

2019 Structure Inspection - National Bridge Inventory (NBI)

Rating System

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1.2 Untitled Slide



This session describes how to:

Utilize NBI coding diagrams

Apply NBI ratings to the deck, superstructure, and substructure

Reflect the element conditions in the NBI ratings

Code the NBI for Reinforced concrete Slab bridges

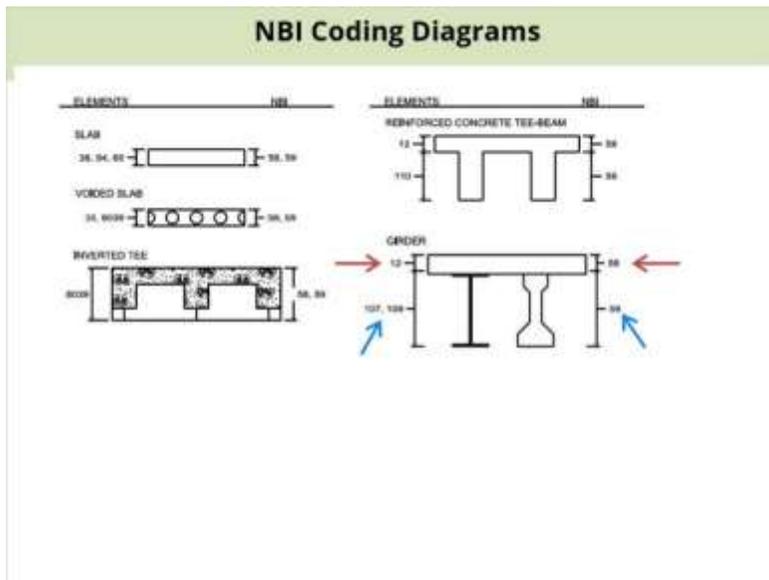
Code the NBI for bridge frames and arches

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The **NBI** is a database, compiled by the [Federal Highway Administration](#), with information on all [bridges](#) and [tunnels](#) in the [United States](#) that have roads passing above or below. Wisconsin uses two distinctly different reporting systems in collecting and managing its structure inspection data: Element Level and the NBI System. Although different systems, the data from one should sync with the data from the other.

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To assist bridge inspections the following coding diagrams are provided in the structure inspection field manual for different span configurations.

The inspector should utilize these to code different elements and their corresponding NBI items.

For instance in the girder configuration the element 12 (Reinforced concrete deck) corresponds with NBI 58 (deck). Element 107 (Steel open girder) and Element 109 (prestressed concrete open girder) corresponds with NBI 59 (superstructure).

The different configurations include Slab, Voided slab, Inverted Tee, reinforced Concrete Tee-Beam, Girder, Adjacent prestressed or reinforced concrete units, spread box girders, reinforced concrete through girder, concrete box girder, and steel box girder. (Show each page that names apply to as they are said).

For more information regarding NBI items see the Recording and Coding guide for the Structure Inventory and Appraisal of the Nation's Bridges. (Sandy to provide following link on slide) <http://www.fhwa.dot.gov/bridge/nbi.cfm>

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NBI Ratings

- NBI deck, superstructure and substructure
- Characterize the bridges' overall general condition

Chapter 9. NBI Rating System
NBI Deck, Superstructure, Substructure Rating System

The following criteria should be used to rate items 58 (Deck), 59 (Superstructure), and 60 (Substructure).

NBI		Description
9	NA	Not Applicable
8	Good	Excellent condition
6		Very good condition – no problems noted
7		Good condition – some minor problems
6	Fair	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	Poor condition – advanced section loss, deterioration, spalling, or scour
3		Serious condition – loss of section, deterioration, spalling, or scour have seriously affected primary structural components. 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	Severe	Imminent failure condition – major deterioration or section loss in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but with corrective action may put back in light service.
0		Failed condition – out of service – beyond corrective action

NBI Commentary

- When a deck has a wearing surface and the bottom side of the deck/flange is not accessible for inspection (e.g. adjacent box beams, decks with stay-in-place forms, etc.), then the deck should be rated on based on the condition of the wearing surface. Non-destructive or partially destructive testing methods can be used to further assess the condition.

