

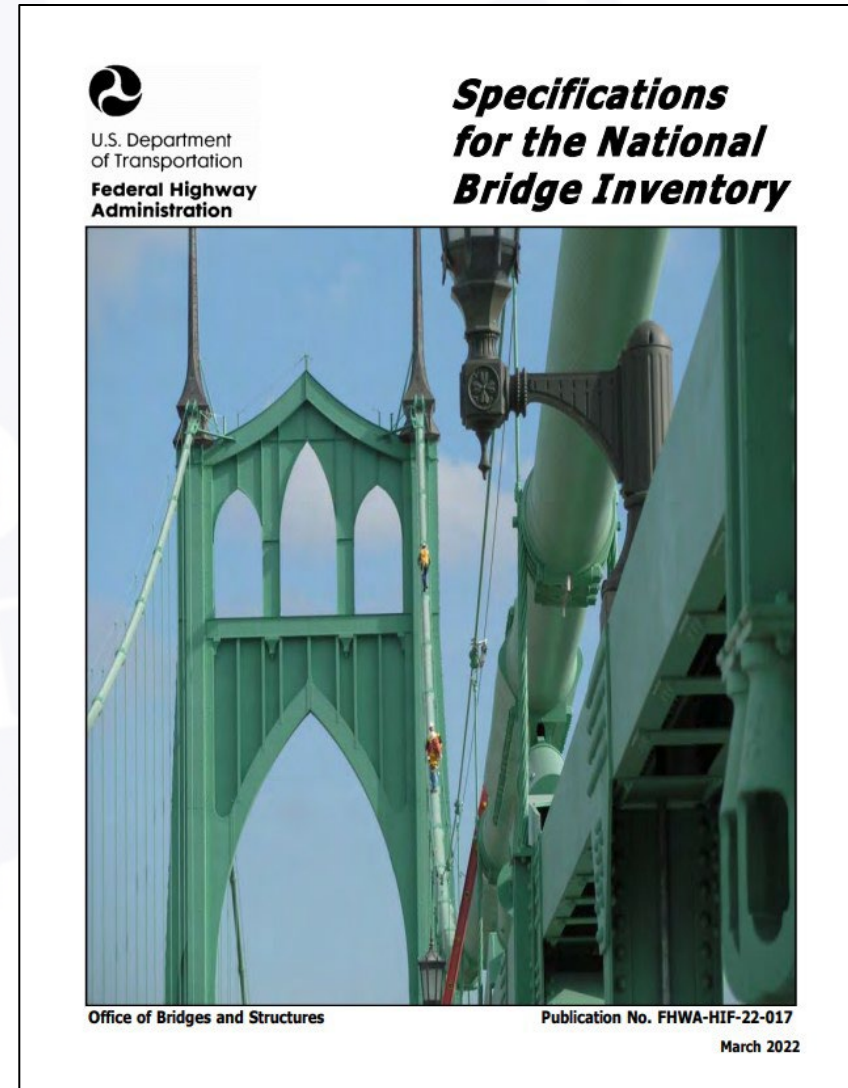
SNBI Section 7: Bridge Condition and Appraisal

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References

- 2022 Specifications for the National Bridge Inventory (SNBI).
- SNBI Training provided by Federal Highway Administration (December 2023).
- The INDOT Bridge Inspection Manual will soon be updated to reflect the changes in the SNBI.



Overview

- Condition Rating Descriptions (**NEW**)
- Condition Items:
 - Deck, Superstructure, Substructure, and Culvert
 - Bridge Railing and Transitions (**NEW**)
 - Bridge Bearings and Joints (**NEW**)
 - Channel, Channel Protection, and Scour (**NEW**)
 - Lowest Condition Rating and Condition Classification (**NEW**)
 - NSTM and Underwater (**NEW**)
- Element Level
- Appraisal Items:
 - Approach Roadway Alignment
 - Overtopping Likelihood (**NEW**)
 - Scour Vulnerability and Scour Plan of Action (**NEW**)
 - Seismic Vulnerability (**NEW**)



Condition Rating Descriptions

- Determine condition rating codes based on field observations
- At first glance this process is the same as the old coding guide
- However, SNBI Condition Rating Descriptions have CHANGED
- Some ratings will change!

Code	Condition
9	EXCELLENT
8	VERY GOOD
7	GOOD
6	SATISFACTORY
5	FAIR
4	POOR
3	SERIOUS
2	CRITICAL
1	IMMINENT FAILURE
0	FAILED

Condition Rating Descriptions

Three main components of condition rating descriptions:

- Defect Severity
 - (Inherent, Minor, Moderate, Major)
- Defect Extent
 - (Isolated, Some, Widespread)
- Effect on Strength and/or Performance



Condition Rating Descriptions

Defect Severity:

- **Inherent Defect** – not damage or deterioration, characteristic of material, result from normal construction practices
- **Minor Defect** – damage or deterioration has initiated but not yet significant
- **Moderate Defect** – damage or deterioration is significant, but strength and/or performance not affected
- **Major Defect** – strength and/or performance is affected



Condition Rating Descriptions

Defect Extent:

- **Isolated** – occurs in one or a few concentrated locations
- **Widespread** – present in many separate areas
- **Some** – more than isolated, less than widespread



Condition Rating Descriptions

Defect Strength and/or Performance Affected:

- Does the defect affect strength or capacity?
 - Loss of strength can happen with or without load posting
 - Load posting just for design loads not meeting current legal loads is NOT a defect and does NOT affect rating code
- Does the defect prevent the component from functioning as intended?
 - Joints, Bearings, Railings



Condition Rating Descriptions

Table 20 in SNBI used for B.C.01 thru B.C.07

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 <u>not</u> affected.

Severity

Extent

Strength/Performance

Condition Rating Descriptions

Table 20 in SNBI used for B.C.01 thru B.C.07

Code	Condition	Description
4	POOR	Widespread moderate or isolated major defects; strength and/or performance is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restriction, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restriction, 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. Bridge replacement is required to restore service.

Severity

Extent

Strength/Performance

Condition Rating Descriptions

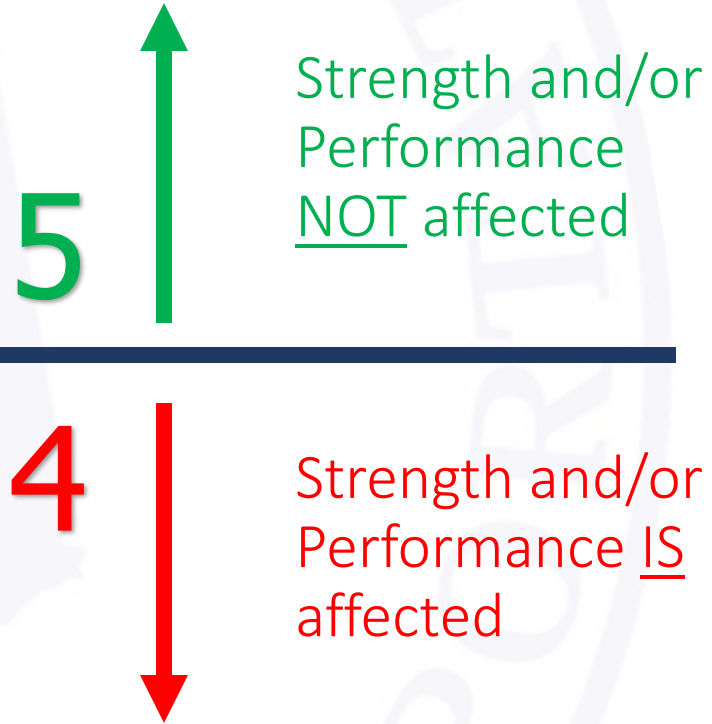
Rating Chart (Unofficial) – Severity and Extent

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				

Condition Rating Descriptions

Shift in how items are rated:

- Loss of strength or structural capacity
 - Rating ≤ 4
- Component not performing as intended
 - Rating ≤ 4
- Deteriorated bridges are likely to have slightly lower ratings now



Condition Rating Descriptions

Shift in how items are rated:

- In 1995 Coding Guide:
 - 9 – Excellent – (No description)
 - 8 – Very Good – No problems noted
 - 7 – Good – Some minor problems
- In SNBI:
 - 9 – Excellent – Isolated inherent defects
- Good condition bridges are likely to have higher ratings now!

