

LOAD RATING – DEVIATION OF LRFR METHODOLOGY FOR INDOT STEEL BRIDGES

ABSTRACT

The design of bridges prior to 1994 was carried out by either the Load Factor Design (LFD) or the Allowable Stress Design (ASD) methodologies. Load rating of these bridges was primarily conducted by Load Factor Rating (LFR). In 1994, the American Association of State Highway and Transportation Officials (AASHTO) developed and encouraged the use of a probabilistic-based method titled Load and Resistance Factor Design (LRFD) for carrying out bridge design. A new methodology consistent with LRFD was also developed and adopted for conducting load rating. Thus, a new Load and Resistance Factor Rating (LRFR) was adopted by AASHTO in 2001 for load rating. Today, the bridges that were constructed by the old LFD methodology are rated by both LFR and LRFR. Continued development suggests that load rating in future will be based only on LRFR, therefore LRFR is the recommended method for carrying out load rating of bridges even if they were design by LFD.

The Indiana Department of Transportation (INDOT) came across some LFD designed bridges which were adequate by LFR methodology, i.e., produced a rating factor of more than 1.0, but inadequate for LRFR. The load ratings were carried out using AASHTOWare Bridge Rating (BrR) software. These bridges belonged to five different limit states: lateral torsional buckling, changes in cross-section along the member length, tight stringer spacings, girder end shear and moment over continuous piers.

This research study explores the inherent differences between LFR and LRFR to justify the inconsistencies in the rating values. To find an explanation for these discrepancies, load ratings of these bridges were carried out extensively on AASHTOWare BrR. To verify the results produced by BrR, a separate analysis was also conducted using Mathcad and structural analysis results from SAP2000 for comparison purposes. Finally, the study also recommends some modifications in the BrR software that can be adopted for each of the above-mentioned limit states to resolve inconsistencies found between LFR and LRFR rating values.