

INTRODUCTION AND PURPOSE OF THE COURSE

9/18/2020

NBI Calibration 2020

Introduction

- **Class Instructor: Mike Cima**
- **Background:**
 - Over 30 years of bridge related structure experience
 - 17+ with IDOT BB&S, now with Quigg Engineering
 - Past experience includes bridge inspection, planning, design and policy development
 - Inspection background includes most types of structures, large and small
 - Licensed PE and SE in Illinois

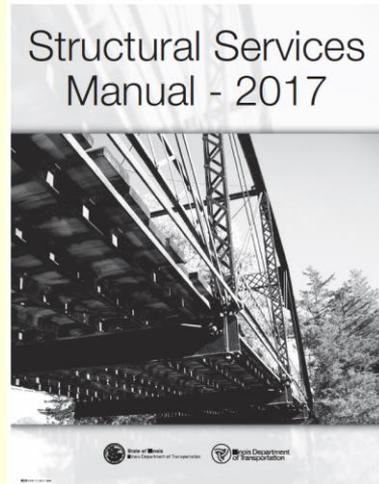
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Introduction

Focus of the Class

- Consistent application of inspection policies
- Determining bridge ratings
- Discuss new and recently revised policies
- Discuss current procedures with “room for improvement”
- Chapter 3 of the Structural Services Manual – Bridge Inspection Policy



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Introduction

DAY 1:

- Introduction & Purpose
- General Policies
- Types of Inspections & Forms
- Approach Roadway
- Wearing Surfaces
- Deck Condition
- PPC Deck Beams

DAY 2:

- PPC I-Beams
- Culverts
- Local Agency Issues
- Inventory Data
- Steel Superstructures
- Fatigue, Fracture & Gusset Plates
- Bearings

DAY 3:

- Access Methods, Test Equip. and MOT
- Reinforced Concrete Superstructures
- Waterway Adequacy
- Substructures
- Scour & Channel Conditions
- Conclusion & Summary

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Introduction

Course Objectives:

1. Improve the understanding of key indicators affecting bridge condition ratings to achieve consistent & accurate reporting
2. Update participants on changes in policy and inspection methods
3. Increase awareness of existing deficiencies in inventory data so they can be corrected

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Introduction

Why Do We Inspect Bridges?

- To ensure public safety
- Inspection of highway bridges is mandated by the NBIS
- Inspection data serves as a programming tool to allocate resources
- Deficiencies noted during inspections identify maintenance needs for owners

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Introduction

What is Calibration, and why do we do it?

- **Quality of information in the database is important**
 - Distribution of bridge funds is affected
 - Decisions (permits, detours, etc.) are made using this information
- **The NBIS includes a requirement for refresher training of bridge inspectors – this class fills that requirement**
- **Consistency across various bridge programs is needed. Several hundred inspectors are involved in Illinois.**
 - The rating of a bridge in “poor” condition should not vary based on the location of the bridge and who inspected it
 - We need to establish and maintain consistent bridge inspection standards

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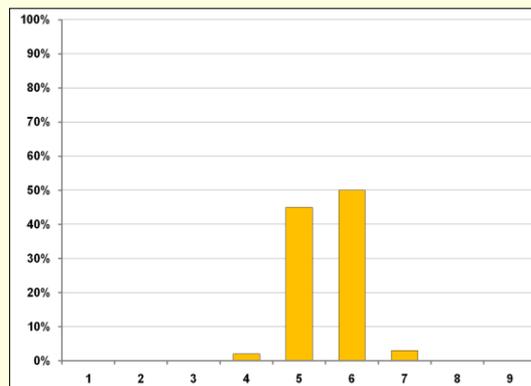
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Introduction

Typical Example of Reported Condition Ratings

Process audits of agencies with well-trained inspectors typically find agreement with Condition Ratings within “1” rating of the correct number

Calibration training is intended to improve consistency by clarifying the boundaries between ratings



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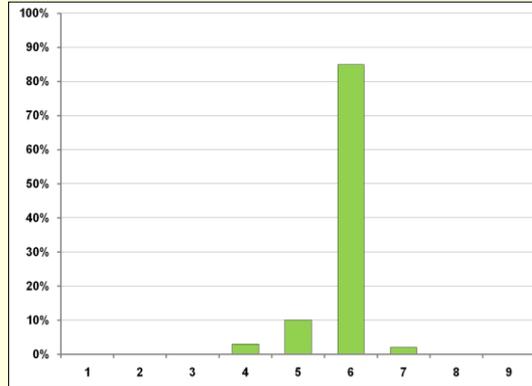
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Introduction

Example of Condition Ratings Reported by Calibrated Inspectors

The desired result of calibrating inspectors is less variability in data

Some variation will exist, but almost all Condition Ratings will be within "1" rating category of the "correct" rating



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Introduction

How do we achieve consistent ratings between inspectors?

1. Use consistent inspection practices
2. Use uniform rating guidelines

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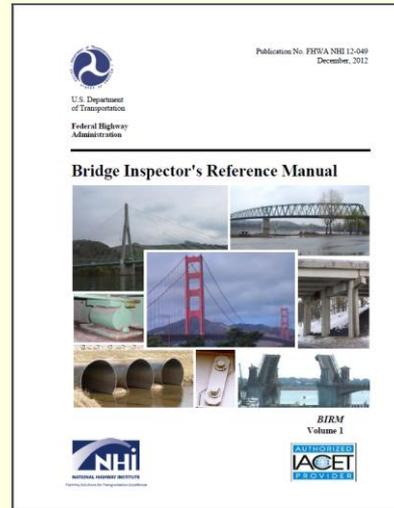
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Introduction

1. Bridge Inspector's Reference Manual (BIRM) (2012)

- Provides detailed information for bridge inspection
- Available at no cost
- Establishes “consistent inspection practices”

<https://www.nhi.fhwa.dot.gov>



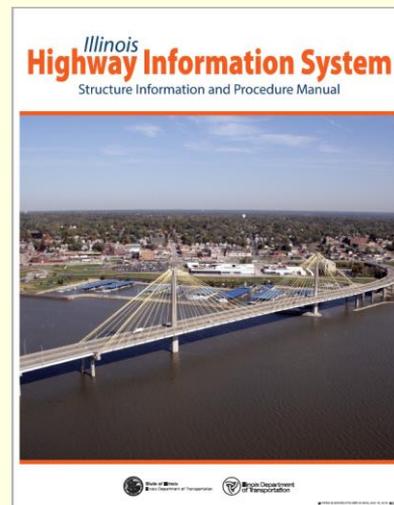
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Introduction

2. Structure Information and Procedure Manual

- Provides detailed information for coding of ISIS data items
- Primary guidance for determining the Condition Rating of bridge elements (“establishes uniform rating guidelines”)
- Course focuses on the application of these guidelines
- Watch for revisions on IDOT’s web site / subscription service
- Last Updated **November 2018**



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Introduction

Code	General Description
N	Not Applicable
9	Excellent Condition (New)
8	Very Good Condition - No problems noted.
7	Good Condition - Some minor problems No section loss).
6	Satisfactory Condition - Structural elements show some minor deterioration (Up to 2% section loss on primary member(s) in critical areas).
5	Fair Condition - All primary structural elements are sound but may have minor section loss, cracking, spalling or scour (Up to 10% section loss on primary member(s)).
4	Poor Condition - Advanced section loss, deterioration, spalling or scour (Up to 30% section loss on primary member(s) in critical areas). A drop in Item 59, 60 or 62 to a rating of 4 or lower or Item 58 to a 3 or lower will require a load rating inspection by the BB&S to determine any change in the inventory and operating ratings, items 66 and 64.
3	Serious Condition - Loss of section, deterioration, spalling or scour have seriously affected primary structural components (Up to 50% section loss on primary member(s)). Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	Critical Condition - Advanced deterioration of primary structural elements (Greater than 50% section loss on primary member(s) in critical areas). Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. It may be necessary to close the bridge until corrective action is taken. When a bridge component is appraised at this level, a special inspection of that component is required at intervals not to exceed 6 months as directed by the Bureau of Bridges and Structures.*The Bureau of Bridges and Structures must be notified immediately.
1	"Imminent" Failure Condition - Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put it back in service with load restrictions.
0	Failed Condition - Out of service; beyond corrective action.

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Introduction

Code:	Description:	Commonly Employed Actions:
9	EXCELLENT CONDITION	<ul style="list-style-type: none"> • Little concern from a safety perspective • Preventive Maintenance (painting, washing, clean deck drains, concrete sealers, joint repairs, etc...)
8	VERY GOOD CONDITION	
7	GOOD CONDITION	
6	SATISFACTORY CONDITION	<ul style="list-style-type: none"> • May be possible to "save" elements at this stage of deterioration with maint. or repair • Preventive Maintenance and/or • Repairs (concrete/steel, replace joints, deck overlays, etc...)
5	FAIR CONDITION	
4	POOR CONDITION	<ul style="list-style-type: none"> • Safety concerns & Load Rating Inspections • Traffic disruptions due to load postings and/or detours possible
3	SERIOUS CONDITION	
2	CRITICAL CONDITION	<ul style="list-style-type: none"> • Rehabilitation (deck replacement, super replacement and major repairs) or • Complete Replacement
1	IMMINENT FAILURE CONDITION	
0	FAILED CONDITION	

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Introduction

References:

- **National Bridge Inspection Standard (NBIS) – (FHWA)**
- **“Bridge Inspector’s Reference Manual” – (FHWA)**
- **“Structural Services Manual” – Chapter 3 – (IDOT)**
- **“Structure Information and Procedure Manual”- (IDOT)**
- **“Bridge Preservation Guide”- (IDOT)**
- **“Manual For Bridge Evaluation” – (AASHTO)**

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DISCUSSION

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GENERAL POLICIES AND REQUIREMENTS

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NBI Calibration 2020

General Policies and Requirements

- **Illinois Bridge Inventory**
- **NBIS Requirements**
- **NBIS Metrics**
- **NBIS Program Managers for Local Agencies**
- **Inspection Due Dates**
- **Critical Findings**
- **Bridge Files**
- **Quality Control & Quality Assurance**

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General Policies and Requirements

IL Bridge Inventory - 2020: (change from previous year)