Why would you rate something a 9 in old system?

Nothing is perfect

Condition Rating Descriptions

Appendix C – Additional defect severity guidance provided for:

- Distortion, Settlement, Scour
- Concrete, Steel, Masonry, Timber, Other
- Bearings, Bridge Joints, Channel

Appendix C – Table 47. Concrete (Partial Table)

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.
Exposed Rebar	Present without measurable section loss.	Present with measurable section loss.

B.C.01 Deck Condition Rating

- Use Table 20 to determine rating
- Rate the top, bottom, and sides of deck based on visual inspection
- Can supplement with destructive or non-destructive testing
- If parts not visible, can use visual indicators, testing, or past records to help



B.C.01 Deck Condition Rating

- Do not consider overlays, SIP forms, joints, rails, etc.
- For bridges with integral decks/top flanges (tee beams, box girders, etc.)
 - Deck condition may affect superstructure rating
 - Superstructure condition does not affect deck rating
- Deck and superstructure ratings are the same for slab bridges



B.C.02 Superstructure Condition Rating



- Use Table 20 to determine rating
- Superstructure includes:
 - Members above bearings for non-integral superstructure/substructure
 - Girders/beams for integral superstructures
 - Members above spring line of arch bridges
 - Slabs of concrete rigid frame bridges
 - Legs, knees and girders for concrete or steel rigid K-frames or delta-frames

B.C.02 Superstructure Condition Rating



- Only consider primary load-carrying members
- Only consider secondary members if they affect primary members
- Do not consider:
 - Bearings
 - Protective coating systems
 - Drift, debris, soil accumulation

B.C.03 Substructure Condition Rating

- Use Table 20 to determine rating
- Substructure includes:
 - Piers and abutments
 - Footings and piles
 - Backwalls and members below bearings for non-integral super/substructure
 - Members below girders/beams for integral superstructures
 - Thrust blocks and other members below spring line of arches
 - Legs of concrete rigid frames



B.C.03 Substructure Condition Rating

- If substructure (or components) not visible, use visual indicators
- Consider condition of integral wingwalls to the first construction or expansion joint
- Scour may affect this item
- Do not consider:
 - Drift, debris, soil accumulation
 - Protective coatings, fenders or protection systems



B.C.04 Culvert Condition Rating



- Use Table 20 to determine rating
- Rate culvert and any footings, piles, or other foundation elements
- Examples:
 - Buried pipe or box (3 or 4-sided)
 - Footings under a 3-sided box
 - Exposed piling

B.C.04 Culvert Condition Rating



- Consider integral wingwalls and headwalls to the first construction or expansion joint
- Scour may affect this item
- Do not consider:
 - Drift, debris, soil accumulation
 - Protective coatings, fenders or protection systems

B.C.05 Bridge Railings Condition Rating

- Use Table 20 to determine rating
- Include all types of traffic railings located on structure or over buried structure:
 - Parapets
 - Median barriers
 - Structure mounted
 - Railings, posts, blocking
- Do not consider pedestrian railings or protective coatings
- Section 2.3 covers what hardware is out there and test level



B.C.06 Bridge Railing Transitions Condition Rating



- Use Table 20 to determine condition rating
- Address condition of transition from bridge railing to approach guardrail
- Include all portions of railing, posts, blocking and curbs that are part of the system
- Not rating approach guardrail or end treatments
- Do not consider protective coatings
- Section 2.3 covers what hardware is out there and test level

B.C.07 Bridge Bearings

- Use Table 20 to determine rating
- Includes all types and shapes of bearings
- If bearing is not visible, assess based on:
 - Alignment
 - Grade across joint
 - Other visual indicators
- Do not consider protective coatings



B.C.08 Bridge Joints Condition Rating



- Condition of joints includes all seals, headers, connections or other metal members
- When a joint is designed as an open joint, leakage or lack of seal is not considered a defect
- Uses condition rating table for joints (similar to Table 20)

B.C.08 Bridge Joints Condition Rating

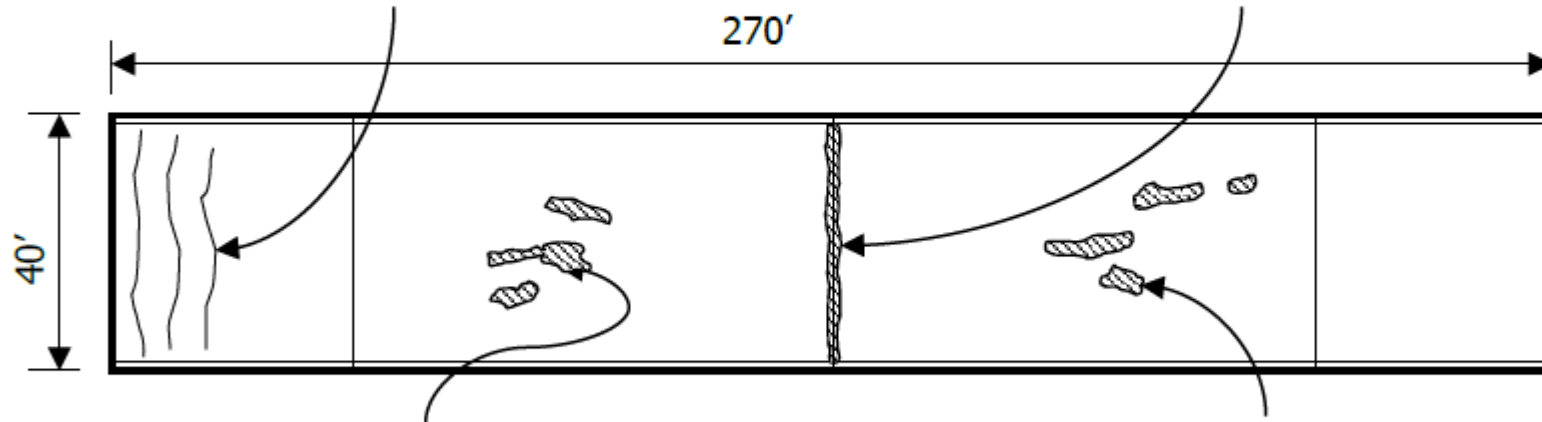
Code	Condition	Description
N	NOT APPLICABLE	Bridge does <u>not</u> have deck joints.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects.
4	POOR	Widespread moderate 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.

Knowledge Check

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.



