INTRODUCTION AND PURPOSE OF THE COURSE

9/15/2015

NBI Calibration 2015

Introduction

- Class Instructor: Mike Cima
- Background:
  - Over 25 years of bridge related structure experience
  - 17+ with IDOT BB&S, 7+ with HLR Engineering (Elgin / Springfield / Woodridge)
  - 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

C-2

9/15/2015

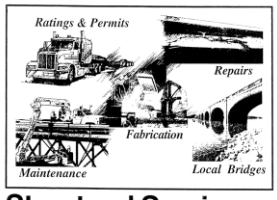
Introduction

Focus of the Class

- Consistent application of current policies
- Discuss new and recently revised policies
- Discuss current procedures with "room for improvement"
- Chapter 3 of the Structural Services Manual – Inspection

(updated June 2015)

(www.dot.state.il.us/bridges/brmanuals.html)



Structural Services Manual

Illinois Department of Transportation
Bureau of Bridges and Structures

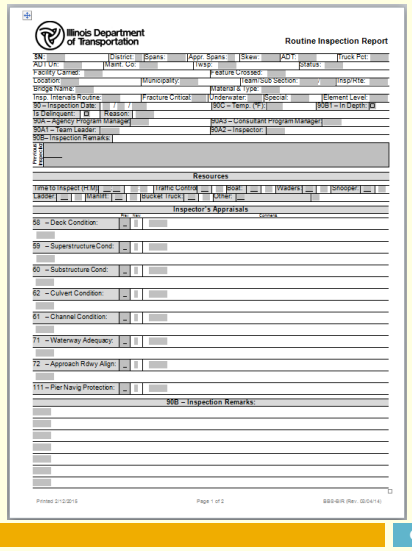
C-3

9/15/2015

Introduction

Material To Be Covered

- Typical items reported on IDOT inspection forms
- Procedures for inspecting, completing forms, and reporting information
- Determining Condition Ratings of various bridge elements
- Feedback from QA process audits regarding common findings and deficiencies



Illinois Department of Transportation

Routine Inspection Report

SN: | District: | Spans: | Appr. Spans: | Skew: | ADT: | Truck Pct:
ADT Yr: | Maint. Co: | NSI: | Status:
Facility Carried: | Feature Crossed:
Location: | Municipality: | Nearest Cross Section: | Insp Hrs:
Bridge Name: | Material & Type:
Insp. Intervals Routine: | Fracture Critical: | Underwater: | Special: | Element Level:
90 – Inspection Date: / / | 90C – Temp. (°F): | 90B1 – In Depth: ☐
Is Delinquent: ☐ | Reason:
90A – Agency Program Manager: | 90A2 – Consultant Program Manager:
90A1 – Team Leader: | 90A2 – Inspector:
90B – Inspection Remarks:
Permanent Remarks:

Resources

Time to Inspect (H:M): __ __ | Traffic Control: __ | Boat: __ | Waders: __ | Snooper: __
Ladder: __ | Manlift: __ | Bucket Truck: __ | Other: __

Inspector's Appraisals

	Rq	Ver	Comments
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:

Printed 2/12/2015 | Page 1 of 2 | BBS-BIR (Rev. 03/04/14)

C-4

9/15/2015

Introduction

Course Objectives:

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

C-5

9/15/2015

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 funding and resources. The Sufficiency Rating, which determines the eligibility for funding, is calculated using inspection & inventory data.
- Deficiencies noted during inspections identify maintenance needs

C-6

9/15/2015

Introduction

What is Calibration, and why do we do it?

- Quality of information in the database is important.
  - Distribution of bridge funds can be affected.
  - Decisions (permits, detours, etc.) are made based on this information.
- Consistency across various bridge programs is needed.
  - The rating of a bridge in "poor" condition should not vary based on the location of the bridge and who inspected it.
- There are several hundred inspectors involved in bridge inspections in Illinois.
  - There needs to be a means to establish and maintain consistent standards for determining the condition of the State's bridges.
- The NBIS includes a requirement for refresher training of bridge inspectors – this class fills that requirement.

C-7

9/15/2015

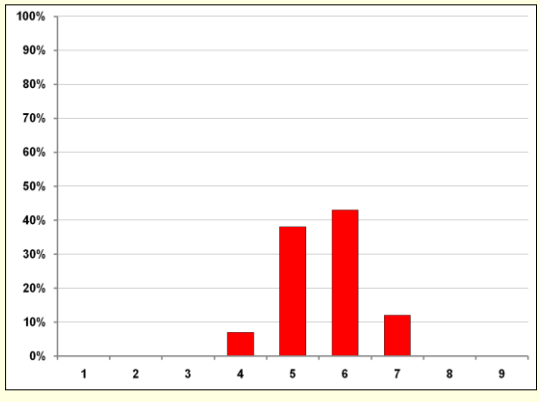
Introduction

Hypothetical Example of Condition Ratings Reported by "Un-Calibrated" Inspectors

Without calibration training, interpretation of rating criteria and policies can vary greatly.

Inspectors may be unaware of new or revised policies.

Some inspectors may not be following policy.



C-8

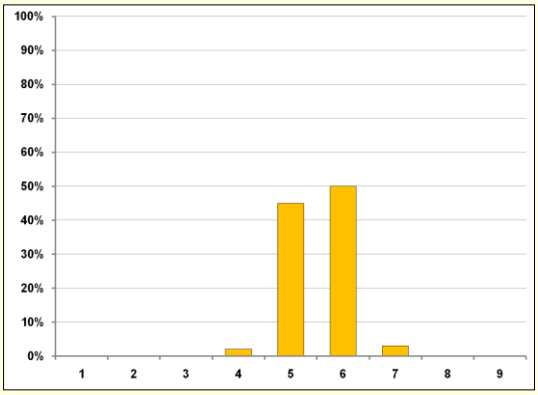
9/15/2015

Introduction

Typical Example of Condition Ratings Reported by Inspectors

Process audits of agencies with well-trained inspectors find agreement with recorded Condition Ratings within "1" rating category.

Calibration training is intended to improve the consistency of reported Condition Ratings by clarifying the boundaries between ratings.



C-9

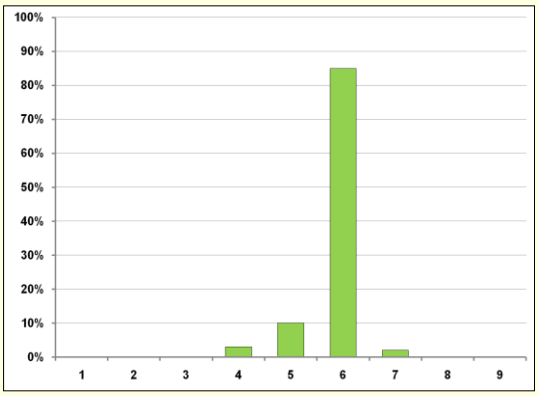
9/15/2015

Introduction

Idealized Example of Condition Ratings Reported by Calibrated Inspectors

The desired result of calibrating inspectors to common standards is less variability in the reported data.

Some variation will still exist, but almost all reported Condition Ratings would be within "1" rating category of the targeted "correct" rating.



C-10

9/15/2015

Introduction

How do we achieve consistent ratings between a group of inspectors on a given structure?

