Are you smarter than a Bridge Inspector?

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Topics

- Scour
- Executive Summary
- Justification of Ratings
- Condition Rating Exercise

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Sherman Minton Bridge | I-64 over Ohio River

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Live quiz

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What is scour?

Describes the ability for water to flow freely under a bridge
1

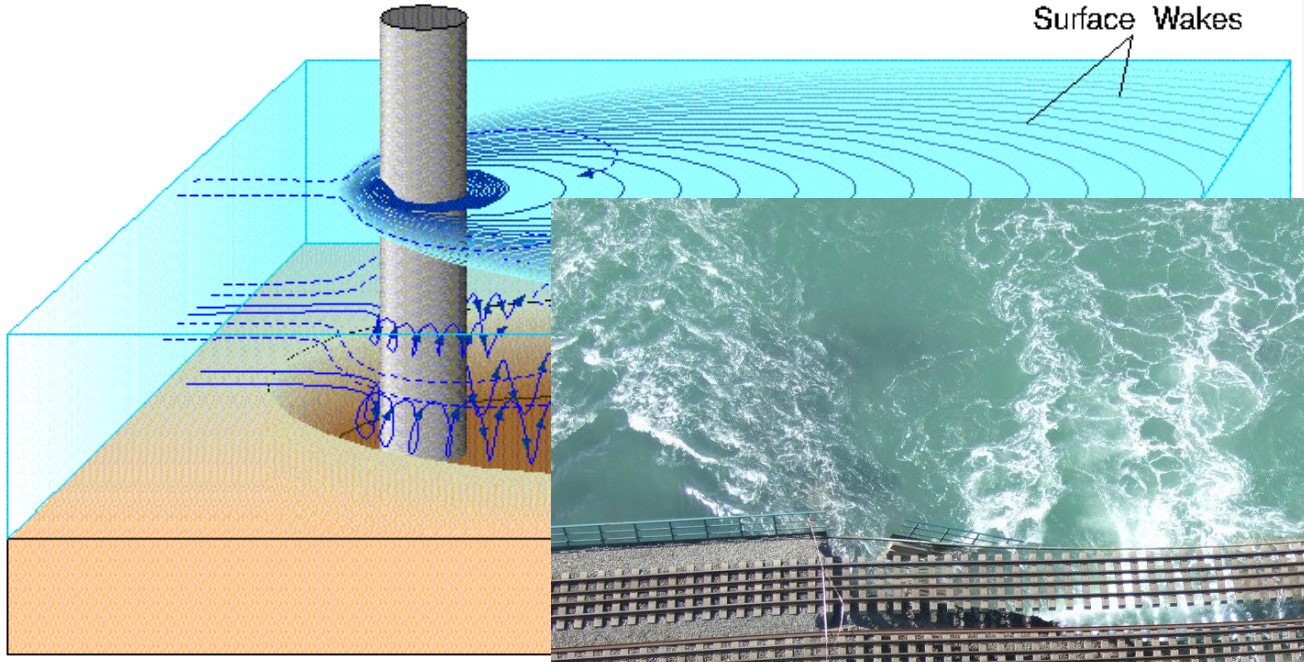
Diarrhea in livestock, especially cattle and pigs
2