- **Total Bridges = 26,831 (+19)**
 - State = 7,859 (+3)
 - Local = 18,972 (+16)
- **Average Age**
 - State = 44 yrs. (0)
 - Local = 41 yrs. (0)
- **Load Posted**
 - State = 78 (-2)
 - Local = 832 (0)
- **Fracture Critical**
 - State = 170 (-4)
 - Local = 310 (-9)
- **Structurally Deficient**
 - State = 723 (-14)
 - Local = 1,636 (-20)

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General Policies and Requirements

FHWA - NBIS Metrics Review:

- **FHWA developed 23 metrics to measure compliance with the NBIS**
 - Intended to provide consistent oversight nationwide
 - They are used to measure compliance with FHWA policy
 - FHWA scrutinizes States (IDOT/locals) to ensure compliance
 - Possible basis for sanctions for non-compliance
 - Sanctions could involve withholding Federal Funds
- *IDOT responds with plans of action to the FHWA to fix all non-compliant items following each yearly review*
- **GREAT improvements have been made by IL in compliance since the start of this program.**

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General Policies and Requirements

FHWA - NBIS Metrics Review:

2019 top 4 FHWA findings and **corrective actions** for Illinois

1. Inspections lack proper documentation for assigned condition ratings – All primary condition ratings ≤ 5 must have note identifying the defect justifying the rating
2. Channel cross sections not developed for all bridges over waterways – All bridges over waterways require submittal of a channel cross section
3. Fracture critical member inspection procedures not developed for all FCM bridges – All bridges with FCM must have an FCM inspection plan submitted to BBS
4. Bridges are inspected late with no justification or pre-approval for the delinquency – Request approval for any inspection that will be delayed-must be approved by IDOT/FHWA

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General Policies and Requirements

Program Managers for Local Agencies

- Program Manager must be approved by IDOT
- Inspections must be led by IDOT approved Team Leaders
- All Local Agencies with NBIS structures must have designated NBIS Program Managers
- Agency Program Manager should sign off on NBIS Inspection Reports prior to submittal to IDOT

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General Policies and Requirements

Inspection Due Dates

- Inspections should be completed prior to or on the due date calendar month based on the last date of inspection.
- Inspections completed in or before the designated month will be considered completed on time by IDOT and FHWA.
- On very rare occasion you may be unable to inspect a structure on time due to conditions beyond your control. In this case a memorandum must be placed in the Bridge File indicating the date and reason why completing the inspection on time was not possible.
- For 2019 IL **inspection delinquencies were at 4.5% (+1.6 increase from previous year)**
- IDOT Bridge Inspection Tracking Date website:
<https://apps.dot.illinois.gov/InspectionDateNotification/>



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General Policies and Requirements

Inspection Due Dates

IDOT *Structural Services Manual* Section 3.4.1

- Currently states: “Routine, Fracture Critical, and Underwater inspections shall be completed by the end of the calendar month in which they are due. An exception is for the Special Inspection with an interval of one month or less in which case inspections must be completed by the day it is due.”
- Revised to state: “Routine, Fracture Critical, Underwater, Element Level and Special Inspection **with an interval \geq 12 months** shall be completed by the end of the calendar month in which they are due. Special Inspections **with an interval $<$ 12 months** must be completed by the date it is due.”



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General Policies and Requirements

Bridge Inspection Entry into BIS

Appropriate and reasonable timeframes for entry:

- Routine, Fracture Critical, Underwater, Element Level and Special Inspection with interval ≥ 12 months:
 - **45-60 Days** – Sufficient time for data entry and allows BBS Bridge Management Group to identify inspection delinquencies well before they become problematic
- Special Inspection with 3 or 6 month interval:
 - **30 Days** – These are “Special Inspections”, which target specific structural deficiencies/problematic structure details and allow structures to remain open
- Special Inspection with 1 month interval:
 - **7 Days** – Same reasoning as SI with 3 or 6 month



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General Policies and Requirements

Critical Findings:

- Per the NBIS, a Critical Finding is a structural or safety related deficiency that may pose an imminent threat to the safety of the traveling public.
- The following findings may constitute a critical finding:
 - Lowering a Deck, Superstructure, Substructure or Culvert rating ≤ 2
 - Lowering a Channel & Channel Protection Condition rating ≤ 2
 - Lowering a Scour Critical Evaluation rating ≤ 2
 - Lowering a Fracture Critical rating ≤ 2
 - Any other situation the inspector considers a threat to the safety of the travelling public

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General Policies and Requirements

Critical Finding Process:

1. On identifying an initial or more severe than previously reported Critical Finding – **immediately secure the bridge as necessary to protect the public** (TL)
2. If the damage seriously reduces the structures load capacity then **isolate the defect** from traffic by closing lanes or the entire structure if necessary (TL)
3. Report Critical Finding:
 - State Bridge – **report immediately** to the District/Area Program Manager who **immediately** forwards it to the State Program Manager (TL/PM)
 - Local Bridge - **report immediately** to the Local Program Manager who **immediately** forwards it to the IDOT Local Program Manager (TL/PM)
 - **Provide sufficient, detailed information** to allow the Bureau of Bridges & Structures to make an initial determination of the severity of the finding (TL/PM)
4. If BB&S determines the deficiency qualifies, Form BBS-CF-1 must be completed and forwarded to the State Program Manager within 7 days (PM)
5. IDOT Website has a YouTube video explaining the process

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General Policies and Requirements

Bridge Files:

- **A collection of information representing the history of a bridge**
- **Separate files are maintained for each structure**
- **A Bridge File Checklist, Form BBS BFC, must be maintained for each bridge and stored with the Bridge File**
- **It is not necessary to physically store all required items in the file, but the location of each must be referenced on the Checklist**
- **Keep these up to date!**



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General Policies and Requirements

Bridge File Checklist BBS BFC :

- Master Structure Report
- Photographs
- Inspection and other Reports
- Channel Cross Sections & History
- Scour Analysis, Flood Data, Scour POA
- Correspondence - Rating, Posting, etc...
- Fracture Crit., Insp. Plans etc...
- Maintenance /Repair History
- Structure Plans
- Structure Design Calcs.
- Etc...

Required Items Per MBE	In Bridge File	Other Location	Not Applicable	Comments/Location Information
Structure Inventory and Appraisal Sheets (Master Structure Report)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
History of Structural Damage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Photographs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	located in computer bridge file under SN xxx-xxxx.
Chronological Histov of Inspection Reports* – Original Signature Required	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

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General Policies and Requirements

Quality Control: (Section 3.9.3 Structural Services Manual)

- **Bridge Inspection Refresher Training**
 - All PMs & TLs must receive refresher training every 60 months
 - IDOT Bridge Inspection Calibration Course – 12 hrs - 1.5 days (**18 hrs in 2021**)
 - FHWA-NHI-130053 Bridge Inspection Refresher Training – 18 hrs - 3 days
 - **May take either course** to meet refresher training requirement (**July 2017**)
- **Review of Bridge Inspectors, Reports & Procedures**
 - Every 24 months PMs must accompany their TLs on 3 inspections to observe and verify their performance is satisfactory
 - A PM who performs NBIS inspections must be field verified by another PM.
 - Document results on Form BBS 2790.

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General Policies and Requirements

Quality Assurance:

- Bridge Management & Inspection Unit conducts yearly QA Reviews
- Department currently performs 18 QA reviews / year
 - 1 - IDOT Districts
 - 17 - Counties
 - Office & Field Reviews at each

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General Policies and Requirements

General Requirements

- Non-IDOT Agencies responsible for a bridge on their right-of-way must report the bridge as part of the NBI (and inspect in accordance with NBIS) even if it carries traffic onto private roadways or entrances. Must provide results to IDOT within the same time period as IDOT bridges.
- Closed bridges that are still linked to a roadway must be inspected to verify proper closure.
- Closed bridges over roadways or navigable waterways must be inspected to verify proper closure and ensure safety of traffic beneath.
- Bridges closed for construction or under staged construction must be inspected prior to the due date of the required inspection.
- Detailed inspection requirements are defined in **Section 3 of the IDOT Structural Services Manual**.

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DISCUSSION

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TYPES OF INSPECTIONS AND FORMS

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NBI Calibration 2020

Types of Inspections and Forms

- **Types of Inspections**
- **Inspection Intervals**
- **Inspection Forms**

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Types of Inspections and Forms

Types of Inspections:

- Initial Inspection
- Routine Inspection
- In-Depth Inspection
- Underwater Inspection
- Fracture Critical Member Inspection
- Special Inspection
- Damage Inspection
- Load Rating Inspection
- Complex Bridge Inspection
- Element Level Inspection
- Hands-On Inspection

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Types of Inspections and Forms

Initial Inspection:

- The 1st inspection of a new or newly rehabilitated bridge to provide data to set baseline conditions.
- Inspection Interval: **All structures must be entered in ISIS within 90 days of opening to traffic** (will likely be reduced)
- Form: BBS BIR Routine Inspection Report

The image shows two overlapping forms. The top form is the 'Routine Inspection Report' from the Ohio Department of Transportation. It includes fields for project name, location, and various inspection categories such as Deck Condition, Substructure Condition, and Channel Condition. The bottom form is the 'BBS Inspection Report', which is a more detailed form with a grid for recording inspection results across different bridge components.

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Types of Inspections and Forms

Routine Inspection:

- A regularly scheduled inspection to determine the physical and functional condition, identify changes from previous inspections and ensure the structure satisfies service requirements.
- Most common type of inspection
- Usually conducted on a 48, 24 or 12-month interval (see Structural Services Manual 3.4 revised July 2017)
- Form: BBS BIR Routine Insp. Report
- YouTube video on “Completing IDOT Bridge Inspection Forms” - website

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Types of Inspections and Forms

Routine Inspection: (In-Depth Procedures)

- Completed in place of the standard Routine Inspection. Same process but **pay closer attention to potential trouble areas**
 - Every 6 yrs. for 24 month interval inspections
 - Every 8 yrs. for 48 month interval inspections
- Typical areas of concern: areas under expansion joints, web stiffeners, X-frame connections, lateral bracing connections, vaulted abutments, etc...
- Form: BBS BIR Routine Insp. Report
- Check the box on the 1st page to indicate you completed an in-depth inspection

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Types of Inspections and Forms

Underwater Inspection:

- Inspection of the underwater portion of a substructure and surrounding channel that cannot be inspected visually at low water by wading & probing, generally requiring other techniques or diving.
- A 60-month inspection interval can be used for structures meeting the criteria specified in Section 3.3.4 of the Structural Services Manual provided they do not fall into any of the Special Inspection categories and are not subject to additional requirements of scour critical POA
- Channel cross sections must be prepared
- Form BBS BIR-UW1

The form is titled "Underwater Inspection Report" and is part of the "Illinois Department of Transportation" forms. It contains the following sections:

- Project Information:** Includes fields for Project No., District, Agency, Agency Name, District, and County.
- Location:** Includes Facility Name, Milepost, Structure Crosses, and Structure Station.
- Inspection Details:** Includes Bridge Name, Material & Type, Date, Inspector, and Inspector's Title.
- Inspector's Approval:** Includes a signature line for the Inspector and a date field.
- Inspector Team Leader:** Includes a signature line for the Team Leader and a date field.

