CULVERTS

3/7/2024

IL NBI Refresher Course 2024

1

Item 62 - Culverts

- Types of Culverts
- Condition Ratings

2

Item 62 - Culverts

Types of Culverts

- Concrete Box Culverts
  - Single or Multiple Cell
  - CIP or Precast Concrete
- Precast Concrete Pipe Culverts
  - Round
  - Elliptical
- Corrugated Metal Pipe Culverts
  - Round or Elliptical
  - Large Arches

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Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Leaching
- Spalls/Delams
- Section Loss
- Scour
- Separation or Deformation of Sections

Code	Description
N	NOT APPLICABLE. Use when structure is not a culvert.
9	EXCELLENT. New with no deficiencies
8	VERY GOOD. No noticeable or noteworthy deficiencies which affect the condition of the culvert, insignificant scrape marks caused by drift.
7	GOOD. Isolated non-structural cracks up to 0.03", light scaling, and insignificant spalling which does not expose reinforcing steel, metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting, insignificant damage caused by drift with no misalignment and not requiring corrective action, some minor scour has occurred near curtain walls, wingwalls, or pipes.

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Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Leaching
- Spalls/Delams
- Section Loss
- Scour
- Separation or Deformation of Sections

Code	Description
6	SATISFACTORY. Extensive non-structural cracks up to .06" with some leaching over the majority of the top slab, spalls and delaminations may be present on up to 10% in a 6' width of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 20% of the surface area of walls and slabs may be map cracked, spalled and delaminated. Metal culverts have a smooth curvature, non-symmetrical shape, minor corrosion or measurable pitting. Local minor scour at curtain walls, wingwalls, or pipes.
5	FAIR. Non-structural cracking with leaching at < 5' intervals over the majority of the slab or wall surfaces, structural cracks < 0.03" in walls or slabs, section loss of primary reinforcement up to 10% in the top slab in a 6' width, up to 10% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 10% section loss of concrete or rebar in a 10' width of wall, up to 10% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting with up to 10% average section loss in a 10' width, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

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Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Leaching
- Spalls/Delams
- Section Loss
- Scour
- Separation or Deformation of Sections

Code	Description
4	POOR. Structural cracks in top slab up to 0.06", structural cracks in walls up to 0.125", section loss of primary reinforcement up to 30% in the top slab in a 6' width, up to 30% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 30% section loss of concrete or rebar in a 10' width of wall, up to 30% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout with up to 30% section loss in a 10' width, considerable settlement or misalignment, considerable scour or erosion at curtain walls, wingwalls or pipes with undermining.
3	SERIOUS. Any worse or combined condition described in condition rating "4", up to 50% loss, metal culverts have extreme distortion and deflection in one section (collapse), extensive corrosion, or deep pitting with scattered perforations, severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe undermining of curtain walls, wingwalls or pipes.

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Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Leaching
- Spalls/Delams
- Section Loss
- Scour
- Separation or Deformation of Sections

Code	Description
2	CRITICAL. Large areas of slab or walls spalled full depth near traffic, large area of reinforcement losses greater than 50% near traffic, metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion, integral wingwalls collapsed, severe settlement of roadway due to loss of fill, section of culvert may have failed and can no longer support embankment, complete undermining of curtain walls and pipes, special feature inspection will be required to keep the structure open with possible load restrictions. The Bureau of Bridges and Structures shall be notified immediately.
1	IMMINENT FAILURE. Bridge closed. Corrective action may return bridge to light service.
0	FAILED. Bridge closed. Replacement necessary.

Item 62 - Culverts

New Construction

No Deficiencies

EXCELLENT. No deficiencies – Allowed first inspection only

Item 62 - Culverts

Very Good Condition

No significant defects

VERY GOOD. No noticeable or noteworthy deficiencies which affect the condition of the culvert, insignificant scrape marks caused by drift.

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Item 62 - Culverts

Good Condition

- Minor scaling
- Insignificant spalling
- No exposed reinforcement

GOOD. Isolated non-structural cracks up to 0.03", light scaling, and insignificant spalling which does not expose reinforcing steel, metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting, insignificant damage caused by drift with no misalignment and not requiring corrective action, some minor scour has occurred near curtain walls, wingwalls, or pipes.

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Item 62 - Culverts

Good Condition

- Hairline vertical cracks in center wall
- Crack spacing greater than 10’
- Light scaling present

GOOD. Isolated non-structural cracks up to 0.03”, light scaling, and insignificant spalling which does not expose reinforcing steel, metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting, insignificant damage caused by drift with no misalignment and not requiring corrective action, some minor scour has occurred near curtain walls, wingwalls, or pipes.

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Item 62 - Culverts

Satisfactory Condition

- Vertical cracks in the walls with leaching
- 10’ crack spacing
- Minor spalls and delaminations present on 5% of surface

SATISFACTORY. Extensive non-structural cracks up to .06” with some leaching over the majority of the top slab, spalls and delaminations may be present on up to 10% in a 6’ width of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 20% of the surface area of walls and slabs may be map cracked, spalled and delaminated. Metal culverts have a smooth curvature, non-symmetrical shape, minor corrosion or measurable pitting. Local minor scour at curtain walls, wingwalls, or pipes.

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Item 62 - Culverts

Satisfactory Condition

- Cracks with leaching at 10’ spacing
- Minor spalls and delaminations present on 3% of surface

SATISFACTORY. Extensive non-structural cracks up to .06” with some leaching over the majority of the top slab, spalls and delaminations may be present on up to 10% in a 6’ width of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 20% of the surface area of walls and slabs may be map cracked, spalled and delaminated. Metal culverts have a smooth curvature, non-symmetrical shape, minor corrosion or measurable pitting. Local minor scour at curtain walls, wingwalls, or pipes.