Dead load specifically on the bridge abutments
0

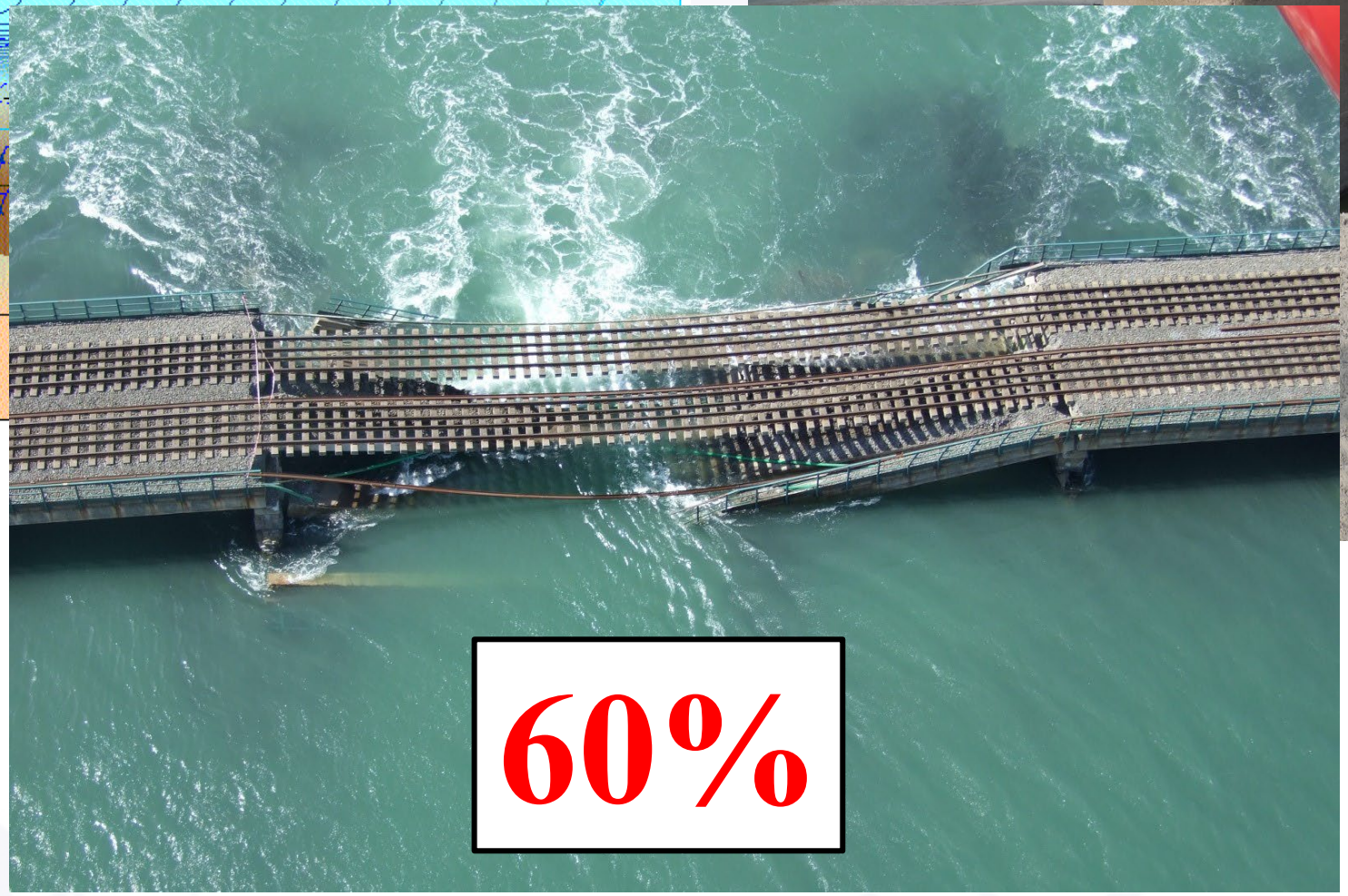
Erosion of soil surrounding a bridge foundation
58

Road kill on the shoulder of the bridge
1

The S word…



USGS.gov



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Item 113: Scour Critical Bridges

Code to identify current status of a bridge regarding its *vulnerability to scour.*

Scour critical bridge → abutment or pier foundations are rated as unstable due to:

1. Observed scour at the bridge site, ***or***
2. Scour potential as determined from a scour evaluation study (Scour Analysis)
   - Actual scour may or may not be present!

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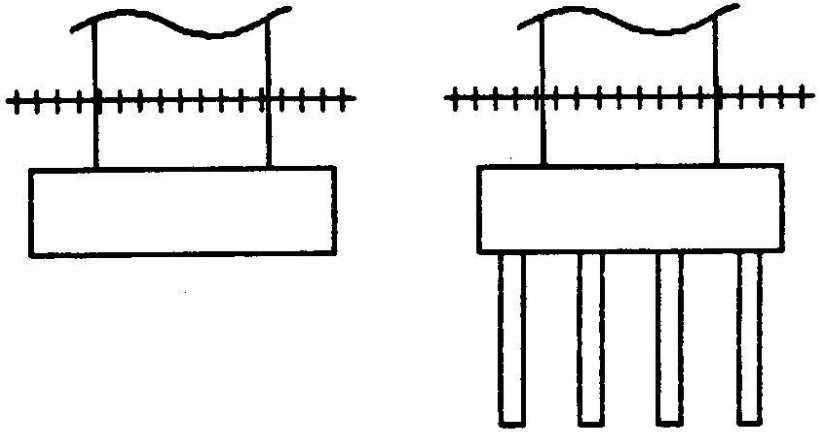
Item 113: Scour Critical Bridges

