INTRODUCTION AND PURPOSE OF THE COURSE

Introduction

- **Class Instructor:** Mike Cima
- **Background:**
  - Over 29 years of bridge related structure experience
  - 17+ with IDOT BB&S, now with Quigg Engineering
  - Past experience includes bridge inspection, planning, design and policy development
  - Inspection background includes most types of structures, large and small
  - Licensed PE and SE in Illinois
**Introduction**

**Focus of the Class**

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

---

**DAY 1:**

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

**DAY 2:**

- Local Agency
- Inventory Data
- Steel Superstructures
- Fatigue, Fracture & Gusset Plates
- Reinforced Concrete Super
- Access Methods, Test Equip.
- Bearings
- Substructures
- Waterway Adequacy
- Scour & Channel Conditions
Introduction

Course Objectives:

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

Introduction

Why Do We Inspect Bridges?

- To ensure public safety
- Inspection of highway bridges is mandated by the NBIS.
- Inspection data serves as a programming tool to allocate resources. The Sufficiency Rating, is calculated using inspection & inventory data.
- Deficiencies noted during inspections identify maintenance needs for owners.
Introduction

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

Hypothetical Example of Condition Ratings Reported by “Un-Calibrated” Inspectors

Without calibration training, interpretation of rating criteria and policies can vary
Inspectors may be unaware of new or revised policies
Some inspectors may not be following policy
Introduction

Typical Example of Reported Condition Ratings

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

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

Example of Condition Ratings Reported by Calibrated Inspectors

The desired result of calibrating inspectors is less variability in data.

Some variation will exist, but almost all Condition Ratings will be within “1” rating category of the “correct” rating.
Introduction

How do we achieve consistent ratings between inspectors?

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

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

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


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

---

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Commonly Employed Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION</td>
<td>• Little concern from a safety perspective</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Preventive Maintenance (painting, washing, clean deck drains, concrete sealers, joint repairs, etc...)</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION</td>
<td>• May be possible to “save” elements at this stage of deterioration with maint. or repair</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION</td>
<td>• Preventive Maintenance and/or Repairs (concrete/steel, replace joints, etc...)</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION</td>
<td>Safety concerns &amp; Load Rating Inspections</td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS CONDITION</td>
<td>• Traffic disruptions due to load postings and/or detours possible</td>
</tr>
<tr>
<td>2</td>
<td>CRITICAL CONDITION</td>
<td>• Rehabilitation (deck replacement, super replacement and major repairs) or Complete Replacement</td>
</tr>
<tr>
<td>1</td>
<td>IMMENENT FAILURE CONDITION</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>FAILED CONDITION</td>
<td></td>
</tr>
</tbody>
</table>

Introduction

References:

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

DISCUSSION
General Policies and Requirements

- Illinois Bridge Inventory
- NBIS Requirements
- NBIS Metrics
- NBIS Program Managers for Local Agencies
- Inspection Due Dates
- Critical Findings
- Bridge Files
- Quality Control & Quality Assurance
IL Bridge Inventory - 2018:

- Total Bridges = 26,782
  - State = 7,801
  - Local = 18,981
- Average Age
  - State = 43 yrs.
  - Local = 40 yrs.
- Load Posted
  - State = 107
  - Local = 826
- Fracture Critical
  - State = 182
  - Local = 353
- Structurally Deficient
  - State = 690
  - Local = 1,649

NBIS Requirements

- AASHTO “Manual for Bridge Evaluation” (MBE) incorporated into the NBIS effective in 2009
- Latest Edition – April 2017
- IDOT incorporates these requirements into their policies
General Policies and Requirements

**NBIS Metrics: (FHWA)**
- FHWA developed 23 metrics to measure compliance with the NBIS
  - Intended to provide consistent oversight nationwide
  - Not new requirements, just a way of measuring compliance
  - FHWA scrutinizes IDOT (and locals) to ensure compliance
  - Possible basis for sanctions for non-compliance
  - Sanctions could involve withholding Federal Funds
- *IDOT responds with plans of action to the FHWA to fix all non-compliant items following each yearly review*
- GREAT improvements have been made by IL in compliance since the start of this program.

