IF YOU'VE EVER ASKED YOURSELF "WHY?" about something related to structural steel design or construction, *Modern Steel Construction*'s monthly Steel Interchange column is for you! Send your questions or comments to solutions@aisc.org.

CB Series Beams

Can you tell me the F_y and allowable stress that the CB series beams were designed for?

That would depend on the year of the design and material production. This CB-shape designation was largely used in the late 1920s and early 1930s when the ASTM A9 minimum yield point was 33 ksi and the basic AISC allowable working stress was 18 ksi. The AISC basic working stress was revised to 20 ksi in 1936. If you have a date for the project, you may want to verify the exact time of the construction.

AISC Design Guide 15 is a reference for historic shapes and specifications. This guide contains listings of which ASTM material standards were in effect during a specific period of time, as well as which AISC specifications were in effect. Design guides are available free to AISC members at **www.aisc.org/epubs**.

AISC has also developed a historic specifications CD, which is available as a free download for AISC members and ePubs subscribers at **www.aisc.org/epubs**.

There was an article published in the February 2007 issue of *Modern Steel Construction* (**www.modernsteel.com/archives**) called "Evaluation of Existing Structures." This article also includes historical information of this nature.

Kurt Gustafson, S.E., P.E.

Drilled-in Anchors

When drilling for post-installed anchors in a concrete support for a steel beam, we encountered embedded reinforcing bars at the intended anchor locations. Is it advisable to cut through the rebar to accomplish anchor installation?

Generally, it is not advisable to cut the rebar; but the question should really be directed to the responsible design professional for the project.

When using drilled anchors into reinforced concrete, it is quite common to locate rebar by means of a "rebar locator meter" prior to the drilling operation. Then, depending on the findings, adjustments may need to be made in the anchor pattern. This should all be coordinated with the responsible design professional.

Kurt Gustafson, S.E., P.E.

Historic Section Properties

I need to know the section properties of several shapes. I seem to be having difficulty because these seem to be old shapes. The sections are W14×311, W14×287, W14×246, and W14×167. Can you help?

You appear to have a mixture of new and old shapes. The section properties for the W14×311 are listed in Table 1-1 of the current 13th edition *Steel Construction Manual*. You will find the section properties for the other three shapes in the 7th edition AISC manual. The CD that is issued as part of the 13th edition manual contains the AISC Shapes Database v13.0 and 13.0H (the H is for "historic"). Look in the Historic ASD7 section for those shapes. Similar information can also be found in AISC Design Guide 15.

Kurt Gustafson, S.E., P.E.

Use of Grade 65 Steel

Do you have a safety factor on the material, particularly on grade 65 steel, when you design according to ASD or LRFD?

There are inherent safety factors built into the specification strength equations regardless of the material type, for both ASD and LRFD. The AISC specification does not place safety factors on the material type, but rather on the limit state being considered. Note that only certain materials are listed for use under the auspices of the specification. See Section A3 for those listings. The yield strength (F_y) and ultimate strength (F_u) of the material is used in the nominal strength Equations where applicable.

Kurt Gustafson, S.E., P.E.

Pretension for TC Bolts

When installing a tension controlled bolt (TC bolt), what pretension force should be induced in the bolt?

If the TC bolt is an ASTM F1852, it is equivalent to an ASTM A325. If the TC bolt is an ASTM F2280, it is equivalent to an ASTM A490. See Table 8.1 in the RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts* (**www.boltcouncil.org**) for minimum bolt pretension. Note that ASTM F2280 is a new designation that was not available at the time of the current RCSC specification development, and thus is not included in the table heading under the ASTM A490 Bolts.

Kurt Gustafson, S.E., P.E.

Remediation for Deflection Problems

I have seen many articles on how to reinforce an existing beam for strength, but none appear to go over deflection issues. Do you know of a resource that discusses how to analyze and determine appropriate reinforcing for an existing steel beam that has adequate strength but fails deflection criteria?