N	Bridge not over waterway
U	Bridge with "unknown" foundation
T	Bridge over "tidal" waters
9	Bridge foundations, including piles, on dry land and well above flood water elevations

Item 113: Scour Critical Bridges

8 Bridge foundations determined to be stable for ***ASSESSED*** or ***CALCULATED*** scour conditions; calculated scour is above top of footing.

A.	Above top of footing		None - indicate rating of 8 for this item

Item 113: Scour Critical Bridges

7 Countermeasures have been ***installed to correct*** a previously existing problem with scour. Bridge is no longer scour critical.

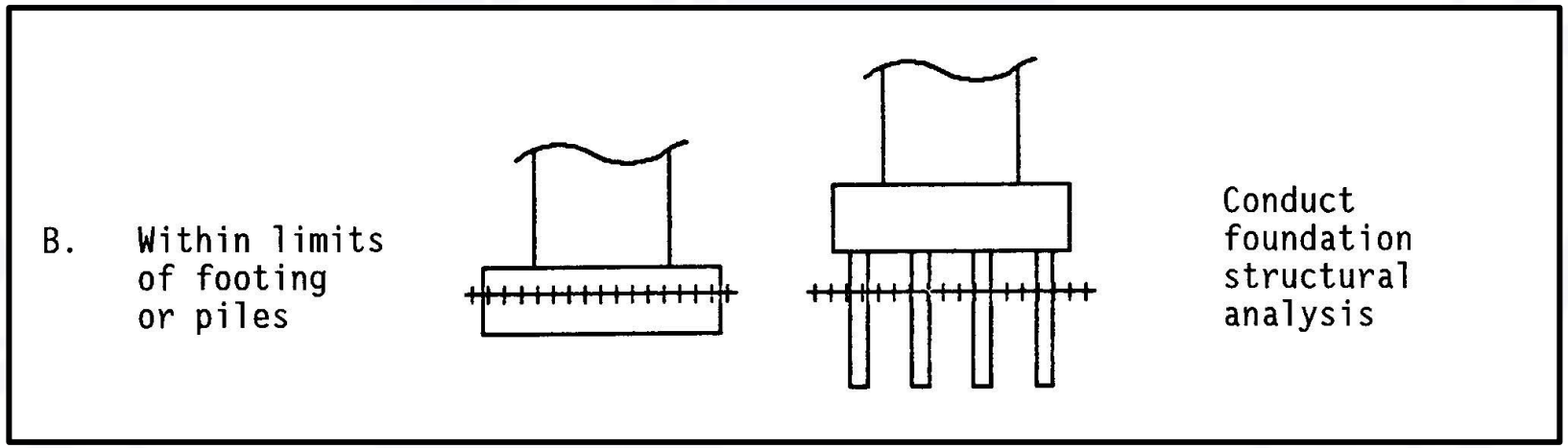
- Installed countermeasures must have been ***designed for site conditions***. Dumped revetment riprap is not sufficient.
- Integrity of installed countermeasures must be documented during each routine inspection to retain this coding
  - If countermeasures become inadequate per requirements, bridge is again scour critical
- Scour Plan of Action is ***not required***.

Item 113: Scour Critical Bridges

6 Scour calculation/evaluation has not been made.

- *This code should never have to be used on any bridges; it will be flagged for correction.*

