AASHTO T-14
2014 Agenda Items
Proposed Revisions to LRFD BDS Section 6

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Agenda Item 20
Article 6.4.9

• Description:
  • Add new Article 6.4.9 on ‘Dissimilar Metals’.
  • Intent is to prevent galvanic corrosion when steel components, including those made of stainless steel, are coupled with aluminum in presence of an electrolyte.

• Background:
  • Proposed revision a result of two failures (March 2011 and September 2012) of lighting fixtures in highway tunnels.
  • Guidelines for full and hybrid use of stainless steel for bridge girders to eventually be developed and added.
Agenda Item 21
Articles 6.6.1.2.1, 6.6.1.2.3 & 6.11.5

- Description:
  - Article 6.6.1.2.1 -> clarification to indicate that when the specified conditions are met, all dead load and live load stresses and live load stress ranges for fatigue design at all sections due to loads applied to the corresponding composite section may be computed assuming the concrete deck to be effective for both positive and negative flexure.

  - Article C6.6.1.2.1 -> clarification of the calculation of the stress or torque range in cross-frame members using refined analyses to check fatigue on members subject to a net tensile stress.
    - Fatigue truck should be confined to one critical transverse position per each longitudinal position throughout the length of the bridge in the analysis.
    - Suggested factor of 0.75 applied to stress range caused by two different transverse positions over adjacent girders removed.
Agenda Item 21
Articles 6.6.1.2.1, 6.6.1.2.3 & 6.11.5 – cont’d

• Table 6.6.1.2.3-1 -> revision to Condition 4.1 to add case where groove welds may be used to connect a bearing stiffener to a flange. Although not a recommended detail, fatigue category is Category C’.

• Articles 6.11.5 & C6.11.5 - > revisions to refer back to the recommendation in Article C6.6.1.2.1 when calculating the stress range for checking load-induced fatigue, and the torque range for computing fatigue due to cross-section distortion, in cross-frame members in box girders.
Agenda Item 22
Article 6.6.2

Description:

- Articles 6.6.2 & C6.6.2 -> revision to ensure that contract documents reference the AASHTO M270 (ASTM A 709) specification, rather than Table 6.6.2-2, to ensure that latest Charpy V-notch requirements are used.
  - Table 6.6.2-2 moved to Commentary and retained for information purposes.

- Article 6.6.2 -> revision to exempt bearing sole plates from FCM requirement.
  - Sole plates welded to tension flanges typically in regions of low (to zero) tensile stress.
  - Components likely to be field welded, and a FCM designation of the welds can result in complications in the field welding.
  - Similar revision recently made in the AREMA Specification.
Agenda Item 23  
Article 6.10.3.4  

- Description:  
  - Provides guidelines for checking the global stability of spans of slender unsupported straight or horizontally curved I-girder bridge erected units (i.e. with 3 or fewer girders) in their non-composite condition during the deck placement operation when:  
    - Unit not braced by other structural units and/or by external bracing within the span; and  
    - Unit does not contain any flange level lateral bracing or lateral bracing from a hardened concrete deck within the span.  

- Intent is to avoid excessive 2nd order amplification of the lateral and vertical displacements of these units during deck placement.  
- Global buckling refers to buckling of the bridge unit as a structural unit, and not buckling of the girders between cross-frames.
Agenda Item 23
Article 6.10.3.4 – cont’d

• For the span under consideration, the sum of the largest total factored positive girder moments during the deck placement should not exceed 50% of the elastic global lateral-torsional buckling resistance of the span acting as a system.
  ➢ Theoretically limits amplification under the nominal loads to a maximum value of approximately 1.5.
  ➢ Equation from Yura et al. (2008) provided in the specification to estimate the elastic global lateral-torsional buckling resistance (eigenvalue buckling analysis or global 2nd order load-deflection analysis may be used instead).
  ➢ Equation not intended for I-girder spans in their composite condition or I-girder units with more than 3 girders.
  ➢ Where girders are nonprismatic or vary across the unit, length-weighted average moments of inertia within the positive moment sections of all the girders in the span may be used.
Agenda Item 23
Article 6.10.3.4 – cont’d

• Should the sum of the largest total factored positive girder moments during the deck placement exceed 50% of the elastic global lateral-torsional buckling resistance:
  ➢ The addition of flange level lateral bracing adjacent to the supports of the span may be considered;
  ➢ The unit may be revised to increase the system stiffness; or
  ➢ The amplified girder 2nd order displacements of the span may be evaluated to verify they are within tolerances permitted by the Owner.

• Where the girder spacing is less than the girder depth, it is recommended that the more general global buckling equation in Yura (2008) be used.
Agenda Item 24
Article 6.12.2.2.4

- Description:
  - Revisions are made to the flexural design provisions for tees and double angles as follows:
    - The upper limit of $M_p$ is removed from the lateral torsional buckling resistance equation to avoid confusion as to whether or not the upper limit of $1.6M_y$ applies when the stem is in tension should yielding control the flexural resistance.
    - A separate equation is introduced for calculating the inelastic local buckling resistance of the compression flange of double angles loaded in the plane of symmetry. The equation is the inelastic local buckling equation for single-angle legs taken from AISC (2010), which may be conservatively applied for this case according to AISC (2010).
    - The local buckling check for the stem in compression is removed because the check is considered redundant. Lateral-torsional buckling and local buckling of the stem are essentially the same phenomenon for these sections.
Agenda Item 25
Various Articles

Description:

New Articles 6.9.6 & 6.12.2.3.3: Provide an improved alternative design approach for circular composite concrete filled steel tubes (CFSTs) subject to axial compression or combined axial compression & flexure.

