

COLORADO DEPARTMENT OF TRANSPORTATION STAFF BRIDGE BRIDGE RATING MANUAL	Section: 15 Effective: April, 1, 2011 Supersedes: None
SECTION 15 - LOAD AND RESISTANCE FACTOR RATING (LRFR)	

15-1 GENERAL LRFR POLICY

This section covers the Load and Resistance Factor Rating (LRFR) method. The LRFR method is required for all structures designed after October 1, 2010 using the AASHTO LRFD Bridge Design Specifications (LRFD). Refer to Section 1-4 in this manual for additional guidance on when the LRFR method is required.

The load rating for structures using the LRFR method shall be in accordance with the current AASHTO LRFD Bridge Design Specifications and, the AASHTO Manual for Bridge Evaluation except where superseded by this manual.

The rating shall include both moment and shear for all interior and exterior girders.

Excluding post-tensioned structures, rigid frames and culverts, the AASHTOWare Virtis software shall be used for all ratings using the LRFR method. The analysis engine for LRFR shall be the Virtis engine. The rating procedure for both in-house and consultant ratings shall be as described in Sections 1-11 and 1-12 on this manual. The rating package requirements shall be as described in Section 1-13 of this manual, except no deck rating is required for structures rated with LRFR.

The requirements for rerating due to design and field changes shall be as stated in Sections 1-17 and 1-18.

15-2 DEAD LOADS

Dead loads used for the LRFR method will be calculated in accordance with Section 1-1 of this manual.

15-3 LIVE LOADS

For Load and Resistance Factor Ratings (LRFR), the live load to be used for rating shall be as specified in the current AASHTO LRFD Bridge Design Specifications, the AASHTO Manual for Bridge Evaluation and the CDOT Staff Bridge Rating Manual.

15-4 IMPACT AND DRISTRIBUTION OF LIVE LOAD

The live load impact used for rating shall be as specified in the current AASHTO LRFD Bridge Design Specifications except as noted in Section 1-3 of this manual. Full impact shall be used for all ratings: HL-93 inventory, HL-93 operating, posting, and overload color code ratings.

For overload permit analysis (i.e., gross vehicle weight over 200,000 lbs) when reduced vehicle speed is enforced, impact may be reduced when crossing the structure.

15-4 IMPACT AND DISTRIBUTION OF LIVE LOAD (CONTINUED)

The live load distribution factors used for rating shall be as specified in the current AAHSTO LRFD Bridge Design Specifications and AASHTO Manual for Bridge Evaluation except as noted in Section 1-3 of this manual.

15-5 MATERIAL PROPERTIES USED TO DETERMINE BRIDGE RATINGS

Material properties shall be as specified on the as built plans. When as built plans are not available, Table 1-1 of this manual may be used.

15-6 LOAD FACTORS, CONDITION FACTORS AND SYSTEM FACTORS

The load factors used in the rating analysis shall be as specified in the current AASHTO Manual for Bridge Evaluation.

The ADTT used to select the Live Load factors shall be taken from the Structure Inspection and Appraisal sheet (SIA Sheet). The ADTT used in the analysis shall be recorded in the comments section of the Rating Summary Sheet. The value should be obtained using the following equation:

$$\text{ADTT} = \text{ADT} \times (\% \text{ Truck}/100)$$

Where: ADT is item 29 and
% Truck is item 109.

If the ADTT is unknown the most conservative table value should be used.

The condition factor for new bridges shall be taken as 1.0.

When re-rating existing structures using the LRFR method, the actual member condition as reported in the most recent inspection shall be used. The condition factor shall be adjusted as specified in the AASHTO Manual for Bridge Evaluation.

The system factor shall be as specified in the current AASHTO Manual for Bridge Evaluation.

15-7 POSTING VEHICLE RATINGS

When performing posting vehicle ratings, Section 1-15 shall be used as a guide except as amended in the following paragraphs.

If a structure rating indicates a need for posting (i.e. operating rating factor less than 1.0), the Staff Bridge Engineer will be notified for approval and generation of a formal letter to the Permit Office, Region RTD and Region Maintenance Superintendent.

Whenever the operating rating factor or the permit truck rating factor for a structural member is less than 1.0 the live load distribution factor may be adjusted using more refined analysis such as grid analysis. If the operating rating factor is still less than 1.0, the structural member shall be rated for the posting trucks. The inventory rating

15-7 POSTING VEHICLE RATINGS (CONTINUED)

shall not be adjusted from the values prescribed by the AASHTO LRFD Design Specifications.

The posting rating shall be computed using the Posting Vehicles shown in Figures 1-2, or 1-3. For mainline Interstate routes, or Interstate access ramps, the Posting Vehicles shown in Figure 1-3, shall be used. For all other routes, including Interstate business routes, the Posting Vehicles shown in Figure 1-2, shall be used.

Posting Vehicles are composed of the maximum vehicle loads allowed by Colorado law. The difference between the live loads in Figures 1-2, and 1-3, is due to the maximum legal loads allowed on Interstate highways being different from those allowed on other Colorado roadways.

The Notional Rating Load (NRL) and Lane Type Legal truck for spans greater than 200 feet as specified in the AASHTO Bridge Evaluation Manual shall be included in the posting analysis.

15-8 OVERLOAD COLOR CODE

The Overload Color Code rating shall be computed using the live load defined in Section 1-16. For span up to 200 feet, only the permit vehicle shall be considered present in the lane. For spans greater than 200 feet and when checking negative moments in continuous span bridges, an additional lane load shall be applied, see section 6A.4.5.4.1 of the Manual for Bridge Evaluation. For distribution of live load see Section 15-4 of this manual. Structures rated using LRFR shall use multi-lane live load distribution to determine overload color code.

15-9 REPORTING LRFR RATING RESULTS

When using the LRFR method, the reported value for the HL-93 load shall be the rating factor. For all other vehicles the reported values shall be in tons.

The results of rating calculations are to be reported by the Rater on the Rating Summary Sheet, CDOT Form 1187a Load and Resistance Factor Rating Summary, see Appendix A for copies of these forms and Section 1-13 for more detail. All ratings shall be reported to tenths of a ton or tenths of a rating factor for the HL-93 loading at inventory and operating levels.