Knowledge Check

Location	Defect and Description	Severity	Extent
1	Cracking <i>(full width transverse cracks 0.01" wide, spaced 3' to 5' for full length of deck)</i>	Inherent	Throughout (widespread)
2	Spalling <i>(spalls >1" deep along expansion joint)</i>	Moderate	~ 40 ft ² (isolated)
3	Spalling with exposed rebar, patched area that is unsound <i>(spalls up to 24"x18" and >1" deep with exposed rebar, no section loss, and patched areas that are unsound)</i>	Moderate	~100 ft ² (isolated)
4	Spalling with exposed rebar, patched area that is unsound <i>(spalls up to 24"x12" and >1" deep with exposed rebar, no section loss, and patched areas that are unsound)</i>	Moderate	~130 ft ² (isolated)

Knowledge Check

Location	Defect	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)

- There are several areas of isolated moderate defects that can be best characterized together as “some moderate defects.” The rest of the deck has inherent defects.
- In Table 20 “Some Moderate Defects” = Rating of 5 (Fair Condition)

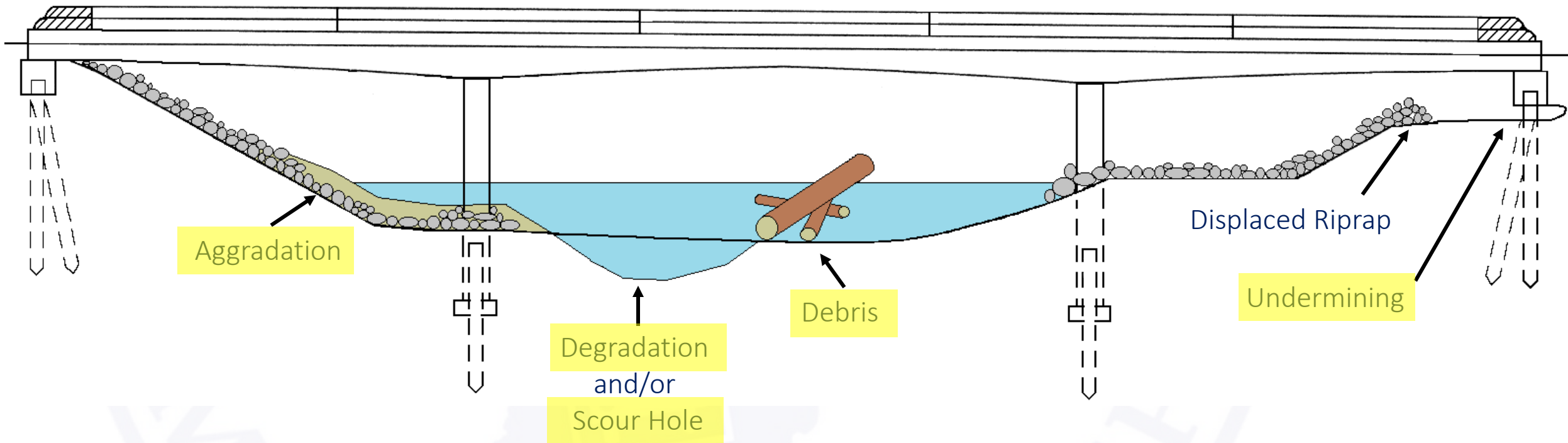
B.C.09 Channel Condition Rating

- Used to provide a condition rating for the channel at the bridge
 - Consider the channel upstream and downstream if it threatens the bridge and approach roadway
- Do not consider the condition of channel protection, it is addressed under Item B.C.10 (Channel Protection Condition Rating)
- For concrete lined channels
 - Channel defects typically do not apply except for Aggradation and Debris
 - Condition of the channel lining would be addressed by Item B.C.10 (Channel Protection Condition Rating)
- Factors to Consider:
 - Alignment
 - Migration
 - Degradation
 - Aggradation
 - Debris
 - Bank Erosion / Instability



Example Channel with Damage

- What deficiencies affect B.C.09 Channel Condition Rating?



B.C.09 Channel Condition Rating continued...

<u>Code</u>	<u>Condition</u>	<u>Description</u>
N	NOT APPLICABLE	<ul style="list-style-type: none"> • Bridge does not cross over water.
9	EXCELLENT	<ul style="list-style-type: none"> • No defects.
8	VERY GOOD	<ul style="list-style-type: none"> • Inherent defects only.
7	GOOD	<ul style="list-style-type: none"> • Some minor defects.
6	SATISFACTORY	<ul style="list-style-type: none"> • Widespread minor or isolated moderate defects.
5	FAIR	<ul style="list-style-type: none"> • Moderate defects; • Bridge and approach roadway are not threatened.
4	POOR	<ul style="list-style-type: none"> • Widespread moderate or isolated major defects; • Bridge and/or approach roadway is threatened.
3	SERIOUS	<ul style="list-style-type: none"> • Major defects; bridge or approach roadway is seriously threatened. • Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	<ul style="list-style-type: none"> • Major defects. • Bridge or approach roadway is severely threatened. • Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions to keep the bridge open.
1	IMMINENT FAILURE	<ul style="list-style-type: none"> • Bridge is closed to traffic due to channel condition. • Channel rehabilitation may return the bridge to service.
0	FAILED	<ul style="list-style-type: none"> • Bridge is closed due to channel condition and is beyond corrective action. • Bridge location / design can no longer accommodate the channel and bridge replacement is needed to restore service.

B.C.10 Channel Protection Condition Rating

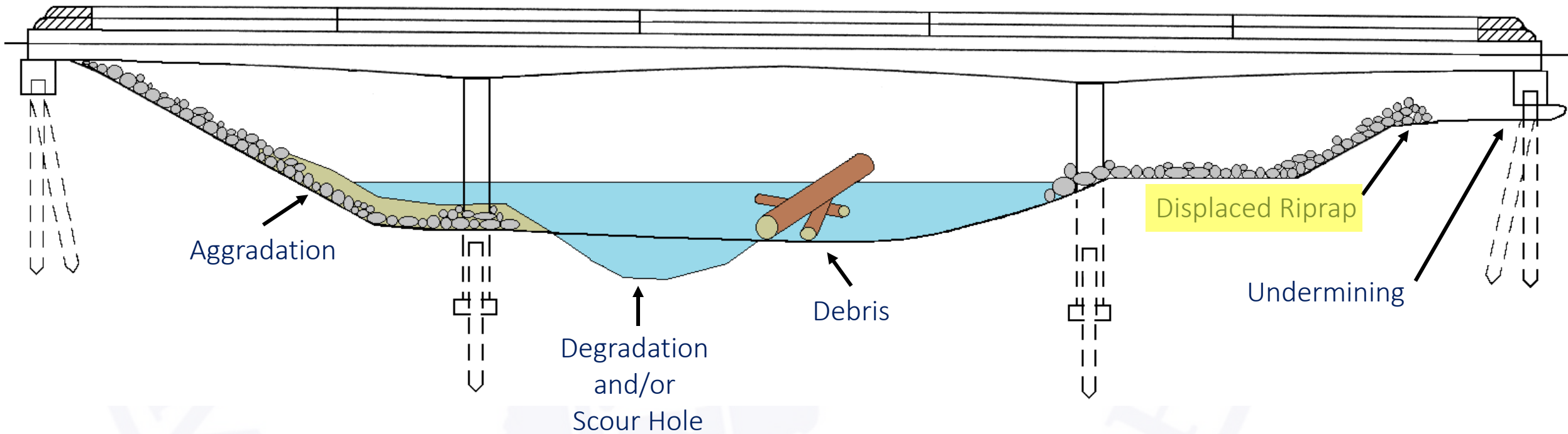
- Evaluate the condition and effectiveness of channel protection devices installed on banks or in the stream to mitigate channel issues that may impact the bridge.
- For bridges that have countermeasures not visible for inspection, use your best judgement to determine the applicable code.
- Channel protection devices are considered countermeasures that control or minimize stream instability/scour problems.
 - Riprap
 - Gabion Baskets
 - Channel Liners
- Factors to Consider
 - Erosion and scour
 - Damage such as displacement, separation, or sagging
 - Material defects such as scaling, spalling, or decay



Detroit Riprap

Example Channel with Damage

- What deficiencies affect B.C.10 Channel Protection Rating?