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Item 62 - Culverts

Satisfactory Condition

Precast Culvert

- Widely spaced cracks with leaching
- Minor spalls and delaminations present on 5% of surface

SATISFACTORY. Extensive non-structural cracks up to .06” with some leaching over the majority of the top slab, spalls and delaminations may be present on up to 10% in a 6’ width of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 20% of the surface area of walls and slabs may be map cracked, spalled and delaminated. Metal culverts have a smooth curvature, non-symmetrical shape, minor corrosion or measurable pitting. Local minor scour at curtain walls, wingwalls, or pipes.

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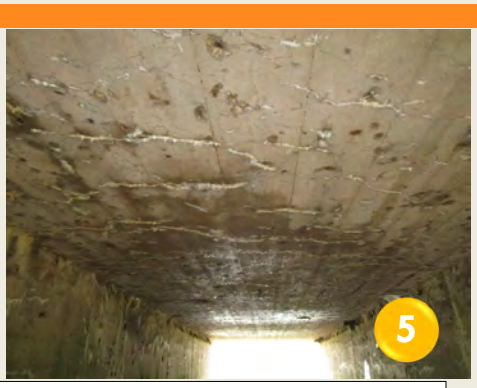
Item 62 - Culverts

Fair Condition

- Leaching map cracks throughout the top slab soffit
- Several small delaminations throughout



FAIR. Non-structural cracking with leaching at < 5' intervals over the majority of the slab or wall surfaces, structural cracks < 0.03" in walls or slabs, section loss of primary reinforcement up to 10% in the top slab in a 6' width, up to 10% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 10% section loss of concrete or rebar in a 10' width of wall, up to 10% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting with up to 10% average section loss in a 10' width, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

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Item 62 - Culverts

Fair Condition

- Scour present on the downstream end
- Cutoff wall exposed, but not undermined
- Minor spalling of the headwall

FAIR. Non-structural cracking with leaching at < 5' intervals over the majority of the slab or wall surfaces, structural cracks < 0.03" in walls or slabs, section loss of primary reinforcement up to 10% in the top slab in a 6' width, up to 10% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 10% section loss of concrete or rebar in a 10' width of wall, up to 10% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting with up to 10% average section loss in a 10' width, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

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Item 62 - Culverts

Fair Condition

- 10% section loss along the bottom and near the water line
- Moderate distortion under the roadway

FAIR. Non-structural cracking with leaching at < 5' intervals over the majority of the slab or wall surfaces, structural cracks < 0.03" in walls or slabs, section loss of primary reinforcement up to 10% in the top slab in a 6' width, up to 10% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 10% section loss of concrete or rebar in a 10' width of wall, up to 10% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting with up to 10% average section loss in a 10' width, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

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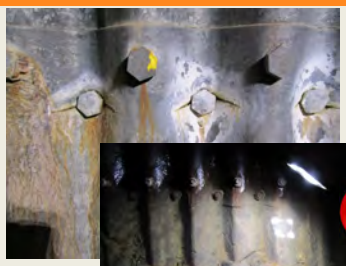
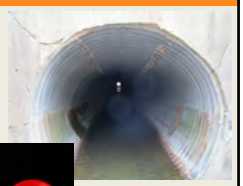
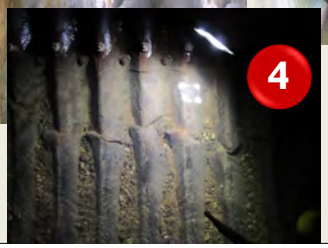
Item 62 - Culverts

Poor Condition

- Large metal pipe culvert
- Bolts pulling thru at joints
- Crushing of floor of pipe beginning to occur in multiple sections







POOR. Structural cracks in top slab up to 0.06", structural cracks in walls up to 0.125", section loss of primary reinforcement up to 30% in the top slab in a 6' width, up to 30% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 30% section loss of concrete or rebar in a 10' width of wall, up to 30% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout with up to 30% section loss in a 10' width, considerable settlement or misalignment, considerable scour or erosion at curtain walls, wingwalls or pipes with undermining.

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Item 62 - Culverts

Poor Condition

- 25% section loss of primary reinf. over 6' width
- Vertical cracks in sidewalls up to 0.125"

POOR. Structural cracks in top slab up to 0.06", structural cracks in walls up to 0.125", section loss of primary reinforcement up to 30% in the top slab in a 6' width, up to 30% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 30% section loss of concrete or rebar in a 10' width of wall, up to 30% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout with up to 30% section loss in a 10' width, considerable settlement or misalignment, considerable scour or erosion at curtain walls, wingwalls or pipes with undermining.

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Item 62 - Culverts

Poor Condition

- Leaching map cracks present in top slab
- Cracks up to 0.06" in top slab
- Leaching vertical cracks in walls up to 0.125"
- Concrete cores may be needed

POOR. Structural cracks in top slab up to 0.06", structural cracks in walls up to 0.125", section loss of primary reinforcement up to 30% in the top slab in a 6' width, up to 30% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 30% section loss of concrete or rebar in a 10' width of wall, up to 30% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout with up to 30% section loss in a 10' width, considerable settlement or misalignment, considerable scour or erosion at curtain walls, wingwalls or pipes with undermining.

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Item 62 - Culverts

Cracking with leaching at < 5' intervals in top slab.

Spalls and delaminations on the bottom concrete slabs.

Structural cracks up to 0.06" in top slab, heavy cracking and leaching in top slab.

Structural cracks up to 0.125" in walls.

