If you've ever asked yourself "Why?" about something related to structural steel design or construction, *Modern Steel*'s monthly Steel Interchange is for you! Send your questions or comments to **solutions@aisc.org**.

steel interchange

*All AISC Design Guides mentioned can be found at **www.aisc.org/dg**. All other AISC publications, unless mentioned otherwise, refer to the current version and are available at **www.aisc.org/specifications**.*

Stability of Beams During Erection

We are erecting a framed structural steel building with long, slender beams. The beams have significant camber. During erection the beams are acting more like open web joists than beams. As soon as a beam is released from the crane, it bows out to the side resulting in a need for temporary bracing to keep the beams "straight." The design engineer has confirmed that the beams are structurally adequate once the slab on metal deck is poured. Is there a way to anticipate such erection issues?

Yes. Page 37 of Design Guide 23: *Constructability of Structural Steel Buildings* provides guidance. It states: "Most girders, as designed, are stable only when their compression flange is laterally supported... As a rule of thumb, most girders with *l/b* less than 80 will be stable during erection; for values greater than 80, the erector should consider some form of temporary support during and/or after the lift. Note that this ratio is not a substitute for an engineering analysis." The presence of camber will also tend to make the beams less stable since it effectively raises the application of load.

Pretensioned Bolts in Moment End Plates

I have designed moment end plate connections using the procedure in AISC Design Guide 16: *Flush and Extended Multiple-Row Moment End-Plate Connections*, which allows the use of snug-tight F3125 Grade A325 bolts. The erector has installed tension control (TC) bolts, which are fully tensioned. Will this cause a problem?

No. The first thing that needs to be recognized is that there is no upper limit on the pretension that can be applied to a bolt installed a snug-tight condition. A snug-tight joint is not a joint without pretension, but more properly should be viewed as a bolt with an undetermined level of pretension—where the level of pretension is irrelevant in meeting the requirements of the connection. Even if (F3125 Grade F1852) bolts had not been installed, it is likely that the bolts would have significant pretension.

The calculations on page 11 of the design guide indicate that the bolt rupture limit state considering prying action is dependent on the level of pretension. When the connection is designed assuming a snug-tight condition, a pretension significantly less than full pretension is assumed. A higher pretension than that assumed in the calculations can only result in greater strength. Therefore the fact that the bolts have potentially been fully pretensioned will not be detrimental to the strength of the connection.

I also have to mention that the use of TC bolts does not guarantee that full pretension will be achieved. Only the use of TC bolts in conjunction with the proper installation procedures will ensure proper pretension.

Limiting the Number of Field Splices

The erector on our project is insisting that conditions indicated as field welded splices in the contract documents should be shop welded for economy. Can we shop weld these splices?

Section 6.7.4 of the AISC *Code of Standard Practice for Steel Buildings and Bridges* (ANSI/AISC 303) states: "Unless otherwise specified in the contract documents, and subject to the approved shop and erection drawings, the fabricator shall limit the number of field splices to that consistent with minimum project cost."

The key phrase here is "Unless otherwise specified in the contract documents." The contract documents must be adhered to unless a change to the contract is agreed to by the parties.

You could submit a request to the engineer of record to modify the connection so that it would result in reduced field welding, but there is nothing that would require you to do so.

If you think the field weld symbol may have been a mistake, you could submit an RFI to clarify this, but it is not your job to identify errors in the contract documents. This is stated in the commentary to Section 3.3, which states: "When a discrepancy is discovered in the contract documents in the course of the fabricator's work, the fabricator shall promptly notify the owner's designated representative for construction so that the discrepancy can be resolved. Such resolution shall be timely so as not to delay the fabricator's work. See Sections 3.5 and 9.3. It is not the fabricator's responsibility to discover discrepancies, including those that are associated with the coordination of the various design disciplines. You cannot change the condition shown in the contract documents without approval from the engineer of record."

Grinding Between Weld Passes

We are welding using metal-cored electrodes and have been told that the AISC *Specification* requires that each completed weld pass must be ground before the next pass can be deposited. Is this correct?

Larry Muir has been AISC's director of technical assistance for the last five years but is returning to the consulting world. **Carlo Lini**, who has served as a senior staff engineer in AISC's Steel Solutions Center, replaces Larry as the new director of technical assistance.

STEEL SOLUTIONS CENTER

Steel Interchange is a forum to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Contact Steel Interchange with questions or responses via AISC's Steel Solutions Center: 866.ASK.AISC | **solutions@aisc.org**

The complete collection of Steel Interchange questions and answers is available online at **www.modernsteel.com**.

No. Section J2 of the AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360) states that, with a few exceptions, all provisions of AWS D1.1 apply under the *Specification*. Section 5.15 of AWS D1.1 requires that the surface to be welded shall be free of slag or other items that would be detrimental to the welds. It does not require grinding between passes.

One of the benefits of metal-cored electrodes is that it produces little slag and therefore minimizes activities such as grinding, chipping the slag or removing spatter. This is alluded to in AISC Design Guide 21: *Welded Connections – A Primer for Engineers*, which states: "GMAW uses a solid- or metal-cored electrode and leaves no appreciable amount of residual slag."

Shear Lag

I am designing the connection of an HSS8x8 brace to a gusset using a 10-in.-wide splice plate. AISC *Specification* Table D3.1 Cases 4 and 6 address shear lag on the splice plate and the HSS. However, the *Specification* does not seem to address shear lag on the wider plate, the gusset in my case. How should shear lag be addressed for the gusset?

You are correct that Case 4 is intended to apply to the narrower plate shown in the figure, not the wider plate. When checking the wider plate, some judgment must be exercised. A local yielding check based on the Whitmore section is typically used, as is indicated in the User Note to Section J4.1.

A Note on Changes at the AISC Steel Solutions Center

After five years as AISC's director of technical assistance, Larry Muir is making the move back to consulting. He will return to the work he performed for six years prior to joining AISC: providing consulting services, primarily related to connection design, to structural engineers, fabricators, erectors, general contractors and steel construction-related organizations like AISC and the Canadian Institute of Steel Construction (CISC). He will also continue his decade-long relationship with the Steel Solutions Center.

We're sad to see Larry go but happy to announce that Carlo Lini, a seven-year AISC employee, will take over as AISC's director of technical assistance. Prior to joining AISC, Carlo worked as an engineer with Ruby and Associates and has also served as secretary of AISC's Specification committee on Nuclear Facilities Design and AISC's Committee on Manuals Member and Systems Design Considerations. This experienced provided him with additional insight into the topics he must address every day with the Steel Solutions Center.

In celebration of his new role at AISC, all of this month's Steel Interchange questions were answered by Carlo.

Lawrence F. Kruth, PE, AISC Vice President of Engineering and Research