B.C.10 Channel Protection Condition continued...

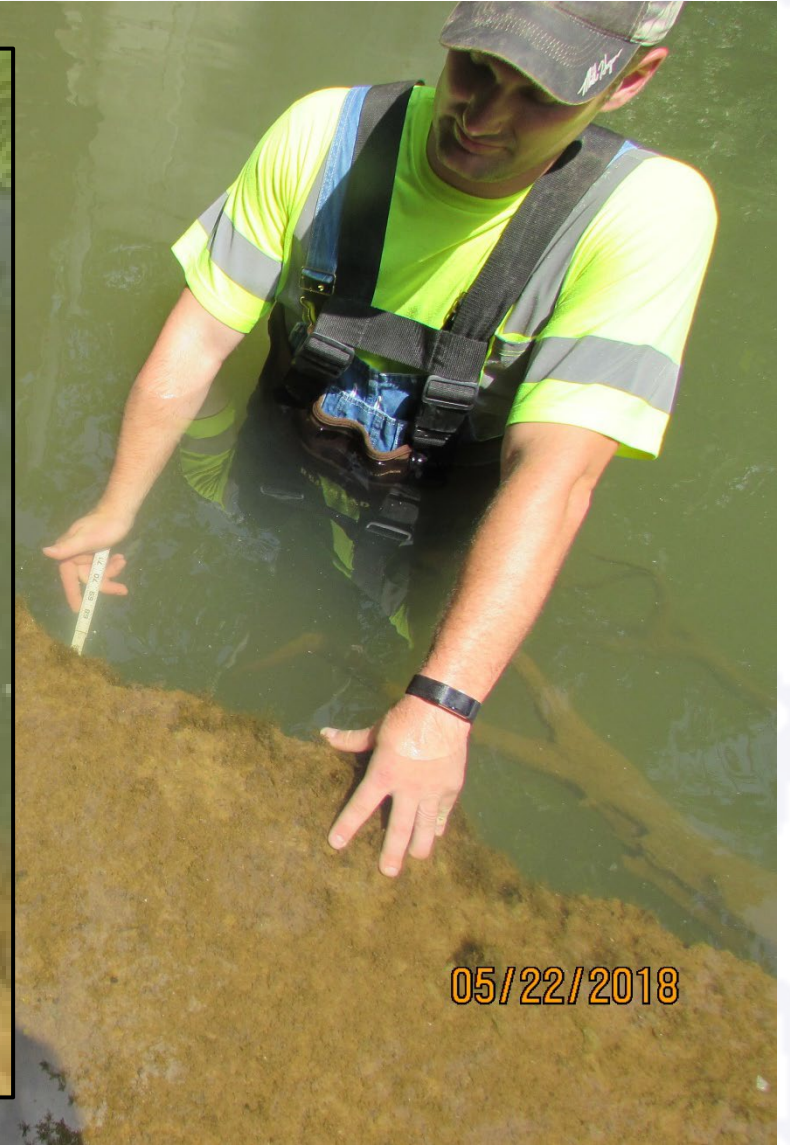
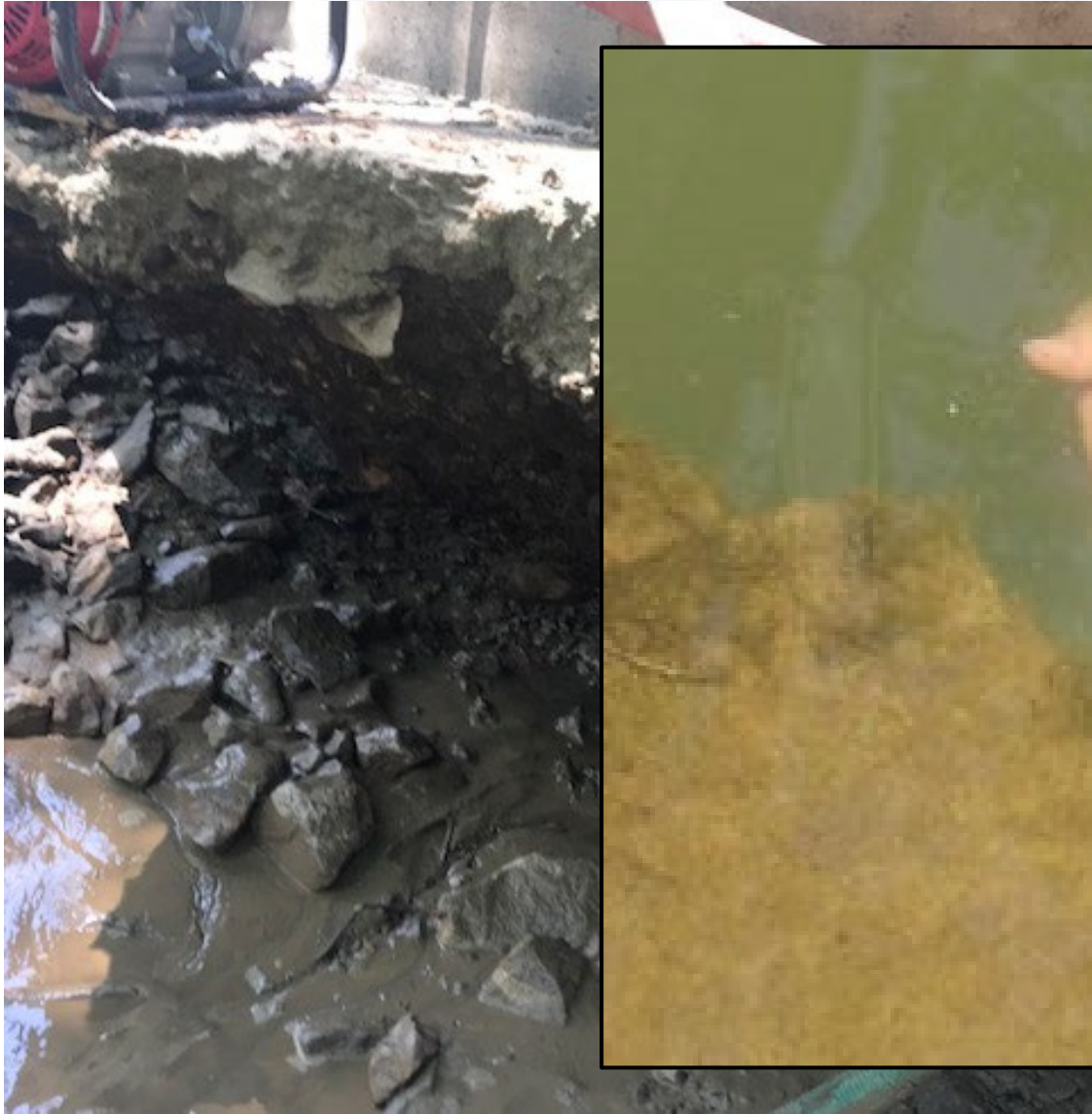
<u>Code</u>	<u>Condition</u>	<u>Description</u>
N	NOT APPLICABLE	<ul style="list-style-type: none"> Bridge does not cross over water or channel protection devices do not exist.
9	EXCELLENT	<ul style="list-style-type: none"> Isolated inherent defects.
8	VERY GOOD	<ul style="list-style-type: none"> Some inherent defects.
7	GOOD	<ul style="list-style-type: none"> Some minor defects.
6	SATISFACTORY	<ul style="list-style-type: none"> Widespread minor or isolated moderate defects.
5	FAIR	<ul style="list-style-type: none"> Some moderate defects; Performance of the channel protection is not affected.
4	POOR	<ul style="list-style-type: none"> Widespread moderate or isolated major defects; Performance of channel protection is affected.
3	SERIOUS	<ul style="list-style-type: none"> Major defects; Performance of channel protection is seriously affected. Condition typically necessitates more frequent monitoring or corrective actions.
2	CRITICAL	<ul style="list-style-type: none"> Major defects; Channel protection is severely compromised. Condition typically necessitates more frequent monitoring or corrective actions.
1	IMMINENT FAILURE	<ul style="list-style-type: none"> Channel protection has failed, but corrective action could restore it to working condition.
0	FAILED	<ul style="list-style-type: none"> Channel protection is beyond repair and must be replaced.

