

## **Bridge Load Capacity Rating Using the Load & Resistance Factor Rating (LRFR) Method**

### **General LRFR Load Rating Requirements**

The Federal Highway Administration (FHWA) has distributed requirements for load rating methods, & reporting procedures in the National Bridge Information System<sup>1</sup>. This document describes NMDOT procedures to meet the FHWA requirements.

The procedures give instructions for modeling, rating & reporting inventory- & operating-level rating factors using the HL-93 rating vehicle only. Additional rating procedures for legal loads & overloads will be developed at a later time

Abbreviations & Definitions – The following abbreviations are used in this document:

- MBE – *The Manual for Bridge Evaluation*, Current Edition, published by AASHTO.
- AASHTOWare BrR Program – *AASHTOWare Bridge Rating Program*, formerly known as *Virtis*.
- NMDOT Procedures – Chapter 11 of the *2013 NMDOT Bridge Procedures and Design Guide*.
- LRFR – Load & Resistance Factor Rating method defined in Section 6A of the MBE.
- LRFD – Load & Resistance Factor Design method.

As of the date of this document, the NMDOT requirements with regards to rating methods & bridge types are as follows:

- New bridges that are designed using the Load & Resistance Factor Design method after September 30, 2010 – Rate & report load ratings using both the traditional Load Factor Rating (LFR) method & the LRFR method.
- All others (existing bridges) – For existing bridges with no pending action & bridges for which rehabilitation or widening is proposed, rate & report load ratings using the traditional Load Factor Rating (LFR) method only.

Perform LRFR ratings as follows:

- In accordance with the MBE & NMDOT procedures.
- Use standard LRFR load & resistance factors per the MBE without modification.
- Use the AASHTOWare BrR Program for modeling & final rating determination (unless otherwise authorized by NMDOT).

Additional guidance & detailed NMDOT rating examples are located on NMDOT's public website at the following address:

[http://dot.state.nm.us/en/Bridge\\_Management\\_Toolbox.html#Load\\_Capacity](http://dot.state.nm.us/en/Bridge_Management_Toolbox.html#Load_Capacity)

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<sup>1</sup> Mr. Lwin's memorandum entitled "INFORMATION: Bridge Load Ratings for the National Bridge Inventory", dated October 30, 2006.

## **AASHTOWare BrR Program Modeling & Rating**

This section includes additional items & procedures necessary to enable LRFR modeling & analysis for models that are otherwise ready for LFR analysis. Refer to previous NMDOT guidance & documents for LFR modeling & rating procedures. Information is presented for common prestressed concrete girder (PSC) & steel girder bridges only.

Note: All program input items are *italicized* below.

### 1. Additional Model Input Items for All PSC & Steel Bridges

- a. *Factors, LRFR* – Do not use this item

*Note: Standard MBE load factors are specified in the program library & used by default. The above Factors, LRFR item is used to override default values.*

- b. Superstructure Definition

- i. *[Superstructure Name], Specs* – Ensure that AASHTO LRFR is specified for the *LRFR Analysis Method Type*.
- ii. *Structure Typical Section, Deck (Cont'd)* – Input *Deck exposure factor* (1.00).
- iii. *[Member Alternative], Member Alternative Description* – Ensure that AASHTO LRFR is specified for the *LRFR Analysis Method Type* (all member alternatives).
- iv. *Live Load Distribution, LRFD* – click *Compute from Typical Section...* (all member alternatives).
- v. *Deck Profile, Deck Concrete* – Ensure that *Start Effective Flange Width (LRFD) & End Effective Flange Width (LRFD)* values are present.
- vi. *Deck Profile, Reinforcement* – Input *LRFD Bar Count* values.

*A Note Regarding Effective Flange Widths & Bar Counts: The LRFR & LFR Effective Flange Widths can differ in value for the same member due to differences in definition from the specifications. This difference affects the LRFR & LFR bar counts in that each must be based on the respective effective flange widths.*

