Bridge Inspections Start to Finish: Condition Ratings

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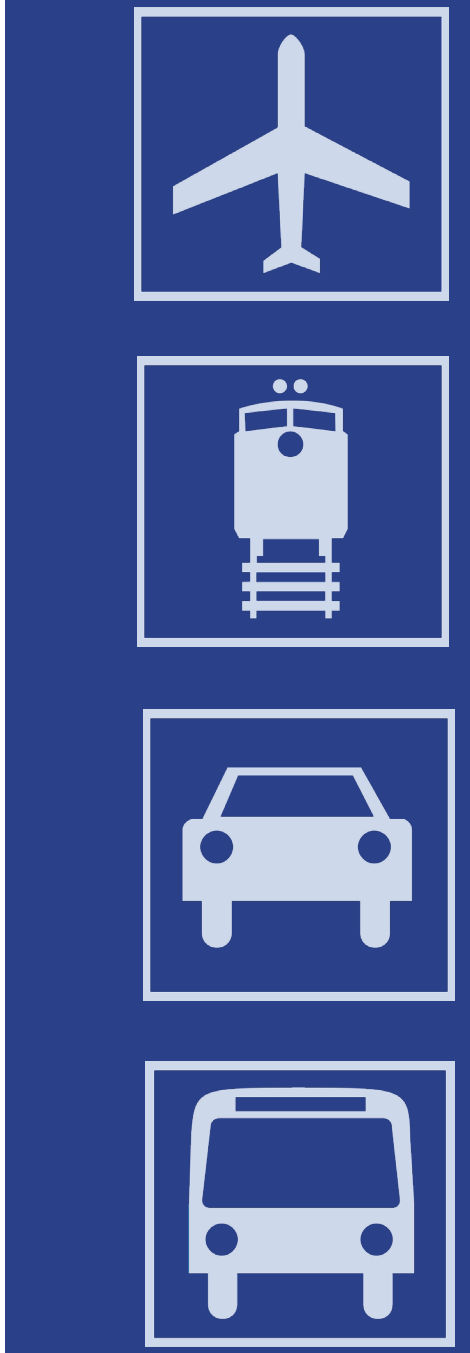
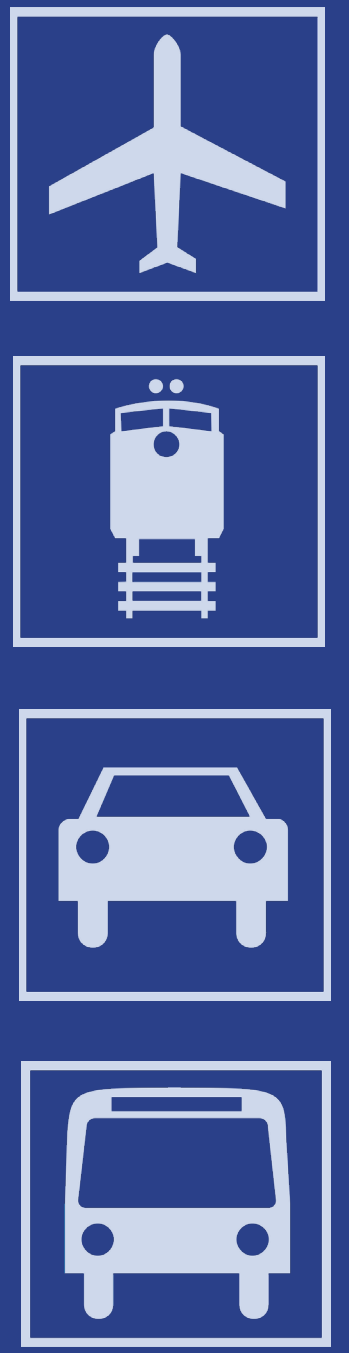
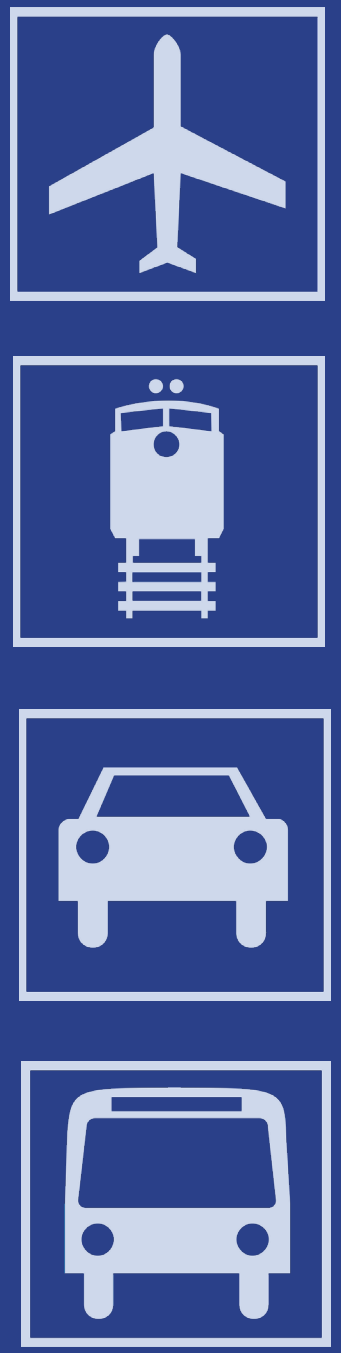


Agenda

- Condition Rating Overview
- Condition Rating Exercises
- Appraisal Rating Exercises
- SNBI and INDOT Specific Items