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 should sign off on NBIS Inspection Reports prior to submittal to IDOT*
- Inspections must be led by IDOT approved Team Leaders
General Policies and Requirements

Inspection Due Dates

- Inspections should be completed prior to or on the due date calendar month based on the last date of inspection.
- Inspections completed in or before the designated month will be considered completed on time by IDOT and FHWA.
- On very rare occasion you may be unable to inspect a structure on time due to conditions beyond your control. In this case a memorandum must be placed in the Bridge File indicating the date and reason why completing the inspection on time was not possible.
- As of 2018 IL inspection delinquencies were at 2.6%
- IDOT Bridge Inspection Tracking Date website: https://apps.dot.illinois.gov/InspectionDateNotification/

Critical Findings:

- Per the NBIS, a Critical Finding is a structural or safety related deficiency that may pose an imminent threat to the safety of the traveling public.
- The following findings 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
General Policies and Requirements

Critical Finding Process:

1. On identifying an initial or more severe than previously reported Critical Finding – immediately secure the bridge as necessary to protect the public (TL)

2. If the damage seriously reduces the structure's load capacity then isolate the defect from traffic by closing lanes or the entire structure if necessary (TL)

3. Report Critical Finding:
   - State Bridge – report immediately to the District/Area Program Manager who immediately forwards it to the State Program Manager (TL/PM)
   - Local Bridge - report immediately to the Local Program Manager who immediately forwards it to the IDOT Local Program Manager (TL/PM)
   - Provide sufficient, detailed information to allow the Bureau of Bridges & Structures to make an initial determination of the severity of the finding (TL/PM)

4. If BB&S determines the deficiency 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 (PM)

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 updated and maintained for each bridge and stored with the Bridge File
- It is not necessary to physically store all required items in the file, but the location of each must be referenced on the Checklist
General Policies and Requirements

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

Quality Control: (Section 3.9.3 Structural Services Manual)
- Bridge Inspection Refresher Training
  - All PMs & TLs must receive refresher training every 60 months
  - IDOT Bridge Inspection Calibration Course – 1.5 days
  - FHWA-NHI-130053 Bridge Inspection Refresher Training – 3 days
  - May take either course to meet refresher training requirement (July 2017)
- Review of Bridge Inspectors, Reports & Procedures
  - Every 24 months PMs must accompany their TLs on 3 inspections to observe and verify their performance is satisfactory
  - A PM who performs NBIS inspections must be field verified by another PM.
  - Document results on Form BBS 2790.
General Policies and Requirements

Quality Assurance:

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

General Policies and Requirements

General Requirements

- Non-IDOT Agencies responsible for a bridge on their right-of-way must report the bridge as part of the NBI (and inspect in accordance with NBIS) even if it carries traffic onto private roadways or entrances. Must report results to IDOT and be entered into ISIS within 90 days of inspection.
- Closed bridges that are still linked to a roadway must be inspected to verify proper closure.
- Closed bridges over roadways or navigable waterways must be inspected to verify proper closure and ensure safety of traffic beneath.
- Bridges closed for construction or under staged construction must be inspected prior to the due date of the required inspection.
- Detailed inspection requirements are defined in Section 3 of the IDOT Structural Services Manual.
Types of Inspections and Forms

- Types of Inspections
- Inspection Intervals
- Inspection Forms
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

Initial Inspection:

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

Routine Inspection:

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

Routine Inspection: (In-Depth Procedures)

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

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

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

Channel Cross Section Requirements:

Example Channel Sketch

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
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
- See Example in Struct. Services Manual

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

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

Damage Inspection:

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

Load Rating Inspection:

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

Complex Inspection:

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

Element Level Inspection:

- Required on all IDOT maintained and National Highway System (NHS) structures (includes Tollway) per federal law enacted by Congress
- Each element is rated for severity and extent of deterioration and a % of that element is assigned to a specific condition state. This data is used to develop the Statewide Bridge Management System.
- AASHTO Manual For Bridge Element Inspection, 2nd Ed, 2013
- Current guidance has 4 rather than 5 condition states like the original
- IDOT placed current State Manual online 2/2014. IDOT version contains more “rated elements” than the FHWA version (“8000” series elements).
- Future: may see more element level inspections? (FHWA preference)
- Form – IDOT spreadsheet
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

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
Discussion
Item 72 – Approach Roadway Alignment

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>No reduction in the operating speed</td>
<td>Code as an “8”</td>
</tr>
<tr>
<td>Minor reduction in operating speed</td>
<td>≤ 9 mph (Code “7 - 4”)</td>
</tr>
<tr>
<td>Substantial reduction in operating speed</td>
<td>≥ 10 mph (Code “3 - 1”)</td>
</tr>
</tbody>
</table>

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.
Item 72 – Approach Roadway Alignment

- **Urban Setting**
  Approaches consistent with bridge geometry - No reduction in speed at bridge – “8”

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

---

Item 72 – Approach Roadway Alignment

Vertical Alignment – Relatively flat

Horizontal Alignment - Straight

No reduction in operating speed
Item 72 – Approach Roadway Alignment

Vertical Alignment – Relatively flat with minor curve on approach

Horizontal Alignment - Straight

Minor reduction in operating speed

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
Item 72 – Approach Roadway Alignment

Vertical Alignment

Horizontal Alignment

Minor reduction in operating speed

Item 72 – Approach Roadway Alignment

Vertical Alignment – 2% Grade

Horizontal Alignment – 50 mph Design Curve; 55 mph Operating Speed
Item 72 – Approach Roadway Alignment

Vertical Alignment - Slight drop at the end of the bridge

Horizontal Alignment – Straight

Significant reduction in operating speed
Item 72 – Approach Roadway Alignment

Vertical Alignment - Slight drop at the end of the bridge
Horizontal Alignment – Straight

Vertical Alignment – Some break at approaches
Horizontal Alignment – Sharp turn at bridge end – 15 mph
Substantial reduction in operating speed, intolerable
Item 72 – Approach Roadway Alignment

Vertical Alignment
- Sharp vertical gradient change; poor sight distance

Substantial reduction in operating speed, intolerable

Discussion
WEARING SURFACE, PROTECTIVE SYSTEMS, AND TOTAL DECK THICKNESS

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
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

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): original deck thickness + wearing surface thickness
- Total deck thickness is key to determining superstructure rating and permit capacities
- LL Capacity = Total Capacity – DL Capacity
- If this value has increased since the last inspection and the structure has not been load rated since the increase, contact the Bureau of Bridges and Structures
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)
### Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Additional Concrete Overlay - not a special mix</td>
</tr>
</tbody>
</table>

![Image of additional concrete overlay](image1)

---

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Latex Modified Concrete Overlay</td>
</tr>
</tbody>
</table>

![Image of latex modified concrete overlay](image2)
## Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Plasticized Dense Concrete Overlay</td>
</tr>
</tbody>
</table>

![Plasticized Dense Concrete Overlay](image)

## Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Micro Silica Concrete Overlay</td>
</tr>
</tbody>
</table>

![Micro Silica Concrete Overlay](image)
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Bituminous Overlay</td>
</tr>
</tbody>
</table>

Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Asbestos Asphalt Overlay</td>
</tr>
</tbody>
</table>
### Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>Timber or Timber Runners</td>
</tr>
</tbody>
</table>

#### Code: J
![Timber or Timber Runners](image1.png)

### Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Gravel - Macadam / Oil &amp; Chip</td>
</tr>
</tbody>
</table>

#### Code: K
![Gravel - Macadam / Oil & Chip](image2.png)
## Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Epoxy Overlay</td>
</tr>
</tbody>
</table>

![Image of Epoxy Overlay](image1)

## Item 108 - Wearing Surface / Protective System

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Grating</td>
</tr>
</tbody>
</table>

![Image of Grating](image2)
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
</table>

**Exception** – When a CIP culvert top slab is “bare” or has only pavement (bituminous or concrete) on top then code items 108 A-C IAW what is present, not an “N”
### Item 108B - Type of Membrane