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

C-11

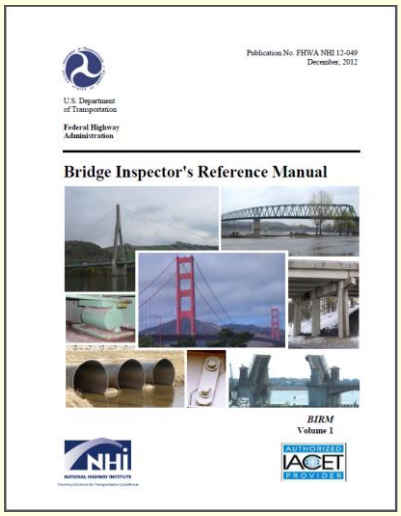
9/15/2015

Introduction

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

- **Provides detailed information for bridge inspection**
- **Available at no cost**
- **Establishes "<u>consistent inspection practices</u>"**

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



C-12

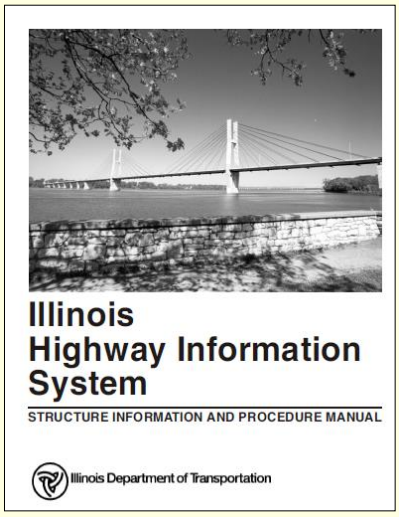
9/15/2015

Introduction

2. Structure Information and Procedure Manual

- Detailed information for coding of ISIS data items
- Primary guidance for determining the Condition Rating of bridge elements ("establishes uniform rating guidlines")
- Course focuses on the application of these guidelines
- Watch for revisions on IDOT's web site / subscription service

(www.dot.state.il.us/isis/structinfo.html)



Introduction

Code	General Description
N	Not Applicable
9	Excellent (New) Condition
8	Very Good Condition - No problems noted.
7	Good Condition - Some minor problems.
6	Satisfactory Condition - Structural elements show some minor deterioration.
5	Fair Condition - All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4	Poor Condition - Advanced section loss, deterioration, spalling or scour. (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 damage inspection by the Bureau of Bridges and Structure 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. 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. 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.

Introduction

Code:	Description:	Commonly Employed Actions:
9	EXCELLENT CONDITION	• Little concern from a safety perspective. • **Preventive Maintenance.**
8	VERY GOOD CONDITION	
7	GOOD CONDITION	
6	SATISFACTORY CONDITION	• May be possible to "save" elements at this stage of deterioration with maint. or repair. • **Preventive Maintenance and/or Repairs.**
5	FAIR CONDITION	
4	POOR CONDITION	•Safety concerns & Load Rating Inspections. • Traffic disruptions due to load postings and/or detours possible. • **Rehabilitation or Replacement.**
3	SERIOUS CONDITION	
2	CRITICAL CONDITION	
1	IMMENENT FAILURE CONDITION	
0	FAILED CONDITION	

C-15

9/15/2015

Introduction

References

- **National Bridge Inspection Standard (NBIS)**
  http://www.fhwa.dot.gov/bridge/nbis.htm
- **"Structure Information and Procedure Manual"**
  http://www.dot.state.il.us/isis/structinfo.html
- **"Structural Services Manual" – Chapter 3**
  http://www.dot.state.il.us/bridges/brmanuals.html
- **"Bridge Inspector's Reference Manual"**
  http://www.fhwa.dot.gov/bridge/bripub.htm
- **"Manual For Bridge Evaluation"**
  https://bookstore.transportation.org/item_details.aspx?ID=1578

C-16

9/15/2015

Introduction

Audience Response System

- Each response card is mapped to a specific attendee
- Immediate display of polling results
- Response Card displays user's choice
- User can change choice as long as polling is open, only most recent choice is counted in results
- **Please return Response Cards and Lanyards at the end of class!**

C-17

9/15/2015

DISCUSSION

C-18

9/15/2015

GENERAL POLICIES AND REQUIREMENTS

9/15/2015

NBI Calibration 2015

General Policies and Requirements

- NBIS Requirements
- NBIS Metrics
- NBIS Program Managers for Local Agencies
- Inspection Due Dates
- Critical Findings
- Bridge Files
- Quality Control
- Load and Resistance Factor Rating

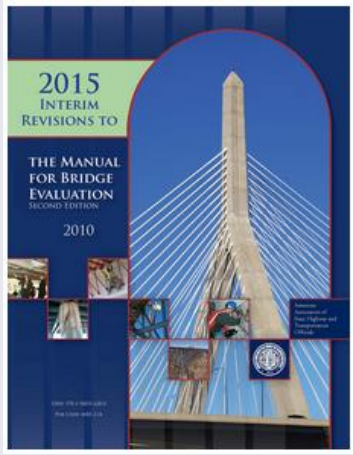
D-2

9/15/2015

General Policies and Requirements

NBIS Requirements

- AASHTO "Manual for Bridge Evaluation" (MBE) incorporated into the NBIS effective in 2009
- Personnel involved with NBIS Inspections and procedures should familiarize themselves with this manual.
- Latest Edition came out in 2010 with interims thru 2015.



D-3

9/15/2015

General Policies and Requirements

NBIS Metrics: (FHWA)

- FHWA developed 23 individual metrics to measure compliance with the NBIS
  - "Risk-based, data-driven" approach
  - Intended to provide a consistent level of oversight throughout the nation
  - Not new requirements, just a new way of measuring compliance
  - IDOT subject to increased oversight and scrutiny to ensure compliance
  - Possible basis for sanctions for non-compliance.
  - Sanctions may involve withholding Federal Funds.
- *IDOT has responded with plans of action to the FHWA to fix all non-compliant items.*
- See CL 2012-08 & CL 2012-13 *for additional background*

D-4

9/15/2015

General Policies and Requirements

Program Managers for Local Agencies

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

D-5

9/15/2015

General Policies and Requirements

Inspection Due Dates

- Inspections should be completed prior to or on the due date month based on the last date of inspection.
- As long as the inspection is completed within or before the designated month, it will be considered completed on time by IDOT and the FHWA.
- On very rare occasion you may be unable to inspect a structure on time due to site conditions beyond the program manager's 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.

D-6

9/15/2015

General Policies and Requirements

Critical Findings: (Revised June 2015)

- 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 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

D-7

9/15/2015

General Policies and Requirements

Critical Finding Process: (Revised June 2015)

- Secure the bridge as necessary to protect the safety of the travelling public.
- If the Team Leader determines the damage seriously reduces the structures load capacity then the defect should be isolated from traffic by closing lanes or the entire structure if necessary.
- State Bridge – report immediately to the District/Area Program Manager who forwards it to the State Program Manager
- Local Bridge - report immediately to the Local Program Manager who forwards it to the IDOT Local Program Manager
- If BB&S determines the deficiency requires FHWA notification, Form BBS-CF-1 must be completed at the lowest Program Manager level and forwarded to the State Program Manager within 7 days

D-8

9/15/2015

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 (12/2013), must be completed, updated and maintained for each bridge and stored with the Bridge File and a copy forwarded to IDOT.**
- **It is not necessary to physically store all required items in the file, but the location of each must be referenced on the Checklist.**

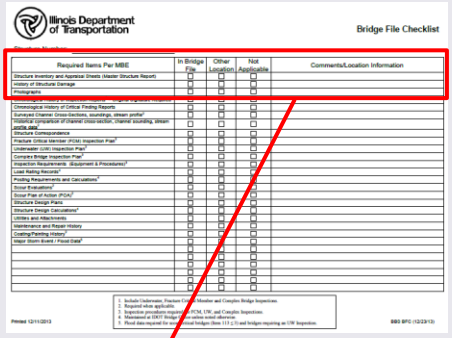
D-9

9/15/2015

General Policies and Requirements

Bridge File Checklist BBS BFC (12/23/13):

- 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…


Illinois Department of Transportation

Bridge File Checklist

Required Items Per MBE	In Bridge File	Other Location	Not Applicable	Comments/Location Information
Structure Inventory and Appraisal Sheets (Master Structure Report)	☐	☐	☐	
History of Structural Damage	☐	☐	☐	
Photographs	☐	☐	☐	
Chronological History of Critical Finding Reports	☐	☐	☐	
Surveyed Channel Cross-Sections, soundings, stream profile[1]	☐	☐	☐	
Historical Comparison of channel cross-section, channel sounding, stream profile data[1]	☐	☐	☐	
Structure Correspondence	☐	☐	☐	
Fracture Critical Member (FCM) Inspection Plan[2]	☐	☐	☐	
Underwater (UW) Inspection Plan[2]	☐	☐	☐	
Complex Bridge Inspection Plan[2]	☐	☐	☐	
Inspection Requirements (Equipment & Procedures)[2]	☐	☐	☐	
Load Rating Records[3]	☐	☐	☐	
Posting Requirements and Calculations[3]	☐	☐	☐	
Scour Evaluation[4]	☐	☐	☐	
Scour Plan of Action (POA)[4]	☐	☐	☐	
Structure Design Plans	☐	☐	☐	
Structure Design Calculations[5]	☐	☐	☐	
Utilities and Attachments	☐	☐	☐	
Maintenance and Repair History	☐	☐	☐	
Coating/Painting History[5]	☐	☐	☐	
Major Storm Event / Flood Data[5]	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

1. Include Underwater, Fracture Critical Member and Complex Bridge Inspections.
2. Required when applicable.
3. Required for structures requiring FCM, UW, and Complex Inspections.
4. Maintained at DBIT Bridge Office unless noted otherwise.
5. Flood data required for all critical bridges (Item 113 g.1) and bridges requiring an UW Inspection.