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Item 62 - Culverts

Serious Condition

- **Large spalls present with exposed primary reinforcement**
- **35% section loss in primary reinforcement**
- **Top slab soffit is delaminated and slightly sagging**

SERIOUS. Any worse or combined condition described in condition rating "4", up to 50% loss, metal culverts have extreme distortion and deflection in one section (collapse), extensive corrosion, or deep pitting with scattered perforations, severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe undermining of curtain walls, wingwalls or pipes.

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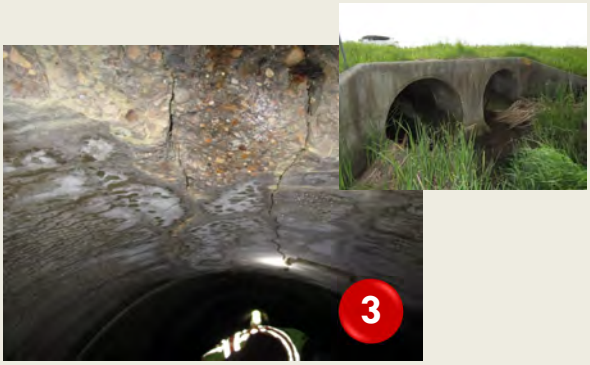
Item 62 - Culverts

Serious Condition

- **Large double RC pipe culvert**
- **Structural cracks in top of pipe ≥ 0.125”**



SERIOUS. Any worse or combined condition described in condition rating "4”, up to 50% loss, metal culverts have extreme distortion and deflection in one section (collapse), extensive corrosion, or deep pitting with scattered perforations, severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe undermining of curtain walls, wingwalls or pipes.

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Item 62 - Culverts

Wingwall Distress:

- Both are failing wings
- Integral wings attachment to barrel count in the culvert rating
- Separate wings **do not**, add comment to BI Form on condition

SERIOUS. Any worse or combined condition described in condition rating "4”, up to 50% loss, metal culverts have extreme distortion and deflection in one section (collapse), extensive corrosion, or deep pitting with scattered perforations, severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe undermining of curtain walls, wingwalls or pipes.

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Item 62 - Culverts

Serious Condition

- Distortion in two sections
- Separation of sections has occurred
- Loss of fill has occurred at separation between sections

SERIOUS. Any worse or combined condition described in condition rating "4", up to 50% loss, metal culverts have extreme distortion and deflection in one section (collapse), extensive corrosion, or deep pitting with scattered perforations, severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe undermining of curtain walls, wingwalls or pipes.

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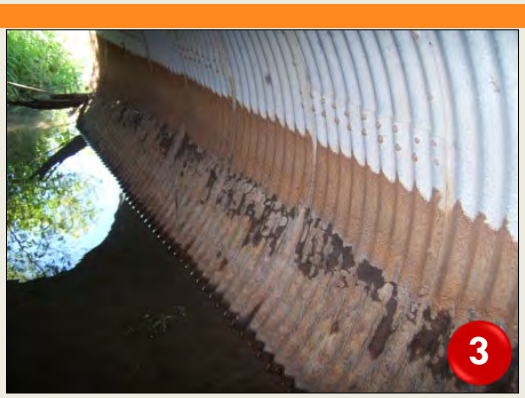
Item 62 - Culverts

Serious Condition

- 45% section loss along water line
- Several holes through the walls near ends of culvert



SERIOUS. Any worse or combined condition described in condition rating "4", up to 50% loss, metal culverts have extreme distortion and deflection in one section (collapse), extensive corrosion, or deep pitting with scattered perforations, severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe undermining of curtain walls, wingwalls or pipes.

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Item 62 - Culverts

Critical Condition

- Large spall under traffic lane with two layers of reinforcement exposed
- There is movement in the remaining slab under live load
- Notify Bureau of Bridges and Structures immediately!

CRITICAL. Large areas of slab or walls spalled full depth near traffic, large area of reinforcement losses greater than 50% near traffic, metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion, integral wingwalls collapsed, severe settlement of roadway due to loss of fill, section of culvert may have failed and can no longer support embankment, complete undermining of curtain walls and pipes, special feature inspection will be required to keep the structure open with possible load restrictions. The Bureau of Bridges and Structures shall be notified immediately.

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Item 62 - Culverts

Critical Condition

- The bottom of the east pipe has failed
- Settlement of approximately 3' has occurred
- Settlement has caused a dip in the roadway

CRITICAL. Large areas of slab or walls spalled full depth near traffic, large area of reinforcement losses greater than 50% near traffic, metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion, integral wingwalls collapsed, severe settlement of roadway due to loss of fill, section of culvert may have failed and can no longer support embankment, complete undermining of curtain walls and pipes, special feature inspection will be required to keep the structure open with possible load restrictions. The Bureau of Bridges and Structures shall be notified immediately.