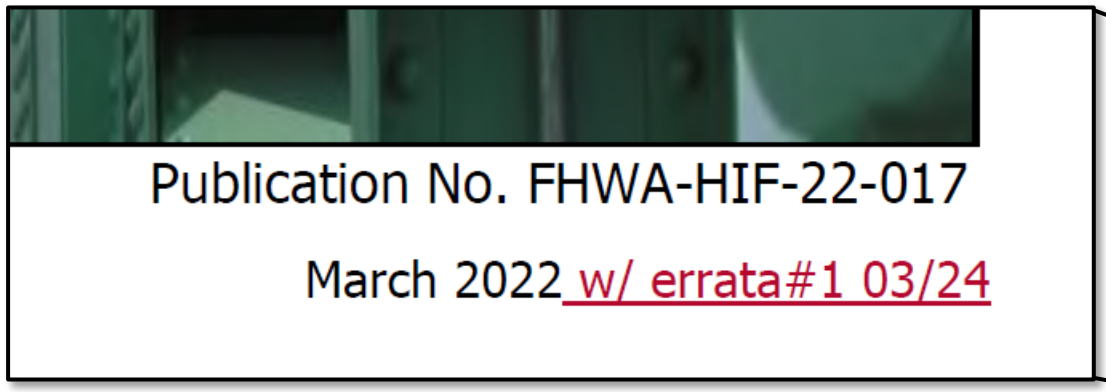


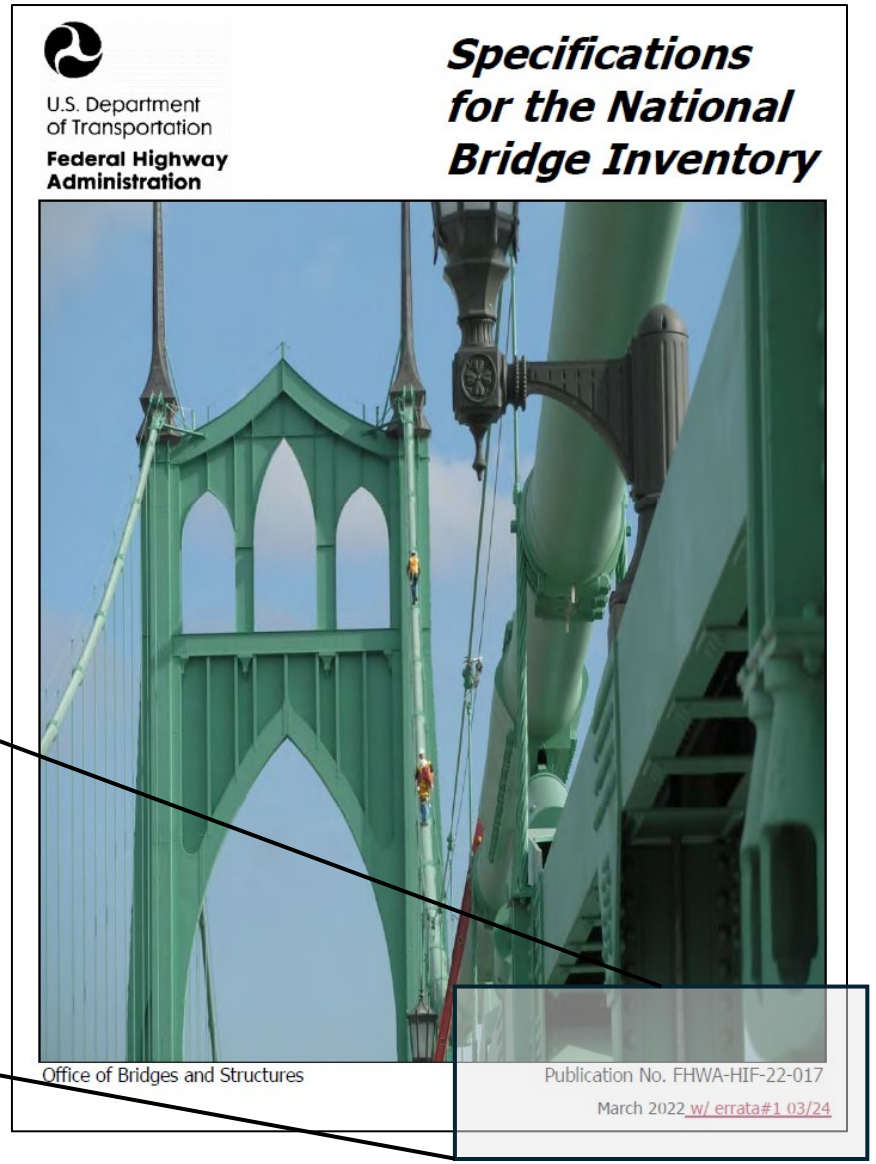
Condition Rating Overview



The SNBI Manual

- Latest version from FHWA website
- Errata #1 03/24





The SNBI Manual

- Section 7: Bridge Condition
  - **7.1 Component Condition Ratings**
  - 7.2 Element Identification
  - 7.3 Element Condition
  - **7.4 Appraisal**
  - 7.5 Work Events
- **Appendix C: Component Condition Rating Guidance**

Three Components of Condition Ratings

- **Severity**:
  - Inherent, Minor, Moderate, Major
- **Extent**:
  - Isolated (<10%), Some, Widespread (>40%)
- **Strength and/or Performance Affected**:
  - Yes or No

Main Condition Items Follow Table 20

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
N	NOT APPLICABLE	Component does not exist.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.
1	IMMINENT FAILURE	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.

Other Condition Tables in Each Item

Bridge Joints Condition Rating

Format	Frequency	Item ID
AN (1)	EI	B.C.08

Specification

Report the bridge deck joint condition using one of the following codes. The entire code description must be satisfied for the code to apply.

Code	Condition	Description
N	NOT APPLICABLE	Bridge does not have deck joints.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects.
4	POOR	Widespread moderate or isolated major defects.
3	SERIOUS	Some major defects.
2	CRITICAL	Widespread major defects.
1	IMMINENT FAILURE	Joints have failed and are ineffective.
0	FAILED	Joints have failed and present a safety hazard.

Unofficial Severity and Extent Table

Condition Rating	Defect Severity			
	Inherent	Minor	Moderate	Major
9	Isolated			
8	Some			
7		Some		
6		Widespread	Isolated	
5			Some	
4			Widespread	Isolated
3				
2				
1				

Appendix C: Condition Rating Guidance

- Defect types
- Different materials
- Descriptions for Minor, Moderate

Table 46. All Materials - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Distortion	Distortion that has been mitigated or does not require mitigation.	Distortion that requires mitigation but has not been addressed.
Settlement	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits.
Scour	Exists within tolerable limits established for the bridge.	Exceeds tolerable limits, but is less than the critical limits established for the bridge.

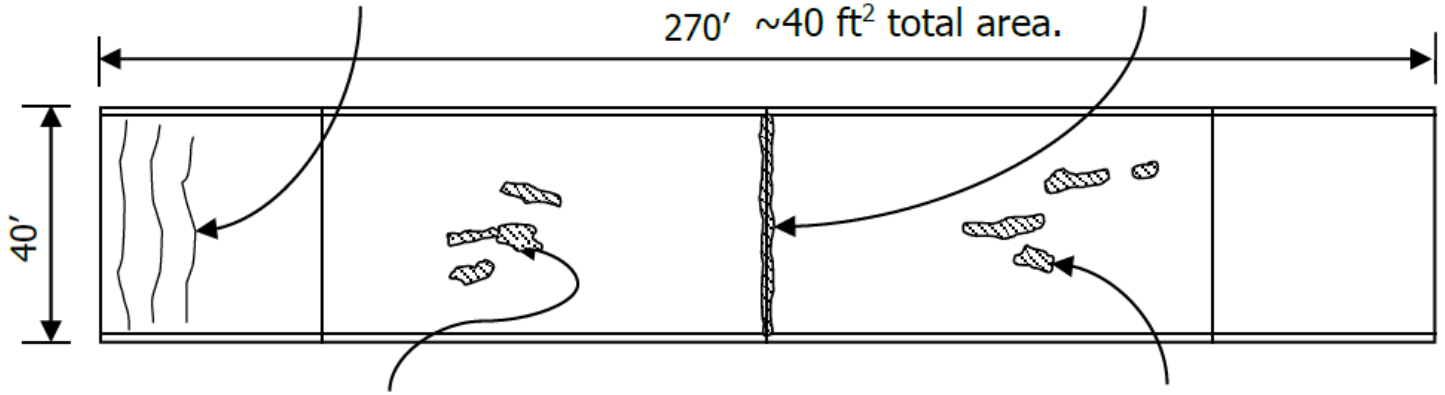
Examples Ratings in SNBI

Example – Deck Condition Rating

Reinforced concrete (RC) bridge deck approximately 270′ long x 40′ wide with the following noted defects.