B.C.11 Scour Condition Rating

- Evaluates the observed or measured scour at a structure.
- Factors to consider against observed/measured scour
 - Design scour depth and critical scour depth
 - Scour evaluations
 - POAs
 - Visible scour
- Critical limit for scour is the scour depth at which the bridge becomes unstable
- 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)

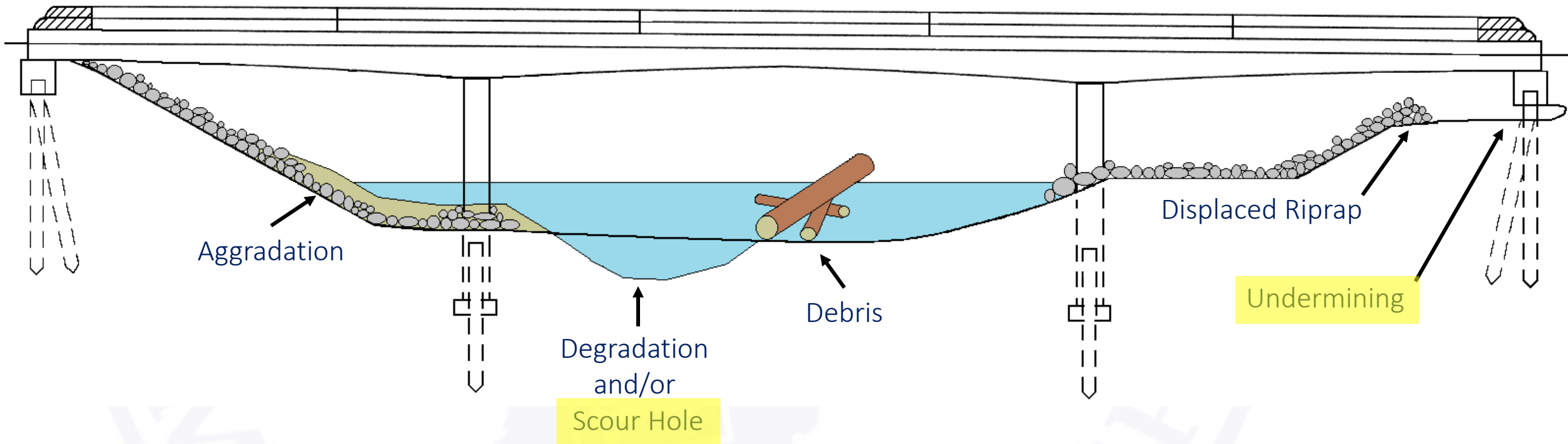


Example Channel with Damage



Example Channel with Damage

- What deficiencies affect B.C.11 Scour Condition Rating?

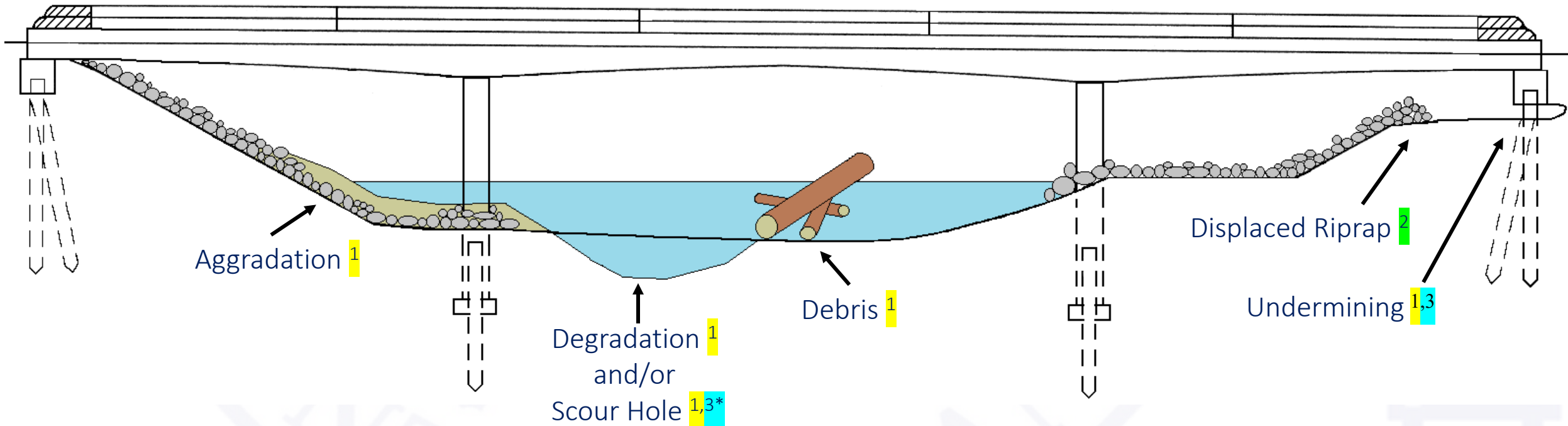


B.C.11 Scour Condition Rating continued...

<u>Code</u>	<u>Description</u>
N	<ul style="list-style-type: none">• Bridge does not cross over water.
9	<ul style="list-style-type: none">• No scour.
8	<ul style="list-style-type: none">• Insignificant scour.
7	<ul style="list-style-type: none">• Some minor scour.
6	<ul style="list-style-type: none">• Widespread minor or isolated moderate scour.
5	<ul style="list-style-type: none">• Moderate scour;• Strength and stability of the bridge are not affected.
4	<ul style="list-style-type: none">• Widespread moderate or isolated major scour;• Strength and/or stability of the bridge is affected.
3	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Bridge is closed to traffic due to scour condition.• Channel rehabilitation may return the bridge to service.
0	<ul style="list-style-type: none">• Bridge is closed due to scour condition and is beyond corrective action.• Bridge replacement is needed to restore service.