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Types of Inspections and Forms

Channel Cross Section Requirements:

- Required for all Scour Critical Bridges (ISIS item 113):
 - Take at the up/downstream fascia's for comparison to original baseline
 - Max 5 yr. interval or after significant storms
- Required for all bridges needing an Underwater Inspection:
 - Take at the up/downstream fascia's for comparison to original baseline
 - Take each underwater inspection cycle
- Results should be compared/plotted to previous findings
- Bridges in low/no flow conditions such as lakes or ponds may have this requirement waived by the Program Manager (must document reasoning in bridge file)

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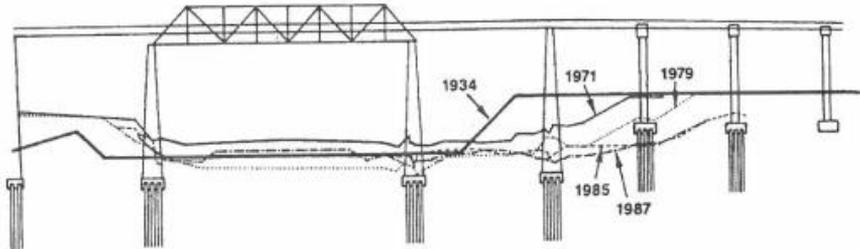
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Types of Inspections and Forms

Channel Cross Section Requirements:

“Top-4 FHWA finding for corrective action in 2019”

See NBI Subscription Announcement 20190717



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Types of Inspections and Forms

Channel Cross Section Requirements:

Example Potential Equipment for Measurements

- Range pole
- Weighted measuring tape
- Laser measuring tape
- Hip/chest waders
- Boat
- Sonar
- Paper & pen for documenting results

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Types of Inspections and Forms

Channel Cross Section Requirements – Bridge:

Must be taken along the up and downstream fascias.

1. Take measurements from datum reference line on bridge that is not likely to move over time (top of parapet/rail, top/bottom of deck, top of sub cap...)
2. Plot all channel cross sections oriented looking downstream.
3. Label substructure units per existing plans.
4. Must measure at all substructure units. Abutments at exposed face, Piers at CL.
5. Should take additional measurements at regular longitudinal intervals at predetermined points.
6. Must measure at beginning and end of slope, edges and low points of scour holes, edge of water, low stream elevation, any other location with substantial change in elevation.
7. Should take measurements at the ends and mid point of significant flat areas.

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Types of Inspections and Forms

Channel Cross Section Requirements – Bridge:

Must be taken along the up and downstream fascias. (cont'd)

8. Take Vertical measurements to nearest ½ foot other than scour holes should be measured to nearest tenth of a foot.
9. Take Horizontal measurements to nearest foot.
10. Debris piles – measure edges and top to document loss of hydraulic opening.
11. For dual bridges with little difference in elevation the measurements for one fascia can be used for both.
12. Take additional cross sections around sub units with significant changes.
13. Graph the results using a format such as an Excel spreadsheet. Additional data can easily be added for future periods.

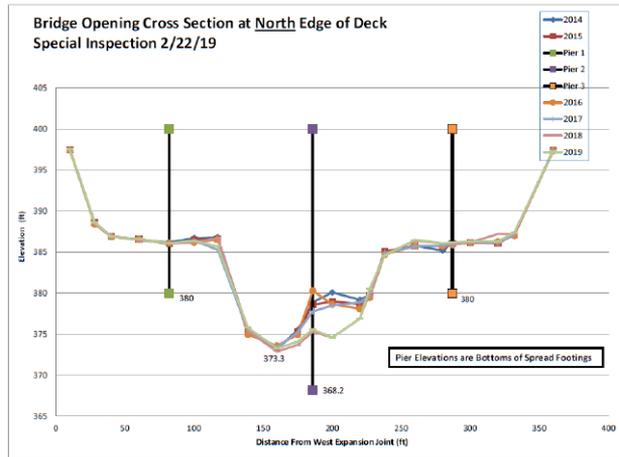
IDOT intends to issue an example spreadsheet for potential use in producing the graph plots in the future.

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Types of Inspections and Forms

Channel Cross Section Requirements - Example Bridge Sketch

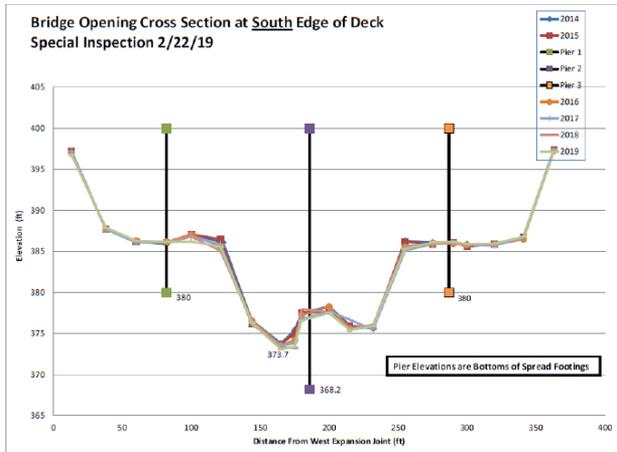


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Types of Inspections and Forms

Channel Cross Section Requirements - Example Bridge Sketch



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Types of Inspections and Forms

Channel Cross Section Requirements – Culvert:

Must be taken along the up and downstream fascias.

1. Take measurements from datum reference line on culvert that is not likely to move over time (headwalls, bottom of top slab...)
2. Plot all channel cross sections oriented looking downstream.
3. Label culvert barrels consistently.
4. Must measure vertically at inside face of all exterior and interior walls.
5. Should take additional measurements at regular longitudinal intervals at predetermined points.
6. Must measure at beginning and end of slope, edges and low points of scour holes, edge of water, low stream elevation, any other location with substantial change in elevation.
7. Should take measurements at the ends and mid point of significant flat areas.

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Types of Inspections and Forms

Channel Cross Section Requirements – Culvert:

Must be taken along the up and downstream fascias. (cont'd)

8. Take Vertical measurements to nearest ½ foot other than scour holes should be measured to nearest tenth of a foot.
9. Take Horizontal measurements to nearest foot.
10. Debris piles – measure edges and top to document loss of hydraulic opening.
11. Take additional cross sections around sub units with significant changes from original construction or previous inspection.
12. Culverts with aprons – vertical measurements should be taken at the end with the top of apron used as the datum point.
13. Graph the results using a format such as an Excel spreadsheet. Additional data can easily be added for future periods.

IDOT intends to issue an example spreadsheet for potential use in producing the graph plots in the future.

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Types of Inspections and Forms

Channel Cross Section Requirements - Example Culvert Sketch

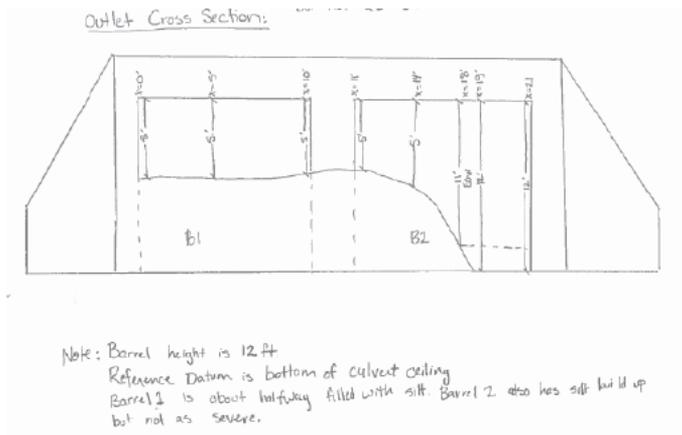


Figure 11- Example of a Stream Cross Sections at Culverts without Aprons

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Types of Inspections and Forms

Channel Cross Section Requirements - Example Culvert Sketch

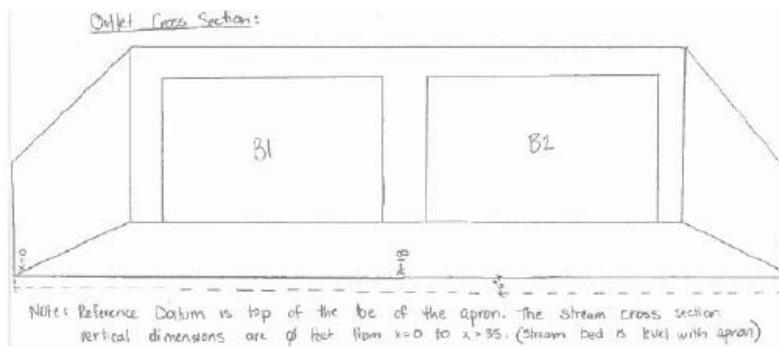


Figure 12- Example of a Stream Cross Sections at Culverts with Aprons

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Types of Inspections and Forms

Fracture Critical Member (FCM) Inspection

- Hands-on, arms-length inspections of fracture critical members
- Inspection interval:
 - 3-months, and again within 24-months from the date of opening to traffic for new or rehabilitated bridges with fracture critical members.
 - 12-months for bridges with a FC Appraisal Rating (ISIS Item 93A1) coded “4” or less.
 - 12-months or less (as specified by the Bureau of Bridges and Structures) for bridges with a history of fatigue crack formation or with structural details susceptible to rapid fracture.
 - 24-months for bridges other than those included in the previously described categories for FCM inspection intervals.
- Form BBS BIR-FC1

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Types of Inspections and Forms

Fracture Critical Member Inspection:

- **“Top-4 FHWA finding for corrective action in 2019”**
- Inspection records must identify the location (by sketch) and a description of all FCM
- Inspection frequency must be identified
- Procedures for inspection of FCMs must be identified
- **See Example in Structural Services Manual**