Printed 12/11/2013 BBS BFC (12/23/13)

Required Items Per MBE	In Bridge File	Other Location	Not Applicable	Comments/Location Information
Structure Inventory and Appraisal Sheets (Master Structure Report)	☒	☐	☐	
History of Structural Damage	☒	☐	☐	
Photographs	☐	☒	☐	located in computer bridge file under SN xxx-xxxx.
Chronological History of Inspection Reports` – Original Signature Required	☒	☐	☐	

D-10

9/15/2015

General Policies and Requirements

Quality Control:

- Bridge Inspection Refresher Training
  - All PMs & TLs must receive refresher training every 60 months
  - FHWA-NHI-130053 Bridge Inspection Refresher Training – 3 days
  - IDOT Bridge Inspection Calibration Course – 1.5 days
  - Must take NHI 3-day course at least every other refresher period
- Review of Bridge Inspection Reports & Procedures
  - Every 24 months PMs must accompany their TLs on 3 inspections to observe and verify their performance is satisfactory
  - Any PM that performs NBIS inspections must be field verified by another PM.
  - Document results on Form BBS 2790.

D-11

9/15/2015

General Policies and Requirements

General Requirements

- Agencies responsible for a bridge on their right-of-way must report the bridge as part of the NBI (and inspect in accordance with the NBIS) even if the bridge carries traffic onto private roadways or entrances.
- 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 for the bridge
- Detailed inspection requirements are defined in Section 3 of the IDOT Structural Services Manual.

D-12

9/15/2015

DISCUSSION

D-13

TYPES OF INSPECTIONS AND FORMS

9/15/2015

NBI Calibration 2015

Types of Inspections and Forms

- Types of Inspections
- Inspection Intervals
- Inspection Forms

R-2

9/15/2015

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

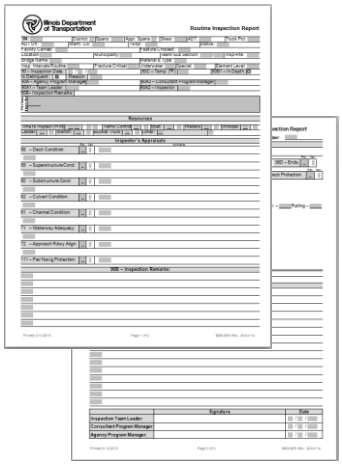
R-3

9/15/2015

Types of Inspections and Forms

Initial Inspection:

- **The 1st inspection of a new or newly rehabilitated bridge to provide data to determine baseline conditions.**
- **Inspection Interval:**
  - **IDOT structures must be entered in ISIS within 90 days of opening to traffic**
  - **All other structures must be entered into ISIS within 180 days of opening to traffic**
- **Form: BBS BIR Routine Inspection Report**



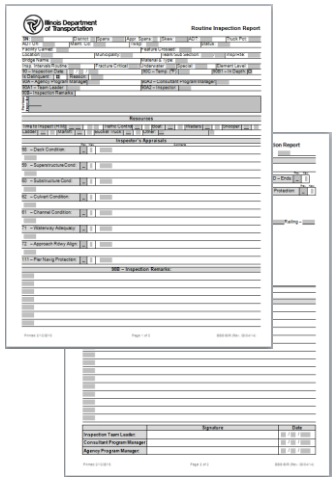
R-4

9/15/2015

Types of Inspections and Forms

Routine Inspection:

- A regularly scheduled inspection to determine the physical and functional condition, identify changes from previous conditions and ensure the structure continues to satisfy service requirements.
- Most common type of inspection
- Usually conducted on a 48, 24 or 12-month interval
- Form: BBS BIR Routine Inspection Report



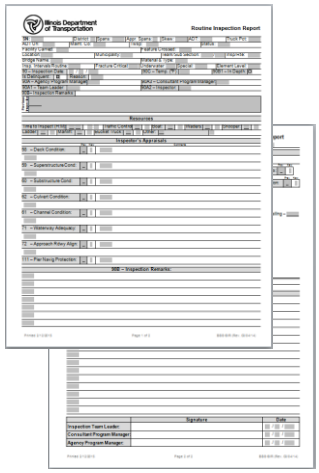
R-5

Types of Inspections and Forms

Routine Inspection:

(In-Depth Procedures) - *NEW*

- Completed in place of the standard Routine Inspection. Same process but 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

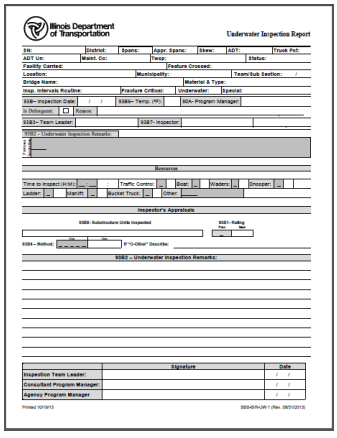


R-6

Types of Inspections and Forms

Underwater Inspection:

- Inspection of the underwater portion of a bridge substructure and surrounding channel that cannot be inspected visually at low water by wading or probing, generally requiring diving or other appropriate techniques.
- 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


Illinois Department of Transportation

Underwater Inspection Report

SN: | District: | Spans: | Appr. Spans: | Skew: | ADT: | Truck Pct.
ADT Un: | Maint. Co: | Twsp: | Status:
Facility Carried: | Feature Crossed:
Location: | Municipality: | Team/Sub Section: /
Bridge Name: | Material & Type:
Insp. Intervals Routine: | Fracture Critical: | Underwater: | Special:
93B– Inspection Date / / | 93B6– Temp. (°F) | 93A– Program Manager:
Is Delinquent: ☐ Reason:
93B3– Team Leader: | 93B7– Inspector:
93B2 – Underwater Inspection Remarks:
Resources
Time to Inspect (H:M): | Traffic Control: | Boat: | Waders: | Dropper:
Ladder: | Manlift: | Bucket Truck: | Other:
Inspector's Approvals
93B8– Substructure Units Inspected | 93B1– Rating Max. Min.
93B4– Method: | If "O–Other" Describe:
93B2 – Underwater Inspection Remarks:

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

Printed 10/19/13 | BBS-BIR-UW 1 (Rev. 08/01/2013)

R-7

Types of Inspections and Forms

Channel Cross Section Requirements: *NEW*

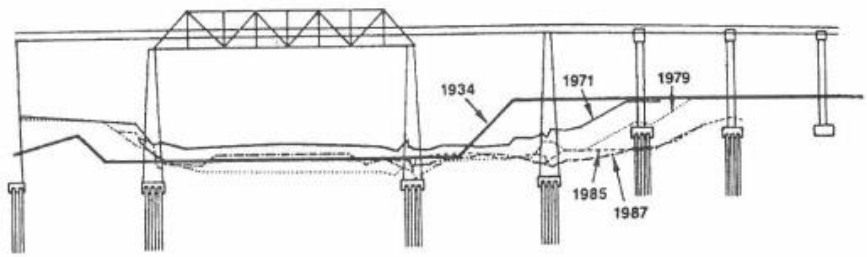
- Required for all Scour Critical Bridges (ISIS item 113):
  - Take at the up/downstream fascia's for comparison to original baseline
  - Max 5 yr. interval or after significant storms
- Required for all bridges requiring an Underwater Inspection:
  - Take at the up/downstream fascia's for comparison to original baseline
  - Take each underwater inspection cycle
- Cross section 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)

R-8

Types of Inspections and Forms

Channel Cross Section Requirements:

