Bridge Inspection Basics
Road Scholar Core Course #9

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Agenda

- Why Inspect Bridges?
- What do we Inspect?
- Inspection Types and Critical Findings
- Project Schedule
- County Summary Reports and BIAS
- Load Ratings and Scour
- LPA’s Responsibility
- What’s Next?
Why Inspect Bridges?

1. Ensure public safety!
Why Inspect Bridges?

- Silver Bridge Collapse, 1967
- Point Pleasant, WV
- 46 dead
- Led to National Bridge Inspection Standards (NBIS)
Why Inspect Bridges?

• Mianus River Bridge Collapse, 1983
• Greenwich, CT
• 3 people died
• Led to new scour provisions
Why Inspect Bridges?

- Schoharie Creek Bridge Collapse, 1987
- Fort Hunter, NY
- 10 dead
- Led to fracture critical member provisions
Why Inspect Bridges?

2. Compliance

- Comply with federal and state laws, rules, and policies
- Federal-aid program
- Failure to comply puts LPA at risk for losing current and future federal funding
Why Inspect Bridges?

3. Responsible spending
   • To provide for the efficient use of resources in maintaining bridges
   • Asset management tool
What do we Inspect?

NBIS Bridge Definition:

“A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet* between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.”
What do we Inspect?

• Single Span Bridges

NBIS Bridge Length, >20’
What do we Inspect?

• Multi-Span Bridges

NBIS Bridge Length, >20’
What do we Inspect?

- Arch Bridges

NBIS Bridge Length, >20’
What do we Inspect?

• Box Culverts

NBIS Bridge Length, >20’
What do we Inspect?

- Pipe Culverts

NBIS Bridge Length, >20’

Must be less than ½ of adjacent pipe opening
What do we Inspect?

- Measured along the centerline of roadway

Can be <20’

NBIS Bridge Length, >20’

© Roadway
Inspection Types

Routine Inspection

- Required for all bridges
- Consists of observations and/or measurements to determine physical and functional condition of bridge
- Walk-around type inspection
- Team Leader certification
Inspection Types

Routine Inspection

- Regularly scheduled
- Maximum frequency of 24 months
- Maximum of 12 months for bridges with a rating of a 4 or less for:
  - Deck, Superstructure, Substructure, Culvert
Inspection Types

Fracture Critical Inspections

• Fracture critical members are steel members in tension, whose failure would probably cause all, or a portion of, the bridge to collapse

• Some common examples: steel trusses, steel two-girder bridges, most railroad flat car bridges
Inspection Types

Fracture Critical Inspections

• Requires additional fracture critical training, qualifications

• “Arm’s length” inspection of fracture critical members or components

• Many inspections require special equipment and traffic control
Inspection Types

Fracture Critical Inspections

• Detailed inspection and report
• Looking for cracks in tension areas
• Noting deterioration of individual members
Inspection Types

Fracture Critical Inspections

- Regularly scheduled
- Maximum frequency of 24 months
- Maximum frequency of 12 months for fracture critical members with rating of 4 or less
Underwater Inspections

• Required for substructure units in water that cannot be waded or probed, even at lowest flow of year
• Requires additional training, certifications
  – Commercial dive training
Inspection Types

Underwater Inspections

• Detailed inspection and report
• Looking for
  – Scour at foundations
  – Structural issues
  – Deterioration
  – Channel migration
Underwater Inspections

- Regularly scheduled
- Typically scheduled for low-flow time of year
- Maximum frequency of 60 months
- 48, 36, 24, or 12 month frequency used based on condition and changes
Inspection Types

**Special Inspections**

- Examine a portion of a bridge in more detail, or at a greater or lesser frequency, than is standard for routine inspections
- May provide follow-up after routine, damage, or initial inspection
Special Inspections

• Some examples:
  – Fatigue category E and E’ details
  – Welded cover plates
  – Hangers
  – Hinge or pin connections
  – Defects/deterioration warranting extra scrutiny
  – Cable-stayed, suspension, and movable bridges
Inspection Types

Special Inspections

- It’s now common to have a special inspection to inspect fracture critical members rated a 4 or less
  - This is completed between full fracture critical inspections in order to meet 12 month frequency requirements
Inspection Types

Special Inspections

• Usually requires fracture critical or other training, certifications
• “Arm’s length” inspection
• May require special equipment, traffic control
• Usually requires detailed inspection and report
Inspection Types

Special Inspections

• Regularly scheduled
• Maximum frequency of 60 months
• Maximum frequency of 12 months for details rated a 4 or less
Inspection Types

Initial Inspection

• Baseline inspection
• Completed on every new bridge, after a rehabilitation, or when configuration changes
• Also for bridges not previously inventoried
Inspection Types

**Initial Inspection**

- Use bridge plans as guide
- Determine what inspections are required in future
- Inspection data required in BIAS within 90 days of opening to traffic
Inspection Types