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

### Item 108C – Deck Protection

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Epoxy Coated Reinforcing</td>
</tr>
<tr>
<td>B</td>
<td>Galvanized Reinforcing</td>
</tr>
<tr>
<td>C</td>
<td>Other Coated Reinforcing</td>
</tr>
<tr>
<td>D</td>
<td>Cathodic Protection</td>
</tr>
<tr>
<td>F</td>
<td>Polymer Impregnated Concrete</td>
</tr>
<tr>
<td>G</td>
<td>Internally Sealed Concrete</td>
</tr>
<tr>
<td>H</td>
<td>Unknown</td>
</tr>
<tr>
<td>I</td>
<td>Other</td>
</tr>
<tr>
<td>J</td>
<td>None</td>
</tr>
<tr>
<td>N</td>
<td>Not Applicable (applies only to structures with no deck)</td>
</tr>
</tbody>
</table>
DISCUSSION
DECK CONDITION

Item 58 – Deck Condition

Deck

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

The condition evaluation should be primarily based on the condition of the bottom of the deck

The condition of the wearing surface, parapets / railings, median, sidewalks, drains, light standards and joints may be recorded on the inspection form, but their conditions should not be considered in the deck condition rating

On bridges where the deck is integral with the superstructure, the superstructure rating may be affected by the deck rating. However, the deck rating will not be affected by the superstructure rating except for slab & PPC deck beam bridges
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)**
  - 4" (min.) reinforced concrete overlay
  - The overlay is rated as the Deck (Item 58) and may have a different rating than the Superstructure

---

Item 58 – Deck Condition

**Channel Beams**

- Found on spans up to 50 feet
- Generally precast
- Mildly reinforced deck cast monolithically with two stems
- Top section of the beam is rated as the deck - do not include stem condition
**Item 58 – Deck Condition**

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

---

**Item 58 – Deck Condition**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

*Culverts and 3-Sided Precast Concrete & Steel Structures are coded “Not Applicable” for Deck*
### Item 58 – Deck Condition – Key Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>VERY GOOD. Transverse cracks &lt; 0.06&quot; at &gt; 15' intervals may be present but no spalling, scaling, pop-outs or delamination.</td>
</tr>
<tr>
<td>7</td>
<td>GOOD. Some transverse cracks &lt; 0.06&quot; at &gt; 5' intervals over the majority of the deck, light scaling (less than 1/4&quot; depth) or pop-outs may be present, no spalling.</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY. Transverse cracks &lt; 0.06&quot; at &lt; 5' or &gt; 0.06&quot; at &gt; 5' intervals over a majority of the deck, isolated longitudinal cracks, spalls and delaminations may be present on up to 5% of the deck riding surface or soffit area, up to 10% of the deck soffit may be spalled, delaminated, and map cracked.</td>
</tr>
<tr>
<td>5</td>
<td>FAIR. Transverse cracks &gt; 0.06” at &lt; 5’ intervals with or without leaching in the majority of the deck, longitudinal cracks &lt; 0.06” in majority of deck, spalls and delaminations may be present on up to 10% of the deck surface or soffit area, up to 25% of the deck surface or soffit may be spalled, delaminated and map cracked, up to 10% loss of primary reinforcement in any 6’ bay length.</td>
</tr>
</tbody>
</table>

**Key Indicators**
- Cracks
- Scaling
- Spalls/Delams
- Section Loss

**Decks must be inspected from both the top and bottom when possible**

**Note differences between ratings**

**Review all descriptions before deciding on a rating**
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.

Concrete Deck on Girders: (Example)

- DAMAGE SKETCH
- Exterior view showing damage.
- Inspection notes:
  1. 100% of the deck surface is deteriorated or spalled.
  2. 95% of the deck surface is deteriorated or spalled.
  3. Leaking into cracks are present over 40% of the deck surface.
  4. The largest area of deck damage is detailed above.
  5. Note the point measurements have previously been taken and converted to # SL for the purpose of this report.
Item 58 – Deck Condition

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

Calculate the Concrete Damage to the Deck Surface:
- The “Inspection Notes” on the sketch indicate 23% of the deck surface was delaminated or spalled.