- For use as bridge piers, piles, drilled shafts and other structural elements in applications where fill plastic hinging of the composite section under a seismic event is not a concern.
- For piers, permits more rapid construction since no formwork or internal reinforcement is required. Less weight and material needed.
- First major proposed update of CFST provisions in the AASHTO LRFD BDS. Proposed provisions are based on other provisions used for CFST construction and the vast body of experimental results on composite CFSTs developed worldwide over the past 25 years, including significant research conducted recently by Roeder and Lehmann at the Univ. of Washington.
Agenda Item 25
Various Articles – cont’d

- Initial proposal soundly defeated at the 2013 AASHTO SCOBS meeting in Portland, OR – back to the drawing board! Responded to helpful comments primarily from AK, CA and MN.
  - Removed proposed connection details.
  - Retained current design provisions for composite columns in Articles 6.9.5 & 6.12.2.3.2, and postured the proposed provisions as an alternative design approach in new Articles 6.9.6 & 6.12.2.3.3.
  - Explicitly disqualified the proposed provisions for applications where full plastic hinging of the composite section during a seismic event is expected to occur – refer to LRFD Guide Specs for LRFD Seismic Bridge Design instead (Article 7.6).
  - Allowed the use of either the Plastic Stress Distribution Method (PSDM) or the Strain Compatibility Method (SCM) for determining the nominal flexural composite resistance of the CFST in the presence of axial load – used to determine a material-based interaction curve (no consideration of buckling).
Agenda Item 25
Various Articles – cont’d

- Proposed shear requirement removed in favor of existing requirement in Article 6.12.3.2.2.
- Addressed concerns related to the specification of the material requirements.
- Evaluated and incorporated numerous suggested editorial comments and enhancements.
- Added the numerous required revisions to the Notation List in Article 6.3.

• The proposed provisions are not perfect...but represent a significant update of provisions that have not been examined or addressed in the specification in 22 years. The provisions merely suggest an improved alternative design approach. They provide a framework for potential future enhancements and developments as additional research is conducted on these efficient members.
Agenda Item 26
Various Articles

• Description:
  • Article 6.10.9:
    - Revisions are made to clarify the definitions & application of the shear-yielding resistance, shear-buckling resistance and post-buckling shear resistance due to tension-field action.
    - Definitions for Web Panel, End Panel and Interior Panel added in Article 6.2.
  • Article 6.10.11.1.3:
    - Revisions are made to clarify and streamline the application of the equations for determining the minimum required moment of inertia of a transverse stiffener adjacent to one or more panels subject to tension-field action – current language left room for potential mixing and matching of the shear resistances of the adjacent panels, which was not the intent.
Agenda Item 27
Section 11, Articles 11.4.3.1 & 11.4.8.1.1 (w/ T-4)

• Description:
  • Article 11.4.3.1:
    ➢ Disqualifies fillers, secondary members, gusset plates, cross-frame connection plates and web splices from the requirement to cut and fabricate steel plates so that the primary direction of rolling is parallel to the direction of the main tensile and/or compressive stress.
    ➢ Operation is inefficient and more costly and is not critical to the structural performance of the plates.

  • Article 11.4.8.1.1:
    ➢ Allows for punching of holes in fillers, including those used in connections of fracture-critical members (FCMs). Large and thin fillers are difficult to drill. Consequences of cracking in service of fillers are not expected to be significant.
Description:

Article 11.5.6.4.1:

- Requires that the bolt length used be such that the end of the bolt is flush with or extends beyond the outer face of the nut after proper installation (with no minimum required projection specified) – language taken from Section 2.3.2 of the RCSC Specification.
- Specifying a minimum required length projection can result in a reduction in the threads within the fastener grip, which reduces the fastener rotational capacity – may cause fracture of the bolts during installation, reduced clamping force, or jamming of the nut against the thread run-out on the bolt.
- Extension of the bolt beyond the nut has no effect on bolt shear or tension capacity.
- Three full threads within the grip is sufficient to provide the required ductility; up to two flat washers may be used under either or both the head and the nut to provide additional threads within the grip.
Agenda Item 29
Updates to AASHTO/NSBA Collaboration Documents

• G13.1 – Guidelines for Steel Girder Bridge Analysis
  ➢ TG 13 chair: Domenic Coletti, HDR

• G10.1 – Steel Bridge Erection Guide Specification
  ➢ TG 10 chair: Jamie Farris, TxDOT

• G8.1 – Guide Specification for Application of Coating Systems with Zinc-Rich Primers to Steel Bridges
  ➢ TG 8 chair: Tom Calzone, Carboline