

The Ten Commandments of Communicating Connection Design

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Accurate and respectful exchange of information is critical to a team's ability to work together; following these rules can help.

WE ALL KNOW that there is a higher being that will judge us when the time comes. At the end of our careers, when we're trying to pass through the galvanized steel gates to the engineers' paradise, how will we be judged? Will we be doomed to an eternity of writing and answering endless RFIs, or will we pass through to a rapture of topping-out parties and award ceremonies? Will we be considered sinners or saints? To what moral and ethical imperatives should we adhere?

Together we have compiled a list of dos and don'ts, commandments if you will, to be followed when communicating connection design requirements. Collectively we offer perspectives from the three disciplines involved in structural steel connection design: the structural engineer of record (SER), the fabricator, and the connection designer.

Although we can't guarantee that the likes of Eiffel, Roebling, Strauss, Telford, and Khan will welcome you with open arms, we do suggest that if you remain vigilant to the following "ten commandments," a sentence to an eternity in RFI purgatory is less likely.

It is very common for the structural engineer to have the fabricator perform the connection design as part of their contract (this is now covered explicitly in the 2010 AISC *Code of Standard Practice*, which is a free download at www.aisc.org/code). In order for the fabricator to provide accurate, economical, and code-compliant connections, it is imperative that the SER and connection designer clearly and accurately communicate the information related to the design of the connections. The information pertinent to connection design that is provided in the construction

documents is crucial to the fabricator during the bid process, procurement, and throughout the connection design and detailing processes. Likewise, this information is critical to the SER's review/approval process.

The Commandments

1. Thou shalt have no other standard than the one you want used for connection design.

It is all too common to find references to multiple standards and specifications in project specifications and structural drawings, including references to different versions of the same standard or specification. To some extent, this may be necessary. However, the SER should state clearly in the General Notes for Structural Steel which standard or specification should be used by the connection designer for the design of the structural steel connections.

Notes contained within the project specifications, general notes, framing notes, and connection concept drawings should be coordinated and consistent.

2. Thou shalt not produce incomplete details/drawings and expect them to be worshiped.

SER's typically will add a note in the contract documents that states, "Where connection details are not complete, the fabricator shall provide a design for that connection." Where details are meant to be conceptual, leave out specifics unless they are sacred. Providing partial design information leads the connection designer to believe that the ¼-in. fillet weld shown on a concept detail is what is required.

Where specific design methodologies are required, the



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SER should explicitly state the required methodology. For example, if the KISS method is preferred over the UF method for the design of vertical brace connections, this should be clearly stated.

3. Thou shalt not take AWS requirements in vain.

If you're not fluent in AWS-ese, let the experts properly apply the welding requirements of AWS D1.1 and D1.8.

4. Remember thy loadings, and don't keep them wholly to yourself.

Provide all forces necessary to complete the connection design accurately and economically.

The SER has the loading information; share it with the connection designer. If you specify UDL loading, the fabricator will bid based on no more than full depth connections, and stipulate that in their bid. If the UDL load requires haunched connections, the fabricator will submit charges for the work that are above and beyond the bid cost. If no transfer forces are noted on the drawings, transfer forces will not be accounted for in the connection design.

For moment frames, provide the fabricator with accurate information for determining the need for doubler and continuity plates. AISC provides free software for selecting beam and column sizes such that these plates are not required. Look for "Clean Columns" at the www.aisc.org. If your structure has collectors/drafts, provide the fabricator with the overstrength loads. If you don't, they won't ask.

5. Honor thy Fabricator's and Connection Designer's expertise as they shall honor the SER's expertise.

Qualified fabricators and connection designers do exist. In some cases, the experience and expertise is formidable. If you plan on transferring connection design responsibility, don't tie their hands with restrictive conceptual designs. Likewise, the SER may have a specific reason for providing a connection detail concept; connection designers shouldn't stray from the concept without seeking permission in advance.

6. Thou shalt not kill the connection design, submittal, and approval process.

SERs, fabricators, and connection designers should be open to communication, and open to ideas.

We all understand the economic advantages of recycling details, sections, etc. However, sometimes minor adjustments to "typical" details can result in significant cost savings to the project. The SER should clearly indicate in the contract documents any exclusions

or limitations on the use of standard connection concepts, such as one-sided shear connections or extended shear tab connections, but allow the connection designer flexibility to develop connections consistent with the fabricator's shop practices where possible.

7. Thou shalt not commit cheater.

In the absence of complete and clear information, fabricators and connection designers should not make leaps in assumptions. The submit/review/approval process is not the correct vehicle for confirming connection design decisions with the EOR. Write the RFI. RFIs should be answered completely, and in a reasonable time frame.

8. Thou shalt not be thoughtless of information provided.

Information provided by the SER should be meaningful and relevant to the specific project. If there are no braced frames on the project, don't show brace frame connection details. The fabricator and connection designer will spend many confusing hours trying to figure out what they have missed. However, if there are window washing davits on the roof, include the appropriate connection and bracing details.

The connection designer and/or fab-

ricator should provide connection design drawings and calculations, and shop drawings/details presented in a neat, thorough, and legible format.

9. Thou shalt not bear false steel reinforcing without engineering calculations.

Provide accurate and thorough loading information to the connection designer in lieu of conservative "will work for any condition" type details. The connection designer will use established engineering procedures to determine the needs for transferring forces.

10. Thou may covet valid connection designs not explicitly presented in AISC manuals and design guides.

AISC design guides and manuals provide examples of how to carry out connection designs. The examples shown are not meant to exclude other proper procedures. Be aware of this, and allow the connection designers to apply their expertise to arriving at an efficient, economical, and code-compliant design. **MSC**

This article is the basis of a presentation the authors will make at NASCC: The Steel Conference, May 11-14 in Pittsburgh. Learn more about The Steel Conference at www.aisc.org/nascc.