Location 1: Full width transverse cracks, 0.010″ wide, spaced at 3′ to 5′ for full length of deck.

Location 2: Spalls >1″ deep along full length of expansion joint *(Figure 132~~Figure 132~~)*. ~40 ft^2 total area.



Location 3: Spalls up to 24″x18″ and >1″ deep with exposed rebar (no section loss) and patched areas that are unsound. ~100 ft^2 total area.

Location 4: Spalls up to 24″x12″ and >1″ deep with exposed rebar (no section loss) and patched areas that are unsound. ~130 ft^2 total area.

Figure 131. Deck plan view showing defects.

Examples Ratings in SNBI

Example Continued – Deck Condition Rating

Summary of Findings:

Location	Defect(s)	Severity	Extent
1	Cracking	Inherent	Throughout (widespread)
2	Spalling	Moderate	~ 40 ft^2 (isolated)
3	Spalling with exposed rebar, patched area that is unsound	Moderate	~ 100 ft^2 (isolated)
4	Spalling with exposed rebar, patched area that is unsound	Moderate	~ 130 ft^2 (isolated)

Results: There are several areas of isolated moderate defects that can best be characterized together as "some moderate defects." The rest of the deck surface has inherent defects. There are no defects visible on the underside of the deck, and none of the observed defects appear to indicate more significant problems. The deck is best characterized as having "some moderate defects." Report 5.

QA of Condition Ratings

- INDOT and FHWA do Quality Assurance Inspections
- Condition ratings must be within +/- 1
- Must be in same classification:
  - Good (7-9)
  - Fair (5-6)
  - Poor (0-4)

QA of Condition Ratings

Examples:

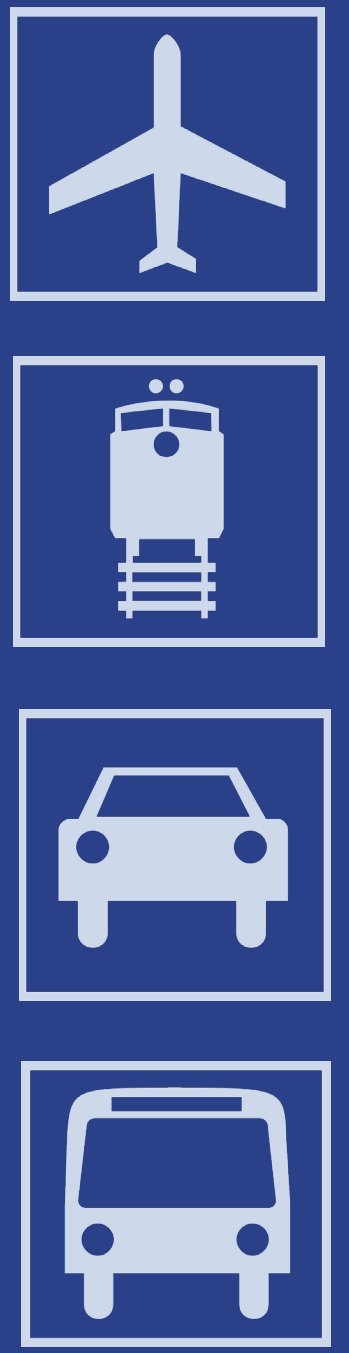
- Inspector rates a 5, QA reviewer rates a 6:
  - OK, within +/- 1, same ‘Fair’ classification

- Inspector rates a 5, QA reviewer rates a 4:
  - Not good, within +/- 1, but different condition classification

Rating Exercises

- Go through real-world examples of each condition item
- Assign condition ratings using SLIDO
- Questions will be addressed at the end

Condition Ratings



Deck

Two-span steel beam bridge with concrete deck built in 1972

Deck

Top of deck has latex-modified concrete overlay

Deck

Underside of deck with medium width cracking throughout

Deck

Exposed steel with minor section loss in bottom of north coping, span A

Deck

- What rating will you assign for the deck?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

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#INBridge

What rating will you assign for the deck?

5 FAIR - Some moderate defects; strength and performance is not affected.

67

6 SATISFACTORY - Widespread minor or isolated defects.

23

4 POOR - Widespread moderate or isolated major defects; strength and/or performance is affected

17

3 SERIOUS - Major defects; strength and/or performance is seriously affected. Often necessitates more frequent monitoring, load restrictions, etc.

0

Deck

- Defect 1 – Cracking
  - Bottom of deck with medium width cracks throughout
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Cracking	Unsealed medium width cracks or unsealed medium pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.

Deck

- Defect 2 – Spalling
  - Exposed steel with minor section loss in bottom of north coping, span A
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Deck

- Defect 3 – Exposed Steel
  - Exposed steel with minor section loss in bottom of north coping, span A
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Exposed Rebar	Present without measurable section loss.	Present with measurable section loss.

Deck

- Defect 1 – Cracking = **Widespread, Minor**
- Defect 2 – Spalling = **Isolated, Moderate**
- Defect 3 – Exposed Steel = **Isolated, Moderate**
- Total of all defects = **Isolated, Moderate**
- Is strength and/or performance affected? **=> No**

Deck

- What rating will you assign for the deck?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Superstructure

Single-span steel beam bridge

Superstructure

Beams with failing paint, surface rust, and minor pitting throughout

Superstructure

Beam 6 at west abutment with 50% of bottom flange rusted away and moderate section loss to the beam web

Superstructure

- What rating will you assign for the superstructure?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

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What rating will you assign for the superstructure?

4 POOR - Widespread moderate or isolated major defects; strength and/or performance is affected.

80

5 FAIR - Some moderate defects; strength and performance are not affected.

16

3 SERIOUS - Major defects; strength and/or performance is seriously affected. Typically necessitates more frequent monitoring, load restrictions, etc.

11

6 SATISFACTORY - Widespread minor or isolated moderate defects.

3

Superstructure

- Defect 1 – Corrosion
  - Beams with failing paint, surface rust, and minor pitting throughout
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 48. Steel - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Corrosion	Freckled rust. Corrosion has initiated.	Section loss is evident.

