Indiana Bridge Load Rating Policies and Procedures

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- **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 16-02**
  - Load Rating Policy Revisions (February 12, 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 attached spreadsheet."*
    - *"AASHTOWare BrR is the program to be used to load rate all bridges. The list of vehicles required for load ratings has been revised. The changes to Part 3 are to get Indiana in compliance with the AASHTO Manual for Bridge Evaluation (MBE)."*
      - The provisions of the Bridge Inspection Manual, Part 3 (3-6.03) govern when a bridge can be load rated using Engineering Judgement
      - Load Rating updates to BrR should be on schedule with the Scour Plans which begin in 2017

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."*

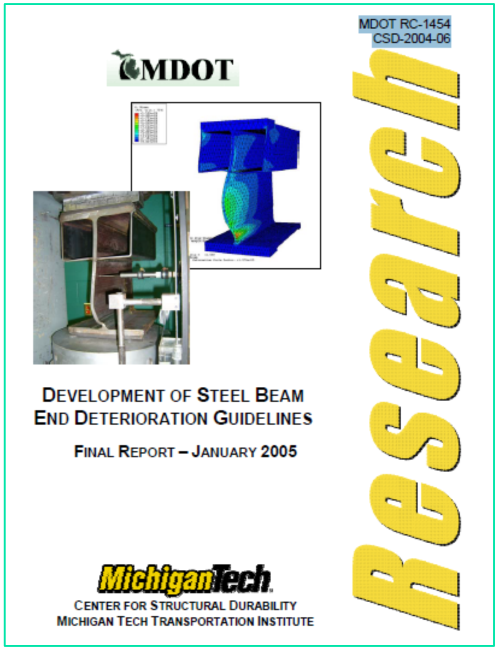
- **Rating Elements To Discuss**
  - Steel Beams
  - Reinforced Concrete Beams and Slabs
  - Prestressed Concrete Beams
  - Trusses
  - Substructures

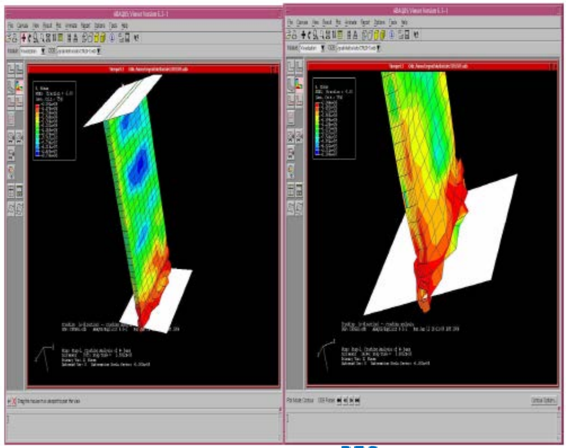
Load Rating For Deterioration

- **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

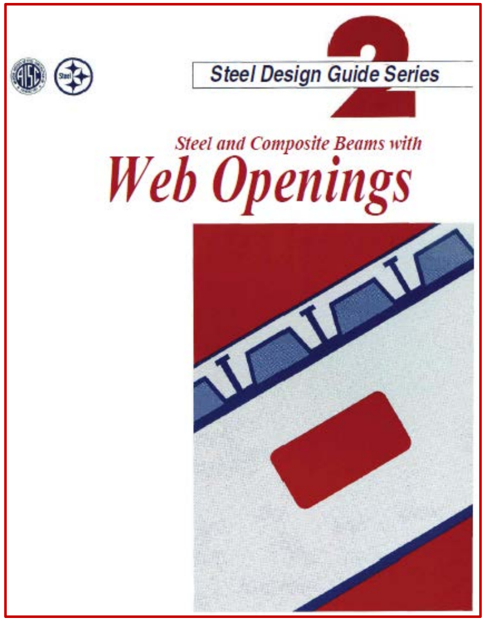
- **Steel Beams**
  - Section Loss of Web
    - Input loss of thickness in BrR as average web thickness
    - MDOT RC 1454 (Michigan Tech Study)
      - Provides tables correlating web loss to residual capacity for W-Beams