The image shows a detailed form titled 'Fracture Critical Inspection Report' from the Idaho Department of Transportation. The form is divided into several sections:

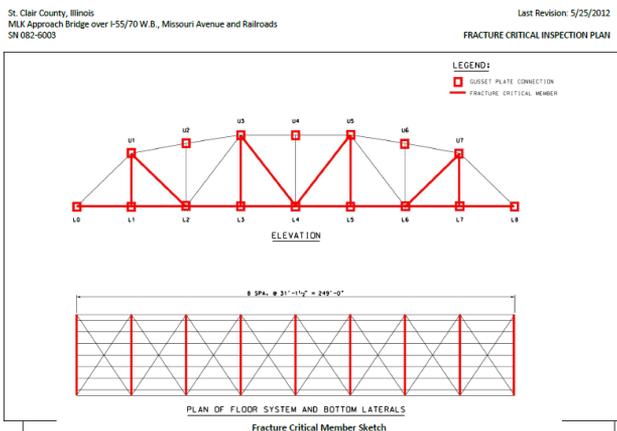
- Project Information:** Includes fields for Project Name, State, County, District, and various codes.
- Inspector's Acknowledgment:** A section where the inspector provides their name, title, and signature, along with a date.
- Fracture Critical Member (FCM) Inspection Data:** A table with columns for 'Item No.', 'Description', 'Inspection Date', and 'Inspection Frequency'. There are four rows in this table, each corresponding to a different FCM item.
- Inspection Team Location:** A section for recording the location of the inspection.
- Signature and Date:** A section for the inspector's signature and the date of the inspection.
- Inspectors:** A list of inspectors with their names, titles, and signatures.

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Types of Inspections and Forms

Fracture Critical Member Inspection: Location Sketch of FCM



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Types of Inspections and Forms

Fracture Critical Member Inspection: Form BBS BIR-FC2: Fracture Critical Member Inventory Report (Identifies type, location & number of FCM on bridge)

Illinois Department of Transportation
Fracture Critical Member Inventory Report

Project Name: _____
 Date: _____
 Inspected By: _____
 Inspected On: _____
 Project Manager: _____

See BBS-1 - Fracture Critical Bridge Types

Bridge Type	Code	Fracture Critical Members	Notes
1. Concrete Deck on Steel Girders	101	...	...
2. Concrete Deck on Concrete Girders	102	...	...
3. Steel Deck on Steel Girders	103	...	...
4. Steel Deck on Concrete Girders	104	...	...
5. Concrete Deck on Steel Girders with Steel Deck	105	...	...
6. Concrete Deck on Steel Girders with Concrete Deck	106	...	...
7. Concrete Deck on Steel Girders with Steel Deck and Concrete Deck	107	...	...
8. Concrete Deck on Steel Girders with Steel Deck and Steel Deck	108	...	...
9. Concrete Deck on Steel Girders with Steel Deck and Concrete Deck and Steel Deck	109	...	...
10. Concrete Deck on Steel Girders with Steel Deck and Steel Deck and Concrete Deck	110	...	...
11. Concrete Deck on Steel Girders with Steel Deck and Steel Deck and Steel Deck	111	...	...
12. Concrete Deck on Steel Girders with Steel Deck and Steel Deck and Steel Deck and Concrete Deck	112	...	...
13. Concrete Deck on Steel Girders with Steel Deck and Steel Deck and Steel Deck and Steel Deck	113	...	...
14. Concrete Deck on Steel Girders with Steel Deck and Steel Deck and Steel Deck and Steel Deck and Concrete Deck	114	...	...
15. Concrete Deck on Steel Girders with Steel Deck and Steel Deck and Steel Deck and Steel Deck and Steel Deck	115	...	...
16. Concrete Deck on Steel Girders with Steel Deck and Concrete Deck	116
17. Concrete Deck on Steel Girders with Steel Deck and Steel Deck	117
18. Concrete Deck on Steel Girders with Steel Deck and Concrete Deck	118
19. Concrete Deck on Steel Girders with Steel Deck and Steel Deck	119
20. Concrete Deck on Steel Girders with Steel Deck and Concrete Deck	120

Fracture Critical Type 1

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 2

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 3

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 4

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 5

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 6

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 7

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 8

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 9

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 10

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 11

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 12

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 13

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 14

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 15

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 16

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 17

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 18

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 19

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Fracture Critical Type 20

SCA1 Fracture Critical Bridge Type _____ Fracture Member _____
 SCB1 Fracture Critical Number of Spans or Substructure Units (For Inclusive Bridge Type) _____
 SCB2 Number of Fracture Critical Members (Total for Inclusive Bridge Type) _____

Page 1 of 2

R-22

Types of Inspections and Forms

Fracture Critical Member Inspection:

- Form BBS 2760: Preliminary Pin and Link Inspection Journal
- Form BBS 2780: Supplemental Pin / Link Inspection Journal

R-23

Types of Inspections and Forms

Special Inspection:

- Used to monitor a known deficiency or condition that must be looked at more often than Routine, Underwater or FC inspection intervals
- Inspection interval varies depending on deficiency severity
- Emphasis on detailed measurements and photographs to monitor change over time
- At times used to defer load restrictions
- Form BBS SI-1 Special Inspection Report

R-24

Types of Inspections and Forms

Damage Inspection:

- Used to assess a bridge for sudden change in structural capacity or stability
- Completed by District staff, BB&S staff or a licensed structural engineer who is an IDOT approved team leader or program manager
- Determines the need for emergency load restrictions/closure and the effort necessary for repair
- No official inspection form



R-25

9/18/2020

Types of Inspections and Forms

Load Rating Inspection:

- A scheduled inspection used to collect detailed information required to complete a load rating analysis
- Required when:
 - Super, Sub or Culvert rating ≤ 4
 - Deck ratings ≤ 3
 - If these ratings fall lower a new Load Rating inspection is required
- No official inspection form, load ratings are submitted on The Structure Load Rating Summary sheet - Form BBS2795



R-26

9/18/2020

Types of Inspections and Forms

Complex Inspection:

- An In-Depth inspection requiring Hands-On inspection procedures
- Covers: suspension, cable-stayed and movable bridges
- Requires: experienced inspection team, extensive coord., traffic control, access equipment, extensive inspection equipment and documentation
- Inspection forms as required.



R-27

9/18/2020

Types of Inspections and Forms

Element Level Inspection:

- Required on all IDOT maintained and National Highway System (NHS) structures (includes Tollway) per Federal law enacted by Congress
- Each element is rated for severity and extent of deterioration and a % of that element is assigned to a specific condition state. This data is used to develop the Statewide Bridge Management System.
- AASHTO Manual For Bridge Element Inspection, 2nd Ed, 2019
- IDOT switching to system closer to FHWA system in 2020.
- Future: may see more element level inspections? (FHWA preference)
- Form – IDOT spreadsheet form

R-28

9/18/2020

Types of Inspections and Forms

Form BBS-BIR: (Routine Insp Report)

- **“Top-4 FHWA finding for corrective action in 2019”**
- **Comments recommended for a rating of 6**
- **All ratings ≤ 5 must have comments on page 1 under “Inspectors Appraisals” justifying rating!!!**
- **Comments must specifically identify criteria met in SIP Manual that required the ≤ 5 rating**

		Inspector's Appraisals		Comments
	Rate	Note		
58 – Deck Condition:	-	||		
59 – Superstructure Cond:	-	||		
60 – Substructure Cond:	-	||		
62 – Culvert Condition:	-	||		
61 – Channel Condition:	-	||		
71 – Waterway Adequacy:	-	||		
72 – Approach Rdwy Align:	-			
111 – Pier Navig Protection:	-			
90B – Inspection Remarks:				

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9/18/2020

Types of Inspections and Forms

Form BBS-BIR: (Routine Insp Report)

- **Insp. Team Leader , Insp. Program Manager & the Agency Program Manager (if different) must sign and date form on page 2**
- **Keep original signed copy in Bridge File**

	Signature	Date
Inspection Team Leader:		■ / ■ / ■
Consultant Program Manager:		■ / ■ / ■
Agency Program Manager:		■ / ■ / ■

R-32

9/18/2020

Discussion

9/18/2020

APPROACH ROADWAY

9/18/2020

NBI Calibration 2020

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

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

P-3

9/18/2020

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")

P-4

9/18/2020

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”



P-5

9/18/2020

Item 72 – Approach Roadway Alignment

**Vertical Alignment –
Relatively flat**

**Horizontal
Alignment - Straight**



No reduction in operating speed

P-6

9/18/2020

Item 72 – Approach Roadway Alignment

**Vertical Alignment –
Relatively flat with
minor curve on
approach**

**Horizontal
Alignment - Straight**



Very minor reduction in operating speed

P-7

9/18/2020

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

P-8

9/18/2020

Item 72 – Approach Roadway Alignment

Vertical Alignment

Horizontal Alignment

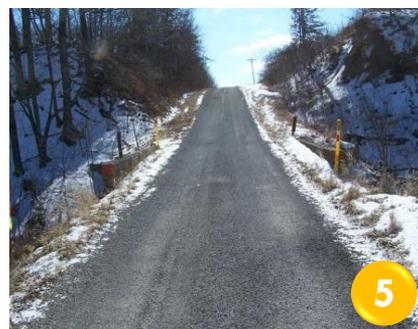


Minor reduction in operating speed

P-9

9/18/2020

Item 72 – Approach Roadway Alignment



Vertical Alignment – 2% Grade

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

P-10

9/18/2020

Item 72 – Approach Roadway Alignment

**Vertical Alignment -
Slight drop at the end
of the bridge**

**Horizontal Alignment –
Straight**

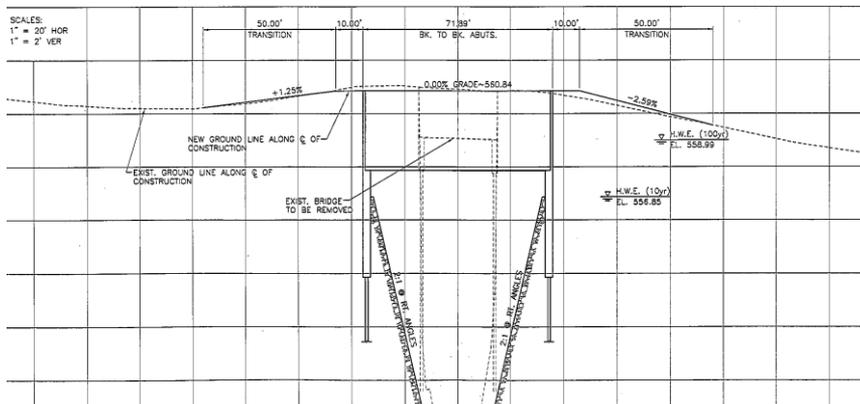


Significant reduction in operating speed

P-11

9/18/2020

Item 72 – Approach Roadway Alignment



P-12

9/18/2020

Item 72 – Approach Roadway Alignment



Vertical Alignment - Slight drop at the end of the bridge

Horizontal Alignment – Straight

P-13

9/18/2020

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

P-14

9/18/2020

Item 72 – Approach Roadway Alignment

**Vertical Alignment
– Sharp vertical
gradient change;
poor sight distance**



Substantial reduction in operating speed, intolerable

P-15

9/18/2020

Discussion

9/18/2020

WEARING SURFACE, PROTECTIVE SYSTEMS, AND TOTAL DECK THICKNESS

9/18/2020

NBI Calibration 2020

Item 108 - Wearing Surface / Protective System

- **Total Deck vs. Deck Structure Thickness**

- **Item 108A-C:**
 - 108A – Type of Wearing Surface
 - 108B – Type of Membrane
 - 108C – Deck Protection

