TOOLBOX TALK #3

Requirements for Connections

(15 minutes)

ODRD: Owner's Designated Representative for Design
(Structural Engineer of Record)

QUESTION: What are connection design responsibilities and requirements for the construction team, including the fabricator and ODRD?

The *Code* says…

3.2.3. Requirements for Connections

The *ODRD* shall indicate one of the following options for each *connection*:

(1) Option 1: The complete *connection* design shall be shown in the structural *design documents*.

(2) Option 2: The *connection* shall be designated in the structural *design documents* or *specifications* to be selected or completed by an experienced *steel detailer*. The experienced *steel detailer* shall utilize reference information provided in the *design documents* in the selection or completion of the *connections*. A list of other reference information, if any, provided by the detailer shall be approved by the *ODRD*.

(3) Option 3: The *connection* shall be designated in the structural *design documents* or *specifications* to be designed by a licensed *engineer* working for the *fabricator*. The following additional requirements apply:

(a) *Substantiating connection information* shall be provided for Option 3.

(b) The *fabricator* shall submit in a timely manner representative samples of the required *substantiating connection information* for all types of *connections* in the *structural steel* frame to the *ODRD*. The *ODRD* shall confirm in writing in a timely manner that these representative samples are consistent with the requirements of the *contract documents*, or shall advise what modifications are required to bring the representative samples into compliance with the requirements of the *contract documents*. This initial submittal and review is in addition to the requirements in Section 4.4.

(c) The licensed *engineer* in responsible charge of the *connection* design shall review and confirm in writing as part of the *substantiating connection information*, that the *approval documents* properly incorporate the *connection* designs. However, this review by this licensed *engineer* in responsible charge of the *connection design* does not replace the approval process of the *approval documents* by the *ODRD* in Section 4.4.

(d) The *fabricator* shall provide a means by which the *substantiating connection information* is referenced to the related *connections* on the *approval documents* for the purpose of review.

TOOLBOX TALKS

If you're using structural steel, the *Code of Standard Practice for Steel Buildings and Bridges* (ANSI/AISC 303-22) applies to your contract.

Simply put, the AISC *Code* defines who's in charge of what, when, where—including before any potential conflict arises—and other members of your project team are already using it in their own contracts. Download it for free at **aisc.org/code**.

Section 3 of the *Code* provides the requirements for connections and should be referenced during preconstruction for managing these requirements with your fabricator and/or erector.

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Requirements for Connections

(15 minutes)

When Option 2 or 3 is specified, the *owner's designated representative for design* shall provide the following *connection* design criteria in the structural *design documents* and *specifications*:

(a) Project specific *connection* details that show the conceptual configuration for the order of magnitude forces to be transferred
(b) Any restrictions on the types of *connections* that are permitted
(c) Data concerning the loads including shears, moments, axial forces, and *transfer forces* that are resisted by the individual members and their *connections*, sufficient to allow selection, completion, or design of the *connection* details while preparing the *approval documents*
(d) Whether the data required in Option 3 is given at the service-load level or the factored-load level
(e) Whether LRFD or ASD is to be used in the selection, completion, or design of *connection details*
(f) What *substantiating connection information* is to be provided with the *approval documents* to the *ODRD*

In all three of the preceding options, the approval process in Section 4.4 shall be followed.

Commentary:
There are three options covered in this Section:

(1) In Option 1, the *ODRD* shows the complete design of the *connections* in the structural *design documents*. The following information is included:
  (a) All work point locations and *connection* geometry
  (b) All plate and angle sizes, thicknesses, dimensions, and material grades
  (c) All weld types, sizes, lengths, locations, and strengths
  (d) All bolt sizes, grades, locations, and quantities
  (e) Member setback distances from the specified work point
  (f) Surface preparation at faying surfaces for bolting or for corrosion protection
  (g) Any member end preparation required such as copes, blocks, cuts, or chipping
  (h) In seismic applications, the information specified in ANSI/AISC 341, Section A4.2
  (i) Any member reinforcement required at *connections* (see Section 3.2.4)
  (j) Consideration of all applicable strength limit states
  (k) Consideration of fit-up and constructability
  (l) Any other items required for consideration in the particular *connection* design and detailing so that a *steel detailer* can detail the *connection* on the *fabrication documents*

The intent of this approach is that complete design information necessary for detailing the *connection* is shown in the structural *design documents*. Typical details are shown for each *connection* type, set of geometric parameters, and adjacent framing conditions. The *steel detailer* will then be able to transfer this information to the *approval documents*, applying it to the individual pieces being detailed.