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BEARINGS

3/7/2024 IL NBI Refresher Course 2024

1

Bearings

Bridge Bearing Types

- **Fixed Bearings**
  - Transmits loads from superstructure to substructure
  - Allows rotation caused by loads
- **Expansion Bearings**
  - Transmits loads from superstructure to substructure
  - Allows rotation caused by loads
  - Permit longitudinal movement

2

Bearings

Basic Bearing Elements

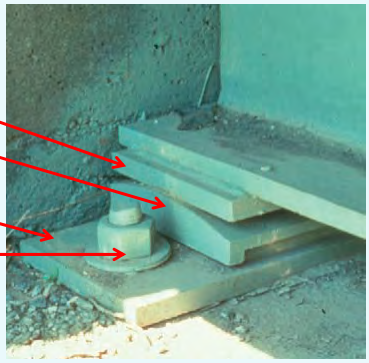
- **Sole Plate –** distributes forces from the superstructure to the bearing
- **Bearing Device** – transmits forces to the masonry plate, allows for superstructure rotation and longitudinal movement (if expansion bearing)
- **Masonry Plate** – distributes forces to the substructure
- **Anchorage** – connects masonry plate/bearing to substructure unit

3

Bearings

Basic Bearing Elements

- **Sole Plate**
- **Bearing Device**
- **Masonry Plate**
- **Anchorage**



Low Profile Fixed Bearing

4

Bearings

General Inspection Procedures

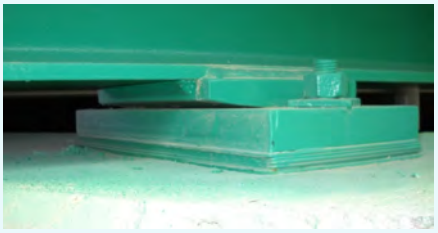
Check For:

- Excessive section loss or wear
- Freedom of movement and clear of foreign material
- Full contact with supporting bearing surfaces
- Properly positioned for location and temperature
- Anchor bolt condition

5

Bearings

Common Fixed Bearing Types



Low Profile Fixed Bearing

High Profile Fixed Bearing

6

Bearings

Common Expansion Bearing Types

- Elastomeric
- Rocker
- Roller
- Sliding Plate
- Pot / HLMR

7

Bearings

Elastomeric Bearing

Inspect For:

- Bearing location in relation to support pads
- Abnormal flattening or bulging of elastomer
- Cracking or splitting
- Complete contact with substructure or masonry PL
- Excessive shear deformation

8

Bearings

Elastomeric Bearing

Cracking & splitting

Excessive bulging

Excessive shear deformation / location

L-9

3/7/2024

9

Bearings

Rocker Bearing

Inspect For:

- Alignment & tilt angle
- Freedom of movement
- Full bearing surface contact
- Excessive section loss
- Anchor bolt condition

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Bearings

Rocker Bearing

Poor alignment w/ masonry PL

Excessive tilt

11

Bearings

Rocker Bearing

Loss of bearing on masonry of sub unit

Heavy section loss of rocker bottom

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Bearings

Roller Bearing

Inspect For:

- Alignment
- Freedom of movement
- Full bearing surface contact
- Section loss
- Anchor bolt condition

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3/7/2024

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Bearings

Roller Bearing

Severe Damage:

- **Section loss on masonry & sole plates**
- **Bearing rotated out of position**
- **Loss of bearing area beneath masonry plate**
- **Check RC Sub condition rating**

L-14

3/7/2024

14

Bearings

Roller Bearing

Severe Damage:

- 30% Loss of concrete bearing area above sole plate of RC T-beam
- Bearing out of position
- Check RC Super condition rating as well

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3/7/2024

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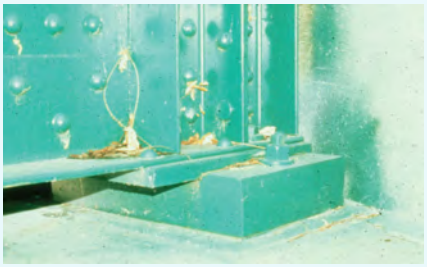
Bearings

Sliding Plate

Inspect For:

- Alignment
- Freedom of movement
- Full bearing surface contact
- Section loss
- Anchor bolt condition



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3/7/2024

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Bearings

Sliding Plate

Severe Damage:

- Anchor bolt broken on one end of masonry PL
- Masonry plate rotated out of position by 7”
- Bearing moved 60% off of masonry plate

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3/7/2024

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Bearings

Sliding Plate

Significant Damage:

- Anchor bolt broken on both ends
- Concrete damage above sole plate
- Sliding surface heavily deteriorated

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3/7/2024

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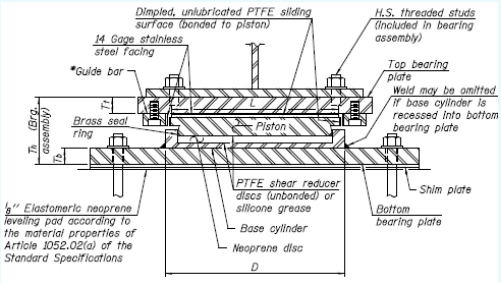
Bearings

Pot / HLMR

Inspect For:

- Excessive leakage of rubber
- Full bearing surface contact
- Guide bar damage
- Cracked welds
- Vertical movement under traffic
- Anchor bolt condition



Bearings

Pot / HLMR

Bearing at extension limit

Excessive leakage of rubber

Damaged guide & rubber loss

Bearings

Bearing Out of Position

1. Due to Sub Movement:

- Caused when sub has moved relative to its original position
- Multiple bearings at sub unit will show movement in a pattern
- Transverse deck joints may close/open if joint is in affected unit

2. Due to Restricted Bearing Movement:

- Heavy debris or rust restricting free movement
- No pattern required in bearing misalignment

Document problem on BI Form in Remarks Section

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3/7/2024

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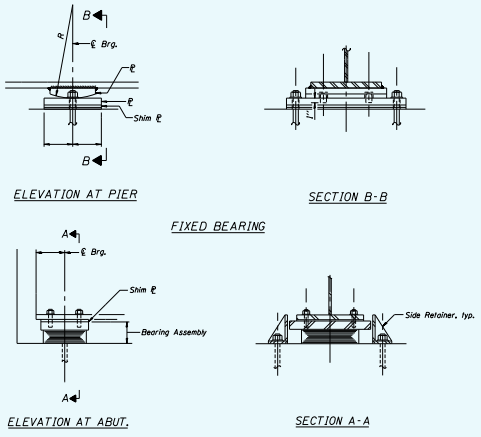
Bearings