I do not know of a resource that discusses this, but can share the following thoughts. Deflection criteria are project-specific requirements based on serviceability needs. If you have a beam that is deflecting more than your criteria allows, you may need to remove some of the dead load prior to adding the reinforcing. Depending on the magnitude of the deflection, you may also need to consider introducing camber by some means such as heat cambering or jacking. This requires an engineering evaluation to determine in-place loads at the time of reinforcement, curvature shape of the beam, and anticipated additional deflection due to future loads after the reinforcing is added.

Kurt Gustafson, S.E., P.E.

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One-third Stress Increase

I have reviewed the AISC specification (AISC 360-05) and the AISC seismic provisions (AISC 341-05) for allowable stress increases with wind or seismic loads. I cannot find any references in these documents. Is there something I am missing, or are no stress increases allowed for wind or seismic loads?

The AISC specification no longer permits the one-third stress increase. Use of the increase stopped with the 1989 ASD specification Supplement No. 1. There is no permitted stress increase on the capacity side of the design equation for steel. The ASCE 7 load standard only permits such increase if it is justified by structural behavior caused by rate of duration of load, which is not usually appropriate for steel design.

There have been several articles written on this subject over the past several years, including "The One-Third Stress Increase: Where it is Now" (MSC, October 2003, **www.modernsteel.com/archives**).

Amanuel Gebremeskel, P.E.

Stiffness Reduction Factors

Why are the stiffness reduction factors in Table 4-21 of the 13th edition manual different than those in Table 4-1 of the LRFD 3rd edition manual?

The 1999 LRFD specification (and its equations) was based on the LRFD load approach only, while the current 2005 specification is based on a unified approach that includes both the LRFD and ASD load approaches. The τ in the 1999 LRFD specification was based on Equation (C-C2-3), which includes P_u, the factored design load. The τ_a in the 2005 specification is based on Equation (C-C2-12), which includes P_n, the nominal strength. This slight difference causes the difference you noted. See the Commentary to Section C2 of the 2005 specification for explanation of the derivation.

Kurt Gustafson, S.E., P.E.

Single-Angle with Single-Bolt End Connection

I am trying to use the AISC 13th edition manual to design a single-angle member for a compression brace with one bolt through a leg at each end. This is a commonly used brace in the automotive industry for bracing conveyors and falling parts guards. There is usually very little load that must be resisted, and historically angles such as L2½×2½×¼ have been used. These braces often have a Kl/r_z that is greater than 200. I have looked at Section E5, but this requires two bolts at each end and limits Kl/r to 200.

First, note that the 2005 AISC specification is written with building structures in mind. The 200 limit on Kl/r for a compression member is a recommendation and no longer a requirement. However, when using the simplified method of Section E5 (i.e., ignoring eccentricity on an axially loaded member) you may elect to use the modified slenderness equations; but in this case Kl/r is strictly limited to 200. While connections with a single bolt are not explicitly prohibited, the parameters for such connections are not specifically discussed in the 13th edition manual.

Amanuel Gebremeskel, P.E.

R = 3.0 in SDC D?

In the AISC seismic provisions (AISC 341-05) there is a discussion for R = 3. As I read the discussion, I understand that if I have a structure in seismic design category D and R = 3, I still have to follow the provisions of AISC 341-05. What I would like to do is reduce the R factor, which increases the base shear, and then not follow the stringent requirements of AISC 341-05.

Such a procedure is not permitted for categories D, E, and F by the ASCE 7 load standard. The AISC *Seismic Provisions* do not define the design parameters that are to be followed; they are defined by the applicable building code or the ASCE 7 load standard. The classification of building structures, as covered by ASCE 7-05, Table 12.2-1, subsection H—where AISC 341-05 need not be followed when R = 3.0 is used—is limited to seismic design categories A, B, and C. If a structure is categorized in seismic design category D or above, this classification does not apply.

Kurt Gustafson, S.E., P.E.

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Steel Interchange is a forum to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Opinions and suggestions are welcome on any subject covered in this magazine.

If you have a question or problem that your fellow readers might help you solve, please forward it to us. At the same time, feel free to respond to any of the questions that you have read here. Contact Steel Interchange via AISC's Steel Solutions Center:

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