An NBI inspection looks at the bridge differently than an element level inspection. Where an element level inspection considers each bridge element separately, the NBI inspection lumps all like-function elements together into a functional group. Because only a single number is used to rate the NBI items of deck, superstructure or substructure the rating must characterize its overall general condition. The same goes for culvert, waterway, and channel NBI items.

The rating should not be used to describe local areas of deterioration, such as isolated heavy corrosion or a bent flange due to a traffic impact for the superstructure. However, widespread heavy corrosion of girders or widespread cracked welds would certainly influence the superstructure rating. A proper rating will therefore consider deterioration severity plus the extent to which it is distributed throughout the deck, superstructure, or substructure.

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NBI Deck Rating

Chapter 9 – NBI Rating System

Quick Assessment Chart for NBI Deck Rating vs. Defect Comparison

DECK RATING	CRACKING	SCALING	SPALLING	DELAM.	ELECTRICAL POTENTIAL	CHLORIDE CONTENT (LB/CY)
9	None	None	None	None	0	0
8	Minor Transverse	None	None	None	None > 0.35	None > 2.0
7	Sealable	Light	None but Visible Tare Wear	None	10% > 0.35	10% > 2.0
6	Excessive (open cracks @ 5 foot Max. Spa.)	Medium	< 2%	< 5%	10%-20% > 0.35	10%-20% > 2.0
5	Excessive	Heavy	2% - 5%	5% - 20%	20%-40% > 0.35	20%-40% > 2.0
4	Many Full Depth Failures Present or Imminent; leaching			> 20%	Over 60% > 0.35	Over 60% > 2.0
3	Many Full Depth Failures Present or Imminent; leaching					
2	Full Depth Failures over Much of Deck					
1	Bridge Closed. Corrective Action May Put Back in Service					
0	Bridge Closed. Replacement necessary					

Note: Values are guidelines only

To help rate the NBI deck item utilize the quick assessment chart NBI deck Rating vs. defect comparison (show chart now). The deck rating considers the sides, topside and underside of the bare deck that you can see. However, when an overlay is placed without repairing the topside of deck, the condition of the deck prior to the overlay should be considered in the deck rating.

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Reflect Element Condition in NBI Ratings

NBI		Description
N	NA	Not Applicable
9	Good	Excellent condition
8		Very good condition – no problems noted
7		Good condition – some minor problems
6	Fair	Satisfactory condition – structural elements show some minor deterioration <small>Each condition – all structural elements must be rated that same or better</small>



When determining the NBI ratings it is important to reflect the bridge element condition. For example this bridge has Element 109 - prestressed concrete open girder all in condition state 1 (good). This is the only element on the bridge that makes up the superstructure NBI. In this case the superstructure NBI should never reach a value of 6-fair condition. (have chart showing 6 come in) Instead the superstructure NBI would be considered in good condition an NBI of 8 or 9. (have chart showing good condition come in)