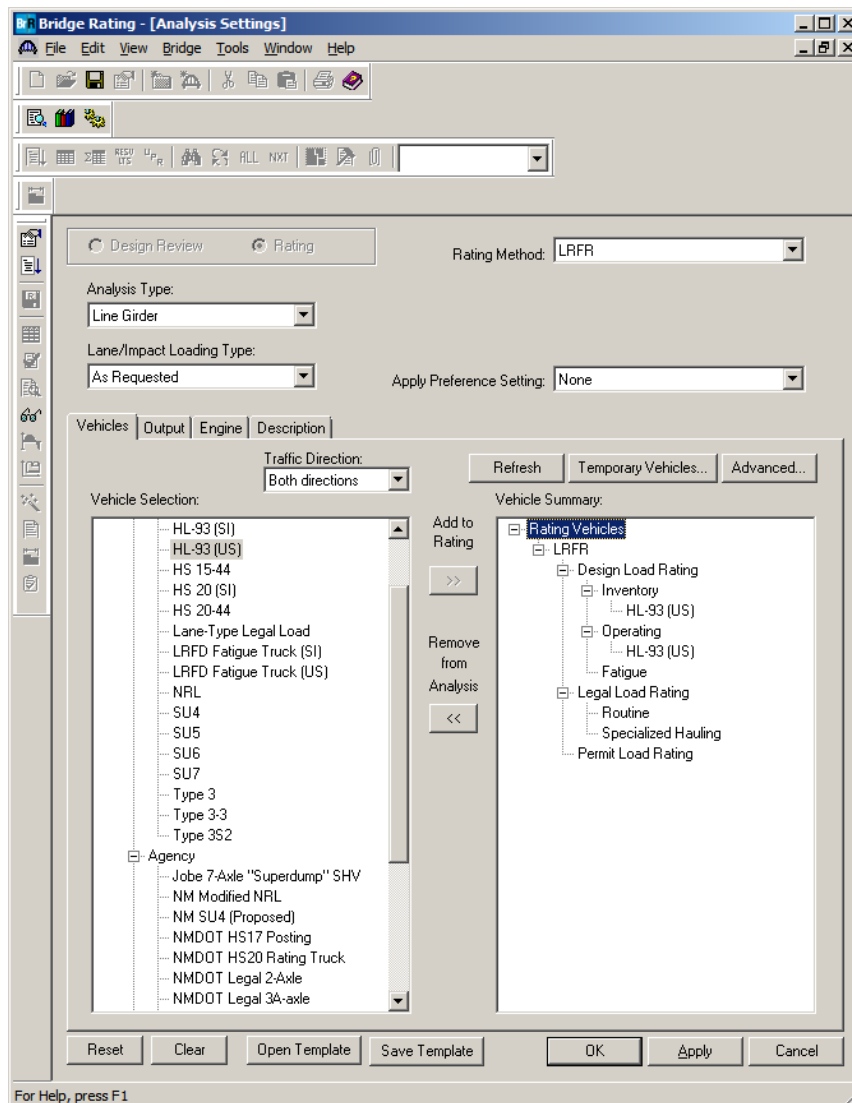
*As an example, assume that for an interior member the girder spacing is 8'-0" = 96". The LRFR Effective Flange Width is therefore 96", but the LFR Effective Flange Width may be a smaller value (say 90") based on other specification limits. In this case, the LFR Bar Count must be based on the reduced 90" width whereas the LRFR Bar Count is based on the full 96" width.*

### 2. Additional Model Input Items for PSC Bridges (in addition to 1. above)

- a. *Superstructure Definition*

- i. *Stress Limits* – Ensure that all LRFD allowable stress values are present.
- ii. *Beam Details, Slab Interface* – Ensure that appropriate LRFD values are present (all member alternatives).

3. Additional Model Input Items for Steel Bridges (in addition to 1. above)
  - a. *Superstructure Definition*
    - i. *Connectors, Bolt Definitions* – If a bolt definition is required, use the *Compute from library...* button to generate LRFD strength values.
    - ii. *Connectors, Weld Definitions* – For each definition, assign an LRFD fatigue category. The program will generate the *LRFD strength value* based on user input.
    - iii. *Shear Connector Definitions* – Enter a value for the *LRFD Steel minimum tensile strength*.
  
4. Program Analysis Settings for All PSC & Steel Bridges – Select LRFR for the *Rating Method* & the HL-93 (US) vehicle for inventory- & operating-level rating under *Vehicle Summary* (see figure below). Then rate the bridge (or member) as normal:



*Note Concerning Fatigue-level Rating:*

*PSC Bridges – Fatigue rating does not apply; ensure that this item is blank under Vehicle Summary.*

*Steel Bridges – Inventory-level rating only is required if fatigue-prone (Category C or lower) details are present. Refer to MBE, Section 6A.6.4.1.*

5. Reporting Format

- a. Bridge Rating Form – Enter LRFR HL-93 rating factors in the designated locations on the form.
- b. Contract Plans – Show rating data on the General Notes sheet of the bridge plans in the following format:

LFR RATINGS	
INVENTORY RATING	HS XX.X
OPERATING RATING	HS XX.X

LRFR RATING FACTORS	
INVENTORY-LEVEL	XX.X
OPERATING-LEVEL	XX.X

THESE RATINGS WERE COMPUTED BY THE LOAD FACTOR RATING (LFR) AND LOAD AND RESISTANCE FACTOR RATING (LRFR) METHODS USING THE AASHTOWARE BRIDGE RATING PROGRAM VERSION XX.X.