

WisDOT Structure Inspection - Concrete Deck/Slab Elements and Assessments

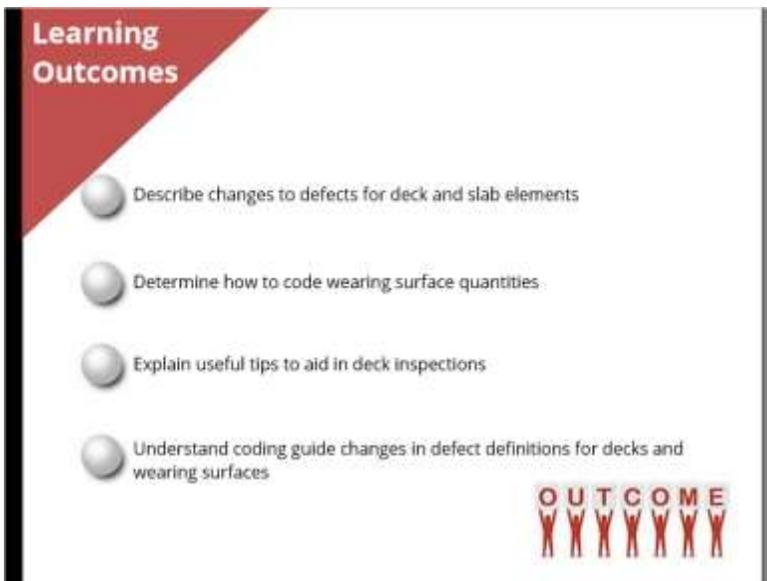
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Welcome to the Structure Inspection Refresher Training Series.

This module details important information on concrete decks/slab elements and assessments that inspection team leaders should use to improve their inspections.

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In this session, you will learn:

To describe changes to defects for deck and slab elements.

To determine how to code wearing surface quantities.

To explain useful tips to aid in deck inspections

To Understand coding guide changes in defect definitions for decks and wearing surfaces

A structure's concrete deck or slab and corresponding wearing surface see more wear and tear than any other component of a bridge due to vehicles and winter de-icing chemicals.

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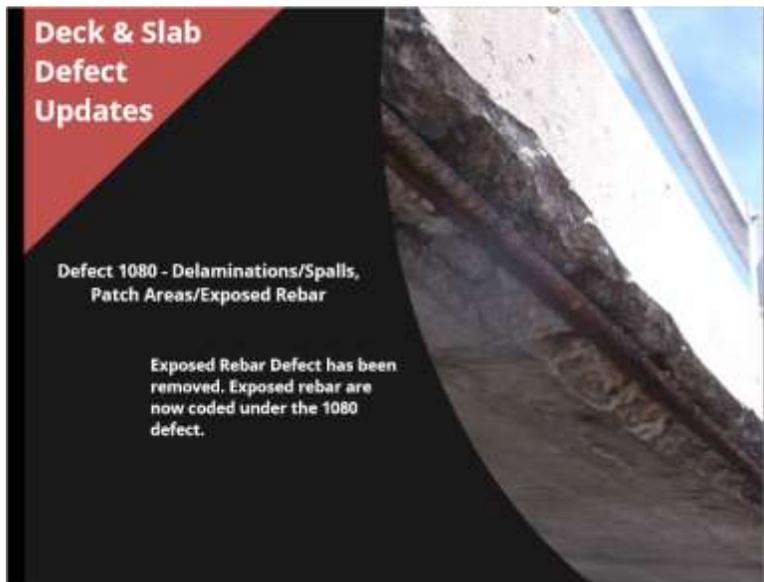


Though there are many types, both Element 12 – Reinforced Concrete Deck and Element 38 – Reinforced Concrete Slab are the most common element type an inspector will encounter.

Recall the difference. A deck typically transfers vehicular loads to superstructure elements such as stringers, floorbeams, or girders. A slab, in contrast, is the superstructure and transfers those loads directly into the substructure units.

Deck and slab elements are used to evaluate the edges and bottom surfaces of the respective element. The top surface of all decks and slabs will be evaluated using an associated wearing surface element. They may or may not be covered with an overlay.

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There are a couple of changes to the Wisconsin Structure Inspection Field Manual in the last few years regarding deck defects.