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NBI for RC Slab Bridges



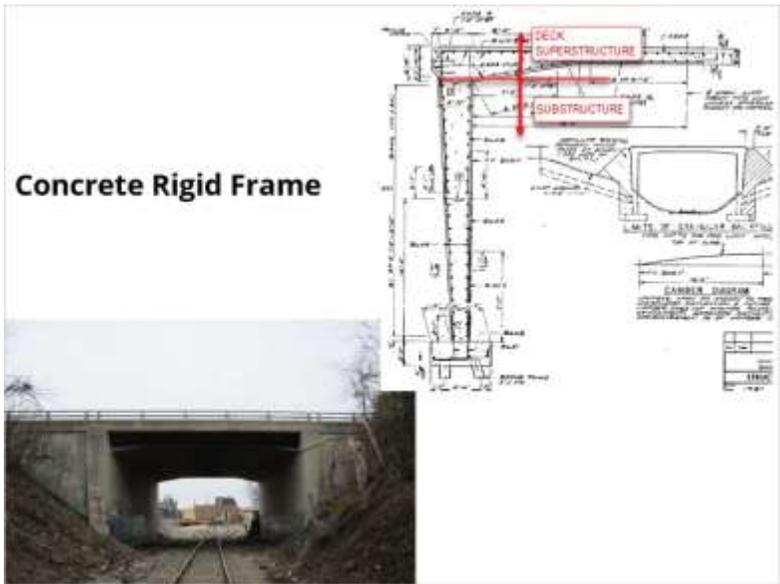
**REINFORCED
CONCRETE SLAB**

A reinforced concrete slab = deck and superstructure

The deck and superstructure receives the same NBI rating number

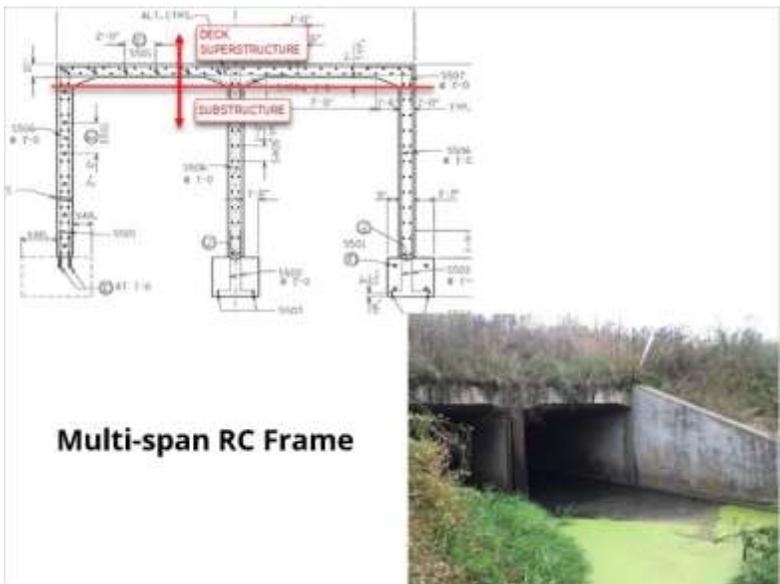
On slab bridges, the deck is the same structural component as the superstructure. The FHWA Guidelines specifically state that ratings of decks built integral with superstructures (including slabs) should not be influenced by the superstructure rating. However, since the deck NBI rating accounts for inspection findings on both the top and underside, NBI condition ratings for the deck and superstructure must be the same.

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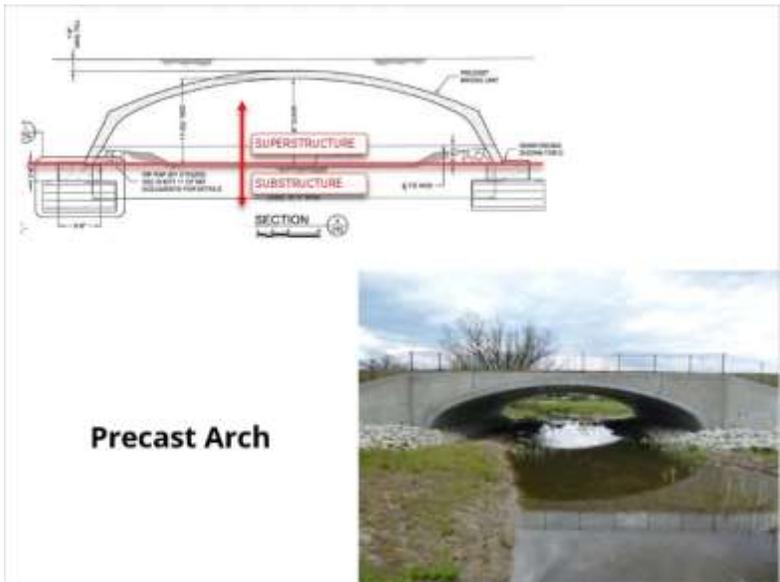
When inspecting concrete rigid frames, the concrete vertical walls and concrete footings, if exposed, are considered NBI substructure. The concrete slab and haunches are considered NBI deck and superstructure.

