Indiana Bridge Load Rating Policies and Procedures

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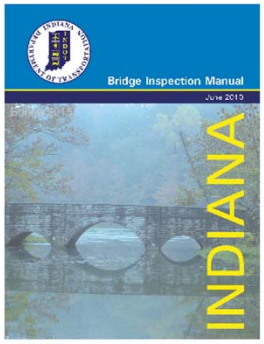
INDOT Bridge Load Rating Policies

- **Consultants Performing Load Ratings**
  - BrIM 3-5.03 Prequalification Requirements
    - Have at least one Registered Professional Engineer, licensed in the state of Indiana, qualified to oversee, review, and certify all load capacity ratings performed by that firm.
    - Have a load capacity rating program or method that produces all load rating results required by the federal regulations and INDOT. See Section 6 for details on requirements for software. As a minimum, this must check moments and shear. All calculations must be performed by an engineer or engineering intern (EI) and must be reviewed by a professional engineer (PE).

INDOT Bridge Load Rating Policies

- **Consultants Performing Load Ratings**
  - BrIM 2.4.12
    - Load Rating Team Leader
  - ATL-R Certification
    - Submit Qualification Form: Appendix B



Part 1 Administration
Appendix B
Part 2 QA/QC
Part 3 Load Rating
Part 4 Bridge Inspection
Part 5 Movable Bridges
Part 6 NDT & PDT Testing

INDOT Bridge Load Rating Policies

- **Engineering Judgment (Current Policy)**
  - Indiana Bridge Inspection Manual 3-6.03
    - *"In case of bridges with unknown structural components where details, plans are not available such as reinforcement or field measurements are not possible, engineering judgment may be used for concrete bridges (MBE 6.1.4). A field inspection of the bridge by a qualified inspector and evaluation by a qualified professional engineer is sufficient to establish an approximate load rating based on rational criteria. The criteria established are a) There are no plans or details available b) It is a concrete superstructure c) The condition rating is at least 6 and there is no change in its condition from the previous inspection d) The physical inspection reveals that the bridge has been carrying normal traffic without distress due to live load e) It is evaluated and signed as well as sealed by a qualified PE (ATL-S) or a Load Rating Engineer (PE). A sample document is shown in Figure 3:6-4."*

INDOT Bridge Load Rating Policies

- **INDOT Bridge Inspection Memo 16-06**
  - Load Rating Requirement for New County Bridges
    - *"New County bridges need to have a load rating performed in accordance with the Indiana Bridge Inspection Manual Part 3 at the time of the initial inspection. This requirement is not dependent on the source of funding used to construct the bridge. The load ratings are to be performed using AASHTOWare BrR. The County is responsible for providing the consultant performing the initial inspection and load rating with a set of as-built plans."*

INDOT Bridge Load Rating Policies

- **INDOT Bridge Inspection Memo 16-10**
  - Load Rating Policy Revisions (December 8, 2016)
    - *"The Indiana Bridge Inspection Manual Part 3 has been revised. The revisions are effective immediately for all new bridge load ratings. Updated load ratings will be performed for all County owned bridges following the dates in the spreadsheet attached to Bridge Inspection Memorandum No. 16-09."*
    - *"All bridges are to be load rated in accordance with the criteria listed in Part 3 of the Indiana Bridge Inspection Manual."*

INDOT Bridge Load Rating Policies

- **INDOT BrIM Part 3-6.01**
  - *Load Rating Software Requirements*
    - *AASHTOWare Bridge Rating or BrR shall be used.*
      - Unless otherwise approved by the State Bridge Inspection Program Manager
    - *If BrR cannot be used to load rate a bridge, other software such as CANDE (arch underfill), Smartculvert (for Conspan type arches), MIDAS/CSI Bridge for FEM and* Consplice for post-tensioned slab structures can be used.
    - The xml file shall be submitted for inclusion in the State bridge file database.

Inspection for Load Rating: Check List

- **Check List @ :** http://www.in.gov/dot/div/contracts/design/dmforms/
- **Pre-Planning before inspection:**
  - Gather Plans, make field copies and sketches
  - Review Plans and familiarize with tension zones and critical areas
  - BIAS Bridge File review for existing load ratings, critical locations and condition ratings, previous section loss areas
  - Prepare tools and see what may be required like calipers, tilt gage or D-meter
- **During Inspection:**
  - Sketches:
    - Use Pre-prepared sketches or quick line drawings to record deterioration (LxWxD or t)
    - All sheets should have structure number, date, name of inspector and indicate span or location
  - Photos:
    - Take at least two clear photos of deterioration, one close up and one farther away (Can print , annotate and scan or use i-pad with some apps for dimensioning)
    - Consider placing a coin, pencil, etc. in the picture to give reference on the size of the defect

