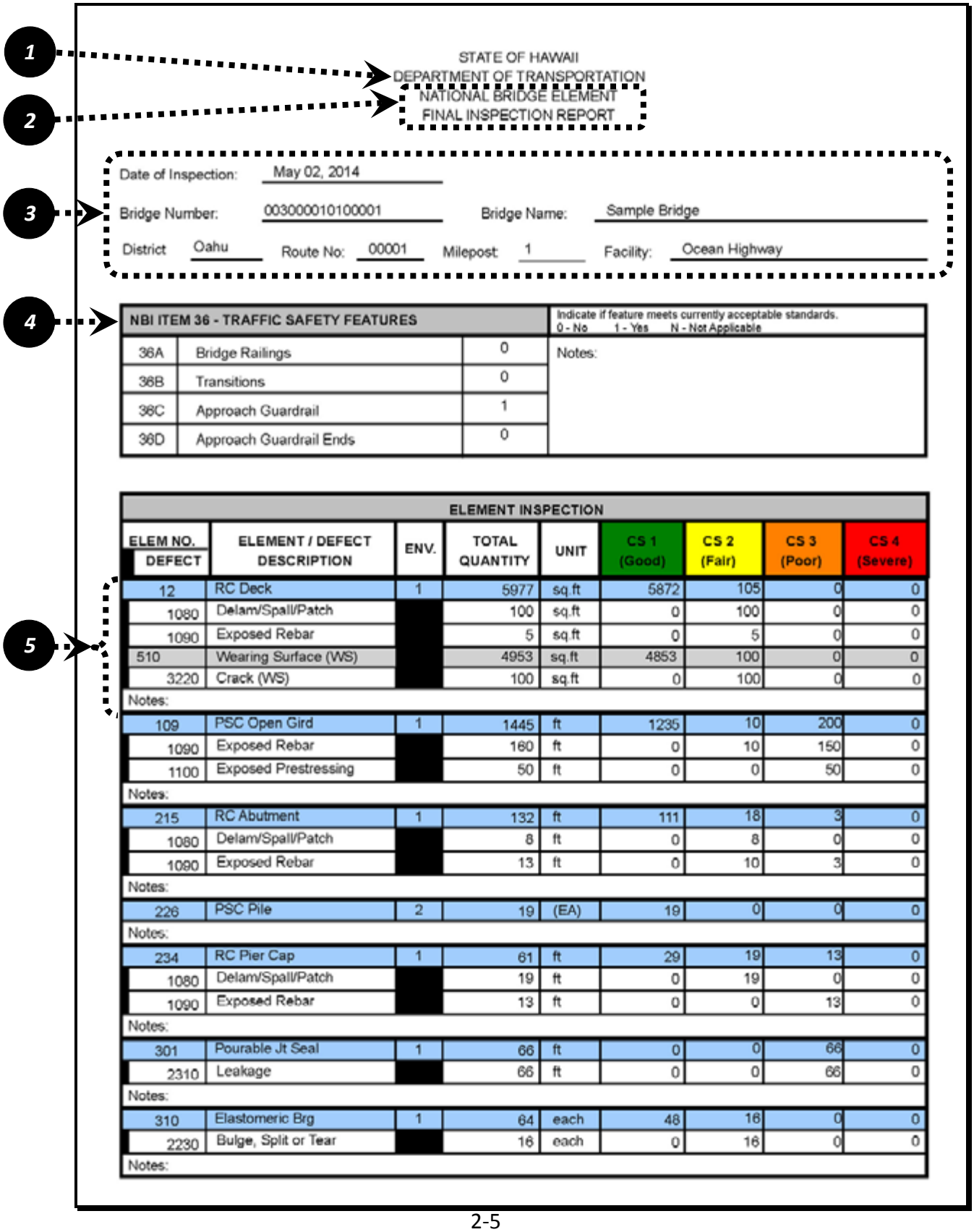
9

OTHER FEATURES			REMARKS
Bridge Posted?	(Provide Posted limit or 'N' if not applicable)		Notes:
Signing for Posting Legible/Visible?	(Y or N)		
Riding Surface (Roughness) Rating	(3 - smooth, 2 - Avg, 1 - Poor)		
Bridge Requires Insp by Bridge Section Applies to in-house inspectors who aren't structural engineers	(Y or N)		

10

REPAIRS, IMPROVEMENTS AND RECOMMENDATIONS
List all work done to this bridge since last inspection (ie: structural repair work, cleaning, maintenance work, etc.)
List proposed and/or recommended work for this bridge including estimated cost (ie: structural repair work, cleaning, maintenance, etc.)
Other comments or observations.

2.3 NBE Final Inspection Report with Descriptions



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
NATIONAL BRIDGE ELEMENT
FINAL INSPECTION REPORT

Date of Inspection: May 02, 2014

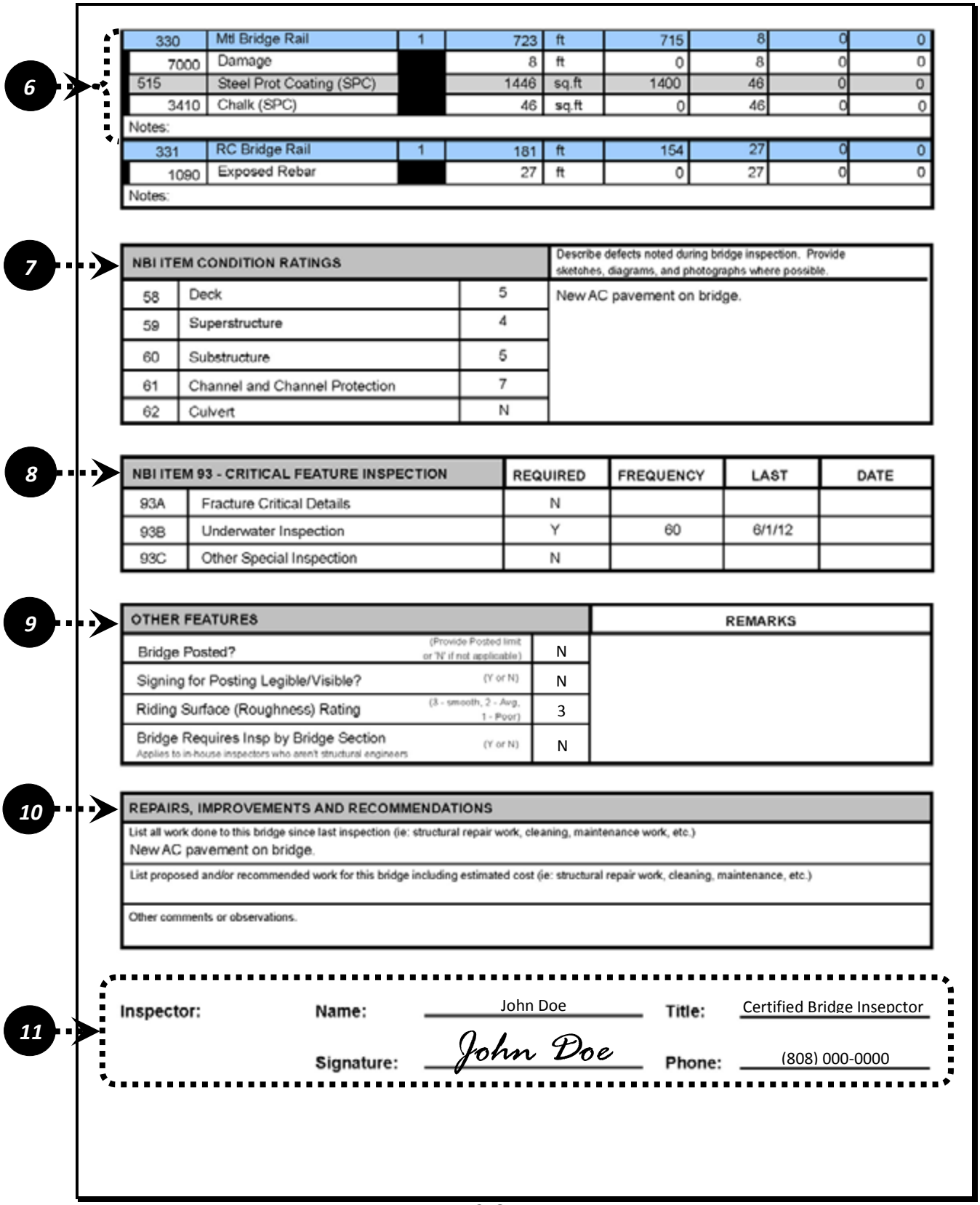
Bridge Number: 003000010100001 Bridge Name: Sample Bridge

District Oahu Route No: 00001 Milepost: 1 Facility: Ocean Highway

NBI ITEM 36 - TRAFFIC SAFETY FEATURES			Indicate if feature meets currently acceptable standards. 0 - No 1 - Yes N - Not Applicable
36A	Bridge Railings	0	Notes:
36B	Transitions	0	
36C	Approach Guardrail	1	
36D	Approach Guardrail Ends	0	

ELEMENT INSPECTION

ELEM NO. / DEFECT	ELEMENT / DEFECT DESCRIPTION	ENV.	TOTAL QUANTITY	UNIT	CS 1 (Good)	CS 2 (Fair)	CS 3 (Poor)	CS 4 (Severe)
12	RC Deck	1	5977	sq.ft	5872	105	0	0
1080	Delam/Spall/Patch		100	sq.ft	0	100	0	0
1090	Exposed Rebar		5	sq.ft	0	5	0	0
510	Wearing Surface (WS)		4953	sq.ft	4853	100	0	0
3220	Crack (WS)		100	sq.ft	0	100	0	0
Notes:								
109	PSC Open Gird	1	1445	ft	1235	10	200	0
1090	Exposed Rebar		160	ft	0	10	150	0
1100	Exposed Prestressing		50	ft	0	0	50	0
Notes:								
215	RC Abutment	1	132	ft	111	18	3	0
1080	Delam/Spall/Patch		8	ft	0	8	0	0
1090	Exposed Rebar		13	ft	0	10	3	0
Notes:								
226	PSC Pile	2	19	(EA)	19	0	0	0
Notes:								
234	RC Pier Cap	1	61	ft	29	19	13	0
1080	Delam/Spall/Patch		19	ft	0	19	0	0
1090	Exposed Rebar		13	ft	0	0	13	0
Notes:								
301	Pourable Jt Seal	1	66	ft	0	0	66	0
2310	Leakage		66	ft	0	0	66	0
Notes:								
310	Elastomeric Brg	1	64	each	48	16	0	0
2230	Bulge, Split or Tear		16	each	0	16	0	0
Notes:								



6

330	Mtl Bridge Rail	1	723	ft	715	8	0	0
7000	Damage		8	ft	0	8	0	0
515	Steel Prot Coating (SPC)		1446	sq.ft	1400	46	0	0
3410	Chalk (SPC)		46	sq.ft	0	46	0	0
Notes:								
331	RC Bridge Rail	1	181	ft	154	27	0	0
1090	Exposed Rebar		27	ft	0	27	0	0
Notes:								

7

NBI ITEM CONDITION RATINGS			Describe defects noted during bridge inspection. Provide sketches, diagrams, and photographs where possible.
58	Deck	5	New AC pavement on bridge.
59	Superstructure	4	
60	Substructure	5	
61	Channel and Channel Protection	7	
62	Culvert	N	

8

NBI ITEM 93 - CRITICAL FEATURE INSPECTION		REQUIRED	FREQUENCY	LAST	DATE
93A	Fracture Critical Details	N			
93B	Underwater Inspection	Y	60	6/1/12	
93C	Other Special Inspection	N			

9

OTHER FEATURES			REMARKS
Bridge Posted?	(Provide Posted limit or 'N' if not applicable)	N	
Signing for Posting Legible/Visible?	(Y or N)	N	
Riding Surface (Roughness) Rating	(3 - smooth, 2 - Avg, 1 - Poor)	3	
Bridge Requires Insp by Bridge Section Applies to in-house inspectors who aren't structural engineers	(Y or N)	N	

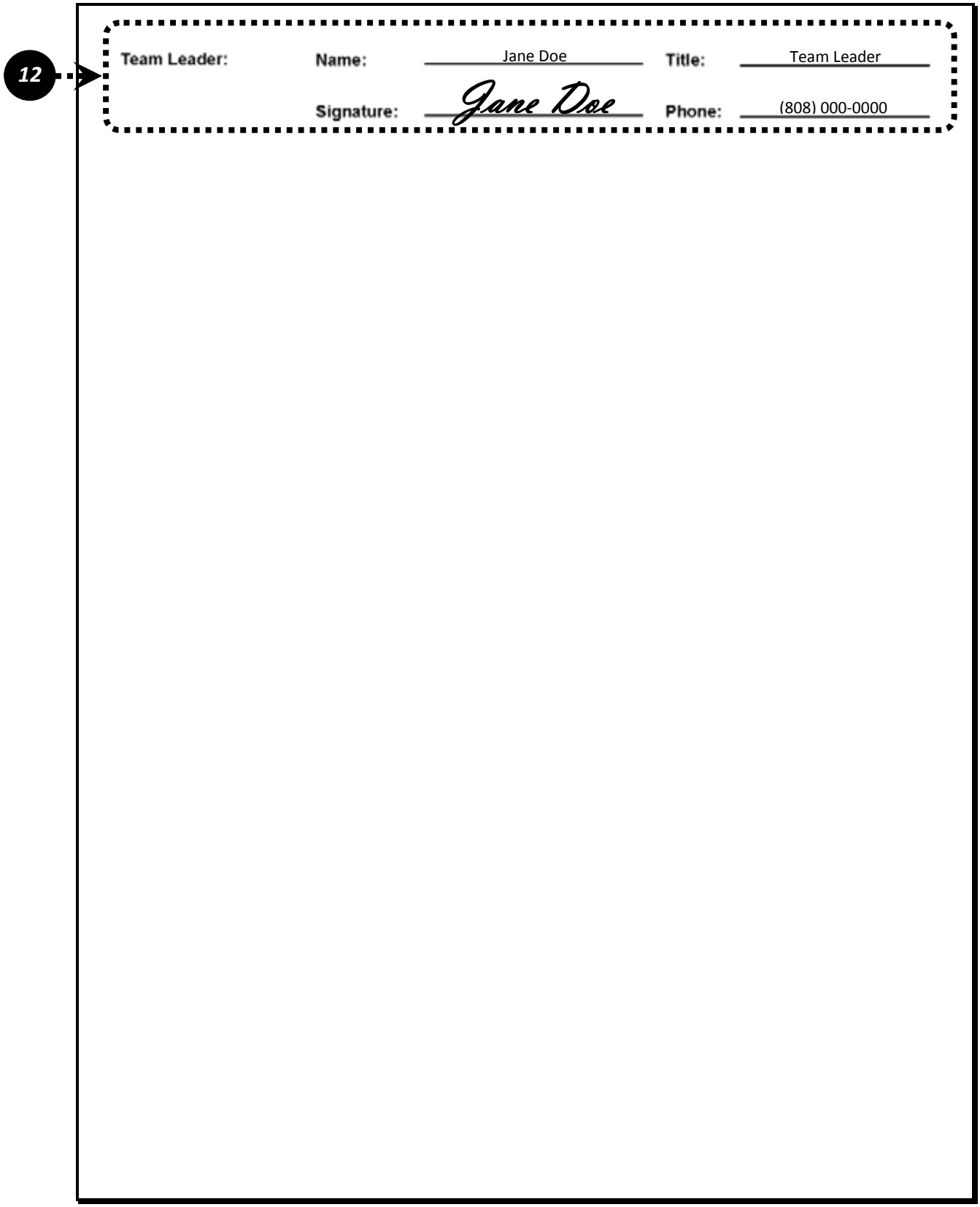
10

REPAIRS, IMPROVEMENTS AND RECOMMENDATIONS
List all work done to this bridge since last inspection (ie: structural repair work, cleaning, maintenance work, etc.) New AC pavement on bridge.
List proposed and/or recommended work for this bridge including estimated cost (ie: structural repair work, cleaning, maintenance, etc.)
Other comments or observations.

11

Inspector: Name: John Doe Title: Certified Bridge Inseptor

Signature: John Doe Phone: (808) 000-0000


12
Team Leader:
Name:
Jane Doe
Title:
Team Leader
Signature:
Jane Doe
Phone:
(808) 000-0000

2.4 Description Key

Key No.	Description	
1	**Owner**	BrM revises the header to indicate the bridge owner. Bridge owners may be one of the following: - Department of Transportation - City & County of Honolulu - County of Hawaii - County of Kauai - County of Maui
2	**Title**	Inspection form and final inspection report: - **NATIONAL BRIDGE ELEMENT INSPECTION FORM (TRANSITION – CORE TO NBE)**: This form is to be printed prior to field inspection and shall be used as a guide during the field visit. All past inspection data are indicated in RED and shall be field verified and revised as necessary. - **NATIONAL BRIDGE ELEMENT FINAL INSPECTION REPORT**: This report is to be printed after the field inspection has been completed and the new bridge inspection data has been input into BrM. The report shall be signed and submitted to the bridge owner along with other pertinent information (i.e., photos, sketches, etc.).
3	**Date of Inspection:** **Bridge Number:** **Bridge Name:** **District:** **Route No:** **Milepost:** **Facility:**	On the NBE Inspection Form (Transition – CoRe to NBE), the date indicated in RED represents the past inspection date. On the NBE Final Inspection Report, the date indicated is the new inspection date. The 15-digit structure number reported to FHWA. Typically, the name of the feature intersected (i.e., stream name) or the name indicated on the trailing endpost of the bridge. The District (or County) that the bridge is located. The route number of the facility carried. The approximate milepost location for the bridge being inspected. The name of the facility carried.
4	**NBI Item 36 – Traffic Safety Features**	Inspectors should note any maintenance work required (such as defects, collision damage, missing bolts, etc.). Inspectors should also include, in the notes, if any bridge railing or guardrail upgrade work has been completed since the last inspection. *(Note: The recording of Item 36 is to evaluate the adequacy of the traffic safety features conformance with the current design standards and shall be evaluated only after construction of the bridge or after bridge railing or guardrail upgrade work has been completed.)*
5	**Element Inspection Format and Layout**	Blue rows highlight Elements (Decks and Slabs, Railings, Joints, Approach Slabs, Superstructure, Bearings, Substructure and Culverts). Gray rows highlight Protective Systems (Wearing Surfaces, Protective Coatings, or Concrete Reinforcing Steel Protective Systems). White rows highlight defects that apply to the element or protective system directly above. Provide notes as required regarding the element, elements defects, protective system, and/or the protective systems defects. *(Note: When the condition state for an element or protective system improves, a note shall be provided to explain the inspected improvement. For example, when a bridge has new A. C. pavement and the condition state improves from 'CS 3' to 'CS 1', a note shall be provided to justify the reason for the improvement.)*

Key No.	Description	
6	**Element Inspection**	Refer to Chapter 4 – Decks and Slabs, Railings, Joints and Approach Slabs; Chapter 5 – Superstructure and Bearings; Chapter 6 – Substructure; Chapter 7 – Culverts; and Chapter 8 – Protective Systems for element descriptions and possible element defects, protective systems and protective system defects. *(Note: The total quantity and units for elements and its corresponding protective system will be different. For example, a metal railing is quantified per feet, but the protective system is per square feet.)*
7	**NBI Item Condition Ratings**	NBI Items 58, 59, 60, 61 and 62 shall be inspected and rated. Refer to Chapter 9 – National Bridge Inventory (NBI) Conditions Ratings for item descriptions and general condition ratings to be used for evaluation. Provide notes as required to justify revised condition ratings. *(Note: When the condition rating for an item improves, a note shall be provided to explain the inspected improvement. For example, when a bridge is repaired and the condition rating improves from '4' to '7', a note shall be provided to justify the reason for the improvement.)*
8	**NBI Item – Critical Feature Inspection**	NBI Items 93A, 93B and 93C shall be verified to determine whether a critical feature inspection is required at this time. The maximum frequency for an inspection of NBI Item 93A-Fracture Critical Details is 24 months. The maximum frequency for an inspection of NBI Item 93B-Underwater Inspection and NBI Item 93C-Other Special Inspection is 60 months.
9	**Other Features:** **- Bridge Posted?** **- Signing for Posting Legible/Visible?** **- Riding Surface (Roughness) Rating** **- Bridge Requires Insp. by Bridge Section**	 Indicate the posted weight limit of the bridge or 'N' if no posted weight limit. Indicate 'Y' if the posted weight limit sign is legible/visible and 'N' if the posted weight limit sign is not legible/visible or bridge is not posted. Riding surface ratings are defined as follows: 3 – smooth riding surface at approaches, bridge deck, and expansion joints; 2 – minor surface deviations or depressions; and 1 – approach and bridge deck conditions with bumps, sags, or other major surface deviations and discontinuities. Indicate 'Y' if there is a concern with the bridge and Bridge Section (HWY-DB) should conduct a Post-Bridge Inspection. Describe the area of concern in the remarks section. *(Note: This only applies to HDOT owned bridges and to in-house inspectors who are not structural engineers.)*
10	**Repairs, Improvements and Recommendations**	List all past work done to the bridge since the last inspection, list all proposed and/or recommended work for the bridge including estimated cost, and provide other comments and observations as necessary.
11	**Inspector**	Provide the Name (printed), Title, Signature and Phone Number of the inspector(s). *(Note: Refer to the HDOT "Bridge Inspection Program" for qualifications of an inspector.)*
12	**Team Leader**	Provide the Name (printed), Title, Signature and Phone Number of the team leader. *(Note: Refer to the HDOT "Bridge Inspection Program" for qualifications of a team leader.)*

Chapter 3 Getting Started Using BrM Software

3.1 Logging On

a. Non-HDOT personnel need access to the HDOT intranet.
    a. Consultants: Please contact your appropriate District or County person who is administering your contract for access to the HDOT Intranet
    b. County Personnel: Please contact James Fu at 808-692-7613 or James.Fu@hawaii.gov regarding access to the HDOT Intranet.

b. Open Internet Explorer. It is recommended to disable pop-up blocker in the Internet Options. As of this writing, Internet Explorer 8.0 through 11.0 are supported.

c. Type the following URL in the address bar: **http://10.156.106.83/BrM521**

d. Login with the user ID and password given to you by HDOT staff then click “Login”

Figure 1 – Login Screen

3.2 The BrM Desktop

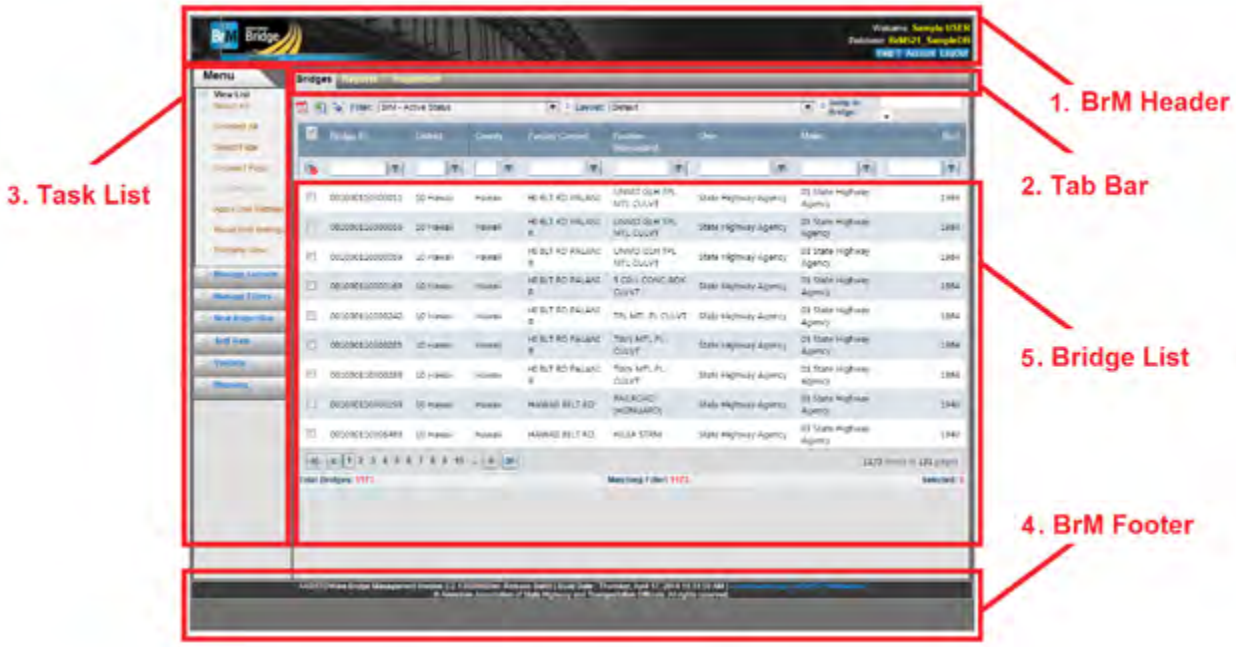


Figure 2 – Desktop

1. The **BrM Header**

Figure 3 – Header

   a. **Help?** – to view the BrM help screen for the current screen.

   b. **Logout** – to quit BrM.

2. The **Tab Bar**

Figure 4 – Tab Bar

   a. **Bridges** – to view the Bridge List.

   b. **Reports** – allows you to select, view and print reports for a selected bridge or for all bridges in the list. See Section 3.3 for instructions on how to select a bridge or multiple bridges.

   c. **Inspection** – to access the inspection and inventory information for a selected bridge.

3. The **Task List**

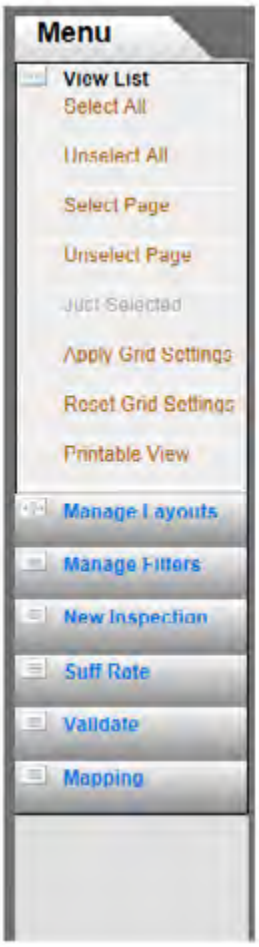


Figure 5 – Task List

a. The **Task List** is located on the left side of the screen and contains commonly used tasks, which change with each tab from the **Tab Bar**. For example, when the **Bridges** tab is selected, the **Task List** will display **View List**, **Manage Layouts**, **Manage Filters**, **New Inspection**, **Suff Rate**, **Validate,** and **Mapping** as shown in Figure 5 – Task List.

b. Any given task can also include sub-tasks. For example, the **View List** task contains the sub-tasks **Select All**, **Unselect All**, **Select Page**, **Unselect Page**, **Just Selected**, **Apply Grid Settings**, **Reset Grid Settings**, **Printable View** as shown in Figure 5 – Task List.

4. The **BrM Footer**

Figure 6 – Footer

a. AASHTOWare Bridge Management Version – shows the current version for BrM.

b. Build Date – shows the build date and time for the latest version of BrM.

5. The **Bridge List**

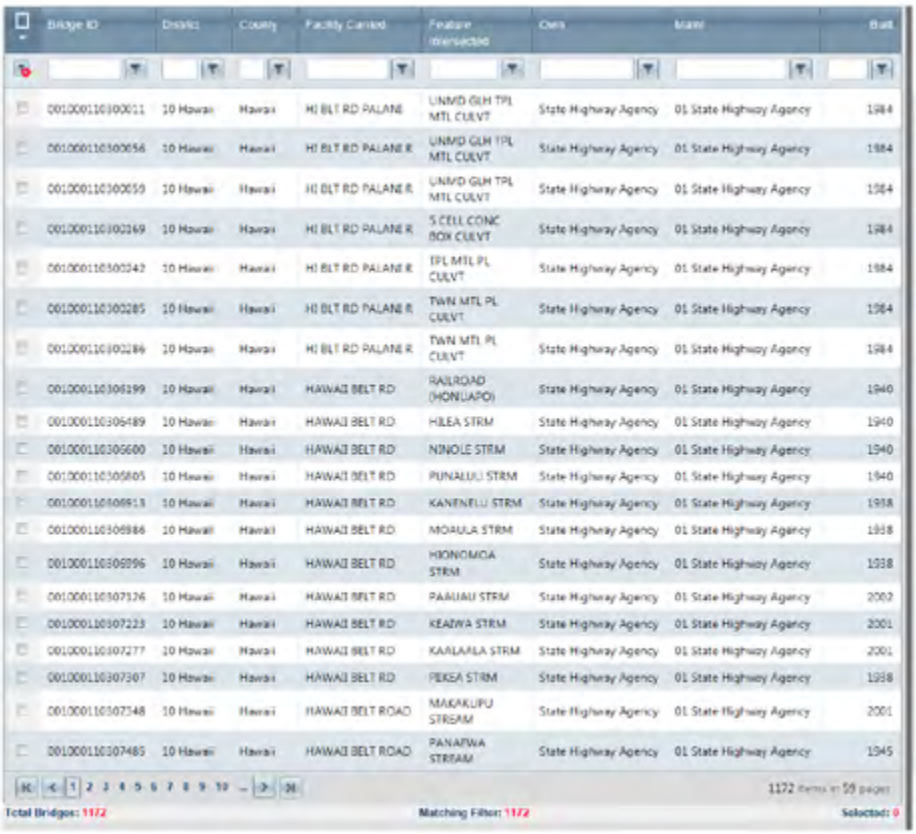


Figure 7 – Bridge List

a. Shows all structures sorted by **Bridge ID**, and includes basic information about each structure, including **Bridge ID**, **District**, **County**, **Facility Carried**, **Feature Intersected**, **Own** (owner), **Maint** (maintenance responsibility), and **Built** (year built).

b. Structures can be sorted by any column by clicking on the desired column header. See Figure 8.

   i. By default, the list is sorted by **Bridge ID** in ascending order.

   ii. If you click on the **District** header, the **Bridge List** will now be sorted by **District** in ascending order. Clicking on the **District** header a second time will sort in descending order. Clicking it a third time will turn off the sorting feature.

Figure 8 – Column Headers

c. Columns can also be reordered by clicking the column header, holding, and dragging to your desired position.

3.3 Finding and Selecting Structures

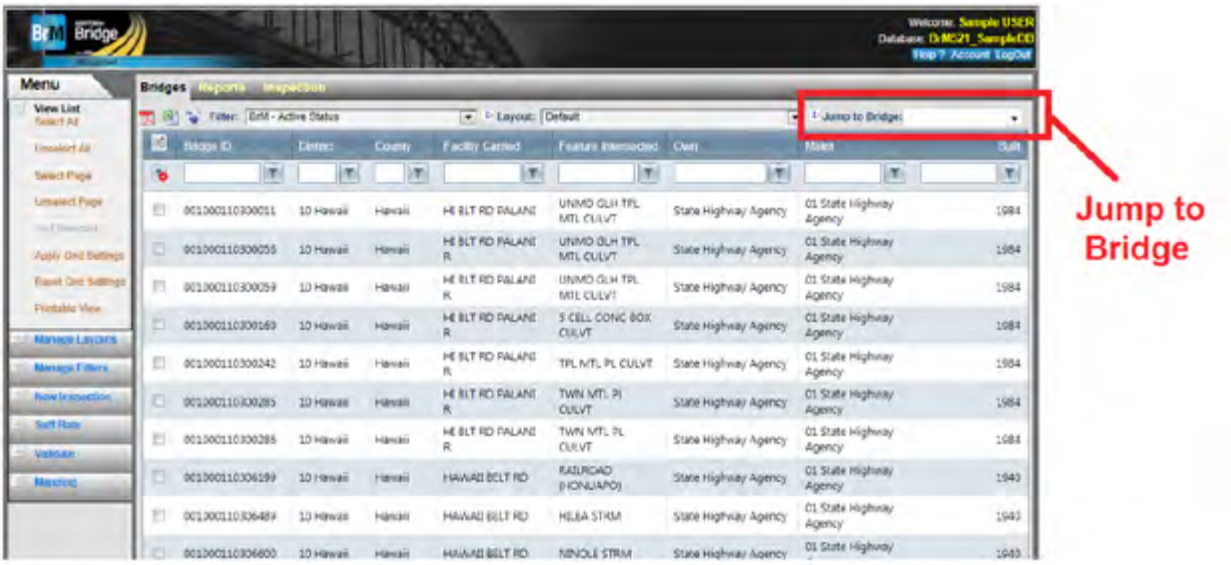


Figure 9 – Jump to Bridge

1. Finding a Structure with “Jump to Bridge”

    a. In the top right corner, locate the blank field labeled **Jump to Bridge:** and start entering the 15-digit structure number; do not enter digits from the middle of the sequence.

    b. A drop down with a list of bridge numbers will appear. Click on your desired bridge number.