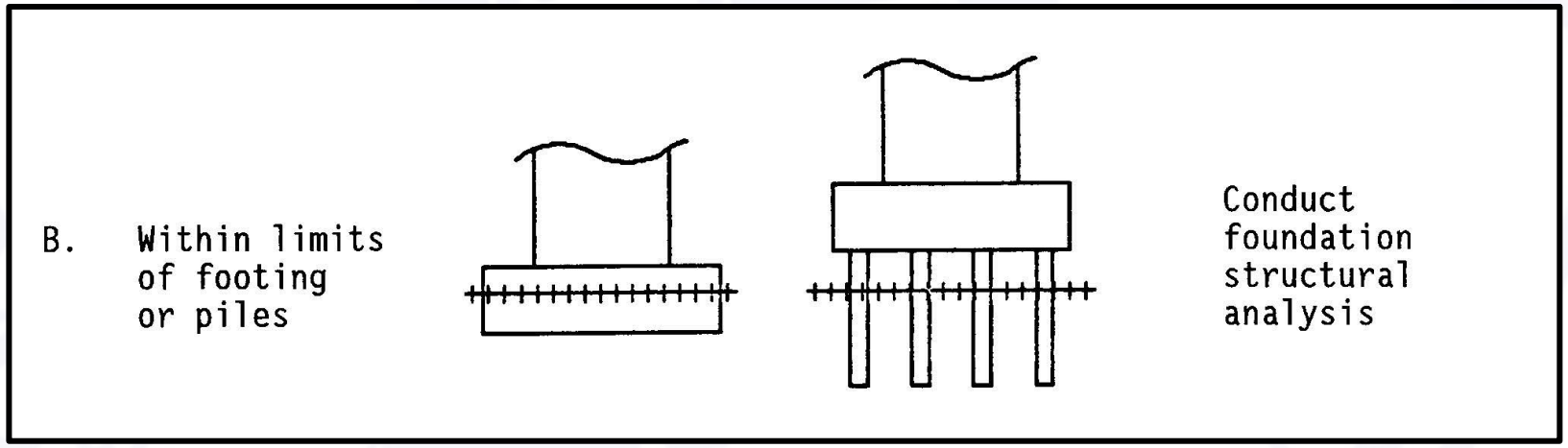
5 Bridge foundations determined to be stable for ***calculated*** scour conditions; scour within limits of footing or piles.



Item 113: Scour Critical Bridges

- Condition **5** coding situations:
  1. Spread footing foundation on hard clay, hardpan, or keyed into bedrock.
  2. Pile Bents on either Steel or Concrete Piles; designed for buckling.

- Check plans for soil borings or pile depths; document in bridge report.



Item 113: Scour Critical Bridges

4 Bridge foundations determined to be stable for ***calculated*** scour conditions (same as "5" coding); field review indicates action is required to protect foundations.

- Bridge file has Hydraulic Analysis on file with conclusion that the bridge is not scour critical by analysis
- Erosion or scour has occurred that is adversely affecting the substructure, to include undercutting the foundation. Especially important if previous inspections did not report such erosion or scour.
- Also use for pile bents where the piles exhibit heavy corrosion, section loss, and any signs of buckling
- Conditions may warrant reducing Item 60 (Substructure) rating to match
- Scour Plan of Action ***not mandatory***

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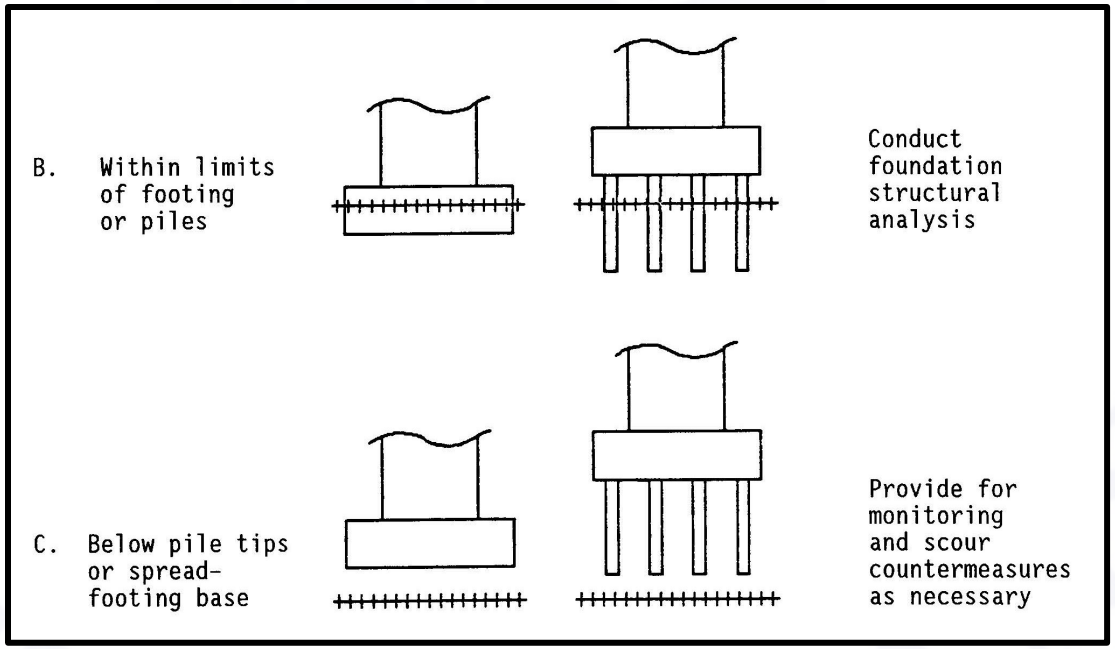
Item 113: Scour Critical Bridges