Superstructure

- Defect 2 – Corrosion
  - Beam 6 at west abutment with 50% of bottom flange rusted away and moderate section loss to the beam web.
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Major**

Table 48. Steel - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Corrosion	Freckled rust. Corrosion has initiated.	Section loss is evident.

Superstructure

- Defect 1 – Cracking = **Widespread, Minor**
- Defect 2 – Exposed Steel = **Isolated, Major**
- Total of all defects = **Isolated, Major**
- Is strength and/or performance affected? **=>Yes**

Superstructure

- What rating will you assign for the superstructure?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Substructure

Two-span bridge with concrete wall abutments and center open pile bent

Substructure

Typical minor honeycombing throughout

Substructure

Bent cap with spalling at one end and exposed steel with no section loss

Substructure

- What rating will you assign for the substructure?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

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What rating will you assign for the substructure?

6 SATISFACTORY - Widespread minor or isolated moderate defects.

69

5 FAIR - Some moderate defects; strength and performance are not affected.

31

4 POOR - Widespread moderate or isolated major defects; strength and/or performance is affected.

2

3 SERIOUS - Major defects; strength and/or performance is seriously affected. Typically necessitates more frequent monitoring, load restrictions, etc.

0

Substructure

- Defect 1 – Honeycombing
  - Typical minor honeycombing throughout
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Abrasion, Wear, Scaling	Exposed coarse aggregate, but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix.

Substructure

- Defect 2 – Spalling
  - Bent cap with spalling at one end and exposed steel with no section loss
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Substructure

- Defect 3 – Exposed steel
  - Bent cap with spalling at one end and exposed steel with no section loss
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Exposed Rebar	Present without measurable section loss.	Present with measurable section loss.

Substructure

- Defect 1 – Honeycombing = **Widespread, Minor**
- Defect 2 – Spalling = **Isolated, Moderate**
- Defect 3 - Exposed Steel = **Isolated, Minor**
- Total of all defects = **Isolated, Moderate**
- Is strength and/or performance affected? **=>No**

Substructure

- What rating will you assign for the substructure?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Culvert

Two-span corrugated steel pipe

Culvert

Typical view of pipe interior

Culvert

Moderate flaking rust at flow line throughout, no rust holes

Culvert

- What rating will you assign for the culvert?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.

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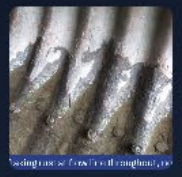

What rating will you assign for the culvert?

6 SATISFACTORY - Widespread minor or isolated moderate defects.

50

5 FAIR - Some moderate defects; strength and performance are not affected.

35

7 GOOD - Some minor defects.

21

4 POOR - Widespread moderate or isolated major defects; strength and/or performance is affected.

4

Culvert

- Defect 1 – Corrosion
  - Moderate flaking rust at flow line throughout. No rust holes.
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 48. Steel - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Corrosion	Freckled rust. Corrosion has initiated.	Section loss is evident.

Culvert

- Defect 1 – Corrosion = **Widespread, Moderate**
- Total of all defects = **Widespread, Moderate**
- Is strength and/or performance affected? =>**No**

Culvert

- What rating will you assign for the superstructure?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

The entire code description must be satisfied for the code to apply.

Channel

East (upstream) side of bridge - cattle fence with minor debris

Channel

Looking east (upstream), note skew

Channel

South abutment – channel impact at 20-30 degrees

Channel

North abutment - channel shifted away

Channel

- What rating will you assign for the channel?

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Moderate defects; bridge and approach roadway are not threatened.
4	POOR	Widespread moderate or isolated major defects; bridge and/or approach roadway is threatened.

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#INBridge

What rating will you assign for the channel?

6 SATISFACTORY - Widespread minor or isolated moderate defects. 43

5 FAIR - Moderate defects; bridge and approach roadway are not threatened. 40

7 GOOD - Some minor defects. 21

4 POOR - Widespread moderate or isolated major defects; bridge and/or approach roadway is threatened. 4

Channel

- Defect 1 – Alignment
  - Channel impacts south abutment at 20-30 degrees
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 54. Channel - defect severity guidance for component condition ratings.

Defect	Minor	Moderate	Major
Alignment	Flow angle of attack 15-30 degrees with respect to the bridge substructure, or 5-15 degrees with respect to wall piers.	Flow angle of attack 30-45 degrees with respect to the bridge substructure, or 15-30 degrees with respect to wall piers.	Flow angle of attack more than 45 degrees with respect to the bridge substructure, or more than 30 degrees with respect to wall piers.

Channel

- Defect 2 – Migration
  - Channel shifted towards south abutment, away from north abutment
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 54. Channel - defect severity guidance for component condition ratings.

Defect	Minor	Moderate	Major
Migration	Thalweg has moved from its baseline location, but movement has arrested or does not threaten the bridge or approach roadway.	Thalweg movement has not arrested and impacts embankment stability.	Thalweg movement has begun to undermine approach roadway.

Channel

- Defect 3 – Debris
  - Cattle fence across opening with minor debris
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 54. Channel - defect severity guidance for component condition ratings.

Defect	Minor	Moderate	Major
Debris	Restricts channel slightly, or is prone to build-up.	Large deposits exist and restrict the channel, causing increased water velocities, redirecting stream flow, or eroding banks.	Hydraulic opening mostly blocked, significantly redirecting stream flow or impacting waterway capacity.

Channel

- Defect 1 – Alignment = **Widespread, Minor**
- Defect 2 – Migration = **Widespread, Minor**
- Defect 3 – Debris = **Widespread, Minor**
- Total of all defects = **Widespread, Minor**
- Is bridge and/or approach roadway threatened? =>**No**

Channel

- What rating will you assign for the channel protection?

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Moderate defects; bridge and approach roadway are not threatened.
4	POOR	Widespread moderate or isolated major defects; bridge and/or approach roadway is threatened.

Channel Protection

North abutment with scattered chunks of concrete and some riprap

Channel Protection

South abutment with scattered chunks of concrete and some riprap

Channel Protection

- What rating will you assign for the channel protection?

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; performance of the channel protection is not affected.
4	POOR	Widespread moderate or isolated major defects; performance of channel protection is affected.

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What rating will you assign for the channel protection?

5 FAIR - Some moderate defects; performance of the channel protection is not affected.

37

6 SATISFACTORY - Widespread minor or isolated moderate defects.

31

7 GOOD - Some minor defects.

13

4 POOR - Widespread moderate or isolated major defects; performance of channel protection is affected.

9

Channel Protection

- Defect 1 – Damage to protection
  - Abutments with scattered chunks of concrete and some riprap
  - Extent = Isolated, Some, or Widespread **=> Some**
  - Severity = Minor, Moderate, or Major **=> Moderate**

No defect table in Appendix C for channel protection.