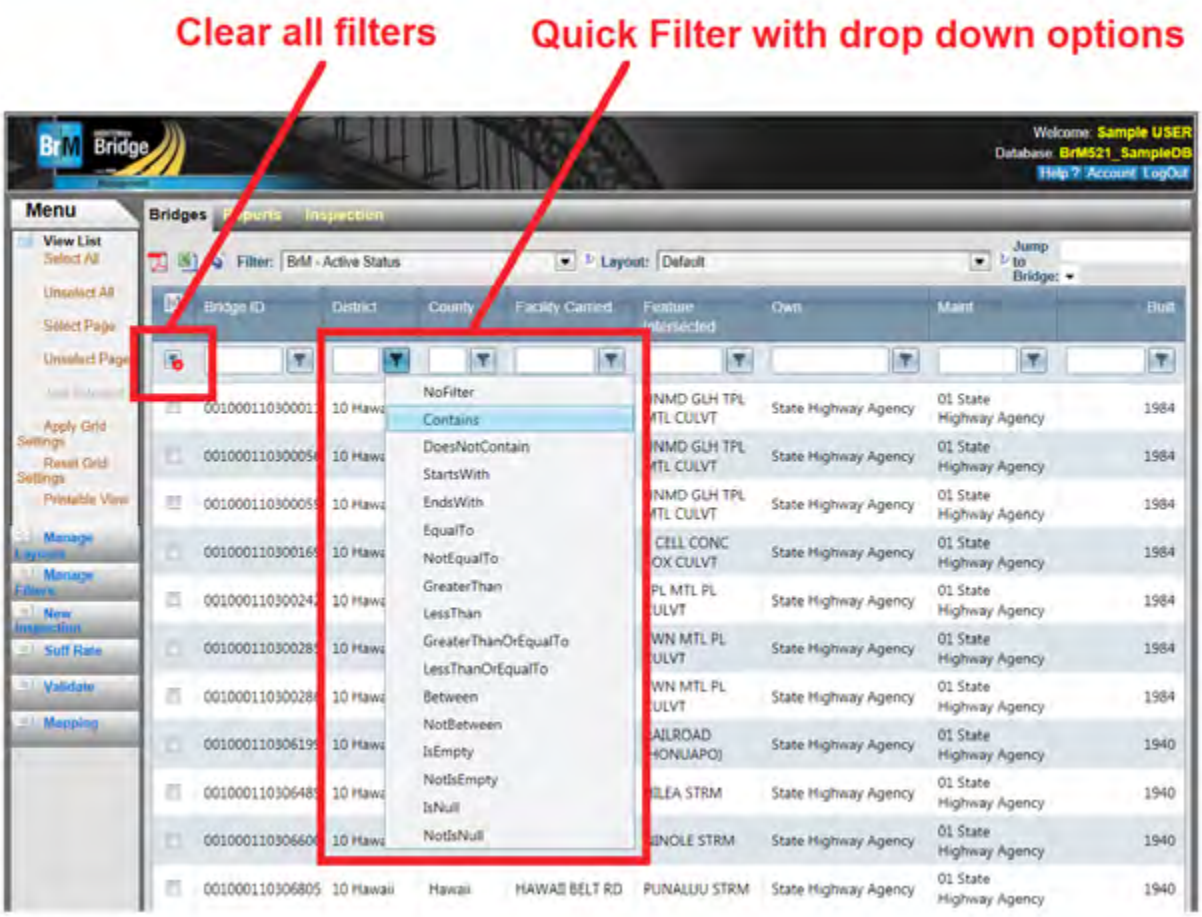


Figure 10 – Quick Filters

2. Finding a Structure with Quick Filters

   a. Start by entering your desired criteria in the appropriate column then click on the filter button and choose how you would like to apply it.

      i. Example: In the **District** column, typing “Oahu” and choosing **Contains** will show all structures that contain the word “Oahu”.

      ii. Example: In the “Bridge ID” column, typing “007” and choosing **StartsWith** will show all structure that start with “007”

   b. Apply multiple filters to narrow your search.

   c. To delete one filter at a time click the filter button and choose **NoFilter**

   d. To clear ALL filters, click on the filter button at the far left .

3.4 Using the HDOT Multimedia Task

1. Search for your desired structure and select it by clicking on the checkbox.
2. Click on the **Inspection** tab at the top.
3. Now click on the **HDOT Multimedia** task in the left column.

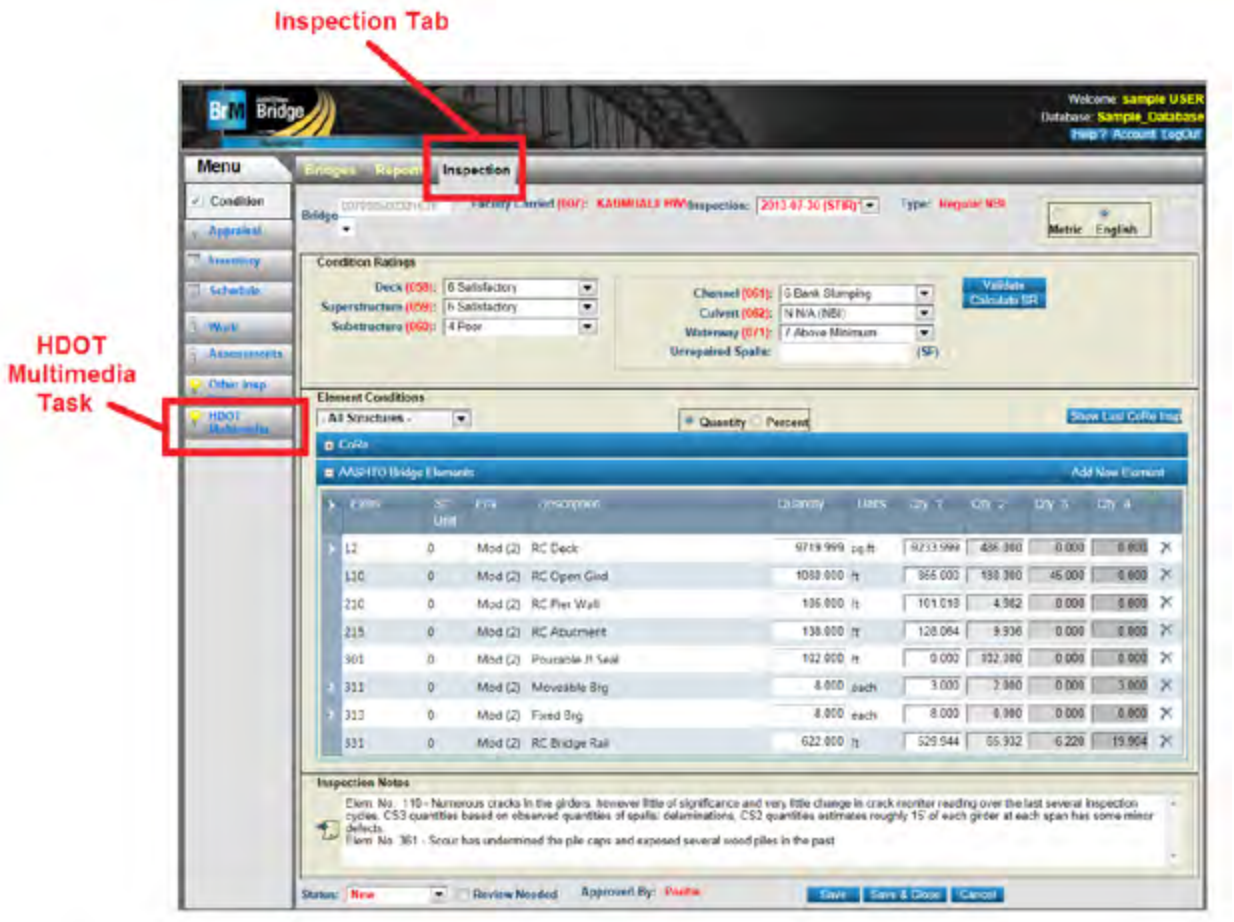


Figure 11 – Custom HDOT Multimedia Task

4. Click on the structure name at the top until the row turns blue.

5. In the **HTML View** you'll see a list of clickable links for previous bridge inspection reports listed in chronological order. There are also clickable links for as-built plans. Please note that previous bridge inspection reports and/or as-built plans may not be available for all structures, especially County owned structures.

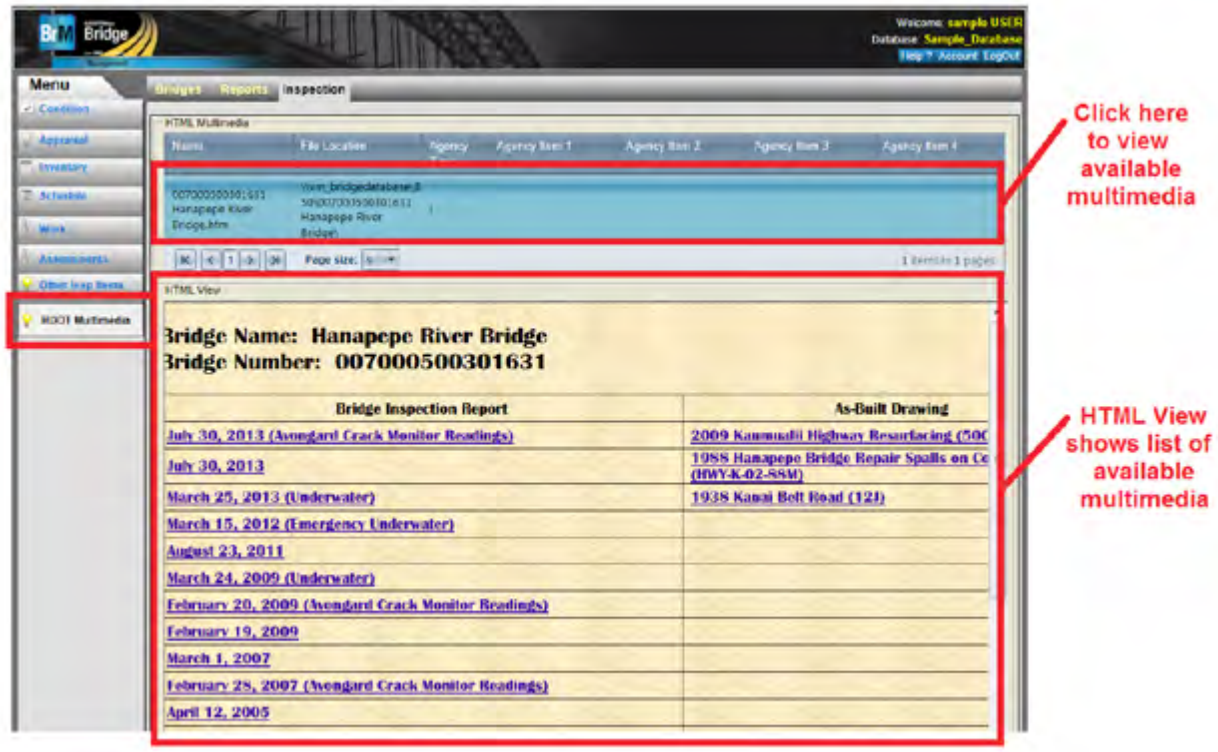


Figure 12 – List of available multimedia

6. Click on your desired link to view the report as a PDF. You have the option to save the file or print.

7. Click on the structure name (highlighted in blue) at the top to return to the list of links. You may also click on **Condition** to return to the **inspection** or click on **Bridges** to return to the list of bridges.

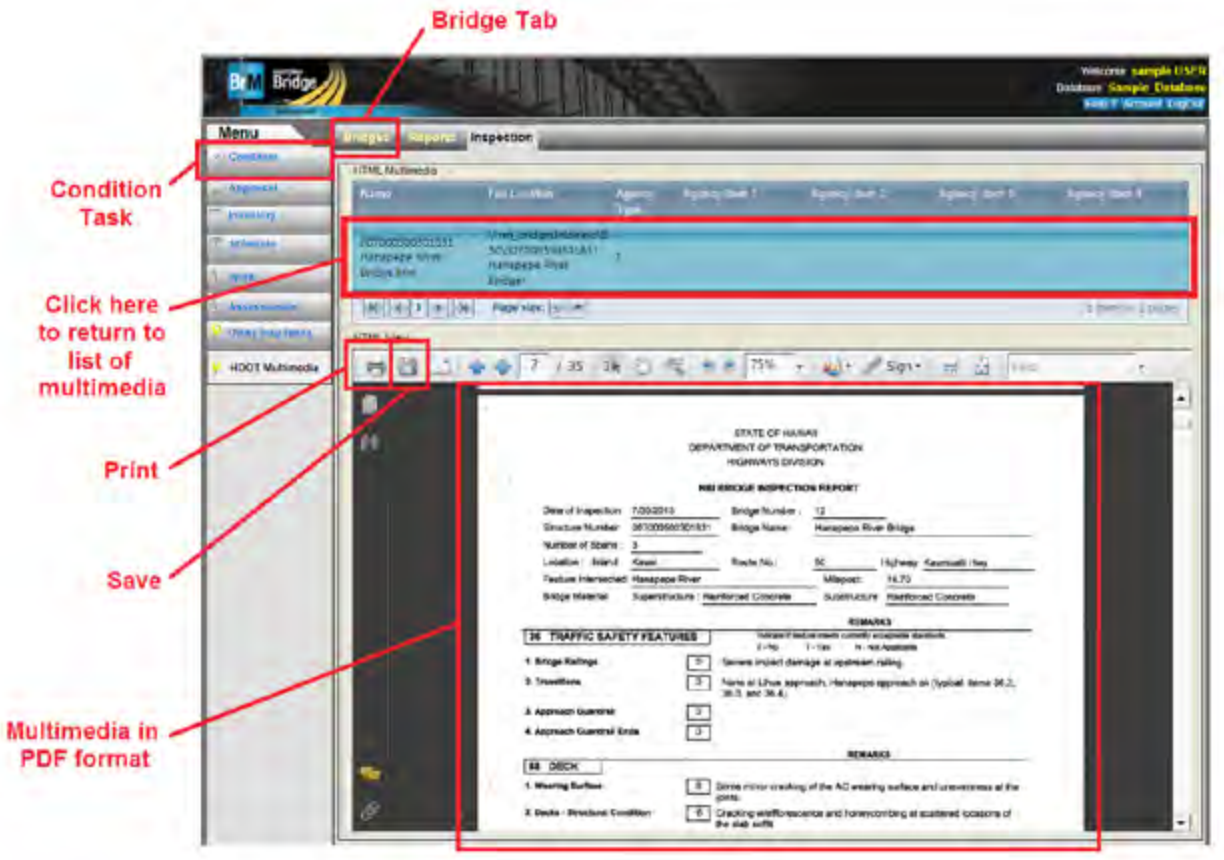


Figure 13 – Viewing available multimedia

3.5 Viewing and Printing the NBE Inspection Form (Transition – CoRe to NBE)

1. Search for and retrieve the desired bridge or subset of bridges. Click on the box(es) corresponding to the desired bridge or subset of bridges. See Section 3.3 for instructions on finding a structure with quick filters.

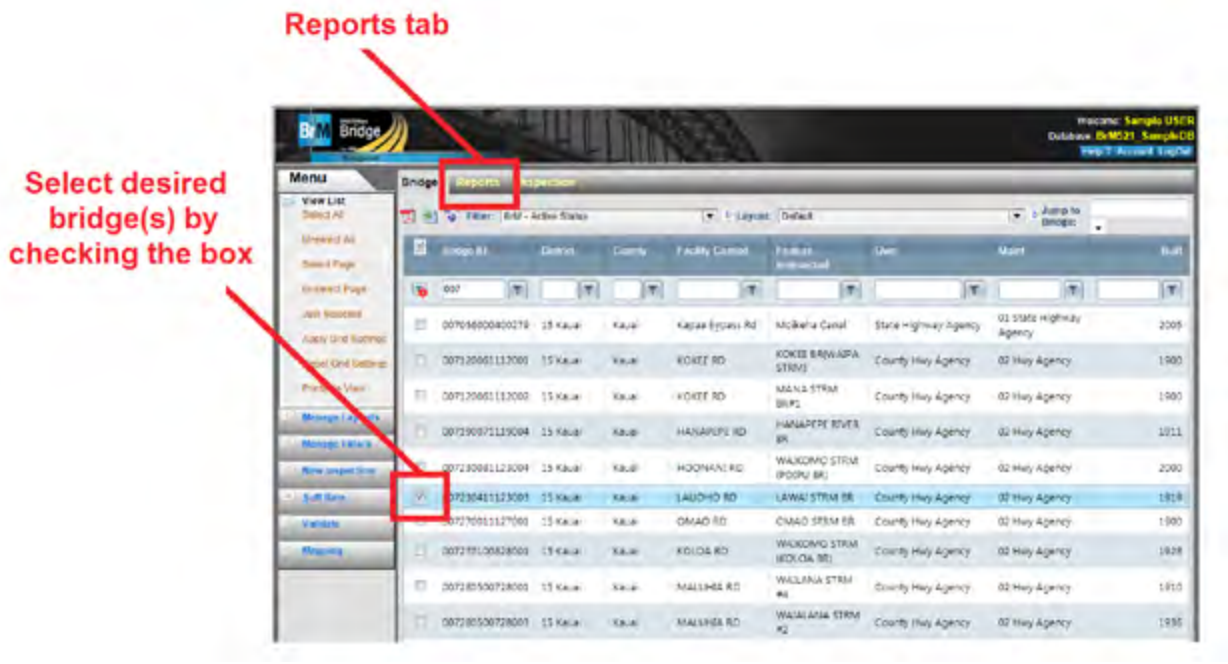


Figure 14 – Viewing and Printing NBE Inspection Forms

2. Select the **Reports** tab from the **Tab Bar**.

3. The report generation window will appear.

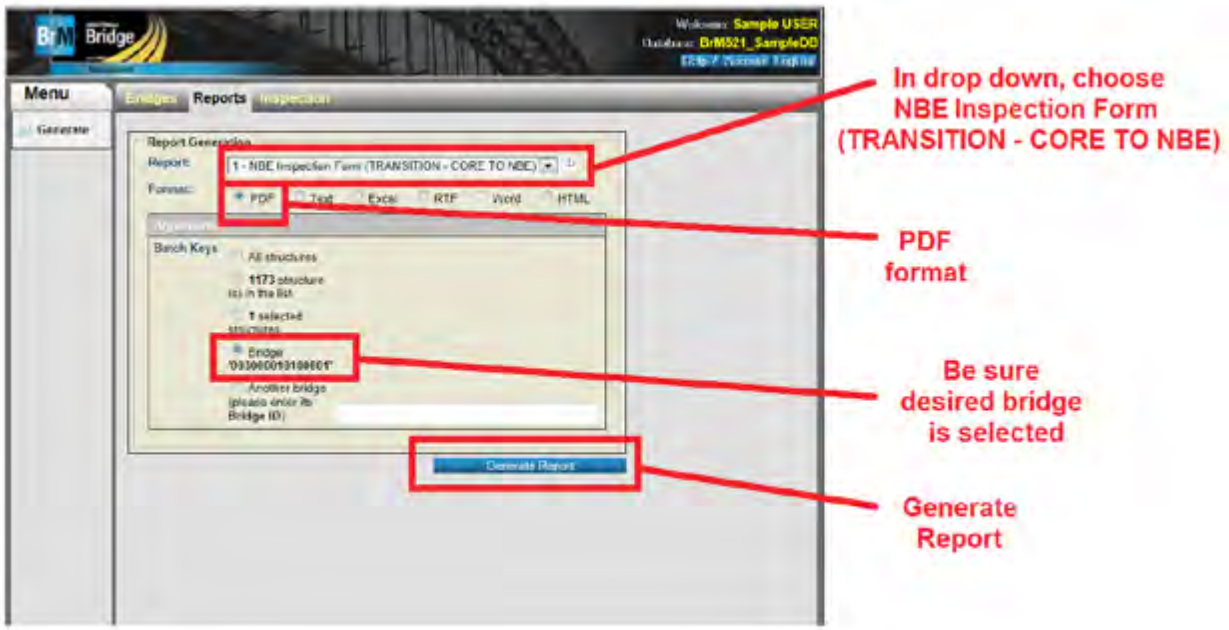


Figure 15 – Report Generation Window

4. Click the drop down menu and choose **1 – NBE Inspection Form (TRANSITION – CORE TO NBE)**

    a. For a description of this Inspection Form, please refer to Chapter 2 National Bridge Element (NBE) – Form and Report

5. Various formats are available, it is recommended to choose **PDF**

6. Click **Generate Report**

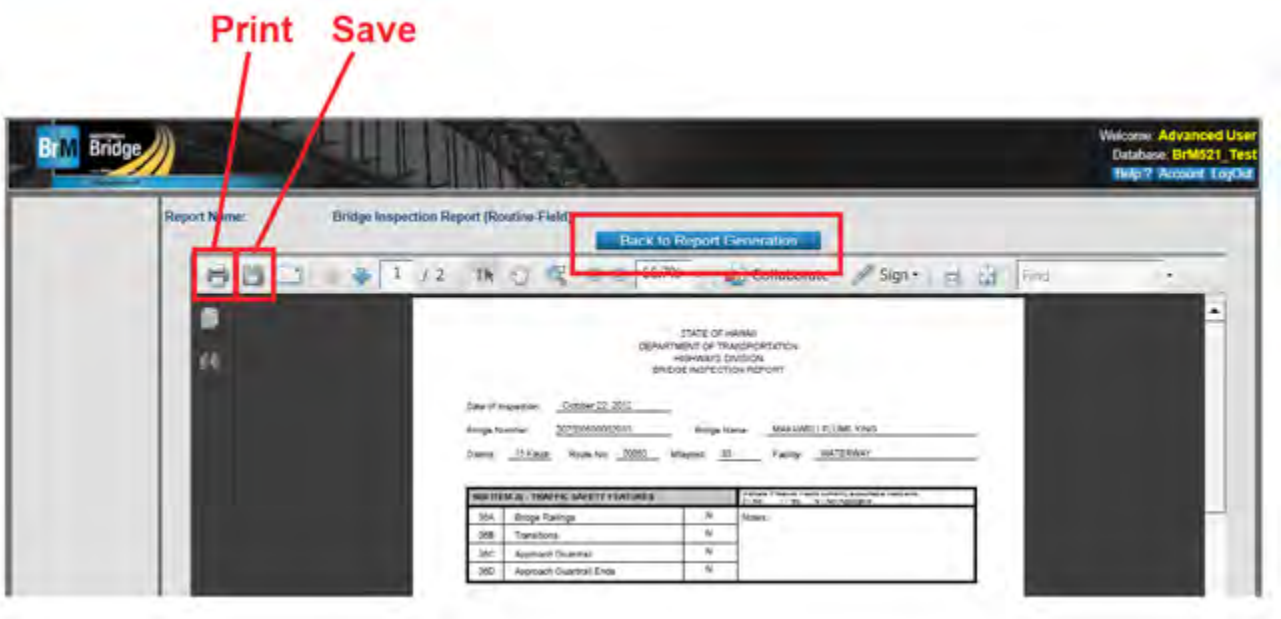


Figure 16 – Navigating Reports

7. To print the report, click the **Print** button. To export the information to external files click the **Save** button.

    a. If you selected multiple bridges, BrM will combine all reports for all bridges into one file.

8. Click the **Back to Report Generation** button to close the Report window.

Chapter 4 Decks and Slabs, Railings, Joints and Approach Slabs

Decks and Slabs

NBE No.	Element	Units	Page No.
12	Reinforced Concrete Deck	sq-ft	4-9
13	Prestresseded Concrete Deck	sq-ft	4-21
15	Prestressed Concrete Top Flange	sq-ft	4-23
16	Reinforced Concrete Top Flange	sq-ft	4-11
28	Steel Deck-Open Grid	sq-ft	4-29
29	Steel Deck-Concrete Filled Grid	sq-ft	4-31
30	Steel Deck-Corrugated/Orthotropic/Etc.	sq-ft	4-32
31	Timber Deck	sq-ft	4-43
38	Reinforced Concrete Slab	sq-ft	4-13
54	Timber Slab	sq-ft	4-45
60	Other Material Deck	sq-ft	4-51
65	Other Material Slab	sq-ft	4-52

- Deck versus Slab

The DECK transmits vehicle loads to the girders, beams, etc. (superstructure) beneath the deck.

The SLAB has no girders, beams ect. (superstructure) supporting it and transmits vehicle loads directly to the abutment, piers, etc. (substructure).

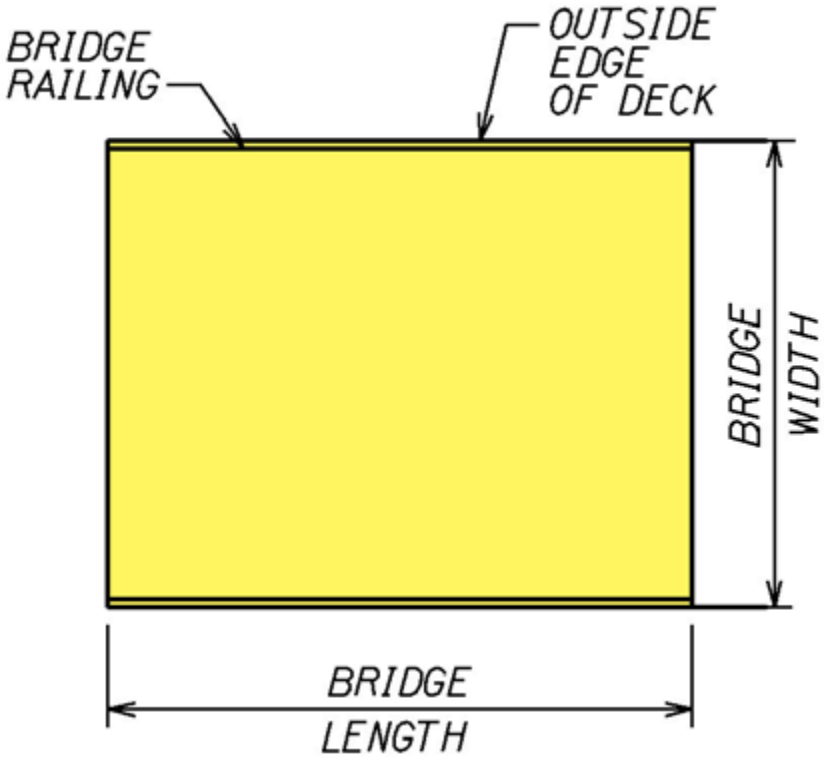


Figure: Deck Area = Bridge Length multiplied by Bridge Width

- Unit of Measure for Deck and Slab Elements
    - Unit of measure for Deck and Slab elements shall be Area (sq. ft.) and can be calculated as the out-to-out bridge width multiplied by bridge length.
        - Use the appropriate as-built drawing to calculate the Deck or Slab element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Deck or Slab element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.

- Protective System and Defects
    - Wearing surfaces are a protective system of Decks and Slabs.
    - See element details for possible Protective System elements.
    - See Chapter 8 for details on Protective System elements.
    - Refer to APPENDIX A for Condition State definitions.

Railings

NBE No.	Element	Units	Page No.
330	Metal Bridge Railing	ft	4-34
331	Reinforced Concrete Bridge Railing	ft	4-17
332	Timber Bridge Railing	ft	4-46
333	Other Bridge Railing	ft	4-53
334	Masonry Bridge Railing	ft	4-39

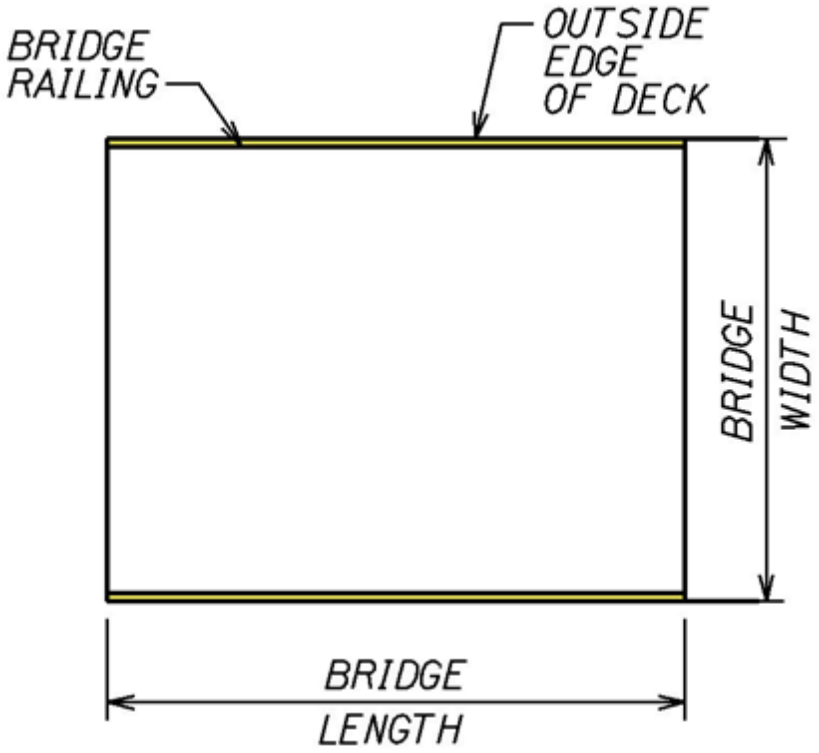


Figure: Railing Total = Bridge Length multiplied by Number of Railings

- Unit of Measure for Railing Elements
    - Unit of measure for Railing elements shall be Length (ft.) and can be calculated as the number of rows of bridge railing on the bridge times the bridge length.
        - Use the appropriate as-built drawing to calculate the Railing element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Railing element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.
- Protective System and Defects
    - See element details for possible Protective System elements.
    - See Chapter 8 for details on Protective System elements.
    - Refer to APPENDIX A for Condition State definitions.

Joints

- For Joints, see Section 4.7.

Approach Slabs

NBE No.	Element	Units	Page No.
320	Prestressed Concrete Approach Slab	sq-ft	4-25
321	Reinforced Concrete Approach Slab	sq-ft	4-15

- Unit of Measure for Approach Slab Elements
    - Unit of measure for Approach elements shall be Area (sq. ft.) and can be calculated as the out-to-out slab width times the slab length.
        - Use the appropriate as-built drawing to calculate the Approach Slab element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for an Approach Slab element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.
- Protective System and Defects
    - Wearing surfaces are a protective system of Approach Slabs.
    - See element details for possible Protective System elements.
    - See Chapter 8 for details on Protective System elements.
    - Refer to APPENDIX A for Condition State definitions.