3 Bridge is scour critical; bridge foundations determined to be unstable for ***calculated*** scour conditions.

- Bridge file has Hydraulic Analysis on file with conclusion that the bridge is scour critical by analysis
- Erosion or scour adversely affecting the substructure, to include undercutting the foundation, may not have yet occurred
- Coding ***REQUIRES*** a Scour Plan of Action be included in the bridge file.



Item 113: Scour Critical Bridges

2 Bridge is scour critical; field review indicates that extensive scour ***has occurred*** at bridge foundations. ***Immediate action*** is required to provide scour countermeasures.

- Severe scour has occurred (foundation undercutting or increased pile exposure) and that the bridge was already likely assessed as scour critical by analysis
- REQUIRES Item 60 (Substructure) to match Item 113
- REQUIRES increased inspection frequency
- REQUIRES submitting Critical Finding per INDOT BIM

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Item 113: Scour Critical Bridges

1 Bridge is scour critical; field review indicates that failure of piers/abutments in imminent. **Bridge is closed to traffic**.

0 Bridge is scour critical. Bridge has failed and is closed to traffic.

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When is a scour POA required?

Item 113: Code 6

3

Item 60: Rated 4

8

Item 113: Code 3

46

Item 113: Code 2

1

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If a bridge has the required scour countermeasures in place and they are in adequate condition, is the bridge still scour critical?

Yes 17

No 38

I do not know 1

I do not like this question 2

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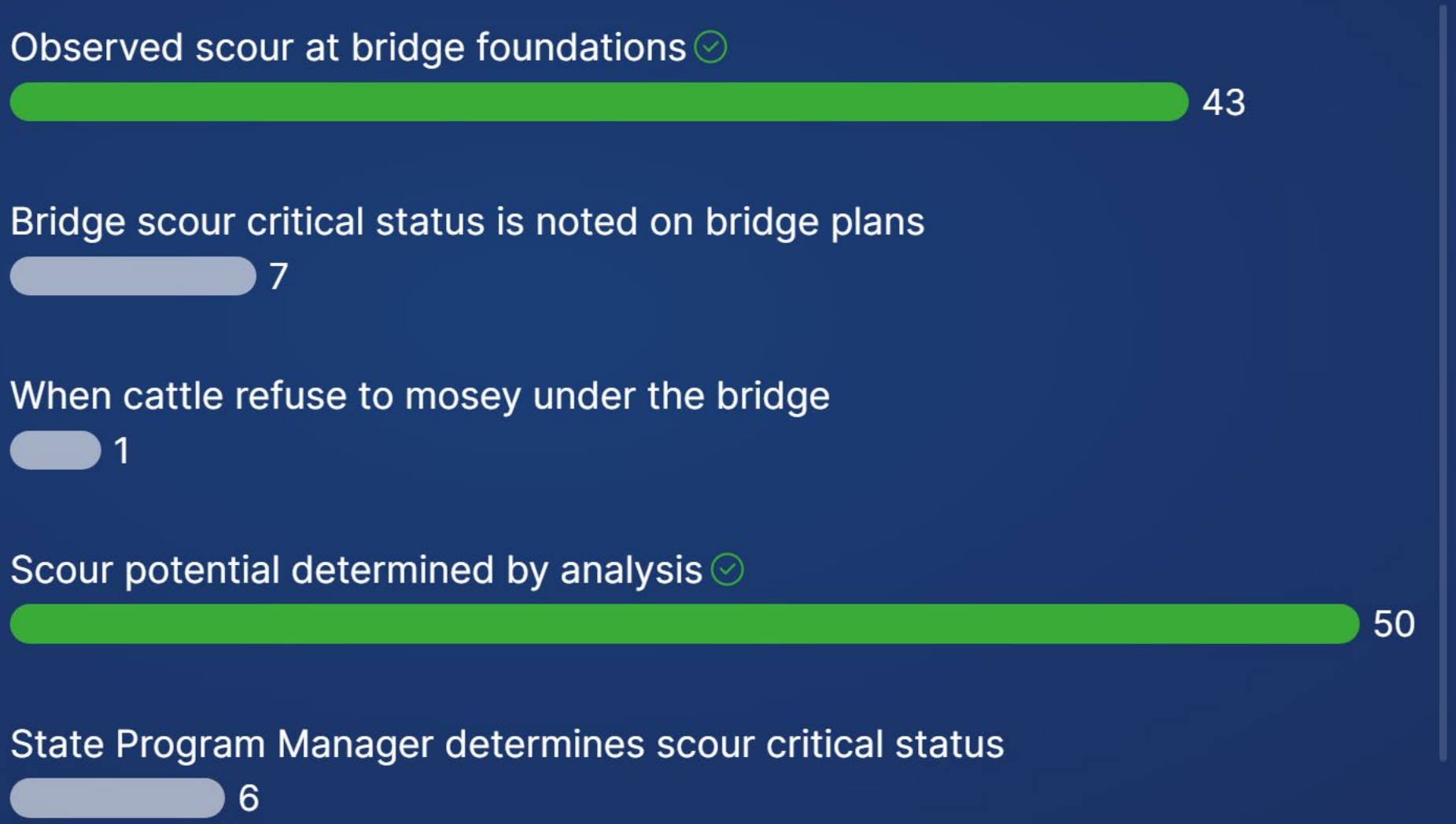
What method(s) is a bridge rated for scour instability?



