

SNBI State Staff Training

New Inventory Items

David Bohnsack

BOS Structures Maintenance Chief

SNBI Training - Pilot
Madison, WI

March 13, 2023

New SNBI items to code by State Inspectors only

March 2023 – data collection

Item ID Data Item

~~B.IE.02~~ Inspection Begin Date

~~B.IE.03~~ Inspection Completion date

B.IR.02 Fatigue Details

B.SP.03 Number of Beam Lines

~~B.SP.04~~ Span Material

~~B.SP.06~~ Span Type

B.SP.13 Deck Stay-in-Place Forms

B.C.05 Bridge Railing Condition Rating

B.C.06 Bridge Railing Transitions Condition Rating

B.C.07 Bridge Bearings Condition Rating

B.C.08 Bridge Joints Condition Rating

B.C.10 Channel Protection Condition Rating

B.C.11 Scour Condition Rating

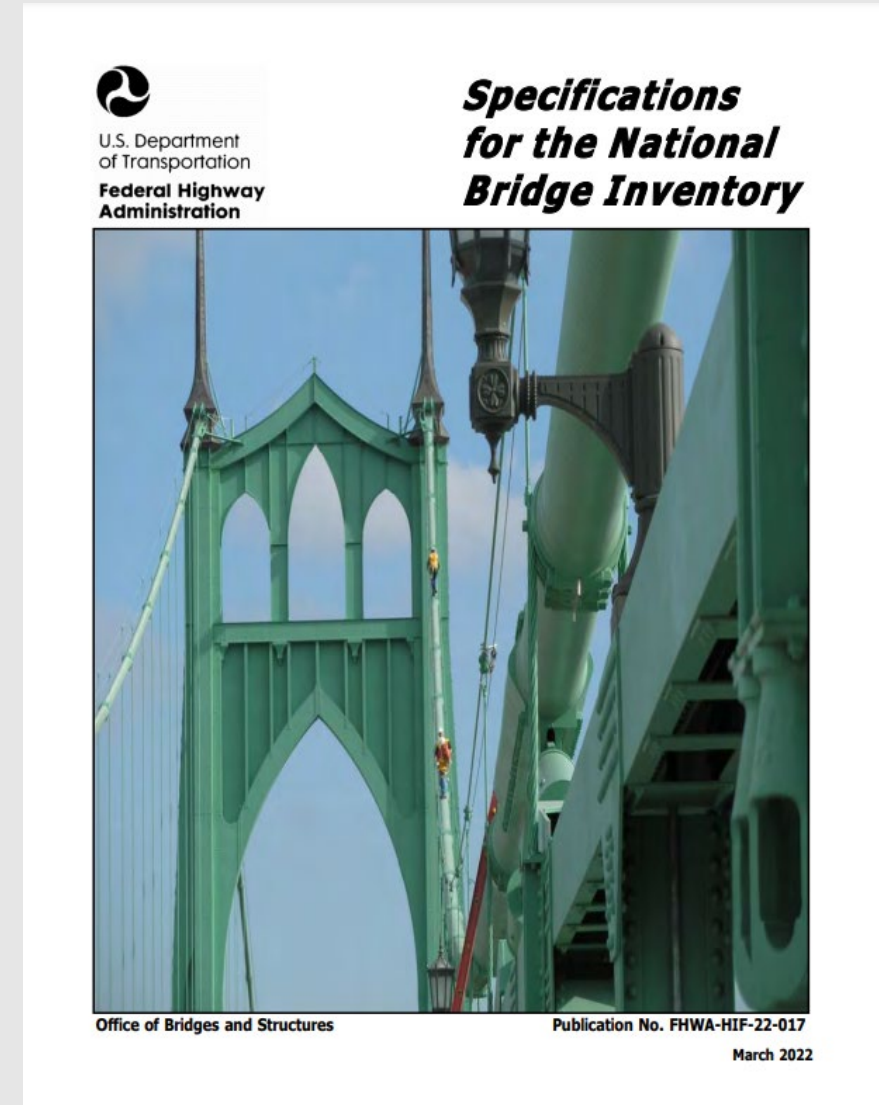
B.C.14 NSTM Inspection Condition

B.C.15 Underwater Inspection Condition



Claims and Disclaimers

- The information provided today was developed using the Specifications for the National Bridge Inventory (SNBI) - Publication No. FHWA-HIF-22-017 which includes tables and examples.
- Link to the publication www.fhwa.dot.gov/bridge/snbi/snbi_march_2022_publication.pdf
- FHWA has not provided additional guidance regarding interpretation of this publication.
- This is not an NHI course and it is not being taught by a certified instructor.
- There are bridges that are difficult to determine the proper item code. For those, bring them up for discussion. We will discuss and determine the best course.



- **Format** – Items grouped by section and subsection
 - Section: Bridge Material and Type
 - Subsection:
 - Span Material and Type
 - Examples
 - B.SP.01 Span Configuration Designation
 - B.SP.02 Number of Spans
 - Etc.
 - Substructure Material & Type
 - B.SB.01 Substructure Configuration Designation
 - B.SB.02 Number of Substructure Units
 - Etc.
 - Roadside Hardware
 - B.RH.01 Bridge Railing
 - B.RH.02 Transition
- **Data Items** – Information provided includes the following
 - Specifications
 - Commentary
 - Examples
 - Tables (when needed)
- **Appendix C** (pages 331-335) – Component Condition Rating Guide

A collection of tables and commentary to help determine the appropriate condition rating code – The tables are provide in the field guide document.

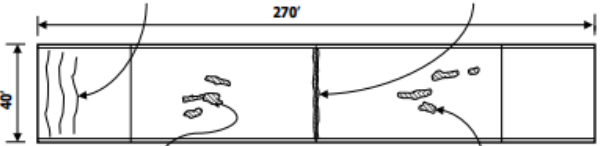
7.1 – COMPONENT CONDITION RATINGS

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). ~40 ft² 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 ft² 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 ft² total area.

Figure 131. Deck plan view showing defects.




Figure 132. Deck spalling along joint. Location 2.




Figure 133. Typical deck spall with exposed rebar. Locations 3 and 4.

March 2022 242 [TOC Condensed](#) [TOC Expanded](#)

Fatigue Details

Item B.IR.02

Report whether the bridge has AASHTO fatigue category E or E' details using one of the following codes.

<u>Code</u>	<u>Description</u>
N	No E/E' details
Y	E/E' details are present

Refer to Table 6.6.1.2.3-1 Detail Categories for Load-Induced Fatigue in AASHTO LRFD Bridge Design Specification or Figure 6.4.43 in the BIRM.

Do not report this item for bridges that do not have steel members as the principal superstructure or substructure material.

Fatigue Details E/E'

Bridge Inspector's Reference Manual

Publication No. FHWA NHI 12-049
December, 2012

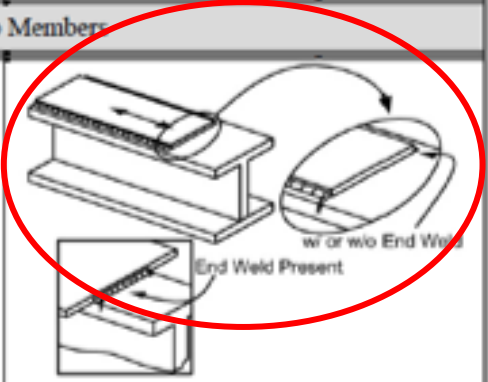
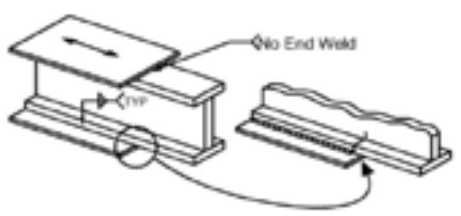


Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 3—Welded Joints Joining Components of Built-Up Members					
<p>3.5 Base metal at the termination of partial length welded cover plates having square or tapered ends that are narrower than the flange, with or without welds across the ends, or cover plates that are wider than the flange with welds across the ends:</p> <p>Flange thickness ≤ 0.8 in. Flange thickness > 0.8 in.</p>	<p>E E'</p>	<p>11×10^8 3.9×10^8</p>	<p>4.5 2.6</p>	<p>In the flange at the toe of the end weld or in the flange at the termination of the longitudinal weld or in the edge of the flange with wide cover plates</p>	<p>w/ or w/o End Weld End Weld Present</p>
<p>3.7 Base metal at the termination of partial length welded cover plates that are wider than the flange and without welds across the ends.</p>	E'	3.9×10^8	2.6	In the edge of the flange at the end of the cover plate weld	<p>No End Weld TYP</p>



Example: Fatigue Details

E/E' Fatigue Details (Page 1 of 3)

Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 3—Welded Joints Joining Components of Built-Up Members					
3.5 Base metal at the termination of partial length welded cover plates having square or tapered ends that are narrower than the flange, with or without welds across the ends, or cover plates that are wider than the flange with welds across the ends:				In the flange at the toe of the end weld or in the flange at the termination of the longitudinal weld or in the edge of the flange with wide cover plates	
Flange thickness ≤ 0.8 in.	E	11×10^8	4.5		
Flange thickness > 0.8 in.	E'	3.9×10^8	2.6		
3.7 Base metal at the termination of partial length welded cover plates that are wider than the flange and without welds across the ends.	E'	3.9×10^8	2.6	In the edge of the flange at the end of the cover plate weld	



Steel girders have a welded bottom flange cover plate with a transversely welded end.