4.1 Reinforced Concrete Elements

NBE No.	Element	Units	Page No.
12	Reinforced Concrete Deck	sq-ft	4-9
16	Reinforced Concrete Top Flange	sq-ft	4-11
38	Reinforced Concrete Slab	sq-ft	4-13
321	Reinforced Concrete Approach Slab	sq-ft	4-15
331	Reinforced Concrete Bridge Railing	ft	4-17

4.1.1 Element 12 - Reinforced Concrete Deck (sq-ft)

Description: This element shall apply to cast-in-place concrete decks and toppings constructed on superstructure elements. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all. Decks in which the top surface is not visible (i.e., overlaid with a wearing surface) shall be assessed based on the visible bottom surface. If the top and bottom surfaces are not visible, the deck condition shall be assessed based on nondestructive testing and/or indicators in the materials covering the surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

Photo: Element 12 - Reinforced Concrete Deck (Highlighted)

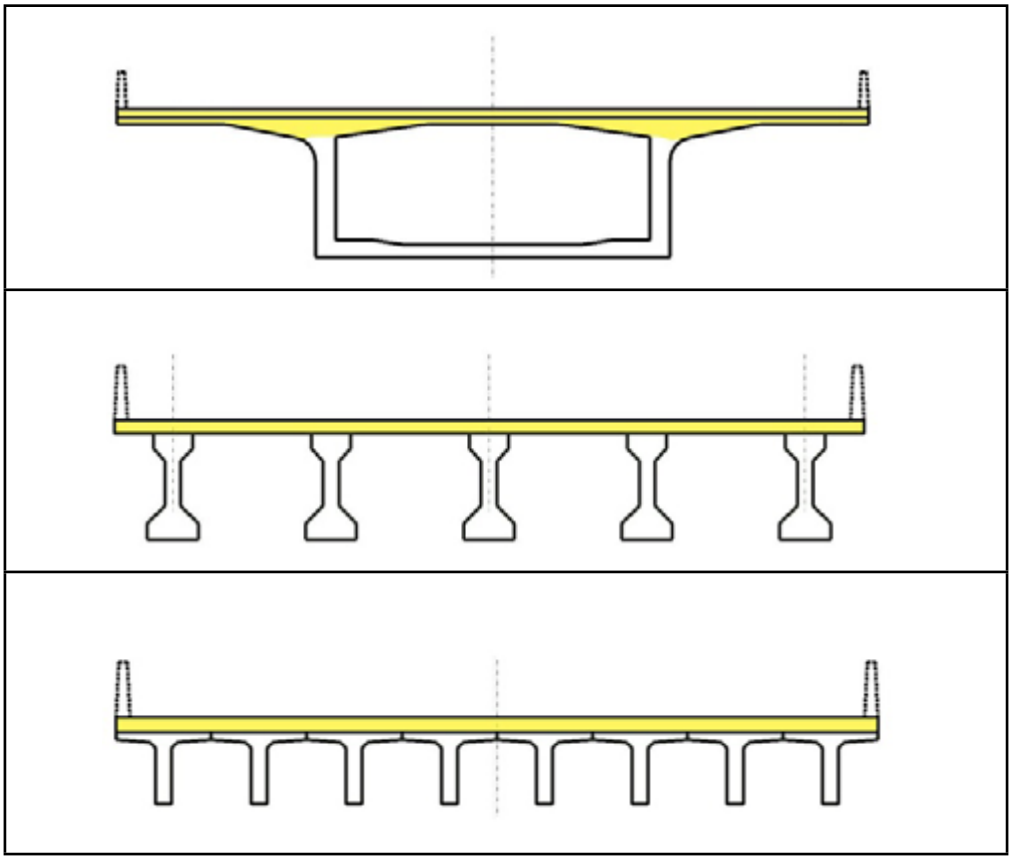


Figure: Element 12 Reinforced Concrete Deck (Highlighted)

To rate Element 12 – Reinforced Concrete Deck, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 12: Reinforced Concrete Deck Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1190 - Abrasion / Wear 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.1.2 Element 16 - Reinforced Concrete Top Flange (sq-ft)

Description: This element shall apply to the top flange of reinforced concrete superstructure elements with no concrete topping. The top flange of the superstructure element shall be the riding surface. The evaluation of the flange shall be based on the observed defects on the top surface, bottom surface, edges, or all. Flanges in which the top surface is not visible (i.e., overlaid with a wearing surface) shall be assessed based on the visible bottom surface. If the top and bottom surfaces are not visible, the flange condition shall be assessed based on nondestructive testing and/or indicators in the materials covering the surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

Photo: Element 16 - Reinforced Concrete Top Flange (Highlighted)

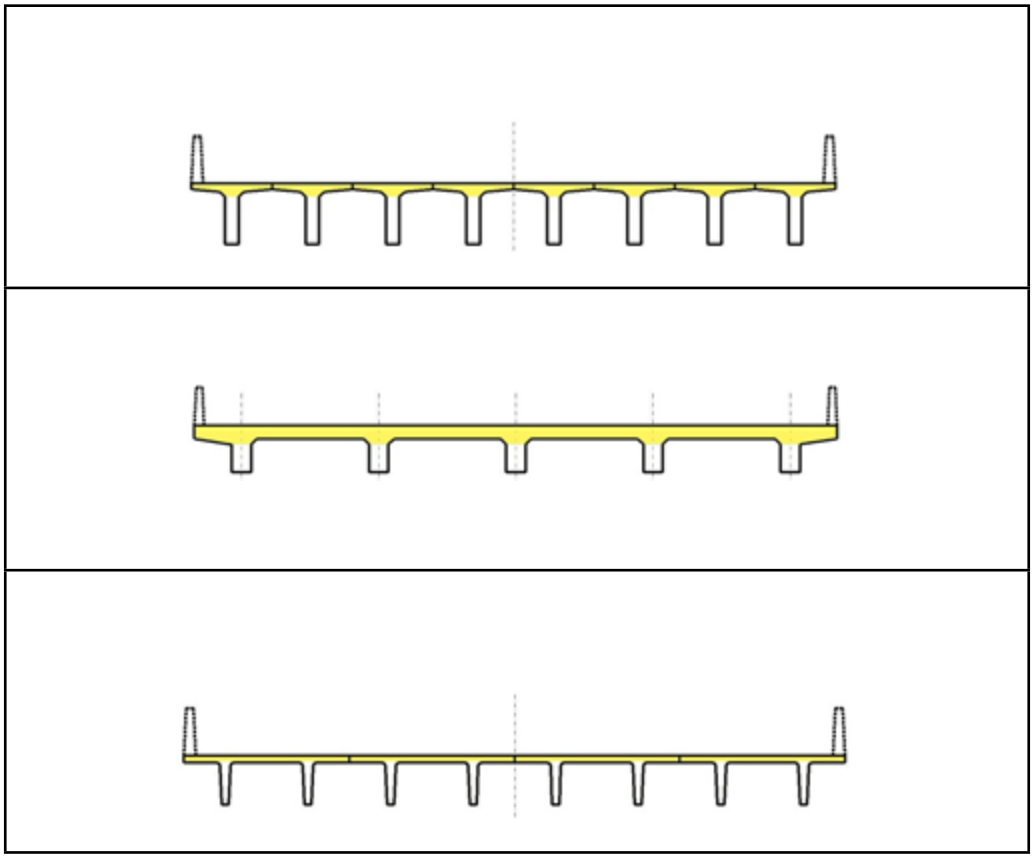


Figure: Element 16 Reinforced Concrete Top Flange (Highlighted)

To rate Element 16 – Reinforced Concrete Top Flange, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 16: Reinforced Concrete Top Flange Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1190 - Abrasion / Wear 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.1.3 Element 38 - Reinforced Concrete Slab (sq-ft)

Description: This element shall apply to reinforced concrete slabs constructed on substructure elements. The evaluation of the slab shall be based on the observed defects on the top surface, bottom surface, edges, or all. Slabs in which the top surface is not visible (i.e., overlaid with a wearing surface) shall be assessed based on the visible bottom surface. If the top and bottom surfaces are not visible, the slab condition shall be assessed based on nondestructive testing and/or indicators in the materials covering the surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

Photo: Element 38 - Reinforced Concrete Slab (Highlighted)

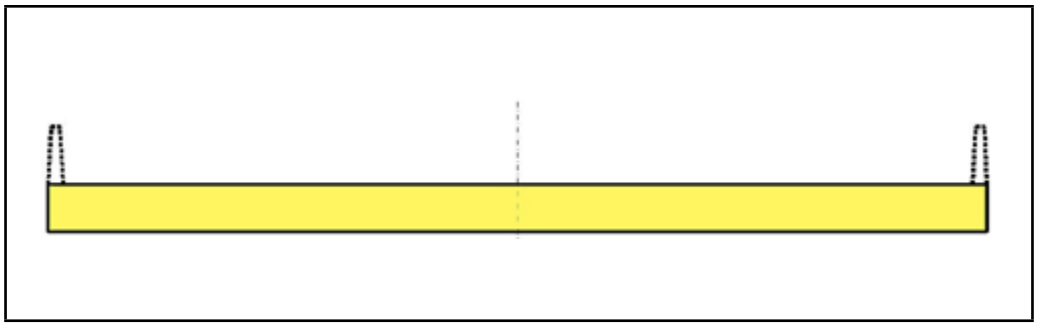


Figure: Element 38 Reinforced Concrete Slab (Highlighted)

To rate Element 38 – Reinforced Concrete Slab, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 38: Reinforced Concrete Slab Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1190 - Abrasion / Wear 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.1.4 Element 321 - Reinforced Concrete Approach Slab (sq-ft)

Description: This element shall apply to mild steel reinforced concrete structural approach slabs between the abutment and the approach pavement.

See page 4-5 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

Photo: Element 321 - Reinforced Concrete Approach Slab (Highlighted)

To rate Element 321 – Reinforced Concrete Approach Slab, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 321: Reinforced Concrete Approach Slab Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1130 - Cracking – RC and Other 1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.1.5 Element 331 - Reinforced Concrete Bridge Railing (ft)

Description: This element shall apply to all types and shapes of reinforced concrete bridge railings. This element shall only apply to the portion of the bridge railing constructed of reinforced concrete. For assessing the condition of a bridge railing constructed of various materials (i.e., metal, timber, masonry, or other) refer to all applicable bridge rail material elements.

See page 4-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 331 - Reinforced Concrete Bridge Railing (Highlighted)

To rate Element 331 – Reinforced Concrete Bridge Railing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 331: Reinforced Concrete Bridge Railing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.2 Prestressed Concrete Elements

NBE No.	Element	Units	Page No.
13	Prestressed Concrete Deck	sq-ft	4-21
15	Prestressed Concrete Top Flange	sq-ft	4-23
320	Prestressed Concrete Approach Slab	sq-ft	4-25

4.2.1 Element 13 - Prestressed Concrete Deck (sq-ft)

Description: This element shall apply to prestressed or post-tensioned concrete decks and toppings constructed on superstructure elements. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all. Decks in which the top surface is not visible (i.e., overlaid with a wearing surface) shall be assessed based on the visible bottom surface. If the top and bottom surfaces are not visible, the deck condition shall be assessed based on nondestructive testing and/or indicators in the materials covering the surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, units of measurement and quantity calculation.

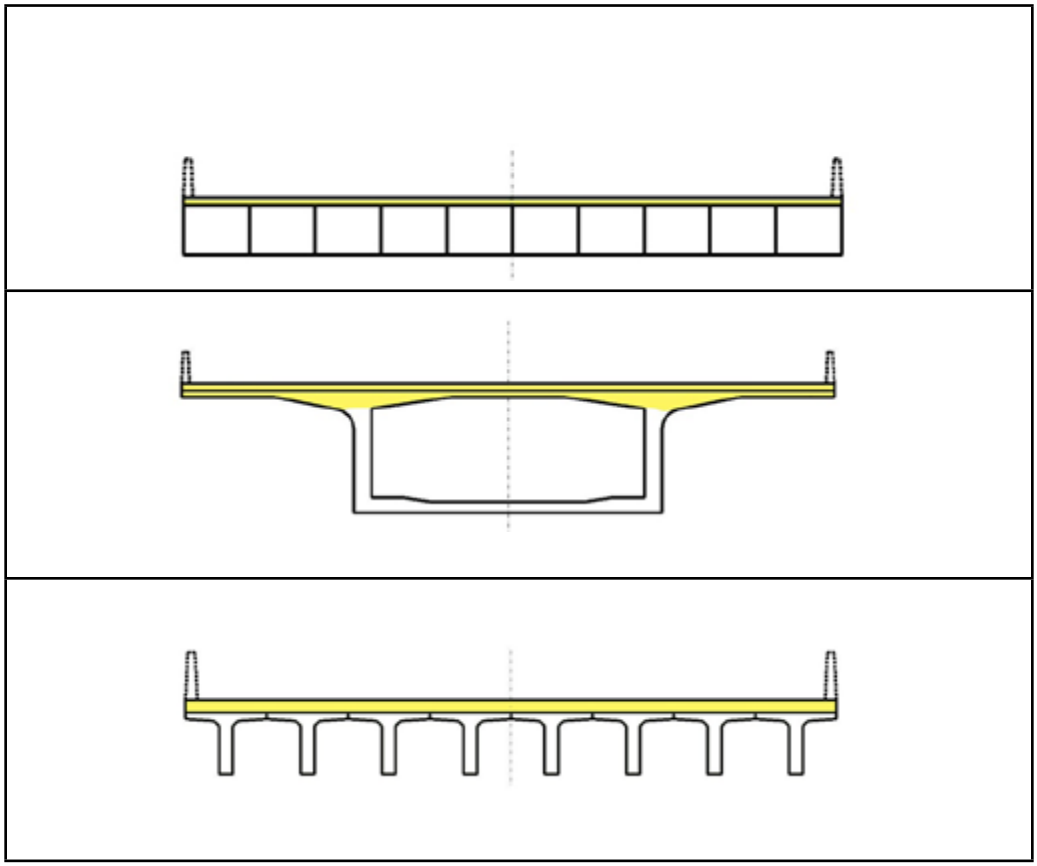


Figure: Element 13 - Prestressed Concrete Deck (Highlighted)

To rate Element 13 – Prestressed Concrete Deck, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 13: Prestressed Concrete Deck Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination /Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 1190 - Abrasion / Wear 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.2.2 Element 15 - Prestressed Concrete Top Flange (sq-ft)

Description: This element shall apply to the top flange of prestressed concrete superstructure elements with no concrete topping. The top flange of the superstructure element shall be the riding surface. The evaluation of the flange shall be based on the observed defects on the top surface, bottom surface, edges, or all. Flanges in which the top surface is not visible (i.e., overlaid with a wearing surface) shall be assessed based on the visible bottom surface. If the top and bottom surfaces are not visible, the flange condition shall be assessed based on nondestructive testing and/or indicators in the materials covering the surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

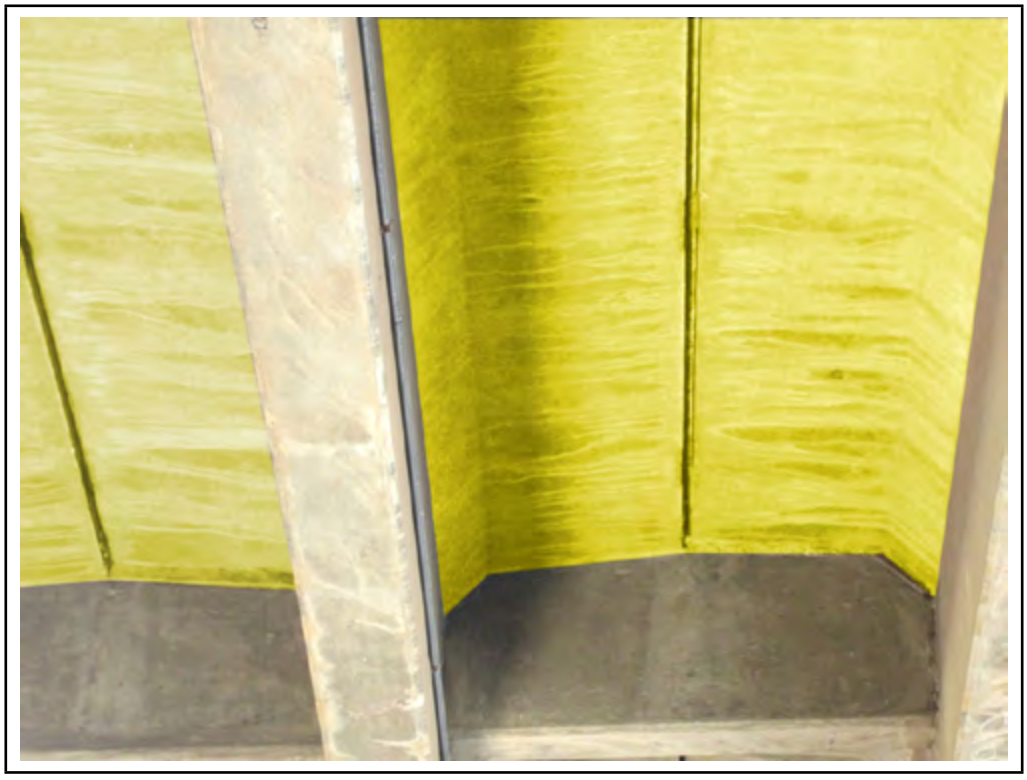


Photo: Element 15 - Prestressed Concrete Top Flange (Highlighted)

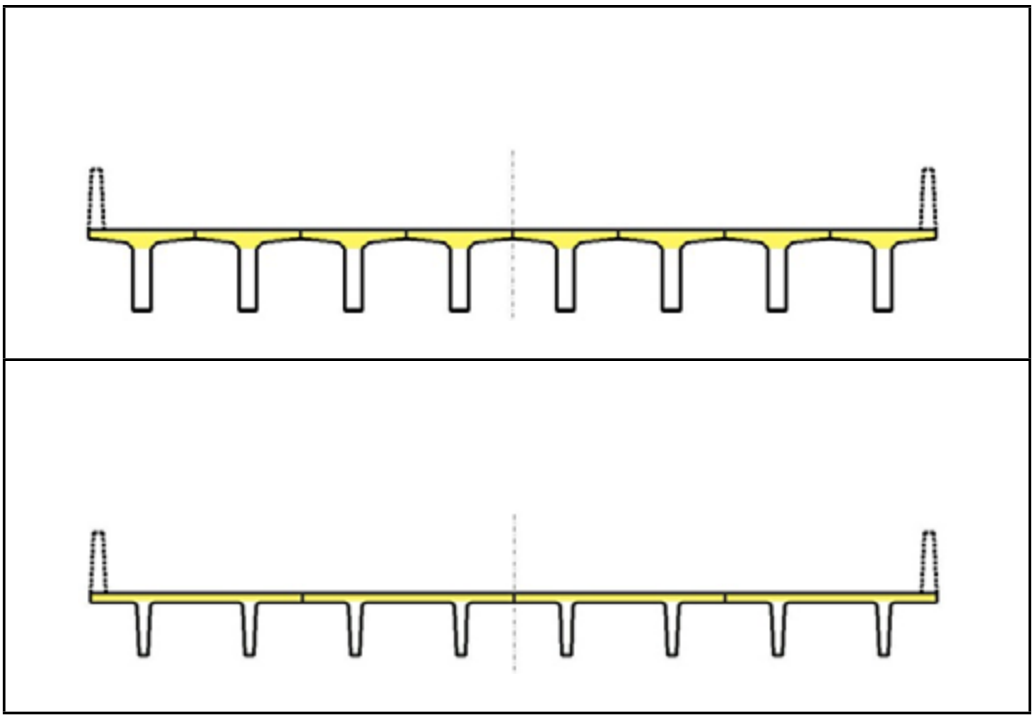


Figure: Element 15 – Prestressed Concrete Top Flange (Highlighted)

To rate Element 15 – Prestressed Concrete Top Flange, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 15: Prestressed Concrete Top Flange Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination /Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 1190 - Abrasion / Wear 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.2.3 Element 320 - Prestressed Concrete Approach Slab (sq-ft)

Description: This element shall apply to pretensioned or post-tensioned concrete structural approach slabs between the abutment and the approach pavement.

See page 4-5 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

To rate Element 320 – Prestressed Concrete Approach Slab, consider the following Defects and Protective Systems (see Appendix A for complete defect and condition state tables):

Element 320: Prestressed Concrete Approach Slab Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

4.3 Steel Elements

NBE No.	Element	Units	Page No.
28	Steel Deck-Open Grid	sq-ft	4-29
29	Steel Deck-Concrete Filled Grid	sq-ft	4-31
30	Steel Deck-Corrugated/Orthotropic/Etc.	sq-ft	4-32
330	Metal Bridge Railing	ft	4-34

4.3.1 Element 28 - Steel Deck with Open Grid (sq-ft)

Description: This element shall apply to open grid steel bridge decks with no concrete fill constructed on superstructure elements. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all. If the deck has concrete filled grids in the wheel tracks only, use Element 29-Steel Deck with Concrete Filled Grid for the concrete filled portion and Element 28-Steel Deck with Open Grid for the unfilled portion of the deck.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

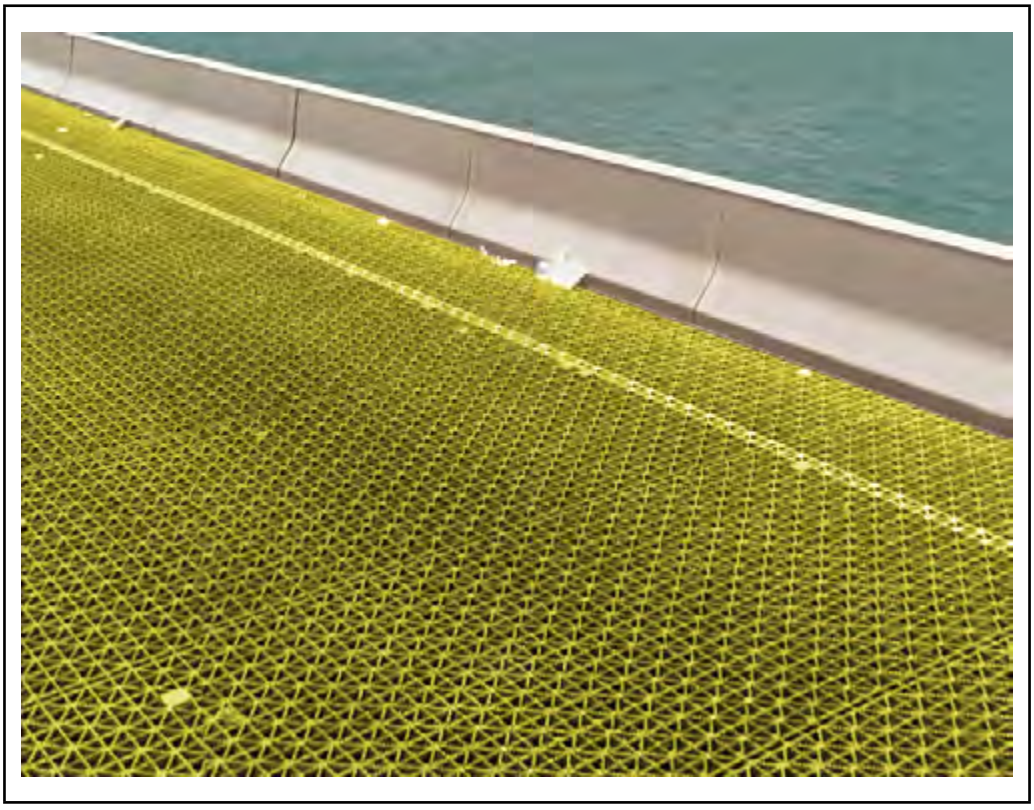


Photo: Element 28 - Steel Deck with Open Grid (Highlighted)

To rate Element 28 – Steel Deck with Open Grid, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 28: Steel Deck with Open Grid Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

4.3.2 Element 29 - Steel Deck with Concrete Filled Grid (sq-ft)

Description: This element shall apply to steel bridge decks with concrete fill constructed on superstructure elements. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all. If the deck has concrete filled grids in the wheel tracks only, use Element 29-Steel Deck with Concrete Filled Grid for the concrete filled portion and Element 28-Steel Deck with Open Grid for the unfilled portion of the deck.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

To rate Element 29 – Steel Deck with Concrete Filled Grid, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 29: Steel Deck with Concrete Filled Grid Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

4.3.3 Element 30 - Steel Deck with Corrugated / Orthotropic / Etc. (sq-ft)

Description: This element shall apply to bridge decks constructed with corrugated metal filled with concrete, asphaltic concrete or other riding surfaces constructed on superstructure elements. Orthotropic steel decks shall be considered as part of this element. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all. Materials added for the riding surface shall not be included as part of this element.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

Photo: Element 30 - Steel Deck with Corrugated / Orthotropic / Etc. (Highlighted)

To rate Element 30 – Steel Deck with Corrugated / Orthotropic / Etc., consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 30: Steel Deck with Corrugated/Orthotropic/Etc. Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage
1020 - Connection 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

4.3.4 Element 330 - Metal Bridge Railing (ft)

Description: This element shall apply to all types and shapes of metal bridge railings. Steel, aluminum, metal beam, rolled shapes, pipes, etc. shall all be considered as part of this element. This element shall only apply to the portion of the bridge railing constructed of metal. For assessing the condition of a bridge railing constructed of various materials (i.e., concrete, timber, masonry, or other) refer to all applicable bridge rail material elements.

See page 4-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 330 - Metal Bridge Railing (Highlighted)

To rate Element 330 – Metal Bridge Railing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 330: Metal Bridge Railing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

4.4 Masonry Elements

NBE No.	Element	Units	Page No.
334	Masonry Bridge Railing	ft	4-39

4.4.1 Element 334 - Masonry Bridge Railing (ft)

Description: This element shall apply to all types and shapes of masonry block or stone masonry bridge railings. This element shall only apply to the portion of the bridge railing constructed of masonry. For assessing the condition of a bridge railing constructed of various materials (i.e., metal, concrete, timber, other) refer to all applicable bridge rail material elements.

See page 4-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 334 - Masonry Bridge Railing (Highlighted)

To rate Element 334 – Masonry Bridge Railing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 334: Masonry Bridge Railing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1610 - Mortar Breakdown – Masonry 1620 - Split / Spall – Masonry 1630 - Patched Area – Masonry 1640 - Masonry Displacement 1900 - Distortion 7000 – Damage	N/A	N/A

4.5 Timber Elements

NBE No.	Element	Units	Page No.
31	Timber Deck	sq-ft	4-43
54	Timber Slab	sq-ft	4-45
332	Timber Bridge Railing	ft	4-46

4.5.1 Element 31 - Timber Deck (sq-ft)

Description: This element shall apply to timber bridge decks constructed on superstructure elements. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all. Timber running planks on a deck shall be included under Element 510-Wearing Surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

Photo: Element 31 - Timber Deck (Highlighted)

To rate Element 31 – Timber Deck, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 31: Timber Deck Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 7000 – Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage

4.5.2 Element 54 - Timber Slab (sq-ft)

Description: This element shall apply to timber bridge slabs constructed on substructure elements. The evaluation of the slab shall be based on the observed defects on the top surface, bottom surface, edges, or all. Timber running planks on a deck shall be included under Element 510-Wearing Surfaces.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

To rate Element 54 – Timber Slab, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 54: Timber Slab Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 7000 – Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage

4.5.3 Element 332 - Timber Bridge Railing (ft)

Description: This element shall apply to all types and shapes of timber bridge railings. This element shall only apply to the portion of the bridge railing constructed of timber. For assessing the condition of a bridge railing constructed of various materials (i.e., metal, concrete, masonry, or other) refer to all applicable bridge rail material elements.

See page 4-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 332 - Timber Bridge Railing (Highlighted)

To rate Element 332 – Timber Bridge Railing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 332: Timber Bridge Railing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 7000 – Damage	N/A	N/A

4.6 Other Material Elements

NBE No.	Element	Units	Page No.
60	Other Material Deck	sq-ft	4-51
65	Other Material Slab	sq-ft	4-52
333	Other Bridge Railing	ft	4-53

4.6.1 Element 60 - Other Deck (sq-ft)

Description: This element shall apply to bridge decks constructed on superstructure elements and made of other materials not classified under the defined deck elements. The evaluation of the deck shall be based on the observed defects on the top surface, bottom surface, edges, or all.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

To rate Element 60 – Other Deck, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 60: Other Deck Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 7000 – Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage

4.6.2 Element 65 - Other Slab (sq-ft)

Description: This element shall apply to slabs constructed on substructure elements and made of other materials not classified under the defined slab elements. The evaluation of the slab shall be based on the observed defects on the top surface, bottom surface, edges, or all.

See page 4-1 for more information on protective systems/wearing surfaces, condition states, unit of measure and quantity calculation.

To rate Element 65 – Other Slab, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 65: Other Slab Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 7000 - Damage	510 - Wearing Surfaces	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage

4.6.3 Element 333 - Other Bridge Railing (ft)

Description: This element shall apply to all types and shapes of bridge railings made of other materials not classified under the defined railing elements. This element shall only apply to the portion of the bridge railing constructed of other materials. For assessing the condition of a bridge railing constructed of various materials (i.e., metal, concrete, timber, masonry) refer to all applicable bridge rail material elements.

See page 4-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 333 - Other Bridge Railing (Highlighted)

To rate Element 333 – Other Bridge Railing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 333: Other Bridge Railing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

Note: Previously, other railing referred to combination railings (metal rail on a concrete barrier). This element refers to materials other than those specifically listed. Metal rail on concrete barrier are coded as 2 elements, (330 and 331).

4.7 Joints

NBE No.	Element	Units	Page No.
300	Strip Seal Expansion Joint	ft	4-57
301	Pourable Joint Seal	ft	4-59
302	Compression Joint Seal	ft	4-61
303	Assembly Joint/Seal (Modular)	ft	4-63
304	Open Expansion Joint	ft	4-65
305	Assembly Joint without Seal	ft	4-66
306	Other Joint	ft	4-68

Unit of Measure for Joint Elements

- Unit of measure for Joint elements shall be Length (ft.) and can be calculated as the sum of the length of all joints measured along the skew.
  - Use the appropriate as-built drawing to calculate the Joint element quantity.
  - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
- The total quantity for a Joint element may be distributed amongst the four Condition States based on existing conditions.

- Element Defects
  - See element details for possible element defects.
  - Refer to APPENDIX A for Condition State definitions.