Example Channel Sketch



R-9

9/15/2015

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

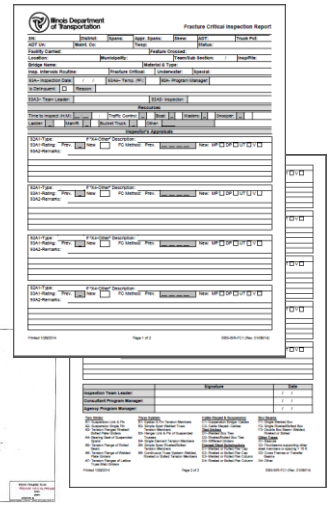
R-10

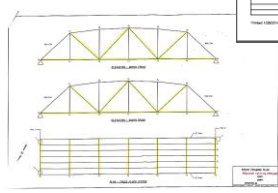
9/15/2015

Types of Inspections and Forms

Fracture Critical Member Inspection:

- 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



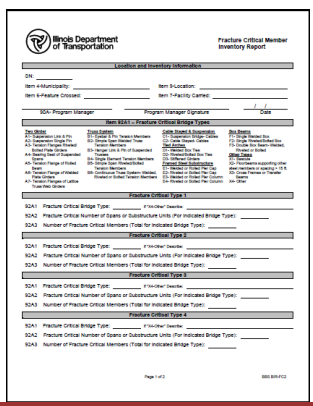


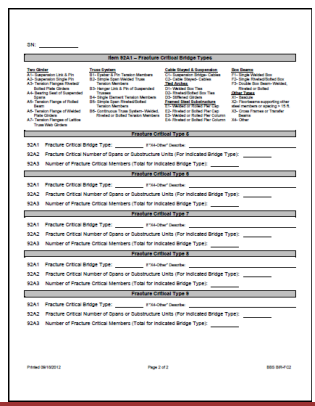
R-11

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)



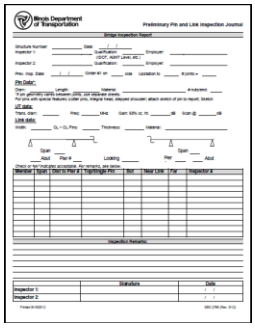


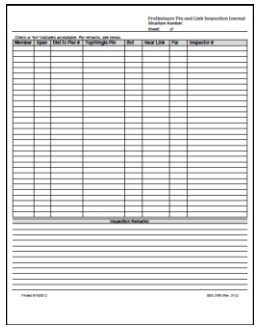
R-12

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**


Illinois Department of Transportation
Preliminary Pin and Link Inspection Journal

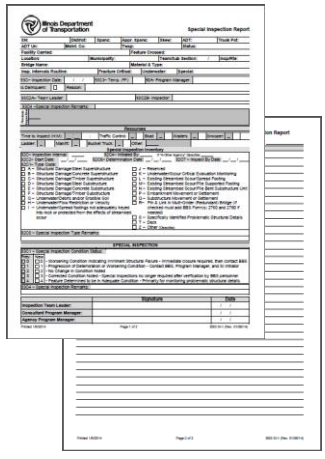

Preliminary Pin and Link Inspection Journal

R-13

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 of conditions over time.**
- **At times used to defer load restrictions**
- **Form BBS SI-1 Special Inspection Report**


Illinois Department of Transportation
Special Inspection Report

R-14

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 assesses the effort necessary to repair the bridge.
- No official inspection form.

R-15

9/15/2015

Types of Inspections and Forms

Load Rating Inspection:

- A scheduled inspection used to collect detailed information required to complete a load rating analysis on the structure.
- 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-16

9/15/2015

Types of Inspections and Forms

Complex Inspection:

- An In-Depth inspection requiring Hands-On inspection procedures to assess the unusual characteristics of the bridge according to a written inspection plan.
- 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-17

9/15/2015

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 in assigned to a specific condition state. This data is used to develop the Statewide Bridge Management System.
- New AASHTO Manual For Bridge Element Inspection, 2nd Ed, 2013 is out
- New guidance has 4 rather than 5 condition states.
- IDOT placed new State Manual online 2/2014. IDOT version contains many more “rated elements” than the FHWA version (“8000” series elements).
- Future: may see more element level inspections? (FHWA preference)
- Form – IDOT spreadsheet.

R-18

9/15/2015

Types of Inspections and Forms

Hands On Inspection:

- An inspection within arms length of a bridge component.
- May use visual techniques and be supplemented by nondestructive testing.
- Inspection forms as required.

R-19

9/15/2015

Types of Inspections and Forms

Form BBS-BIR:
Routine Insp. Report

- Comments recommended for a rating of 6.
- All ratings ≤ 5 must have comments on page 1 under "Inspectors Appraisals" justifying rating.
- Insp. Team Leader , Insp. Program Manager & the Agency Program Manager (if different) must sign and date form on page 2.

Inspector's Appraisals		
	Prev	New
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		

	Signature
Inspection Team Leader:	
Consultant Program Manager:	
Agency Program Manager:	

R-20

9/15/2015

Discussion

APPROACH ROADWAY

9/15/2015

NBI Calibration 2015

Item 72 – Approach Roadway Alignment

- Identifies if bridges function adequately based on the approach roadway alignment
- Speed reductions necessary because of structure width and not due to alignment are not considered in evaluating this item
- Not intended that the approach roadway alignment be compared to current standards, rather to <u>existing highway alignment</u>

P-2

9/15/2015

Item 72 – Approach Roadway Alignment

- **Based on Operating Speed – NOT Design Speed**
- **Note: Regulatory Speed on 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

9/15/2015

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 "4 - 7")
Substantial reduction in operating speed	≥ 10 mph (Code "1 - 3")

P-4

9/15/2015

Item 72 – Approach Roadway Alignment

- **Urban Setting**

  Approaches consistent with bridge geometry. No reduction in speed necessary 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

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment – Relatively flat

Horizontal Alignment - Straight

No reduction in operating speed

P-6

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment – Relatively flat with minor curve on approach

Horizontal Alignment - Straight

Minor reduction in operating speed

P-7

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment – 2% Grade

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

A very minor reduction in operating speed

P-8

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment

Horizontal Alignment

Minor reduction in operating speed

P-9

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment – 2% Grade

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

P-10

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment - Slight drop at the end of the bridge

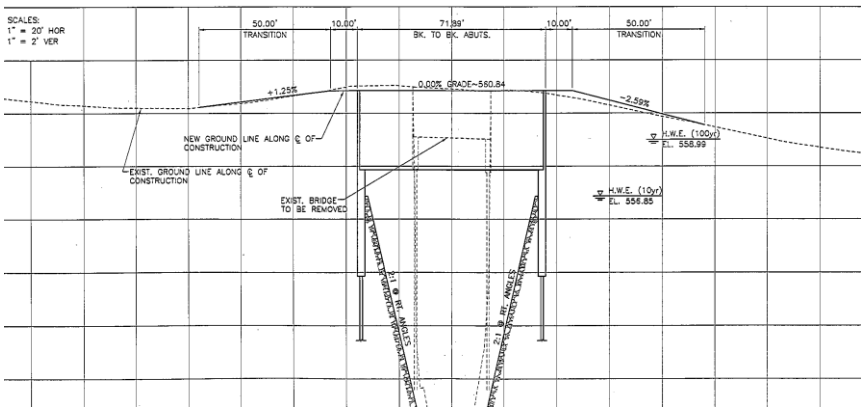
Horizontal Alignment – Straight

Significant reduction in operating speed

P-11

9/15/2015

Item 72 – Approach Roadway Alignment



P-12

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment - Slight drop at the end of the bridge

Horizontal Alignment – Straight

P-13

9/15/2015

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

9/15/2015

Item 72 – Approach Roadway Alignment

Vertical Alignment – Sharp vertical gradient change; poor sight distance

Substantial reduction in operating speed, intolerable

P-15

9/15/2015

Discussion

9/15/2015

WEARING SURFACE, PROTECTIVE SYSTEMS, AND TOTAL DECK THICKNESS

9/15/2015

NBI Calibration 2015

Item 108 - Wearing Surface / Protective System

- Total Deck Thickness vs. Deck Structure Thickness
- Item 108A-C
  - 108A – Type of Wearing Surface
  - 108B – Type of Membrane
  - 108C – Deck Protection