H-2

Item 108 - Wearing Surface / Protective System

Total Deck vs. Deck Structure Thickness

Related Inventory Items:

- **Deck Structure Thickness** (Item 107A): Deck thickness originally built, does not include built up wearing surface thickness
- **Total Deck Thickness** (Items 108D): Deck thickness originally built + built up existing wearing surface thickness

H-3

9/18/2020

Item 108 - Wearing Surface / Protective System

Total Deck Thickness

- **Conc. Slab Bridge**
 - Measure along the edge of the deck or when a curb is present along the curblin.
 - If haunched then at midpoint of longest span
- **Total Deck Thickness (Items 108D): original deck thickness + wearing surface thickness**
- **Total deck thickness is key to determining superstructure rating and permit capacities**
- **LL Capacity = Total Capacity – DL Capacity**
- **If this value has increased since the last inspection and the structure has not been load rated since the increase, contact the Bureau of Bridges and Structures**

H-4

9/18/2020

Item 108 - Wearing Surface / Protective System

Code	Item 108A – Type of Wearing Surface: Description
A	Bare Deck - No Overlay
B	Additional Concrete Overlay - not a special mix
C	Latex Modified Concrete Overlay
D	Low Slump Concrete Overlay
E	Plasticized Dense Concrete Overlay
F	Micro Silica Concrete Overlay
G	Bituminous Overlay
H	Asbestos Asphalt Overlay
I	Asphalt Block
J	Timber or Timber Runners
K	Gravel - Macadam (Oil & Chip)
L	Other
M	Epoxy Overlay
P	Grating
Q	High Reactivity Metakaolin Concrete
R	Additional Concrete Overlay - Reinforced
S	Ground Granulated Blast-Furnace Slag Concrete Overlay
T	Fly Ash Concrete Overlay
N	Not Applicable (applies only to structures with no deck)

9/18/2020

Item 108 - Wearing Surface / Protective System

Code	Description
A	Bare Deck - No Overlay



7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
B	Additional Concrete Overlay - not a special mix



H-7

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
C	Latex Modified Concrete Overlay



H-8

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
E	Plasticized Dense Concrete Overlay



H-9

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
F	Micro Silica Concrete Overlay



H-10

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
G	Bituminous Overlay



H-11

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
H	Asbestos Asphalt Overlay



H-12

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
J	Timber or Timber Runners



H-13

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
K	Gravel - Macadam / Oil & Chip

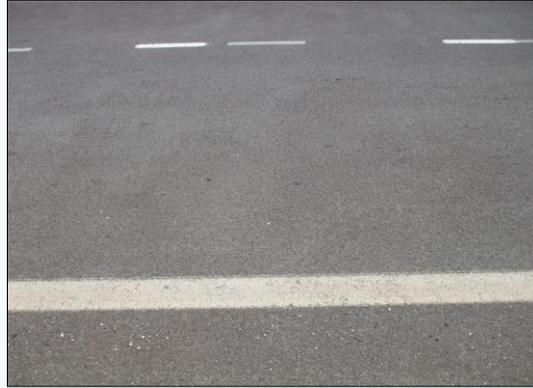


H-14

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
M	Epoxy Overlay

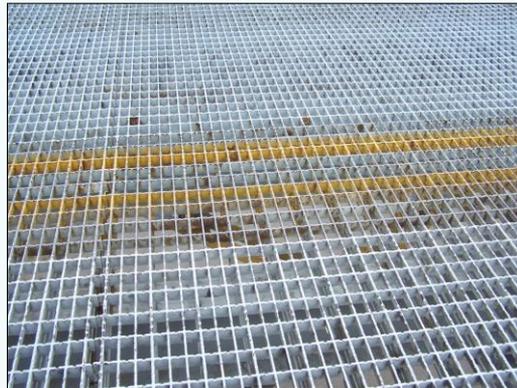


H-15

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
P	Grating



H-16

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
R	Additional Conc. Overlay – Reinf.



H-17

7/19/2010

Item 108 - Wearing Surface / Protective System

Code	Description
N	Not Applicable (applies only to structures with no deck)

Exception – When a CIP culvert top slab is “bare” or has fill $\leq 2'$ on top then code items 108 A-C IAW what is present, not an “N”



H-18

7/19/2010

Item 108 - Wearing Surface / Protective System

Item 108B - Type of Membrane

Code	Description
A	Waterproofing Membrane System
B	Other Preformed Fabric System
C	Epoxy
D	Unknown
E	Other
F	None
G	Waterproofing Membrane for Railroad Structures (Section 580)
H	Asbestos Waterproofing Membrane System
I	Spray Applied Waterproofing Membrane
J	Sheet Waterproofing Membrane
N	Not Applicable (applies only to structures with no deck)

H-19

9/18/2020

Item 108 - Wearing Surface / Protective System

Item 108C – Deck Protection

Code	Description
A	Epoxy Coated Reinforcing
B	Galvanized Reinforcing
C	Other Coated Reinforcing
D	Cathodic Protection
F	Polymer Impregnated Concrete
G	Internally Sealed Concrete
H	Unknown
I	Other
J	None
N	Not Applicable (applies only to structures with no deck)

H-20

9/18/2020

DISCUSSION

H-21

9/18/2020

DECK CONDITION

9/18/2020

NBI Calibration 2020

Item 58 – Deck Condition

Deck

- Component of the bridge to which the live load is directly applied and provides a riding surface for traffic
- Can be concrete, steel or timber (all covered in SIP)
- This module will focus on concrete deck inspection

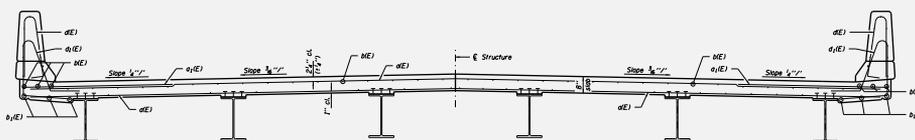


G-2

Item 58 – Deck Condition

Concrete Slab on Stringers

- May be cast in place or precast
- Primary reinforcement typically perpendicular to stringers
- Typically 6 1/2" - 9" thick



G-3

9/18/2020

Item 58 – Deck Condition

Concrete Slab on Stringers

- The condition evaluation should be primarily based on the condition of the bottom of the deck.
- The condition of the wearing surface, parapets, railings, median, sidewalks, drains, light standards and joints may be recorded on the inspection form, but their conditions should not be considered in the deck condition rating.
- On bridges where the deck is integral with the superstructure, the superstructure rating may be affected by the deck rating. However, the deck rating will not be affected by the superstructure rating except for slab & PPC deck beam bridges.



G-4

9/18/2020

Item 58 – Deck Condition

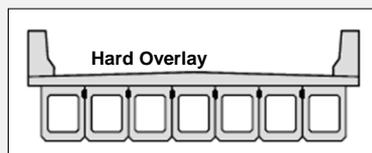
- PPC Deck Beam (**with no or soft overlay**)

For deck beam bridges, the deck condition rating shall be rated the same as the Superstructure (Item 59) using the Superstructure criteria



- PPC Deck Beam (**w/hard overlay**)

- 4" (min.) reinforced concrete overlay
- The overlay is rated as the Deck (Item 58) and may have a different rating than the Superstructure



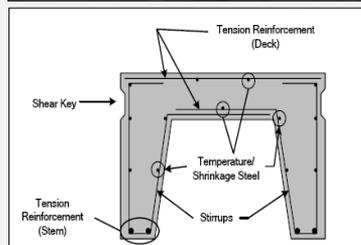
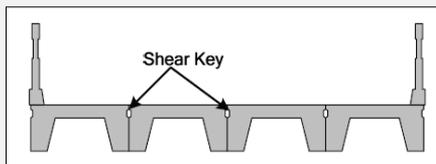
G-5

9/18/2020

Item 58 – Deck Condition

Channel Beams

- Found on spans up to 50 feet
- Generally precast
- Mildly reinforced deck cast monolithically with two stems
- Top section of the beam is rated as the deck - do not include stem condition



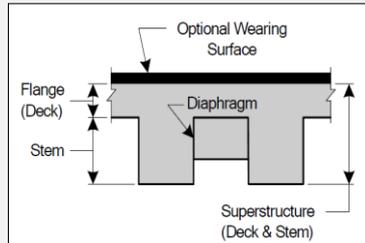
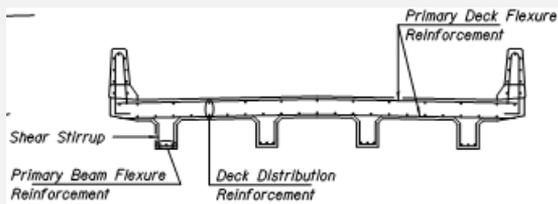
G-6

9/18/2020

Item 58 – Deck Condition

T-Beams

- Built during the 1930's - 1950's
- Generally cast-in-place monolithic concrete deck and stem forming a letter "T"
- Top section of the beam is rated as the deck - do not include stem condition