Calculate the Concrete Damage to the Deck Soffit:
- The “Inspection Notes” on the sketch indicate 16% of the deck soffit was delaminated or spalled and 10% of the soffit has leaching map cracks, 16 + 10 = 26%

Item 58 – Deck Condition

Concrete Deck on Girders: (Example)

Calculate the Section Loss (SL) in the Rebar at Section A-A:
- The SL in the longitudinal (flexure) reinforcement is calculated for the primary rebars running longitudinally from beam to beam.
- For concrete deck and slab structures, a 6’ wide representative section will be analyzed. The section reviewed should be transverse to the direction of the primary reinforcement and at the most heavily damaged location, Section A-A in this case.
- The 6’ wide section represents the area a wheel load would be roughly distributed over on the deck or slab.
**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 = \[\frac{(\text{original area} – \text{current area})}{\text{original area}}\] x 100%

- %SL = \[\frac{[(6’x100%) – (5’x85% + 1’x100%)]}{(6’x100%)}\] x 100
  = \[\frac{(600 – 525)}{600}\] x 100
  = **12.5%** steel SL for the rebar over the 6’ width

- Deck Damage Summary for Example:
  - Concrete Damage to the Deck Surface = 23%
  - Concrete Damage to the Deck Soffit = 26%
  - Longitudinal Rebar SL over 6’ Section = 12.5%
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.

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.
**Item 58 – Deck Condition**

**New Deck**
No problems noted

**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.

**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.
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.

---

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.
Item 58 – Deck Condition

Satisfactory Condition

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

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

Item 58 – Deck Condition

Satisfactory Condition

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

Satisfactory. Transverse cracks < 0.06” at < 5’ or > 0.06” at > 5’ intervals over a majority of the deck, isolated longitudinal cracks, spalls and delaminations may be present on up to 5% of the deck riding surface or soffit area, up to 10% of the deck soffit may be spalled, delaminated, and map cracked.
Item 58 – Deck Condition

Fair Condition

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

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

Item 58 – Deck Condition

Fair Condition

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

**FAIR.** Transverse cracks > 0.06” at < 5’ intervals with or without leaching in the majority of the deck, longitudinal cracks < 0.06” in majority of deck, spalls and delaminations may be present on up to 10% of the deck surface or soffit area, up to 25% of the deck surface or soffit may be spalled, delaminated and map cracked, up to 10% loss of primary reinforcement in any 6’ bay length.
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 over 15% of the deck.

---

**Item 58 – Deck Condition**

**Poor Condition**

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

POOR. Longitudinal cracks > 0.06” in majority of deck, spalls and delaminations may be present on up to 25% of the deck surface or soffit area, up to 50% of the deck surface or soffit may be spalled, delaminated and map cracked, up to 30% loss of primary reinforcement in any 6’ bay length.
Item 58 – Deck Condition

Poor Condition

- Spalls, delamination, and map cracks present on 30% of the deck soffit
- 20% loss of primary reinforcement in the outside bay

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

Item 58 – Deck Condition

Poor Condition

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

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

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.
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.
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
PPC DECK BEAMS

Item 59 - PPC 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
Item 59 - PPC Deck Beams

Precast Prestressed Concrete Deck Beams

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

“Soft” Overlay

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

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

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

Repair patches are considered delaminated.

General Notes:

Prestressing strands adjacent to longitudinal cracks shall be considered exposed.