H-2

9/15/2015

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

9/15/2015

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 curbline.**
  - **If haunched then at midpoint of longest span**
- **Total Deck Thickness (Items 108D): Deck thickness originally built + includes built up wearing surface thickness**
- **Total deck thickness is key to determining accurate super rating and permit capacities.**

LL Capacity = Total Capacity – DL Capacity

H-4

9/15/2015

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)

H-5

9/15/2015

Item 108 - Wearing Surface / Protective System

Code	Description
A	Bare Deck - No Overlay

H-6

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

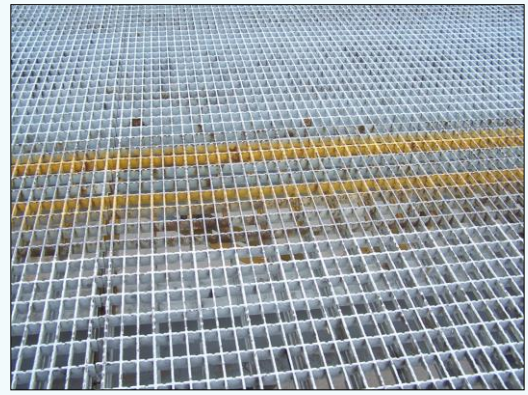
Code	Description
M	Epoxy Overlay

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)

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
H	Asbestos Waterproofing Membrane System
N	Not Applicable (applies only to structures with no deck)

H-19

9/15/2015

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

9/15/2015

DISCUSSION

H-21

9/15/2015

DECK CONDITION

9/15/2015

NBI Calibration 2015

Item 58 – Deck Condition

Definition and Purpose of a Deck

Component of a bridge to which the live load is directly applied that provides a smooth riding surface for traffic.

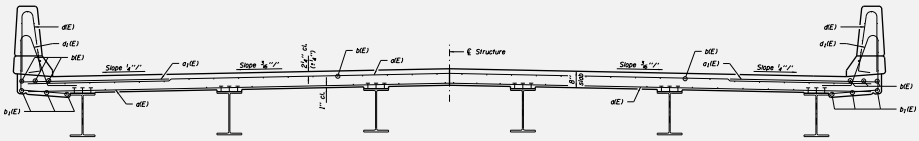
G-2

9/15/2015

Item 58 – Deck Condition

Concrete Slab on Stringers

- May be cast in place or precast
- Primary reinforcement typically perpendicular to stringers
- Typically 6 ½” - 9” thick

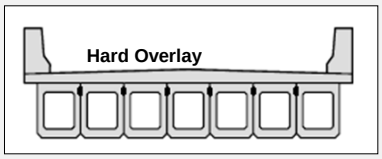


G-3

Item 58 – Deck Condition

- **PPC Deck Beam (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 (hard overlay)**
  - Deck beam with 4” (min.) reinforced concrete overlay
  - The overlay is rated as the Deck (item 58) and may be different than the rating for the Superstructure

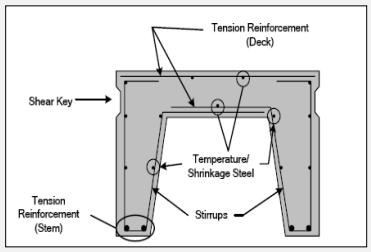


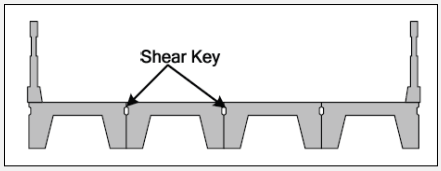
G-4

Item 58 – Deck Condition

Channel Beams

- Found on spans up to 50 feet
- Generally precast
- Mildly reinforced deck cast monolithically with two stems
- Conventionally reinforced or may be prestressed



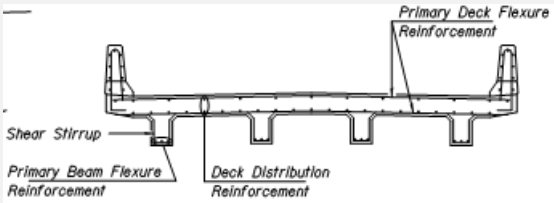


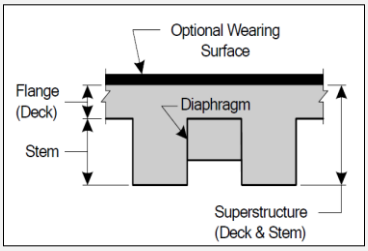
G-5

Item 58 – Deck Condition

T-Beams

- Predominant built during the 1930's - 1950's
- Generally cast-in-place monolithic concrete deck and stem system formed in the letter "T"





G-6

Item 58 – Deck Condition

Code	Description
N	Not Applicable

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

Item 58 – Deck Condition – Key Indicators

- Key Indicators
  - Cracks
  - Scaling
  - Spalls/Delams
  - Section Loss
- Note differences between ratings
- Review all descriptions before deciding on a rating

Code	Description
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, 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, some longitudinal cracks < 0.06" in the 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.

Item 58 – Deck Condition – Key Indicators

- Key Indicators
  - Cracks
  - Scaling
  - Spalls/Delams
  - Section Loss
- Decks should be inspected from both the top and the bottom

Code	Description
4	POOR. Longitudinal cracks over majority of deck and soffit, 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-9

9/15/2015

Item 58 – Deck Condition

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

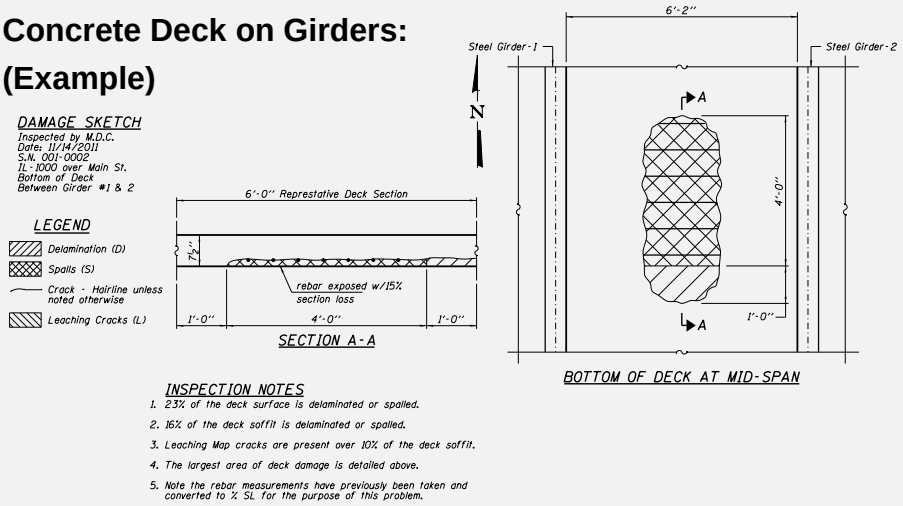
- A 6' bay length is a 6' wide section of deck oriented transversely to the direction of the primary reinforcement.
- The section loss in the reinforcement is measured as the % section loss over the full 6' width of the section, not the loss in individual bars.

G-10

9/15/2015

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)



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-11

9/15/2015

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

<u>Calculate the Concrete Damage to the Deck Surface</u>:

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

<u>Calculate the Concrete Damage to the Deck Soffit</u>:

- 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-12

9/15/2015

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 that a wheel load would be roughly distributed over on the deck or slab.

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.

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

- %SL = [(original area – current area) / original area] x 100%
- %SL = {[(6'x100%) – (5'x85% + 1'x100%)] / (6'x100%)} x100
  = [(600 – 525) / 600] x 100
  = 12.5% steel SL for the rebar over the 6' width
- Section Loss 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-15

9/15/2015

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 ≤ 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 ≤ 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 ≤ 30% in the primary reinforcement.