G-7

9/18/2020

Item 58 – Deck Condition

Code	Description
N	Not Applicable

Culverts and 3-Sided Precast Concrete & Steel Structures are coded "Not Applicable" for Deck



G-8

9/18/2020

Item 58 – Deck Condition – Key Indicators

Key Indicators	Code		Description
	Code	Description	
<ul style="list-style-type: none"> ▪ Cracks ▪ Scaling ▪ Spalls/Delams ▪ Section Loss 	8	VERY GOOD. Transverse cracks < 0.06" at > 15' intervals may be present but no spalling, scaling, pop-outs or delamination.	
	7	GOOD. Some transverse cracks < 0.06" at > 5' intervals over the majority of the deck, light scaling (less than 1/4" depth) or pop-outs may be present, no spalling.	
	6	SATISFACTORY. Transverse cracks < 0.06" at < 5' or > 0.06" at > 5' intervals over a majority of the deck, isolated longitudinal cracks, spalls and delaminations may be present on up to 5% of the deck riding surface or soffit area, up to 10% of the deck soffit may be spalled, delaminated, and map cracked .	
	5	FAIR. Transverse cracks > 0.06" at < 5' intervals with or without leaching in the majority of the deck, longitudinal cracks < 0.06" in majority of deck, spalls and delaminations may be present on up to 10% of the deck surface or soffit area, up to 25% of the deck surface or soffit may be spalled, delaminated and map cracked , up to 10% loss of primary reinforcement in any 6' bay length .	

G-9

9/18/2020

Item 58 – Deck Condition – Key Indicators

Key Indicators	Code		Description
	Code	Description	
<ul style="list-style-type: none"> ▪ Cracks ▪ Scaling ▪ Spalls/Delams ▪ Section Loss 	4	POOR. Longitudinal cracks > 0.06" in majority of deck, spalls and delaminations may be present on up to 25% of the deck surface or soffit area, up to 50% of the deck surface or soffit may be spalled, delaminated and map cracked , up to 30% loss of primary reinforcement in any 6' bay length .	
	3	SERIOUS. Condition is similar to the description for a condition rating of "4", though more extensive full depth failures are evident to the point that wheel loads may need restricted or temporary measures implemented.	
	2	CRITICAL. Full depth failures needing patching over much of the deck on a regular basis which requires special inspections to keep the bridge open, possibly with reduced load limits, temporary measures may be needed to allow continued use of the structure. The Bureau of Bridges and Structures shall be notified immediately.	

G-10

9/18/2020

Item 58 – Deck Condition

Define what is meant by a 6' bay length and the % section loss in reinforcement?

- A 6' bay length is a 6' wide section of deck oriented transversely to the direction of the primary reinforcement
- The section loss in the reinforcement is measured as the % section loss over the full 6' width of the section, not the loss in individual bars

G-11

9/18/2020

Item 58 – Deck Condition

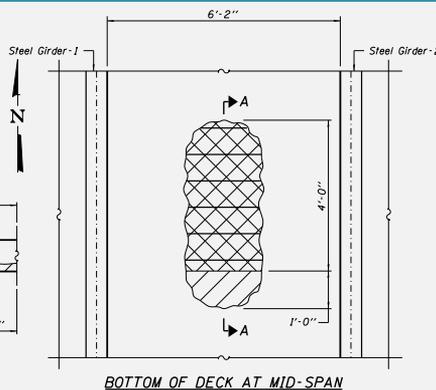
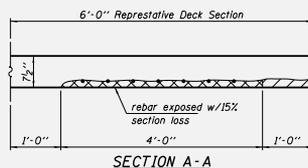
Concrete Deck on Girders: (Example)

DAMAGE SKETCH

Inspected by M.D.C.
Date: 11/14/2011
S.N. 001-0002
IL-1000 over Main St.
Bottom of Deck
Between Girder #1 & 2

LEGEND

-  Delamination (D)
-  Spalls (S)
-  Crack - Hairline unless noted otherwise
-  Leaching Cracks (L)



INSPECTION NOTES

1. 23% of the deck surface is delaminated or spalled.
2. 16% of the deck soffit is delaminated or spalled.
3. Leaching Map cracks are present over 10% of the deck soffit.
4. The largest area of deck damage is detailed above.
5. Note the rebar measurements have previously been taken and converted to % SL for the purpose of this problem.

G-12

9/18/2020

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

- Based on information from the Damage Sketch, we need to investigate damage to three elements of the deck:
 - Concrete Damage on the Deck Surface
 - Concrete Damage on the Deck Soffit
 - Longitudinal Reinforcement SL at Section A-A

Calculate the Concrete Damage to the Deck Surface:

- The “Inspection Notes” on the sketch indicate 23% of the deck surface was delaminated or spalled.

Calculate the Concrete Damage to the Deck Soffit:

- The “Inspection Notes” on the sketch indicate 16% of the deck soffit was delaminated or spalled and 10% of the soffit has leaching map cracks, $16 + 10 = 26\%$

G-13

9/18/2020

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

Calculate the Section Loss (SL) in the Rebar at Section A-A:

- The SL in the longitudinal (flexure) reinforcement is calculated for the primary rebars running longitudinally from beam to beam.
- For concrete deck and slab structures, a 6’ wide representative section will be analyzed. The section reviewed should be transverse to the direction of the primary reinforcement and at the most heavily damaged location, Section A-A in this case.
- The 6’ wide section represents the area a wheel load would be roughly distributed over on the deck or slab.

G-14

9/18/2020

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

- Determine the SL % over the 6' wide section:
 - The inspector has determined the exposed rebars have 15% SL (by unseen calculation) over the 4.0' of spalled area of deck.
 - 1.0' of the deck adjacent to the spall is delaminated and is assumed to be in similar condition to the spalled area.
 - An additional 1.0' of undamaged deck must be included to reach the 6' width required for the calculation.
- From the above discussion a 4' + 1' = 5' section of the deck will be considered as having 15% SL. The remaining 1' undamaged section will be considered as having 0% SL.

G-15

9/18/2020

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

- $\%SL = [(original\ area - current\ area) / original\ area] \times 100\%$
- $\%SL = \{[(6' \times 100\%) - (5' \times 85\% + 1' \times 100\%)] / (6' \times 100\%)\} \times 100$
 $= [(600 - 525) / 600] \times 100$
 $= \underline{12.5\% \text{ steel SL}}$ for the rebar over the 6' width
- Deck Damage Summary for Example:
 - Concrete Damage to the Deck Surface = 23%
 - Concrete Damage to the Deck Soffit = 26%
 - Longitudinal Rebar SL over 6' Section = 12.5%

G-16

9/18/2020

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

- Determine the correct NBI element rating for the deck based on the Damage Sketch and the calculated results using the IDOT SIP Manual. Refer to Item # 58, Deck Condition – Concrete Bridge Decks.
- Using 23% delaminated & spalled area on the deck surface you get a rating of “4” for damage \leq 25% of the deck surface area.
- Using 26.0% delaminated, spalled or map cracked area on the deck soffit, you get a rating of “4” for damage \leq 50% of soffit delaminations, spalls and map cracks.
- Using SL of 12.5% on the primary rebar over the 6' representative width in the deck you get a rating of “4” for steel SL $>$ 10% and \leq 30% in the primary reinforcement.

G-17

9/18/2020

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

- Use the lowest of the three ratings as the controlling rating for the deck. In this case all three ratings are the same.
- The deck NBI rating should be a “4”, POOR, based on all locations checked.

G-18

9/18/2020

Item 58 – Deck Condition

New Deck

No problems noted



New Deck – Typically first inspection only

G-19

9/18/2020

Item 58 – Deck Condition

Very Good Condition

0.03" (1/32")
transverse cracks
at 25' intervals



VERY GOOD. Transverse **cracks** < 0.06" at > 15' intervals may be present but no spalling, scaling, pop-outs or delamination.

G-20

9/18/2020

Item 58 – Deck Condition

Very Good Condition

0.05" transverse cracks at 30' intervals



VERY GOOD. Transverse **cracks** < 0.06" at > 15' intervals may be present but no spalling, scaling, pop-outs or delamination.

G-21

9/18/2020

Item 58 – Deck Condition

Good Condition

0.05" transverse cracks at 6' intervals



GOOD. Some transverse **cracks** < 0.06" at > 5' intervals over the majority of the deck, **light scaling** (less than 1/4" depth) or pop-outs may be present, no spalling.

G-22

9/18/2020

Item 58 – Deck Condition

Good Condition

0.05" transverse cracks at 7'-6" intervals



GOOD. Some transverse **cracks** < 0.06" at > 5' intervals over the majority of the deck, **light scaling** (less than 1/4" depth) or pop-outs may be present, no spalling.

G-23

9/18/2020

Item 58 – Deck Condition

Good Condition

- RC Slab Bridge
- 0.03" longitudinal cracks at 8' intervals
- Spans longitudinally, not transversely
- **Item 58 incorrect!!**
- Rate Deck same as the Super **based on Item 59**



- **Use Item-59 (Reinforced Concrete Superstructure) not Item-58**
- **GOOD.** Isolated non-structural cracks up to 0.03", minor pop-outs or spalls without exposed primary reinforcing steel, stirrups may be exposed in a few locations.

G-24

9/18/2020

Item 58 – Deck Condition

Satisfactory Condition

- 0.05" transverse cracks at 3' intervals
- Spalls and delamination on 4% of deck surface



SATISFACTORY. **Transverse cracks** < 0.06" at < 5' or > 0.06" at > 5' intervals over a majority of the deck, isolated longitudinal cracks, **spalls and delaminations** may be present on up to 5% of the deck riding surface or soffit area, up to 10% of the deck soffit may be spalled, delaminated, and map cracked.

G-25

9/18/2020

Item 58 – Deck Condition

Satisfactory Condition

- 0.07" transverse cracks at 10' intervals
- Spalls and delamination on 4% of deck surface
- Spalls & delaminations are the primary difference between "7" and "6" ratings



SATISFACTORY. **Transverse cracks** < 0.06" at < 5' or > 0.06" at > 5' intervals over a majority of the deck, isolated longitudinal cracks, **spalls and delaminations** may be present on up to 5% of the deck riding surface or soffit area, up to 10% of the deck soffit may be spalled, delaminated, and map cracked.