Inspection Report – Executive Summary

Things to remember:

- Professional document seen by many customers – ***even the public!!*** 
- Inspection report is a snapshot in time
- Summary will be redundant
- Passive form
- Proper grammar & punctuation

Items to include:

- Bridge posting
- Scour status
- Overall condition
- Condition of components without rating category
- Highlights of inspection: poor condition components or previous damage
- Maintenance needs
- Recommendations (projects/actions)
- Upcoming projects
- Bridge history

Do not include names of inspectors or date of inspection.

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Executive Summary Example

(Bridge over water)

"The substructure is in good condition but the superstructure is in poor condition. There are many bottom of beam spalls with exposed strands and several spalls in top of deck.

Rehabilitation should include replacing superstructure."

Ponder these questions:
Is this an adequate summary?
How would you rewrite?
What is missing?
Are there any grammar or punctuation mistakes?

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Give some constructive feedback on this executive summary.

Condition 5 | Detail 5 | Vague 3 | Deck 3 | Mention 3 | Location 3 | History 3 | Bridge

Lacking detail, particularly location and extents

Not enough detail. Vague.

Not adequate. It does not propose maintenance or repairs for poor condition.

How many spells, which beams? Where are the deck spalls located approximately?

Executive Summary Example

“Road over Creek {RP/Coordinates Location}
3-span continuous, pre-stressed concrete I-beam bridge built in 1988 {Contract Info}. No rehab work to date. Programmed for a superstructure replacement in 2023 {Contract Info}.

Bridge Railings: a few widely-spaced, hairline vertical cracks with light efflorescence;

Ponder these questions:
Is this an adequate summary?
How would you rewrite?
What is missing?
Are there any grammar or punctuation mistakes?

OVERALL: Fair Condition
Deck/Wearing Surface --- Minor-to-moderate surface abrasion (exposed aggregate, worn down tining) and some areas of map cracking to top surface. Underside has only minor cracks.

Superstructure --- Beam ends (especially on west end of Span A and east end of Span C) have numerous spalls and delaminations, with some exposed strands. See sketch attached in master files for locations and details. Bridge is scheduled for a superstructure replacement in 2023 {Contract Info}.

Substructure --- Some minor surface scaling to intermediate piers; minor cracks and some large areas of delamination/spalling to abutments (possible beam contact).”

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Give some constructive feedback on this executive summary.