Damage Inspections

• Unscheduled inspection to assess structural damage from environmental or human actions

• Shall be completed ASAP
  – not more than 7 days after event

• May require critical finding and/or bridge closure
Critical Findings

- A critical finding is a structural or safety related deficiency that requires immediate follow-up inspection or action.
- Typically triggered by inspector during scheduled inspection.
- Can also be triggered by bridge owner.
Critical Findings

• Inspector first notifies employee in responsible charge (ERC), then notifies the State Program Manager (SPM)
  – Via phone and/or email
• Following notification, critical findings need to be documented within BIAS within 24 hours.
Critical Findings

• Immediate actions **ARE:**
  – Close bridge, close lanes or shoulders, restrict traffic, add barrels or barricades, plate hole, quick repair, quick load rate, re-inspection, etc.

• Immediate actions **ARE NOT:**
  – Replace bridge, rehab bridge, repair bridge when crew is free, wait for all load ratings in county to be completed
Critical Findings

• Immediate action timeline
  – Intent is days, not weeks or months

• Once the immediate action is completed, the critical finding can be closed out by the SPM

• After close-out, further action may still be needed by bridge owner
  – Replace, rehab, or repair
Project Schedule

Contract Phases

• Year 1: Phase I  Inspect all bridges
• Year 2: Phase IA Inspect poor condition bridges
• Year 3: Phase II  Inspect all bridges
• Year 4: Phase IIA Inspect poor condition bridges

• Years 1-2: Interim I Additional inspections
• Years 3-4: Interim II Additional inspections
1. Field Inspections

- After Notice to Proceed (NTP)
- During compliance months
  - If more than one compliance month, need to keep bridge in same month as previous inspection month
- Avoid bad weather, snow, or high water
2. BIAS Reports

- Start report in BIAS and update inspection date by end of compliance month
- Reports complete and approved in BIAS within 60 days of inspection
Project Schedule

3. Draft Summary Report

- Typically due 3 or 4 months after date of 1st inspection
  - Depends on phase
- Consultant to deliver and review report with County
- County to review and sign off on report
4. Final Summary Report

• County will receive final reports 1 month after draft report

• Final reports also submitted in ERMS, INDOT’s long term file storage system
County Summary Reports

Summary Tables

- Priority list for major work
- Req’d inspections and inspection dates
- Load posted bridges
- Scour critical bridges
- Summary of changes
- Maintenance items
- Etc.
County Summary Reports

SIA Reports

• Pictures documenting bridge, deficiencies
• Elevation sketch with channel measurements
• Condition ratings
• Description of deficiencies
  – location, size, severity
County Summary Reports

SIA Reports

- Location, structure type, year built, geometry, inspection dates
- Load rating and posting
- Recommendations for major work, maintenance
- Sufficiency rating and status
County Summary Reports

Sufficiency Rating

• Score 0-100
• Automatically calculated based on:
  – Condition
  – Geometry
  – ADT
  – Load rating
  – Appraisal items
  – Etc.
Status

0 = Not Deficient (ND)
1 = Structurally Deficient (SD)
2 = Functionally Obsolete (FO)

- Automatically calculated based on NBI data, similar to sufficiency rating
County Summary Reports

Federal Funding Eligibility

• Rehabilitation:
  – S.R. < 80
  – S.D. or F.O.

• Replace:
  – S.R. < 50
  – S.D. or F.O.

• Preventative Maintenance:
  – S.R. ≥ 50
Federal Funding Eligibility

- Cannot have been new, replaced, rehabbed, or reconstructed within past:
  - 10 years (replace, rehabilitation)
  - 5 years (preventative maintenance)
  - Funding source doesn’t matter (Fed vs. Local)
BIAS

- Official location for bridge inspection data
- Always up to date
- Has historical inspection reports
- Powerful query tools
- Link to ERMS files
- LPA encouraged to use
Load Ratings

A Lot of Changes

• All bridges to be re-load rated by October 2019 following new procedures

• Everyone to use AASHTOWare BrR software
  – Or engineering judgment (when details unknown)

• Rating results go into BRADIN, files into ERMS
Load Ratings

A Lot of Changes

• Indiana will be more in line with Manual for Bridge Evaluation (MBE), other states

• Approx. 15 new vehicles
  – Vehicles from MBE
  – Legal vehicles in Indiana
  – Emergency vehicles: EV2, EV3

• Only re-rated when change in condition

• New load posting criteria
Load Ratings

Basic Load Rating Process

1. Load rate bridge for all vehicles
2. Get Rating Factor (RF) for each vehicle:
   - RF > 1.0 is good
   - RF < 1.0 is bad
3. There are two rating levels:
   - Design (Inventory)
   - Legal (Operating)
Load Ratings