4.7.1 Element 300 - Strip Seal Expansion Joint (ft)

Description: This element shall apply to strip seal expansion joints that have a single layer of neoprene strip type gland (typically in a “V” shape) anchored to metal side rails or epoxied inside the joint opening.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

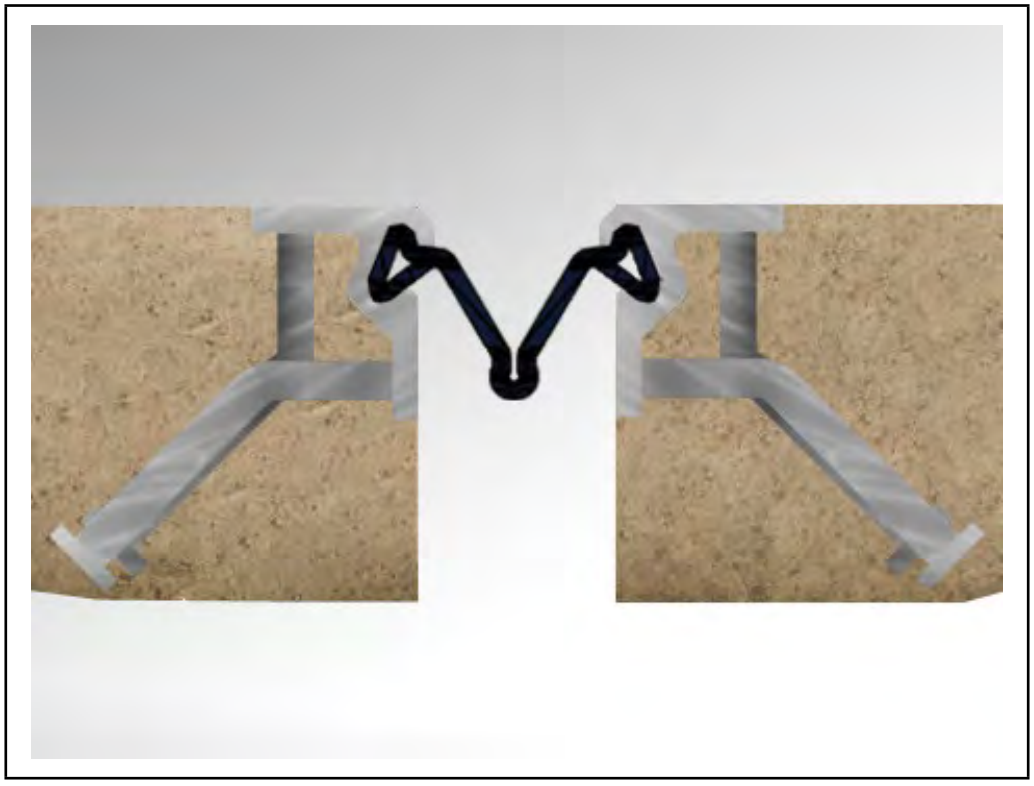


Figure: Element 300 - Strip Seal Expansion Joint

To rate Element 300 – Strip Seal Expansion Joint, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 300: Strip Seal Expansion Joint Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2310 - Leakage 2320 - Seal Adhesion 2330 - Seal Damage 2340 - Seal Cracking 2350 - Debris Impaction 2360 - Adjacent Deck or Header 2370 - Metal Deterioration or Damage 7000 – Damage	N/A	N/A

4.7.2 Element 301 - Pourable Joint Seal (ft)

Description: This element shall apply to joints filled with a pourable joint sealer with or without a backer. Pourable joint sealants and flexible asphaltic joint fillers shall be considered as part of this element.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

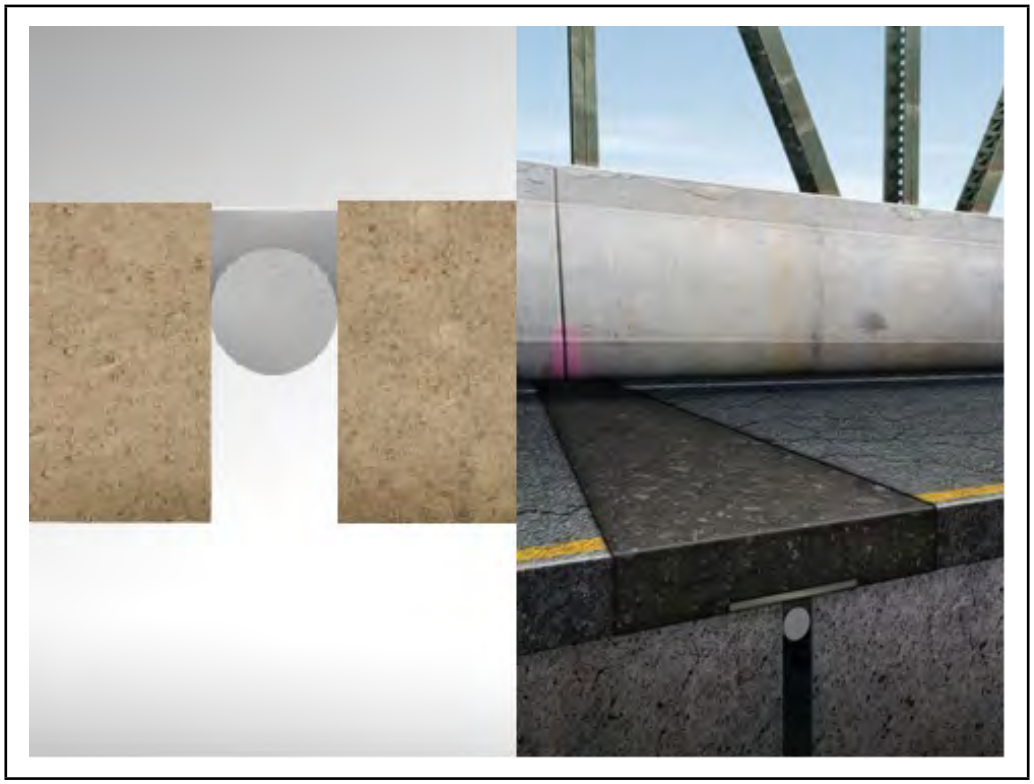


Figure: Element 301 - Pourable Joint Seal

To rate Element 301 – Pourable Joint Seal, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 301: Pourable Joint Seal Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2310 - Leakage 2320 - Seal Adhesion 2330 - Seal Damage 2340 - Seal Cracking 2350 - Debris Impaction 2360 - Adjacent Deck or Header 7000 – Damage	N/A	N/A

4.7.3 Element 302 - Compression Joint Seal (ft)

Description: This element shall apply to joints filled with a preformed compression type seal.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

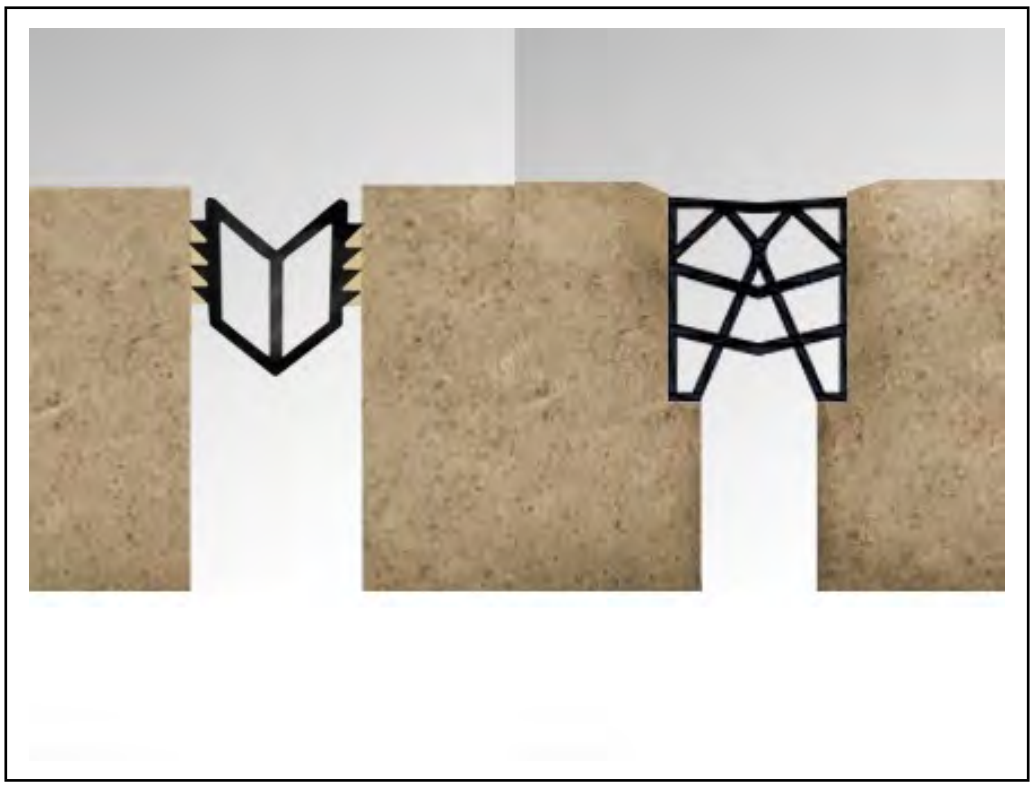


Figure: Element 302 - Compression Joint Seal

To rate Element 302 – Compression Joint Seal, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 302: Compression Joint Seal Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2310 - Leakage 2320 - Seal Adhesion 2330 - Seal Damage 2340 - Seal Cracking 2350 - Debris Impaction 2360 - Adjacent Deck or Header 7000 – Damage	N/A	N/A

4.7.4 Element 303 - Assembly Joint with Seal (ft)

Description: This element shall apply to assembly joints with seal. Modular expansion joint systems with strip seals shall be considered as part of this element.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

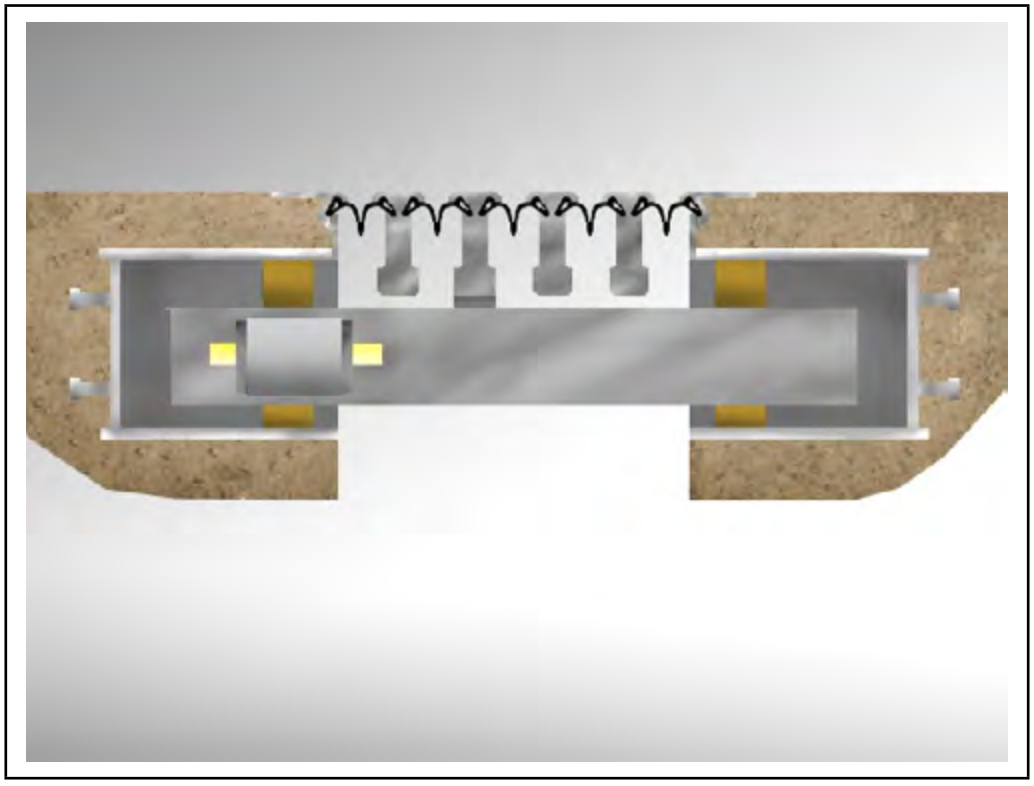


Figure: Element 303 - Assembly Joint with Seal

To rate Element 303 – Assembly Joint with Seal, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 303: Assembly Joint with Seal Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2310 - Leakage 2320 - Seal Adhesion 2330 - Seal Damage 2340 - Seal Cracking 2350 - Debris Impaction 2360 - Adjacent Deck or Header 2370 - Metal Deterioration or Damage 7000 – Damage	N/A	N/A

4.7.5 Element 304 - Open Expansion Joint (ft)

Description: This element shall apply to open expansion joints that are not sealed. Joints that were designed to have a seal, but the seal is currently missing, shall not be considered as part of this element.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

To rate Element 304 – Open Expansion Joint, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 304: Open Expansion Joint Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2350 - Debris Impaction 2360 - Adjacent Deck or Header 7000 – Damage	N/A	N/A

4.7.6 Element 305 - Assembly Joint without Seal (ft)

Description: This element shall apply to assembly joints without seal. Finger joint assemblies and sliding plate joint assemblies shall be considered as part of this element. This element shall include open assembly joints with or without a drainage trough below the joint.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 305 - Assembly Joint without Seal

To rate Element 305 – Assembly Joint without Seal, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 305: Assembly Joint without Seal Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2350 - Debris Impaction 2360 - Adjacent Deck or Header 2370 - Metal Deterioration or Damage 7000 – Damage	N/A	N/A

4.7.7 Element 306 - Other Joint (ft)

Description: This element shall apply to joints made of other materials and/or designs not classified under the defined joint elements.

See page 4-55 for more information on condition states, unit of measure and quantity calculation.

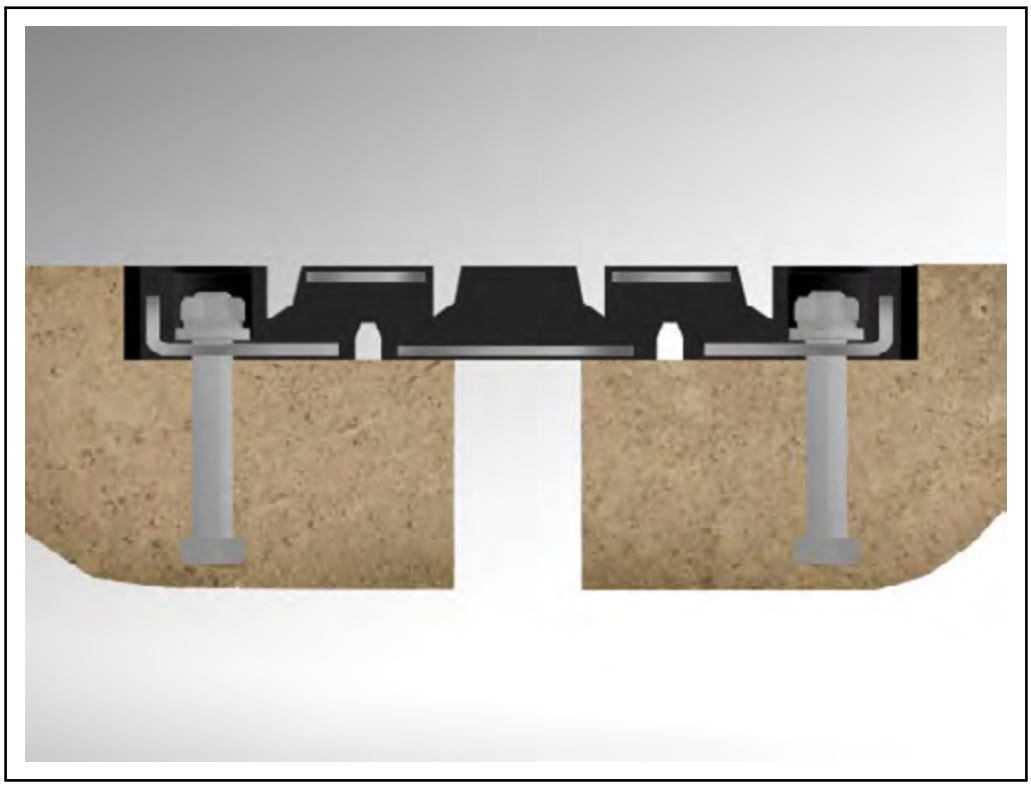


Figure: Element 306 - Other Joint

To rate Element 306 – Other Joint, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 306: Other Joint Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
2310 - Leakage 2350 - Debris Impaction 2360 - Adjacent Deck or Header 2370 - Metal Deterioration or Damage 7000 – Damage	N/A	N/A

Chapter 5 Superstructure and Bearings

NBE No.	Element	Units	Page No.
102	Closed Web/Box Girder, Steel	ft	5-29
104	Closed Web/Box Girder, Prestressed Concrete	ft	5-19
105	Closed Web/Box Girder, Reinforced Concrete	ft	5-7
106	Closed Web/Box Girder, Other	ft	5-59
107	Girder/Beam, Steel	ft	5-30
109	Girder/Beam, Prestressed Concrete	ft	5-21
110	Girder/Beam, Reinforced Concrete	ft	5-9
111	Girder/Beam, Timber	ft	5-51
112	Girder/Beam, Other	ft	5-60
113	Stringer, Steel	ft	5-32
115	Stringer, Prestressed Concrete	ft	5-23
116	Stringer, Reinforced Concrete	ft	5-11
117	Stringer, Timber	ft	5-53
118	Stringer, Other	ft	5-61
120	Truss, Steel	ft	5-34
135	Truss, Timber	ft	5-54
136	Truss, Other	ft	5-62
141	Arch, Steel	ft	5-36
142	Arch, Other	ft	5-63
143	Arch, Prestressed Concrete	ft	5-24
144	Arch, Reinforced Concrete	ft	5-12
145	Arch, Masonry	ft	5-47
146	Arch, Timber	ft	5-55
147	Cable – Main, Steel	ft	5-37
148	Cable – Secondary, Steel	ea	5-38
149	Cable – Secondary, Other	ea	5-64
152	Floor Beam, Steel	ft	5-39
154	Floor Beam, Prestressed Concrete	ft	5-25
155	Floor Beam, Reinforced Concrete	ft	5-14
156	Floor Beam, Timber	ft	5-56
157	Floor Beam, Other	ft	5-65
161	Pin, Pin and Hanger Assembly, or both	ea	5-41
162	Gusset Plate	ea	5-42

Superstructure

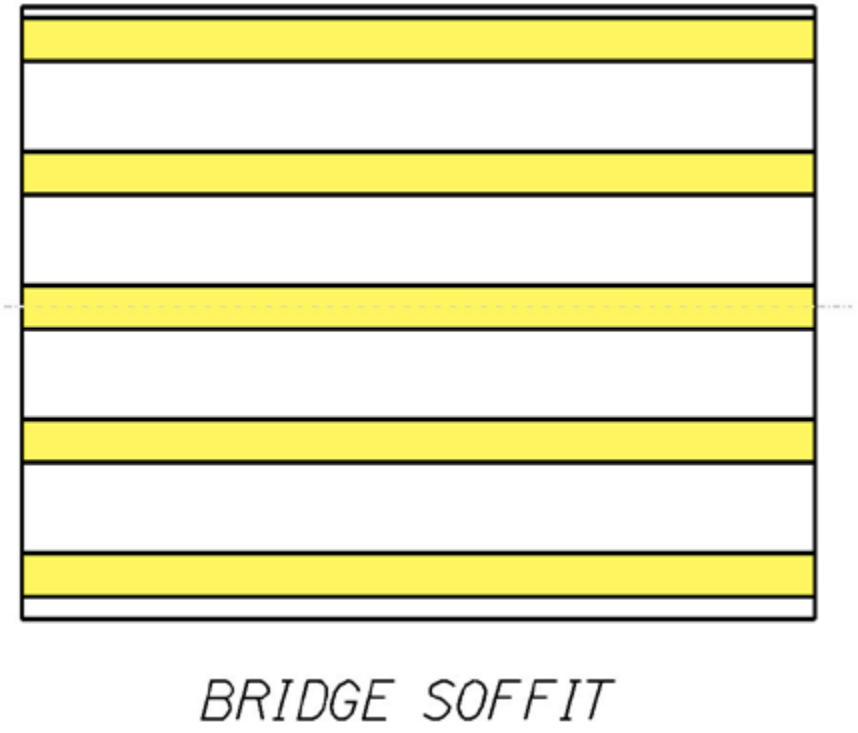


Figure: Beam Type Element Total = Element Length multiplied by the Number of Beams

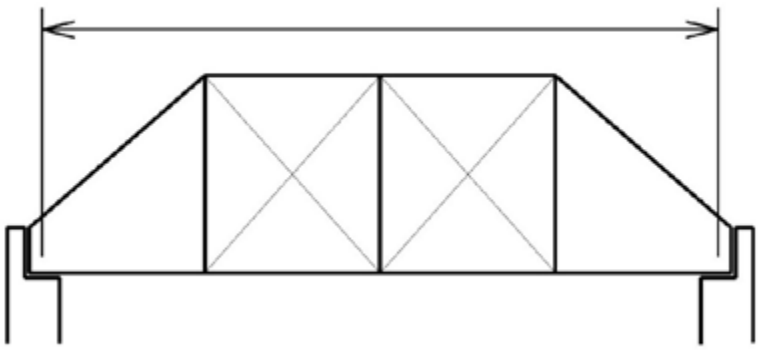


Figure: Truss and Arch elements are measured along the length of the bridge

- Unit of Measure for Superstructure Elements
    - Unit of measure for Superstructure elements shall be Length (ft.) and can be calculated as the number of superstructure elements times the bridge length.
        - Use the appropriate as-built drawing to calculate the Superstructure element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Superstructure element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.
- Protective System and Defects
    - See element details for possible Protective System elements.
    - See Chapter 8 for details on Protective System elements.
    - Refer to APPENDIX A for Condition State definitions.

Bearings

- For Bearings, see Section 5.7.

5.1 Reinforced Concrete Elements

NBE No.	Element	Units	Page No.
105	Closed Web/Box Girder, Reinforced Concrete	ft	5-7
110	Girder/Beam, Reinforced Concrete	ft	5-9
116	Stringer, Reinforced Concrete	ft	5-11
144	Arch, Reinforced Concrete	ft	5-12
155	Floor Beam, Reinforced Concrete	ft	5-14

5.1.1 Element 105 - Reinforced Concrete Closed Web / Box Girder (ft)

Description: This element shall apply to reinforced concrete closed web girders or box girders. When the top flange of the superstructure element is the riding surface, the evaluation of the top flange shall be considered as Element 16-Reinforced Concrete Top Flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 105 - Reinforced Concrete Closed Web / Box Girder (Highlighted)

To rate Element 105 – Reinforced Concrete Closed Web / Box Girder, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 105: Reinforced Concrete Closed Web / Box Girder Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.1.2 Element 110 - Reinforced Concrete Open Girder / Beam (ft)

Description: This element shall apply to mild steel reinforced concrete open web girders (I-sections, T-Sections, etc.). The evaluation of the girder shall be based on the observed defects on the web face and the top and bottom flange surfaces. When the top flange of the superstructure element is the riding surface, the evaluation of the top flange shall be considered as Element 16-Reinforced Concrete Top Flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 110 - Reinforced Concrete Open Girder / Beam (Highlighted)

To rate Element 110 – Reinforced Concrete Open Girder / Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 110: Reinforced Concrete Open Girder / Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.1.3 Element 116 - Reinforced Concrete Stringer (ft)

Description: This element shall apply to mild steel reinforced concrete stringers supporting the deck in a stringer floor beam system.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 116 – Reinforced Concrete Stringer, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 116: Reinforced Concrete Stringer Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - RC and Other 1190 - Abrasion / Wear – PSC / RC 7000 - Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.1.4 Element 144 - Reinforced Concrete Arch (ft)

Description: This element shall apply to mild steel reinforced concrete arches. Observed distress in arch vertical (including spandrel columns), diagonal members and spandrel walls shall be reported as the projected length along the arch length. For filled arches, the arch quantity shall be determined as the distance from spring line to spring line. The length below the spring line shall be considered as substructure.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 144 - Reinforced Concrete Arch (Highlighted)

To rate NBE No. 144 – Reinforced Concrete Arch, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

<table>
<tr><th colspan="3">National Bridge Element No. 144: Reinforced Concrete Arch Defects and Protective Systems</th></tr>
<tr><th>Element Defects</th><th>Protective System</th><th>Protective System Defects</th></tr>
<tr><td rowspan="2">1080 - Delamination / Spall / Patched Area

1090 - Exposed Rebar

1120 - Efflorescence / Rust Staining

1130 - RC and Other

1190 - Abrasion / Wear – PSC / RC

7000 - Damage</td><td>520 - Concrete Reinforcing Steel Protective System</td><td>3600 - Effectiveness – Protective System, Cathodic

7000 – Damage</td></tr>
<tr><td>521 - Concrete Protective Coating</td><td>3510 - Wear – Concrete Protective Coatings

3540 - Effectiveness – Concrete Protective Coatings

7000 – Damage</td></tr>
</table>

5.1.5 Element 155 - Reinforced Concrete Floor Beam (ft)

Description: This element shall apply to mild steel reinforced concrete floor beams supporting the stringers in a stringer floor beam system.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 155 - Reinforced Concrete Floor Beam (Highlighted)

To rate Element 155 – Reinforced Concrete Floor Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 155: Reinforced Concrete Floor Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 7000 - Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.2 Prestressed Concrete Elements

NBE No.	Element	Units	Page No.
104	Closed Web/Box Girder, Prestressed Concrete	ft	5-19
109	Girder/Beam, Prestressed Concrete	ft	5-21
115	Stringer, Prestressed Concrete	ft	5-23
143	Arch, Prestressed Concrete	ft	5-24
154	Floor Beam, Prestressed Concrete	ft	5-25

5.2.1 Element 104 - Prestressed Concrete Closed Web / Box Girder (ft)

Description: This element shall apply to pretensioned or post-tensioned concrete closed web girders or box girders. The evaluation of the girder shall be based on the observed defects on the exterior and interior surfaces. When the top flange of the superstructure element is the riding surface, the evaluation of the top flange shall be considered as Element 15-Prestressed Concrete Top Flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 104 - Prestressed Concrete Closed Web / Box Girder (Highlighted)

To rate Element 104 – Prestressed Concrete Closed Web / Box Girder, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 104: Prestressed Concrete Closed Web / Box Girder Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.2.2 Element 109 - Prestressed Concrete Open Girder / Beam (ft)

Description: This element shall apply to pretensioned or post-tensioned concrete open web girders (I-sections, T-sections, rectangular sections, solid planks, etc.). When the top flange of the superstructure element is the riding surface, the evaluation of the top flange shall be considered as Element 15-Prestressed Concrete Top Flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 109 - Prestressed Concrete Open Girder / Beam (Highlighted)

To rate Element 109 – Prestressed Concrete Open Girder / Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 109: Prestressed Concrete Open Girder / Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.2.3 Element 115 - Prestressed Concrete Stringer (ft)

Description: This element shall apply to pretensioned or post-tensioned concrete stringers supporting the deck in a stringer floor beam system. The evaluation of the stringer shall be based on the observed defects on the web faces and the top and bottom flange surfaces.

See page 5-3 for more information on protective systems,condition states, unit of measure and quantity calculation.

To rate Element 115 – Prestressed Concrete Stringer, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 115: Prestressed Concrete Stringer Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 7000 - Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.2.4 Element 143 - Prestressed Concrete Arch (ft)

Description: This element shall apply to pretensioned or post-tensioned concrete arches. Observed distress in arch vertical (including spandrel columns) and diagonal members shall be reported as the projected length along the arch length. For filled arches, the arch quantity shall be determined as the distance from spring line to spring line. The length below the spring line shall be considered as substructure.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 143 – Prestressed Concrete Arch, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 143: Prestressed Concrete Arch Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 1190 - Abrasion / Wear – PSC / RC 7000 - Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.2.5 Element 154 - Prestressed Concrete Floor Beam (ft)

Description: This element shall apply to pretensioned or post-tensioned concrete floor beams supporting the stringers in a stringer floor beam system.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 154 – Prestressed Concrete Floor Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 154: Prestressed Concrete Floor Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 7000 - Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

5.3 Steel Elements

NBE No.	Element	Units	Page No.
102	Closed Web/Box Girder, Steel	ft	5-29
107	Girder/Beam, Steel	ft	5-30
113	Stringer, Steel	ft	5-32
120	Truss, Steel	ft	5-34
141	Arch, Steel	ft	5-36
147	Cable – Main, Steel	ft	5-37
148	Cable – Secondary, Steel	ea	5-38
152	Floor Beam, Steel	ft	5-39
161	Pin, Pin and Hanger Assembly, or both	ea	5-41
162	Gusset Plate	ea	5-42

5.3.1 Element 102 - Steel Closed Web / Box Girder (ft)

Description: This element shall apply to steel closed web girders or steel box girders. The evaluation of the girder shall be based on the observed defects on the exterior and interior surfaces.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 102 – Steel Closed Web / Box Girder, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 102: Steel Closed Web / Box Girder Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.2 Element 107 - Steel Open Girder / Beam (ft)

Description: This element shall apply to steel open girders (I-sections). The evaluation of the girder shall be based on the observed defects on the web face and the top and bottom faces of the flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 107 - Steel Open Girder / Beam (Highlighted)

To rate Element 107 – Steel Open Girder / Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 107: Steel Open Girder / Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.3 Element 113 - Steel Stringer (ft)

Description: This element shall apply to steel stringers supporting the deck in a stringer floor beam system. The evaluation of the stringer shall be based on the observed defects on the web faces and the top and bottom faces of the flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 113 - Steel Stringer (Highlighted)

To rate Element 113 – Steel Stringer, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 113: Steel Stringer Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.4 Element 120 - Steel Truss (ft)

Description: This element shall apply to all steel truss members (tension and compression members) for through and deck trusses. Observed distress in truss vertical and diagonal members shall be reported as the projected length along the length of the truss.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 120 - Steel Truss (Highlighted)

To rate Element 120 – Steel Truss, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 120: Steel Truss Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.5 Element 141 - Steel Arch (ft)

Description: This element shall apply to steel arches. Observed distress in arch vertical (including spandrel columns) and diagonal members shall be reported as the projected length along the arch length.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 141 – Steel Arch, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 141: Steel Arch Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings
1010 - Cracking		3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings
1020 - Connection		3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings
1900 - Distortion		3440 - Effectiveness – Steel Protective Coatings
7000 - Damage		7000 – Damage

5.3.6 Element 147 – Steel Main Cables (ft)

Description: This element shall apply to all steel main cables in suspension or cable stayed bridges. The evaluation of suspender cables or other smaller cables shall be considered as Element 148-Secondary Steel Cables.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 147 – Steel Main Cables, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 147: Steel Main Cables Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.7 Element 148 - Secondary Steel Cables (ea)

Description: This element shall apply to steel secondary cables (suspender cables, other smaller cables, or groups of cables) used as a system to carry loads from the superstructure to the main cable or arch. The evaluation of steel main cables in suspension or cable stayed bridges shall be considered as Element 147-Steel Main Cables.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 148 – Secondary Steel Cables, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 148: Secondary Steel Cables Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.8 Element 152 - Steel Floor Beam (ft)

Description: This element shall apply to steel floor beams supporting the stringers in a stringer floor beam system. The evaluation of the floor beam shall be based on the observed defects on the web faces and the top and bottom faces of the flange.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 152 - Steel Floor Beam (Highlighted)

To rate Element 152 – Steel Floor Beam, consider the following Defects and Protective Systems (See APPENDIX A for complete defect and condition state tables):

Element 152: Steel Floor Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.9 Element 161 - Steel Pin and Pin & Hanger Assembly or Both (ea)

Description: This element shall apply to steel pins and/or pin and hanger assemblies. Observed distress on either hanger assembly plate shall be considered in the evaluation.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 161 – Steel Pin and Pin & Hanger Assembly or Both, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 161: Steel Pin and Pin & Hanger Assembly or Both Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.3.10 Element 162 - Steel Gusset Plate (ea)

Description: This element shall apply to steel gusset plate connections on the main truss or arch members. These steel gusset plate connections may be constructed with one or more plates and fastened by bolting, riveting, or welding. For built-up gusset plates, observed distress on any of the gusset plates shall be considered in the evaluation.

See page 5-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 162 - Steel Gusset Plate (Highlighted)

To rate Element 162 – Steel Gusset Plate, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 162: Steel Gusset Plate Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

5.4 Masonry Elements

NBE No.	Element	Units	Page No.
145	Arch, Masonry	ft	5-47

5.4.1 Element 145 - Masonry Arch (ft)

Description: This element shall apply to masonry block or stacked stone arches. Observed distress in arch spandrel walls shall be reported as the projected length along the arch length. For filled arches, the arch quantity shall be determined as the distance from spring line to spring line. The length below the spring line shall be considered as substructure.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 145 - Masonry Arch (Highlighted)

To rate NBE No. 145 – Masonry Arch, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

National Bridge Element No. 145: Masonry Arch Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1610 - Mortar Breakdown – Masonry 1620 - Split / Spall – Masonry 1630 - Patched Area – Masonry 1640 - Masonry Displacement 7000 – Damage	N/A	N/A

5.5 Timber Elements

NBE No.	Element	Units	Page No.
111	Girder/Beam, Timber	ft	5-51
117	Stringer, Timber	ft	5-53
135	Truss, Timber	ft	5-54
146	Arch, Timber	ft	5-55
156	Floor Beam, Timber	ft	5-56

5.5.1 Element 111 - Timber Open Girder / Beam (ft)

Description: This element shall apply to timber open girders (solid sawn, rough sawn, glu-lam, etc.).

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 111 - Timber Open Girder / Beam (Highlighted)

To rate Element 111 – Timber Open Girder / Beam, consider following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 111: Timber Open Girder / Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion /Wear – Timber 7000 – Damage	N/A	N/A

5.5.2 Element 117 - Timber Stringer (ft)

Description: This element shall apply to timber stringers supporting the deck in a stringer floor beam system.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 117 – Timber Stringer, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 117: Timber Stringer Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion /Wear – Timber 7000 – Damage	N/A	N/A

5.5.3 Element 135 - Timber Truss (ft)

Description: This element shall apply to all timber truss members (tension and compression members) for through and deck trusses. Observed distress in truss vertical and diagonal members shall be reported as the projected length along the length of the truss.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 135 – Timber Truss, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 135: Timber Truss Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion /Wear – Timber 7000 – Damage	N/A	N/A

5.5.4 Element 146 - Timber Arch (ft)

Description: This element shall apply to timber arches. Observed distress in arch vertical (including spandrel columns) and diagonal members shall be reported as the projected length along the arch length.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 146 – Timber Arch, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 146: Timber Arch Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion /Wear – Timber 7000 – Damage	N/A	N/A

5.5.5 Element 156 - Timber Floor Beam (ft)

Description: This element shall apply to timber floor beams supporting the stringers in a stringer floor beam system.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 156 – Timber Floor Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 156: Timber Floor Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion /Wear – Timber 7000 – Damage	N/A	N/A

5.6 Other Material Elements

NBE No.	Element	Units	Page No.
106	Closed Web/Box Girder, Other	ft	5-59
112	Girder/Beam, Other	ft	5-60
118	Stringer, Other	ft	5-61
136	Truss, Other	ft	5-62
142	Arch, Other	ft	5-63
149	Cable – Secondary, Other	ea	5-64
157	Floor Beam, Other	ft	5-65

5.6.1 Element 106 - Other Closed Web / Box Girder (ft)

Description: This element shall apply to closed web girders or box girders made of other materials not classified under the defined closed web/box girder elements. The evaluation of the girder shall be based on the observed defects on the exterior and interior surfaces.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 106 – Other Closed Web / Box Girder, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 106: Other Closed Web / Box Girder Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

5.6.2 Element 112 - Other Open Girder / Beam (ft)

Description: This element shall apply to open girders made of other materials not classified under the defined open girder/beam elements.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 112 – Other Open Girder / Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 112: Other Open Girder / Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

5.6.3 Element 118 - Other Stringer (ft)

Description: This element shall apply to stringers supporting the deck in a stringer floor beam system and made of other materials not classified under the defined stringer elements.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 118 – Other Stringer, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 118: Other Stringer Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

5.6.4 Element 136 - Other Truss (ft)

Description: This element shall apply to all truss members (tension and compression members) for through and deck trusses made of other materials not classified under the defined truss elements. Observed distress in truss vertical and diagonal members shall be reported as the projected length along the length of the truss.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 136 – Other Truss, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 136: Other Truss Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

5.6.5 Element 142 - Other Arch (ft)

Description: This element shall apply to arches made of other materials not classified under the defined arch elements. Observed distress in arch vertical (including spandrel columns) and diagonal members shall be reported as the projected length along the arch length.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 142 – Other Arch, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 142: Other Arch Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

5.6.6 Element 149 - Other Secondary Cable (ea)

Description: This element shall apply to secondary cables (suspender cables, other smaller cables, or groups of cables) made of other materials not classified under the defined secondary cable elements. The evaluation of steel main cables in suspension or cable stayed bridges shall be considered as Element 147-Steel Main Cables.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate NBE No. 149 – Other Secondary Cable, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

National Bridge Element No. 149: Other Secondary Cable Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1220 - Deterioration – Other 1990 - Distortion 7000 – Damage	N/A	N/A

5.6.7 Element 157 - Other Floor Beam (ft)

Description: This element shall apply to floor beams supporting the stringers in a stringer floor beam system and made of other materials not classified under the defined floor beam elements.