Fatigue Detail – Section 3 Subsection 3.5

Results: B.IR.02 = Y

Number of Beam Lines

Item B.SP.03

Report the number of beam lines. Principal beam lines include the main longitudinal load-carrying members of the superstructure such as beams, girders, trusses, and arches or arch ribs, but do not include stringers of a floor beam system or spandrel walls of an arch.

Code = Number of principle beam lines, main longitudinal load carrying members.
(ie. Beams, girders, trusses, aches/arch ribs)

Code 1 = Slab, box culvert, concrete and masonry arch, or rigid frame bridges

Code 0 = Pipe culvert

Use the average number of beam lines for bridges with variable number of beam lines within a span configuration, rounded down.

Some bridges will have a different code for each span.



Examples: Number of Beam Lines

Item B.SP.03

<u>Example Bridge</u>	<u>Code</u>
• Timber multi-beam bridge with 12 beams	12
• Steel through truss bridge with 2 trusses and ten stringers	2
• Flared 3-span tee-beam bridge with 12 beams at the south end and 17 beams at the north end	14 $[(17+12)/2]$
• Steel arch bridge with 3 arch ribs	3
• Concrete arch bridge with masonry spandrel walls	1
• 4-barrel corrugated steel pipe culvert, modified by adding four concrete culvert pipes (2 data sets)	0 for steep pipe 0 for concrete pipes
• 3-sided frame culvert, lengthened by adding a 4-sided box culvert to the end (2 data sets)	1 for 3-sided frame 1 for 4-sided frame

Deck Stay-In-Place Forms

Item B.SP.13

Report the type of deck stay-in-place forms for the span configuration that stay in place after construction. When there is a combination of stay-in-place form types, code the predominant type based on the deck area.

<u>Code</u>	<u>Description</u>
0	None
C01	Concrete – reinforced
C02	Concrete – prestressed
F01	FRP composite
M01	Metal
T01	Timber
X	Other

Code C01 – when a precast reinforced concrete panel is used with a CIP reinforced concrete placement on top.

Code C02 - when a precast prestressed concrete panel is used with a CIP reinforced concrete placement on top.

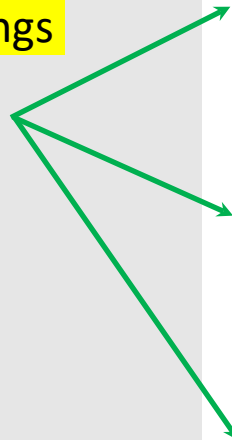
Do not report when the bridge is under fill - buried bridges (ie. pipe and box culverts, others).

Component Condition Ratings

SNBI Subsection 7.1

<u>Item ID</u>	<u>Data Item</u>
B.C.01	<u>Deck Condition Rating</u>
B.C.02	<u>Superstructure Condition Rating</u>
B.C.03	<u>Substructure Condition Rating</u>
B.C.04	<u>Culvert Condition Rating</u>
B.C.05	<u>Bridge Railing Condition Rating</u>
B.C.06	<u>Bridge Railing Transitions Condition Rating</u>
B.C.07	<u>Bridge Bearings Condition Rating</u>
B.C.08	<u>Bridge Joints Condition Rating</u>
B.C.09	<u>Channel Condition Rating</u>
B.C.10	<u>Channel Protection Condition Rating</u>
B.C.11	<u>Scour Condition Rating</u>
B.C.12	<u>Bridge Condition Classification</u> Automatically
B.C.13	<u>Lowest Condition Rating Code</u> determined
B.C.14	<u>NSTM Inspection Condition</u>
B.C.15	<u>Underwater Inspection Condition</u>

New condition ratings to determine and gather by State inspectors in 2023



Component Condition Rating Codes

Code	Condition	SNBI Description	Old NBI Description
N	Not Applicable	Component does not exist	Not Applicable
9	Excellent	Isolated inherent defects	Excellent condition.
8	Very Good	Some inherent defects	Very Good condition. - no problems noted.
7	Good	Some minor defects	Good condition - some minor problems
6	Satisfactory	Widespread minor or isolated moderate defects	Satisfactory condition - structural elements show some minor deterioration.
5	Fair	Some moderate defects; strength and performance of the component are not affected.	Fair condition - all primary structural elements are sound but may have minor section loss, cracking, spalling, or scour.
4	Poor	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.	Poor condition - Advanced section loss, deterioration, spalling or scour.
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.	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	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.	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 structural support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	Imminent Failure	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.	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	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.	Failed condition - Out of service. Beyond corrective action.

Defect Descriptions

Density of Defects

Isolated – occur in one or a few concentrated locations.

Widespread - present in many separate areas of the component.

Some - more than isolated and less than widespread

Severity of Defects

Inherent Defect CS1 defect (WisDOT guidance)

- Material defects or workmanship/normal construction defects that are not attributed to deterioration.

Minor CS2 defect (WisDOT guidance)

- One where damage or deterioration has initiated but is not yet considered significant.

Moderate CS3 defect (WisDOT guidance)

- One where damage or deterioration are significant, but the strength and performance of the component are not affected.

Major CS4 defect (WisDOT guidance)

- One where damage or deterioration affect the strength and/or performance of the component, as determined by a structural review and/or hydraulic review.
- For joints, bearings, railings, and railing transitions, a major defects prevents the component from functioning as intended.

Component Condition Rating Guidance

All Materials – defect severity guidance for component condition ratings

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Distortion	Distortion that has been mitigated or does not require mitigation.	Distortion that requires mitigation but has not been addressed.
Settlement (1)	Exists within tolerable limits or arrested with no observed structural distress.	Exceeds tolerable limits. (2)
Scour (3)	Exists within tolerable limits established for the bridge.	Exceeds tolerable limits, but is less than the critical limits established for the bridge.

- (1) The Settlement defect applies to substructure components, pipes, and other components that are directly affected by settlement. Indirect effects of settlement on superstructure and deck components are evaluated by the resulting defects.
- (2) Tolerable settlement can be considered as uniform or differential settlement that is not causing other bridge defects or increased impact on the bridge.
- (3) The critical limit for scour is the scour depth at which the bridge becomes unstable.

Component Condition Rating Guidance

Table 47: Concrete (modified)

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.
Exposed Rebar	Present without measurable section loss.	Present with measurable section loss.
Exposed Prestressing	Present without section loss.	Present with section loss.
Cracking	Unsealed narrow width cracks or unsealed narrow pattern (map) cracking.	Medium cracks or extensive pattern (map) cracking.
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.
Efflorescence, Rust Staining	Surface white or leaching with little or no build-up. No rust staining present.	Rust staining or heavy build-up of efflorescence.

Component Condition Rating Guidance

Concrete Delamination, Spalling, Patched Area

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.

Spall defect descriptions:

- Small spall: $\leq 1''$ deep or $\leq 6''$ in diameter.
- Large spall: $> 1''$ deep or $> 6''$ in diameter.

Component Condition Rating Guidance

Concrete Cracking

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Cracking	Unsealed narrow width cracks or unsealed narrow pattern (map) cracking.	Medium cracks or extensive pattern (map) cracking.

The concrete crack defect description definitions describe generalized distress, but the width, spacing, location, orientation, and structural or non-structural nature of the cracking should also be considered.

Crack defect descriptions:

- **Hairline** (SNBI-Insignificant) – crack width < 0.004” (prestressed) or 0.012” (reinforced), or sealed narrow (SNBI-medium) width crack.
- **Narrow** (SNBI-Medium) – crack width ranging from 0.004 – 0.009” (prestressed) or 0.012 to 0.05” (reinforced).
- **Medium** (SNBI-Wide) – crack width > 0.009” (prestressed) or 0.05” (reinforced).
- **Moderate** (SNBI Medium) pattern (map) – crack spacing of 1 ft. to 3 ft.
- **Extensive** (SNBI-Heavy) pattern (map) – crack spacing < 1 ft.

Component Condition Rating Guidance

Table 48: Steel

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Corrosion (1)	Freckled rust. Corrosion has initiated.	Section loss is evident.
Cracking	Crack that has been effectively arrested.	Crack that has not been arrested.
Connection (2)	Loose fasteners, or pack rust without distortion. Connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.

(1) Weathering Steel - a well-formed patina is considered a protective coating and is not considered a defect.

(2) Connection defect applies to any members of a component that are fastened by bolts, rivets, or welds.