One big change was for defect 1080, which covers spalls and delaminations of concrete. In 2018, the exposed reinforcing steel defect language was rolled into this defect for simplification.

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Another change was the language for delaminations. In the 2019 version of the field manual, delamination's are coded in condition state two, regardless of the size of the delamination. This change was made to better mirror the defect language in the AASHTO Manual for Bridge Element Inspections.

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The final change involves patched areas of concrete that are sound. To keep consistent with the AASHTO Manual for Bridge Element Inspections, all sound patches will be coded in condition state 2, fair condition.

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Deck & Slab Defect Updates

Defect	CS 1	CS 2	CS 3	CS 4
	Good	Fair	Poor	Severe
Discoloration (8904)	No discoloration of concrete is present.	Concrete is slightly darker than surrounding area; may contain scaling.	Medium discoloration; may contain hairline map cracking.	Very dark discoloration. Structural Review not required.



In addition, a new Defect 8904 – Discoloration was added. The intent is to quantify areas of the deck or slab which show signs of higher permeability or water retention and are potentially accelerating the deterioration of the concrete in that area. It is important to note that discoloration from construction materials or locomotive exhaust is not considered a defect. Only discoloration related to moisture penetration is considered.

A quick reminder: For overlapping defects in the same condition state, the lower numbered defect controls. For example if you had a discoloration defect of condition state 2 and in that same area you had a cracking defect of condition state 2, your defect quantity would be coded in the 1130 – Cracking defect due to the hierarchy rules.

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Recall that the top surface of all concrete decks and slabs are evaluated using an associated wearing surface element. If no overlay exists then element 8000, wearing surface –bare is used. If an overlay is present, then the type of overlay (asphalt, thin polymer, concrete or polyester) is coded for the wearing surface.

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Wearing Surface Elements Updates

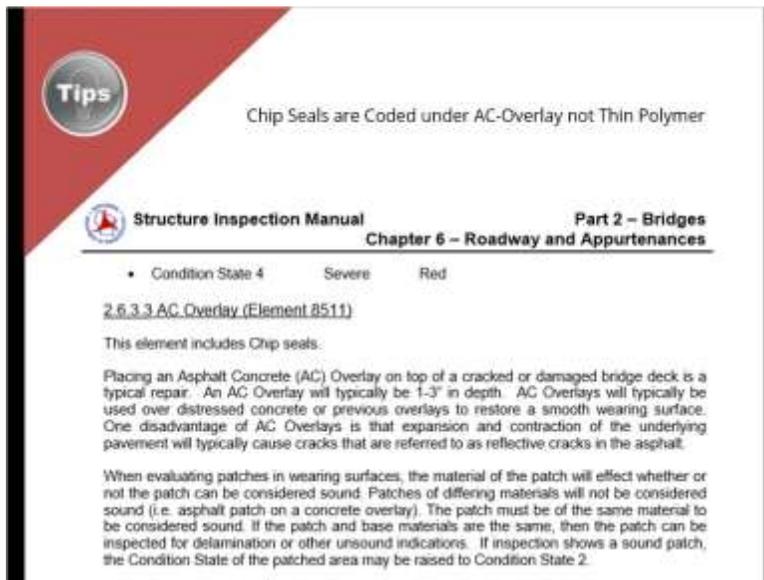
- Defect 3210 - Debonding/Delaminations
Sound Patches are now coded in CS1 (Good) provided the patching material is not asphalt for a concrete wearing surface
- Defect 3220 - Cracking/Wearing Surface
Sealed cracks are now coded in CS1 (Good)

There are a couple of changes to the Wisconsin Structure Inspection Field Manual in the last few years regarding wearing surface defects.

First, wearing surfaces that have been patched where the patches are sound are to be coded in CS1 or Good condition for that area. The only exception to that is when asphalt patching materials have been used on a concrete wearing surface. Those patches are considered unsound and should be coded in CS3 or Poor condition.

The second change involves cracks that have been sealed. Sealed cracks will be coded in CS1 or Good condition as long as the seal is functioning.

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Tips

Chip Seals are Coded under AC-Overlay not Thin Polymer

Structure Inspection Manual **Part 2 – Bridges**
Chapter 6 – Roadway and Appurtenances

• Condition State 4 Severe Red

2.6.3.3 AC Overlay (Element 8511)

This element includes Chip seals.

