• T-16 June 25, 2018
• LRFD Bridge Design Specifications Section 10, Article 10.7.8 - FYI
AASHTO T-16

2018 AASHTO BRIDGE COMMITTEE AGENDA ITEM: 18

SUBJECT: LRFD Bridge Design Specifications: Section 10, Article 10.7.8

TECHNICAL COMMITTEE: T-15 Substructures and Retaining Walls

☐ REVISION ☐ ADDITION ☐ NEW DOCUMENT
☐ DESIGN SPEC ☐ CONSTRUCTION SPEC ☐ MOVABLE SPEC
☐ MANUAL FOR BRIDGE EVALUATION ☐ SEISMIC GUIDE SPEC ☐ MANUAL BRIDGE ELEMENT INSP
☐ OTHER Click here to enter text

DATE PREPARED: 1/2/2018
DATE REVISED: Click here to enter a date

AGENDA ITEM:

In Article 10.7.8, revise Equation 10.7.8-7 as follows:

\[
\sigma_{dr} = \varphi \cdot (2.6f_{ce})
\]  

(10.7.8-7)

OTHER AFFECTED ARTICLES:

None

BACKGROUND:

In previous Allowable stress design practice, \( \sigma_{dr} = 3(F_{ce}) \). During a previous update of the Section 10, Article 10.7.8, Equation 10.7.8-7 was adjusted to remove a factor of 3. This appears to have been done to accommodate an issue in translation of the driving stress equation from allowable stress design to load and resistance factor design. The change in the equation results in a driving stress for timber piles that is greatly reduced from successful past practice, and limits potential use in transportation applications. To be consistent with that previous practice, considering the currently specified resistance factor in Article 8.5.2.2 of 1.15, need a coefficient of \( 3/1.15 = 2.6 \) to restore the equation to be consistent with past practice. The proposed equation has been modified to bring the equation into alignment with past practice without affecting any other articles in the design specifications.
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(10.7.8-7)
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• Wisconsin DOT regarding the Wet Service Factor $C_M$, affecting the permissible bending stress.

1. Various codes (AASHTO Standard Specs 2002, the most recent AASHTO LRFD, NDS versions in 2015 and 2018) all say to use $C_M=1.0$ for flexure when $(F_b)(C_F) \leq 1150$ psi, otherwise $C_M=0.85$. 
Wet Service Factor, $C_M$

When dimension lumber is used where moisture content will exceed 19% for an extended time period, design values shall be multiplied by the appropriate wet service factors from the following table:

<table>
<thead>
<tr>
<th>Wet Service Factors, $C_M$</th>
<th>$F_b$</th>
<th>$F_l$</th>
<th>$F_v$</th>
<th>$F_{e-1}$</th>
<th>$F_c$</th>
<th>$E$ and $E_{min}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.85*</td>
<td>1.0</td>
<td>0.97</td>
<td>0.67</td>
<td>0.8**</td>
<td>0.9</td>
</tr>
</tbody>
</table>

* when $(F_b)(C_k) \leq 1,150$ psi, $C_M = 1.0$

** when $(F_c)(C_k) \leq 750$ psi, $C_M = 1.0$

- 2018 NDS
AASHTO T-16 Glulam

- Wisconsin uses with 3x12 laminations, so $C_F = 1.0$. Usually the species is Douglas Fir-Larch, No. 1 & Better. In the most recent versions of NDS and AASHTO LRFD, $F_b = 1200$ psi. However, in older codes such as the AASHTO 2002 Standard Specifications, $F_b = 1150$ psi. The 1200 psi value at least goes back to 2005, which is the version (year) of NDS specifically referenced by the MBE and its ASR load rating example.

- Due to the $(F_b)(C_F) \leq 1150$ psi threshold, the calculations using $F_b = 1200$ psi actually result in a lower load rating then if one were to use $F_b = 1150$ psi. The threshold of 1150 psi seems somewhat arbitrary; do you know the history?
Wisconsin is suggesting this reduction in calculated capacity is likely an unintended consequence of changing the tabulated design values. Seems there should be a provision that says something like \((C_M)(F_b)(C_F)\) should not be less than 1150 psi when \((F_b)(C_F)\) is between 1150 psi and 1350 psi. Otherwise bridges adequately designed and in good condition using use \(F_b = 1150\) psi have lower load ratings and will require load postings due to the increase in tabulated \(F_b\) from 1150 psi to 1200 psi.

How could we go about coordinating a change as suggested by Wisconsin with NDS and thus a resulting change in AASHTO?