

STEEL INTERCHANGE

Steel Interchange is an open forum for *Modern Steel Construction* readers 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 to solve, please forward it to *Modern Steel Construction*. At the same time, feel free to respond to any of the questions that you have read here. Please send them to:

**Steel Interchange
Modern Steel Construction
One East Wacker Dr., Suite 3100
Chicago, IL 60601-2001**

*** Questions and answers can now be e-mailed to: grubb@aiscmail.com ***

The following responses from previous Steel Interchange columns have been received:

Question from February 1999:

What is the status/prognosis of the OSHA requirements for a minimum of four bolts in column base plates?

Norman Golinkin

On Thursday, August 13, 1998 the Department of Labor published proposed rulemaking for Steel Erection as part of 29 CFR Part 1926, Subpart R. As published, 1926.755(a) requires that "all columns shall be anchored by a minimum of 4 anchor bolts." Written comments on the proposed rulemaking were to be postmarked by November 12, 1998 and a public hearing was commenced on December 1, 1998.

As of this date a final rulemaking has not been issued. However, on February 10, 1999, the Directorate of Construction at OSHA in Washington D.C. issued an enforcement policy for steel erection in the interim period pending enactment of final rulemaking. In this document, OSHA is allowing steel erectors to follow either the current Subpart R or the proposed rulemaking (with a minor restriction on fall protection for deck layers). It is not clear at this time whether a steel erector's decision to follow the proposed rulemaking binds other entities to its requirements (e.g. the structural engineer of record), or if the erector is not liable for those parts of the proposed rulemaking outside of its control. Formal comment by OSHA would be helpful to steel erectors, fabricators and designers.

Tom Henke

**Construction Supply & Erection, Inc.
Germantown, WI**

via email:

I need to get some clarification in regards to the permitted size of holes drilled in column base plates for anchor bolts. There appears to be two conditions. The standard $db + 1/16$ " seems restrictive for a column with vertical loads and nominal lateral loads at the base. However, using larger holes in base

Answers and/or questions should be typewritten and double-spaced. Submittals that have been prepared by word-processing are appreciated on computer diskette (either as a Word file or in ASCII format).

The opinions expressed in *Steel Interchange* do not necessarily represent an official position of the American Institute of Steel Construction, Inc. and have not been reviewed. It is recognized that the design of structures is within the scope and expertise of a competent licensed structural engineer, architect or other licensed professional for the application of principles to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 800/644-2400.

plates for columns which are a part of a lateral load resisting system would allow slippage prior to the bolts engaging. Could you please shed some light?

Dwight Drew

There are no requirements in the AISC Specification or in the AISC Code of Standard Practice regarding the size of anchor rod holes. However, it has generally been accepted that anchor rod holes are oversized to account for unavoidable variability in the placement of the rods. The AISC LRFD Manual shows recommended sizes for anchor rod holes in base plates in Table 11-3.

Oversized holes become a concern when significant shear forces must be transferred through the base of the column. One way to account for oversized holes is to provide a positive shear transfer mechanism—for example, with shear lugs or through column base embedment in a slab. Lesser amounts of shear may be transferred through friction between the base plate and the concrete/grout, or through shear friction.

A common shear transfer detail, which uses the anchor rods to transfer shear, couples oversized holes in the base plate with standard holes in plate washers field-welded to the base plate. Some concerns in this detail are the bending of the rod and crushing of concrete/grout at the top of the anchor rod, along with the corresponding potential for movement.

Standard-sized holes are almost never used in based plates because of constructability concerns. Per the AISC Code of Standard Practice, section 7.5.1.(a), anchor rods are usually set so that the center-to-center spacing of any two rods within a group is off by no more than 1/8". Standard holes are 1/16" larger than the fastener diameter. The discrepancy between these two tolerances is obvious—anchor rod mismatch is almost a certainty.

I think I'd vote for shear lugs, in spite of their inherent construction difficulties, when significant shear forces must be transferred at the column base.

Keith A. Grubb, P.E.

**American Institute of Steel Construction
Chicago, IL**

via telephone:

For crane rails, the AISC LRFD Manual, p. 1-139, recommends that "odd lengths, which must be included to complete a run or obtain the necessary stagger, should be not less than 10 feet long." What is the basis of this recommendation?

Dennis Price
Fair Hill Fabricators
Lansdale, PA

The thought behind this recommendation is that a minimum length of crane rail is required to adequately clip the rail to its supporting structure. Typically, clips are spaced anywhere from 2'-0" to 3'-6" on center, so a 10-foot length of rail would have about three pairs of clips. A sufficient number of clips is required to transfer the longitudinal and transverse forces in the crane rail into the supporting structure. Note that even if stop blocks are used at the end of the crane rail, significant longitudinal forces must be resisted by the clips, because of the expansion gap (typically 2") left between the stop block and the end of the rail.

David T. Ricker, P.E.
Consulting Engineer
Payson, AZ

Question from March 1999:

In a large composite slab, construction joints may be required. Where should one put construction joints in composite floors?

When locating construction joints in composite slab, it may be convenient to place construction joints along structural grid lines as is common in slabs-on-grade. However, this approach in steel-framed composite floors may compromise the capacity of the shear connectors. Locating construction joints off the column grid lines in composite floors makes more sense. Cracks may form over composite members but it isn't wise to purposely build in a weakened plane at shear connector locations. There are two situations to consider:

1. Construction joints running parallel to the in-fill beams: In this situation, a good solution is to place the construction joint mid-way between the in-fill beams and maintain the slab reinforcing (WWF) continuous through the joint.
2. Construction joints running perpendicular to the in-fill beams: In this case, one solution is to locate the joint at the third or quarter point of the in-fill beam span. Again, slab reinforcing should be continuous through the joint. Top reinforcing steel is often placed over the girders to minimize crack width over the girder. It is prudent to locate a construction joint

beyond the termination of this reinforcing.

John L. Ruddy, P.E.
Structural Affiliates International
Nashville, TN

New Questions

Is there a publication or research paper which discusses the design of column base plate shear lugs made out of the standard W sections? In particular, should such shear lugs be designed for overall section bending and shear only due to the bearing pressure exerted against the concrete face, or should the effect of local flange or web bending be considered? Shear lugs are assumed to be confined in shear pockets by a non-shrink grout.

Mark Trojanowski, P.Eng.
Hatch
Mississauga, Ontario, Canada

Are there any recommendations for a limiting slenderness ratio for drag collectors? Limiting Kl/r to 120 (the value for braces) seems overly conservative.

Gary Harris
Hunt and Joiner
Dallas, TX

Anchor bolts (A307 or A36 material) occasionally get knocked and bent prior to the installation of the structural steel columns. Are there any guidelines or provisions for bending the anchor bolts back into position? Are there limits to the degree of bending that can be straightened?

Michael D. Gregory, P.E.
Teton Structural Engineers
Idaho Falls, ID

Do you enjoy reading Steel Interchange? Then check out the forum section at Modern Steel Construction's new website:

www.modernsteel.com

Registration is free.