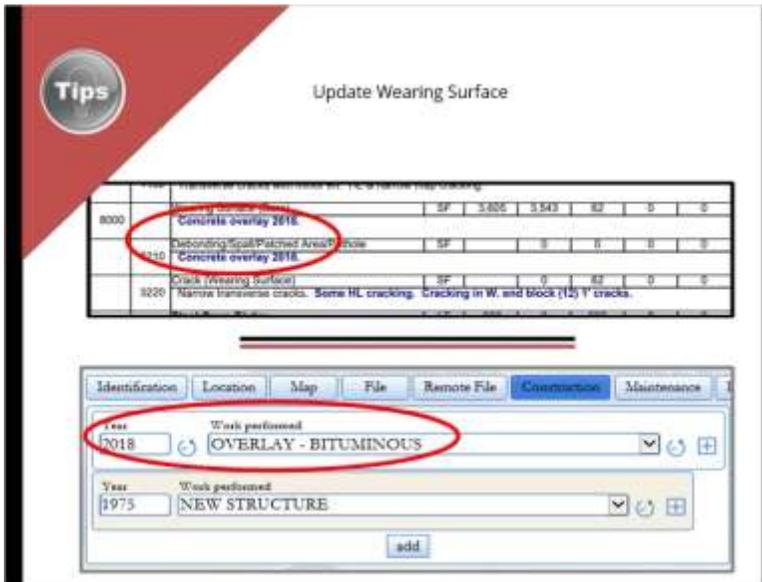
Placing an Asphalt Concrete (AC) Overlay on top of a cracked or damaged bridge deck is a typical repair. An AC Overlay will typically be 1-3" in depth. AC Overlays will typically be used over distressed concrete or previous overlays to restore a smooth wearing surface. One disadvantage of AC Overlays is that expansion and contraction of the underlying pavement will typically cause cracks that are referred to as reflective cracks in the asphalt.

When evaluating patches in wearing surfaces, the material of the patch will effect whether or not the patch can be considered sound. Patches of differing materials will not be considered sound (i.e. asphalt patch on a concrete overlay). The patch must be of the same material to be considered sound. If the patch and base materials are the same, then the patch can be inspected for delamination or other unsound indications. If inspection shows a sound patch, the Condition State of the patched area may be raised to Condition State 2.

During the most recent inspection quality assurance reviews, one item that was coded inconsistently in the inspection documentation was bridges that have chip seals.

Per Part 2, Chapter 6 of the Structures Inspection Manual, if the surface of the bridge deck is covered with a traditional "chip seal" consisting of emulsion oil and stone chips, the wearing surface shall be coded as a AC Overlay – Element number 8511.

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Another item that needs attention based on Quality Assurance reviews involves the wearing surface element. In general, this element needs to be updated when new wearing surfaces are placed on the bridge.

For example, the notes on this inspection indicate a concrete overlay was placed on this bridge in 2018. While that note is good, the element needed to be updated to 9514 – Concrete Overlay along with an update to the construction history to show the 2018 improvement.

Contact the Bureau of Structures Bridge Management Unit for more information on updating inventory information in the Highway Structures Information System

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Another common error involves the overlay thickness. Inspectors are responsible with accurately reporting the depth of any overlays on the inspection form, and are encouraged to verify the overlay thickness during each inspection. The results are entered into the Highway Structures Information System on the Structure Information Tab, along with the appropriate deck surface material.

Often overlays can vary in thickness on a bridge. For our purposes, the thickness is taken as the average depth of the overlay across the width of the wearing surface.

Overlay thickness can be measured at edge of deck or at floor drains as shown in the photos.

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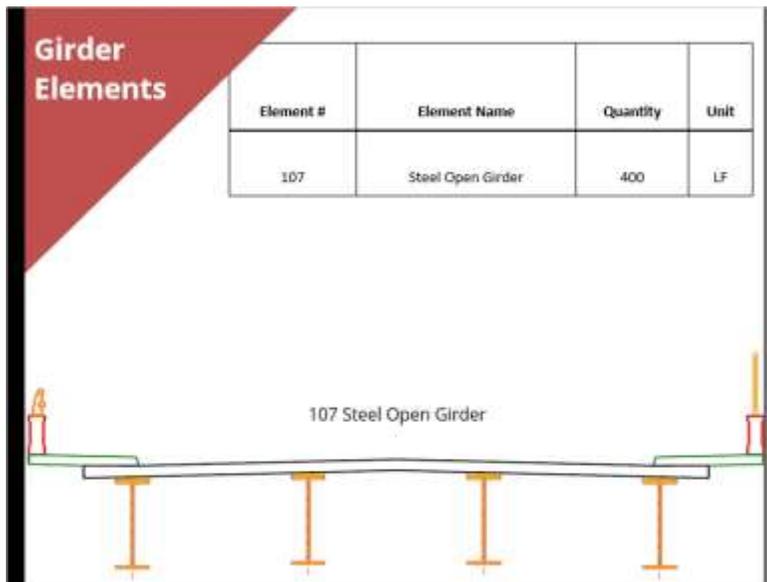


