



INDIANA DEPARTMENT OF TRANSPORTATION

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Bridge Inspection Memorandum No. 26-10 Load Rating Method – Engineering Judgment

August 5, 2026

TO: All Inspection Personnel and Consultants

FROM: /s/ Anthony Marino SPM
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SUBJECT: Load Rating Method – B.LR.04: Field Evaluation and Documented Engineering Judgment

REVISION: INDOT Bridge Inspection Manual Part 3: Load Rating

EFFECTIVE: Immediately

To ensure that the INDOT Statewide Bridge Inspection Program complies with the requirements for FHWA National Bridge Inspection Compliance Metric 14: Inspection Procedures – Post or Restrict, the following actions shall be taken as part of inspection operations for each upcoming inspection:

1. Analytical load ratings shall be performed for bridges with measurable primary components.
2. INDOT is aware that some bridges coded EJ for B.LR.04 have analytical models developed, and that the coding of EJ is based on an owner's decision to post the bridge below computed values. This is not the intended use of the EJ code. Load ratings should be recorded in BRADIN consistent with analytical results. The decision to post below computed values is independent of the load rating determination. BRADIN is to be reviewed and updated as needed for bridges that the Owner has elected to post for a weight limit that is less than the calculated safe posting load.
 - a. A note shall be included in BRADIN documenting the Owner's decision to post the bridge for a weight limit that is lower than required by the load rating analysis.
 - b. Confirm B.LR.04 – Load Rating Method is consistent with the method used to determine the load ratings reported.

The following updates will be included in Part 3: Load Rating of the INDOT Bridge Inspection Manual to provide clarification.

3-4.01 MODELING GUIDELINES & ASSUMPTIONS

AASHTOWare Bridge Rating (BrR) shall be used to perform load ratings whenever possible for State and Local bridges. It is permissible to use other programs in cases where the use of BrR is insufficient or not plausible due to software limitations.

Typically, it is not necessary to analyze concrete bridge decks on redundant girder systems. Concrete decks that have significant deterioration, along with other less redundant deck types such as steel grid decks or timber decks must be load rated.

Analytical methods shall be used for load rating whenever possible. Though plans may not be available for some bridges, it may be possible to perform analytical load ratings for certain bridge types. For example, field measurements can be taken for steel or timber bridges and metal pipes without plans. This information along with material property assumptions based on the era of construction could be used as the basis of evaluation.

Historical State and Local standard drawings for prestressed I-beam, box beams, reinforced concrete slabs, and arches may be used as the basis for evaluation, provided those details are not associated with known problems that adversely affect structural capacity. Where documented problems exist with older details, and common practices of that era chose to take exception to those details, reliance on such provisions is not appropriate.

Research and review of bridge history records, testing reports, repair or rehabilitation plans may be helpful to determine the load carrying capacity of the structure. In addition, another bridge within close proximity to the location, having similar geometry, built within the same year, or by the same contractor may have available plans. The available plan set could be used as the basis of evaluation.

In service load rating models must include deterioration as documented by Bridge Inspection. Deterioration may be present in multiple members of the bridge and may change over the structure's lifespan through repairs, retrofits, or continued deterioration. Additional areas of deterioration may also appear over time. For this reason, State load rating models must reflect the deterioration reported at each specific location along each member, even if that deterioration does not govern the overall rating. The load rating summary report must include the Load Rating Engineer's interpretation of the deterioration documented by the Bridge Inspector for the date of the inspection, along with an explanation of how this deterioration was incorporated into the load rating model. This process is also recommended for Local bridges.

Load rating models prepared for design review purposes should include a separate model for each construction phase that will carry traffic.

3-5.01(04) Load Rating Method – B.LR.04

The method used to calculate the load rating.

6. Field Evaluation and Documented Engineering Judgment (EJ)

Decisions supporting the use of engineering judgment should be clear to an experienced observer. Only when bridge geometry or material properties are not available and cannot be obtained by physical measurements or without destructive testing, may engineering judgment be applied in lieu of analytical methods. MBE 6.1.4 discusses the use of engineering judgment in place of analytical methods when the necessary details to load rate are missing or incomplete.

Engineering judgment shall not be used as the sole basis for waiving the results of calculations, non-destructive load testing for capacity evaluation, or inspection findings. The process for determining decisions regarding posting, restricting, and closure shall be documented in a manner that identifies the serviceability, limiting component, risk of failure, and imminent safety hazard.

For load rating purposes, engineering judgment should be based on the current condition of the structure, including information gathered by qualified personnel, drawings or details from the era of construction, knowledge of AASHTO and local codes and design manuals of the time, and available live load history.

When using engineering judgment to evaluate a bridge, consideration should be given to the typical size, weight, and configuration of the loads it routinely carries. For example, a bridge predominantly serving passenger vehicles should not automatically be assumed to be capable of supporting an HS-20 load solely based on its age or continued service. Non-destructive testing and/or load testing should be considered to verify capacity.

Once a baseline engineering judgment rating is determined, the LRE may compare simple-span shear, and moment demands generated by loads routinely carried by the bridge with those that are produced by legal loads. This comparison may help the LRE assess whether the bridge's historical usage provides a reasonable basis for load rating assumptions. This baseline assessment shall be re-evaluated for changes in condition or deterioration.

When field measurements are collected for primary structural components and are used to perform analytical load ratings, B.LR.04 is to be coded with respect to the load rating methodology used. B.LR.04 should not be coded EJ.

When an analytical approach is used based on assumed similar drawings or details, B.LR.04 is to be coded EJ.

When a bridge has been load rated using analytical methods, but the Owner has elected to post it for a weight limit that is less than the calculated safe posting load, it is not considered to have been load rated using engineering judgment. This is a posting decision, rather than a load rating methodology. The calculated load ratings shall be reported in BRADIN and the methodology used to calculate the load ratings shall be recorded for B.LR.04. The Owner's decision to post below the allowable safe posting load limits shall be documented in the load rating summary report and in the notes in BRADIN.

Load ratings that rely on engineering judgment require coordination between the Load Rating Engineer and the Bridge Inspector. This coordination ensures that the structure's observed performance under routine traffic conditions is appropriately reflected in the rating. Following any bridge inspection that shows a drop in the superstructure, substructure or culvert condition rating, the load ratings must be reviewed considering the updated bridge condition. This review verifies that the bridge continues to perform satisfactorily under the loads that engineering judgment has assumed it routinely carries.

The LRE shall report and document the basis for use of engineering judgment. The LRE's assessment should consider all available information to determine the load rating, including, but not limited to:

- **Year of construction and common material properties for that era,**
- **Assumed design load,**
- **All field measurable structure dimensions,**
- **Similar standard drawings as available,**
- **Load path redundancy,**
- **Level of risk,**
- **Deterioration levels and location,**
- **Results of any load testing,**
- **Physical evidence of distress such as transverse cracks in high moment regions or diagonal cracks in high shear regions, and**
- **Changes to the structure such as increased dead loads since original construction.**