Common Modern IDOT Bearings



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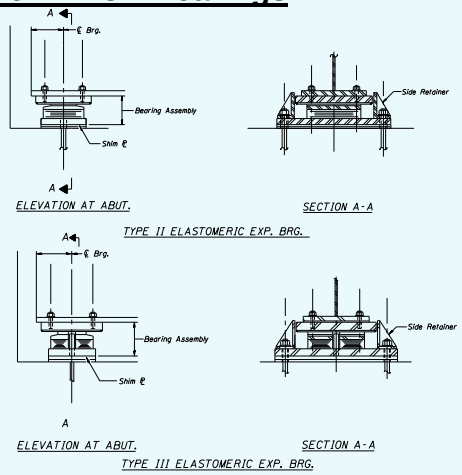
Bearings

Common Modern IDOT Bearings



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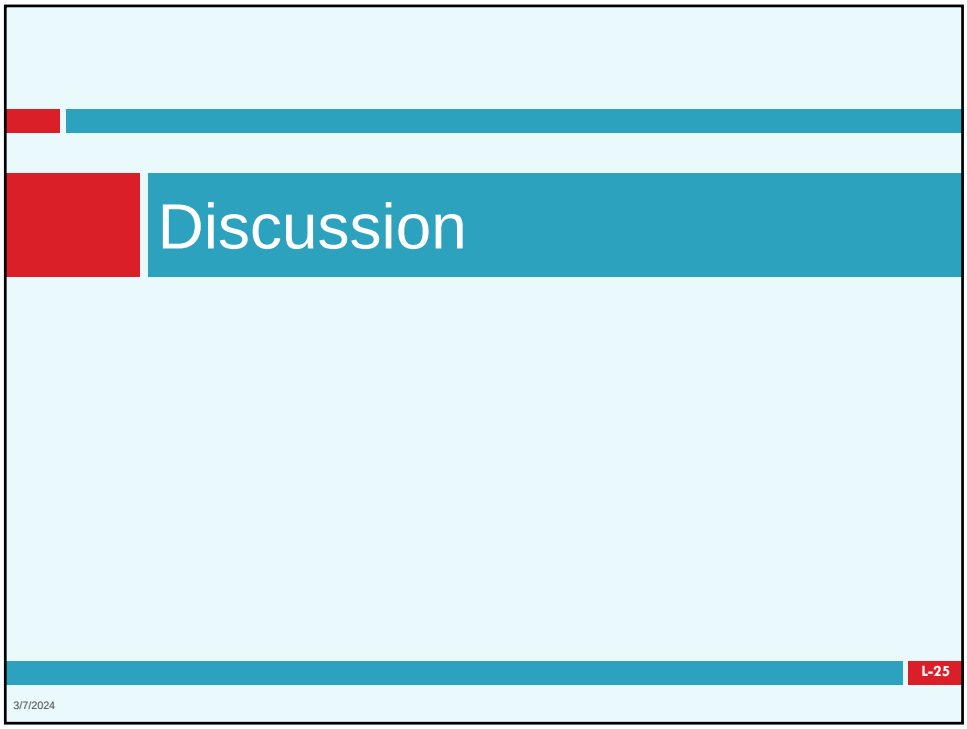
Bearings

NBI Rating Guidelines for Item 59 Superstructure

- The condition of bearings is not often included in the superstructure rating except in extreme situation (Steel Super Item 59 Codes 5 & 4)
- However, deficiencies identified in bearings should be noted on the inspection form Remarks Section so they may be addressed when necessary
- Unexplained excessive movement of bearings can be a clue to other significant problems. Try to identify if out of position bearings are due to sub movement or restricted bearing conditions.

24



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APPROACH ROADWAY

3/7/2024 IL NBI Refresher Course 2024

1

Item 72 – Approach Roadway Alignment

- Identifies bridges that do not function adequately due to the alignment of the approach roadways
- Speed reductions necessary because of structure width and not due to alignment are not considered in this evaluation
- Not intended that approach roadway alignment be compared to current standards, but to existing road alignment
- The basic criteria is how the alignment of the roadway approaches to the bridge relate to the general highway alignment for the section of highway the bridge is on

P-2

2

Item 72 – Approach Roadway Alignment

- **Based on Operating Speed – NOT Design Speed**
- **Note: Regulatory Speed on most Rural Roads is 55 mph!**
- **May be necessary to drive the location to determine if there is a reduction in speed from the surrounding or approach highway**
- **If general terrain of approach roadway is rolling and curved, with low operating speed, do not downgrade Item 72 if bridge approaches are consistent**

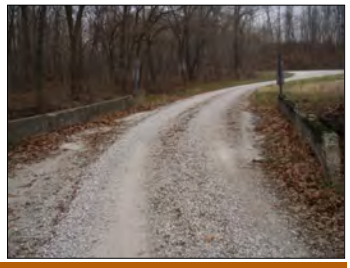
Item 72 – Approach Roadway Alignment

If the location is corrected by proper installation of a warning sign or lowered speed limit sign, appraisal rating for this item should not be rated down

Description	Code
No reduction in the operating speed	Code as an "8"
Minor reduction in operating speed	≤ 9 mph (Code "7 - 4")
Substantial reduction in operating speed	≥ 10 mph (Code "3 - 1")

