• AASHTO Adopted the LRFR Manual to replace the 1994 *Manual for Condition Evaluation* with the following modifications:

  • Change title to “The Manual for Bridge Evaluation (MBE)”
  • Include Load Factor and Allowable Stress ratings in a new section in the Manual.
  • No priority will be placed on any rating method.
  • Include new legal loads for rating & posting.
  • Update to be consistent with LRFD Fourth Edition.
### MBE Sections

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<td>Non-Destructive Load Testing</td>
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Appendix A: Illustrative Examples

### Section 6. Load Rating

Section 6 is organized in two parts as follows:

- **PART A** — LRFR
- **PART B** — Allowable Stress & Load Factor Ratings
Section 6. Load Rating

The Interims for 2005 and 2006 for all three rating methods have been incorporated.

LRFR rating provisions have been updated to be consistent with the fourth edition of the LRFD Design Specifications.

Includes LRFR provisions for Concrete Segmental Bridges & Steel Curved Girder Bridges.

Includes new AASHTO legal loads for rating & posting – Notional Rating Load NRL, SU4, SU5, SU6, SU7

2005 REVISIONS TO AASHTO LOADS

NOTIONAL RATING LOAD NRL

- GVW = 80 KIPS
- V — 6’0” TO 14’-0”. SPACING
- AXLES THAT DO NOT CONTRIBUTE TO THE MAXIMUM LOAD EFFECT UNDER CONSIDERATION SHALL BE NEGLECTED.
2005 AASHTO REVISIONS

ADOPTS NEW POSTING LOADS RECOMMENDED BY NCHRP 12-63

SU4 TRUCK
GVW = 54 KIPS

SU5 TRUCK
GVW = 62 KIPS

ADOPTS NEW POSTING LOADS RECOMMENDED BY NCHRP 12-63

SU6 TRUCK
GVW = 69.5 KIPS

SU7 TRUCK
GVW = 77.5 KIPS
LRFR STEEL BRIDGE RATING

A-6.6.1 Scope
The provisions of this section apply to components of straight or horizontally curved I-girder bridges and straight or horizontally curved single or multiple closed-box or tub girder bridges.

CURVED STEEL BRIDGES

6A.6.9.7 Diaphragms and Cross-Frames

Diaphragm and cross-frame members in horizontally curved bridges shall be considered to be primary members and should be load rated accordingly.
LRFR Timber Bridge Rating Provisions

- Timber base resistance values have been changed in LRFD fourth edition to make it consistent with NDS 2005
- Strength specified in terms of allowable stress, even for LRFD.
- Dynamic Load Allowance has been taken out
- Major changes to resistance adjustment factors

LRFR Timber Bridge Rating

LRFD 3rd Edition with 2006 Interims

\[ F_b = F_{bo} C_{KF} C_M \left( C_F \text{ or } C_T \right) C_{Fb} C_{CI} C_{Da} C_{\lambda} \]

**LRFD Eq. 8.4.4.1-1**

- **\( F_{bo} = 1.25 \text{ Ksi} \)** Reference Design Value
- **\( C_{KF} = 2.5 / \phi = 2.5 / 0.85 = 2.94 \)** Format Conversion Factor
- **\( C_M = 1.0 \)** Wet service factor
- **\( C_F = 1.0 \)** Size Effect factor for sawn lumber
- **\( C_m = 1.0 \)** Flat Use Factor
- **\( C_i = 0.8 \)** Incising Factor
- **\( C_d = 1.0 \)** Deck Factor
- **\( C_\lambda = 0.8 \)** Time Effect Factor for STRENGTH I

\[ F_b = 1.25 \times 2.94 \times 1.0 \times 1.0 \times 0.8 \times 1.0 \times 0.8 \]

Adjusted Design Value = 2.35 Ksi
The load-rating capacity of post-tensioned concrete segmental bridges shall be checked in the longitudinal and transverse direction.

*It is possible for transverse effects in a typical segmental box section to govern a load rating for a bridge.*

### GENERAL RATING REQUIREMENTS

The number of live load lanes may be taken as the number of striped lanes.

### SERVICE LIMIT STATES

- Service I and Service III limit states are mandatory for load rating of segmental concrete box girder bridges.
- Service III limit state specifically includes the principal tensile stress check of LRFD Design Article 5.8.6 with a stress limit of $0.126\sqrt{f_{c}}$.
- The principal tensile stress check is necessary in order to verify the adequacy of webs of segmental box girder bridges for longitudinal shear and torsion.
- The number of live load lanes may be taken as the number of striped lanes.
\[ RF = \frac{\phi_c \phi_s (R - \gamma_{DC} DC - \gamma_{DW} DW)}{\gamma_L (LL + IM)} \]

\[ \phi_c \phi_s \geq 0.85 \]

\( \phi_s \) SYSTEM FACTOR FOR REDUNDANCY (0.85 to 1.0)

\( \phi_c \) CONDITION FACTOR

In the context of post-tensioned segmental box girders, the system factor must properly account for a few significant and important aspects different than other types of bridges:

- Longitudinally continuous versus simply supported spans,
- The inherent integrity afforded by the closed continuum of the box section,
- Multiple-tendon load paths,
- Number of webs per box, and
- Types of details and their post-tensioning.
**SYSTEM FACTOR $\phi_s$**

- SYSTEM FACTORS FOR THE DESIGN OF SIMPLE AND CONTINUOUS SEGMENTAL BRIDGES WITH A MINIMUM OF 4 TENDONS PER WEB COULD BE AS HIGH AS 1.10 AND 1.20, RESPECTIVELY (NCHRP Report 406).

- LONGITUDINAL CONTINUITY IS RECOGNIZED THROUGH THE SIMPLE CONCEPT OF THE NUMBER OF PLASTIC HINGES NEEDED TO FORM A COLLAPSE MECHANISM:

- A SYSTEM FACTOR FOR TRANSVERSE FLEXURE OF 1.0 IS APPROPRIATE.

---

**LRFR System Factors for Longitudinal Flexure in Segmental Concrete Box Girder Bridges.**

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Span Type</th>
<th># of Hinges to Failure</th>
<th>System Factors ($\phi_s$)</th>
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<tr>
<td></td>
<td></td>
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<tr>
<td>Precast Balanced Cantilever</td>
<td>Interior Span</td>
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<td>0.90</td>
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<tr>
<td>Type A Joints</td>
<td>End or Hinge Span</td>
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<td>0.85</td>
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<tr>
<td>Statically Determinate</td>
<td>1</td>
<td>n/a</td>
<td>0.90</td>
</tr>
<tr>
<td>Precast Span-by-Span</td>
<td>Interior Span</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Type A Joints</td>
<td>End or Hinge Span</td>
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<td>n/a</td>
</tr>
<tr>
<td>Statically Determinate</td>
<td>1</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Precast Span-by-Span</td>
<td>Interior Span</td>
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<tr>
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