Component Condition Rating Guidance

Table 49: Masonry

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Efflorescence, Rust Staining	Surface white or leaching with little or no build-up. No rust staining present.	Rust staining or heavy build-up of efflorescence.
Mortar Breakdown	Cracking or partial depth voids.	Full depth voids.
Splits, Spalls	Block or stone has split or spalled with no shifting.	Block or stone has split or spalled with shifting.
Patched Area	Sound patch.	Unsound patch.
Displacement	Block or stone has shifted slightly out of alignment.	Block or stone has shifted significantly out of alignment or is missing.

Component Condition Rating Guidance

Table 50: Timber

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Cracking	Crack that has been effectively arrested.	Crack that has not been arrested.
Connection	Loose fasteners, or pack rust without distortion. Connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.
Decay, Section Loss	Affects up to 10% of the member section.	Affects more than 10% of the member section.
Checks, Shakes	Penetrates 5% to 50% of the thickness of the member; not in a high stress zone.	Penetrates more than 50% of the member thickness and length equal to or greater than the member depth, or penetrates more than 5% of the member thickness in a high stress zone.
Splits, Delamination	Length less than the member depth or arrested with effective actions taken to mitigate.	Length equal to or greater than the member depth.
Abrasion, Wear	Affects up to 10% of the member section.	Affects more than 10% of the member section.

Bridge Railings

Item B.C.05

- This item is the condition rating of all bridge railings located on the bridge or that cross over a buried structure combined into a single rating. Consider the overall condition of all parts of the bridge railing elements (regardless of material) when determining the overall bridge railing condition – railings, parapets, posts, blocking, curb, etc.
 - 330 Metal Bridge Railing
 - 331 Reinforced Concrete Bridge Railing
 - 332 Timber Railing
 - 333 Other Material Bridge Railing
 - 9335 Decorative Rail*

* Additional guidance in coming slide



Consider condition of all railing elements when determining Bridge Railing Condition Rating

Bridge Railings

Item B.C.05

- **Do not consider** pedestrian railings when coding this item, except to the extent that the pedestrian railing is integral to the traffic barrier. Do not consider these items.
 - 9335 Decorative Rail*
 - 9337 Protective Screening
- **Do not consider** the condition of protective coatings when determining the condition rating for bridge railing. Do not consider the condition of these items.
 - 515 Steel Protective Coating – Other
 - 8516 Painted Steel
 - 8517 Weathering Steel
 - 8518 Galvanization
 - 8519 Duplex System

* Additional guidance in coming slide



Decorative Rail

Bridge Railing

- History: Assessment 9335 Decorative Rail was introduced by WisDOT as part of a concrete rail or parapet (former combination rail).



for B.C.05.

Tubular Rail –
Vehicle Redirecting

**CONSIDERED AS
PART OF B.C.05**



Example 1: Bridge Railings



Consider condition of all railing elements for Bridge Railing Condition Rating

1094 ft reinforced concrete bridge railing (concrete railing, posts, curb)

Railing defects from inspection report below:

CS2 (minor defects) = 65% (widespread prevalence)

CS3 (moderate defects) = 35% (widespread prevalence)

X	331	Reinforced Concrete Bridge Rail	LF	1,094	0	714	380	0	
		Spalls with exposed corroding rebar with LOS in horizontal rail. Vertical posts have large cracks, rust staining and spalls with exposed corroding rebar. See inspection sketches and photos for additional notes of rail conditions.							
		1080	Delamination - Spall - Patched Area	LF		0	178	380	0
		1130	Cracking (RC)	LF		0	536	0	
			Cracking is due to corrosion of rebar.						

Results: B.C.05 = 5 (fair) – some moderate defects; strength and/or performance of the component are not affected.

Example 2: Bridge Railings



650 ft metal bridge rail (W & Type Z metal rail, timber block-out posts, concrete curb)

Railing defects from inspection report:

CS2 (minor defects) = 11 % (some prevalence)

CS3 (moderate defects) = 3% (isolated prevalence)

CS4 (major defects) = <1% (isolated prevalence)

X	330	Metal Bridge Rail	LF	1,299	1,117	144	33	5
		Thrie beam with timber posts on top of concrete curb head in front of original steel rail.						
	1000	Corrosion	LF		0	0	0	0
		Original steel rail was cleaned and painted (125 posts).						
	1010	Cracking	LF		0	0	20	0
		Curb showing areas of cracking distress with rust stains (CS3 = 20').						
	1020	Connection	LF		0	107	13	5
		13 posts with sheared anchor bolts (CS3 = 13'). 5 posts with 2 sheared anchor bolts (CS4 = 5').						
	1080	Delamination - Spall - Patched Area	LF		0	137	0	0
		Concrete curb full length of both sides. North: [20] Curb patched (CS2=39'). South: [20] Curb patched (CS2=98').						
	1140	Decay/Section Loss	LF		0	45	11	0
		228 timber blockout posts. ~20% are rotted with penetration of 5 to 50%. ~20% cracked/split that penetrates 5 to 50% (CS2=45'). 5% cracked/split that penetrate >50% (CS3 = 11'). Some timber posts are rotting with holes in the top. Some posts are sheared off from traffic impacts.						
	1900	Distortion	LF		0	0	25	0
		Thrie beam panels at east end have been crushed by vehicle impacts (CS3=25')						

Results:

B.C.05 = 4 (poor) –

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

Bridge Railings

Buried Bridges

Rate the guard rail and barrier wall located directly over a buried bridge.

Consider condition of all railing/barrier on both sides and median if divided highway.



Bridge Railings Transition

Item B.C.06

This item addresses the condition of the transition from the bridge railing to the approach guardrail. The condition assessment includes the portions of the railings, posts, blocking, and curbs that are part of the bridge railing transitions.

Do not consider the condition of protective coatings when determining the condition rating code for transitions.

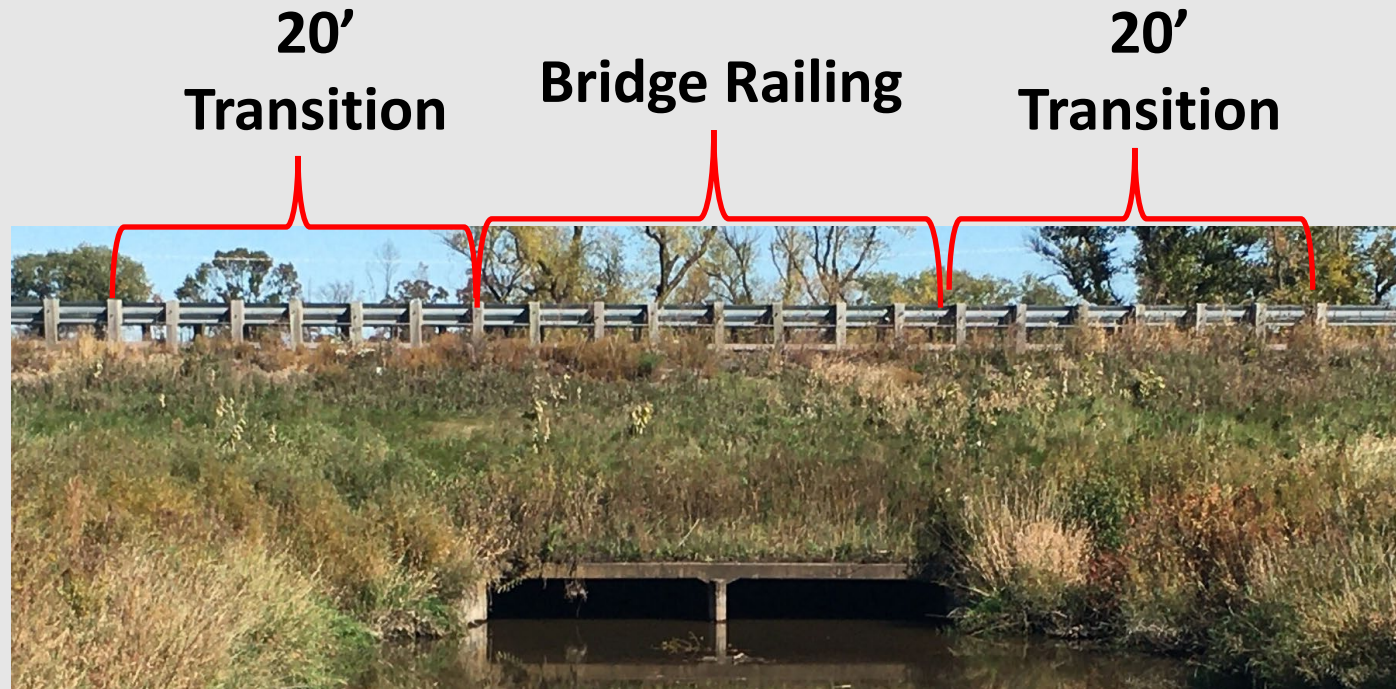
Transition



Bridge Railings Transition

Item B.C.06

For buried structures, the transition length is not defined by the SNBI. WisDOT will define the transition length as 20' from the approximate edge of the buried structure unless there is a distinct transition such as with nested W beam.