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

The “end quarters of span” do not include the beam ends (last 3’).
Item 59 - PPC Deck Beams

Key Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>VERY GOOD. No notable problems.</td>
</tr>
<tr>
<td>7</td>
<td>GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. <em>Moderate cracking and leakage</em> may be present in keyways, but no differential movement occurring between deck beams.</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY. Center half of span: No beams with prestressing strands, stirrup reinforcement or wire mesh bars exposed, no longitudinal cracking or spalling along the bottom of the beams. 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 wide spread leakage, but beams are still fully acting together.</td>
</tr>
</tbody>
</table>

Item 59 - PPC Deck Beams

Key Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAIR.</td>
<td>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.</td>
</tr>
</tbody>
</table>
## Item 59 - PPC Deck Beams

### Key Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
</table>
| **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 ⅓ 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 ⅓" cover), keyway has failed with groups of beams acting independently of others. |

### Key Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
</table>
| **SERIOUS.** | Center half of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than ⅓ 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 ⅓ 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 and unsound concrete above the bottom layer.  
Keyways have failed causing 3 or 4 beams to act independently from others. |
Item 59 - PPC Deck Beams

Key Indicators

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>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.</td>
</tr>
<tr>
<td>1</td>
<td>“IMMINENT” FAILURE. Superstructure in “imminent failure” condition requiring bridge closure or temporary measures to allow structure to remain open.</td>
</tr>
<tr>
<td>0</td>
<td>FAILED. Superstructure that has failed and is beyond repair, requiring bridge closure.</td>
</tr>
</tbody>
</table>

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

- If one or more beams meets the condition state requirements of a “4” or lower rating, this condition state should be applied to the superstructure as a whole
- The condition rating of “4” POOR CONDITION was selected as this is the level where loss of Structural Load Capacity generally begins to occur
- An initial rating of “4” or below will trigger a Load Rating Inspection by IDOT staff
**Item 59 - PPC Deck Beams**

**New Construction**

No deficiencies

New Deck Beam – Typically first inspection only

---

**Item 59 - PPC Deck Beams**

**Very Good Condition**

- No Deficiencies
- Not new construction

VERY GOOD. No notable problems.
Item 59 - PPC Deck Beams

**Good Condition**

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

GOOD. No beams with prestressing strands, stirrup reinforcement bars or wire mesh exposed. **Moderate cracking and leakage may be present in keyways, but no differential movement occurring between deck beams.**
Item 59 - PPC Deck Beams

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

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

Item 59 - PPC Deck Beams

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

SATISFACTORY. Center half of span: No beams with prestressing strands, stirrup reinforcement or wire mesh bars exposed, no longitudinal cracking reinforcement or wire mesh bars exposed, no longitudinal cracking or spalling along the bottom of the beams. End quarters of span: No more than 2 strands or 3” of stirrup reinforcement bars or 3” of wire mesh exposed in the bottom of any beam. Larger widths of wire mesh may be exposed due to inadequate concrete cover occurring during manufacturing (up to 1/4” cover), keyway cracking may be evident with wide spread leakage, but beams are still fully acting together.
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.

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.
**Item 59 - PPC Deck Beams**

**Poor Condition**

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

POOR. Center half of span: Prestressed strands, stirrup reinforcement bars or wire mesh exposed for no more than 1/3 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. 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 ¼” cover), keyway has failed with groups of beams acting independently of others.
Item 59 - PPC Deck Beams

Serious Condition

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

SERIOUS. Center half of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than 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 ½ 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.

Item 59 - PPC Deck Beams

Serious Condition

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

SERIOUS. Center half of span: Prestressing strands, stirrup reinforcement bars or wire mesh exposed for no more than 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 ½ 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.
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.

Item 59 - PPC Deck Beams

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

Discussion
Item 59 – PPC I-Beams

Prestressed Concrete I-Beam

- Used since the 1950’s
- "I" or "Bulb T" shape
- High Strength Concrete (5-10 ksi typically)
- New hybrid sections introduced by IDOT in March 2015

PPC I-Beam

PPC Bulb-T
Item 59 – PPC I-Beams

Prestressed Concrete I-Beam

- The condition of the beam “PERIMETER” is used to determine the condition rating
- It is the bottom flange length enclosing the prestressing strands

Sounding

- Use hammer sounding to detect delaminated areas
- Delaminations have a distinctive “hollow or clacking” sound when struck
- Sound concrete has a solid "pinging" sound
Item 59 – PPC I-Beams