G-16

9/15/2015

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-17

9/15/2015

Item 58 – Deck Condition

New Deck

New Deck – Typically first inspection only

G-18

9/15/2015

Item 58 – Deck Condition

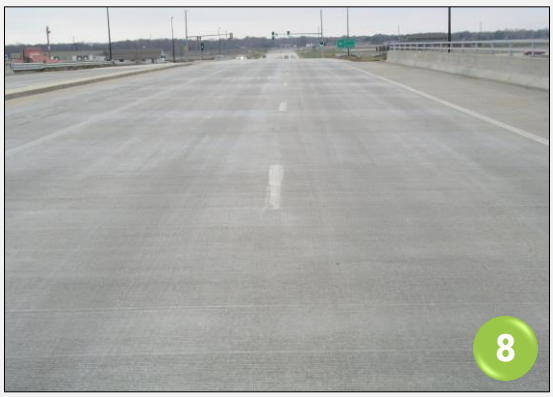
New Deck

New Deck – Typically first inspection only

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.

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

9/15/2015

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

9/15/2015

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

9/15/2015

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

9/15/2015

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, 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

9/15/2015

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, 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

9/15/2015

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, some longitudinal cracks < 0.06" in the 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

9/15/2015

Item 58 – Deck Condition

Fair Condition

- Transverse and longitudinal cracks < 0.06" present
- Minor spalls, delamination, and map cracking present on 20% of deck soffit
- 8% of deck soffit is spalled & delaminated
- 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, some longitudinal cracks < 0.06" in the 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

9/15/2015

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 2' intervals. 0.05" longitudinal cracks present with leaching

G-29

9/15/2015

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 over majority of deck and soffit, 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

9/15/2015

Item 58 – Deck Condition

Poor Condition

- Spalls, delamination, and longitudinal cracks present on 28% of the deck surface
- 20% loss of primary reinforcement in the outside bay

POOR. Longitudinal cracks over majority of deck and soffit, 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

9/15/2015

Item 58 – Deck Condition

Poor Condition

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

POOR. Longitudinal cracks over majority of deck and soffit, 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

9/15/2015

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

9/15/2015

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

9/15/2015

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

9/15/2015

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

9/15/2015

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

9/15/2015

DISCUSSION

G-38

9/15/2015

PPC DECK BEAMS

9/15/2015

NBI Calibration 2015

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

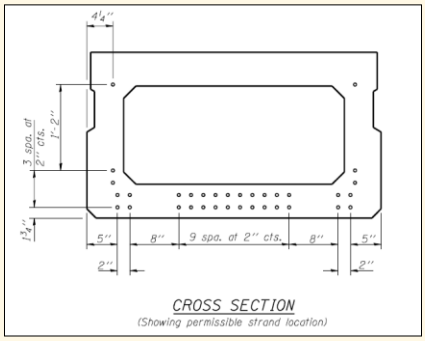
KD-2

9/15/2015

Item 59 - PPC Deck Beams

Precast Prestressed Concrete Deck Beams

- Introduced in the 1950's
- Advantages over non-prestressed reinforced concrete superstructures:
  - Eliminates need to form, pour, and cure a deck
  - Shallow structural depth
  - Rapid construction



KD-3

Item 59 - PPC Deck Beams

"Soft" Overlay

- Deck (Item 58) and Superstructure (Item 59) are rated and coded the same
- Generally consist of bituminous or oil & chip overlays
- Longitudinal Cracks in the overlay usually indicate failed shear keys

KD-4

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

9/15/2015

Item 59 - PPC Deck Beams

Sounding

- Hammer sounding is used to detect delaminated areas
- Delaminated areas will have a distinctive "hollow or clacking" sound when struck
- Sound concrete will result in a solid "pinging" sound
- Remove loose & delaminated concrete

KD-6

9/15/2015

Item 59 - PPC Deck Beams

General Notes:

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

KD-7

9/15/2015

Item 59 - PPC Deck Beams

General Notes:

Prestressing strands adjacent to longitudinal cracks shall be interpreted as being exposed.

The dimensions stated on the following pages relate to the width of the cross section of the beams. The "end quarters of span" do not include the beam ends (up to 3').

KD-8

9/15/2015

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands
- Failed Keyway

Code	Description
8	VERY GOOD. No notable problems.
7	GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. Minor cracking may be present in keyways, but no leakage occurring through them, and no differential movement occurring between deck beams.
6	SATISFACTORY. Center half of span: No beams with prestressing strands, stirrup reinforcement or wire mesh bars exposed, no longitudinal 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 ½" cover), keyway cracking may be evident with minor leakage, but beams are still fully acting together.

KD-9

9/15/2015

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands
- Failed Keyway

Code	Description
5	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 ½" cover), keyway cracking with extensive leakage and evidence that beams are beginning to act independently of each other.

KD-10

9/15/2015

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands
- Failed Keyway

Code	Description
4	POOR. Center half of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than ⅓ 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 ½ 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 ½" cover), keyway has failed with groups of beams acting independently of others.

KD-11

9/15/2015

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands
- Failed Keyway

Code	Description
3	SERIOUS. Center half of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more that ½ 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 ⅔ 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-12

9/15/2015

Item 59 - PPC Deck Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands
- Failed Keyway

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

9/15/2015

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 deck beams meets the condition state requirements for a "4" or below, 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.**

KD-14

9/15/2015

Item 59 - PPC Deck Beams

New Construction

- **No deficiencies**

New Deck Beam – Typically first inspection only

KD-15

9/15/2015

Item 59 - PPC Deck Beams

Very Good Condition

- **No Deficiencies**
- **Not new construction**

VERY GOOD. No notable problems.

KD-16

9/15/2015

Item 59 - PPC Deck Beams

- 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. Minor cracking may be present in keyways, but no leakage occurring through them, and no differential movement occurring between deck beams.

KD-17

9/15/2015

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. Minor cracking may be present in keyways, but no leakage occurring through them, and no differential movement occurring between deck beams.

KD-18

Item 59 - PPC Deck Beams

Satisfactory Condition

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

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 ½" cover), keyway cracking may be evident with minor leakage, but beams are still fully acting together.

KD-19

9/15/2015

Item 59 - PPC Deck Beams

Satisfactory Condition

- Minor keyway leakage
- Beams still acting together
- Inadequate concrete cover has exposed mesh on one beam
- Verify that 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 ½" cover), keyway cracking may be evident with minor leakage, but beams are still fully acting together.

KD-20

9/15/2015

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 ½" cover), keyway cracking with extensive leakage and evidence that beams are beginning to act independently of each other.

KD-21

9/15/2015

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 ½" cover), keyway cracking with extensive leakage and evidence that beams are beginning to act independently of each other.

KD-22

9/15/2015

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 ⅓ 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 ½ 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 ½” cover), keyway has failed with groups of beams acting independently of others.

KD-23

9/15/2015

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 ⅓ 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 ½ 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 ½” cover), keyway has failed with groups of beams acting independently of others.

KD-24

9/15/2015

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 that ½ 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 ⅔ 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

9/15/2015

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 that ½ 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 ⅔ 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

9/15/2015

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

9/15/2015

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

9/15/2015

Discussion

KD-30

9/15/2015

PPC I-BEAMS

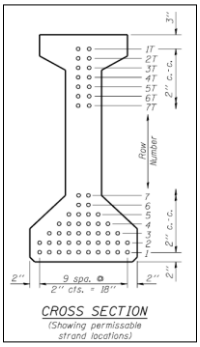
9/15/2015

NBI Calibration 2015

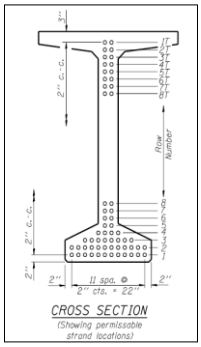
Item 59 – PPC I-Beams

Prestressed Concrete I-Beam

- Used since the 1950's
- "I" or "Bulb T" shape
- High Strength Concrete
- New sections introduced by IDOT in March 2015



PPC I-Beam



PPC Bulb-T

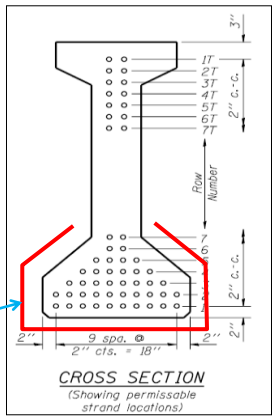
KI-2

9/15/2015

Item 59 – PPC I-Beams

Prestressed Concrete I-Beam

- **Discuss the "PERIMETER" of the beam used to define the beam condition state**
- **Bottom flange length enclosing the bottom prestressing strands**



Perimeter

Item 59 – PPC I-Beams

Sounding

- **Hammer sounding is used to detect delaminated areas**
- **Delaminated areas will have a distinctive "hollow or clacking" sound when struck**
- **Sound concrete will result in a solid "pinging" sound**

Item 59 – PPC I-Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands

Code	Description
8	VERY GOOD. No notable problems.
7	GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. Minor shrinkage or release cracks may be present. Minor map cracking at drains with sound concrete.
6	SATISFACTORY. Center half of span: No beams with prestressing strands, stirrup reinforcement exposed. End quarters of span: No more than 2 strands or 3" of stirrup reinforcement bars exposed in the bottom of any beam. Beam ends (up to 3'): Prestressed strands or stirrup reinforcement bars exposed up to ½ the perimeter of the bottom flange of any beam. Larger width of stirrups may be exposed due to inadequate concrete cover occurring during manufacturing (up to ½ cover). Webs may be spalled with exposed stirrups and only surface rust.