Item 72 – Approach Roadway Alignment

- **Urban Setting**
  - **Approaches consistent with bridge geometry - No reduction in speed at bridge – "8"**
- **Rural Setting**
  - **Approaches are rolling and curved alignment, consistent with general terrain, user already traveling at reduced speed - No reduction in speed at bridge – "8"**



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Item 72 – Approach Roadway Alignment

Vertical Alignment – Relatively flat

Horizontal Alignment - Straight

No reduction in operating speed

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Item 72 – Approach Roadway Alignment

Vertical Alignment – Relatively flat with minor curve on approach

Horizontal Alignment - Straight

Very minor reduction in operating speed

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Item 72 – Approach Roadway Alignment

Vertical Alignment – 2% Grade

Horizontal Alignment – 50 mph Design Curve; 55 mph Operating Speed

A minor reduction in operating speed

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Item 72 – Approach Roadway Alignment

Vertical Alignment

Horizontal Alignment

Minor reduction in operating speed

P-9

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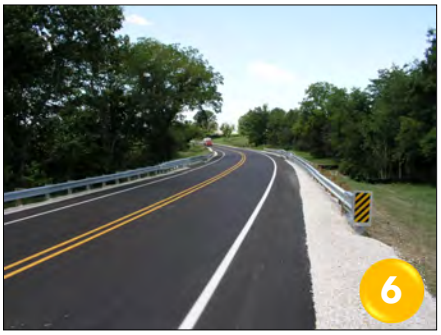
9

Item 72 – Approach Roadway Alignment



Vertical Alignment – 2% Grade

Horizontal Alignment – 50 mph Design Curve; 55 mph Operating Speed

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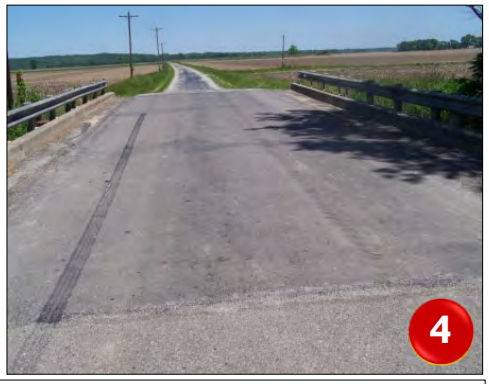
Item 72 – Approach Roadway Alignment

Vertical Alignment - Slight drop at the end of the bridge

Horizontal Alignment – Straight



Significant reduction in operating speed

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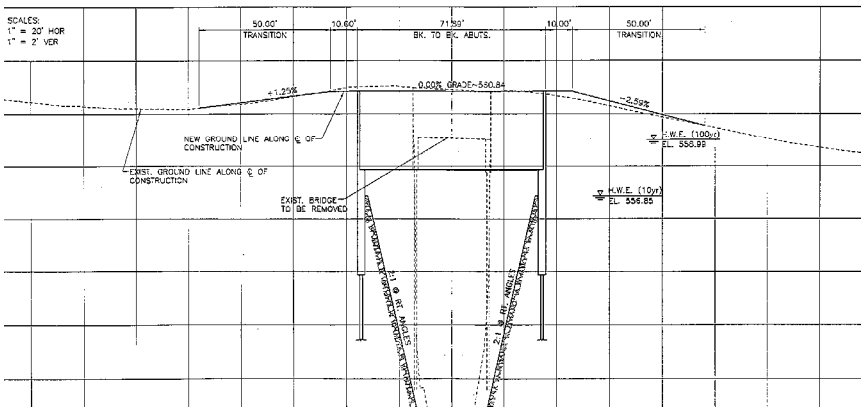
Item 72 – Approach Roadway Alignment



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Item 72 – Approach Roadway Alignment

Vertical Alignment - Slight drop at the end of the bridge

Horizontal Alignment – Straight

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Item 72 – Approach Roadway Alignment

Vertical Alignment – Some break at approaches

Horizontal Alignment – Sharp turn at bridge end – 15 mph

Substantial reduction in operating speed, intolerable

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Item 72 – Approach Roadway Alignment

Vertical Alignment – Sharp vertical gradient change; poor sight distance

Substantial reduction in operating speed, intolerable

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Discussion

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SCOUR & CHANNEL CONDITIONS

3/7/2024

IL NBI Refresher Course 2024

1

Scour Review

DEFINITIONS

- **Scour: The removal of material from the streambed or embankment as a result of the erosive action of stream flow.**
- **Scour Critical: A bridge with a foundation element that has been determined to be unstable for the observed or evaluated scour condition.**

2

Scour Review

TYPES OF SCOUR

- General Scour
- Contraction Scour
- Local Scour
- Lateral Stream Migration

3

Scour Review

General Scour/Degradation

- This is the gradual lowering of a streambed along a considerable length of waterway
- Occurs even if bridge crossing is not there
- Can be accelerated by:
  - Natural cutoffs in a meandering stream
  - Straightening or narrowing the channel
  - Dredging

4

Scour Review

General Scour/Degradation

5

Scour Review

Contraction Scour

- This is the lowering of the streambed under the bridge only, resulting from accelerated stream flow due to reduced waterway opening
- Occurs when the bridge waterway opening is restrictive
- Can be caused by:
  - Embankments
  - Debris or Vegetation
  - Substructure units
  - Ice

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Scour Review

Contraction Scour

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Scour Review

Contraction Scour

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Scour Review

Local Scour

- **This is the lowering of the streambed adjacent to an obstruction in the waterway.**
- **Often much greater than general scour (up to 10 times)**
- **Often caused by:**
  - **Abutments**
  - **Wide, long, unusually shaped or poorly skewed piers**
  - **Streamflow depth (as depth increases vortex action is magnified)**
  - **Debris or Ice accumulation**