Consider erosion, scour, damage, and material defects when rating this item.

Channel Protection

- Defect 1 – Damage to protection = **Some, Moderate**
- Total of all defects = **Some, Moderate**
- Is channel protection performance affected? =>**No**

Channel Protection

- What rating will you assign for the channel protection?

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; performance of the channel protection is not affected.
4	POOR	Widespread moderate or isolated major defects; performance of channel protection is affected.

Scour Condition

Three-sided box culvert on spread footings on sandy/gravely soil

Scour Condition

Both footings exposed on top and about 1 ft on sides

Scour Condition

Some riprap in place. Probing 1 ft down didn’t locate bottom of footing
No plans available

Scour Condition

- What rating will you assign for the scour condition?

Code	Condition Description
7	Some minor scour.
6	Widespread minor or isolated moderate scour.
5	Moderate scour; strength and stability of the bridge are not affected.
4	Widespread moderate or isolated major scour; strength and/or stability of the bridge is affected.

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What rating will you assign for the scour condition?

5 - Moderate scour; strength and stability of the bridge are not affected.

52

6 - Widespread minor or isolated moderate scour.

30

4 - Widespread moderate or isolated major scour; strength and/or stability of the bridge is affected.

11

7 - Some minor scour.

5

Scour Condition

- Defect 1 – Exposed footings
  - Both footings exposed on top and about 1 ft on sides
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 46. All Materials - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Scour	Exists within tolerable limits established for the bridge.	Exceeds tolerable limits, but is less than the critical limits established for the bridge.

Scour Condition

- Defect 1 – Exposed footings = **Widespread, Minor**
- Total of all defects = **Widespread, Minor**
- Is strength and/or stability affected? =>**No**

Scour Condition

- What rating will you assign for the scour condition?

Code	Condition Description
7	Some minor scour.
6	Widespread minor or isolated moderate scour.
5	Moderate scour; strength and stability of the bridge are not affected.
4	Widespread moderate or isolated major scour; strength and/or stability of the bridge is affected.

Joints

Joint filled with debris, no movement restriction, no leaking

Joints

- What rating will you assign for the joints?

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects.
4	POOR	Widespread moderate or isolated major defects.

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What rating will you assign for the joints?

7 GOOD - Some minor defects.

56

6 SATISFACTORY - Widespread minor or isolated moderate defects.

39

5 FAIR - Some moderate defects.

2

4 POOR - Widespread moderate or isolated major defects.

0

Joints

- Defect 1 – Debris Impaction
  - Joint filled with debris, no movement restriction, no leaking
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 53. Bridge Joints - defect severity guidance for component condition ratings.

Defect	Minor	Moderate	Major
Debris Impaction	Partially filled with hard-packed material, but still allowing free movement.	Completely filled; impacts joint movement.	Completely filled; prevents joint movement.

Joints

- Defect 1 – Debris Impaction = **Widespread, Minor**
- Total of all defects = **Widespread, Minor**
- Is strength and/or performance affected?
  - Not part of condition description for joints

Joints

- What rating will you assign for the joints?

Code	Condition	Description
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects.
4	POOR	Widespread moderate or isolated major defects.

Bearings

Surface rust to top plate and anchor bolts at 4 of 20 bearings

Bearings

- What rating will you assign for the bearings?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.

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#INBridge

What rating will you assign for the bearings?

7 GOOD - Some minor defects. 67

6 SATISFACTORY - Widespread minor or isolated moderate defects. 20

8 VERY GOOD - Some inherent defects. 6

5 FAIR - Some moderate defects; strength and performance are not affected. 3

Bearings

- Defect 1 – Corrosion
  - Surface rust to top plate and anchor bolts at 4 of 20 bearings
  - Extent = Isolated, Some, or Widespread **=> Some**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 52. Bearings - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Corrosion	Freckled rust. Corrosion has initiated.	Section loss is evident.

Bearings

- Defect 1 – Corrosion = **Some, Minor**
- Total of all defects = **Some, Minor**
- Is strength and/or performance affected? =>**No**

Bearings

- What rating will you assign for the bearings?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.

Bridge Railing

Medium width cracks throughout with small area of spalling

Bridge Railing

- What rating will you assign for the railing?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

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#INBridge

What rating would you assign for the bridge railing?

6 SATISFACTORY - Widespread minor or isolated moderate defects.

57

5 FAIR - Some moderate defects; strength and performance of the component are not affected.

37

4 POOR - Widespread moderate or isolated major defects; strength and/or performance of the component is affected.

6

3 SERIOUS - Major defects; strength and/or performance of the component is seriously affected.

0

Bridge Railing

- Defect 1 – Cracking
  - Medium width cracks throughout
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Cracking	Unsealed medium width cracks or unsealed medium pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.

Bridge Railing

- Defect 2 – Spalling
  - Small area of spalling
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Bridge Railing

- Defect 1 - Cracking - **Widespread, Minor**
- Defect 2 - Spalling - **Isolated, Minor**
- Total of all defects = **Widespread, Minor**
- Is strength and/or performance affected? **=> No**

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Bridge Transition

Large areas of spalling & delamination and
wide & medium width cracks in one of the four transitions

Bridge Transition

- What rating will you assign for the bridge railing transition?

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

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#INBridge

What rating would you assign for the bridge railing transition?

4 POOR - Widespread moderate or isolated major defects; strength and/or performance of the component is affected.

70

5 FAIR - Some moderate defects; strength and performance of the component are not affected.

14

3 SERIOUS - Major defects; strength and/or performance of the component is seriously affected.

14

6 SATISFACTORY - Widespread minor or isolated moderate defects.

2

Bridge Transition

- Defect 1 – Spalling
  - Large areas of spalling & delamination in one of the four transitions
  - Extent = Isolated, Some, or Widespread **=> Some**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Bridge Transition

- Defect 2 – Cracking
  - Wide & medium width cracks through length of railing in one of four transitions
  - Extent = Isolated, Some, or Widespread **=> Some**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Cracking	Unsealed medium width cracks or unsealed medium pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.