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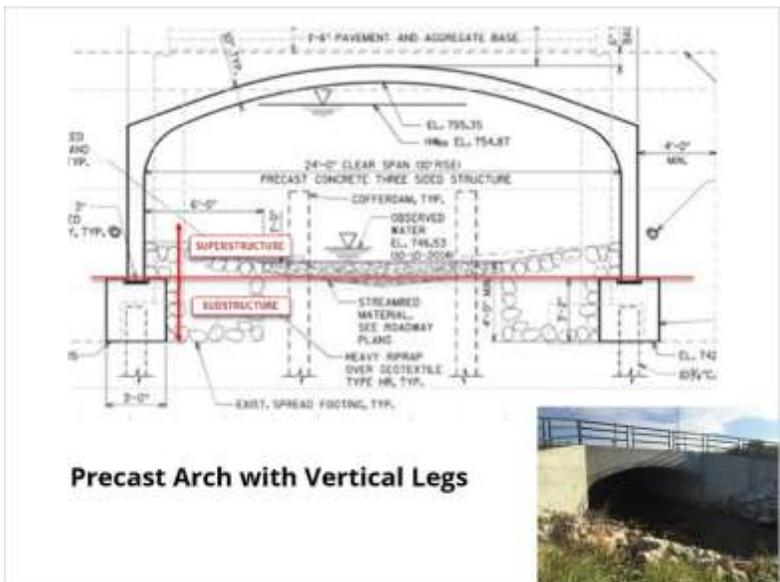
For a multi-span reinforced concrete frame, the concrete vertical walls and concrete footings, if exposed, are considered the NBI substructure. The concrete slab and haunches are considered NBI deck and superstructure.

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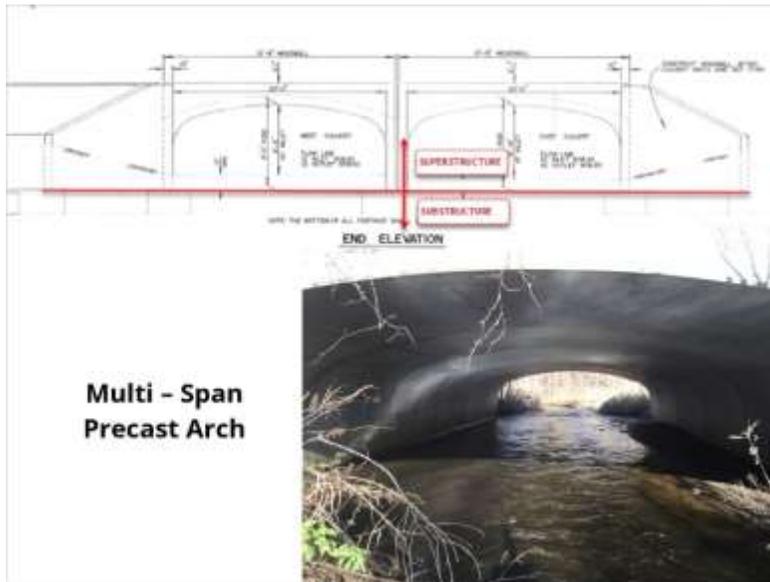
For a precast arch, the concrete footings, if exposed, are considered the NBI substructure and everything above is considered NBI superstructure.

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For a precast arch with vertical legs, the concrete footings, if exposed, are considered the NBI substructure and everything above is considered NBI superstructure.

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For a multi-span precast arch, the concrete footings, if exposed, are considered the NBI substructure and everything above is considered NBI superstructure.

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For a steel arch on a footing, the concrete footings, if exposed, are considered the NBI substructure and everything above is considered NBI superstructure. For any of these cases when the footing is not exposed rate the substructure the same as the superstructure.

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1.22 QUIZ RESULTS

(Results Slide, 0 points, 1 attempt permitted)