Basic Load Rating Process

4. If Design (Inventory) RF < 1.0:
   - Not designed adequately
   - Designed using older standards
   - Not designed for that vehicle

5. If Legal (Operating) RF < 1.0:
   - Bridge MUST be load posted!

### DESIGN LOADS

<table>
<thead>
<tr>
<th>Vehicle Configuration</th>
<th>Inventory Rating Factors</th>
<th>Load Capacity (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL-93</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fatigue</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>H 20-44</td>
<td>1.207</td>
<td>24.14</td>
</tr>
<tr>
<td>HS 20-44</td>
<td>0.924</td>
<td>33.20</td>
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<tr>
<td>HS-25</td>
<td>0.750</td>
<td>33.75</td>
</tr>
<tr>
<td>Alternate Military</td>
<td>0.948</td>
<td>22.75</td>
</tr>
<tr>
<td>Toll Road Truck (89.6K)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Toll Road Truck (90K)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Full RV (83K)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### LEGAL & ROUTINE PERMIT LOADS

<table>
<thead>
<tr>
<th>Vehicle Configuration</th>
<th>Rating Factors</th>
<th>Load Capacity (tons)</th>
<th>Safe Posting Load (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV2</td>
<td>1.038</td>
<td>29.84</td>
<td></td>
</tr>
<tr>
<td>EV3</td>
<td>0.679</td>
<td>29.20</td>
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<td></td>
<td></td>
<td></td>
<td>Single Axle: 16.75</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Tandem: 21.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gross: 29.20</td>
</tr>
</tbody>
</table>
Load Ratings

Basic Load Rating Process

6. Establish safe posting load
   - Use safe posting load equation from MBE
   - Example in LFD code:
     (30 Ton vehicle)
     
     \[ (30 \text{ Ton vehicle}) \times (0.8 \text{ RF}) = 24 \text{ Tons} \]
   - Use min. safe posting load
   - Can post at lower levels at discretion of load rating engineer and bridge owner
Load Ratings

Basic Load Rating Process

7. Notify County of changes
8. County required to install signs within 30 days
9. Signs recommended at bridge and nearest intersections
10. Pictures of installed signs needed to update BIAS
Load Ratings

The Result

- Some bridges being load rated in ways they were never designed for
- Some rating vehicles cause higher stresses than design vehicles
- Some newer bridges in good condition require load posting
Load Ratings

The Result

• More bridges posted
• Higher posting values
  – less conservative
• How to avoid load posting:
  – Good practice: Design for HL-93 using LRFD
  – Best practice: Check load rating during design
Scour Evaluations

• All Bridges required to have scour screening and/or assessment on file:
  – Inspector fills out in BIAS

• Bridges on “Moderate Risk” channels require additional evaluation:
  – If foundation known, model with HEC-RAS
  – If foundation unknown, make scour critical
Scour Evaluations

If Scour Critical:

• Must have Scour Plan of Action (POA) on file

• Monitor bridges during floods:
  – Example: every 12 hours during County Flood Warning announced by National Weather Service
  – Look for damage to bridge and surroundings
  – County to follow directions on POA, fill out log, and keep on file
LPA’s Responsibility

• Develop RFP
  – Start minimum 12 months in advance
  – Longer if in MPO

• Review proposals and select Consultant

• Review and approve
  – LPA-Consultant agreement
  – LPA-INDOT agreement
LPA’s Responsibility

• Each phase:
  – Request FMIS funds
  – Issue NTP (after INDOT OK)
• Process invoices and voucher claims
• Submit local quarterly reports and “attend” phone meetings
• Notify consultant:
  – Initial inspections (new, replace, rehab)
  – Damage to bridges
LPA’s Responsibility

• Provide consultant with any previous and new bridge files
• Address any critical findings or posting changes
• Monitor scour critical bridges following POA
• Review inspection reports and findings
• Use the inventory as a tool to efficiently manage your bridges
What’s New?

• Extended Frequency
  – Being built into newer contracts now
  – If approved, go to 48-month routine

• Some requirements
  – Condition ≥ 6 (deck, super, sub)
  – Steel or concrete bridge (box beams need deck)
  – Load rating Operating RF > 1.0
  – Not fracture critical, no special details
  – No narrow bridges
  – Not at risk of water overtopping
What’s New?

• Compliance Months
  – Likely transitioning to 2 months

• Contract Dates and NTP
  – Trying to get NTP 30-60 days before compliance months
  – May need to terminate or amend existing contracts so there is no overlap

• Statewide reschedule
  – Balance months and years
References

• INDOT Bridge Inspection Manual (BIM)
• Manual for Bridge Evaluation (MBE)
• LPA Guidance Document
• Asset Management for LPA Bridges
• Indiana Manual on Uniform Traffic Control Devices (MUTCD)
• LPA Consultant Boilerplate Contract for County Bridge Inspections
Any Questions?

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