Clarification of Channel & Scour Fields

- **B.C.09 Channel Condition Rating** - Used to provide a condition rating for the channel at the bridge.
 - **B.C.10 Channel Protection Condition Rating** - Evaluate the condition and effectiveness of channel protection devices installed on banks or in the stream to mitigate channel issues that may impact the bridge.
 - **B.C.11 Scour Condition Rating** - Evaluates the observed or measured scour at a structure.
- All three of these components can eventually affect the other ratings as well as the stability of the structure.
 - Location of the scour may change which component is affected.



Knowledge Check

A large debris pile has built up to Pier 2 which is in the water. Due to the changes of flow the debris has caused the following:

- Riprap has washed downstream
- The pier footing has been undermined
- A large scour hole has formed in the channel and around the pier

What ratings are affected?

- B.C.09 Channel Condition Rating
- B.C.10 Channel Protection Condition Rating
- B.C.11 Scour Condition Rating

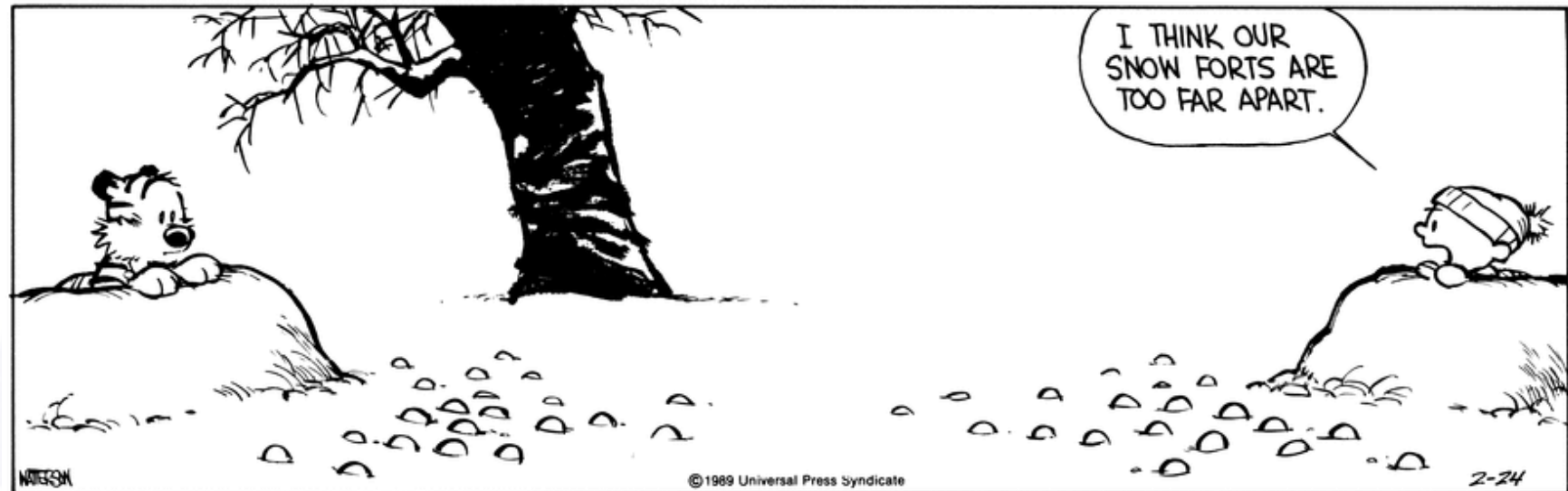


Knowledge Check

Kids decided to move the riprap that was next to Bent 1 and make a fort. No scour is present but is now more susceptible to scour.

What ratings are affected?

- B.C.09 Channel Condition Rating
- B.C.10 Channel Protection Condition Rating
- B.C.11 Scour Condition Rating



B.C.12 & B.C.13

B.C.13 Lowest Condition Rating Code

- The code for this item is the lowest condition rating code from the following items
 - B.C.01 (Deck Condition Rating)
 - B.C.02 (Superstructure Condition Rating)
 - B.C.03 (Substructure Condition Rating)
 - B.C.04 (Culvert Condition Rating)

B.C.12 Bridge Condition Classification

- A method to classify a bridge which takes the lowest condition rating code from the list of items for B.C.13.
- The bridge condition classification is indicated using one of the codes in the table on the right.



<u>Code</u>	<u>Condition</u>	<u>Lowest Condition Rating</u>
G	Good	7 – 9
F	Fair	5 – 6
P	Poor	4 - 0

Both items are calculated by FHWA and are not required to be reported.

B.C.14 & 15 NSTM & UW Inspection Condition

B.C.14 NSTM Inspection Condition

- Represents the condition of NSTM(s) items identified to be inspected.
- For a bridge with NSTM(s) in both the superstructure and substructure, report only the lower of the two condition values.

B.C.15 Underwater Inspection Condition

- Represents the condition of underwater items identified to be inspected.

Both condition ratings use the codes and descriptions are from Table 20.

Do not report these items when Item B.IR.01 (NSTM Inspection Required) or B.IR.03 (Underwater Inspection Required) are coded N



NSTM, Underwater, or Both?

Element Level Identification and Condition

- The way elements are reported in SNBI 2022 is the same as the current Element Level Manual.
- Element inspections are currently required for bridges on the National Highway System.
- Element numbers, quantities, and condition states have all stayed the same.