KI-5

9/15/2015

Item 59 – PPC I-Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands

Code	Description
5	FAIR. Center half of span: Prestressed strands or stirrup reinforcement bars exposed for no more than 1/4 the perimeter of the bottom flange of any beam. End quarters of span: Prestressed strands or stirrup reinforcement bars exposed for no more than 1/3 the perimeter of the bottom flange of any beam. Beam ends (up to 3'): Prestressed strands or stirrup reinforcement bars exposed from ½ to full perimeter of the bottom flange of any beam. Larger areas of stirrup may be exposed due to inadequate concrete cover that occurs during manufacturing (up to ½ cover). Webs may be spalled with exposed stirrups minor section loss.

KI-6

9/15/2015

Item 59 – PPC I-Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands

Code	Description
4	POOR. Center half of span: Prestressed strands or stirrup reinforcement bars exposed for no more than 2/3 the perimeter of the bottom flange of any beam. End quarters of span: Prestressed strands or stirrup reinforcement bars exposed up to full perimeter of the bottom flange of any beam. No strands are exposed inside the exterior perimeter of strands. Beam ends (up to 3'): Prestressed strands or stirrup reinforcement bars exposed full perimeter of the bottom flange of any beam with some strands exposed inside the exterior perimeter of strands. Webs are spalled with exposed stirrups with up to 30% section loss at ends of beams.

KI-7

9/15/2015

Item 59 – PPC I-Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands

Code	Description
3	SERIOUS. Center half of span: Prestressed strands or stirrup reinforcement bars exposed up to full perimeter of the bottom flange of any beam. No strands are exposed inside the exterior perimeter of strands. End quarters of span: Prestressing strands, stirrup reinforcement bars exposed for the full perimeter of the bottom flange of any beam with some strands exposed inside the exterior perimeter of strands. Hairline transverse cracks in bottom of beams or hairline vertical/diagonal shear cracks in beam webs may be developing.

KI-8

9/15/2015

Item 59 – PPC I-Beams

Key Indicators

- Cracks
- Exposed Reinforcement
- Exposed Strands

Code	Description
2	CRITICAL. Similar to but more serious and extensive than what is described for a condition rating of "3". Structural elements that are judged to be in critical condition must receive special inspections in order for the structure to remain open to traffic. Measurable shear or transverse cracks. The Bureau of Bridges and Structures shall be notified immediately.

KI-9

9/15/2015

Item 59 – PPC I-Beams

New Construction

- No defects
- First inspection

New PPC I-Beam – Typically first inspection only

KI-10

9/15/2015

Item 59 – PPC I-Beams

Very Good

- No deficiencies
- Second inspection

VERY GOOD. No notable problems.

KI-11

9/15/2015

Item 59 – PPC I-Beams

Good

Minor shrinkage cracks present in beams

GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. Minor shrinkage or release cracks may be present. Minor map cracking at drains with sound concrete.

KI-12

9/15/2015

Item 59 – PPC I-Beams

Satisfactory

Three strands exposed at the end of the beam

SATISFACTORY. Center half of span: No beams with prestressing strands, stirrup reinforcement exposed. End quarters of span: No more than 2 strands or 3" of stirrup reinforcement bars exposed in the bottom of any beam. Beam ends (up to 3'): Prestressed strands or stirrup reinforcement bars exposed up to ½ the perimeter of the bottom flange of any beam. Larger width of stirrups may be exposed due to inadequate concrete cover occurring during manufacturing (up to ½ cover). Webs may be spalled with exposed stirrups and only surface rust.

KI-13

9/15/2015

Item 59 – PPC I-Beams

Fair

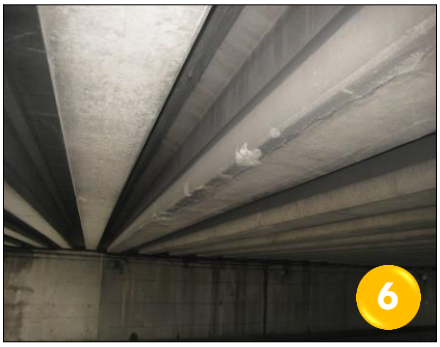
Reinforcement bars exposed for less than 30% of perimeter of bottom flange in end quarter of span

FAIR. Center half of span: Prestressed strands or stirrup reinforcement bars exposed for no more than 1/4 the perimeter of the bottom flange of any beam. End quarters of span: Prestressed strands or stirrup reinforcement bars exposed for no more than 1/3 the perimeter of the bottom flange of any beam. Beam ends (up to 3'): Prestressed strands or stirrup reinforcement bars exposed from ½ to full perimeter of the bottom flange of any beam. Larger areas of stirrup may be exposed due to inadequate concrete cover that occurs during manufacturing (up to ½ cover). Webs may be spalled with exposed stirrups minor section loss.

KI-15

9/15/2015

Item 59 – PPC I-Beams



No beams with reinforcement exposed at center span

Spall with 4 exposed strands in the end quarter

KI-16

9/15/2015

Item 59 – PPC I-Beams

Poor

Reinforcement bars exposed for more than 55% of perimeter of bottom flange

POOR. Center half of span: Prestressed strands or stirrup reinforcement bars exposed for no more than 2/3 the perimeter of the bottom flange of any beam. End quarters of span: Prestressed strands or stirrup reinforcement bars exposed up to full perimeter of the bottom flange of any beam. No strands are exposed inside the exterior perimeter of strands. Beam ends (up to 3'): Prestressed strands or stirrup reinforcement bars exposed full perimeter of the bottom flange of any beam with some strands exposed inside the exterior perimeter of strands. Webs are spalled with exposed stirrups with up to 30% section loss at ends of beams.

KI-17

9/15/2015

Item 59 – PPC I-Beams

Serious

Strands exposed for full perimeter of bottom flange in center half of span

SERIOUS. Center half of span: Prestressed strands or stirrup reinforcement bars exposed up to full perimeter of the bottom flange of any beam. No strands are exposed inside the exterior perimeter of strands. End quarters of span: Prestressing strands, stirrup reinforcement bars exposed for the full perimeter of the bottom flange of any beam with some strands exposed inside the exterior perimeter of strands. Hairline transverse cracks in bottom of beams or hairline vertical/diagonal shear cracks in beam webs may be developing

KI-18

9/15/2015

Item 59 – PPC I-Beams

Critical

- Exterior beam has failed
- Strands exposed for full perimeter of bottom flange at center span

CRITICAL. Similar to but more serious and extensive than what is described for a condition rating of "3". Structural elements that are judged to be in critical condition must receive special inspections in order for the structure to remain open to traffic. Measurable shear or transverse cracks.

KI-19

9/15/2015

Discussion

CULVERTS

9/15/2015

NBI Calibration 2015

Item 62 - Culverts

- Types of Culverts
- Related Inventory Items
- Requirements for Concrete Coring
- Condition Ratings

N-2

9/15/2015

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

N-3

9/15/2015

Item 62 - Culverts

Related Inventory Items

- Guardrail over Culverts
  - Not Bridge Railing (Item 36A)
  - Items 36E/F – Guardrails on Structure Type (Right/Left)
  - Usually coded “1” for Steel Plate Beam Guardrail
- Structure Length (Item 48)
  - Measured along centerline of roadway, not at right angle to culvert
  - Length along roadway is equal to the right-angle dimension divided by the cosine of the skew angle.