(2) In Option 2, the *ODRD* allows an experienced steel detailer to select or complete the connections. This is commonly done by referring to loads embedded in the digital model, tables or schematic information in the structural design documents, tables in the AISC *Steel Construction Manual*, or other reference information approved by the *ODRD*, such as journal papers and recognized software output. Tables and schematic information in the structural design documents should provide such information as weld types and sizes, plate thicknesses, and quantities of bolts. However, there may be some geometry and dimensional information that the steel detailer must develop. The steel detailer will then configure the connections based upon the design loads and other information given in the structural design documents and specifications.

The intent of this method is that the steel detailer will select the connection materials and configuration from the referenced tables or complete the specific connection configuration (e.g., dimensions, edge distances and bolt spacing) based upon the connection details that are shown in the structural design documents.

The steel detailer must be experienced and familiar with AISC requirements for connection configurations, the use of the connection tables in the AISC *Steel Construction Manual*, the calculation of dimensions, and adaptation of typical connection details to similar situations. Notations of loadings in the structural design documents 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.

(3) Option 3 reflects the practice to have a licensed *engineer* working for or retained by the *fabricator* design the *connections*, and recognizes the information required by the *fabricator* to do this work. The *ODRD*, who has the knowledge of the structure as a whole, must review and approve the *approval documents,* and the *substantiating connection information* that is requested. See Section 4.4 for the approval process.

When, under Section 3.2.3, the *ODRD* designates that *connections* are to be designed by a licensed *engineer* employed or retained by the *fabricator*, this work is incidental to, and part of the requirements for fabricating and constructing the steel frame. The licensed *engineer* performing the *connection* design is not providing a peer review of the *contract documents*.

The *ODRD* reviews the *approval documents* 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.

One of these options should be indicated for each *connection* in a project. It is acceptable to group *connection* types and utilize a combination of these options for the various *connection* types involved in a project. Option 3 is not normally specified for *connections* that can be selected or completed as noted in Option 2 without practicing engineering.

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 documents* 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, in the structural *design documents* and *specifications* will help to avoid repeated changes to the *approval documents* due to the selection of a *connection* that is not acceptable to the *ODRD*, thereby avoiding additional cost and/or delay for revising the *approval documents*.

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(15 minutes)

For Option 2 and Option 3, the structural design documents must indicate the design loads for *connections* including *transfer forces*. *Transfer forces* can be determined using the *connection* geometry and statics for an individual load combination. However, *transfer forces* must be explicitly provided by the *engineer of record* when *connection* design loads are provided as maximum/minimum member forces resulting from more than one load combination or resulting from prescriptive rules provided in the *contract documents*.

The structural *design documents* must indicate the method of design used as LRFD or ASD. In order to conform to the spirit of ANSI/AISC 360, the *connections* must be selected using the same method and the corresponding references.

Substantiating connection information can take many forms. When Option 2 is designated, the *approval documents* may suffice unless additional information is requested by the *engineer of record*. When Option 3 is designated, the *substantiating connection information* is required and may take the form of hand calculations and/or software output, and any additional information as requested by the *ODRD*.

When *substantiating connection information* is required, it is required that representative samples of that information be agreed upon prior to preparation of the *approval documents*, in order to avoid additional cost and/or delay for the *connection* redesign and/or revising that might otherwise result.

The *ODRD* may require that the *substantiating connection information* be signed and sealed for Option 3. The signing and sealing of the cover letter transmitting the *approval documents* and *substantiating connection information* may suffice. This signing and sealing indicates that a licensed *engineer* performed the work but does not replace the approval process provided in Section 4.4.

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 *ODRD* and the licensed *engineer's* work in performing the connection design. Such a requirement may not be possible when submitting *fabrication* and *erection models*.