See page 5-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 157 – Other Floor Beam, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 157: Other Floor Beam Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

5.7 Bearing Elements

NBE No.	Element	Units	Page No.
310	Elastomeric Bearing	ea	5-69
311	Movable Bearing (roller, sliding, etc.)	ea	5-71
312	Enclosed/Concealed Bearing	ea	5-73
313	Fixed Bearing	ea	5-75
314	Pot Bearing	ea	5-77
315	Disk Bearing	ea	5-79
316	Other Bearing	ea	5-80

Bearings

- Unit of Measure for Bearing Elements
    - Unit of measure for Bearing elements shall be Each (EA) and can be calculated as the of the Bearing elements.
        - Use the appropriate as-built drawing to calculate the Bearing element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Bearing element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.

5.7.1 Element 310 - Elastomeric Bearing (ea)

Description: This element shall apply to non-reinforced and steel laminated elastomeric bearings made of neoprene or natural rubber.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 310 - Elastomeric Bearing (Highlighted)

To rate Element 310 – Elastomeric Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 310: Elastomeric Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2230 - Bulging, Splitting, or Tearing 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

5.7.2 Element 311 - Moveable Bearing (ea)

Description: This element shall apply to bridge bearings that allow for rotation and longitudinal movement of the superstructure by means of a roller, rocker, or sliding plate.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 311 - Moveable Bearing (Highlighted)

To rate Element 311 – Moveable Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 311: Movable Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

5.7.3 Element 312 - Enclosed / Concealed Bearing (ea)

Description: This element shall apply to bridge bearings that are enclosed or concealed such that they are not visible for a detailed inspection. In-span hinge bearings that are not visible for inspection shall be considered as part of this element. In cases where the bearing element is not visible, the inspector shall evaluate the condition based on alignment, grade across the joint, persistence of debris, or other indirect indicators of condition.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 312 - Enclosed / Concealed Bearing

To rate Element 312 – Enclosed / Concealed Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 312: Enclosed / Concealed Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

5.7.4 Element 313 - Fixed Bearing (ea)

Description: This element shall apply to bridge bearings that allow for rotation only (no longitudinal movement) of the superstructure.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 313 - Fixed Bearing (Highlighted)

To rate Element 313 – Fixed Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 313: Fixed Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

5.7.5 Element 314 - Pot Bearing (ea)

Description: This element shall apply to high load bridge bearings with a confined elastomeric disk. This bearing type may be fixed against horizontal movement, guided to allow movement in one direction, or floating to allow movement in any direction.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 314 - Pot Bearing (Highlighted)

To rate Element 314 – Pot Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 314: Pot Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2230 - Bulging, Splitting, or Tearing 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

5.7.6 Element 315 - Disk Bearing (ea)

Description: This element shall apply to high load bridge bearings with a hard bearing disk. This bearing type may be fixed against horizontal movement, guided to allow for movement in one direction, or floating allowing movement in any direction.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

To rate Element 315 – Disk Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 315: Disk Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

5.7.7 Element 316 - Other Bearing (ea)

Description: This element shall apply to bridge bearings made of other materials and/or designs not classified under the defined bearing elements. Seismic isolation bearings shall be considered as part of this element.

See page 5-76 for more information on condition states, unit of measure and quantity calculation.

To rate Element 316 – Other Bearing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 316: Other Bearing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1020 - Connection 2210 - Movement 2220 - Alignment 2240 - Loss of Bearing Area 7000 – Damage	N/A	N/A

Chapter 6 Substructure

NBE No.	Element	Units	Page No.
202	Columns, Steel	ea	6-27
203	Columns, Other	ea	6-53
204	Columns, Prestressed Concrete	ea	6-21
205	Columns, Reinforced Concrete	ea	6-7
206	Columns, Timber	ea	6-43
207	Column Tower (Trestle), Steel	ft	6-29
208	Column Tower (Trestle), Timber	ft	6-45
210	Pier Wall, Reinforced Concrete	ft	6-9
211	Pier Wall, Other	ft	6-54
212	Pier Wall, Timber	ft	6-46
213	Pier Wall, Masonry	ft	6-37
215	Abutment, Reinforced Concrete	ft	6-11
216	Abutment, Timber	ft	6-47
217	Abutment, Masonry	ft	6-39
218	Abutment, Other	ft	6-55
219	Abutment, Steel	ft	6-31
220	Pile Cap/Footing	ft	6-13
225	Pile, Steel	ea	6-32
226	Pile, Prestressed Concrete	ea	6-22
227	Pile, Reinforced Concrete	ea	6-14
228	Pile, Timber	ea	6-48
229	Pile, Other	ea	6-56
231	Pier Cap, Steel	ft	6-33
233	Pier Cap, Prestressed Concrete	ft	6-24
234	Pier Cap, Reinforced Concrete	ft	6-16
235	Pier Cap, Timber	ft	6-49
236	Pier Cap, Other	ft	6-57

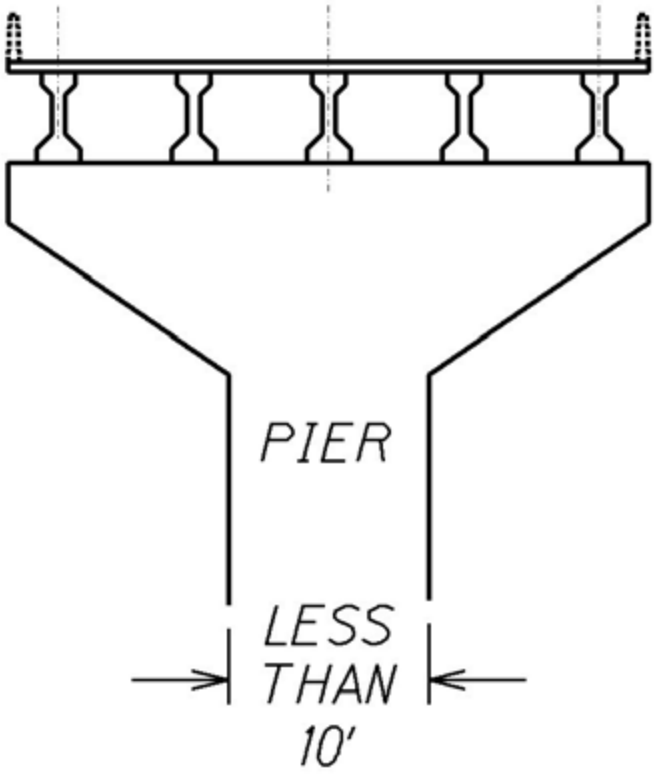


Figure: Columns are less than 10 feet wide

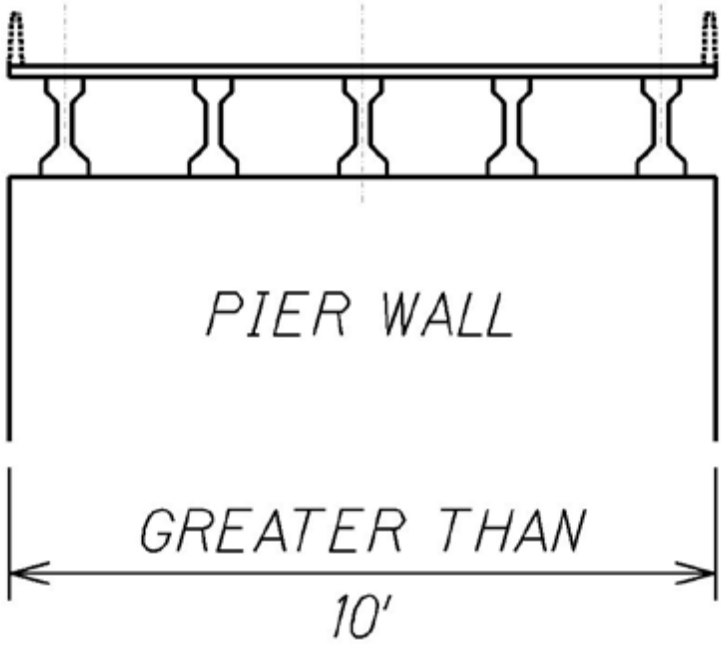


Figure: Pier Walls are 10 feet or more

- Unit of Measure for Substructure Elements
    - Unit of measure for Substructure elements varies depending on the element.
        - Column and Pile elements shall have unit of measure Each (EA) and can be calculated as the total number of elements.
        - Column Tower (Trestle), Pier Wall, Abutment, Pile Cap/Footing, and Pier Cap elements shall have unit of measure Length (ft.) and can be calculated as the sum of the lengths
        - Use the appropriate as-built drawing to calculate the Substructure element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Substructure element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.
- Protective System and Defects
    - See element details for possible Protective System elements.
    - See Chapter 8 for details on Protective System elements.
    - Refer to APPENDIX A for Condition State definitions.

6.1 Reinforced Concrete Elements

NBE No.	Element	Units	Page No.
205	Columns, Reinforced Concrete	ea	6-7
210	Pier Wall, Reinforced Concrete	ft	6-9
215	Abutment, Reinforced Concrete	ft	6-11
220	Pile Cap/Footing	ft	6-13
227	Pile, Reinforced Concrete	ea	6-14
234	Pier Cap, Reinforced Concrete	ft	6-16

6.1.1 Element 205 - Reinforced Concrete Column (ea)

Description: This element shall apply to reinforced concrete columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 205 - Reinforced Concrete Column (Highlighted)

To rate Element 205 – Reinforced Concrete Column, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

<table>
<tr><th colspan="3">Element 205: Reinforced Concrete Column Defects and Protective Systems</th></tr>
<tr><th>Element Defects</th><th>Protective System</th><th>Protective System Defects</th></tr>
<tr><td rowspan="2">1080 - Delamination / Spall / Patched Area

1090 - Exposed Rebar

1120 - Efflorescence / Rust Staining

1130 - Cracking – RC and Other

1190 - Abrasion / Wear – PSC / RC

4000 - Settlement

6000 - Scour

7000 – Damage</td><td>520 - Concrete Reinforcing Steel Protective System</td><td>3600 - Effectiveness – Protective System, Cathodic

7000 – Damage</td></tr>
<tr><td>521 - Concrete Protective Coating</td><td>3510 - Wear – Concrete Protective Coatings

3540 - Effectiveness – Concrete Protective Coatings

7000 - Damage</td></tr>
</table>

6.1.2 Element 210 - Reinforced Concrete Pier Wall (ft)

Description: This element shall apply to reinforced concrete pier walls.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 210 - Reinforced Concrete Pier Wall (Highlighted)

To rate Element 210 – Reinforced Concrete Pier Wall, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 210: Reinforced Concrete Pier Wall Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 - Damage
1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 6000 - Scour 7000 – Damage	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

6.1.3 Element 215 - Reinforced Concrete Abutment (ft)

Description: This element shall apply to reinforced concrete abutments. Material retaining the embankment, integral wingwalls, and abutment extensions shall be considered as part of this element. Wingwalls that are constructed monolithically with the abutment, up to the first construction joint, shall be considered in the quantity and evaluation of the abutment element.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 215 - Reinforced Concrete Abutment (Highlighted)

To rate Element 215 – Reinforced Concrete Abutment, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

<table>
<tr><th colspan="3">Element 215: Reinforced Concrete Abutment Defects and Protective Systems</th></tr>
<tr><th>Element Defects</th><th>Protective System</th><th>Protective System Defects</th></tr>
<tr><td rowspan="2">1080 - Delamination / Spall / Patched Area

1090 - Exposed Rebar

1120 - Efflorescence / Rust Staining

1130 - Cracking – RC and Other

1190 - Abrasion / Wear – PSC / RC

4000 - Settlement

6000 - Scour

7000 – Damage</td><td>520 - Concrete Reinforcing Steel Protective System</td><td>3600 - Effectiveness – Protective System, Cathodic

7000 - Damage</td></tr>
<tr><td>521 - Concrete Protective Coating</td><td>3510 - Wear – Concrete Protective Coatings

3540 - Effectiveness – Concrete Protective Coatings

7000 - Damage</td></tr>
</table>

6.1.4 Element 220 - Reinforced Concrete Pile Cap / Footing (ft)

Description: This element shall apply to reinforced concrete pile caps and footings that are visible for inspection. Pile caps and footings that are exposed due to erosion, scour or visible during an underwater inspection shall be considered as part of this element.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 220 – Reinforced Concrete Pile Cap / Footing, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 220: Reinforced Concrete Pile Cap / Footing Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 6000 - Scour 7000 – Damage	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

6.1.5 Element 227 - Reinforced Concrete Pile (ea)

Description: This element shall apply to reinforced concrete piles that are visible for inspection. Piles exposed due to erosion, scour or visible during an underwater inspection shall be considered as part of this element.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 227 - Reinforced Concrete Pile (Highlighted)

To rate Element 227 – Reinforced Concrete Pile, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 227: Reinforced Concrete Pile Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 6000 - Scour 7000 – Damage	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

6.1.6 Element 234 - Reinforced Concrete Pier Cap (ft)

Description: This element shall apply to reinforced concrete pier caps that support girders and transfer loads to piles or columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 234 - Reinforced Concrete Pier Cap (Highlighted)

To rate Element 234 – Reinforced Concrete Pier Cap, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 234: Reinforced Concrete Pier Cap Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 7000 - Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

6.2 Prestressed Concrete Elements

NBE No.	Element	Units	Page No.
204	Columns, Prestressed Concrete	ea	6-21
226	Pile, Prestressed Concrete	ea	6-22
233	Pier Cap, Prestressed Concrete	ft	6-24

6.2.1 Element 204 - Prestressed Concrete Column (ea)

Description: This element shall apply to prestressed concrete columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 204 – Prestressed Concrete Column, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 204: Prestressed Concrete Column Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 6000 - Scour 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

6.2.2 Element 226 - Prestressed Concrete Pile (ea)

Description: This element shall apply to prestressed concrete piles that are visible for inspection. Piles exposed due to erosion, scour or visible during an underwater inspection shall be considered as part of this element.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

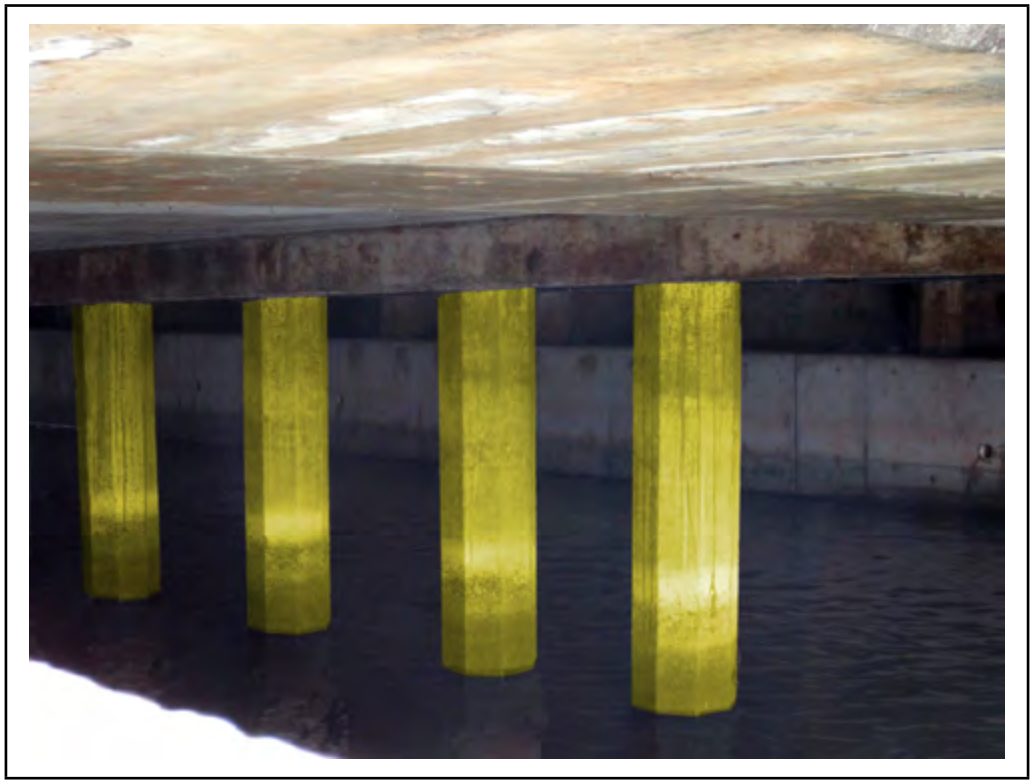


Photo: Element 226 - Prestressed Concrete Pile (Highlighted)

To rate Element 226 – Prestressed Concrete Pile, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 226: Prestressed Concrete Pile Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 1190 - Abrasion / Wear – PSC / RC 4000 - Settlement 6000 - Scour 7000 – Damage	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

6.2.3 Element 233 - Prestressed Concrete Pier Cap (ft)

Description: This element shall apply to prestressed concrete pier caps that support girders and transfer loads to piles or columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 233 – Prestressed Concrete Pier Cap, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 233: Prestressed Concrete Pier Cap Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

6.3 Steel Elements

NBE No.	Element	Units	Page No.
202	Columns, Steel	ea	6-27
207	Column Tower (Trestle), Steel	ft	6-29
219	Abutment, Steel	ft	6-31
225	Pile, Steel	ea	6-32
231	Pier Cap, Steel	ft	6-33

6.3.1 Element 202 - Steel Column (ea)

Description: This element shall apply to steel columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 202 - Steel Column (Highlighted)

To rate Element 202 – Steel Column, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 202: Steel Column Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 - Damage

6.3.2 Element 207 - Steel Tower (ft)

Description: This element shall apply to steel built-up or framed tower supports. This element shall apply to large supports and towers associated with suspension bridges, cable stayed bridges, movable bridges, or other similar structural configurations.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 202 - Steel Tower (Highlighted)

To rate Element 207 – Steel Tower, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 207: Steel Tower Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 - Damage

6.3.3 Element 219 - Steel Abutment (ft)

Description: This element shall apply to steel abutments. Material retaining the embankment, integral wingwalls, and abutment extensions shall be considered as part of this element. Wingwalls that are constructed monolithically with the abutment, up to the first construction joint, shall be considered in the quantity and evaluation of the abutment element.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 219 – Steel Abutment, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 219: Steel Abutment Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 - Damage

6.3.4 Element 225 - Steel Pile (ea)

Description: This element shall apply to steel piles that are visible for inspection. Piles exposed due to erosion, scour or visible during an underwater inspection shall be considered as part of this element.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 225 – Steel Pile, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 225: Steel Pile Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 - Damage

6.3.5 Element 231 - Steel Pier Cap (ft)

Description: This element shall apply to steel pier caps that support girders and transfer loads to piles or columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 231 - Steel Pier Cap (Highlighted)

To rate Element 231 – Steel Pier Cap, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 231: Steel Pier Cap Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 7000 - Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

6.4 Masonry Elements

NBE No.	Element	Units	Page No.
213	Pier Wall, Masonry	ft	6-37
217	Abutment, Masonry	ft	6-39

6.4.1 Element 213 - Masonry Pier Wall (ft)

Description: This element shall apply to masonry block or stone masonry pier walls that are constructed with or without mortar.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 213 - Masonry Pier Wall (Highlighted)

To rate Element 213 – Masonry Pier Wall, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 213: Masonry Pier Wall Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1610 - Mortar Breakdown – Masonry 1620 - Split / Spall – Masonry 1630 - Patched Area – Masonry 1640 - Masonry Displacement 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.4.2 Element 217 - Masonry Abutment (ft)

Description: This element shall apply to masonry block or stone masonry abutments that are constructed with or without mortar. Material retaining the embankment, integral wingwalls, and abutment extensions shall be considered as part of this element. Wingwalls that are constructed monolithically with the abutment, up to the first construction joint, shall be considered in the quantity and evaluation of the abutment element.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 217 - Masonry Abutment (Highlighted)

To rate Element 217 – Masonry Abutment, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 217: Masonry Abutment Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1610 - Mortar Breakdown – Masonry 1620 - Split / Spall – Masonry 1630 - Patched Area – Masonry 1640 - Masonry Displacement 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.5 Timber Elements

NBE No.	Element	Units	Page No.
206	Columns, Timber	ea	6-43
208	Column Tower (Trestle), Timber	ft	6-45
212	Pier Wall, Timber	ft	6-46
216	Abutment, Timber	ft	6-47
228	Pile, Timber	ea	6-48
235	Pier Cap, Timber	ft	6-49

6.5.1 Element 206 - Timber Column (ea)

Description: This element shall apply to timber columns.

See page 6-3 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 206 - Timber Column (Highlighted)

To rate Element 206 – Timber Column, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 206: Timber Column Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.5.2 Element 208 - Timber Trestle (ft)

Description: This element shall apply to timber built-up or framed tower supports. This element shall apply to large supports and towers associated with large deck truss bridges.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 208 – Timber Trestle, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 208: Timber Trestle Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.5.3 Element 212 - Timber Pier Wall (ft)

Description: This element shall apply to timber pier walls constructed of piles, timber sheet material, and filler.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 212 – Timber Pier Wall, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 212: Timber Pier Wall Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.5.4 Element 216 - Timber Abutment (ft)

Description: This element shall apply to timber abutments. Material retaining the embankment, integral wingwalls, and abutment extensions shall be considered as part of this element. Wingwalls that are constructed monolithically with the abutment, up to the first construction joint, shall be considered in the quantity and evaluation of the abutment element.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 216 – Timber Abutment, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 216: Timber Abutment Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.5.5 Element 228 - Timber Pile (ea)

Description: This element shall apply to timber piles that are visible for inspection. Piles exposed due to erosion, scour or visible during an underwater inspection shall be considered as part of this element.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 228 – Timber Pile, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 228: Timber Pile Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.5.6 Element 235 - Timber Pier Cap (ft)

Description: This element shall apply to timber pier caps that support girders and transfer loads to piles or columns.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

Photo: Element 235 - Timber Pier Cap (Highlighted)

To rate Element 235 – Timber Pier Cap, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 235: Timber Pier Cap Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 7000 – Damage	N/A	N/A

6.6 Other Material Elements

NBE No.	Element	Units	Page No.
203	Columns, Other	ea	6-53
211	Pier Wall, Other	ft	6-54
218	Abutment, Other	ft	6-55
229	Pile, Other	ea	6-56
236	Pier Cap, Other	ft	6-57

6.6.1 Element 203 - Other Column (ea)

Description: This element shall apply to columns made of other materials not classified under the defined column elements.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 203 – Other Column, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 203: Other Column Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.6.2 Element 211 - Other Pier Wall (ft)

Description: This element shall apply to pier walls made of other materials not classified under the defined pier wall elements.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 211 – Other Pier Wall, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 211: Other Pier Wall Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.6.3 Element 218 - Other Abutments (ft)

Description: This element shall apply to abutments made of other materials not classified under the defined abutment elements. Material retaining the embankment, integral wingwalls, and abutment extensions shall be considered as part of this element.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 218 – Other Abutments, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 218: Other Abutments Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.6.4 Element 229 - Other Pile (ea)

Description: This element shall apply to piles that are visible for inspection and are made of other materials not classified under the defined pile elements. Piles exposed due to erosion, scour or visible during an underwater inspection shall be considered as part of this element.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 229 – Other Pile, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 229: Other Pile Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

6.6.5 Element 236 - Other Pier Cap (ft)

Description: This element shall apply to pier caps that support girders and transfer loads to piles or columns and are made of other materials not classified under the defined pier cap elements.

See page 6-3 for more information on condition states, unit of measure and quantity calculation.

To rate Element 236 – Other Pier Cap, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 236: Other Pier Cap Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 7000 – Damage	N/A	N/A

Chapter 7 Culverts

NBE No.	Element	Units	Page No.
240	Culvert, Steel	ft	7-3
241	Culvert, Reinforced Concrete	ft	7-5
242	Culvert, Timber	ft	7-7
243	Culvert, Other	ft	7-8
244	Culvert, Masonry	ft	7-9
245	Culvert, Prestressed Concrete	ft	7-10

- Unit of Measure for Culvert Elements
    - Unit of measure for Culvert elements shall be Length (ft.) and can be calculated as the flow line length of the barrel times the number of barrels.
        - Use the appropriate as-built drawing to calculate the Culvert element quantity.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Culvert element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.
- Protective System and Defects
    - See element details for possible Protective System elements.
    - See Chapter 8 for details on Protective System elements.
    - Refer to APPENDIX A for Condition State definitions.

7.1 Element 240 - Steel Culvert (ft)

Description: This element shall apply to all types and shapes of steel culverts (including arched, round, or elliptical shapes).

See page 7-1 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 240 - Steel Culvert

To rate Element 240 – Steel Culvert, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 240: Steel Culvert Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	515 - Steel Protective Coating	3410 - Chalking – Steel Protective Coatings 3420 - Peeling / Bubbling / Cracking – Steel Protective Coatings 3430 - Oxide Film Degradation Color / Texture Adherence – Steel Protective Coatings 3440 - Effectiveness – Steel Protective Coatings 7000 – Damage

7.2 Element 241 - Reinforced Concrete Culvert (ft)

Description: This element shall apply to all types and shapes of reinforced concrete culverts (including box, arched, round, or elliptical shapes).

See page 7-1 for more information on protective systems, condition states, unit of measure and quantity calculation.

Photo: Element 241 - Reinforced Concrete Culvert

To rate Element 241 – Reinforced Concrete Culvert, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 241: Reinforced Concrete Culvert Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1190 - Abrasion / Wear – PSC / RC 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 – Damage

7.3 Element 242 - Timber Culvert (ft)

Description: This element shall apply to all timber culverts.

See page 7-1 for more information on condition states, unit of measure and quantity calculation.

To rate Element 242 – Timber Culvert, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 242: Timber Culvert Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1020 - Connection 1140 - Decay / Section Loss 1150 - Check / Shake 1160 - Crack – Timber 1170 - Split / Delamination – Timber 1180 - Abrasion / Wear – Timber 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

7.4 Element 243 - Other Culvert (ft)

Description: This element shall apply to all types and shapes of culverts (including arches, round or elliptical shapes) made of other materials not classified under the defined culvert elements.

See page 7-1 for more information on condition states, unit of measure and quantity calculation.

To rate Element 243 – Other Culvert, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 243: Other Culvert Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1000 - Corrosion 1010 - Cracking 1020 - Connection 1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1130 - Cracking – RC and Other 1220 - Deterioration – Other 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

7.5 Element 244 - Masonry Culvert (ft)

Description: This element shall apply to all masonry block or stone masonry culverts.

See page 7-1 for more information on condition states, unit of measure and quantity calculation.

To rate Element 244 – Masonry Culvert, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 244: Masonry Culvert Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1120 - Efflorescence / Rust Staining 1610 - Mortar Breakdown – Masonry 1620 -Split / Spall – Masonry 1630 - Patched Area – Masonry 1640 - Masonry Displacement 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	N/A	N/A

7.6 Element 245 - Prestressed Concrete Culvert (ft)

Description: This element shall apply to all prestressed concrete culverts.

See page 7-1 for more information on protective systems, condition states, unit of measure and quantity calculation.

To rate Element 245 – Prestressed Concrete Culvert, consider the following Defects and Protective Systems (see APPENDIX A for complete defect and condition state tables):

Element 245: Prestressed Concrete Culvert Defects and Protective Systems		
Element Defects	**Protective System**	**Protective System Defects**
1080 - Delamination / Spall / Patched Area 1090 - Exposed Rebar	520 - Concrete Reinforcing Steel Protective System	3600 - Effectiveness – Protective System, Cathodic 7000 – Damage
1100 - Exposed Prestressing 1110 - Cracking – PSC 1120 - Efflorescence / Rust Staining 1190 - Abrasion / Wear – PSC / RC 1900 - Distortion 4000 - Settlement 6000 - Scour 7000 – Damage	521 - Concrete Protective Coating	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

Chapter 8 Protective Systems

NBE No.	Element	Units	Page No.
510	Wearing Surface	sq-ft	8-3
515	Steel Protective Coating	sq-ft	8-5
520	Concrete Reinforcing Steel Protective System	sq-ft	8-7
521	Concrete Protective Coating	sq-ft	8-8

- Unit of Measure for Protective System Elements
    - Unit of measure for Protective System elements shall be Area (sq. ft.) and can be calculated as the surface area of the element being protected by the Protective System.
        - If the calculated quantity differs by more than 10% from the NBE inspection form, the quantity shall be revised in BrM and the revision noted in the element notes.
    - The total quantity for a Protective System element may be distributed amongst the four Condition States based on existing conditions.
- Element Defects
    - See element details for possible element defects.
    - Refer to APPENDIX A for Condition State definitions.

8.1 Element 510 - Wearing Surfaces (sq-ft)

Description: This element shall apply to all decks or slabs that have a wearing surface overlay. Flexible (asphaltic concrete), semi-rigid (epoxy and polyester materials), rigid (portland cement), and timber running planks shall be considered as part of this element.

See page 8-1 for more information on unit of measure and quantity calculation.

Photo: Element 510 - Wearing Surfaces

To rate Element 510 – Wearing Surfaces, consider the following Defects (see APPENDIX A for complete defect and condition state tables):

Element No. 510: Wearing Surfaces Defects		
Element Defects	**Protective System**	**Protective System Defects**
N/A	N/A	3210 - Delamination / Spall / Patched Area / Pothole – Wearing Surfaces 3220 - Crack – Wearing Surface 3230 - Effectiveness – Wearing Surface 7000 - Damage

8.2 Element 515 - Steel Protective Coating (sq-ft)

Description: This element shall apply to steel elements that have a protective coating. Paint, galvanizing, weathering steel patina, or other top coat steel corrosion inhibitor shall be considered as part of this element.

See page 8-1 for more information on unit of measure and quantity calculation.

Photo: Element 515 - Steel Protective Coating

To rate Element 515 – Steel Protective Coating, consider the following Defects (see APPENDIX A for complete defect and condition state tables):

Element 515: Steel Protective Coating Defects		
Element Defects	**Protective System**	**Protective System Defects**
N/A	N/A	3410 - Chalking 3420 - Peeling / Bubbling / Cracking 3430 - Oxide Film Degradation Color / Texture Adherence (weathering steel patina) 3440 - Effectiveness 7000 - Damage

8.3 Element 520 - Concrete Reinforcing Steel Protective System (sq-ft)

Description: This element shall apply to protective systems used to protect reinforcing steel in concrete elements from corrosion. Reinforcing steel coatings, cathodic protection, or other similar protection methods shall be considered as part of this element.

See page 8-1 for more information on unit of measure and quantity calculation.

To rate Element 520 – Concrete Reinforcing Steel Protective System, consider the following Defects (see APPENDIX A for complete defect and condition state tables):

Element 520: Concrete Reinforcing Steel Protective System Defects		
Element Defects	**Protective System**	**Protective System Defects**
N/A	N/A	3600 - Effectiveness 7000 - Damage

8.4 Element 521 - Concrete Protective Coating (sq-ft)

Description: This element shall apply to concrete elements that have a protective coating. Silane/siloxane waterproofing, crack sealers such as high molecular weight methacrylate (HMWM), or any top coat barrier that protects concrete from deterioration and reinforcing steel from corrosion shall be considered as part of this element.