Quality assurance reviews also revealed some confusion on how to properly code bridges with raised sidewalks or medians.

For this reason, let's look at a typical bridge and define both the elements and the quantities associated with the elements.

The bridge consists of four steel girders with a concrete deck and raised sidewalks on both sides. The bridge is 100 feet long.

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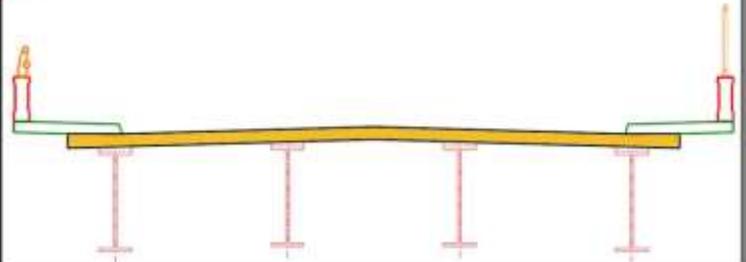


The girders are coded under element 107 – Steel Open Girder. Since the bridge is 100' long and there are 4 girders, the total quantity is 400 lineal feet of girder.

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Deck/Wearing Surface Elements

Element #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF



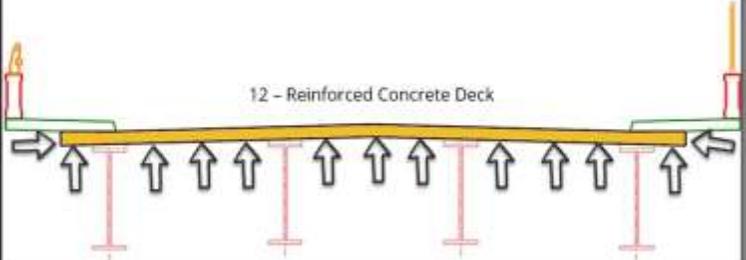
The diagram shows a cross-section of a bridge deck/wearing surface element. It is supported by four steel open girders. The deck is shown as a thin layer on top of the girders. The girders are supported by four vertical supports. The deck is highlighted in green, and the girders are highlighted in yellow.

Next we need to code the reinforced concrete deck and associated wearing surface.

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Deck Element

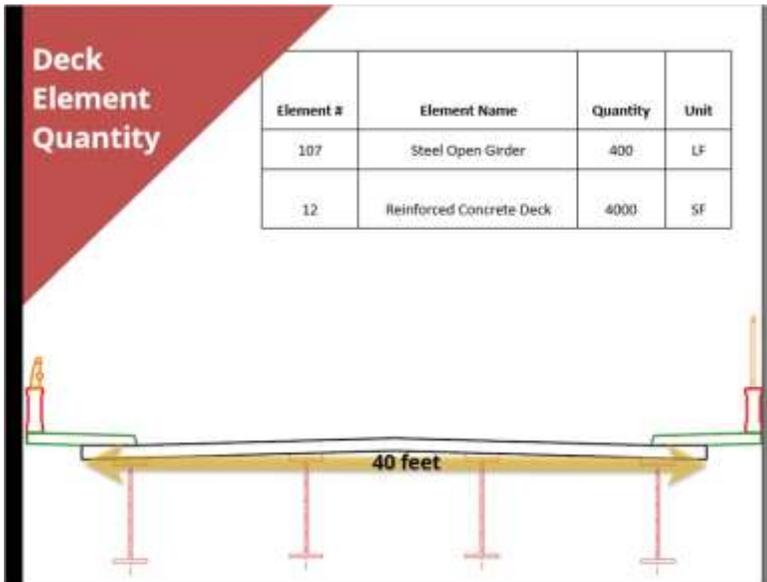
Element #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF



The diagram shows a cross-section of a deck element supported by four steel open girders. The deck is highlighted in green, and the girders are highlighted in yellow. The text "12 - Reinforced Concrete Deck" is written above the deck. Arrows point upwards from the girders to the deck, indicating forces or loads. The girders are supported by four vertical supports.