Bridge Bearings

Item B.C.07

If the bearing device is not visible, assess based on alignment, grade across the joint, or other indirect indicators of the condition.

Do not consider the condition of protective coatings when determining the condition rating code for bearings.

Table 52

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)
Movement	Minor restriction.	Restricted.
Alignment	Lateral or vertical alignment that is inconsistent with temperature conditions, but is tolerable.	Approaching limits of lateral or vertical alignment for the bearing.
Bulging, Splitting, Tearing	Bulging less than 15% of bearing thickness.	Bulging 15% or more of bearing thickness. Splitting or tearing. Bearing's surfaces are not parallel.
Loss of Bearing Area	Up to 10%	More than 10%.
Corrosion	Freckled rust. Corrosion has initiated.	Section loss is evident.
Connection	Loose fasteners, or pack rust without distortion. Connection is in place and functioning as intended.	Missing bolts, rivets, or fasteners; broken welds; or pack rust with distortion.

Bridge Bearings

Item B.C.07

Table 20:

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.

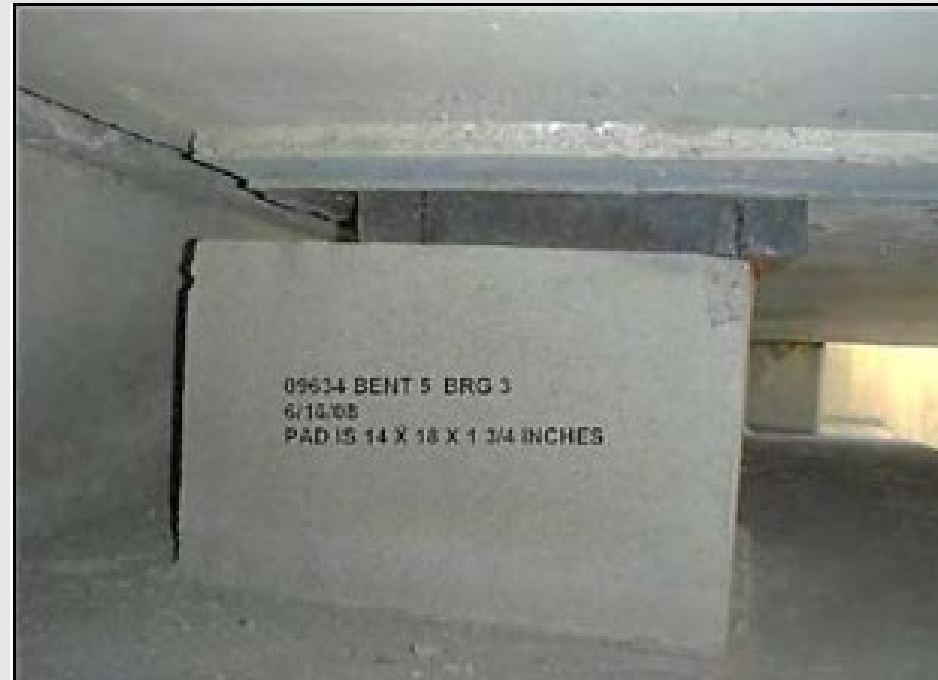
Example 1: Bridge Bearings

Item B.C.07

Results:

B.C.07 = 5 (fair)

The bearings have “some moderate defects.”



5 of 25 bearings have 10% bearing area loss.

Defect: Loss of bearing area

Severity: Moderate

Extent: 20% of bearings (some)

Example 2: Bridge Bearings

Item B.C.07

Results:

B.C.07 = 3 (serious)

The bearings have “major defects” affecting performance.



8 of 20 bearings are rotated beyond performance limits - the anchor bolts are bent and the nuts are loose. Surface rust is present on all bearings.

Defect: Alignment and connection

Severity: Major

Extent: 8 bearings (widespread)

Defect: Corrosion

Severity: Minor

Extent: All bearings

Example 3: Bridge Bearings

Item B.C.07

Results:

B.C.07 = 6 (satisfactory)

The bearings have “widespread minor defects”.



20 of 20 bearings have surface rust with no section loss. Bearings are free to move and alignment is as expected for temperature conditions.

Defect: Corrosion

Severity: Minor

Extent: All bearings

Bridge Joints

Item B.C.08

Applies to all types of bridge deck joints.

Includes all aspects of the joints such as seals, headers (metal or concrete), connections, and other metal members.

When the joint is not visible, assess based on other indirect indicators of the condition.

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.

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

Component Condition Rating Guidance

Table 53: Bridge Joints

Defect	Minor (CS2 - fair)	Moderate (CS3 - poor)	Major (CS4 - severe)
Leakage	Minimal. Minor dripping through the joint.	Moderate. More than a drip and less than free flow of water.	Free flow of water through the joint.
Seal Adhesion	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 Cracking	Surface crack.	Crack that partially penetrates the seal.	Crack that fully penetrates the seal.
Seal Damage	Seal abrasion without punctures.	Punctured, torn, or partially pulled out.	Punctured completely through, pulled out, or missing.
Debris Impaction	Partially filled with hard-packed material, but still allowing free movement.	Completely filled; impacts joint movement.	Completely filled; prevents joint movement.
Adjacent Deck or Header	Edge delamination or spall 1" or less deep or 6" or less in diameter. No exposed rebar. Patched area that is sound.	Spall greater than 1" deep or greater than 6" 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	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. Joint still functioning.	Section loss, cracking of the metal, damage, or connection failure that prevents the joint from functioning as intended.

Example 1: Bridge Joints



Results: B.C.08 = 6 (satisfactory)
The joints have “widespread minor defects”.

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.

All compression seal joints are partially filled with debris but are still free to move. Seals are intact.

Defect: Debris impaction
Severity: Minor
Extent: All joints (widespread)

Example 2: Bridge Joints



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.

Results:

B.C.08 = 6 (satisfactory)

The joints have “isolated moderate defects”.

Strip seal joint 44’ long at each end of a bridge. 3” deep x 12” wide x 6’ long spall with exposed rebar in deck adjacent to joint header. Joint is loose, but functioning. Strip seal is intact. No other defects.

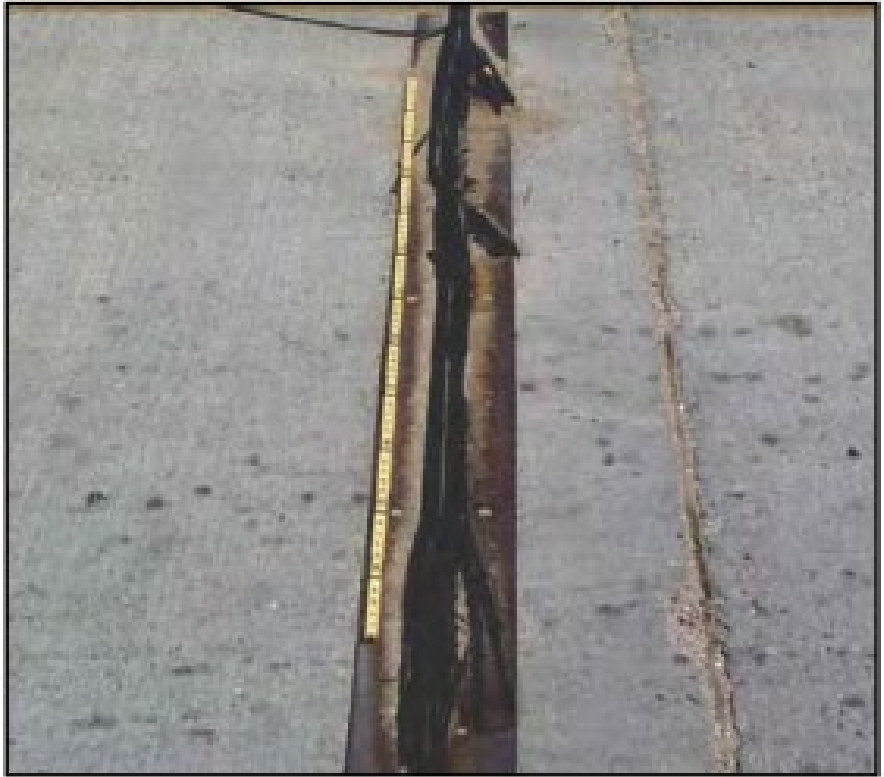
Defect: Adjacent deck or header

Severity: Moderate

Extent: 6’ of one joint (isolated)



Example 3: Bridge Joints



Results:

B.C.08 = 4 (poor)

The joints have “widespread moderate defects”.

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.

Compression seal joint 56' long at each end of a bridge. The seal is torn and partially pulled out for the full length of both joints. Performance of the joints is affected.