See page 8-1 for more information on unit of measure and quantity calculation.

To rate Element 521 – Concrete Protective Coating, consider the following Defects (see APPENDIX A for complete defect and condition state tables):

Element 521: Concrete Protective Coating Defects		
Element Defects	**Protective System**	**Protective System Defects**
N/A	N/A	3510 - Wear – Concrete Protective Coatings 3540 - Effectiveness – Concrete Protective Coatings 7000 - Damage

Chapter 9 National Bridge Inventory (NBI) Inspection Items

9.1 Item 36 – Traffic Safety Features

Traffic Safety Features shall include the following:

- Bridge Railings (Item 36A): Bridge railings must be capable of smoothly redirecting an impacting vehicle. Bridge railings should be crash tested per FHWA policy. Railings that meet these criteria and loading conditions are considered acceptable. Other railings that have been successfully crash tested are considered acceptable even though they may not meet the static loading analysis and geometric requirements. Acceptable guidelines for bridge railing design and testing are also found in the AASHTO Guide Specification for Bridge Railings, 1989. Additional guidance for testing is found in National Cooperative Highway Research Program – Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features, 1993.

- Transitions (Item 36B): The transition from approach guardrail to bridge railing requires that the approach guardrail be firmly attached to the bridge railing. It also requires that the approach guardrail be gradually stiffened as it comes closer to the bridge railing. The ends of curbs and safety walks need to be gradually tapered out or shielded.

- Approach Guardrail (Item 36C): The structural adequacy and compatibility of approach guardrail with transition designs should be determined. Rarely does the need for a barrier stop at the end of a bridge. Thus, an approach guardrail with adequate length and structural qualities to shield motorists from the hazards at the bridge site needs to be installed. In addition to being capable of safely redirecting an impacting vehicle, the approach guardrail must also facilitate a transition to the bridge railing that will not cause snagging or pocketing of an impacting vehicle. Acceptable guardrail design suggestions are contained in the AASHTO Roadside Design Guide and subsequent FHWA and/or AASHTO guidelines.

- Approach Guardrail Ends (Item 36D): As with guardrail ends in general, the ends of approach guardrails to bridges should be flared, buried, made breakaway, or shielded. Design treatment of guardrail ends is given in the AASHTO Roadside Design Guide.

The recording of Item 36 shall be to evaluate the adequacy of the traffic safety features conformance with the current design standards. The data collected for traffic safety features shall apply only to the route on the bridge and shall be evaluated and recorded after construction of the bridge or after bridge railing or guardrail upgrade work has been completed.

Inspectors are required to inspect all traffic safety features and note any maintenance work required (such as defects, collision damage, missing bolts, etc.). Inspectors should also include, in the notes, if any bridge railing or guardrail upgrade work has been completed.

9.2 Item 58 – Deck

This item describes the overall condition rating of the deck. The condition rating shall be in accordance with the general conditions in the table below. Code 'N' for culverts and other structures without decks (i.e., filled arch bridge). The condition rating for the deck shall be based on the condition state for the deck element and the defects determined in the element inspection.

The condition of the railings, joints, approach slabs, curbs, sidewalks, drains, wearing surface, etc. shall not be considered in the overall deck evaluation. Decks that are integral with the superstructure shall be rated for the deck only and not how its condition influences the superstructure rating.

Condition Rating	Item 58 – Deck
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION – No problems noted.
7	GOOD CONDITION – Some minor problems.
6	SATISFACTORY CONDITION – Structural elements show some minor deterioration.
5	FAIR CONDITION – All primary structural elements are sound but may have minor section loss, cracking, or spalling.
4	POOR CONDITION – Advanced section loss, deterioration, or spalling.
3	SERIOUS CONDITION – Loss of section, deterioration, or spalling have seriously affected primary structural elements. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION – Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION – Major deterioration or section loss present in critical structural components. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION – Out of service. Beyond corrective action.

9.3 Item 59 – Superstructure

This item describes the physical condition of all structural members. The condition rating shall be in accordance with the general conditions in the table below. Code 'N' for all culverts. The condition rating for the superstructure shall be based on the condition state for the superstructure element and the defects determined in the element inspection.

The condition of the bearings, protective system, etc. shall not be considered in the overall superstructure evaluation. The superstructure of an integral deck-type bridge shall be rated for the superstructure only and not how its condition influences the deck rating.

Fracture critical components shall receive careful attention because failure could lead to collapse of a span or the bridge.

Condition Rating	Item 59 – Superstructure
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION – No problems noted.
7	GOOD CONDITION – Some minor problems.
6	SATISFACTORY CONDITION – Structural elements show some minor deterioration.
5	FAIR CONDITION – All primary structural elements are sound but may have minor section loss, cracking, or spalling.
4	POOR CONDITION – Advanced section loss, deterioration, or spalling.
3	SERIOUS CONDITION – Loss of section, deterioration, or spalling have seriously affected primary structural elements. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION – Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION – Major deterioration or section loss present in critical structural components. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION – Out of service. Beyond corrective action.

9.4 Item 60 – Substructure

This item describes the physical condition of piers, abutments, piles, fenders, footings, or other components. The condition rating shall be in accordance with the general conditions in the table below. Code 'N' for all culverts. The condition rating for the substructure shall be based on the condition state for the substructure element and the defects determined in the element inspection.

The condition rating of the substructure shall be evaluated independent of the deck and superstructure.

Condition Rating	Item 60 – Substructure
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION – No problems noted.
7	GOOD CONDITION – Some minor problems.
6	SATISFACTORY CONDITION – Structural elements show some minor deterioration.
5	FAIR CONDITION – All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4	POOR CONDITION – Advanced section loss, deterioration, spalling or scour.
3	SERIOUS CONDITION – Loss of section, deterioration, spalling or scour have seriously affected primary structural elements. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION – Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION – Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION – Out of service. Beyond corrective action.

9.5 Item 61 – Channel and Channel Protection

This item describes the physical conditions associated with the flow of water through the bridge such as stream stability and the condition of the channel, riprap, slope protection, or stream control devices including spur dikes. The inspector should be particularly concerned with visible signs of excessive water velocity which may affect undermining of slope protection, erosion of banks, and realignment of the stream which may result in immediate or potential problems. Accumulation of drift and debris on the superstructure and substructure should be noted on the inspection report but not included in the condition rating. The condition rating shall be in accordance with the general conditions in the table below.

Condition Rating	Item 61 – Channel and Channel Protection
N	NOT APPLICABLE – Use when bridge is not over a waterway (channel).
9	EXCELLENT CONDITION – There are no noticeable or noteworthy deficiencies which affect the condition of the channel.
8	VERY GOOD CONDITION – Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.
7	GOOD CONDITION – Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.
6	SATISFACTORY CONDITION – Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor stream bed movement evident. Debris is restricting the channel slightly.
5	FAIR CONDITION – Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.
4	POOR CONDITION – Bank and embankment protection is severely undermined. River control devices have severe damage. Large deposits of debris are in the channel.
3	SERIOUS CONDITION – Bank protection has failed. River control devices have been destroyed. Stream bed aggradation, degradation or lateral movement has changed the channel to now threaten the bridge and/or approach roadway.
2	CRITICAL CONDITION – The channel has changed to the extent the bridge is near a state of collapse.
1	"IMMINENT" FAILURE CONDITION – Bridge closed because of channel failure. Corrective action may put back in light service.
0	FAILED CONDITION – Bridge closed because of channel failure. Replacement necessary.

9.6 Item 62 – Culverts

This item evaluates the alignment, settlement, joints, structural condition, scour, and other items associated with culverts. The condition rating shall be an overall condition evaluation of the culvert and shall be in accordance with the general conditions in the table below. The condition rating for culverts shall be based on the condition state for the culvert element and the defects determined in the element inspection.

Item 58 – Deck, Item 59 – Superstructure, and Item 60 – Substructure shall be coded 'N' for all culverts.

Condition Rating	Item 62 – Culverts
N	NOT APPLICABLE – Use if structure is not a culvert.
9	EXCELLENT CONDITION – No deficiencies
8	VERY GOOD CONDITION – No noticeable or noteworthy deficiencies which affect the condition of the culvert. Insignificant scrape marks caused by drift.
7	GOOD CONDITION – Shrinkage cracks, light scaling, and insignificant spalling which does not expose reinforcing steel. Insignificant damage caused by drift with no misalignment and not requiring corrective action. Some minor scouring has occurred near curtain walls, wingwalls, or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.
6	SATISFACTORY CONDITION – Deterioration of initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls, or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion or moderate pitting.
5	FAIR CONDITION – Moderate to major deterioration or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection in one section, significant corrosion or deep pitting.
4	POOR CONDITION – Large spalls, heavy scaling, wide cracks, considerable efflorescence, or opened construction joint permitting loss of backfill. Considerable settlement or misalignment. Considerable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection throughout, extensive corrosion or deep pitting.
3	SERIOUS CONDITION – Any condition described in Condition Rating 4 but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme distortion and deflection in one section, extensive corrosion, or deep pitting with scattered perforations.
2	CRITICAL CONDITION – Integral wingwalls collapsed, severe settlement of roadway due to loss of fill. Section of culvert may have failed and can no longer support embankment. Complete undermining at curtain walls and pipes. Corrective action required to maintain traffic. Metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion.
1	"IMMINENT" FAILURE CONDITION – Bridge closed. Corrective action may put back in light service.
0	FAILED CONDITION – Bridge closed. Replacement necessary.

9.7 Item 93 – Critical Feature Inspection Date

Critical feature inspections are special inspections that require special emphasis. NBI Item 92 denotes whether a critical feature inspection is required under Item 92A-Fracture Critical Details, Item 92B-Underwater Inspection, and Item 92C-Other Special Inspection. Item 93 denotes the date that the critical feature inspection was performed. During inspection, inspectors shall determine whether a critical feature inspection is required and indicate the date of when it was performed.

The following is the maximum allowable frequency between critical feature inspections:

- Fracture Critical Details = 24 months
- Underwater Inspection = 60 months
- Other Special Inspections = 60 months.

Chapter 10 Inspection Data Management Using BrM Software

10.1 Creating a new Inspection

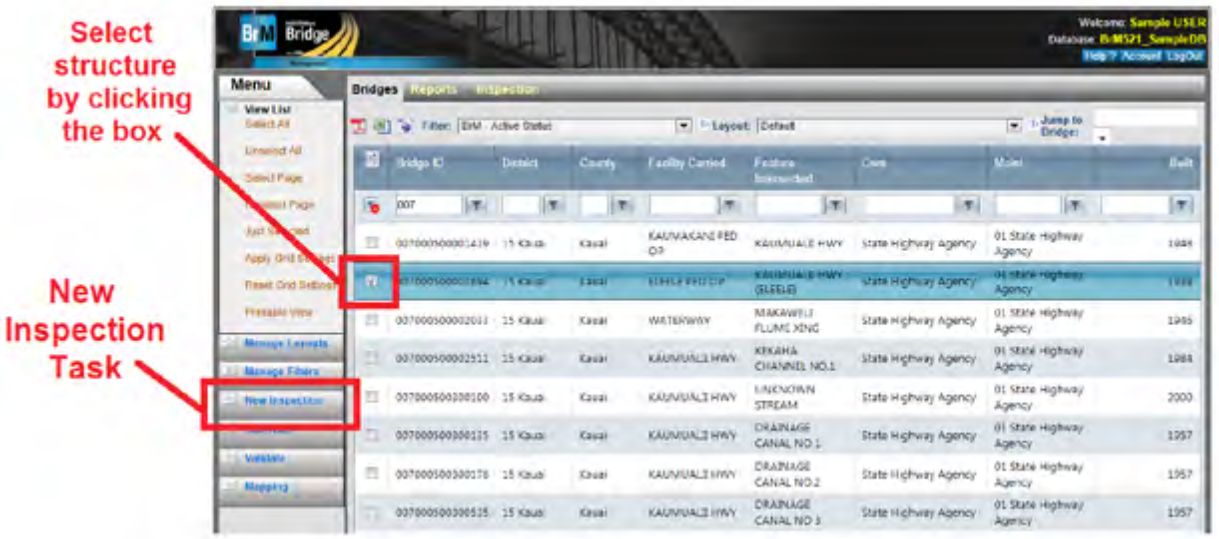


Figure 17 – Creating a New Inspection

1. While in the **Bridge Tab** and **View List**, select the structure for the new inspection by clicking on the corresponding box and adding a check mark.

2. Click the **New Inspection** task on left. See Figure 17 – Creating a New Inspection).

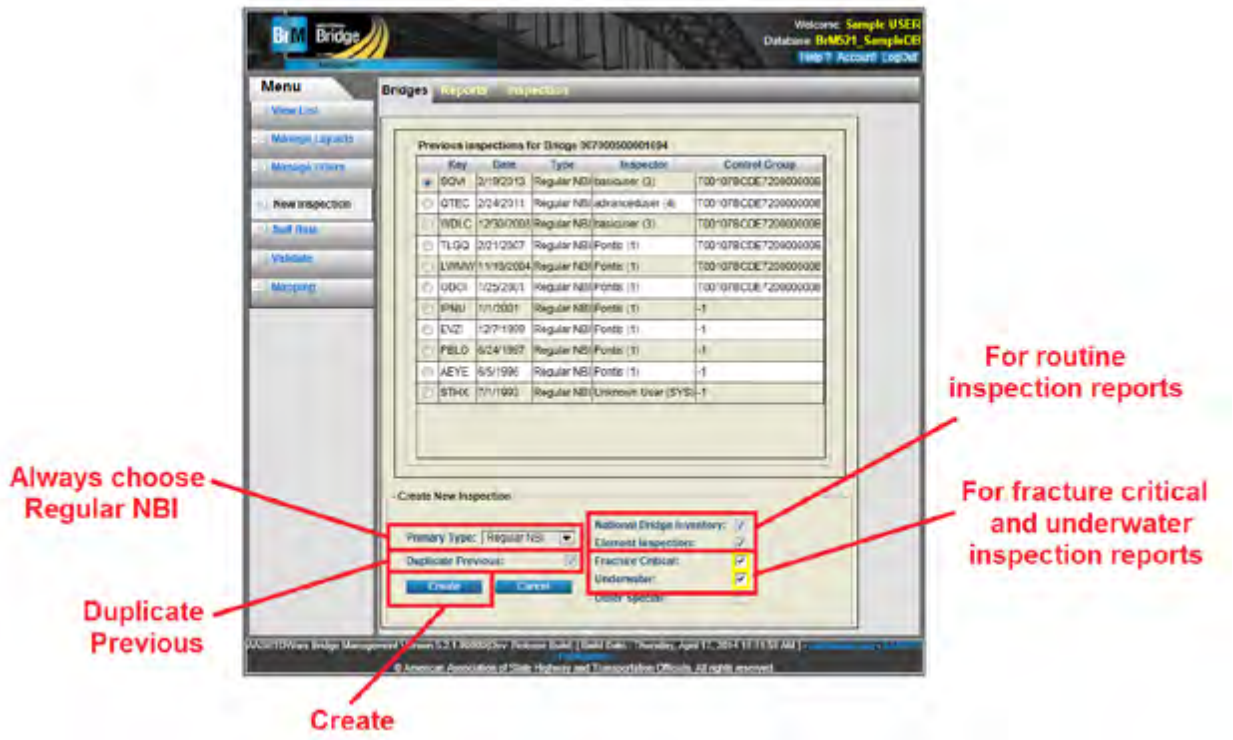


Figure 18 – Settings for New Inspections

3. If you want the new inspection to be created with the same information as the previous inspection, select the **Duplicate Previous** checkbox at the bottom of the screen. See Figure 18 – Settings for New Inspections). If you want the new inspection to be blank, with elements initialized to the best condition state, de-select the **Duplicate Previous** checkbox.

    a. When submitting a routine bridge inspection report, make sure that the check boxes for **National Bridge Inventory (NBI)** and **Element Inspection** are selected.

    b. When submitting a **Fracture Critical** and/or **Underwater** inspection report in conjunction with a routine inspection report, select the appropriate boxes.

c. For the **Primary Type** drop down menu, always choose **Regular NBI** even if you're submitting a Fracture Critical and/or Underwater inspection report.

4. Click Create.

5. The **Schedule** screen will appear. Enter the date of the new inspection in the **Inspection Date (090)** box. All information can be modified later if needed.

6. To save the new inspection that was just created, click **Save**. To save the inspection and come back later to change or add data, click **Save & Close**. If you don't want to create the inspection, click **Cancel**. When prompted to navigate away from the page, click **OK**.

7. If you clicked **Save**, the **Condition** task of the **Inspection** tab will be displayed. You can proceed to Section 10.2 Modifying Element Information. If you wish to enter the data later, click **Save & Close**.

10.2 Modifying Element Information

When a new inspection is conducted, it is possible that the types, quantities, structure units or environments observed in the field for the elements may not match those entered for the previous inspection. This may be the result of actual physical changes on the bridge (e.g. overlaying a bare concrete deck would change its element ID), or the result of an error in the previous inspection information. Past inspections will not be affected by the change.

When modifying element information (quantities, environment, adding or deleting elements, etc.) please provide a brief note in Element Notes describing why the change was needed.

1. Go to the **Condition** task of the **Inspection** tab.

2. The total quantity and the condition state quantity of an element, can be modified directly on the screen.

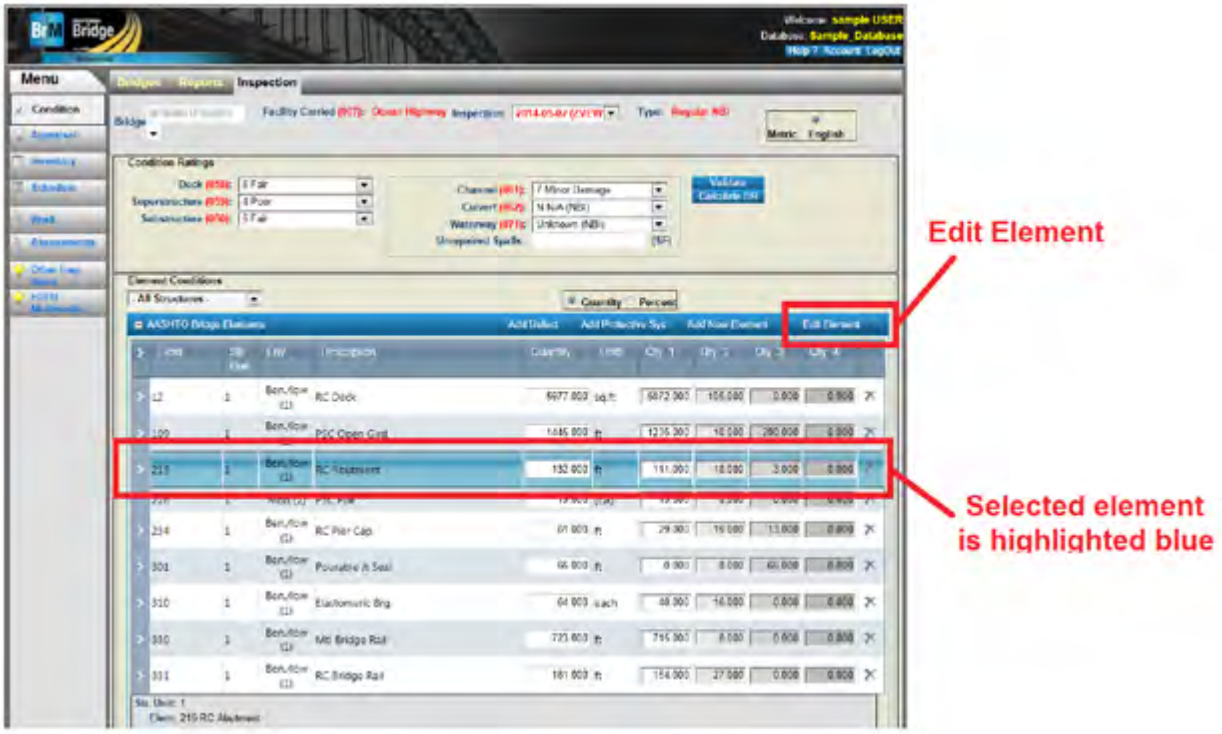


Figure 19 – Edit Element

3. To change the environment of an element, click on the element, and then click on the **Edit Element** button.

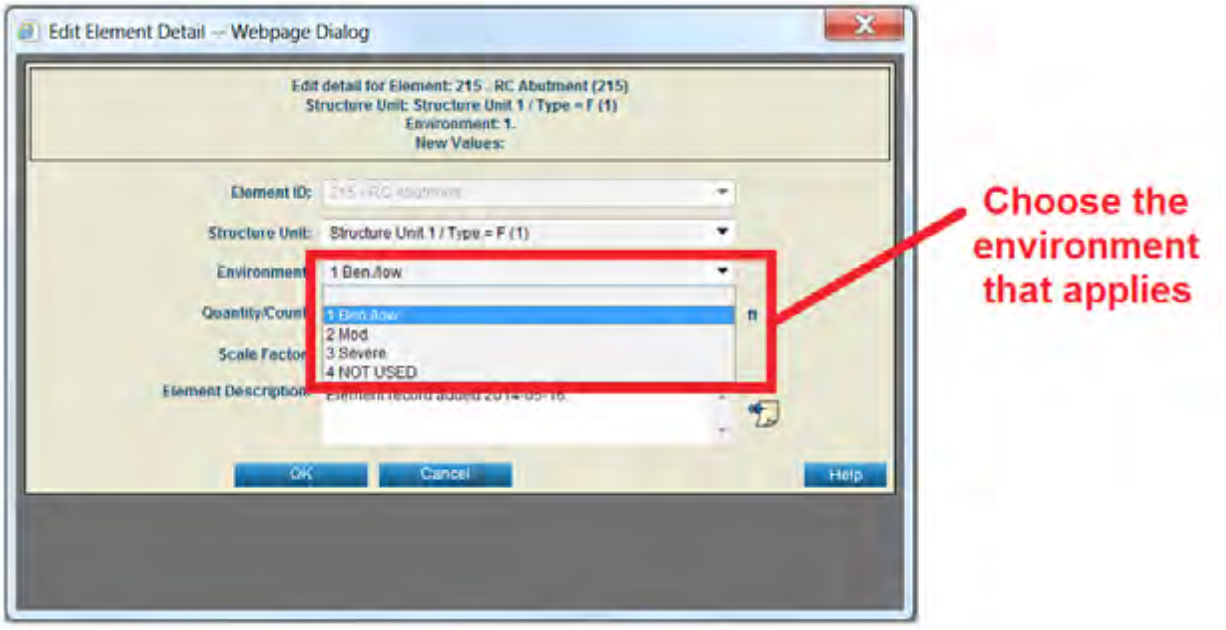


Figure 20 – Edit Element Pop-up

4. A pop-up window will appear. Choose the appropriate environment from the drop down menu.

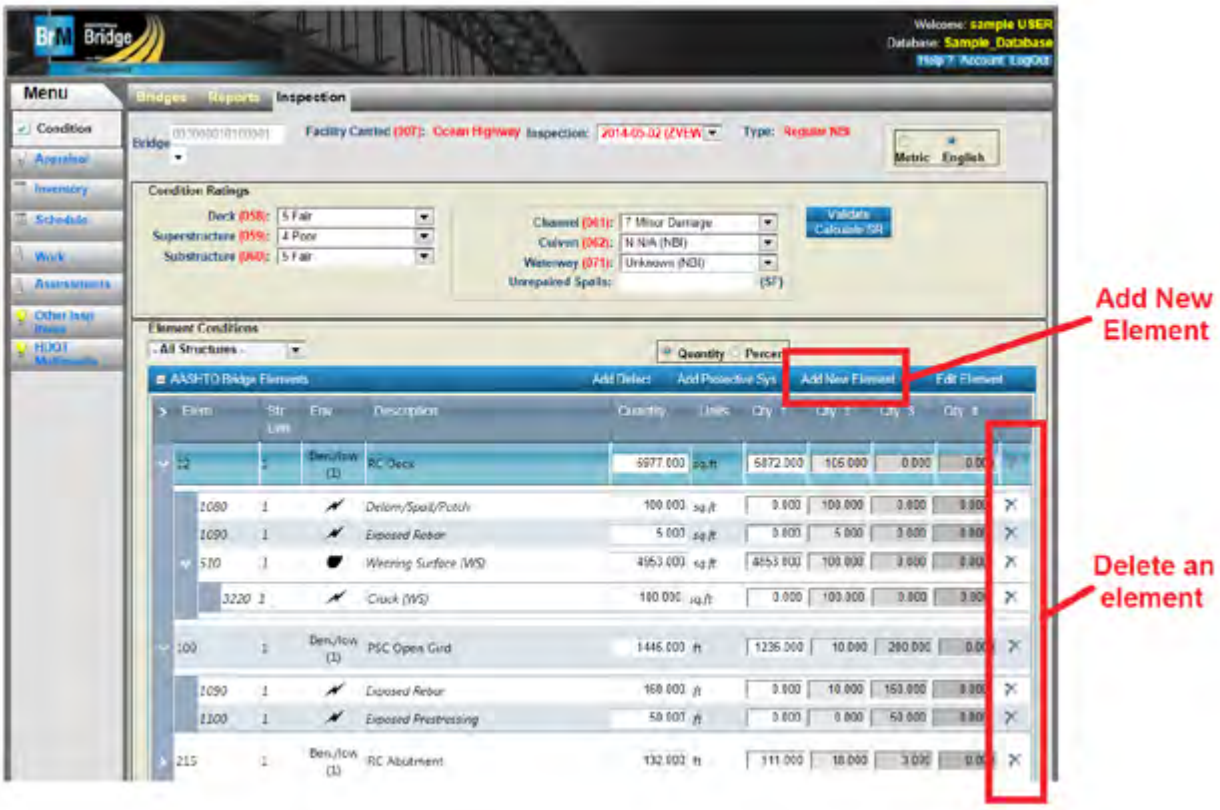


Figure 21 – Replace Element

5. To replace an element on the structure, you will need to add a new element (using the **Add New Element** button), and then delete the old one (using the delete icon). When you remove an element, you will need to confirm that you want to remove the element.

10.3 Adding a New Element

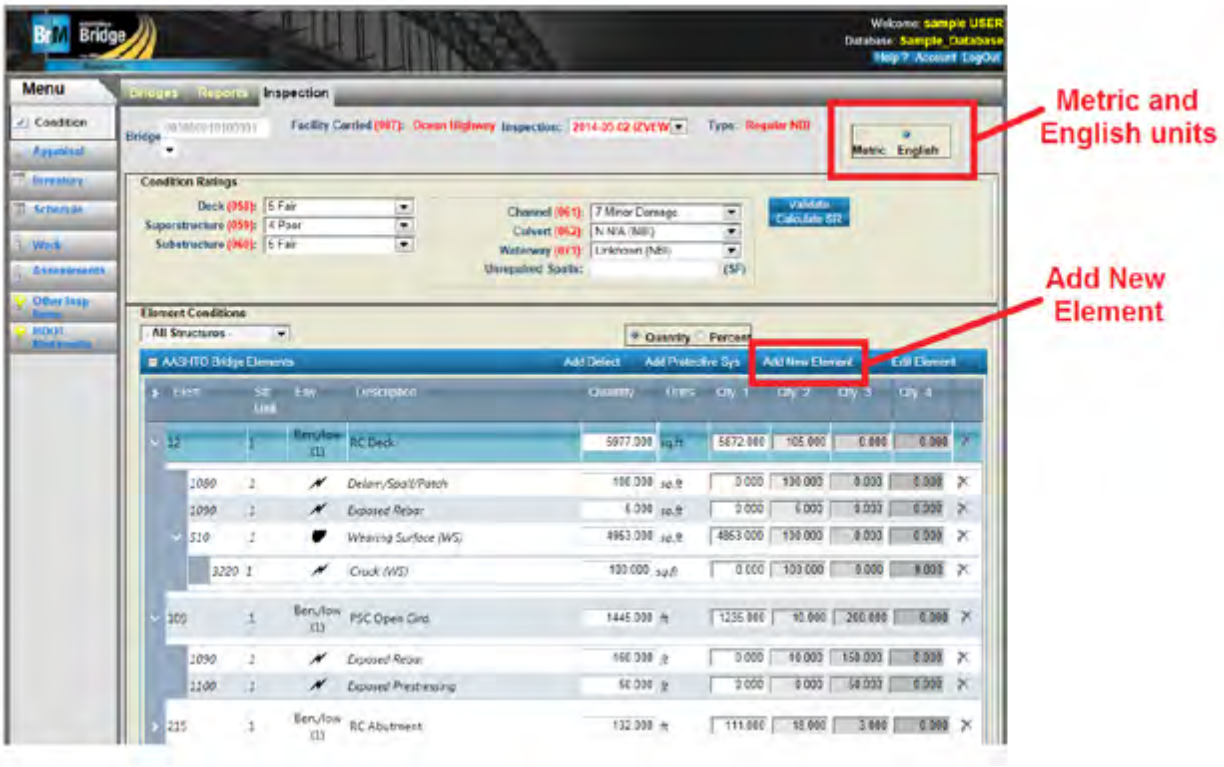


Figure 22 – Add New Element

1. You should be in the **Condition** task under the **Inspection** tab.

2. Make sure the **Metric/English** radio button is set to the measurement units that you want.

3. Click on the **Add New Element** button.

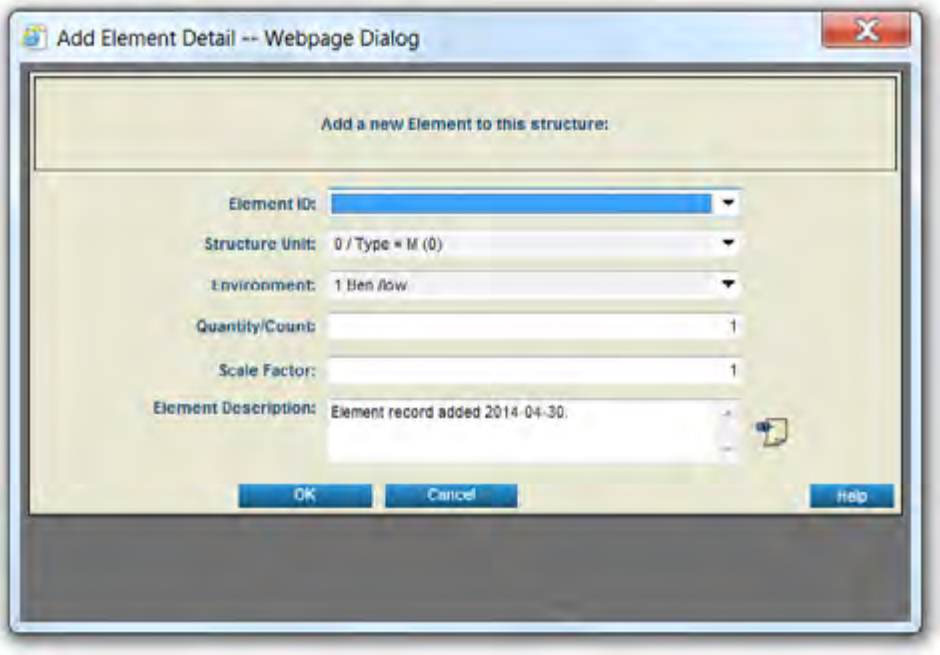


Figure 23 – Add Element Pop-up

4. The **Add Element** screen will appear.

5. Select the **Element ID**. By default, this list includes all of the elements. Any elements defined by your agency will also appear on the pick list.

6. Select the **Environment**.

7. Enter the total **Quantity** of the element on the selected structure unit. The measurement units are automatically determined.