Overall I think this one was well written. Gives a good level of general information

List recommendations for future maintenance if needed.

It does give scheduled maintenance. Too much info without recommendations.

Summary of condition state.

Location of cracks, which piers

Justification of Ratings

- Based on 2022 QA Review, 10 out of 36 (28%) reviewed bridges did not have adequate rating justification.
- What to include in your comments
  - ✓Location
  - ✓Type *Where is it? What is it? How bad is it?*
  - ✓Severity

Justification of Ratings – Substructure Example

- Bad Substructure comment justification:
  - Two concrete end bents with a pier having steel pier columns and concrete cap
  - Rating: 4
  - Original Comment:

    "Surface rust – pitting – debris on the bearing area"

- Good Substructure comment justification:
  - New Comment:

    "All pier columns have minor surface rust and minor pitting throughout the entire length with the heaviest being at the top. There is also minor debris build-up on the bearing areas of the west end bent."

Justification of Ratings – Superstructure Example

- Bad Superstructure comment justification:
  - Prestressed I-Beams
  - Rating: 3
  - Original Comment:

    "Beam cracks sealed"

- Good Superstructure comment justification:
  - New Comment:

    "Heavy diagonal cracking in the beam ends of beams 1A (South), 2B (North), and 3C (South). These cracks all measure approximately 10" long. These cracks have been sealed with epoxy."

Blank Comments for Condition Ratings

Executive Summary	(58) Deck	(59) Superstructure	(60) Substructure	(62) Culverts
9.58%	**0.26%**	**0.62%**	**0.53%**	**0.03%**

(61) Channel	(71) Waterway Adequacy	(72) Approach Roadway Alignment	(113) Scour Critical Bridges
0.44%	**13.30%**	**23.00%**	**20.74%**

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Bridge Component Rating Exercise

Example bridge components will be presented with justification & pictures.

Superstructure

- 075-32-06871

Component	Rating	Comment
Superstructure	?	All copings have heavy spalling with exposed and hanging steel. Steel has minor surface rust and section loss. Up to four bars on each coping are exposed with spalling up to 2’ wide. All spans have a hairline longitudinal crack along the centerline with spans A & B also having rust staining.

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What would you rate the superstructure?

5 ✓	40
6	13
4	5
3	1
7	0

Culvert

- Clinton 095

Component	Rating	Comment
Culvert	?	Large hole/spall at the base of the arch at the southwest corner 2’-3’ deep. Heavy cracking, spalling, delaminations, and exposed steel throughout the arch and headwalls. 8 longitudinal bars exposed. Much of the exposed steel is no longer in contact with the concrete. The southwest wingwall previously failed. Other wingwalls are cracked and leaning (SE = 3”, NE = 1”, NW = 4.5”)

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What would you rate the culvert?

4	37
3 ✓	22
6	1
2	1
7	0

Stringers

- Orange 91
  - Pony Truss with Floor Beam / Stringer System
  - 8 stringers support the deck (2 channel beams on exterior with S-Beams on interior)

Member	Rating	Comments
Stringers	?	Simple span with top flanges embedded. <5% section loss for interior stringers. Exterior stringers with rust perforations throughout web and 25% section loss to web. Exterior top and bottom flanges have light pitting and 0% section loss. Northwest stringer with 2” tall rust perforation at the abutment bearing.

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What would you rate the stringers?

5 ✓ 26

4 21

6 10

3 1

7 0

Truss Members – Lower Chord

- Martin 59

Location / Member	Fatigue Category	Rating	Comments
L0-L2	A	?	Interior member replaced with 0% section loss. Exterior member loose and partially ineffective. Approximately 25% loss of load carrying capacity.

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What would you rate the lower chord?

4 ✓	27
5	22
3	6
6	3
7	1

Truss Members - Vertical

- Lawrence 139

Location / Member	Fatigue Category	Rating	Comments
U4-L4	D	?	Major impact damage to the member at rail height. Moderate pitting with 10% section loss

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What would you rate the truss vertical?

4 ✓ 28

3 17

5 9

2 1

7 0

Scour

- Lawrence 125

Component	Rating	Comment
Scour	?	Both end bents are partially undermined ~1’ with exposed piles along the entire length. Good riprap protection on the slopes.

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What would you rate scour?

5
38

4
12

6
4

7
3

3
0