Defect: Seal damage

Severity: Moderate

Extent: All joints (widespread)

Channel Protection Condition

Item B.C.10

Evaluate the condition and effectiveness of channel protection devices installed on banks or in the stream - *How it impacts the bridge.* Consider erosion and scour, damage (unraveling, displacement, separation, and sagging), and material defects (scaling, abrasion, spalling, corrosion, cracking, splitting, and decay).

Channel protection devices - control, inhibit, delay, or minimize stream instability and scour problems – includes armoring.

River training - spurs, bend-way weirs, guide banks, drop structures, check dams, and others.

Armoring countermeasures - rock riprap, grouted riprap, concrete slope paving, articulating concrete blocks, gabion mattresses, grout-filled mats, and others.

Hidden countermeasures - use visual condition indicators, probing, and other streambed measurements.

Minor defect - does not limit the effectiveness of the channel protection.

Moderate defect - may limit channel protection effectiveness.

Major defect - indicates the channel protection is missing or is no longer effective.



Component Condition Rating Guidance

Channel Protection

Report the channel protection device(s) using one of the codes.

Code	Condition	Description
N	NOT APPLICABLE	Bridge does not cross over water or channel protection devices do 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; performance of the channel protection is not affected.
4	POOR	Widespread moderate or isolated major defects; performance of channel protection is affected.
3	SERIOUS	Major defects; performance of channel protection is seriously affected. Condition typically necessitates more frequent monitoring or corrective actions.
2	CRITICAL	Major defects; channel protection is severely compromised. Condition typically necessitates more frequent monitoring or corrective actions.
1	IMMINENT FAILURE	Channel protection has failed, but corrective action could restore it to working condition.
0	FAILED	Channel protection is beyond repair and must be replaced.

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

Example: Channel Protection Condition



Code	Condition	Description
N	NOT APPLICABLE	Bridge does not cross over water or channel protection devices do 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; performance of the channel protection is not affected.
4	POOR	Widespread moderate or isolated major defects; performance of channel protection is affected.
3	SERIOUS	Major defects; performance of channel protection is seriously affected. Condition typically necessitates more frequent monitoring or corrective actions.
2	CRITICAL	Major defects; channel protection is severely compromised. Condition typically necessitates more frequent monitoring or corrective actions.
1	IMMINENT FAILURE	Channel protection has failed, but corrective action could restore it to working condition.
0	FAILED	Channel protection is beyond repair and must be replaced.

Results:

B.C.10 = 4 (poor)

The channel has “widespread moderate defects”.

Some stones are missing and revetment has limited effectiveness. Streambed is scouring and undermining the remaining riprap and culvert.

Defect: Scour and damage Severity: Moderate Extent: Widespread

Scour Condition

Item B.C.11

Refer to Item B.AP.03 Scour Vulnerability to verify if the bridge has been determined to be stable or unstable for appraised scour conditions.

Consider design scour depth and critical scour depth, commonly found in hydraulic designs, scour evaluations, and POAs, when determining the scour condition ratings.

When observed conditions are not consistent with the scour design or the assumptions used in the scour appraisal, this indicates a need to reevaluate Item B.AP.03 Scour Vulnerability. Notify the PM.



Scour Condition

Item B.C.11

Report the scour condition that represents the observed or measured scour.

Code	Condition Description
N	Bridge does not cross over water.
9	No scour.
8	Insignificant scour.
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.
3	Major scour; strength and/or stability of the bridge is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	Major scour; strength and/or stability of the bridge is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions to keep the bridge open.
1	Bridge is closed to traffic due to scour condition. Channel rehabilitation may return the bridge to service.
0	Bridge is closed due to scour condition, and is beyond corrective action. Bridge replacement is needed to restore service.

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

Example 1: Scour Condition



Code	Condition Description
N	Bridge does not cross over water.
9	No scour.
8	Insignificant scour.
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.
3	Major scour; strength and/or stability of the bridge is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	Major scour; strength and/or stability of the bridge is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions to keep the bridge open.
1	Bridge is closed to traffic due to scour condition. Channel rehabilitation may return the bridge to service.
0	Bridge is closed due to scour condition, and is beyond corrective action. Bridge replacement is needed to restore service.

Results:

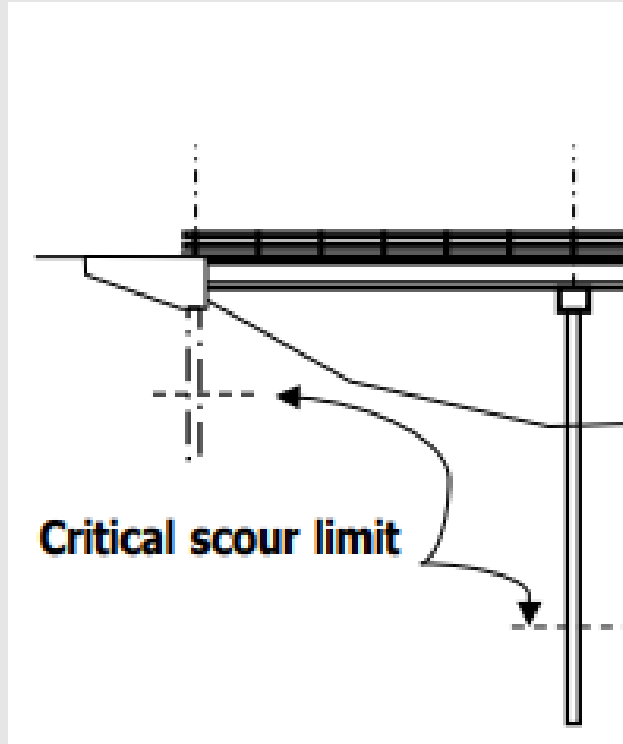
B.C.11 = 3 (serious)

Major scour.

3 span scour critical bridge on spread footings - not bedrock. The scour elevation for 3 spread footings at Pier 2 is at the bottom of the footings with one footing having 1' of undermining at one corner. More frequent monitor until repairs are completed.

Severity: Major Extent: 3 of 6 pier footings

Example 2: Scour Condition



Code	Condition Description
N	Bridge does not cross over water.
9	No scour.
8	Insignificant scour.
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.
3	Major scour; strength and/or stability of the bridge is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	Major scour; strength and/or stability of the bridge is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions to keep the bridge open.
1	Bridge is closed to traffic due to scour condition. Channel rehabilitation may return the bridge to service.
0	Bridge is closed due to scour condition, and is beyond corrective action. Bridge replacement is needed to restore service.

Results:

B.C.11 = 7 (good)

Isolated minor scour.

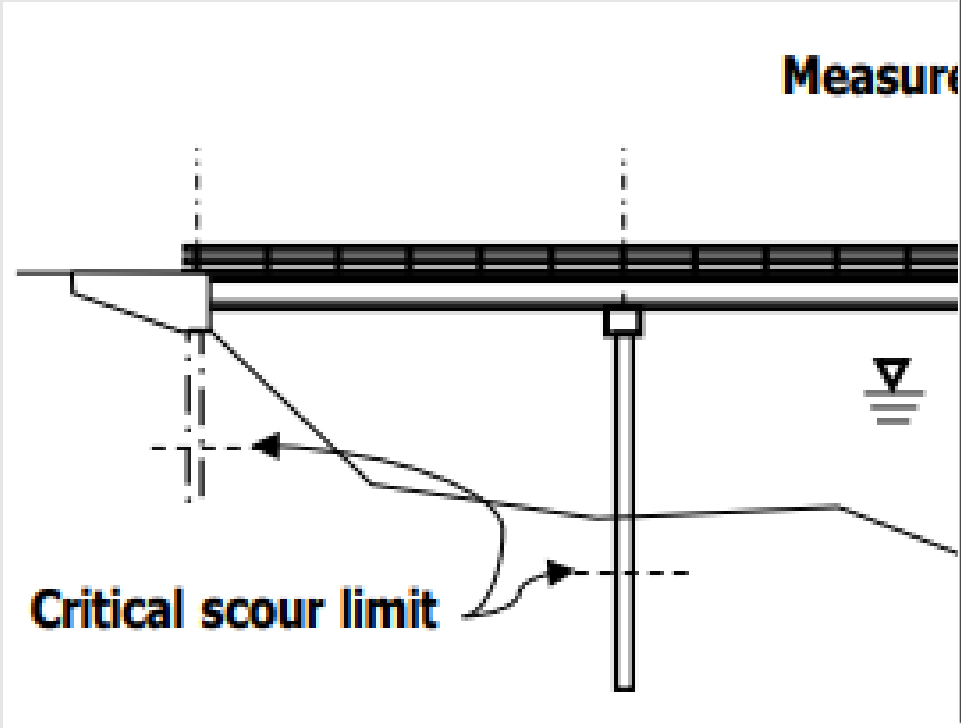
Scour critical bridge. Critical scour limit was established in the Plan of Action.

Inspectors measured the streambed cross-section shown here.