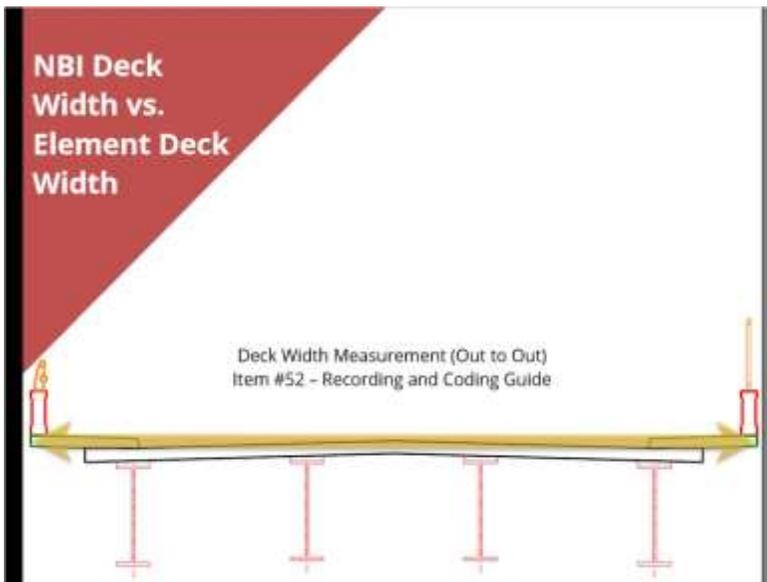
Element 12 – Reinforced concrete deck, is used for the bottom and sides of the element.

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The deck element quantity would be the length of the bridge times the width of the deck. As you can see from this example, the width used in the calculation does not include the cantilevered portion of the sidewalks in the calculation. For this bridge, the quantity would be 40 feet wide times 100 feet long, or 4000 square feet of deck element.

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One thing to note. The Deck width stored in the Highway Structures Information System for Item #52 of the National Bridge Inventory (or NBI file) is NOT the same as the element quantity. The NBI deck width for this structure would be measured between outside edges of the sidewalks.

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Wearing Surface

Element #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF
12	Reinforced Concrete Deck	4000	SF

8000 Wearing Surface Bare

The top of the deck or riding surface is bare and no overlay system has been applied. For this case, element 8000 – Wearing surface bare is used to inspect and document defects on the top of the deck.

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Wearing Surface Quantity

Element #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF

36 feet

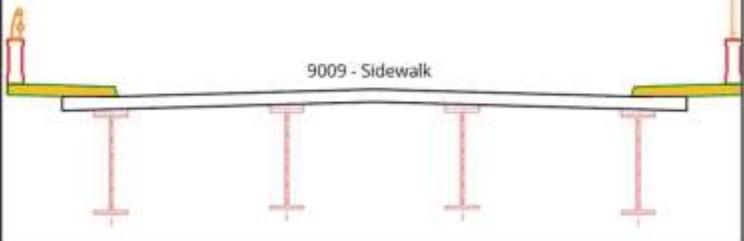
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The quantity for the wearing surface would only consist of the portion of the deck that is exposed and not covered by the cantilever sidewalks. For this example, the quantity would be the width of 36 feet times the length of 100 feet resulting in 3600 square feet of wearing surface.

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Sidewalk Assessment

Element #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF
12	Reinforced Concrete Deck	4000	SF
8000	Wearing Surface - Bare	3600	SF

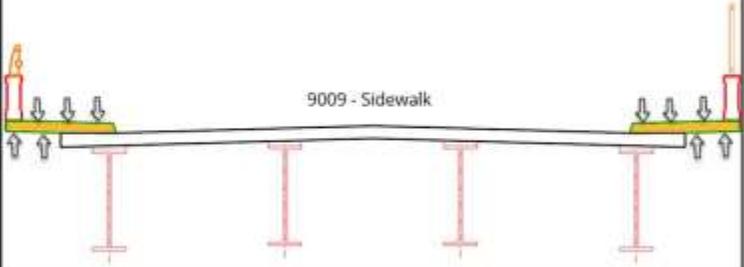


The cantilever sidewalks would be inspected under assessment 9009 Sidewalk.