Bridge Transition

- Defect 1 – Spalling - **Some, Moderate**
- Defect 2 – Cracking - **Some, Moderate**
- Total of all defects = **Widespread, Moderate**
- Is strength and/or performance affected? => **Yes**

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

Bridge Railing & Transition | Test Rating

- SNBI 2.3 Roadside Hardware
  - B.RH.01 (Railing) & B.RH.02 (Transition)
- INDOT Field Guide: Bridge Railings & Transitions (DRAFT)

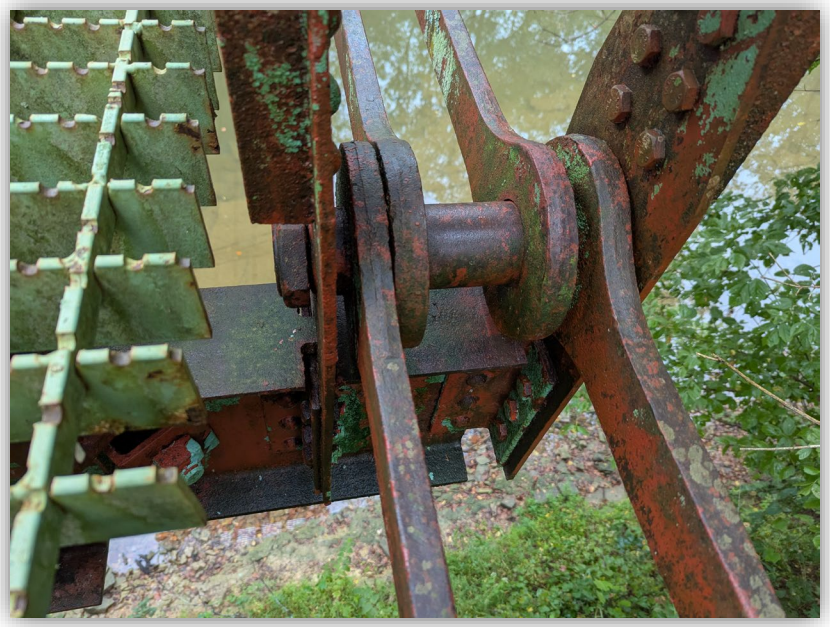
NSTM & UW Condition Ratings

- Overall rating of NSTM & UW components using Table 20

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
N	NOT APPLICABLE	Component does not exist.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.
1	IMMINENT FAILURE	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.

NSTM Condition Rating



100 Total NSTMs Inspected {Comments include peeling paint, surface rust, pitting, up to 15% section loss, no cracks}

- 20 NSTMs Rated **7** for **Some Minor Defects**
- 35 NSTMs Rated **6** for **Widespread Minor Defects**
- 45 NSTMs Rated **5** for **Some Moderate Defects**

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#INBridge

What overall rating would you assign for NSTM?

5 FAIR - Some moderate defects; strength and performance of the component are not affected.

68

6 SATISFACTORY - Widespread minor or isolated moderate defects.

14

7 GOOD - Some minor defects.

2

4 POOR - Widespread Moderate or isolated major defects; strength and/or performance of the component is affected.

2

NSTM Condition Ratings

100 Total NSTMs Inspected

- 20 NSTMs Rated **7** for **Some Minor Defects**
- 35 NSTMs Rated **6** for **Widespread Minor Defects**
- 45 NSTMs Rated **5** for **Some Moderate Defects**

Extent: **=> Widespread**

Severity: **=> Moderate**

Is strength and/or performance affected?

=>No

NSTM Condition Ratings

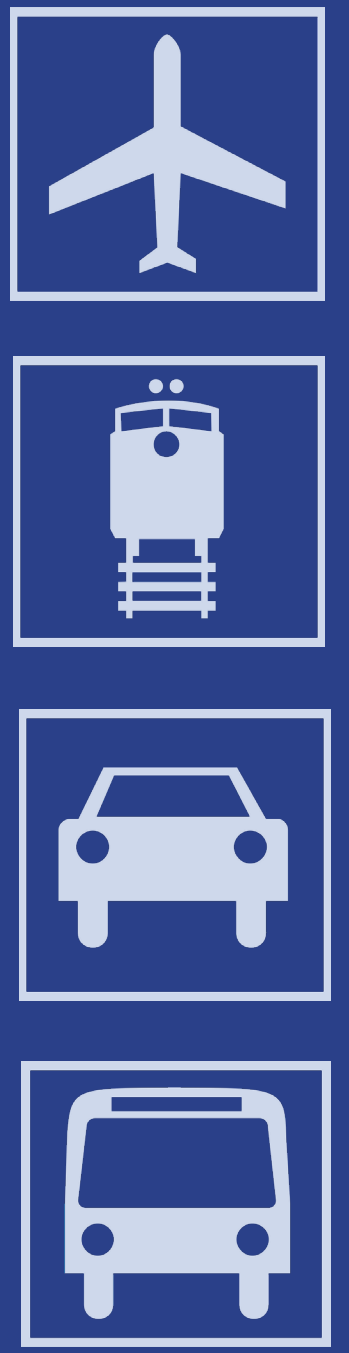
Is strength and/or performance affected?
=>**No**

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
N	NOT APPLICABLE	Component does not exist.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.
1	IMMINENT FAILURE	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.

The entire code description must be satisfied for the code to apply.

Agency Defined Condition Ratings



Paint

Surface rusting on bottom of flanges

Paint

Typical corrosion at all beam ends, measurable section loss

Paint

- What rating will you assign for the paint?

INDOT Agency Defined Condition Rating Descriptions for Paint

9. EXCELLENT CONDITION – New
8. VERY GOOD CONDITION – Very minor surface dulling
7. GOOD CONDITION – Minor chalking and surface dulling
6. SATISFACTORY CONDITION – Minor areas of rusting and chalking
5. FAIR CONDITION – Areas of light rust and minor peeling
4. POOR CONDITION – Larger areas of rust and peeling
3. SERIOUS CONDITION – Greater than 40% loss of paint, large areas of section loss
2. CRITICAL CONDITION – Large areas of section loss, greater than 60% loss of paint
1. FAILED PAINT SYSTEM – Large areas of section loss, greater than 75% loss of paint
0. FAILED CONDITION – No paint remaining

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#INBridge

What rating would you assign for the paint?

4 POOR - Larger areas of rust and peeling

40

5 FAIR - Areas of light rust and minor peeling

34

6 SATISFACTORY - Minor areas of rusting and chalking

15

3 SERIOUS - Greater than 40% loss of paint, large areas of section loss

3

Paint

- Defect 1 – Surface rusting on bottom flanges & heavy corrosion at beam ends
- Defect 2 – Up to 15% section loss at beam ends
- Paint remaining = **85%**

★This is a three-span bridge and only beam ends at abutments are showing heavy corrosion.

Paint

INDOT Agency Defined Condition Rating Descriptions for Paint

9. EXCELLENT CONDITION – New
8. VERY GOOD CONDITION – Very minor surface dulling
7. GOOD CONDITION – Minor chalking and surface dulling
6. SATISFACTORY CONDITION – Minor areas of rusting and chalking
5. FAIR CONDITION – Areas of light rust and minor peeling
4. POOR CONDITION – Larger areas of rust and peeling
3. SERIOUS CONDITION – Greater than 40% loss of paint, large areas of section loss
2. CRITICAL CONDITION – Large areas of section loss, greater than 60% loss of paint
1. FAILED PAINT SYSTEM – Large areas of section loss, greater than 75% loss of paint
0. FAILED CONDITION – No paint remaining

Approach Slab

Sound patch left lane (12SF) in east approach
Spalling & chipping at construction joints & bridge joint in both approaches

Approach Slab

- What rating will you assign for the approach slab?