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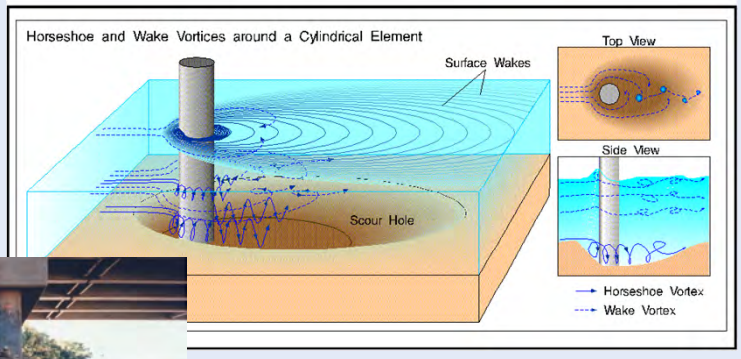
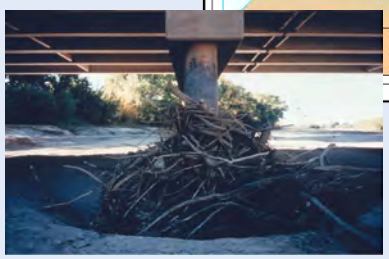
Scour Review

Local Scour

(images from USGS)





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Scour Review

Lateral Stream Migration

- This is the relocation of the channel over time due to lateral scour of the embankment.
- Lateral stream migration process:
  - Bank damage
  - Sloughing bank
  - Undermined bank
  - Channel misalignment

11

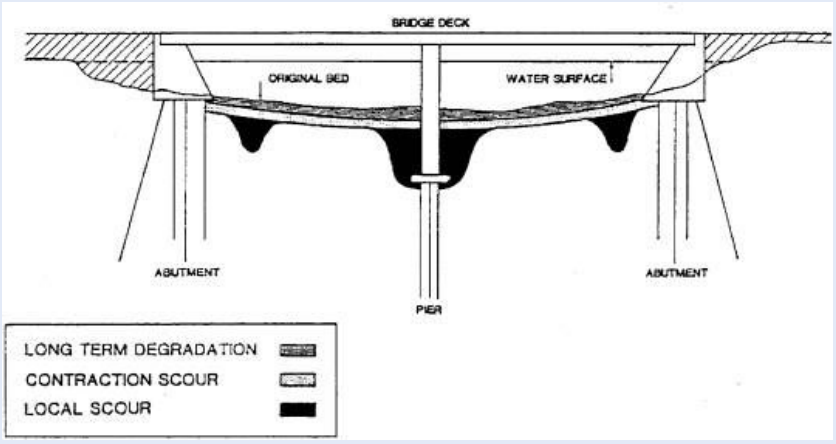
Scour Review

Lateral Stream Migration

12

Scour Review

Types Of Scour



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Scour Review

Scour Plans of Action

- Plans of Action (POA's) should be complete for all scour-critical bridges & bridges with unknown foundation types.
- Requirements are outlined in IDOT BLR&S Circular Letter 2007-05, CL 2007-21, and CL 2009-07.
- Plan of Action must be kept up-to-date to reflect changes in condition, personnel, and contact information.
- Documentation should be maintained in the bridge file for site visits made during activation of POA.

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Scour Review

Reporting Requirements for New Scour at Bridges

- **Scour Critical Bridge (ISIS Item-113 ≤ 3)**
  - Scour ≥ 25% as-built overburden on footing has occurred
  - Exposed top of footing or > 6’ of scour at a pile bent sub unit
- **Scour Susceptible & Other Bridge (ISIS Item-113 = 4 - 9)**
  - Scour ≥ 50% as-built overburden on footing has occurred
  - Exposed top of footing or > 6’ of scour at a pile bent sub unit
  - The scour countermeasure has been damaged by scour
- **Notify the responsible Program Manager and IDOT Bridge Management & Inspection Unit as soon as possible in these cases. Change ISIS Item-113 to “A” (new code indicating re-evaluation necessary).**

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Scour Review

Bridge Scour Monitoring System

- **The NBIS require owners to monitor structures with known or potential scour deficiencies.**
- **IDOT has contracted to use BRIDGE WATCH® to assist with these efforts on the state & local system. (CL 2012-18)**
  - Web based system
  - Monitors rainfall in drainage areas associated with bridges
  - Predicts when rainfall has created a predetermined storm event
- **Structures with a scour rating of 1 - 8 are monitored.**

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Scour Review

Bridge Scour Monitoring System (BRIDGE WATCH®)

- This monitoring service assists in implementing Scour POA.
- Agencies with structures meeting this criteria have been contacted by IDOT.
- Warnings & Alerts are sent via text / email.

Scour Rating	Storm Event			
	10 yr.	25 yr.	50 yr.	100 yr.
4 or Less	Warning	Alert		
5		Warning	Alert	
6	Warning	Alert		
7 or 8			Warning	Alert

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Item 61 – Channel Conditions

- **CHANNEL CONDITIONS - Describes the physical conditions associated with the flow of water through the bridge**
  - Stream stability
  - Condition of the channel
  - Condition of riprap, slope protection, and stream control devices including spur dikes
- **Inspectors should be particularly concerned with visible signs of excessive water velocity**
  - Undermining of slope protection or footings
  - Erosion of banks
  - Realignment of the stream

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Item 61 – Channel Conditions

Code	Description
N	NOT APPLICABLE. Use when bridge is not over a waterway.
9	EXCELLENT. There are no noteworthy deficiencies that affect the condition of the channel.
8	VERY GOOD. Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.
7	GOOD. Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel may have minor amounts of drift not affecting the waterway opening.
6	SATISFACTORY. Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor streambed movement evident. Debris is restricting the waterway slightly.
5	FAIR. Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.
4	POOR. Bank and embankment protection is severely undermined. River control devices have severe damage. Deposits of debris in the waterways are severely restricting the opening.
3	SERIOUS. Bank protection has failed. River control devices have been destroyed. Streambed aggradation, degradation or lateral movement has changed the waterway to now threaten the bridge and/or approach roadway.
2	CRITICAL. The waterway has changed to the extent the bridge is near a state of collapse.
1	IMMINENT FAILURE. Bridge closed. Corrective action may return bridge to light service.
0	FAILED. Bridge closed. Replacement necessary.