Severity: Minor (scour at Bent 3 does not exceed tolerance limit)

Extent: 1 of 5 substructure units (isolated)

Example 3: Scour Condition



Code	Condition Description
N	Bridge does not cross over water.
9	No scour.
8	Insignificant scour.
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.
3	Major scour; strength and/or stability of the bridge is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	Major scour; strength and/or stability of the bridge is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions to keep the bridge open.
1	Bridge is closed to traffic due to scour condition. Channel rehabilitation may return the bridge to service.
0	Bridge is closed due to scour condition, and is beyond corrective action. Bridge replacement is needed to restore service.

Results:

B.C.11 = 1 (imminent failure)

Major scour.

Scour critical bridge with the critical scour limit established in the POA. Inspectors measured the streambed cross-section shown here, which indicates a scour depth at one bent that is below the critical scour elevation.

Severity: Moderate

Extent: 2 of 5 substructure units (some)

Severity: Major

Extent: 1 of 5 substructure units (isolated)

NSTM (FC) Inspection Condition

Item B.C.14

Report the condition rating of the Nonredundant Steel Tension Members (NSTM) using one of the codes from the table.

Do not report this item when the bridge has no NSTM (when item B.IR.01 = N).

Report the general overall condition of all of the NSTM(s) into a single code.

For a bridge with NSTM(s) in both the superstructure and substructure, report only the lower of the two condition values for the condition of the NSTM(s).

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.

Underwater Inspection Condition

Item B.C.15

Report the condition rating of the members inspected during an underwater dive inspection using one of the codes from the table.

Do not report this item when the bridge does not require an underwater dive inspection (when item B.IR.03 = N).

Report the general overall condition of all of the underwater elements into a single code.

If this has previously been coded, continue to report even when unusually low water when a dive is not necessary.

Use the defect conditions found in the latest underwater dive inspection.

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.

Now, go out and get some inspections done!

Questions?



Slides beyond this point are intended for coming training.



Approach Roadway Alignment

Item B.AP.01

Identifies bridges that do not function adequately due to the horizontal or vertical alignment of the bridge and approach roadway. Report the operating speed reduction at the bridge using one of the following codes.

<u>New Code</u>	<u>Old Code</u>	<u>Description</u>
G	8	Good
F	6	Fair
P	3	Poor

How does the alignment of the bridge and approach roadway relate to the general highway alignment?

Do not consider speed reductions due to the bridge width or intersecting highways when reporting this item.

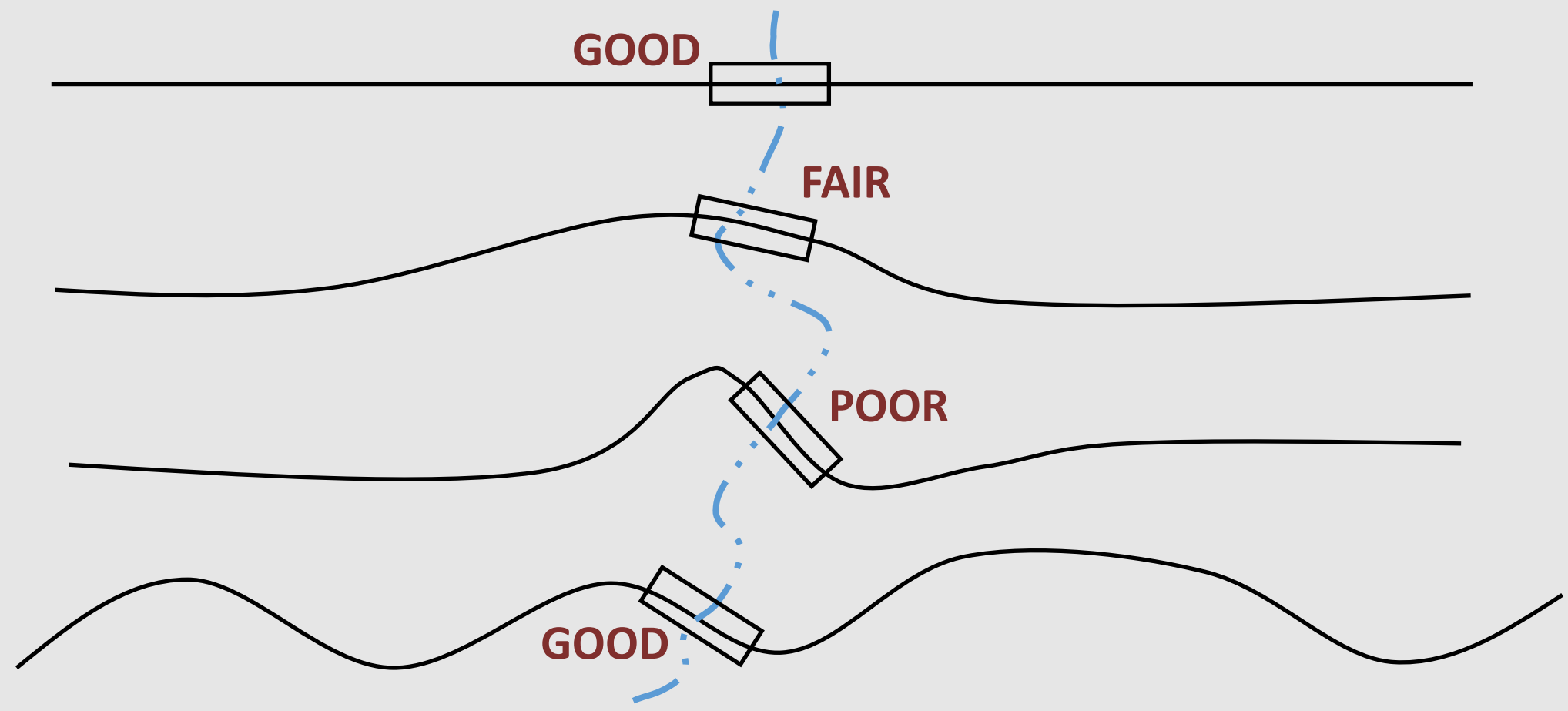
G = the operating speed is no different at the bridge than the rest of the highway segment.

F = the operating speed is noticeably different at the bridge than the rest of the highway segment.

P = the operating speed is substantially different at the bridge than the rest of the highway segment.

Examples: Approach Roadway Alignment

Item B.AP.01



Channel Condition

Item B.C.09

Rate the condition of the channel at the bridge - consider the channel upstream and downstream only insofar as it threatens the bridge and approach roadway.

The condition of channel protection devices is addressed under Item B.C.10 Channel Protection Condition Rating.

For concrete lined channels, only Aggradation and Debris defects apply. The condition of the channel lining would be addressed under Item B.C.10 Channel Protection Condition Rating.



Component Condition Rating Guidance

Channel

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.
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.
Degradation	Exists within tolerable limits or has arrested.	Sloughing of banks, resulting in vertical embankments on both sides of the channel. Bridge is not yet impacted.	Sloughing of banks, resulting in vertical embankments on both sides of the channel. Bridge is impacted.
Aggradation	Exists within tolerable limits or has arrested.	Exceeds tolerable limits. Hydraulic opening is significantly blocked, increasing potential for overtopping or channel restriction.	Hydraulic opening is mostly blocked. May cause frequent overtopping or channel restriction.
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.
Bank Erosion/ Instability	Erosion/instability that does not impact the bridge or approach roadway.	Significant erosion/instability that is progressing toward the bridge or approach roadway.	Stability of the approach roadway embankment is impacted.

Channel Condition

Item B.C.09

Report the channel condition using one of the codes in the table.

Code	Condition	Description
N	NOT APPLICABLE	Bridge does not cross over water.
9	EXCELLENT	No defects.
8	VERY GOOD	Inherent defects only.
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.
3	SERIOUS	Major defects; bridge or approach roadway is seriously threatened. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects. Bridge or approach roadway is severely threatened. 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 channel condition. Channel rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to channel condition, and is beyond corrective action. Bridge location or design can no longer accommodate the channel, and bridge replacement is needed to restore service.

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

Component Condition Rating Guidance

Channel Condition

Report the channel condition using one of the following codes.

Code	Condition	Description
N	NOT APPLICABLE	Bridge does not cross over water.
9	EXCELLENT	No defects.
8	VERY GOOD	Inherent defects only.
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.
3	SERIOUS	Major defects; bridge or approach roadway is seriously threatened. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects. Bridge or approach roadway is severely threatened. 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 channel condition. Channel rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to channel condition, and is beyond corrective action. Bridge location or design can no longer accommodate the channel, and bridge replacement is needed to restore service.

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

Example: Channel Condition



Code	Condition	Description
N	NOT APPLICABLE	Bridge does not cross over water.
9	EXCELLENT	No defects.
8	VERY GOOD	Inherent defects only.
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.
3	SERIOUS	Major defects; bridge or approach roadway is seriously threatened. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects. Bridge or approach roadway is severely threatened. 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 channel condition. Channel rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to channel condition, and is beyond corrective action. Bridge location or design can no longer accommodate the channel, and bridge replacement is needed to restore service.