Inspection for Load Rating: Check List

- **What to look for:**
  - General
    - Smoothness of the Road approach onto the bridge (Impact from trucks)
    - Substructure
      - Loss of Bearing Area
      - Exposed Pile Deterioration
  - Steel Bridges
    - Section Loss measurement (L x W x D or t) or % loss (material left/original material)
    - Cracks : (L x W), location
    - Check for repeat condition
    - Check for pack rust, out of plane bending, weld cracks, retrofit deterioration
    - Corrosion and previous vehicle impact areas
    - Document in notes and sketches
  - Concrete Bridges
    - Check for section loss (L x W x D or t) or delamination/unsound concrete (L x W)
    - Check for cracks (L x W), location
    - Sound concrete and establish delaminated areas (Lx W)
    - Check for exposed rebar and section loss
    - Document in notes and sketches

Inspection for Load Rating: Check List

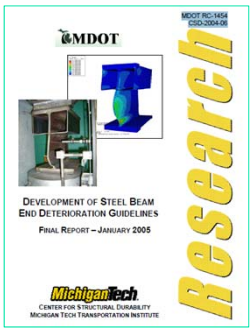
- **What to look for:**
  - Prestressed concrete bridges
    - Check for longitudinal cracks at bottom and sides of beam (L x W, location, condition)
    - Check for vertical cracks at ends of beam (L x W, location, condition)
    - Check for cracks/spalls/rust stains/water seepage or stains, efflorescence (L x W x D)
    - Check for repeat condition (Are cracks appearing on all beams or focused at ends?)
    - Check for Beam Sag
    - Check for broken strands, vehicle impact and unsound concrete
    - Document in notes and sketches
  - Trusses
    - Check for section loss (L x W x D or t) or delamination/unsound concrete (L x W)
    - Check for cracks (L x W), at all steel components
    - Check Gusset plates and connections
    - Document Rivet Head Section Loss / Hammer Sound Rivets
    - Document in notes and sketches

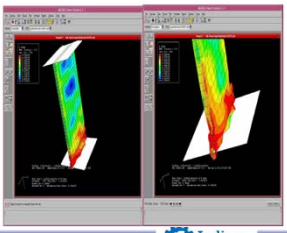
Load Rating For Deterioration

- **Steel Beams**
  - Section Loss of Tension Flange
    - Input loss of thickness in BrR
  - Section Loss of Compression Flange
    - Input loss of thickness in BrR
  - Crack in Flange
    - Options
  - Collision Damage of Flange / Web

Load Rating For Deterioration

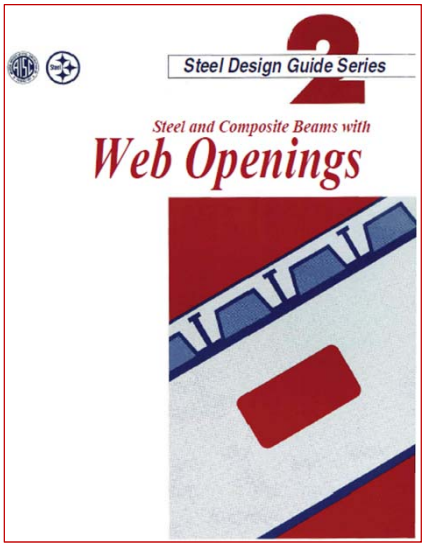
- **Steel Beams**
  - Section Loss of Web
    - Input loss of thickness in BrR as average web thickness
    - MDOT RC 1454 (Michigan Tech Study)
      - Provides tables correlating web loss to residual capacity for W-Beams





Load Rating For Deterioration

- **Steel Beams**
  - Holes in Web
    - Input reduced average web in BrR
    - AISC Design Guide 2
      - (Dr. David Darwin, Kansas)



Load Rating For Deterioration

- **Reinforced Concrete Beams and Slabs**
  - Spalling / reinforcing section loss
    - Reduce area of reinforcing based on section loss
  - Concrete Deterioration in Compression Zone
    - Testing
    - Reduce compressive strength in BrR
    - Use Condition Reduction Factors from MBE

Load Rating For Deterioration

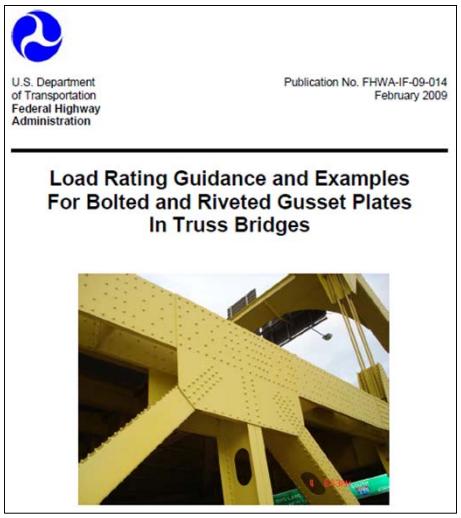
- **Prestressed Concrete Beams**
  - Continuous Beams in BrR Consideration
    - Shear Rating Reported at Centerline of Pier
  - P/S Box Beams
    - Exposed Strands (BrIM 3-8.06)
      - Box-Beams: Remove visible and adjacent strands
      - I-Beams: Consider removing exposed strands, or debonding from the end of the beam to a point beyond the exposed strand
    - Top Flange Concrete Deterioration
      - Reduce compressive strength in BrR
      - Use Condition Reduction Factors from MBE