8. Click **OK** to save the information.

10.4 Adding an Element Defect

1. To add an element defect, start in the **Condition** task under the **Inspection** tab.

2. Select the element that the defect will be applied to.

3. Click on **Add Defect**.

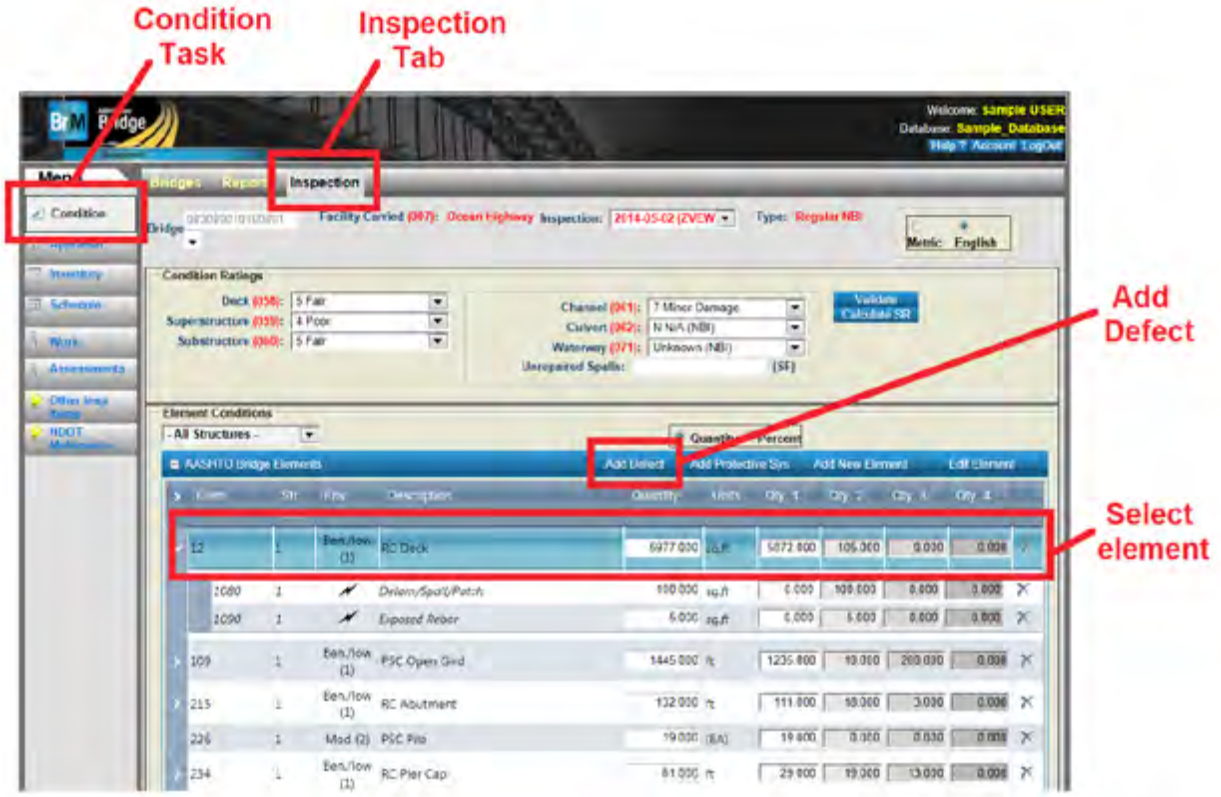


Figure 24 – Adding an Element Defect

4. The **Add Element** pop-up will appear.

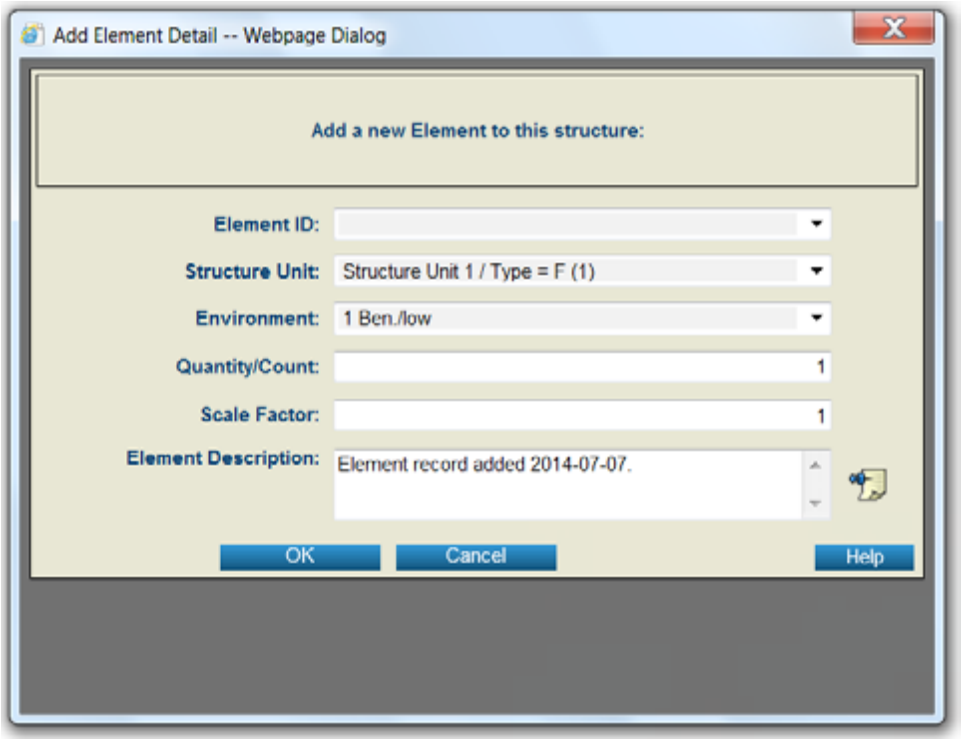


Figure 25 – Add Element Defect Pop-up

5. Under the **Element ID** drop down menu, choose the defect that you want. Once the defect is chosen, the **Parent Element** will appear at the top of the pop-up, *above* **Element ID**.

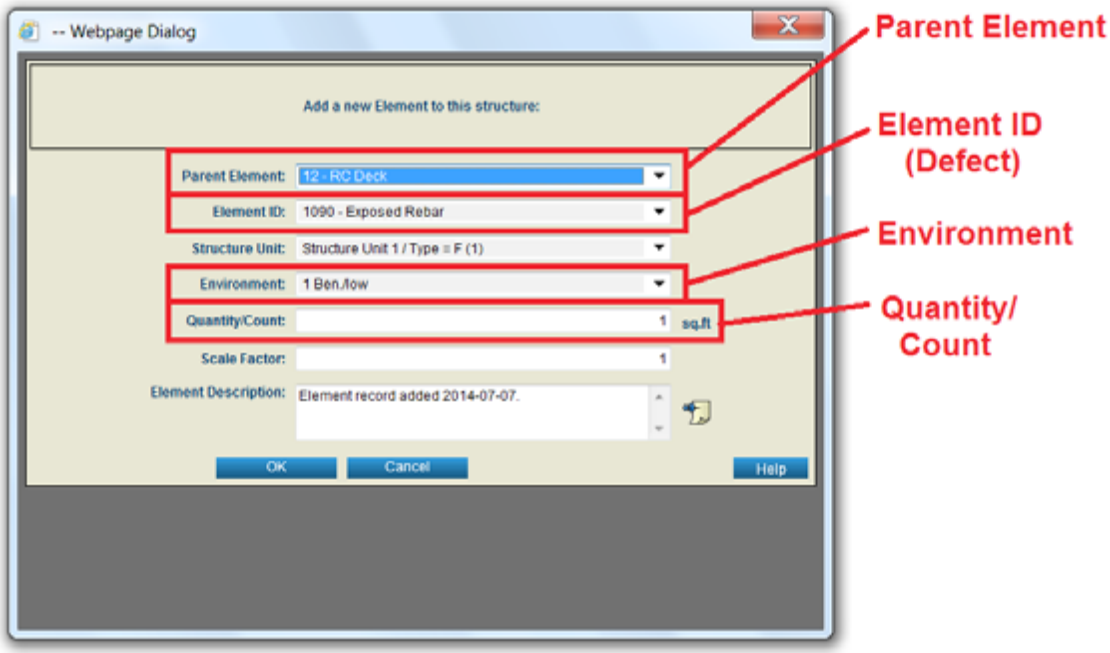


Figure 26 – Parent Element in pop-up

6. The **Environment** is already set to match the **Parent Element**.

7. For **Quantity/Count**, enter the defects quantity. The measurement units are automatically determined.

8. Click **OK** to add the defect and return to your inspection.

9. You should now see the defect with a lightning bolt icon.

10. Modify the condition state quantities as needed making sure it is also reflected in the **Parent Element** condition state quantities.

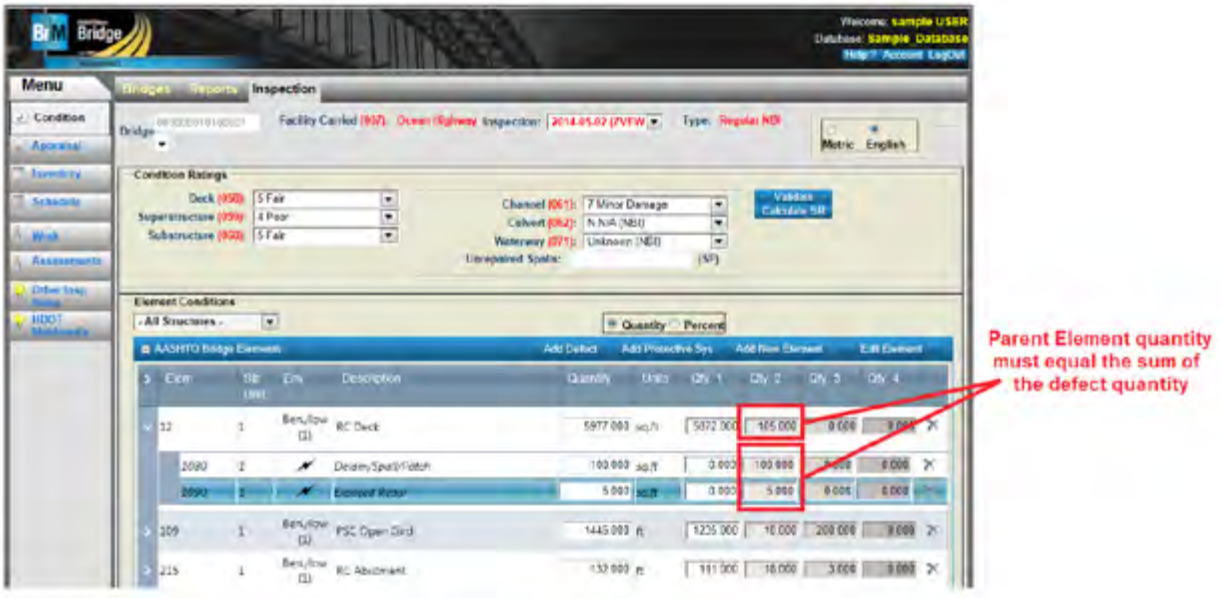


Figure 27 – Quantity for Element Defects

11. Click **Save** at the bottom of the screen to save your work.

10.5 Adding a Protective System

1. To add a protective system, start in the **Condition** task of the **Inspection** task

2. Select the element that the protective system will be applied to.

3. Click on the **Add Protective Sys** button.

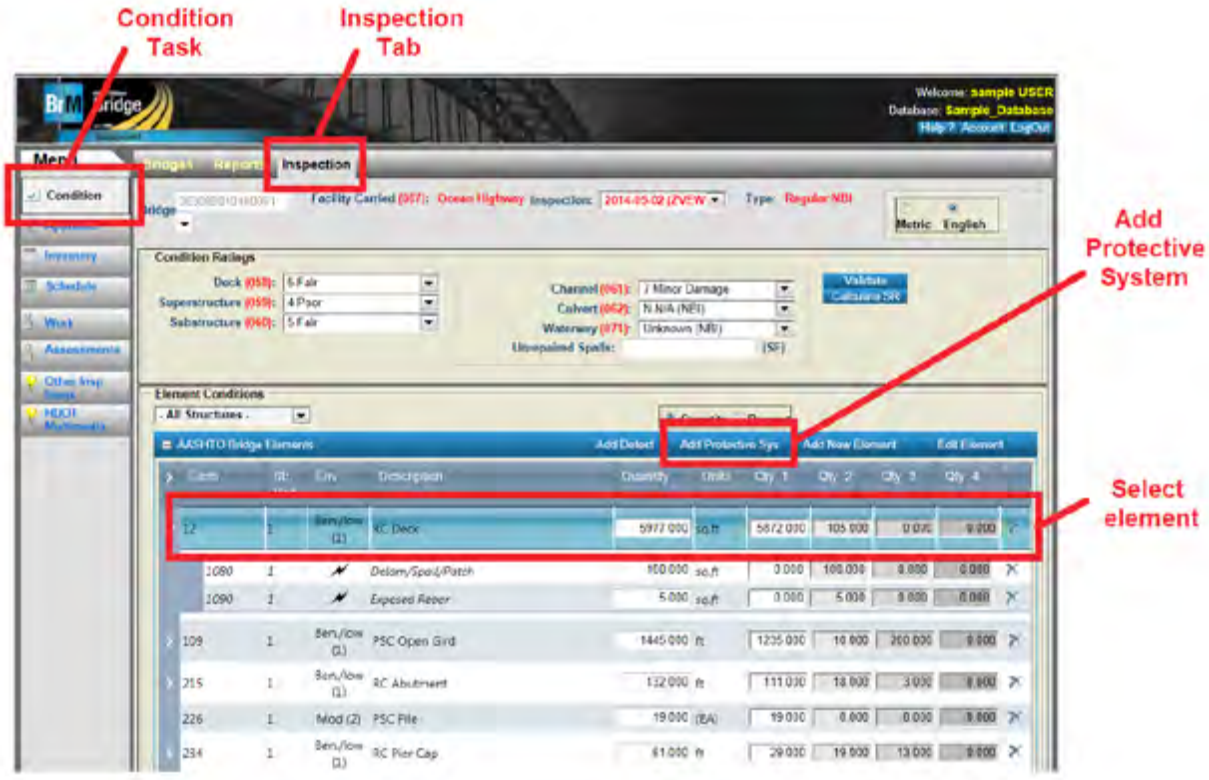


Figure 28 – Add a Protective System

4. The **Add Element** pop-up will appear.

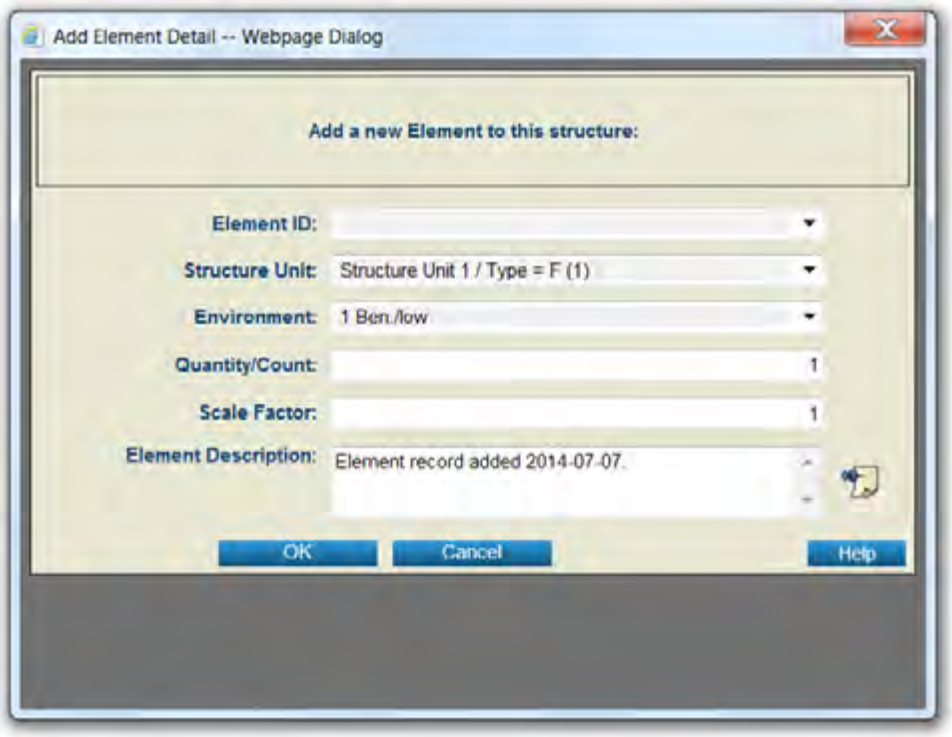


Figure 29 – Add Protective System Pop-up

5. Under the **Element ID** drop down menu, choose the protective system that you want. Once the protective system is chosen, the **Parent Element** will appear at the top of the pop-up, *above* the **Element ID**.

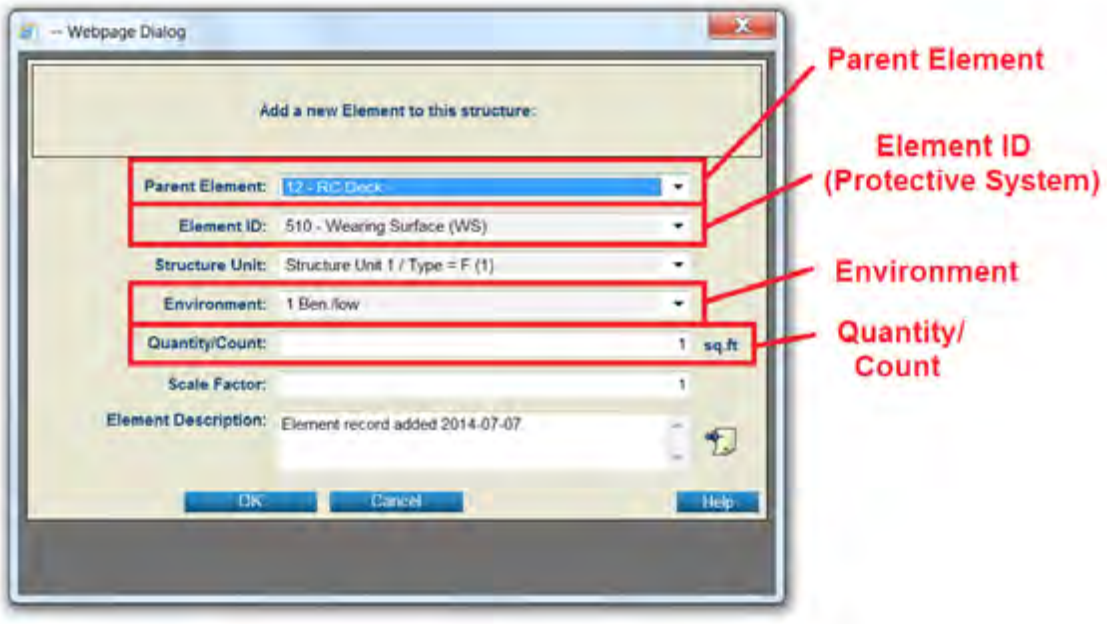


Figure 30 – Parent Element in Pop-up

6. The **Environment** is already set to match the **Parent Element**.

7. For **Quantity/Count**, enter the quantity of the protective system. The measurement units are automatically determined.

8. Click **OK** to add the protective system and return to your inspection.

9. You should now see the protective system with a shield icon. 

10. Modify the condition state quantities of this protective system as needed.

11. Click **Save** at the bottom of the screen to save your work.

10.6 Adding a Protective System Defect

1. To add a protective system defect, start in the **Condition** task of the **Inspection** task.

2. Select the **Protective System** that the defect will be applied to.

3. Click on the **Add Defect** button.

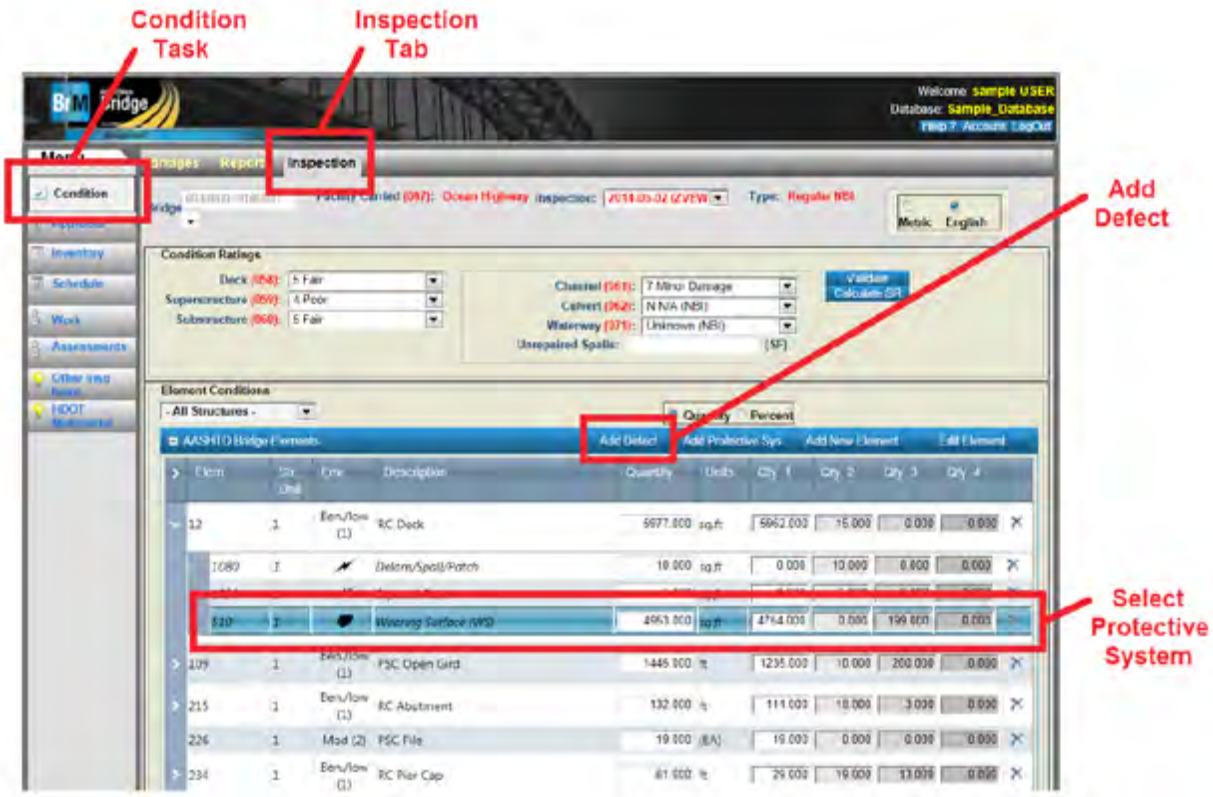


Figure 31 – Add a Protective System Defect

4. The **Add Element** pop-up will appear.

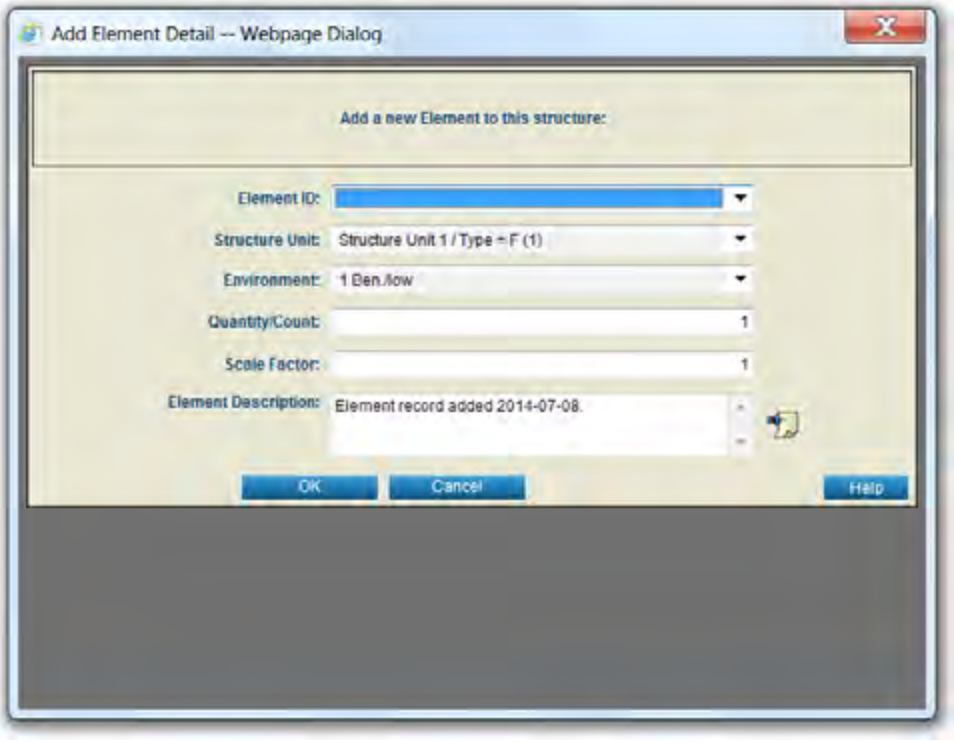


Figure 32 – Add Protective System Defect Pop-up

5. Under the **Element ID** drop down menu, choose the defect that you want. Once the defect is chosen, the **Parent Element** drop down menu will appear at the top of the pop-up, above the **Element ID**.

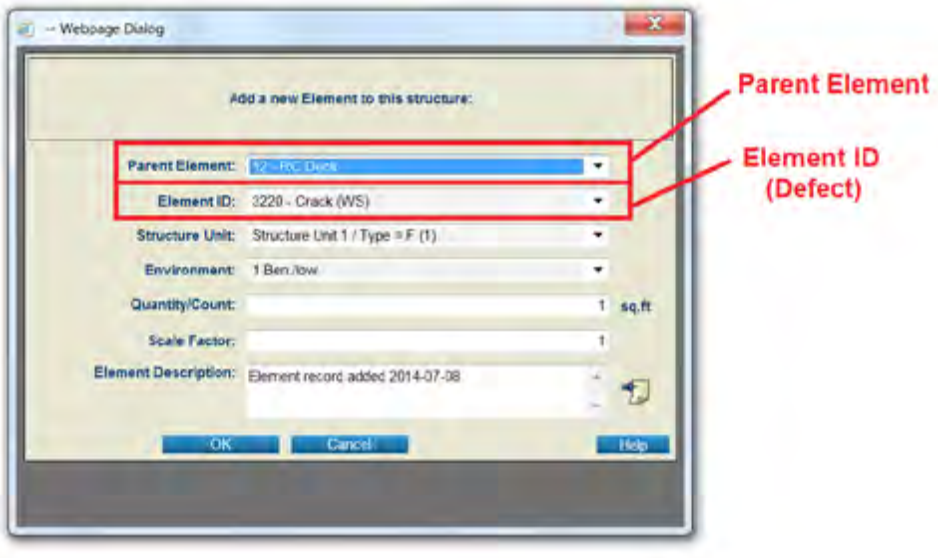


Figure 33 – Parent Element in Pop-up

6. In the **Parent Element** drop down, choose the **Protective System** that the defect will be applied to.

7. Now you should see a **Grandparent Element** drop down menu at the top of the pop-up, above the **Parent Element**. Choose the correct **Grandparent Element** if it is not already chosen.

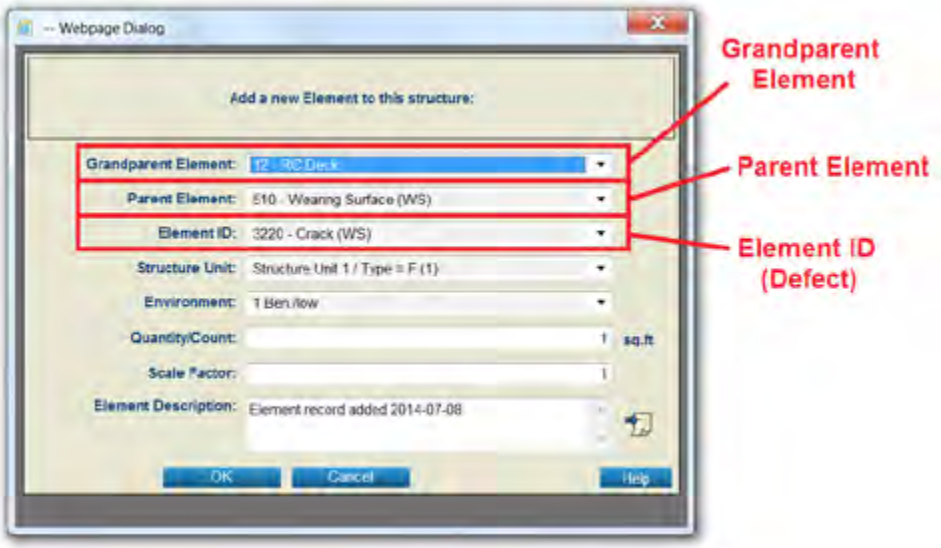


Figure 34 – Grandparent Element in Pop-up

8. The **Environment** is already set to match the **Parent Element** and **Grandparent Element**.

9. For **Quantity/Count**, enter the quantity of the protective system defect. The measurement units are automatically determined.

10. Click **OK** to add the protective system defect and return to your inspection.

11. You should now see the protective system defect with a lightning bolt icon indented under the **Protective System**

12. Modify the condition state quantities as needed making sure it is also reflected in the **Parent Element** (**Protective System**) condition state quantities.

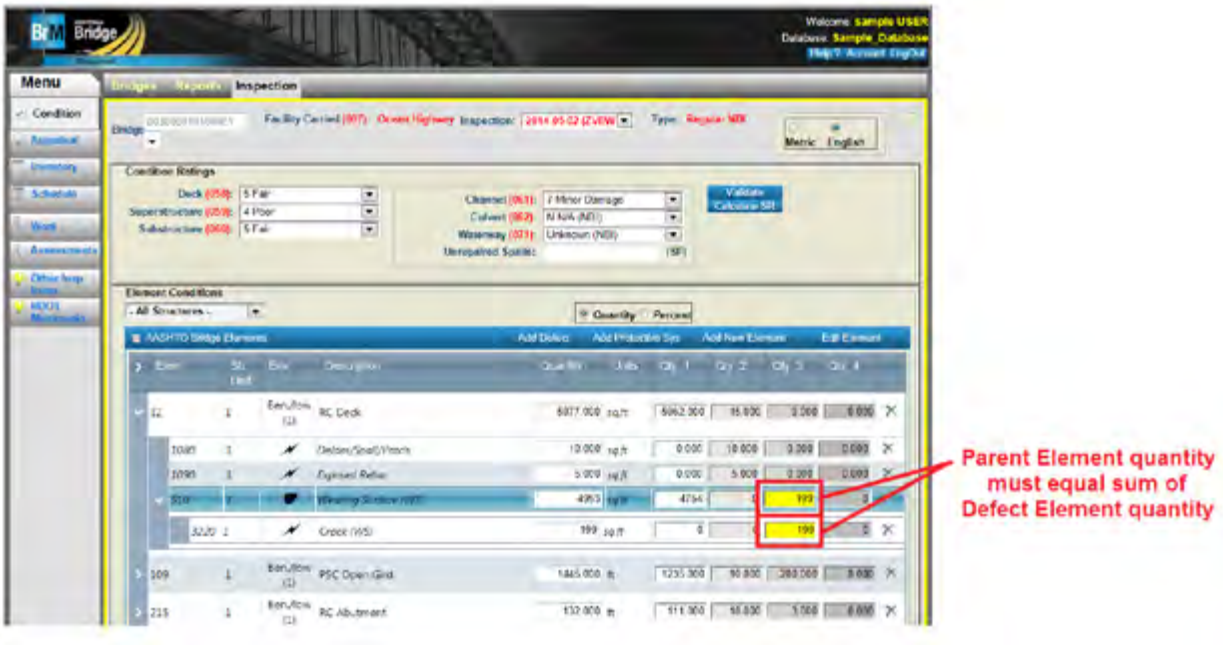


Figure 35 – Quantity for Protective System Defects

13. Click **Save** at the bottom of the screen to save your work.

10.6 Entering Condition Information

You may enter NBI condition ratings directly at the top of the task screen. Note that all information for special inspections can be recorded in the **Schedule** task. Other information related to Condition Ratings (NBI Inspection) can be entered in the **Inspection Notes**, at the bottom of the screen.

When entering information for an element inspection, you will need to enter quantities by condition state for each element, defect, protective system, and protective system defect in the condition task.