Results:

B.C.09 = 4 (poor)

The joints have “widespread moderate defects”.

Single span bridge. Channel is aggrading and requires periodic excavation to maintain a tolerable opening. The thalweg has migrated such that flow is directed at one abutment and threatens the approach roadway. However, a structural and hydraulic review has determined that the stability of the bridge is not impacted.

Defect: Aggradation and migration Severity: Moderate Extent: Widespread

Inspection Begin Date

Item B.IE.02

Report the date for the inspection type performed. For multiple day inspections, record the first day that field inspection begins.

If multiple site visits occur for scour monitoring inspections, for a triggering storm event, report the first site visit date for that storm event.



Inspection Completion Date

Item B.IE.03

Report the completion date for the inspection type performed.

For single day inspections report the same date that field inspection begins.

If multiple site visits occur for scour monitoring inspections, for a triggering storm event, report the last site visit date for that storm event.



Span Material

Item B.SP.04

Report the principal span material. A principal span member includes the main longitudinal load-carrying members of the span such as beams, girders, trusses, arches, or pipes, but does not include the floor system.

<u>Code</u>	<u>Description</u>	<u>Code</u>	<u>Description</u>
A01	Aluminum	P01	Plastic – Polyethylene
		PX	Plastic - other
C01	Reinforced concrete – cast in place	S01	Steel – rolled shapes
C02	Reinforced concrete – precast	S02	Steel – welded shapes
C03	Prestressed concrete – pre-tensioned	S03	Steel – bolted shapes
C04	Prestressed concrete – cast-in-place post-tensioned	S04	Steel – riveted shapes
C05	Prestressed concrete – precast posttensioned	S05	Steel – bolted and riveted shapes
CX	Concrete – other	SX	Steel – other
F01	FRP composite – aramid fiber	T01	Timber – glue laminated
F02	FRP composite – carbon fiber	T02	Timber – nail laminated
F03	FRP composite – glass fiber	T03	Timber – solid sawn
FX	FRP composite – other	T04	Timber – stress laminated
I01	Iron – cast	TX	Timber – other
I02	Iron – wrought		
M01	Masonry – block	X	Other
M02	Masonry – stone		



Examples: Span Material

Item B.SP.04

<u>Example Bridge</u>	<u>Code</u>
• Spliced concrete girder: post-tensioned, precast, pre-tensioned bulb-T	C05
• Stress laminated timber slab	T04
• CIP reinforced concrete slab span	C01
• Concrete encased steel rolled beam	S01
• Bolted steel truss with timber stringers	S03
• CIP reinforced concrete tee-beams strengthened with carbon fiber FRP	C01
• Corrugated steel pipes with bolted seams	S03
• Nest of pre-cast concrete culvert pipes & corrugated steel pipe culvert with riveted seams	C02 & S04
CIP reinf conc box culvert extended w/ a corrugated steel pipe culvert with riveted seams	C01 & S04



Span Type

Item B.SP.06

Report the span type using the following codes:

<u>Code</u>	<u>Description</u>	<u>Code</u>	<u>Description</u>
A01	Arch – under fill without spandrel	G09	Girder/beam – girder & floor beam
A02	Arch – open spandrel	G10	Girder/beam – through girder
A03	Arch – closed spandrel	GX	Girder/beam – other
A04	Arch – through	L01	Cable – suspension
A05	Arch – tied	L02	Cable – cable-stayed
B01	Box girder/beam – single	L03	Cable – extradosed
B02	Box girder/beam – multiple adjacent	LX	Cable – other
B03	Box girder/beam – multiple spread	M01	Movable – vertical lift
B04	Box girder/beam – segmental	M02	Movable – bascule
F01	Frame – three-sided	M03	Movable – swing
F02	Frame – four-sided	MX	Movable – other
F03	Frame – K-shaped	P01	Pipe - Rigid
F04	Frame – delta-shaped	P02	Pipe - Flexible
G01	Girder/beam – I-shaped adjacent	S01	Slab – solid
G02	Girder/beam – I-shaped spread	S02	Slab – voided
G03	Girder/beam – tee-beam	T01	Truss – deck
G04	Girder/beam – inverted tee-beam	T02	Truss – through
G05	Girder/beam – double-tee adjacent	T03	Truss – pony
G06	Girder/beam – double-tee spread	X01	Other – railroad flat car
G07	Girder/beam – channel adjacent	X02	Other – ferry transfer
G08	Girder/beam – channel spread	X03	Other – floating
		X	Other



Span Type

Item B.SP.06

Adjacent girders/beams - those sections that are placed directly next to each other and are touching or nearly touching.

Spread girders/beams - those sections that are spaced so that the deck spans the space between the sections.

Box girder/beams - boxes, tubs, and cellular structures where interior surfaces may or may not be accessible.

Concrete (4-sided) box culvert type bridges - code F02

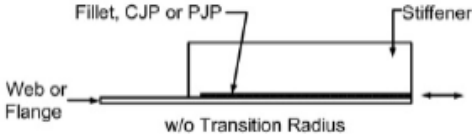
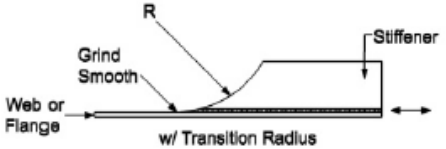
Bulbtee and deck bulb-tee girders/beams - code G01 or G02, as applicable.

Girder with floor beam systems - code G09 regardless of the girder shape.

Through girder - code G10 regardless of the girder shape.

Pipe-Flexible (code P02) - pipes that rely on the stability of surrounding soils to maintain their structural shape.



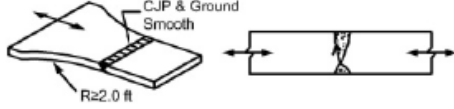
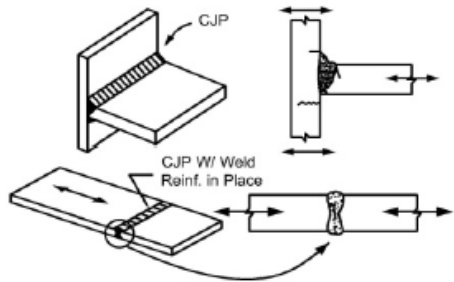
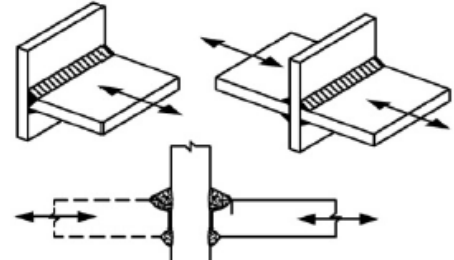
Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 4—Welded Stiffener Connections					
<p>4.3 Base metal at the termination of longitudinal stiffener-to-web or longitudinal stiffener-to-box flange welds:</p> <p>With the stiffener attached by fillet welds and with no transition radius provided at the termination:</p> <p>Stiffener thickness < 1.0 in. Stiffener thickness ≥ 1.0 in.</p> <p>With the stiffener attached by welds and with a transition radius R provided at the termination with the weld termination ground smooth:</p> <p>$R \geq 24$ in 24 in. > $R \geq 6$ in. 6 in. > $R \geq 2$ in. 2 in. > R</p>	<p>E E'</p> <p>B C D E</p>	<p>11×10^8 3.9×10^8</p> <p>120×10^8 44×10^8 22×10^8 11×10^8</p>	<p>4.5 2.6</p> <p>16 10 7 4.5</p>	<p>In the primary member at the end of the weld at the weld toe</p> <p>In the primary member near the point of tangency of the radius</p>	 



U.S. Department
of Transportation

**Federal Highway
Administration**

Publication No. FHWA NHI 12-049
December, 2012

Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 5—Welded Joints Transverse to the Direction of Primary Stress					
5.2 Base metal and weld metal in or adjacent to complete joint penetration groove welded butt splices, with weld soundness established by NDT and with welds ground parallel to the direction of stress at transitions in width made on a radius of not less than 2 ft with the point of tangency at the end of the groove weld (see also Figure 6.13.6.2-1).	B	120×10^8	16	From internal discontinuities in the filler metal or discontinuities along the fusion boundary	
5.3 Base metal and weld metal in or adjacent to the toe of complete joint penetration groove welded T or corner joints, or in complete joint penetration groove welded butt splices, with or without transitions in thickness having slopes no greater than 1:2.5 when weld reinforcement is not removed. (Note: cracking in the flange of the 'T' may occur due to out-of-plane bending stresses induced by the stem).	C	44×10^8	10	From the surface discontinuity at the toe of the weld extending into the base metal or along the fusion boundary	
5.4 Base metal and weld metal at details where loaded discontinuous plate elements are connected with a pair of fillet welds or partial joint penetration groove welds on opposite sides of the plate normal to the direction of primary stress.	C as adjusted in Eq. 6.6.1.2.5-4	44×10^8	10	Initiating from the geometrical discontinuity at the toe of the weld extending into the base metal or, initiating at the weld root subject	



