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 .

Transverse Stiffeners as Stability Bracing

, L

. Stiffeners can be used to reduce the web deformation and improve the efficiency of torsional braces. However, used alone, web stiffeners are ineffective in enhancing the stability of members.

Bo Dowswell, PE, PhD

Mill Orders

?

No. There are published documents, such as Sections 107 or 1603 of the 2015 *IBC* and Section 3 of the AISC *Code of Standard Practice for Steel Buildings and Bridges* (a free download from), which give requirements for information to be included in the final "for construction" documents, but a "steel mill order" or a "steel fabrication package" are partially developed packages negotiated on a project-by-project basis to provide information to the contractor.

For better or worse, it has become quite common for an owner or contractor to request an early release steel package in advance of the final "for construction" documents. Different clients, owners, contractors, fabricators, erectors, architectns in advand s3.5 (contrana.5 (cti rul9)0.ets)0.rc3pTacjm.00.90Trhcrtdbcont-g (documenDteam Tprovide incd03package (o)0.6 der cea.)27intpTac("fo)0.6 Tc 0.1 ntra.)27contracTw -in advpack8 Tw -26.111 -1.204 some further information to assist you.

Appendix E of AISC Design Guide 28: *Stability Design of Steel Buildings* (a free download for members from) provides background related to the stability bracing requirements beyond what is included in the Commentary to the *Specification*.

Stability is very important, and for typical members it is not difficult to provide. The adequacy of the vast majority of member stability bracing is commonly judged by inspection. Stability concepts can be traced pretty far back into the history of steel design. However, their explicit presence in the *Specification* is fairly recent. For example, the 1986 *Specification* (the first LRFD specification) states: "The stability of individual elements must also be provided." And this appeared in the Commentary. It did point to other resources as well: "Considerable attention has been given to this subject in the technical literature, and various methods of analysis are available to assure stability. The SSRC *Guide to Design Criteria for Metal Compression Member* devotes several chapters to the stability of different types of members considered as individual elements, and then considers the effects of individual elements on the stability of the structure as a whole."

None of this directly helps you with your issue. However, it

One issue that sometimes gets overlooked is that the stiffness equations assume one end of the brace is attached to something very stiff. A 14×730 can be a brace but if one end attaches to the face of a piece of sheet metal, it still may not have sufficient stiffness. Though shown relative to a different condition, Equation C-A-6-12 illustrates how to calculate the stiffness of a series of elements. Again, I suspect explicit checks are rarely performed after one is familiar with the usual results from the checks provided in the *Specification*, but it is good practice to look at both ends of whatever you are assuming to be a brace.

Larry S. Muir, PE

Transverse Reinforcement of Composite Beams at Edge Conditions

Specification

Specification

We can only comment on requirements set by the AISC *Specification*. Relative to edge conditions, the Commentary to the *Specification* states:

"The use of edge distances in ACI 318 Appendix D (which is now ACI 318 Chapter 17 in the reorganized version) to compute the strength of a steel anchor subjected to concrete crushing failure is complex. It is rare in composite construction that there is a nearby edge that is not uniformly supported in a way that prevents the possibility of concrete breakout failure due to a close edge. Thus, for brevity, the provisions in this *Specification* simplify the assessment of whether it is warranted to check for a concrete failure mode. Additionally, if an edge is supported uniformly, as would be common in composite construction, it is assumed that a concrete failure mode will not occur due to the edge condition. Thus, if these provisions are to be used, it is important that it be deemed by the engineer that a concrete breakout failure mode in shear is directly avoided through having the edges perpendicular to the line of force supported, and the edges parallel to the line of force sufficiently distant that concrete breakout through a side edge is not deemed viable."

The research cited in the Commentary (Pallarés and Hajjar, 2010a, 2010b) also asserts such restraint commonly exists, but does not clarify the basis for this. AISC Design Example I.2 clarifies, stating: "The slab edge is often uniformly supported by a column flange or pour stop in typical composite construction, thus preventing the possibility of a concrete breakout failure and nullifying the edge distance requirement as discussed in AISC *Specification* Commentary Section I8.3." Design Examples are a free download at /.

The User Note in Section I8.3 again points to this sort of restraint, stating: "If concrete breakout strength in shear is an applicable limit state (for example, where the breakout prism is not restrained by an adjacent steel plate, flange or web), appropriate anchor reinforcement is required for the provisions of this Section to be used. Alternatively, the provisions of the applicable building code or ACI 318, Appendix D may be used."

Larry S. Muir, PE

Eccentric Stability Bracing