G-26

9/18/2020

Item 58 – Deck Condition

Fair Condition

- 0.05" transverse cracks at 4' intervals
- 0.03" longitudinal cracks present
- Spalls and delamination present on 8% of concrete deck surface
- Do not use condition of overlay for Deck rating



FAIR. Transverse cracks > 0.06" at < 5' intervals with or without leaching in the majority of the deck, longitudinal cracks < 0.06" in majority of deck, spalls and delaminations may be present on up to 10% of the deck surface or soffit area, up to 25% of the deck surface or soffit may be spalled, delaminated and map cracked, up to 10% loss of primary reinforcement in any 6' bay length.

G-27

9/18/2020

Item 58 – Deck Condition

Fair Condition

- Transverse and longitudinal cracks < 0.06" present over most of the deck
- Minor spalls, delamination, and map cracking present on 20% of deck soffit
- 8% of deck soffit is spalled & delaminated
- Larger areas of longitudinal cracks are the primary difference between "6" and "5" ratings

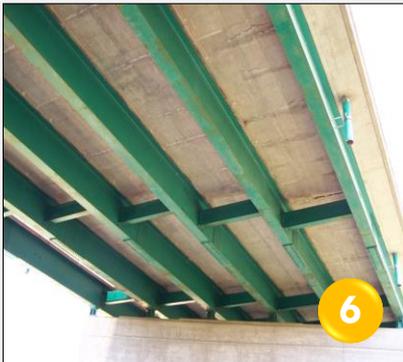


FAIR. Transverse cracks > 0.06" at < 5' intervals with or without leaching in the majority of the deck, longitudinal cracks < 0.06" in majority of deck, spalls and delaminations may be present on up to 10% of the deck surface or soffit area, up to 25% of the deck surface or soffit may be spalled, delaminated and map cracked, up to 10% loss of primary reinforcement in any 6' bay length.

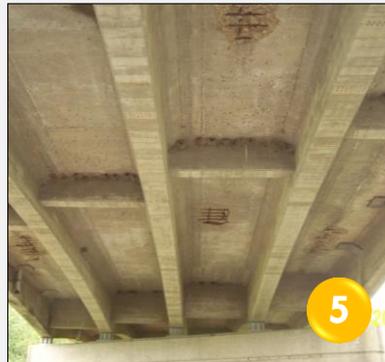
G-28

9/18/2020

Item 58 – Deck Condition



Satisfactory: 0.03" transverse cracks at 3' intervals. Minor spalls, delamination, and map cracking present for less than 10% of deck



Fair: 0.03" transverse cracks at 4' intervals. 0.05" **longitudinal cracks** present with delams, spalls & map cracking over 15% of the deck soffit

G-29

9/18/2020

Item 58 – Deck Condition

Poor Condition

- 0.03" transverse cracks at 3' intervals
- Spalls & delaminations present on 23% of the deck surface and longitudinal cracks over the majority of the deck



POOR. **Longitudinal cracks** > 0.06" in majority of deck, **spalls and delaminations** may be present on up to 25% of the deck surface or soffit area, up to 50% of the deck surface or soffit may be spalled, delaminated and map cracked, up to 30% loss of primary reinforcement in any 6' bay length.

G-30

9/18/2020

Item 58 – Deck Condition

Poor Condition

- Spalls, delamination, and map cracks present on 35% of the deck soffit
- 20% loss of primary reinforcement in the outside bay



POOR. Longitudinal cracks $> 0.06''$ in majority of deck, spalls and delaminations may be present on up to 25% of the deck surface or soffit area, up to 50% of the deck surface or soffit may be **spalled, delaminated and map cracked**, up to 30% loss of primary reinforcement in any 6' bay length.

G-31

9/18/2020

Item 58 – Deck Condition

Poor Condition

- Transverse and longitudinal cracks with leaching are present
- Spalls, delaminations, and map cracking present on 40% of deck soffit
- 22% of deck soffit is spalled and delaminated



POOR. Longitudinal cracks $> 0.06''$ in majority of deck, **spalls and delaminations** may be present on up to 25% of the deck surface or soffit area, up to 50% of the deck surface or soffit may be **spalled, delaminated and map cracked**, up to 30% loss of primary reinforcement in any 6' bay length.

G-32

9/18/2020

Item 58 – Deck Condition

Serious Condition

- Spalls, delaminations, and cracks present on 54% of the deck soffit
- Bituminous patches present on 51% of the deck surface



SERIOUS. Condition is **similar to** the description for a condition rating of “4”, though **more extensive** full depth failures are evident to the point that wheel loads may need restricted or temporary measures implemented.

G-33

9/18/2020

Item 58 – Deck Condition

Serious Condition

- Spalls, delaminations, and cracking are present on 53% of the deck soffit
- 45% loss of reinforcement present in the wheel line



SERIOUS. Condition is **similar to** the description for a condition rating of “4”, though **more extensive** full depth failures are evident to the point that wheel loads may need restricted or temporary measures implemented.

G-34

9/18/2020

Item 58 – Deck Condition

Critical Condition

- 3' long full-depth deck failure present
- Map cracking is present throughout the deck



CRITICAL. Full depth failures needing patching over much of the deck on a regular basis which requires special inspections to keep the bridge open, possibly with reduced load limits, temporary measures may be needed to allow continued use of the structure. The Bureau of Bridges and Structures shall be notified immediately.

G-35

9/18/2020

Item 58 – Deck Condition

Critical Condition

- 4' long full-depth deck failure present
- Map cracking is present throughout the deck



CRITICAL. Full depth failures needing patching over much of the deck on a regular basis which requires special inspections to keep the bridge open, possibly with reduced load limits, temporary measures may be needed to allow continued use of the structure. The Bureau of Bridges and Structures shall be notified immediately.

G-36

9/18/2020

Item 58 – Deck Condition

Major Learning Points for Deck Rating:

- Document crack size, spacing and orientation
- Document area of spalls, delaminations and map cracking
- Document % SL on reinforcement in 6' typical width
- Refer to SIP Manual to select correct rating

G-37

9/18/2020

DISCUSSION

G-38

9/18/2020

PPC DECK BEAMS

9/18/2020

NBI Calibration 2020

Item 59 - PPC Deck Beams

Precast Prestressed Concrete Deck Beams

- Characteristics of PPC Deck Beams
- Effect of overlays type on rating codes
- Sounding and scaling beams during inspection
- Key Indicators for PPC Deck Beams
- Determining Condition Ratings using Key Indicators

KD-2

9/18/2020

Item 59 - PPC Deck Beams

“Hard” Overlay

- Rate the overlay as the Deck (Item 58) and the beams as the Superstructure (Item 59)
- Thickness of Conc. overlay must be 4” or greater
- Concrete overlay must be reinforced



KD-5

9/18/2020

Item 59 - PPC Deck Beams

Sounding

- Use hammer sounding to detect delaminated areas
- Delaminations have a distinctive “hollow or clacking” sound when struck
- Sound concrete has a solid “pinging” sound
- Remove loose & delaminated concrete if practical



KD-6

9/18/2020

Item 59 - PPC Deck Beams

General Notes:

Prestressing strands, reinforcement bars or wire mesh should be considered exposed in areas where concrete appears deteriorated or is unsound (delaminated) to the level of the strands, bars or mesh

Repair patches are considered delaminated



KD-7

9/18/2020

Item 59 - PPC Deck Beams

General Notes:

Prestressing strands adjacent to longitudinal cracks shall be considered as exposed

The dimensions stated on the following pages relate to the width of the cross section of a beam

The "end quarters of span" do not include the beam ends (last 3')



KD-8

9/18/2020

Item 59 - PPC Deck Beams

Key Indicators		Code	Description
<ul style="list-style-type: none"> ▪ Cracks ▪ Delams & Spalls ▪ Exposed Reinf & Strands ▪ Cracked or Failed Keyways 	8	VERY GOOD. No notable problems.	
	7	GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. Moderate cracking and leakage may be present in keyways, but no differential movement occurring between deck beams.	
	6	<p>SATISFACTORY.</p> <p>Center half of span: No beams with prestressing strands, stirrup reinforcement or wire mesh bars exposed, no longitudinal cracking or spalling along the bottom of the beams.</p> <p>End quarters of span: No more than 2 strands or 3" of stirrup reinforcement bars or 3" of wire mesh exposed in the bottom of any beam.</p> <p>Larger widths of wire mesh may be exposed due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway cracking may be evident with wide spread leakage, but beams are still fully acting together.</p>	

KD-9

9/18/2020

Item 59 - PPC Deck Beams

Key Indicators		Code	Description
<ul style="list-style-type: none"> ▪ Cracks ▪ Delams & Spalls ▪ Exposed Reinf & Strands ▪ Cracked or Failed Keyways 	5	<p>FAIR.</p> <p>Center half of span: No more than 2 strands or 3" of stirrup reinforcement bars or 3" of wire mesh exposed in any beam, longitudinal cracking or spalling limited to one edge with no other defects exposing reinforcement, wire mesh or strands.</p> <p>End quarters of span: No more than 4 strands or 6" of stirrup reinforcement bars or 6" of wire mesh exposed in the bottom of any beam, no more than one longitudinal crack in any beam without any other defect.</p> <p>Beam ends (up to 3'): Prestressed strands, stirrup reinforcement bars or wire mesh exposed up to full width of any beam bottom.</p> <p>Larger widths of wire mesh may be exposed due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway cracking with extensive leakage and evidence that beams are beginning to act independently of each other.</p>	

KD-10

9/18/2020

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Delams & Spalls
- Exposed Reinf & Strands
- Cracked or Failed Keyways

Code	Description
4	<p>POOR.</p> <p>Center half of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than ½ the width of any beam bottom, spalling or delamination of the top of the beams down to the top reinforcement, one longitudinal crack in the bottom of any beam.</p> <p>End quarters of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than ½ the width of any beam bottom, two longitudinal cracks in the bottom of any beam.</p> <p>Beam ends (up to 3'): Prestressed strands, stirrup reinforcement bars or wire mesh exposed up to full width of adjacent beam bottom with no exposed strands in the second layer of strands and sound concrete above the bottom layer.</p> <p>Larger width of wire mesh exposed and actively corroding due to inadequate concrete cover occurring during manufacturing (up to ½" cover), keyway has failed with groups of beams acting independently of others.</p>

KD-11

9/18/2020

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Delams & Spalls
- Exposed Reinf & Strands
- Cracked or Failed Keyways

Code	Description
3	<p>SERIOUS.</p> <p>Center half of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than ½ the width of any beam bottom, two longitudinal cracks in the bottom of any beam, combinations of deterioration in condition rating "4".</p> <p>End quarters of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than ¾ the width of any beam bottom, combination of deterioration in condition rating "4".</p> <p>Beam ends (up to 3'): Prestressed strands, stirrup reinforcement bars or wire mesh exposed full width of adjacent beam bottom with exposed strands in the second layer of strands or unsound concrete above the bottom layer.</p> <p>Keyways have failed causing 3 or 4 beams to act independently from others.</p>

KD-12

9/18/2020

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Delams & Spalls
- Exposed Reinf & Strands
- Cracked or Failed Keyways

Code	Description
2	CRITICAL. Similar to but more serious and extensive than what is described for a condition rating of "3", transverse cracks full width in the bottom of the beams, keyways have failed causing 1 or 2 beams to act independently from others. Structural elements that are judged to be in critical condition must receive special inspections in order for the structure to remain open to traffic. The Bureau of Bridges and Structures shall be notified immediately.
1	"IMMINENT" FAILURE. Superstructure in "imminent failure" condition requiring bridge closure or temporary measures to allow structure to remain open.
0	FAILED. Superstructure that has failed and is beyond repair, requiring bridge closure.