PERIODIC TABLE OF ELEMENTS
Chemical Group Block

PubChem

1 1.0080 H Hydrogen Nonmetal																	18 4.00260 He Helium Noble Gas									
3 7.0 Li Lithium Alkali Metal	4 9.012183 Be Beryllium Alkaline Earth Me...											5 10.81 B Boron Metalloid	6 12.011 C Carbon Nonmetal	7 14.007 N Nitrogen Nonmetal	8 15.999 O Oxygen Nonmetal	9 18.9984... F Fluorine Halogen	10 20.180 Ne Neon Noble Gas									
11 22.989... Na Sodium Alkali Metal	12 24.305 Mg Magnesium Alkaline Earth Me...											13 26.981... Al Aluminum Post-Transition M...	14 28.085 Si Silicon Metalloid	15 30.973... P Phosphorus Nonmetal	16 32.07 S Sulfur Nonmetal	17 35.45 Cl Chlorine Halogen	18 39.9 Ar Argon Noble Gas									
19 39.0983 K Potassium Alkali Metal	20 40.08 Ca Calcium Alkaline Earth Me...	21 44.95591 Sc Scandium Transition Metal	22 47.867 Ti Titanium Transition Metal	23 50.9415 V Vanadium Transition Metal	24 51.996 Cr Chromium Transition Metal	25 54.93804 Mn Manganese Transition Metal	26 55.84 Fe Iron Transition Metal	27 58.93319 Co Cobalt Transition Metal	28 58.693 Ni Nickel Transition Metal	29 63.55 Cu Copper Transition Metal	30 65.4 Zn Zinc Transition Metal	31 69.723 Ga Gallium Post-Transition M...	32 72.63 Ge Germanium Metalloid	33 74.92159 As Arsenic Metalloid	34 78.97 Se Selenium Nonmetal	35 79.90 Br Bromine Halogen	36 83.80 Kr Krypton Noble Gas									
37 85.468 Rb Rubidium Alkali Metal	38 87.62 Sr Strontium Alkaline Earth Me...	39 88.90584 Y Yttrium Transition Metal	40 91.22 Zr Zirconium Transition Metal	41 92.90637 Nb Niobium Transition Metal	42 95.95 Mo Molybdenum Transition Metal	43 96.90636 Tc Technetium Transition Metal	44 101.1 Ru Ruthenium Transition Metal	45 102.9055 Rh Rhodium Transition Metal	46 106.42 Pd Palladium Transition Metal	47 107.868 Ag Silver Transition Metal	48 112.41 Cd Cadmium Transition Metal	49 114.818 In Indium Post-Transition M...	50 118.71 Sn Tin Post-Transition M...	51 121.760 Sb Antimony Metalloid	52 127.6 Te Tellurium Metalloid	53 126.9045 I Iodine Halogen	54 131.29 Xe Xenon Noble Gas									
55 132.90... Cs Cesium Alkali Metal	56 137.33 Ba Barium Alkaline Earth Me...											72 178.49 Hf Hafnium Transition Metal	73 180.9479 Ta Tantalum Transition Metal	74 183.84 W Tungsten Transition Metal	75 186.207 Re Rhenium Transition Metal	76 190.2 Os Osmium Transition Metal	77 192.22 Ir Iridium Transition Metal	78 195.08 Pt Platinum Transition Metal	79 196.96... Au Gold Transition Metal	80 200.59 Hg Mercury Transition Metal	81 204.383 Tl Thallium Post-Transition M...	82 207 Pb Lead Post-Transition M...	83 208.98... Bi Bismuth Post-Transition M...	84 208.98... Po Polonium Metalloid	85 209.98... At Astatine Halogen	86 222.01... Rn Radon Noble Gas
87 223.01... Fr Francium Alkali Metal	88 226.02... Ra Radium Alkaline Earth Me...											104 267.1... Rf Rutherfordium Transition Metal	105 268.1... Db Dubnium Transition Metal	106 269.1... Sg Seaborgium Transition Metal	107 270.1... Bh Bohrium Transition Metal	108 269.1... Hs Hassium Transition Metal	109 277.1... Mt Meitnerium Transition Metal	110 282.1... Ds Darmstadtium Transition Metal	111 282.1... Rg Roentgenium Transition Metal	112 286.1... Cn Copernicium Post-Transition M...	113 286.1... Nh Nihonium Post-Transition M...	114 290.1... Fl Flerovium Post-Transition M...	115 290.1... Mc Moscovium Post-Transition M...	116 293.2... Lv Livermorium Post-Transition M...	117 294.2... Ts Tennessine Halogen	118 295.2... Og Oganesson Noble Gas
		57 138.9055 La Lanthanum Lanthanide	58 140.116 Ce Cerium Lanthanide	59 140.90... Pr Praseodymium Lanthanide	60 144.24 Nd Neodymium Lanthanide	61 144.91... Pm Promethium Lanthanide	62 150.4 Sm Samarium Lanthanide	63 151.964 Eu Europium Lanthanide	64 157.2 Gd Gadolinium Lanthanide	65 158.92... Tb Terbium Lanthanide	66 162.500 Dy Dysprosium Lanthanide	67 164.93... Ho Holmium Lanthanide	68 167.26 Er Erbium Lanthanide	69 168.93... Tm Thulium Lanthanide	70 173.05 Yb Ytterbium Lanthanide	71 174.9668 Lu Lutetium Lanthanide										
		89 227.02... Ac Actinium Actinide	90 232.038 Th Thorium Actinide	91 231.03... Pa Protactinium Actinide	92 238.0289 U Uranium Actinide	93 237.04... Np Neptunium Actinide	94 244.06... Pu Plutonium Actinide	95 243.06... Am Americium Actinide	96 247.07... Cm Curium Actinide	97 247.07... Bk Berkelium Actinide	98 251.07... Cf Californium Actinide	99 252.0830 Es Einsteinium Actinide	100 257.0... Fm Fermium Actinide	101 258.0... Md Mendelevium Actinide	102 259.1... No Nobelium Actinide	103 266.1... Lr Lawrencium Actinide										

The Wrong Table of Elements

B.AP.01 Approach Roadway Alignment

- Item identifies bridges that don't function adequately due to the horizontal or vertical alignment of the bridge and roadway.
- This code is used to report the operating speed reduction at the bridge compared to the existing roadway alignment and posted speed limit.
- Factors to NOT Consider:
 - Speed reductions due to the bridge width
 - Intersecting roads
 - Current highway and bridge standards

<u>Code</u>	<u>Condition</u>	<u>Description</u>
G	Good	The operating speed is no different at the bridge than the rest of the highway segment that crosses the bridge.
F	Fair	The operating speed is noticeably different ...
P	Poor	The operating speed is substantially different ...



B.AP.02 Overtopping Likelihood

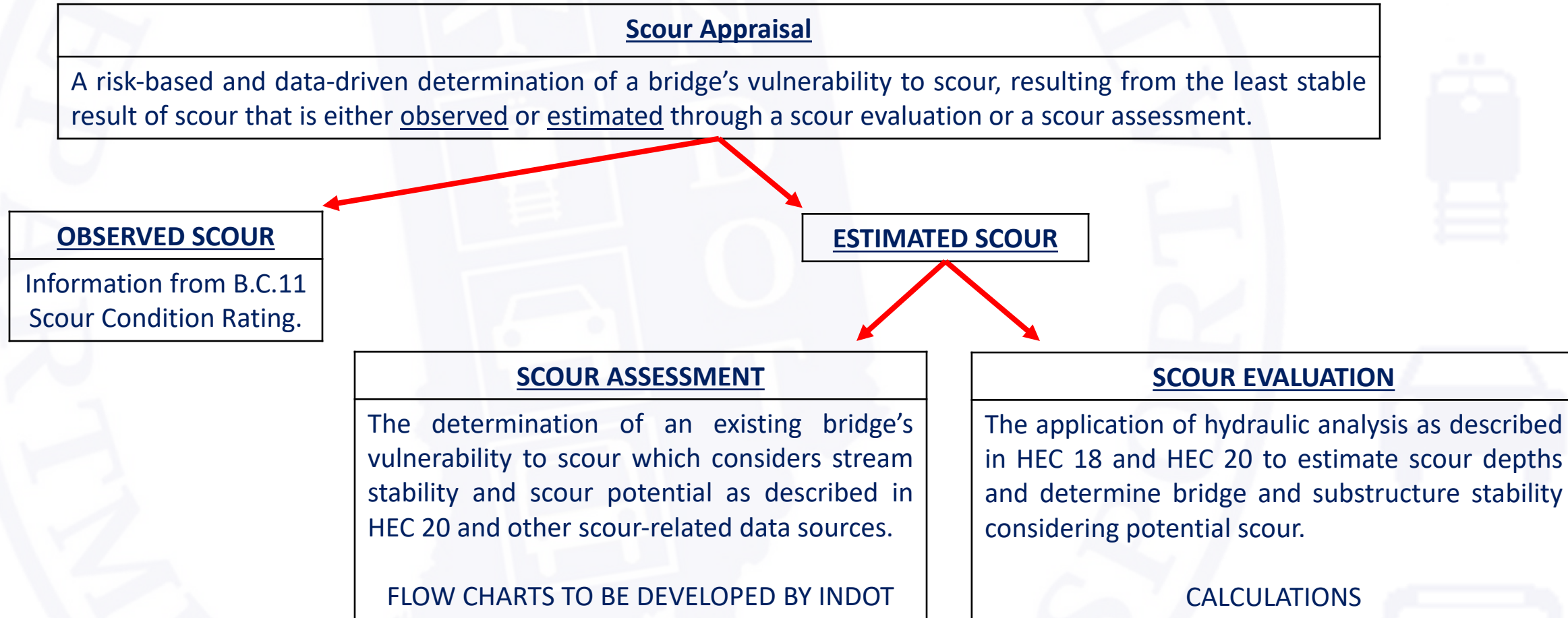
- Reports the likelihood of the waterway overtopping the bridge riding surface, not the approach roadway.
- An overtopping occurrence is when the waterway overtops the riding surface on the bridge, not the approach roadway.
- Factors to Consider:
 - Historical records – Inspections, maintenance, hydraulic studies, or notifications from nearby residents/landowner
 - Site indicators – Highwater marks on the bridge/surroundings or debris remains on bridge upper members

<u>Code</u>	<u>Condition</u>	<u>Description</u>
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



B.AP.03 Scour Vulnerability

The intent of this item is to report the status and vulnerability determination from scour appraisals.