(G) GOOD
Ratings 9 - 7

(F) FAIR
Ratings 6 - 5

(P) POOR
Ratings 4 - 0

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
N	NOT APPLICABLE	Component does not exist.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.
1	IMMINENT FAILURE	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.

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#INBridge

What rating would you assign for the approach slab?

(F) Fair

84

(P) Poor

9

(G) Good

3

Approach Slab

- Defect 1 – Patch Spall
  - Sound patch in left lane at bridge joint (12SF) in east approach
  - Extent = Isolated, Some, or Widespread **=> Isolated**
  - Severity = Minor, Moderate, or Major **=> Minor**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Approach Slab

- Defect 2 – Spalling
  - Spalling & chipping at construction joints & bridge joint in both approaches
  - Extent = Isolated, Some, or Widespread **=> Widespread**
  - Severity = Minor, Moderate, or Major **=> Moderate**

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Approach Slab

- Defect 1 – Patch Spall - **Isolated, Minor**
- Defect 2 – Spalling - **Widespread, Moderate**
- Total of all defects = **Widespread, Moderate**
- Is strength and/or performance affected? **=> No**

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.

(F) FAIR ←

The entire code description must be satisfied for the code to apply.

Wearing Surface

- INDOT BIM Part 7 – Wearing Surfaces
- Condition Rating Guidance for the following:
  - Structural Decks with Sacrificial Thickness Cast Monolithically
  - Rigid PCC Overlay
  - **Semi-Rigid Epoxy Overlay**
  - Bituminous Overlay

Wearing Surface

Widespread peeling, nearly 50% of bare deck exposed

Wearing Surface

- What rating will you assign for the approach slab?
  - INDOT BIM Part 7 – Semi-Rigid Epoxy Overlay Condition Ratings

Code	Description
N	NOT APPLICABLE – Code N when Item 58 is also coded N.
9	EXCELLENT CONDITION – no visible defects or visible wearing of the friction surface aggregate.
8	VERY GOOD CONDITION – minor intermittent wearing of the friction surface aggregate across less than 5% total surface area within the travel lanes.
7	GOOD CONDITION – minor wearing, glazing, or polishing of the friction surface aggregate across less than 40% total surface area within the travel lanes.
6	SATISFACTORY CONDITION – deep wearing, glazing, or polishing of the friction surface aggregate across more that 40% total surface area. Less than 5% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling. For this condition rating or lower, areas of full thickness material loss that are visible within 6” of bridge deck joints shall not be included within these condition rating parameters.
5	FAIR CONDITION – Greater than 5% and less than 10% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling.
4	POOR CONDITION – Greater than 10% and less than 15% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling.
3	SERIOUS CONDITION – Greater than 15% of the total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling. The wearing surface is no longer effective.

Condition ratings less than 3 shall not be coded.

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#INBridge

What rating would you assign for the wearing surface?

3 (Serious Condition) Greater than 15% of the total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling. The wearing surface is no longer effective

84

4 (Poor Condition) Greater than 10% and less than 15% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling

9

5 (Fair Condition) Greater than 5% and less than 10% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling

0

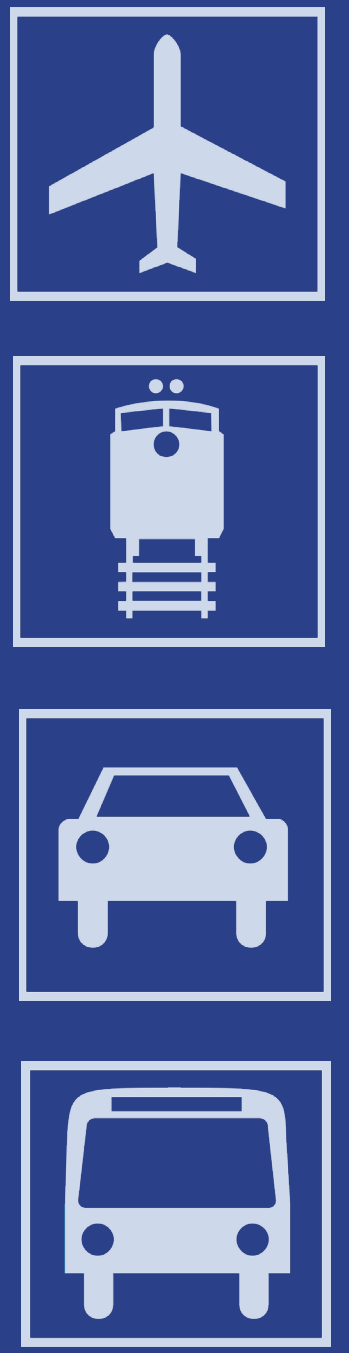
Wearing Surface

- Defect 1 – Widespread peeling
  - 50% bare deck exposed

Code	Description
N	NOT APPLICABLE – Code N when Item 58 is also coded N.
9	EXCELLENT CONDITION – no visible defects or visible wearing of the friction surface aggregate.
8	VERY GOOD CONDITION – minor intermittent wearing of the friction surface aggregate across less than 5% total surface area within the travel lanes.
7	GOOD CONDITION – minor wearing, glazing, or polishing of the friction surface aggregate across less than 40% total surface area within the travel lanes.
6	SATISFACTORY CONDITION – deep wearing, glazing, or polishing of the friction surface aggregate across more that 40% total surface area. Less than 5% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling. For this condition rating or lower, areas of full thickness material loss that are visible within 6” of bridge deck joints shall not be included within these condition rating parameters.
5	FAIR CONDITION – Greater than 5% and less than 10% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling.
4	POOR CONDITION – Greater than 10% and less than 15% total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling.
3	SERIOUS CONDITION – Greater than 15% of the total surface area exhibiting areas of full thickness wearing down to bare deck, surface voids, or peeling. The wearing surface is no longer effective.

Condition ratings less than 3 shall not be coded.

