

From the 2009 NASCC in Phoenix, Arizona.

Connection Design Responsibility: Is the Debate Over?

BY CHARLES J. CARTER, S.E., P.E.

MY COLLEAGUE SCOTT MELNICK is a journalist, and so he loves controversy. (If you read his editorials in this magazine, you already know this.) I suspect he picked the title of this article—"Connection Design Responsibility: Is the Debate Over?"—in his best attempt to give us a "man-bites-dog" headline.

I'm an engineer, however, and engineers don't tend to seek controversy as much. I might have picked a more innocuous title like "Proposed Changes in Section 3.1.2 of the AISC *Code of Standard Practice*" to downplay the controversy. Of course, it really doesn't matter what title this article carries—the substance remains that we are happy to share with you what the AISC Committee on the Code of Standard Practice believes is a solution to a debate that has been with us for at least four decades.

As Secretary of the AISC Code Committee, it has been my pleasure to be involved in the work that resulted in the 2000 *Code of Standard Practice* as well as the 2005 *Code of Standard Practice*. I am further privileged to be able to write here about the work we have been doing to prepare one piece of the 2010 *Code of Standard Practice*: modifications of Section 3.1.2 to include an option whereby the Structural Engineer of Record (SER) can delegate the work of connection design to a licensed Professional Engineer working for the Fabricator.

A Brief Review of History

There is a long history that has led up to the draft changes proposed in the AISC *Code of Standard Practice*. There have been many debates, some of which took place in formal settings like the AISC Conference, and many others in meetings and gatherings sponsored by other organizations. There may be no other topic that so equally lends itself to the panel discussion and the spontaneous argument.

There have been speeches given and position statements writ-

ten, rewritten, retracted, and revised. There have been attempts to draft appropriate language for codes, specifications, contracts, and other documents. And the museum of shop drawing approval stamps is replete with many creative ways to say everything but "approved." For the better part of 40 years, this issue has been a question, and it simply is not going to go away if it continues to be ignored, letting whatever will be prevail. Part of the challenge in this process was that the Code Committee is tasked with describing what standard practice is, not prescribing it. And yet this is an area with a multitude of differing practices, which required the Committee to be selective and wise in its process of refinement.

In the late 1990s, AISC reconstituted its Committee on the Code of Standard Practice as a balanced group with representation of all disciplines with an interest in the Code. What a successful action that was! The 2000 and 2005 versions of the AISC *Code of Standard Practice* revitalized the document. Attempts were made in the deliberations for both of these versions to address the common practice of delegating connection design work. However, no proposal succeeded.

Throughout this time, AISC and the Council of American Structural Engineers (CASE) were collaborating through a joint task group, attempting to find a viable path. The task group had representatives of both the AISC Code Committee and the CASE Guidelines Committee. After three distinct proposals and nearly five years of discussion, white smoke finally rose from the deliberation.

As a result, we can discuss the proposal in its current form. This is called a proposal because there are still Committee ballots to complete. Nonetheless, we know at this point that the fundamentals of this proposal are accepted. We are now just down to the punch list of comments and concerns.

Current Draft

The current proposal for Section 3.1.2 in the 2010 AISC *Code of Standard Practice* is available for review at www.aisc.org/code312. It covers three options:

- (1) The complete connection design shall be shown in the structural design drawings;
- (2) The connection shall be designated to be selected or completed by an experienced steel detailer;
- (3) The connection shall be designated to be designed by a licensed professional engineer working for the fabricator.

Stated more succinctly, these options can be expressed as follows:

- (1) The SER designs the connections.
- (2) The SER provides the schematics and the steel detailer completes the details.
- (3) The SER provides design criteria and a licensed professional engineer working for the fabricator designs the connections.

Some flexibility is allowed here. One of these methods must be specified for each connection, but it is acceptable to group connection types and utilize a combination of these options for the various connection types involved in a project.

Option (1)

Option (1) was covered in previous versions of the AISC *Code of Standard Practice* and has not changed much, if at all, in this proposal. In this case, the SER shows the complete design of the connections in the structural design drawings. This includes:

- (a) All weld types, sizes, and lengths;
- (b) All bolt sizes, locations, quantities, and grades;
- (c) All plate and angle sizes, thicknesses and dimensions; and,
- (d) All work point locations and related information.

The intent of this approach is that complete design information necessary for detailing the connection is shown in the structural design drawings. The steel detailer will then be able to transfer this information to the shop and erection drawings.

Option (2)

Option (2) also was covered in previous versions of the Code, but in a less specific and somewhat more ambiguous form. It has been focused and clarified in this proposal.

In this case, the SER designates connections to be selected or completed by an experienced steel detailer, and provides schematic connection details in the structural design drawings. These schematic details may include tables in the design drawings or reference to tables in the AISC *Steel Construction Manual*, or other reference information, such as journal papers. Perhaps there is recognized software output that is considered acceptable. Whatever the basis the SER establishes, the steel detailer uses that information to select the connection materials and develop the specific connection geometry and dimensional information.

Often in this case, loads must be given in the structural design drawings. It is important to note in this option that these loads are only to facilitate selection of the connections from the referenced tables. It is not the intent that this method be used when the practice of engineering is required.