The B.AP.03 Scour Vulnerability and B.C.11 Scour Condition ratings should be consistent with each other.

B.AP.03 Scour Vulnerability continued...

<u>Code</u>	<u>Condition</u>
0	<ul style="list-style-type: none">• Scour appraisal has not been completed.
A	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge determined to be stable for scour.
B	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures.
C	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge could become unstable for scour.• Temporary (not designed) countermeasure installed to mitigate scour.• Bridge is scour critical.
D	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge is, or may become, unstable for scour.• Bridge is scour critical.
E	<ul style="list-style-type: none">• Scour appraisal has not been completed.• Temporary (not designed) countermeasure installed to mitigate scour.
U	<ul style="list-style-type: none">• Scour appraisal has not been completed due to unknown foundations.

Knowledge Check

- Bridge 42 has been found to be scour critical due to the scour appraisal showing instability at Bent 1. Adequate riprap has been placed around the structure; however, the riprap was not designed.
- What coding would be applied to B.AP.03 Scour Vulnerability?

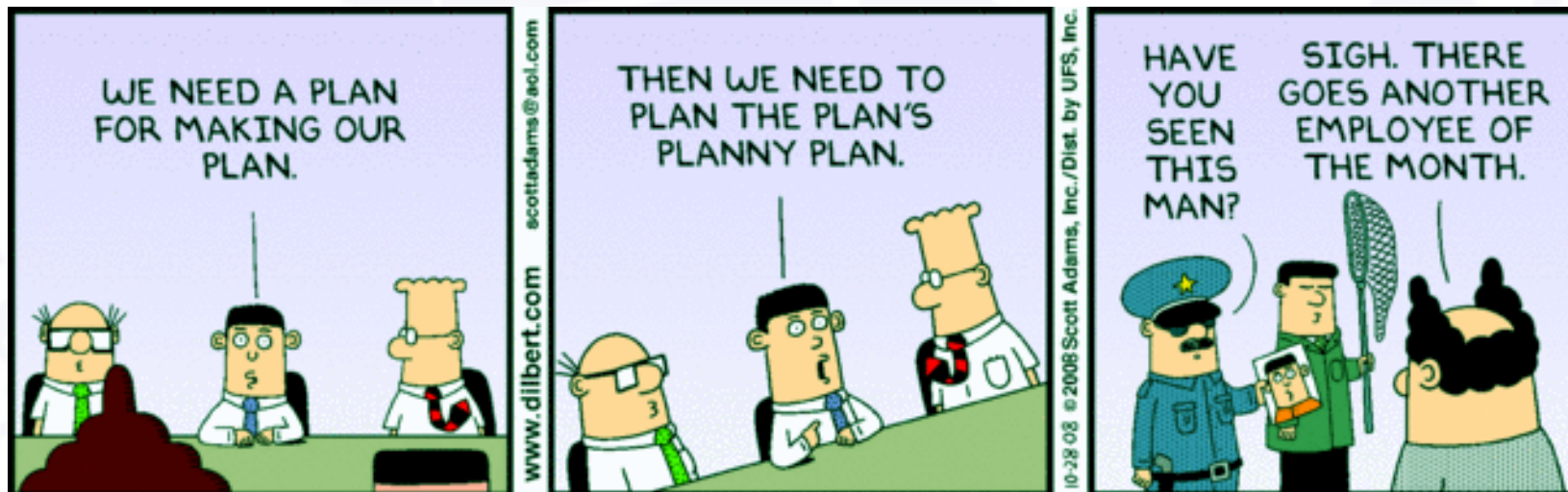
<u>Code</u>	<u>Condition</u>
0	<ul style="list-style-type: none">• Scour appraisal has not been completed.
A	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge determined to be stable for scour.
B	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge determined to be stable for scour, dependent upon designed, and functioning countermeasures.
C	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge could become unstable for scour.• Temporary (not designed) countermeasure installed to mitigate scour.• Bridge is scour critical.
D	<ul style="list-style-type: none">• Scour appraisal completed.• Bridge is, or may become, unstable for scour.• Bridge is scour critical.
E	<ul style="list-style-type: none">• Scour appraisal has not been completed.• Temporary (not designed) countermeasure installed to mitigate scour.
U	<ul style="list-style-type: none">• Scour appraisal has not been completed due to unknown foundations.

- 0
- A
- B
- C
- D
- E
- U

B.AP.04 Scour Plan of Action

- The NBIS requires a scour POA for a bridge over water that is determined to be scour critical.
 - When B.AP.03 Scour Vulnerability is rated C, D, E, or U.
- A scour POA is a document that addresses factors such as risk, monitoring schedule, opening/closing information, etc.
 - INDOT will provide additional guidance on what information is required.
- Use code 0 if a bridge was considered scour critical but now has designed & fully functioning scour countermeasures.

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



B.AP.05 Seismic Vulnerability

- This item provides available information resulting from seismic evaluation and retrofit programs that an agency has created.
- If the agency has not developed evaluation criteria, refer to the “FHWA Seismic Retrofitting Manual for Highway Structures: Part 1 - Bridges, Publication No. FHWA-HRT-06-032, January 2006”
- Long story short – INDOT will be providing more guidance in the Bridge Inspection Manual as to how to code this item.

**For sale an all in one:
tornado, earthquake,
nuclear bomb shelter**



B.AP.05 Seismic Vulnerability continued...

<u>Rating</u>	<u>Description</u>
0	<ul style="list-style-type: none">• Seismic evaluation not completed.
A	<ul style="list-style-type: none">• Seismic evaluation completed.• Bridge determined to meet the agency's performance criteria established for the evaluation without need for retrofit.
B	<ul style="list-style-type: none">• Seismic evaluation completed.• Satisfactory performance is dependent upon a designed, installed, and functioning retrofit.• Retrofit <u>is</u> in place.
C	<ul style="list-style-type: none">• Seismic evaluation completed.• Satisfactory performance is dependent upon a designed, installed, and functioning retrofit.• <u>Partial</u> retrofit is in place.
D	<ul style="list-style-type: none">• Seismic evaluation completed.• Satisfactory performance is dependent upon a designed, installed, and functioning retrofit.• Retrofit is <u>not</u> in place.
N	<ul style="list-style-type: none">• Bridge does not require seismic evaluation due to low anticipated ground motion or agency prioritization.