Item 61 – Channel Conditions

Excellent Condition

- The Channel is well aligned
- Banks are vegetated

EXCELLENT. There are no noteworthy deficiencies that affect the condition of the channel.

Item 61 – Channel Conditions

Very Good Condition

- The Channel is well aligned
- Banks are vegetated

VERY GOOD. Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.

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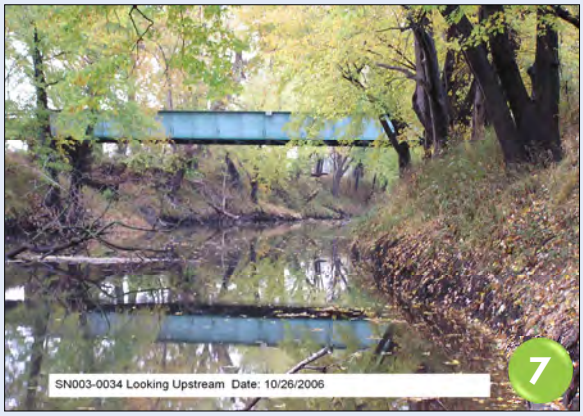
Item 61 – Channel Conditions

Good Condition

- The Channel is well aligned
- Banks are in need of minor repair with removal of fallen trees
- Drift not affecting waterway opening



GOOD. Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel may have minor amounts of drift not affecting the waterway opening.

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Item 61 – Channel Conditions

Satisfactory Condition

- Minor streambed movement evident
- Banks are beginning to slump

SATISFACTORY. Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor streambed movement evident. Debris is restricting the waterway slightly.

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Item 61 – Channel Conditions

Fair Condition

- Bank protection is being eroded
- Fallen trees are restricting the channel

FAIR. Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.

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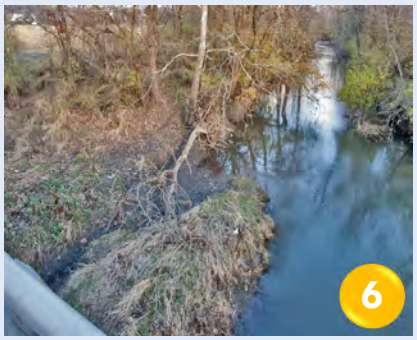
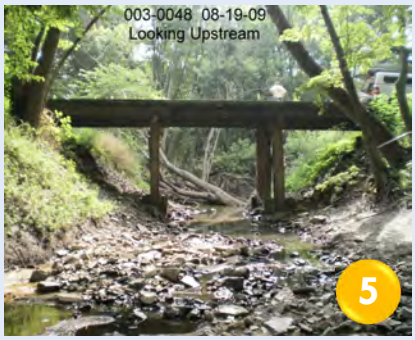
Item 61 – Channel Conditions



Debris is restricting waterway slightly.



Trees and brush restrict channel.

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Item 61 – Channel Conditions

Poor Condition

Debris is severely restricting the waterway.

POOR. Bank and embankment protection is severely undermined. River control devices have severe damage. Deposits of debris in the waterways are severely restricting the opening.

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Item 61 – Channel Conditions

Bank protection is being eroded.

Debris is severely restricting the waterway.

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Item 61 – Channel Conditions

Serious Condition

- Channel has shifted toward road
- Bank protection has failed
- Road and abutment threatened by erosion

SERIOUS. Bank protection has failed. River control devices have been destroyed. Streambed aggradation, degradation or lateral movement has changed the waterway to now threaten the bridge and/or approach roadway.

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Item 61 – Channel Conditions

Critical Condition

- Photo 1 of 2
- Banks are severely eroded
- Fallen trees are blocking channel

CRITICAL. The waterway has changed to the extent the bridge is near a state of collapse.

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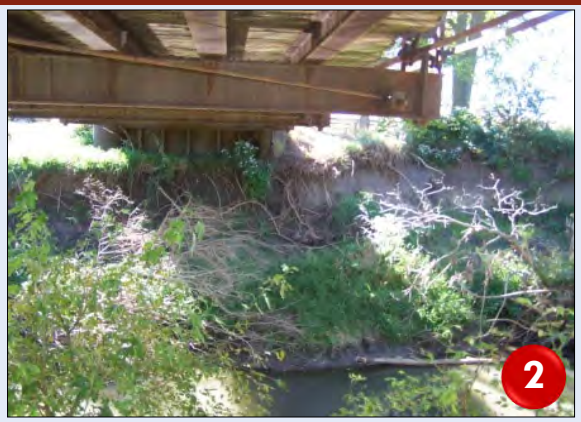
Item 61 – Channel Conditions

Critical Condition

- Photo 2 of 2
- Bank erosion and debris in stream have redirected stream flow towards abutment
- Scour is undermining abutment and exposing caissons



CRITICAL. The waterway has changed to the extent the bridge is near a state of collapse.

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