Load Rating For Deterioration

- **Trusses**
  - Tension Member Section Loss
    - Input Reduced Member Capacity in BrR
  - Compression Member Section Loss
    - Input Reduced Member Capacity in BrR
  - Compression Member Distortion
    - Thresholds for reduction
  - Rivet Head Section Loss

Load Rating For Deterioration

- **Trusses**
  - LRFD 6.14.2.8
    - Gusset Plate Design and Analysis
  - Gusset Plate Deterioration
    - Calculate Capacity Reduction
    - Input Capacity in BrR


U.S. Department of Transportation
Federal Highway Administration

Publication No. FHWA-IF-09-014
February 2009

Load Rating Guidance and Examples For Bolted and Riveted Gusset Plates In Truss Bridges

Load Rating For Deterioration

- **Substructure**
  - Loss of Bearing Area
  - Exposed Pile Deterioration

Load Rating For Deterioration

- **BrIM 3-6.01**
  - New Bridge and Superstructure Replacement Capacity Policy
  - *"New bridges and those with total superstructure replacement are to be rated using the LRFR methodology during the design load rating check."*
  - *"The load rating factor for the design load rating shall be greater than 1.06."*
    - Clarification on this policy is forthcoming

Load Rating For Deterioration

- **BrIM 3-6.01 Interim Solution**
- ***"The load rating factor for the design load rating shall be greater than 1.06."***
  - LRFD 1.3.5 – Operational Importance (Use 1.06)

1.3.5—Operational Importance

This Article shall apply to the strength and extreme event limit states only.

The Owner may declare a bridge or any structural component and connection thereof to be of operational priority.

For the strength limit state:

$\eta_I \geq$ 1.05 for critical or essential bridges

$=$ 1.00 for typical bridges

$\geq$ 0.95 for relatively less important bridges.

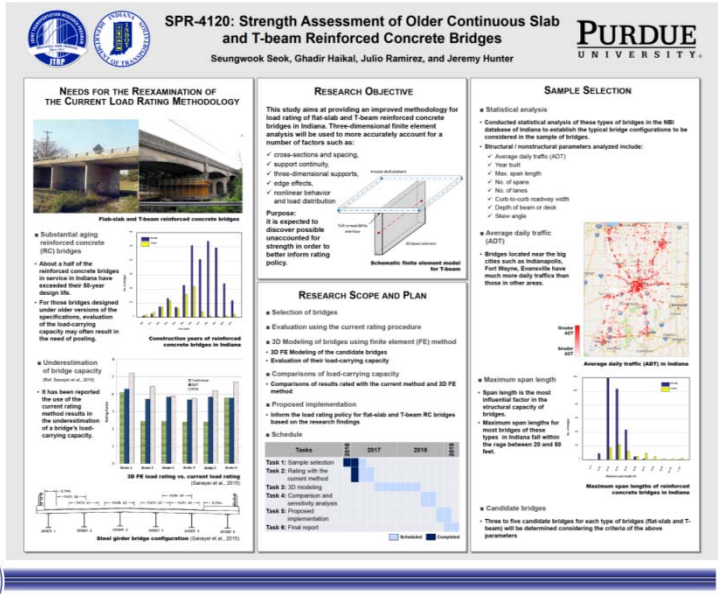
For all other limit states:

$\eta_I =$ 1.00

INDOT Bridge Load Rating JTRP Research

- **JTRP Active Projects Related to Load Rating**
  - SPR-3816 Load Rating Buried Structures
  - SPR-3913 Legal and Permit Loads
  - SPR-4009 Box Beam Risk Assessment and Mitigation
  - SPR-4120 Slabs and T-Beams
  - SPR-4121 Pack Rust
  - SPR-4122 Fiber-Reinforced Polymer Strengthening

INDOT Bridge Load Rating JTRP Research


SPR-4120: Strength Assessment of Older Continuous Slab and T-beam Reinforced Concrete Bridges

Seungwook Seok, Ghadir Haikal, Julio Ramirez, and Jeremy Hunter

PURDUE UNIVERSITY

NEEDS FOR THE REEXAMINATION OF THE CURRENT LOAD RATING METHODOLOGY

RESEARCH OBJECTIVE

SAMPLE SELECTION

RESEARCH SCOPE AND PLAN