Key Indicators

- Cracks
- Delams & Spalls
- Exposed Reinf & Strands

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>VERY GOOD. No notable problems.</td>
</tr>
<tr>
<td>7</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>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 stirrups may be exposed due to inadequate concrete cover that occurs during manufacturing (up to ½ cover). Webs may be spalled with exposed stirrups and minor section loss.</td>
</tr>
</tbody>
</table>
Item 59 – PPC I-Beams

**Key Indicators**

- **Cracks**
- **Delams & Spalls**
- **Exposed Reinf & Strands**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POOR</td>
<td>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.</td>
</tr>
<tr>
<td>SERIOUS</td>
<td>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.</td>
</tr>
</tbody>
</table>
Item 59 – PPC I-Beams

**Key Indicators**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>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. <strong>Measurable shear or transverse cracks.</strong> The Bureau of Bridges and Structures shall be notified immediately.</td>
</tr>
</tbody>
</table>

- Cracks
- Delams & Spalls
- Exposed Reinf & Strands

**New Construction**

- No defects
- First inspection

New PPC I-Beam – Typically first inspection only
Item 59 – PPC I-Beams

**Very Good**

- No deficiencies
- Second inspection

**VERY GOOD. No notable problems.**

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.**
**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.

**Fair**

Reinforcement bars exposed for 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 stirrups 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.
Item 59 – PPC I-Beams

No beams with reinforcement exposed at center span

Spall with 4 exposed strands in the end quarter

Item 59 – PPC I-Beams

Poor

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

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.
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.

Item 59 – PPC I-Beams

Critical

- Prestressing strands exposed over full perimeter
- Open shear cracks
- Damage in middle half of beam

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.
Item 59 – PPC I-Beams

Imminent Failure

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

IMMINENT FAILURE. Condition requiring bridge closure or temporary measures to allow structure to remain open

Discussion
CULVERTS

Item 62 - Culverts

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

Related Inventory Items

- Guardrail on Culverts (Items 36 A-F)
  - NOT Bridge Railing (Item 36A)
  - Items 36E/F – Guardrails on Structure Type (Right/Left)
  - Usually coded “0” for None or “1” for Steel Plate Beam
- Structure Length (Item 49)
  - 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.
### Item 62 - Culverts

#### Key Indicators

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE. Use when structure is not a culvert.</td>
</tr>
<tr>
<td>9</td>
<td>EXCELLENT. New with no deficiencies</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD. No noticeable or noteworthy deficiencies which affect the condition of the culvert, insignificant scrape marks caused by drift.</td>
</tr>
<tr>
<td>7</td>
<td>GOOD. Isolated non-structural cracks up to 0.03&quot;, 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.</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY. Extensive non-structural cracks up to .06&quot; with some leaching over the majority of the top slab, spalls and delaminations may be present on up to 10% in a 6’ width of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 20% of the surface area of walls and slabs may be map cracked, spalled and delaminated. Metal culverts have a smooth curvature, non-symmetrical shape, minor corrosion or measurable pitting. Local minor scour at curtain walls, wingwalls, or pipes.</td>
</tr>
<tr>
<td>5</td>
<td>FAIR. Non-structural cracking with leaching at &lt; 5’ intervals over the majority of the slab or wall surfaces, structural cracks &lt; 0.03” in walls or slabs, section loss of primary reinforcement up to 10% in the top slab in a 6’ width, up to 10% of compression surface area spalled or delaminated on top slabs in a 6’ width (tension areas may be totally spalled), up to 10% section loss of concrete or rebar in a 10’ width of wall, up to 10% section loss of concrete or reinforcement steel in a 10’ width of bottom slab. Metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting with up to 10% average section loss in a 10’ width, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.</td>
</tr>
</tbody>
</table>
# Item 62 - Culverts