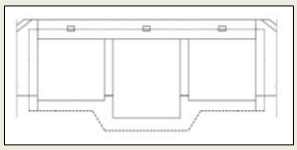
N-4

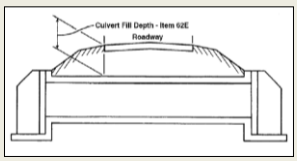
9/15/2015

Item 62 - Culverts

Related Inventory Items

- Item 62A – Culvert Cells (Count)
- Item 62B – Culvert Cell Width (Ft.)
  - Horizontal width, measured at right angle to culvert, of individual cells or openings in the culvert
- Item 62C – Culvert Cell Height
  - Vertical height of individual cells or openings in the culvert
  - If more than one height exist, record the predominate height
- Item 62D – Culvert Opening Area
  - Total cross section area of all cells of the culvert
  - Areas of dissimilar individual cells, report the true calculated square footage of opening.
  - Measurement does not have to agree with the calculation made from values reported in Items 62B and 62C
  - Variable opening dimensions should be recorded in Item 8A1 – Bridge Remarks (General)
- Item 62E – Culvert Fill Depth
  - The depth of fill (earth and pavement thickness) measured from the top of the culvert structure to the top of the pavement surface





N-5

9/15/2015

Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Spalls/Delams
- Section Loss

Code	Description
N	NOT APPLICABLE. Use when structure is not a culvert.
9	EXCELLENT. 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. Non structural cracks at > 10' spacing, 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.

N-6

9/15/2015

Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Spalls/Delams
- Section Loss

Code	Description
6	SATISFACTORY. Non-structural cracking with some leaching at >5' spacing over the majority of the top slab, spalls and delaminations may be present on up to 5% of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 10% 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, isolated structural cracks < 0.03" in walls or slabs, spalls and delaminations on the bottom concrete slabs with up to 10% loss of primary reinforcement over a 6' width, spalls on concrete walls with up to 10% loss of concrete or reinforcement area, up to 10% of the top surface area of the top slab may be spalled and delaminated, metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting, up to 10% average section loss, up to ½ the wall thickness in one section, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

N-7

9/15/2015

Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Spalls/Delams
- Section Loss

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%, up to 25% of compression surface area spalled or delaminated on slabs and walls(tension areas may be totally spalled), metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout up to 30% section loss on average, 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.

N-8

9/15/2015

Item 62 - Culverts

Key Indicators

- Cracks
- Scaling
- Spalls/Delams
- Section Loss

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.

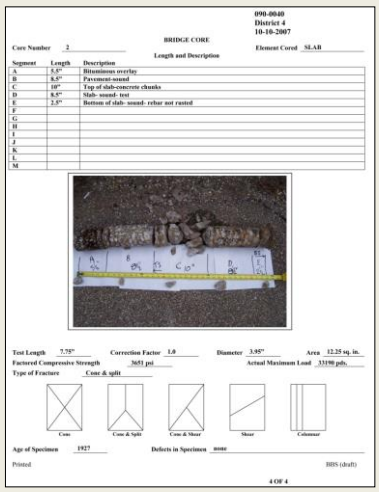
N-9

9/15/2015

Item 62 - Culverts

Requirements for Concrete Coring

- IDOT BLRS-CL 2008-16: Inspection and Coring of Reinforced Concrete Structures
- Concrete cores may be required for Reinforced Concrete Box Culverts having Culvert (Item 62) condition ratings of "4" or less.
- The cores are needed in order to make an accurate determination of remaining load-carrying capacity.



090-0040
District 4
10-10-2007

BRIDGE CORE

Core Number 2 Element Cored SLAB

Length and Description

Segment	Length	Description
A	5.5"	Bituminous overlay
B	8.5"	Pavement-sound
C	10"	Top of slab-concrete chunks
D	8.5"	Slab- sound- test
E	2.5"	Bottom of slab- sound- rebar not rusted
F		
G		
H		
I		
J		
K		
L		
M		

Test Length 7.75" Correction Factor 1.0 Diameter 3.95" Area 12.25 sq. in.
Factored Compressive Strength 3651 psi Actual Maximum Load 33590 pds.
Type of Fracture Cone & split

Cone | Cone & Split | Cone & Shear | Shear | Columnar

Age of Specimen 1927 Defects in Specimen none

Printed BBS (draft)

4 OF 4

N-10

9/15/2015

Item 62 - Culverts

New Construction

No Deficiencies

EXCELLENT. No deficiencies – Typically first inspection only

N-11

9/15/2015

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.

N-12

9/15/2015

Item 62 - Culverts

Good Condition

- Minor scaling
- Insignificant spalling
- No exposed reinforcement

GOOD. Non structural cracks at > 10' spacing, 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.

N-13

9/15/2015

Item 62 - Culverts

Good Condition

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

GOOD. Non structural cracks at > 10' spacing, 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.

N-14

9/15/2015

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. Non-structural cracking with some leaching at >5' spacing over the majority of the top slab, spalls and delaminations may be present on up to 5% of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 10% 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

N-15

9/15/2015

Item 62 - Culverts

Satisfactory Condition

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

SATISFACTORY. Non-structural cracking with some leaching at >5' spacing over the majority of the top slab, spalls and delaminations may be present on up to 5% of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 10% 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

N-16

9/15/2015

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, isolated structural cracks < 0.03" in walls or slabs, spalls and delaminations on the bottom concrete slabs with up to 10% loss of primary reinforcement over a 6' width, spalls on concrete walls with up to 10% loss of concrete or reinforcement area, up to 10% of the top surface area of the top slab may be spalled and delaminated, metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting, up to 10% average section loss, up to ½ the wall thickness in one section, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

N-17

9/15/2015

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, isolated structural cracks < 0.03" in walls or slabs, spalls and delaminations on the bottom concrete slabs with up to 10% loss of primary reinforcement over a 6' width, spalls on concrete walls with up to 10% loss of concrete or reinforcement area, up to 10% of the top surface area of the top slab may be spalled and delaminated, metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting, up to 10% average section loss, up to ½ the wall thickness in one section, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

N-18

9/15/2015

Item 62 - Culverts

Fair Condition

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

FAIR. Non-structural cracking with leaching at < 5' intervals over the majority of the slab or wall surfaces, isolated structural cracks < 0.03" in walls or slabs, spalls and delaminations on the bottom concrete slabs with up to 10% loss of primary reinforcement over a 6' width, spalls on concrete walls with up to 10% loss of concrete or reinforcement area, up to 10% of the top surface area of the top slab may be spalled and delaminated, metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting, up to 10% average section loss, up to ½ the wall thickness in one section, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.

N-19

9/15/2015

Item 62 - Culverts

Poor Condition

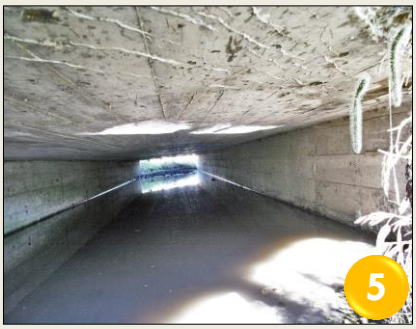
- Leaching map cracks present in top slab
- Cracks up to 0.06" in top slab
- Leaching vertical cracks in walls up to 0.125"
- Concrete cores may be needed

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%, up to 25% of compression surface area spalled or delaminated on slabs and walls(tension areas may be totally spalled), metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout up to 30% section loss on average, considerable settlement or misalignment, considerable scour or erosion at curtain walls, wingwalls or pipes with undermining.

N-20

9/15/2015

Item 62 - Culverts



Isolated structural cracks less than 0.03" in walls or slabs.

Spalls and delaminations on the bottom concrete slabs.

Structural cracks up to 0.06" in top slab.

Structural cracks up to 0.125" in walls.

N-21

9/15/2015

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.

N-22

9/15/2015

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.

N-23

9/15/2015

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.

N-24

9/15/2015

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 inspection will be required to keep the structure open with possible load restrictions. The Bureau of Bridges and Structures shall be notified immediately.

N-25

9/15/2015

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 inspection will be required to keep the structure open with possible load restrictions. The Bureau of Bridges and Structures shall be notified immediately.

N-26

9/15/2015

REVIEW

Discussion