Appraisal Ratings



Roadway Alignment

- Good / Fair / Poor Rating

➢Use code **(G) Good** when the speed is **no different** at the bridge than the rest of the highway segment that crosses the bridge

➢Use code **(F) Fair** when the speed is **noticeably different** at the bridge than the rest of the highway segment that crosses the bridge

➢Use code **(P) Poor** when the speed is **substantially different** at the bridge than the rest of the highway segment that crosses the bridge

Overtopping

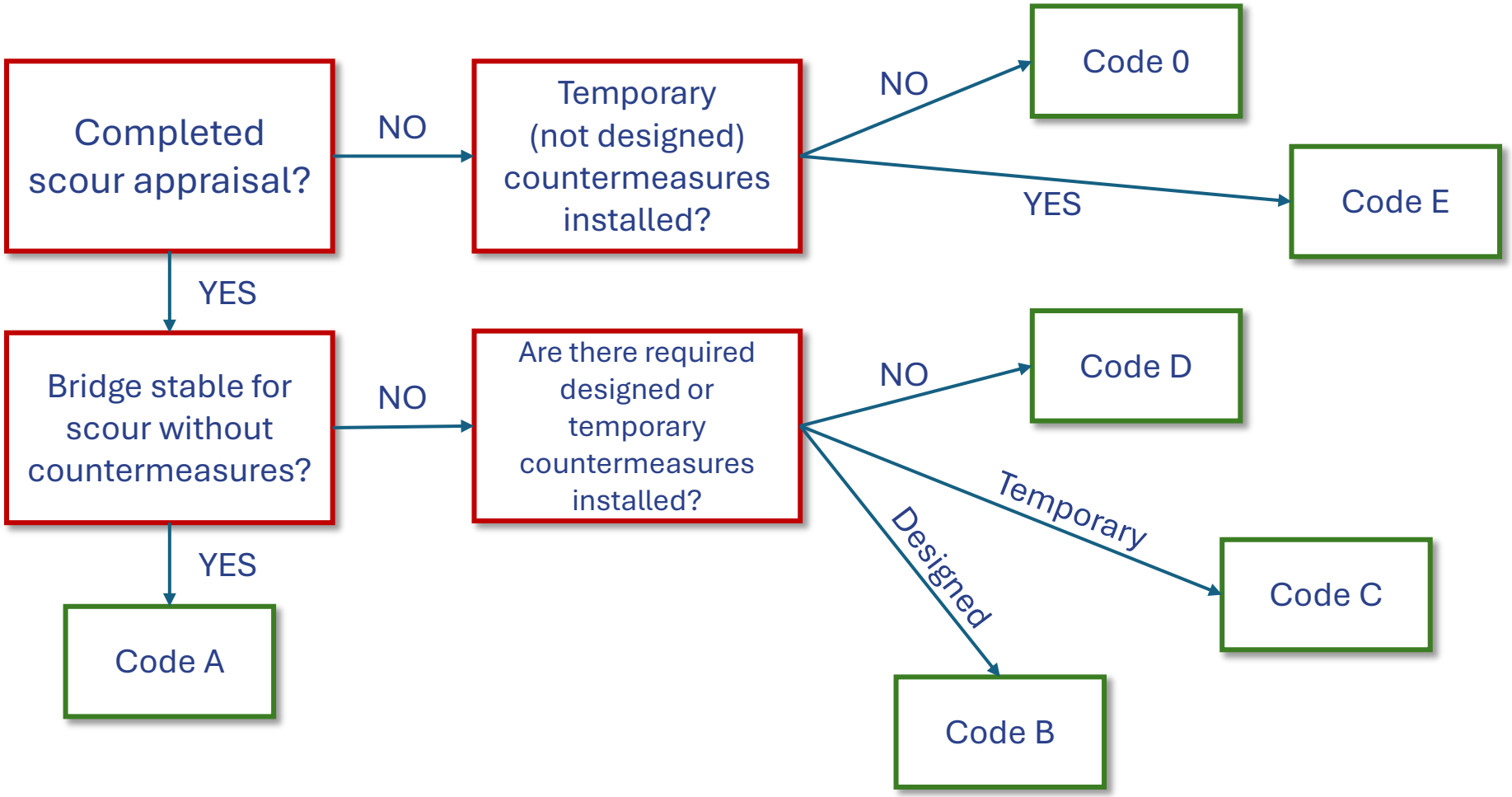
- Use historical records, hydraulic studies, site indicators, etc.
- Hydraulic design information can be used

Code	Description
0	Never
1	Remote – once every 100 years or less frequently
2	Very low – once every 51 to 99 years
3	Low – once every 26 to 50 years
4	Moderate – once every 11 to 25 years
5	High – once every 3 to 10 years
6	Very High – once every 2 years or more frequently

Scour Vulnerability

Code	Description
0	Scour appraisal has not been completed.
A	Scour appraisal completed. Bridge determined to be stable for scour.
B	Scour appraisal completed. Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures.
C	Scour appraisal completed. Bridge could become unstable for scour. Temporary (not designed) countermeasure installed to mitigate scour. Bridge is scour critical.
D	Scour appraisal completed. Bridge is, or may become, unstable for scour. Bridge is scour critical.
E	Scour appraisal has not been completed. Temporary (not designed) countermeasure installed to mitigate scour.
U	Scour appraisal has not been completed due to unknown foundations.

Scour Vulnerability



Scour POA

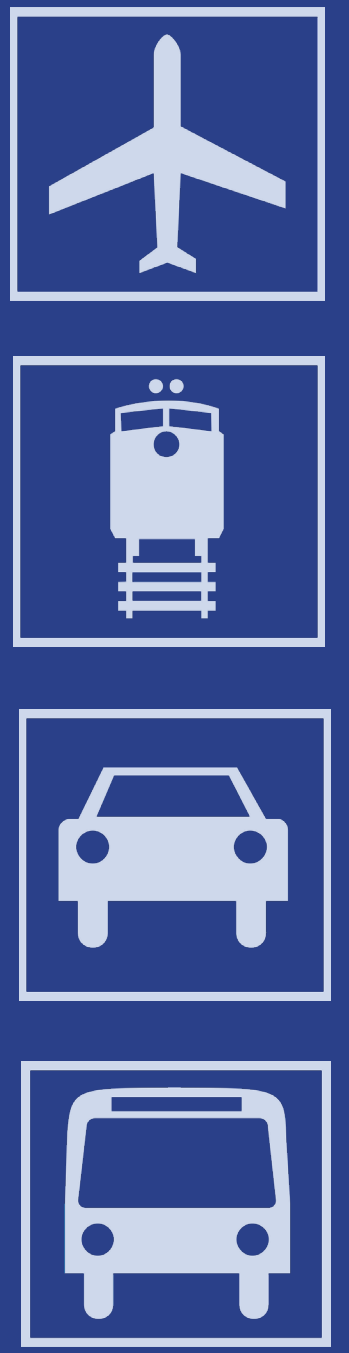
- Is it required? Is it implemented?

Code	Description
0	A scour POA is not required
N	A scour POA is required, but not implemented
Y	A scour POA is required and implemented

Seismic Vulnerability

- Code 0
- More guidance to come ☺

Agency Defined Appraisal Ratings



Bats & Birds

- Can bats or guano be seen or heard?
  - Yes or No
- Are cliff swallows or nests present?
  - Yes or No

Bridge Inspections Start to Finish: Condition Ratings

Jonathan Olson, PE – Butler, Fairman & Seufert
Cristy Burlage, PE – INDOT

THE END