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.

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.

If you have a question or problem that your fellow readers might help you to 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 at:

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Crane Design

I would like to know if there's a reference similar to what could be called "Crane Rail Design for Dummies." I am looking for a handbook or manual on cranes for industrial buildings. Subjects mainly needed are bridge beams, runway beams, columns, bracings, brackets, load considerations, load combinations, etc. Crane information is not relevant because the supplier or manufacturer supplies it all. I would like a reference that focuses on the structure that supports them.

Question from Structural Engineers Association International (SEAINT) email list-server

AISC's *Design Guide No. 7: Industrial Buildings: Roofs to Column Anchorage* would be an excellent reference and is available by calling AISC publications sales at 800/644-2400. Another must-have reference is AISE *Technical Report No. 13* (available from AISE, 412/281-6323, www.aise.org).

There have been several related papers in AISC conference proceedings; a summary of these papers is below (reprints are available through AISC's Steel Solutions Center, solutions@aiscmail.com):

1. "New Fatigue Provisions for the Design of Crane Runway Girders" by James M. Fisher and Julius P. Van de Pas (2000)
2. "Design of Crane Runway Beams with Channel Cap" by Duane S. Ellifritt (1996)
3. "Crane Runway Design" by James M. Fisher and Julius P. Van de Pas (1996)
4. "Load and Resistance Factor design of Stepped Crane Columns in Industrial Buildings" by D.J. Laurie Kennedy and Robert A. MacCrimmon (1996)
5. "Tips for Avoiding Crane Runway Problems" by David T. Ricker, P.E. (1982)

Many considerations in crane-girder design are also addressed in the following FAQ from AISC's web site (www.aisc.org):

Q: What special considerations should be noted in crane-girder design?

A: The following special design considerations should be noted (contributed by David T. Ricker, P.E.):

- Adequate vertical and lateral stiffness are of primary importance.
- Simple-span construction should be used.
- The cross-section should be proportioned on the basis of its elastic flexural strength.
- Lateral stability should be provided at the bearing ends without inhibiting end rotations.
- Vertical and lateral impact loads should be considered.
- Lateral forces due to trolley acceleration and braking, runway misalignment, crane skew, and other sources should be considered.
- Fatigue should be considered.
- The class of service to which the crane will be subject should be considered.
- The local strength of the web under crane wheel loads should be checked.
- Biaxial bending of the top flange should be checked.
- Bottom-flange bracing should be provided when required; bottom-flange bracing is recommended for spans over 36 ft.
- For built-up crane-girders, the weld between the top flange and the web should be a CJP groove weld.
- Suitable provision should be made for the crane-rail attachment system.
- Suitable provision should be made for the electrification of the crane system.

Keith Mueller, Ph.D.
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Building Lines

While researching a column plumbness issue on a recent project, a dispute arose over the definition of the "building line" shown in Figure C-7.5 of the *2000 Code of Standard Practice for Steel Buildings*

and Bridges. We argued that the building line represented the exterior of the building, therefore at the 20th floor the column must not extend more than 1" towards the exterior or 2" towards the interior of the building. Where can we find AISC's definition of the term "building line" and are we correct in our interpretation?

Greg Ruberto, P.E.
Civilsmith Engineering, Inc.
State College, PA

The building line may be the face of the building. However, any suitably "referenceable" datum can also serve as the building line. Per *Code of Standard Practice* Section 7.4, the Owner's Designated Representative for Construction is responsible for the accurate location of building lines at the job site. The steel erector then positions the columns relative to the building lines.

The final location of an erected column, relative to the building line, must fall within the tolerances outlined in the *Code of Standard Practice.* The mating connections between the structural steel and the building façade are then often detailed with adjustable connections, which can be configured to allow façade placement to architectural tolerances. Download the complete AISC *Code of Standard Practice for Buildings and Bridges* at www.aisc.org/code.html.

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New Questions

Anchor Rods too Short

Are there any guidelines or recommendations concerning the repair of anchor rods without adequate projections? This question applies particularly to applications in rigid frames and braced frames where tension is a limiting design condition. Also these are applications where epoxy anchors are not applicable. We know of several methods of repair - couplers or cutting and welding bolt projections. Could you supply some information on the applicability of each repair—minimum/maximum size of anchor, minimum/maximum projection, minimum/maximum plate size?

Kurt Swensson
KSI Structural Engineers
Atlanta, GA

Stiffener Requirements

Regarding Chapter K of the ASD *Manual,* reference page 5-82 section K1-8 paragraph 3:

If Sections K1.4 or K1.6 requires stiffeners, the stiffeners shall be designed as axially compressed members (columns) in accordance with requirements of Section E2.

If Section K1.4 requires the stiffener, I would design the stiffener as compression member with an axial load of R from section K1.4. If Section K1.6 requires the stiffener, should the stiffener be designed for an axial load of P_{bf} from section K1.6 or from the computed force delivered by the flange? If P_{bf} is used, often the stiffener (assuming the same width as the flange) will be thicker than the flange and this appears odd to me.

I would appreciate any information you could supply me concerning this information.

Paul Howell

Curved Structural Members

Due to architectural characteristics, I am in the process of plan-checking a few moment frames using curved members (curved beams to column). I have questions regarding curved moment frames.

1. Are they allowed in current codes?
2. Has there been testing done on curved moment frames?
3. In calculations, how do you design the beam-column connection? Will torsion be introduced in this connection and the frame members?
4. If HSS beams and columns are used, please suggest a beam to column connection that will be acceptable.

David Chung, P.E.