Load Rating For Deterioration

- **Steel Beams**
  - Holes in Web
    - Input reduced average web in BrR
    - AISC Design Guide 2 (Dr. David Darwin, Univ. of 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**
  - 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
      - Testing
      - Reduce compressive strength in BrR
      - Use Condition Reduction Factors from MBE
    - Cracked Bottom Flange due to Ice expansion inside void

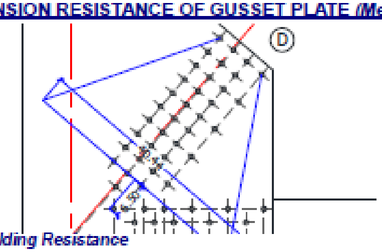
Load Rating For Deterioration

- **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**
  - Gusset Plate Deterioration
    - Calculate Capacity Reduction
    - Input Capacity in BrR

LFR: CHECK TENSION RESISTANCE OF GUSSET PLATE (Member D)



Gross Section Yielding Resistance

$L_{wD} := 40.44 \cdot in$ — *Effective Width in Tension (Whitmore)*

$A_{gD} := L_{wD} \cdot t_{PL} = 20.22 \cdot in^2$ — *Gross Area of Effective Tension Plane*

$N_{holesD\_T} := 3$ — *Number of holes across TENSION failure plane*

$A_{nD} := \left[L_{wD} - N_{holesD\_T} \cdot \left(\phi_{rivet} + \frac{1}{8} in\right)\right] \cdot t_{PL} = 18.72 \cdot in^2$ — *Net Area of Effective Tension Plane*

$A_{eD} := A_{nD} + 0.15 \cdot A_{gD} = 21.75 \cdot in^2$

$P_{r\_D} := F_y \cdot \min(A_{eD}, A_{gD}) \cdot N_{PL} = 1334.52 \cdot kip$

Block Shear Rupture Resistance

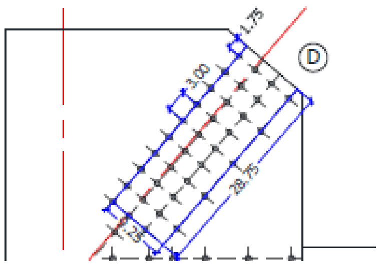
$L_{tD} := 9.25 \cdot in$ — *Length along plane resisting tension*

$L_{vD} := 28.75 \cdot in$ — *Length along plane resisting shear*

$N_{holesD\_Tbs} := 2.5$ — *Number of holes across Block-Shear Tension failure plane*

$N_{holesD\_Vbs} := 9.5$ — *Number of holes across Block-Shear Shear failure plane*

$N_{vp\_D} := 2$ — *Number of Shear Planes*



$A_{tnD} := t_{PL} \cdot \left[L_{tD} - N_{holesD\_Tbs} \cdot \left(\phi_{rivet} + \frac{1}{8} in\right)\right] = 3.38 \cdot in^2$

$A_{vnD} := N_{vp\_D} \cdot t_{PL} \cdot \left[L_{vD} - N_{holesD\_Vbs} \cdot \left(\phi_{rivet} + \frac{1}{8} in\right)\right] = 19.25 \cdot in^2$

$A_{tgD} := t_{PL} \cdot L_{tD} = 4.62 \cdot in^2$

$A_{vgD} := N_{vp\_D} \cdot t_{PL} \cdot L_{vD} = 28.75 \cdot in^2$

$0.58 \cdot A_{vnD} = 11.16 \cdot in^2$

$R_{r\_D} := \text{if}\left[A_{tnD} > 0.58 \cdot A_{vnD}, 0.85 \cdot (0.58 \cdot F_y \cdot A_{vgD} + F_u \cdot A_{tnD}), 0.85 \cdot (0.58 \cdot F_u \cdot A_{vnD} + F_y \cdot A_{tgD})\right] \cdot N_{PL} = 1398.29 \cdot kip$

2

Load Rating For Deterioration

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