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Sidewalk Assessment

Element or Assessment #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF
12	Reinforced Concrete Deck	4000	SF
8000	Wearing Surface - Bare	3600	SF
9009	Sidewalk	2	EA

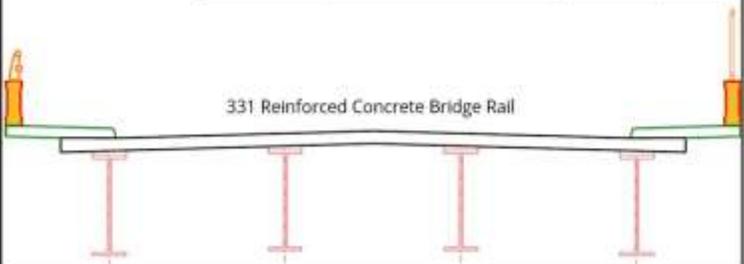


The inspection of the sidewalk includes both the top side and underside that are visible to the inspector. The quantity per the Wisconsin structure inspection field manual is coded in units of one each per sidewalk. In this example, we have multiple sidewalks so the quantity would be two.

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Rail Elements

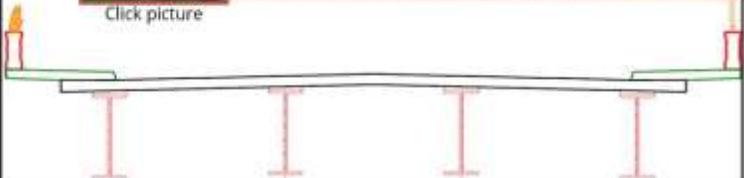
Element or Assessment #	Element Name	Quantity	Unit
107	Steel Open Girder	400	LF
12	Reinforced Concrete Deck	4000	SF
8000	Wearing Surface - Bare	3600	SF
9009	Sidewalk	2	EA
331	Reinforced Concrete Bridge Rail	200	LF



This example also has parapets coded under 331 reinforced concrete bridge rail. The quantity is in lineal feet, so for a bridge with parapets that are 100 feet long on both sides, the total quantity is 200 lineal feet.

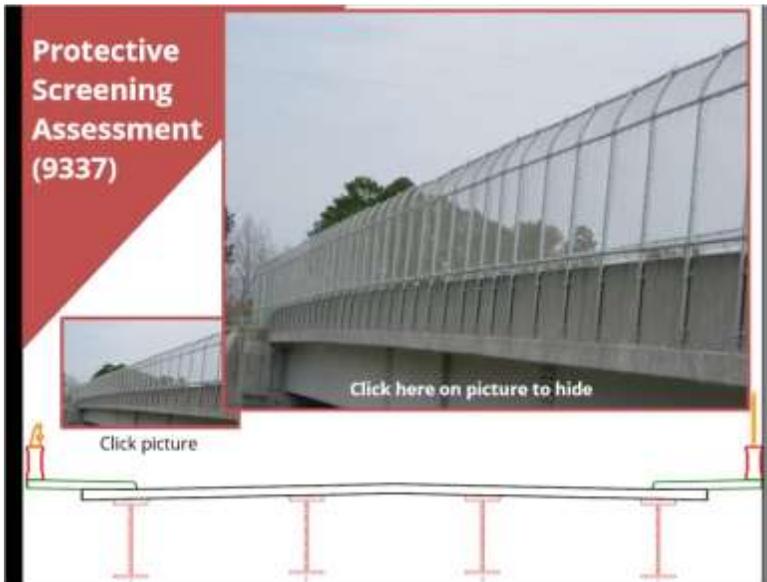
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Decorative Rail Assessment (9335)



One of the parapets has an aluminum rail mounted to the top. This is coded under assessment 9335 for decorative rails. Similar to the sidewalk assessment, the quantity is one each per rail.

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The other rail has a chain link pedestrian fence attached to the top. Similar to the decorative rail, the quantity is one each and the assessment used is 9337 Protective Screening.

That's it. All the elements and assessments that are shown in the example have been coded.

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