## Key Indicators
- **Cracks**
- **Scaling**
- **Leaching**
- **Spalls/Delams**
- **Section Loss**
- **Scour**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>POOR. Structural cracks in top slab up to 0.06&quot;, structural cracks in walls up to 0.125&quot;, section loss of primary reinforcement up to 30% in the top slab in a 6' width, up to 30% of compression surface area spalled or delaminated on top slabs in a 6' width (tension areas may be totally spalled), up to 30% section loss of concrete or reinforcement steel in a 10' width of bottom slab. Metal culverts have significant distortion and deflection on more than one section, extensive corrosion or deep pitting throughout with up to 30% section loss in a 10' width, considerable settlement or misalignment, considerable scour or erosion at curtain walls, wingwalls or pipes with undermining.</td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS. Any worse or combined condition described in condition rating &quot;4&quot;, 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.</td>
</tr>
</tbody>
</table>

## Item 62 - Culverts

## Key Indicators
- **Cracks**
- **Scaling**
- **Leaching**
- **Spalls/Delams**
- **Section Loss**
- **Scour**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>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.</td>
</tr>
<tr>
<td>1</td>
<td>IMMINENT FAILURE. Bridge closed. Corrective action may return bridge to light service.</td>
</tr>
<tr>
<td>0</td>
<td>FAILED. Bridge closed. Replacement necessary.</td>
</tr>
</tbody>
</table>
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 to make an accurate determination of remaining load-carrying capacity.

Item 62 - Culverts

New Construction

No Deficiencies

EXCELLENT. No deficiencies – Typically first inspection only
**Item 62 - Culverts**

**Very Good Condition**

No significant defects

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

**Good Condition**

- Minor scaling
- Insignificant spalling
- No exposed reinforcement

GOOD. Isolated non-structural cracks up to 0.03”, light scaling, and insignificant spalling which does not expose reinforcing steel, metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting, insignificant damage caused by drift with no misalignment and not requiring corrective action, some minor scour has occurred near curtain walls, wingwalls, or pipes.
Item 62 - Culverts

Good Condition

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

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

Satisfactory Condition

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

Satisfactory. Extensive non-structural cracks up to .06" with some leaching over the majority of the top slab, spalls and delaminations may be present on up to 10% in a 6’ width of the concrete or masonry walls or slabs exposing primary reinforcement with surface rust only, up to 20% of the surface area of walls and slabs may be map cracked, spalled and delaminated. Metal culverts have a smooth curvature, non-symmetrical shape, minor corrosion or measurable pitting. Local minor scour at curtain walls, wingwalls, or pipes.
**Item 62 - Culverts**

**Satisfactory Condition**

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

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

**Item 62 - Culverts**

**Fair Condition**

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

Fair. Non-structural cracking with leaching at < 5’ intervals over the majority of the slab or wall surfaces, structural cracks < 0.03” in walls or slabs, section loss of primary reinforcement up to 10% in the top slab in a 6’ width, up to 10% of compression surface area spalled or delaminated on top slabs in a 6’ width (tension areas may be totally spalled), up to 10% section loss of concrete or rebar in a 10’ width of wall, up to 10% section loss of concrete or reinforcement steel in a 10’ width of bottom slab. Metal culverts have significant distortion and deflection in no more than one section, or significant corrosion or deep pitting with up to 10% average section loss in a 10’ width, minor settlement or misalignment, noticeable scour or erosion at curtain walls, wingwalls, or pipes without undermining.
Item 62 - Culverts

Fair Condition

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

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

**N-19**

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

**N-20**

**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.**
### 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.

---

#### 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.
**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.

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

CRITICAL. Large areas of slab or walls spalled full depth near traffic, large area of reinforcement losses greater than 50% near traffic, metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion, integral wingwalls collapsed, severe settlement of roadway due to loss of fill, section of culvert may have failed and can no longer support embankment, complete undermining of curtain walls and pipes, special feature inspection will be required to keep the structure open with possible load restrictions. The Bureau of Bridges and Structures shall be notified immediately.
Item 62 - Culverts

Critical Condition

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

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

Discussion
Conclusion – Day 1

- Class resumes tomorrow morning at 8:00 am
- Keep your Response Card, Lanyard, and Name Card together
- Leave your Response Card with us, make sure your Name Card is visible to facilitate redistribution of the Cards tomorrow morning.

Questions? or Comments

Don't forget to return your Response Cards and Lanyards