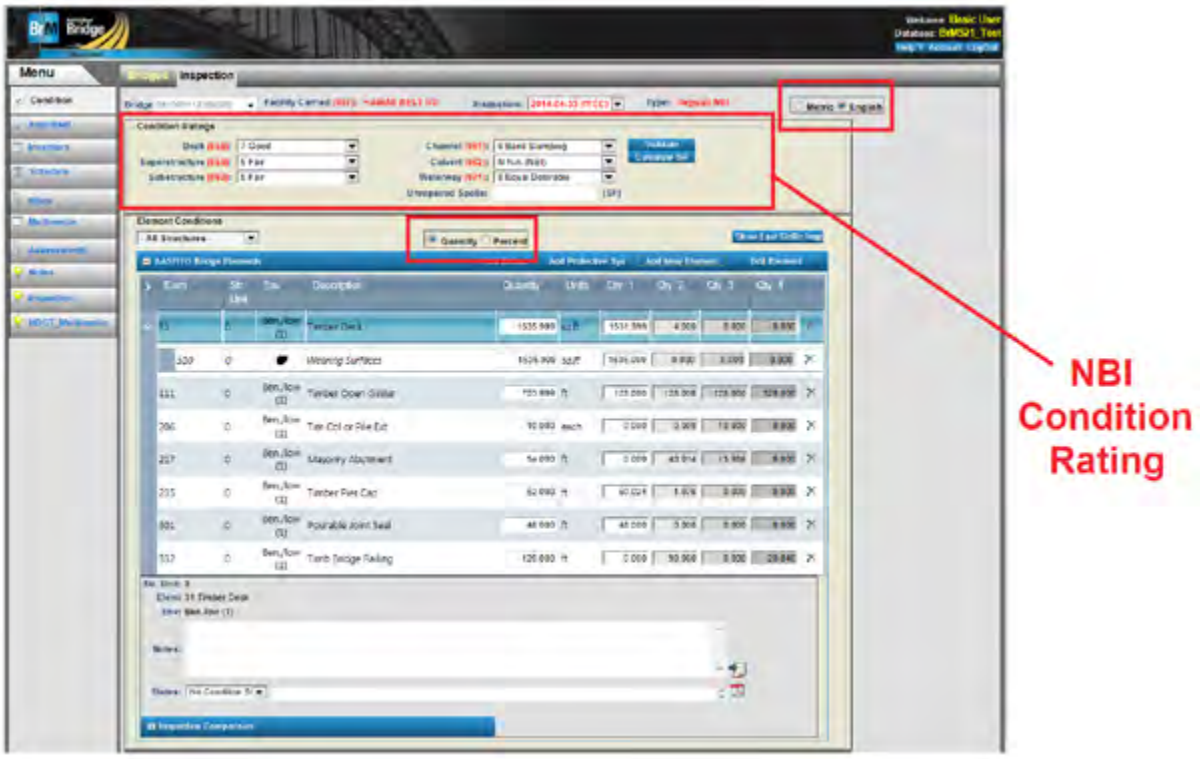


Figure 36 – Entering Condition Ratings

1. Go to the **Condition** task of the **Inspection** tab.

2. If you want to enter the percent of each element in the different condition states, click on the **Percent** radio button in the **Element Conditions** grid. If you want to enter the actual quantity in each condition state, click on the **Quantity** radio button. If you are entering quantities, select either **English or Metric** units from the radio buttons at the top right of the screen.

3. (For element inspections only) Fill in the percent or quantity of each element in condition states 2 to 4. The remaining percent or quantity will automatically be put into condition state 1.

4. Enter NBI condition ratings at the top of the screen.

5. It is recommended to save your work frequently.

10.8 Entering Inspection Notes and Element Notes

In BrM notes about the NBI inspection should be put in **Inspection Notes**. Notes about the element inspection (NBE) should be put in **Element Notes** under the element that it pertains to.

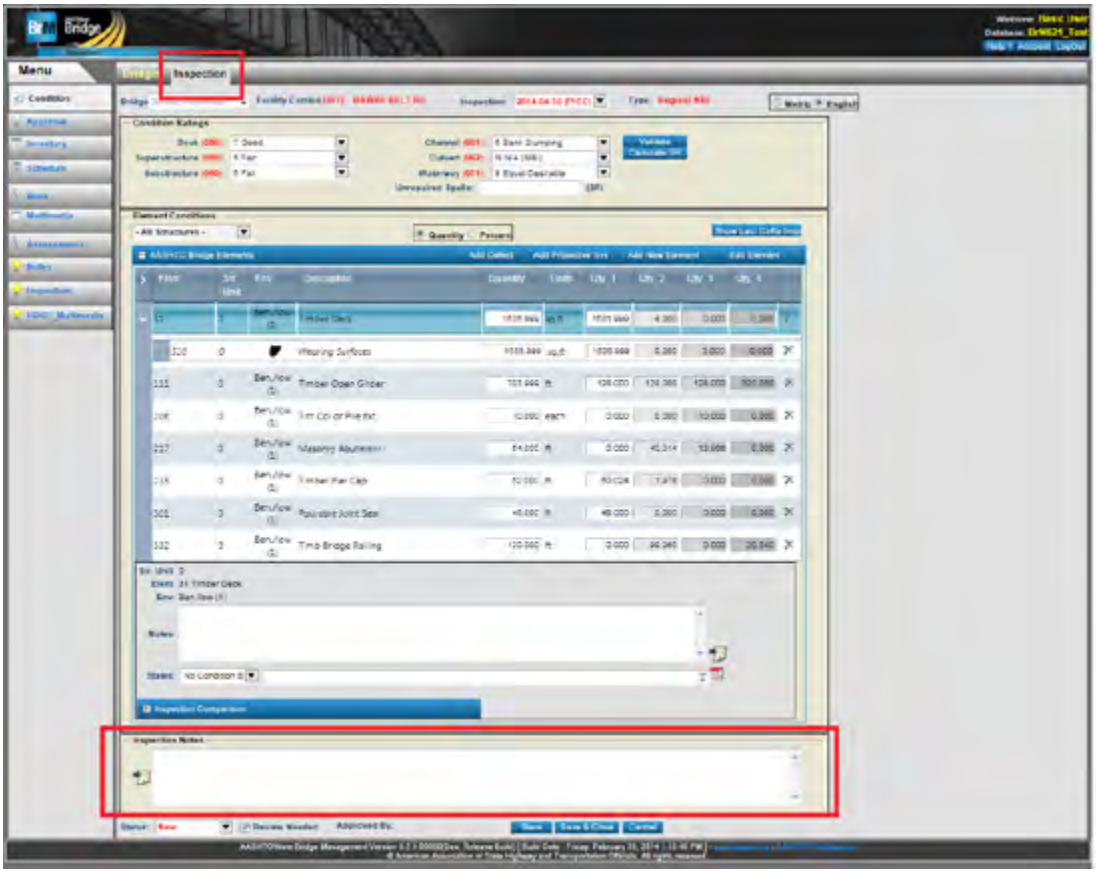


Figure 37 – Inspection Notes

1. Notes about the NBI inspection can be entered in the box provided or by clicking on the notes icon , both at the bottom of the screen.

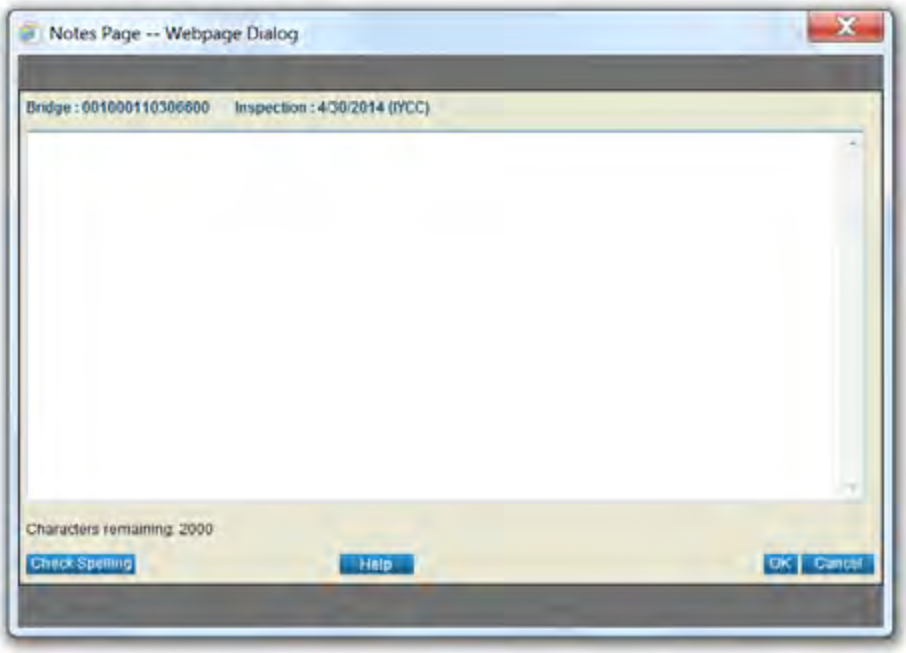


Figure 38 – Inspection Notes Pop-up

a. After clicking on the notes icon , an inspection notes pop-up will appear giving you the option to check spelling and view the number of characters remaining. There is a character limit of 2,000.

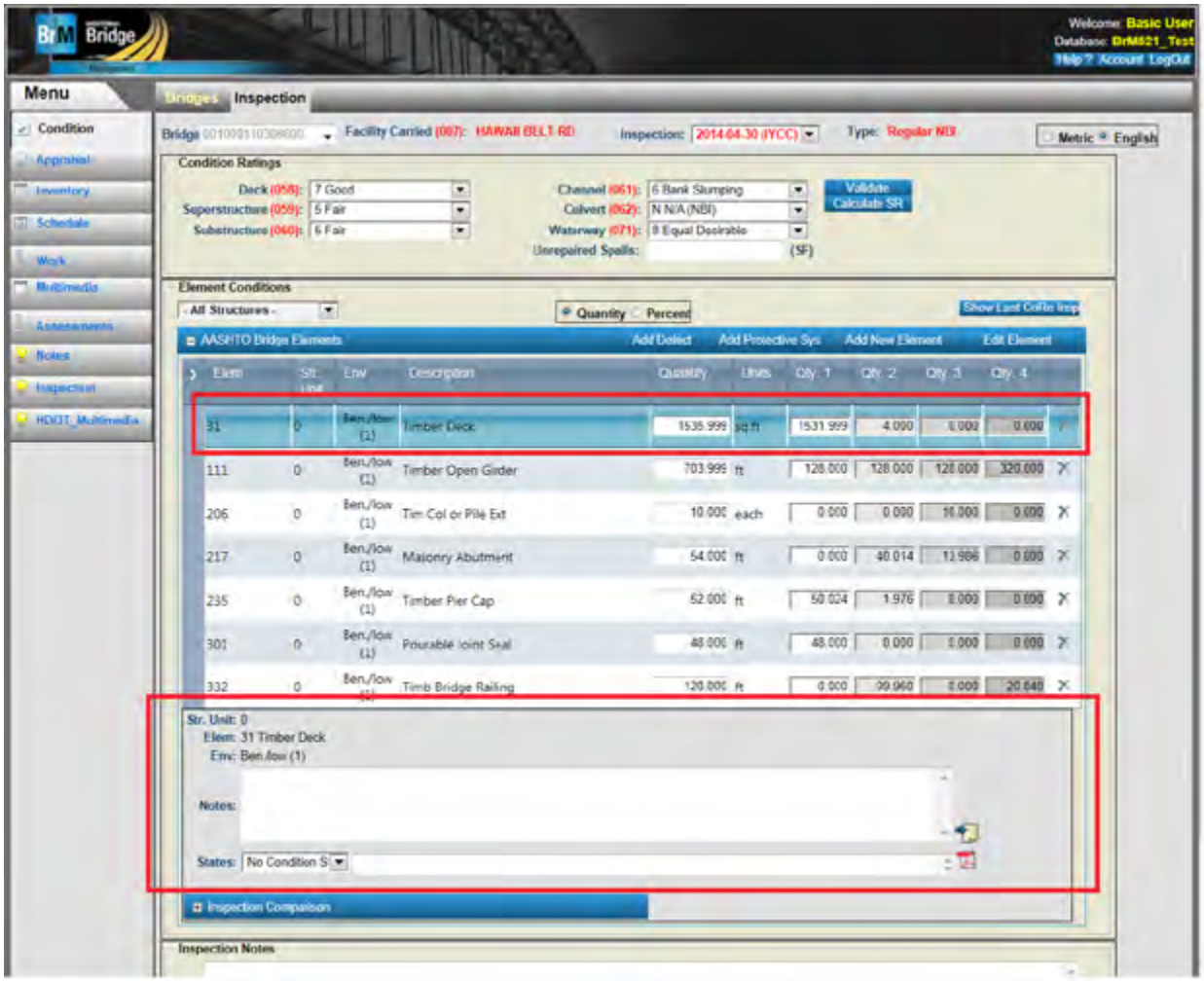


Figure 39 – Element Notes

2. To enter notes about a particular element, click on the element to select it. The row will now be a darker blue and a section for element notes will now appear at the bottom of the screen. Enter notes in the box provided or by clicking on the notes icon .

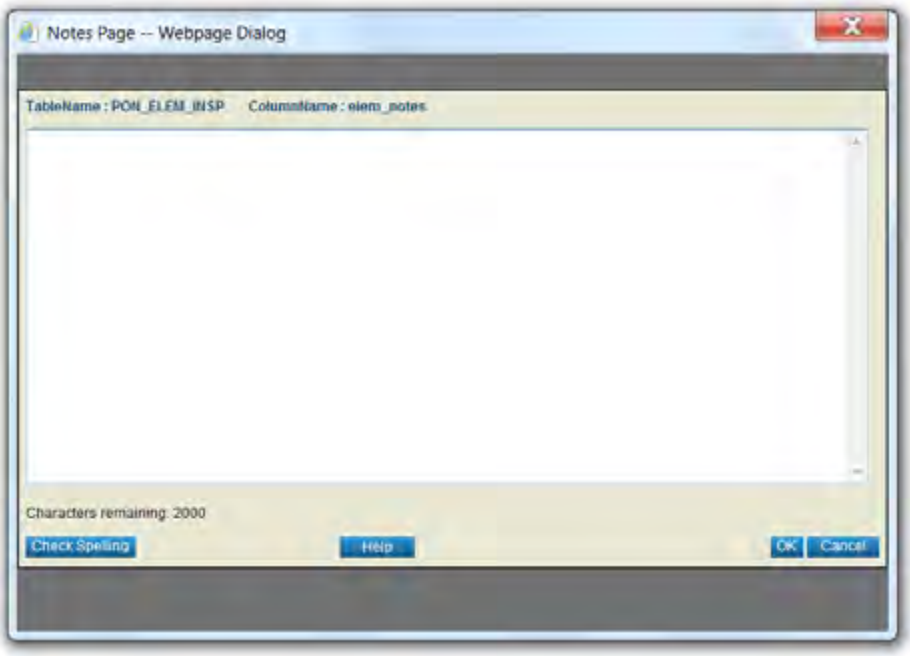


Figure 40 – Element Notes Pop-up

a. After clicking on the notes icon , an element notes pop-up will appear giving you the option to check spelling and view the number of characters remaining. There is a character limit of 2,000.

*REMEMBER: When entering notes about a **Defect** or **Protective System**, the **Parent Element** must be selected. When entering notes about a **Protective System Defect**, the **Grandparent Element** must be selected.*

*REMEMBER: **Element Notes** must also be used when modifying element information such as changing quantities, changing the environment, adding or deleting an element, or improving a condition state. Please provide a brief not describing why the change or improvement was needed.*

3. When you have finished your edits, click the **Save** button to commit your changes to the database.

10.9 Entering Other Inspection Items

In addition to an NBI inspection (Items 58 – 62) and an element inspection, HDOT also requires an inspection and/or notes on **Traffic Safety Features** (Items 36A, 36B, 36C, and 36D), **Other Features** (bridge posting, riding surface, etc.), **Repairs**, **Improvements**, and **Recommendations**. This information should be entered into BrM under **Other Inspection Items**.

1. To enter other inspection items, start in the **Condition** task under the **Inspection** tab.

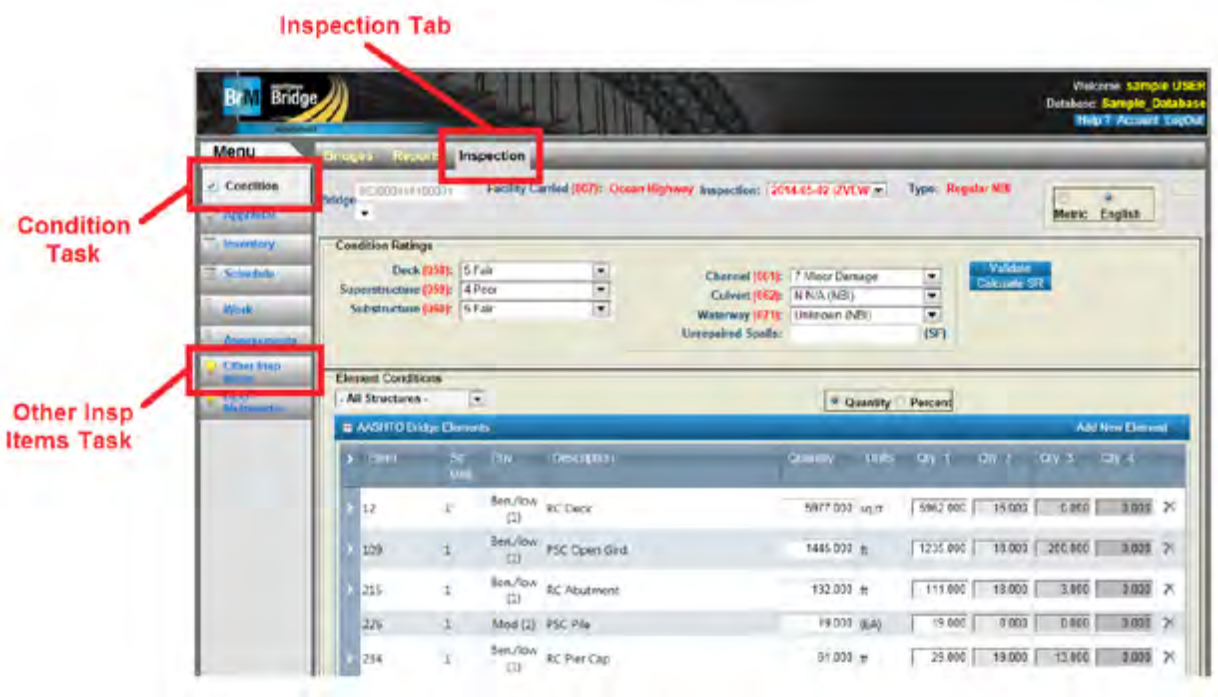


Figure 41 – Accessing Other Inspection Items

2. Click on **Other Insp Items** task in the left column.

3. You can now enter information and/or notes about **Traffic Safety Features**, **Other Features**, **Repairs**, **Improvements**, and **Recommendations**. For details about **Other Inspection Items**, please refer to *Chapter 2* in this manual.

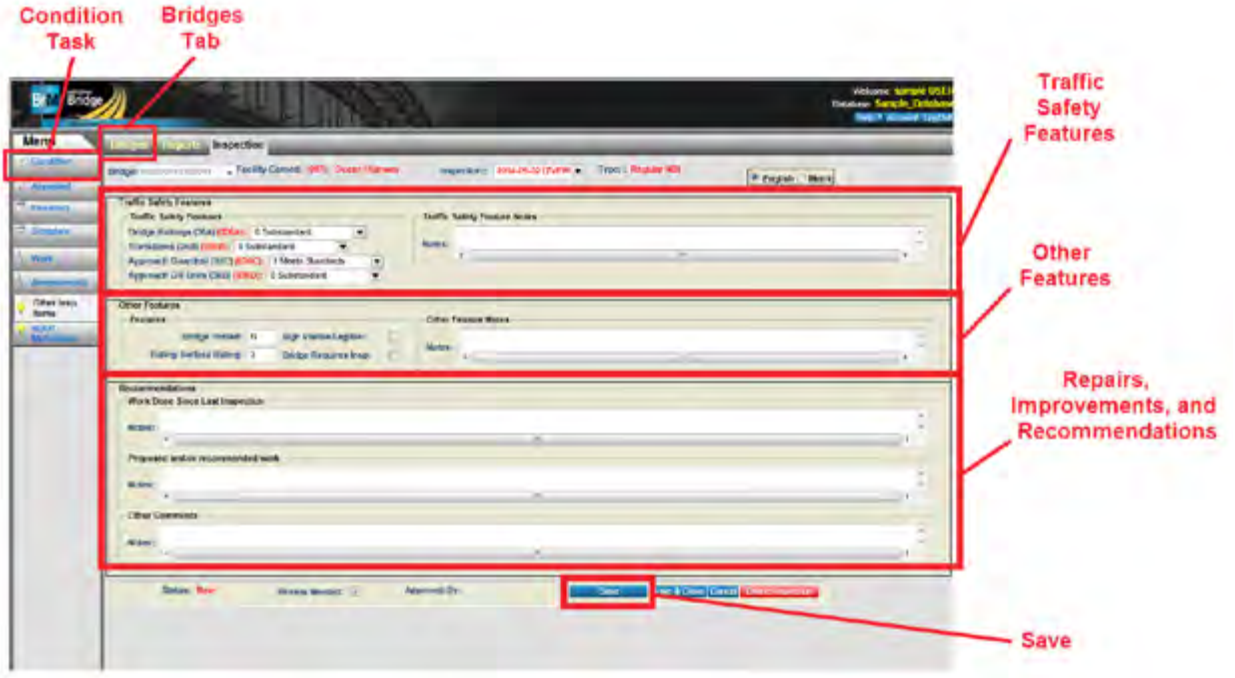


Figure 42 – Other Inspection Items

4. Click **Save** to save your work

5. Click **Condition** to return to your inspection or click **Bridges** to return to the list of bridges.

10.10 Viewing and Printing the (NBE) Final Inspection Report

1. Use quick filters to retrieve the desired bridge or subset of bridges. Select a bridge or set of bridges by clicking on the box(es) next to the desired Bridge ID(s). See Section 3.3 for instructions on finding a structure with quick filters.

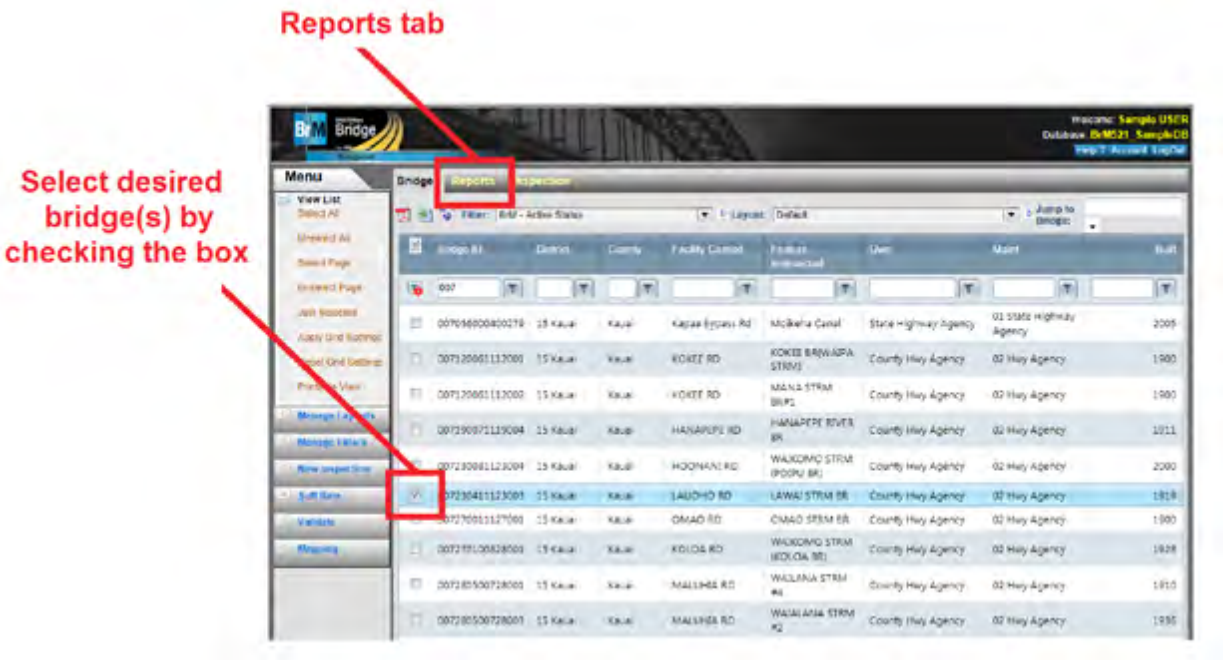


Figure 43 – Viewing and Printing Final Inspection Reports

2. Select the **Reports** tab from the **Tab Bar**.

3. The report generation window will appear.

4. Click the drop down menu and choose **2 – NBE Final Report (SIGN & SUBMIT)**

    a. For a description of this Final Inspection Report, please refer to Chapter 2, National Bridge Element (NBE) Inspection – Form and Report

5. Various formats are available, it is recommended to choose **PDF**

6. Click **Generate Report**

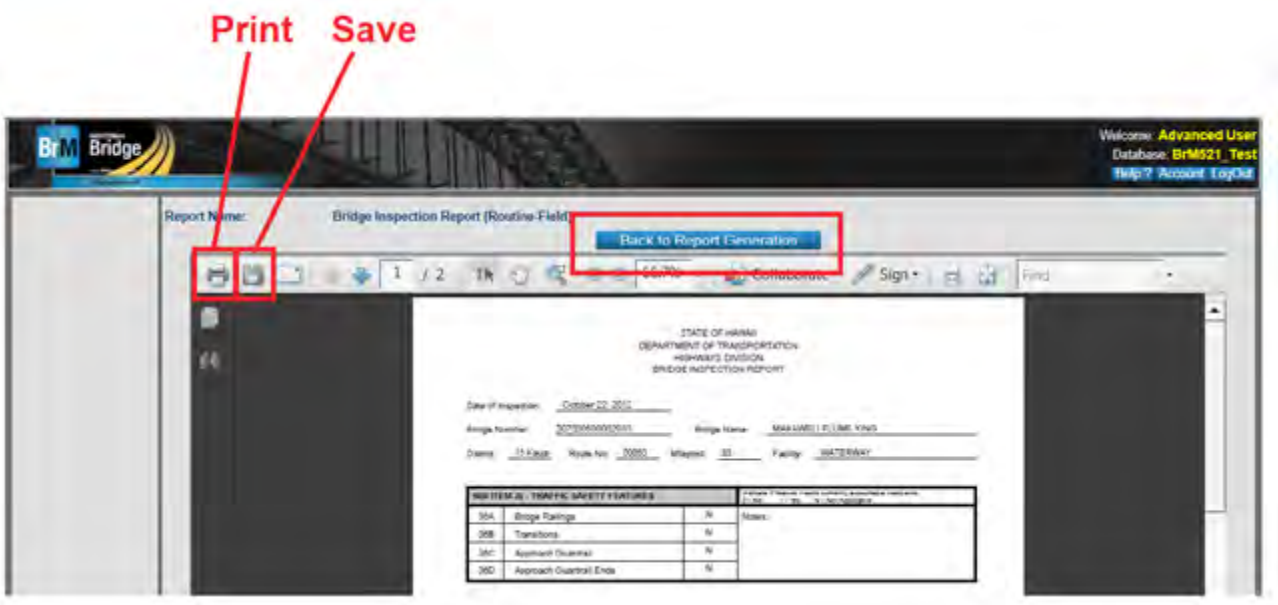


Figure 44 – Navigating Reports

7. To print the report, click the **Print** button. To export the information to external files click the **Save** button.

    a. If you selected multiple bridges, BrM will combine all reports for all bridges into one file.

8. Click the **Back to Report Generation** button to close the Report window.

APPENDIX A Condition State Definitions

Table A-1 Reinforced Concrete

Reinforced Concrete Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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 0.012-0.05 in. or spacing of 1.0-3.0 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.	
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.

Table A-2 Prestressed Concrete

Prestressed Concrete Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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 3.0 ft.	Width 0.004-0.009 in. or spacing 1.0-3.0 ft.	Width greater than 0.009 in. or spacing less than 1 ft.	
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.	
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.

Table A-3 Steel

Steel Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Distortion (1900)	None.	Distortion not requiring mitigation or mitigated distortion.	Distortion that requires mitigation that has not been addressed but does not warrant structural review.	
Settlement (4000)	None.	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits but does not warrant structural review.	
Scour (6000)	None.	Exists within tolerable limits or has been arrested with effective countermeasures.	Exceeds tolerable limits but is less than the critical limits determined by scour evaluation and does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Table A-4 Masonry

Masonry Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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.
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 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.	
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.

Table A-5 Timber

Timber Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review has been completed and the defects impact strength or serviceability of the element or bridge.
Decay / Section Loss (1140)	None.	Affects less than 10% of the member section.	Affects 10% or more of the member but does not warrant structural review.	
Check / Shake (1150)	Surface penetration less than 5% of the member thickness regardless of location.	Penetrates 5%-50% of the thickness of the member and not in a tension zone.	Penetrates more than 50% of the thickness of the member or more than 5% of the member thickness in a tension zone. Does not warrant structural review.	
Crack (Timber) (1160)	None.	Crack that has been arrested through effective measures.	Identified crack that is not arrested but does not require structural review.	
Split / Delamination (Timber) (1170)	None.	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth but does not require structural review.	
Abrasion / Wear (Timber) (1180)	None or no measurable section loss.	Section loss less than 10% of the member thickness.	Section loss 10% or more of the member thickness but does not warrant structural review.	
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.

Table A-6 Other

Other Material Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Delamination / Spall / Patched Area (1080)	None.	Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.	Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.	
Efflorescence / Rust Staining (1120)	None.	Surface white without build-up or leaching without rust staining.	Heavy build-up with rust staining.	
Cracking (RC and Other) (1130)	Width less than 0.012 in. or spacing greater than 3.0 ft.	Width 0.012-0.05 in. or spacing of 1.0-3.0 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.	
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.

Table A-7 Joints

Joint Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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 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.
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.

Table A-8 Bearings

Bearing Elements – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 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, or fasteners; broken welds; or pack rust with distortion but does not warrant a structural review.	
Movement (2210)	Free to move.	Minor restriction.	Restricted but not warranting structural review.	
Alignment (2220)	Lateral and vertical alignment is as expected for the temperature conditions.	Tolerable lateral or vertical alignment that is inconsistent with the temperature conditions.	Approaching the limits of lateral or vertical alignment for the bearing but does not warrant a structural review.	
Bulging, Splitting, or Tearing (2230)	None.	Bulging less than 15% of the thickness.	Bulging 15% or more of the thickness. Splitting or tearing. Bearing's surfaces are not parallel. Does not warrant structural review.	
Loss of Bearing Area (2240)	None.	Less than 10%.	10% or more but does not warrant structural review.	
Damage (7000)	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Table A-9 Wearing Surfaces

Element 510 – Wearing Surfaces – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 4 (Severe)**
Delamination / Spall / Patched Area / Potholes (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.-0.05 in. or spacing of 1.0-3.0 ft.	Width of more than 0.05 in. or spacing of less than 1.0 ft.	
Effectiveness (Wearing Surface) **(3230)**	Fully effective. No evidence of leakage or further deterioration of the protected element.	Substantially effective. Deterioration of the protected element has slowed.	Limited effectiveness. Deterioration of the protected element has progressed.	
Damage **(7000)**	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.

Table A-10 Steel Protective Coating

Element 515 – Steel Protective Coating – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 4 (Severe)**
Chalking (Steel Protective Coatings) **(3410)**	None.	Surface dulling.	Loss of pigment.	Not applicable.
Peeling / Bubbling / Cracking (Steel Protective Coatings) **(3420)**	None.	Finish coats only.	Finish and primer coats.	Exposure of bare metal.
Oxide Film Degradation Color / Texture Adherence (Steel Protective Coatings) **(3430)**	Yellow-orange or light brown for early development. Chocolate brown to purple-brown for fully developed. Tightly adhered, capable of withstanding hammering or vigorous wire brushing.	Granular texture.	Small flakes, less than ½-in. diameter.	Dark black color. Large flakes, ½-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.

Table A-11 Concrete Reinforcing Steel Protective System

Element 520 – Concrete Reinforcing Steel Protective System – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 4 (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.

Table A-12 Concrete Protective Coating

Element 521 – Concrete Protective Coating – Condition State Definitions				
Defects	**CS 1 (Good)**	**CS 2 (Fair)**	**CS 3 (Poor)**	**CS 4 (Severe)**
Wear (Concrete Protective Coatings) **(3510)**	None.	Underlying concrete not exposed; coating showing wear from UV exposure; friction course missing.	Underlying concrete is not exposed; thickness of the coating is reduced.	Underlying concrete exposed. Protective coating no longer effective.
Effectiveness (Concrete Protective Coatings) **(3540)**	Fully effective.	Substantially effective.	Limited effectiveness.	The protective system has failed or is no longer effective.
Damage **(7000)**	Not applicable.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 2 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 3 under the appropriate material defect entry.	The element has impact damage. The specific damage caused by the impact has been captured in Condition State 4 under the appropriate material defect entry.