U.S. Department of Transportation

Federal Highway Administration

Publication No. FHWA NHI 12-049
December, 2012

Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 6—Transversely Loaded Welded Attachments					
<p>6.1 Base metal in a longitudinally loaded component at a transversely loaded detail (e.g. a lateral connection plate) attached by a weld parallel to the direction of primary stress and incorporating a transition radius R with the weld termination ground smooth.</p> <p>$R \geq 24$ in.</p> <p>24 in. $> R \geq 6$ in.</p> <p>6 in. $> R \geq 2$ in.</p> <p>2 in. $> R$</p> <p>(Note: Condition 6.2, 6.3 or 6.4, as applicable, shall also be checked.)</p>	<p>B</p> <p>C</p> <p>D</p> <p>E</p>	<p>120×10^8</p> <p>44×10^8</p> <p>22×10^8</p> <p>11×10^8</p>	<p>16</p> <p>10</p> <p>7</p> <p>4.5</p>	<p>Near point of tangency of the radius at the edge of the longitudinally loaded component</p>	



U.S. Department
of Transportation

**Federal Highway
Administration**

Publication No. FHWA NHI 12-049
December, 2012

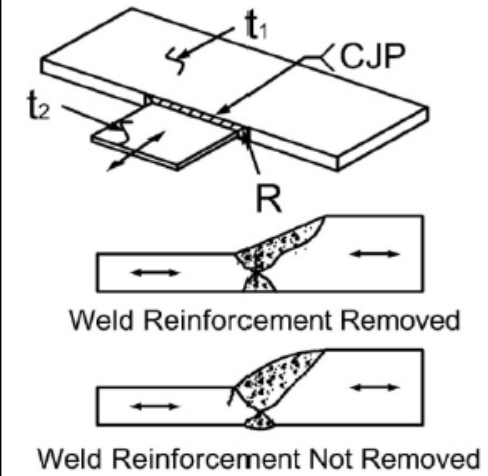
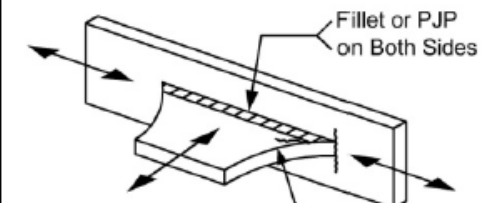


U.S. Department of Transportation

Federal Highway Administration

Publication No. FHWA NHI 12-049
December, 2012

Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 6—Transversely Loaded Welded Attachments					
<p>6.2 Base metal in a transversely loaded detail (e.g. a lateral connection plate) attached to a longitudinally loaded component of equal thickness by a complete joint penetration groove weld parallel to the direction of primary stress and incorporating a transition radius R, with weld soundness established by NDT and with the weld termination ground smooth:</p> <p>With the weld reinforcement removed:</p> <p>$R \geq 24$ in.</p> <p>24 in. $> R \geq 6$ in.</p> <p>6 in. $> R \geq 2$ in.</p> <p>2 in. $> R$</p>	<p>B</p> <p>C</p> <p>D</p> <p>E</p>	<p>120×10^8</p> <p>44×10^8</p> <p>22×10^8</p> <p>11×10^8</p>	<p>16</p> <p>10</p> <p>7</p> <p>4.5</p>	<p>Near points of tangency of the radius or in the weld or at the fusion boundary of the longitudinally loaded component or the transversely loaded attachment</p>	
<p>With the weld reinforcement not removed:</p> <p>$R \geq 24$ in.</p> <p>24 in. $> R \geq 6$ in.</p> <p>6 in. $> R \geq 2$ in.</p> <p>2 in. $> R$</p> <p>(Note: Condition 6.1 shall also be checked.)</p>	<p>C</p> <p>C</p> <p>D</p> <p>E</p>	<p>44×10^8</p> <p>44×10^8</p> <p>22×10^8</p> <p>11×10^8</p>	<p>10</p> <p>10</p> <p>7</p> <p>4.5</p>	<p>At the toe of the weld either along the edge of the longitudinally loaded component or the transversely loaded attachment</p>	

Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
<p>6.3 Base metal in a transversely loaded detail (e.g. a lateral connection plate) attached to a longitudinally loaded component of unequal thickness by a complete joint penetration groove weld parallel to the direction of primary stress and incorporating a weld transition radius R, with weld soundness established by NDT and with the weld termination ground smooth:</p> <p>With the weld reinforcement removed:</p> <p>$R \geq 2$ in.</p> <p>$R < 2$ in.</p> <p>For any weld transition radius with the weld reinforcement not removed:</p> <p>(Note: Condition 6.1 shall also be checked.)</p>	<p>D</p> <p>E</p> <p>E</p>	<p>22×10^8</p> <p>11×10^8</p> <p>11×10^8</p>	<p>7</p> <p>4.5</p> <p>4.5</p>	<p>At the toe of the weld along the edge of the thinner plate</p> <p>In the weld termination of small radius weld transitions</p> <p>At the toe of the weld along the edge of the thinner plate</p>	<p>Illustrative Examples</p> 
<p>6.4 Base metal in a transversely loaded detail (e.g. a lateral connection plate) attached to a longitudinally loaded component by a fillet weld or a partial joint penetration groove weld, with the weld parallel to the direction of primary stress</p>	<p>See Condition 5.4</p>				



U.S. Department
of Transportation

**Federal Highway
Administration**

Publication No. FHWA NHI 12-049
December, 2012

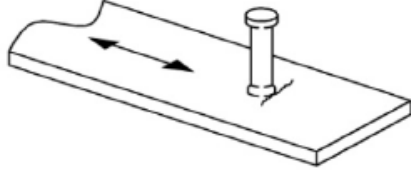
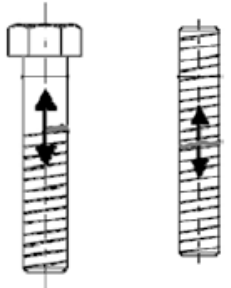
Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 6—Transversely Loaded Welded Attachments					
<p>6.1 Base metal in a longitudinally loaded component at a transversely loaded detail (e.g. a lateral connection plate) attached by a weld parallel to the direction of primary stress and incorporating a transition radius R with the weld termination ground smooth.</p> <p>$R \geq 24$ in.</p> <p>$24 \text{ in.} > R \geq 6$ in.</p> <p>$6 \text{ in.} > R \geq 2$ in.</p> <p>$2 \text{ in.} > R$</p> <p><i>(Note: Condition 6.2, 6.3 or 6.4)</i></p>	<p>B</p> <p>C</p> <p>D</p> <p>E</p>	<p>120×10^8</p> <p>44×10^8</p> <p>22×10^8</p> <p>11×10^8</p>	<p>16</p> <p>10</p> <p>7</p> <p>4.5</p>	<p>Near point of tangency of the radius at the edge of the longitudinally loaded component</p>	
Section 7—Longitudinally Loaded Welded Attachments					
<p>7.1 Base metal in a longitudinally loaded component at a detail with a length L in the direction of the primary stress and a thickness t attached by groove or fillet welds parallel or transverse to the direction of primary stress where the detail incorporates no transition radius:</p> <p>$L < 2$ in.</p> <p>$2 \text{ in.} \leq L \leq 12t$ or 4 in.</p> <p>$L > 12t$ or 4 in.</p> <p>$t < 1.0$ in</p> <p>$t \geq 1.0$ in.</p>	<p>C</p> <p>D</p> <p>E</p> <p>E'</p>	<p>44×10^8</p> <p>22×10^8</p> <p>11×10^8</p> <p>3.9×10^8</p>	<p>10</p> <p>7</p> <p>4.5</p> <p>2.6</p>	<p>In the primary member at the end of the weld at the weld toe</p>	



U.S. Department of Transportation

Federal Highway Administration

Publication No. FHWA NHI 12-049
December, 2012

Description	Category	Constant A (ksi ³)	Threshold $(\Delta F)_{TH}$ ksi	Potential Crack Initiation Point	Illustrative Examples
Section 8—Miscellaneous					
8.1 Base metal at stud-type shear connectors attached by fillet or automatic stud welding	C	44×10^8	10	At the toe of the weld in the base metal	
8.2 Nonpretensioned high-strength bolts, common bolts, threaded anchor rods and hanger rods with cut, ground or rolled threads. Use the stress range acting on the tensile stress area due to live load plus prying action when applicable.				At the root of the threads extending into the tensile stress area	
(Fatigue II) Finite Life	E'	3.9×10^8	N/A		
(Fatigue I) Infinite Life	D	N/A	7		



U.S. Department
of Transportation

**Federal Highway
Administration**

Publication No. FHWA NHI 12-049
December, 2012