KD-13

9/18/2020

Item 59 - PPC Deck Beams

When does the condition rating of an individual deck beam effect that of the whole superstructure if the other beams are in better condition?

- *If one or more beams meets the condition state requirements of a "4" or lower rating, this condition state should be applied to the superstructure as a whole*
- *The condition rating of "4" POOR CONDITION was selected as this is the level where loss of Structural Load Capacity generally begins to occur*
- *An initial rating of "4" or below will trigger a Load Rating Inspection by IDOT staff*

KD-14

9/18/2020

Item 59 - PPC Deck Beams

New Construction

No deficiencies



New Deck Beam – Typically first inspection only

KD-15

9/18/2020

Item 59 - PPC Deck Beams

Very Good Condition

- No Deficiencies
- Not new construction



VERY GOOD. No notable problems.

KD-16

9/18/2020

Item 59 - PPC Deck Beams

Good Condition

- Cracks in the RC overlay (0.02")
- No noticeable keyway leakage
- Hard overlay would be rated as the Deck (Item 58)
- Deck would be rated "4" due to widespread map cracking.
- Item 59 is still a "7"



GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. **Moderate cracking** and leakage **may be present in keyways**, but no differential movement occurring between deck beams.

KD-17

9/18/2020

Item 59 - PPC Deck Beams

Good Condition

- Underside of the Superstructure in the previous slide
- Reflective cracking in the hard overlay indicated potential for keyway cracking



GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. **Moderate cracking** and leakage **may be present in keyways**, but no differential movement occurring between deck beams.

KD-18

Item 59 - PPC Deck Beams

Good Condition

- Moderate keyway leakage with efflorescence
- Beams are still acting together



GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. **Moderate cracking and leakage may be present in keyways, but no differential movement occurring between deck beams.**

KD-19

9/18/2020

Item 59 - PPC Deck Beams

Satisfactory Condition

- Keyway leakage
- Beams still acting together
- Inadequate concrete cover has exposed mesh on one beam
- Verify exposed wire is not a strand



SATISFACTORY. Center half of span: No beams with prestressing strands, stirrup reinforcement or wire mesh bars exposed, no longitudinal cracking reinforcement or wire mesh bars exposed, no longitudinal cracking or spalling along the bottom of the beams. End quarters of span: No more than 2 strands or 3" of stirrup reinforcement bars or 3" of wire mesh exposed in the bottom of any beam. Larger widths of wire mesh may be exposed due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway cracking may be evident with wide spread leakage, but beams are still fully acting together.

KD-20

9/18/2020

Item 59 - PPC Deck Beams

Fair Condition

- Spall up to 6" wide in the end quarter of the span with reinforcement exposed
- Spall with reinforcement exposed near the beam end



FAIR. Center half of span: No more than 2 strands or 3" of stirrup reinforcement bars or 3" of wire mesh exposed in any beam, longitudinal cracking or spalling limited to one edge with no other defects exposing reinforcement, wire mesh or strands. End quarters of span: No more than 4 strands or 6" of stirrup reinforcement bars or 6" of wire mesh exposed in the bottom of any beam, no more than one longitudinal crack in any beam without any other defect. Beam ends (up to 3'): Prestressed strands, stirrup reinforcement bars or wire mesh exposed up to full width of any beam bottom. Larger widths of wire mesh may be exposed due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway cracking with extensive leakage and evidence that beams are beginning to act independently of each other.

KD-21

9/18/2020

Item 59 - PPC Deck Beams

Fair Condition

- Spall full width on the beam end with reinforcement exposed
- No other defects



FAIR. Center half of span: No more than 2 strands or 3" of stirrup reinforcement bars or 3" of wire mesh exposed in any beam, longitudinal cracking or spalling limited to one edge with no other defects exposing reinforcement, wire mesh or strands. End quarters of span: No more than 4 strands or 6" of stirrup reinforcement bars or 6" of wire mesh exposed in the bottom of any beam, no more than one longitudinal crack in any beam without any other defect. Beam ends (up to 3'): Prestressed strands, stirrup reinforcement bars or wire mesh exposed up to full width of any beam bottom. Larger widths of wire mesh may be exposed due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway cracking with extensive leakage and evidence that beams are beginning to act independently of each other.

KD-22

9/18/2020

Item 59 - PPC Deck Beams

Poor Condition

- Spalls with reinforcement exposed
- Width is 8" of the 36" beam width (less than 1/3 of the beam width)
- Location of defect is near mid-span



POOR. Center half of span: **Prestressed strands, stirrup reinforcement bars or wire mesh exposed** for no more than 1/4 the width of any beam bottom, spalling or delamination of the top of the beams down to the top reinforcement, one longitudinal crack in the bottom of any beam. End quarters of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than 1/4 the width of any beam bottom, two longitudinal cracks in the bottom of any beam. Beam ends (up to 3'): Prestressed strands, stirrup reinforcement bars or wire mesh exposed up to full width of adjacent beam bottom with no exposed strands in the second layer of strands and sound concrete above the bottom layer. Larger width of wire mesh exposed and actively corroding due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway has failed with groups of beams acting independently of others.

KD-23

9/18/2020

Item 59 - PPC Deck Beams

Poor Condition

- Spalls with reinforcement exposed
- Full width of adjacent beam ends



POOR. Center half of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than 1/4 the width of any beam bottom, spalling or delamination of the top of the beams down to the top reinforcement, one longitudinal crack in the bottom of any beam. End quarters of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than 1/4 the width of any beam bottom, two longitudinal cracks in the bottom of any beam. Beam ends (up to 3'): **Prestressed strands, stirrup reinforcement bars or wire mesh exposed up to full width of adjacent beam bottom** with no exposed strands in the second layer of strands and sound concrete above the bottom layer. Larger width of wire mesh exposed and actively corroding due to inadequate concrete cover occurring during manufacturing (up to 1/2" cover), keyway has failed with groups of beams acting independently of others.

KD-24

9/18/2020

Item 59 - PPC Deck Beams

Serious Condition

- Spalls or delaminations
- Width is 15" of 36" beam width (roughly 1/2 of width)
- Location of defect is near mid-span



SERIOUS. Center half of span: **Prestressing strands, stirrup reinforcement bars or wire mesh exposed** for no more than $\frac{1}{4}$ the width of any beam bottom, two longitudinal cracks in the bottom of any beam, combinations of deterioration in condition rating "4". End quarters of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than $\frac{1}{4}$ the width of any beam bottom, combination of deterioration in condition rating "4". Beam ends (up to 3'); Prestressed strands, stirrup reinforcement bars or wire mesh exposed full width of adjacent beam bottom with exposed strands in the second layer of strands or unsound concrete above the bottom layer. Keyways have failed causing 3 or 4 beams to act independently from others.

KD-25

9/18/2020

Item 59 - PPC Deck Beams

Serious Condition

- Spalls or delaminations
- Width is 14" (8" + 6") of the 36" beam width (roughly 1/2 of width)
- Located near mid-span
- Keyway failure



SERIOUS. Center half of span: **Prestressing strands, stirrup reinforcement bars or wire mesh exposed** for no more than $\frac{1}{4}$ the width of any beam bottom, two longitudinal cracks in the bottom of any beam, combinations of deterioration in condition rating "4". End quarters of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than $\frac{1}{4}$ the width of any beam bottom, combination of deterioration in condition rating "4". Beam ends (up to 3'); Prestressed strands, stirrup reinforcement bars or wire mesh exposed full width of adjacent beam bottom with exposed strands in the second layer of strands or unsound concrete above the bottom layer. **Keyways have failed** causing 3 or 4 beams to act independently from others.

KD-26

9/18/2020

Item 59 - PPC Deck Beams

Critical Condition

- Spalls or delaminations
- Combined width is 26" of the 36" beam width (over 2/3 of width)
- Several keyways have failed with beams acting independently



CRITICAL. Similar to but more serious and extensive than what is described for a condition rating of "3", transverse cracks full width in the bottom of the beams, **keyways have failed causing 1 or 2 beams to act independently** from others. Structural elements that are judged to be in critical condition must receive special inspections in order for the structure to remain open to traffic. **The Bureau of Bridges and Structures shall be notified immediately.**

KD-27

9/18/2020

Item 59 - PPC Deck Beams

- Example of beams acting independently due to keyway failure
- Bituminous overlay becomes dislodged by differential movement of beams



KD-28

Item 59 - PPC Deck Beams

Critical Condition

- Spalls or delaminations
- Width extends 34" across the 36" beam width
- Exposed strands visible
- Keyway failure
- Load Rating Inspection required



CRITICAL. Similar to but more serious and extensive than what is described for a condition rating of "3", transverse cracks full width in the bottom of the beams, **keyways have failed** causing 1 or 2 beams to act independently from others. Structural elements that are judged to be in critical condition must receive special inspections in order for the structure to remain open to traffic. **The Bureau of Bridges and Structures shall be notified immediately.**

KD-29

9/18/2020

Discussion

KD-30

9/18/2020