Option (3)

Option (3) is completely new to the AISC *Code of Standard Practice* in this proposal. In this option, the SER designates connections to be designed by a licensed professional engineer working for the fabricator. Although this option is new in the Code, it reflects a

practice that is common, even if the specifics of how it is being done do tend to vary.

With that variation in mind, it is important to recognize in this option that there are some aspects of what is required that express how this option should be done. Admittedly, this involves qualitative judgment. Nonetheless, the proposal represents the collective wisdom of the AISC Code Committee as well as the CASE Guidelines Committee.

Communication is required in this method! Up front, the SER must provide some information:

- (a) If there are any restrictions as to the types of connections to be used, it is required that these limitations be set forth in the structural design drawings and specifications. There are a variety of connections available in the AISC *Steel Construction Manual* for a given situation. Preference for a particular type will vary between fabricators and erectors. Stating these limitations, if any, will help to avoid repeated changes to the shop and erection drawings due to the selection of a connection that is not acceptable to the SER. This will help avoid additional cost and/or delay for the redrawing of the shop and erection drawings.
- (b) The connection design loads and associated criteria must be defined. Forces, moments, whether the loads provided are ASD or LRFD loads, and similar information is key here.
- (c) What substantiating connection information, if any, is required.

The term *substantiating connection information* is a new defined term in this proposal for the Code. It is the information submitted by the fabricator, if requested by the SER, when option (2) or option (3) is designated for connections.

Substantiating connection information, when required, can take many forms. When option (2) is designated, shop and erection drawings may suffice with no additional substantiating connection information required. When option (3) is designated, the substantiating





Rather, it is in addition to that.

(c) It is required that the fabricator must provide a means by which the substantiating connection information and the connections on the shop and erection drawings are linked. This helps the SER find information during the review and approval process.

connection information may take the form of hand calculations and/or software output. The focus in this article is on substantiating connection information for option (3).

The SER may require that the substantiating connection information be signed and sealed for option (3). The signing and sealing of the cover letter transmitting the shop and erection drawings and substantiating connection information may suffice. This signing and sealing indicates that a licensed professional engineer performed the work but does not replace the traditional review and approval process that is provided in Section 4.4 of the Code.

A requirement to sign and seal each sheet of the shop and erection drawings is discouraged, as it may serve to confuse the design responsibility between the SER and the licensed professional engineer performing the connection design.

Some additional requirements are included to facilitate this option and make it acceptable. It must be recognized that there is information that the fabricator needs to do this work. Moreover, option (3) requires cooperation between the SER, fabricator, and licensed professional engineer in responsible charge of the connection design when this option is used. And it is a two-way street.

(a) Early in the process, the fabricator and SER should discuss and agree on representative samples of the required substantiating connection information. A little time spent up front here will save a lot of rework and arguments later on. It will also save cost and delays.

(b) It is required that the licensed professional engineer in responsible charge of the connection design must review and confirm in writing, as part of the substantiating connection information, that the shop and erection drawings properly incorporate the connection designs. This review by the licensed professional engineer in responsible charge of the connection design does not replace the approval process of the shop and erection drawings by the SER.

Simply stated, when the SER selects option (3) for connection design, the SER is inviting the fabricator and the licensed professional engineer in responsible charge of the connection design to be a part of the SER's design team. And it is even more simply stated that teams work when there is teamwork. Not working as a team when option (3) is selected is one of the abusive practices the Code Committee hopes will become rare, if not nonexistent.

Review and Approval

In all three options covered in the proposal for Section 3.1.2, the approvals process in Section 4.4 of the Code is followed. That is, the SER reviews and approves the shop and erection drawings regardless of what option is specified.

In options (1) and (2), there is only the SER involved in an engineering capacity. Thus, the responsibility for the connection designs is clear. In option (3), the SER is permitted to rely upon the work of the licensed professional engineer in responsible charge of the connection design. Nonetheless, the SER reviews and approves the shop and erection drawings during the approvals process as specified in Section 4.4 for conformance with the specified criteria and compatibility with the design of the primary structure.

When substantiating connection information is required, the SER must take such action on substantiating Connection information as the SER deems appropriate. Note the difference: where

the shop and erection drawings are required to be reviewed and approved, it is left to the discretion of the SER to determine what review of the substantiating connection information is appropriate.

Final Authority

The SER is identified as the final authority in the case of a dispute between the SER and the licensed professional engineer in responsible charge of the connection design when option (3) is specified. This is simple and straightforward, and it is how it must be because only the SER has the full knowledge of the structure.

Simple and Straightforward

In summary, the AISC Code Committee believes this proposal provides a simple and straightforward approach to a practice that already exists, is in wide use, and currently is widely varying in how it is used. The AISC Code Committee believes that this proposal bounds all three options within appropriate limits. The proposed language allows all parties to control their own risks, and no party is asked to assume the responsibility for the negligence of another party.

The AISC Code Committee believes this proposal will succeed in practice and make structural steel more competitive. The proposal is still being finalized, and your input is welcome! After you read the draft at www.aisc.org/code312, tell us what you think. **MSC**

Charles Carter is a vice president and chief structural engineer with AISC. This article is based on his presentation at NASCC last month in Phoenix.

The keynote presentation was made by D. Kirk Harman, Glenn Bishop, and Charles Carter (pictured below from left to right).

