steelwise

SPEAKING THE SAME LANGUAGE

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AISC's latest *Code of Standard Practice* includes new terminology that accommodates the construction industry's ongoing transition from drawing-based to model-based workflows.

TECHNOLOGY PERPETUALLY ENHANCES the structural steel design, fabrication and erection industry, and the AISC *Code of Standard Practice* (ANSI/AISC 303-16, available at **www.aisc.org/specifications**) must change to reflect innovations as they come into being and evolve.

A significant advancement in recent years has been the steady incorporation of digital 3D models into the construction workflow. In 2005, the *Code* added Appendix A, Digital Building Product Models, to offer an easily referenced method for engineers, fabricators and erectors to use and exchange digital models—and digital model use has become more prevalent ever since. For this reason, Appendix A has been removed from the 2016 version and model-related language has been incorporated directly into the main text of the *Code*. This language includes new terminology recognizing the current industry transition from drawings to models and the fact that a combination of both is used on many projects, a trend that will likely continue for quite some time.

Design Phase

In exploring this new terminology, let's start with the design phase. These terms are intended to help clarify communications and contracts so that an engineer can expect an equivalent project whether they issue drawings, a model or both:

- *design documents*. These are *design drawings* or, where the parties have agreed in the *contract documents* to provide digital model(s), the *design model*. A combination of drawings and digital models may also be provided
- *design model*. A dimensionally accurate 3D digital model of the structure that conveys the structural steel requirements given in Section 3.1 for the building

The definition of *contract documents* has not changed:

- *contract documents*. The documents that define the responsibilities of the parties are involved in bidding, fabricating and erecting structural steel. These documents normally include the *design documents*, the specifications and the contract.

Section 1.4 of the *Code* also clarifies the identification of the controlling document. This section states: "When the design drawings and a design model are both provided, the *owner's designated representative for design* shall specify which document is the controlling contract document."

- *owner's designated representative for design*. The owner or the entity that is responsible to the owner for the overall structural design of the project, including the structural steel frame. This is usually the structural engineer of record.

Additional Terminology

While many new *Code of Standard Practice* terms are defined in this article, several terms from past versions of the *Code* have also been referenced:

- *Contract documents*. The documents that define the responsibilities of the parties that are involved in bidding, fabricating and erecting structural steel. These documents normally include the design documents, the specifications and the contract.
- *Design drawings*. The graphic and pictorial portions of the *contract documents* showing the design, location and dimensions of the work. These documents generally include, but are not necessarily limited to, plans, elevations, sections, details, schedules, diagrams and notes.
- *Embedment drawings*. Drawings that show the location and placement of items that are installed to receive structural steel.
- *Erection drawings*. Field-installation or member-placement drawings that are prepared by the fabricator to show the location and attachment of the individual structural steel shipping pieces.
- *Shop drawings*. Drawings of the individual structural steel shipping pieces that are to be produced in the fabrication shop.

When design documents are issued for construction, the structural engineer of record must communicate whether

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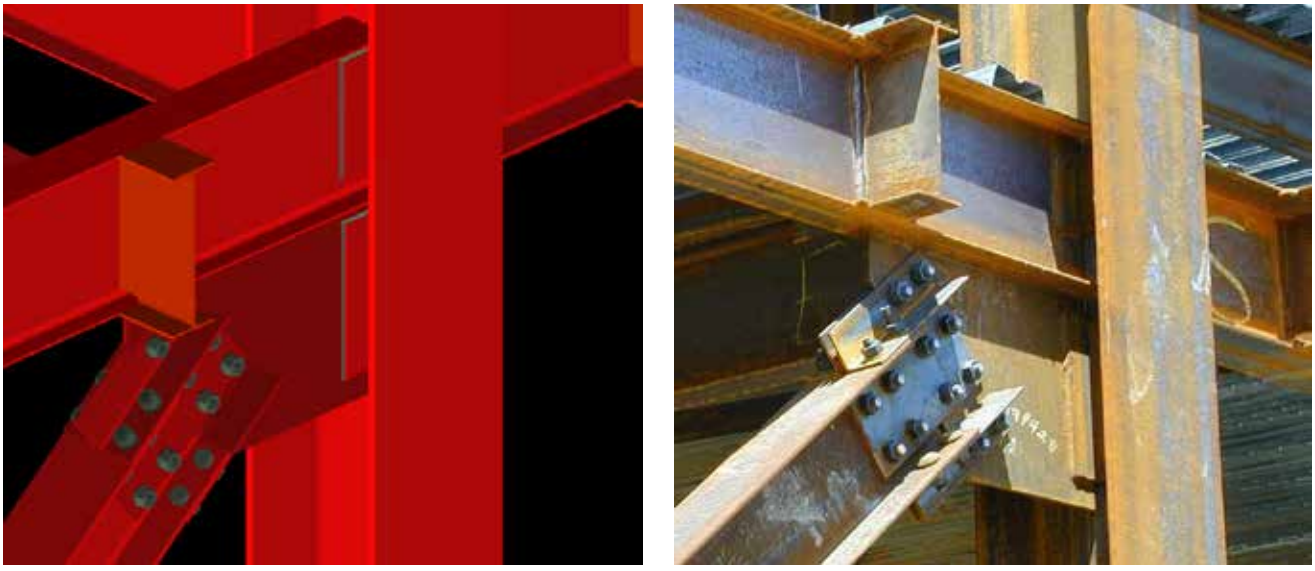


▲ A screen shot of an assembly in a 3D model and a view of the same assembly in the as-built condition.

the drawings or the model shall be used to complete the fabrication and erection documents, and Section 3.3 of the *Code* deals with discrepancies. To clarify which document governs, the following wording was added to this section: "When discrepancies exist between the design drawings and the design model, the governing document shall be as identified per Section 1.4."

In Section 1.4, the owner's designated representative for design identifies whether the drawings or the model govern the construction; the same document will govern discrepancies.

Construction Phase

As more fabricators directly use 3D modeling to complete fabrication documents, new terminology has been developed in this area too. Similar to the design process, the new term *fabrication documents* is an intentional generalization to reflect the use of models and/or drawings:

- *fabrication documents*. The *shop drawings* or, where the parties have agreed in the *contract documents* to provide digital model(s), the *fabrication model*. A combination of drawings and digital models also may be provided
- *fabrication model*. A dimensionally accurate 3D digital model produced to convey the information necessary to fabricate the structural steel. This may be the same digital model as the *erection model*, but it is not required to be

New erection-related terminology has also been developed, given the proliferation of 3D models being used in the field:

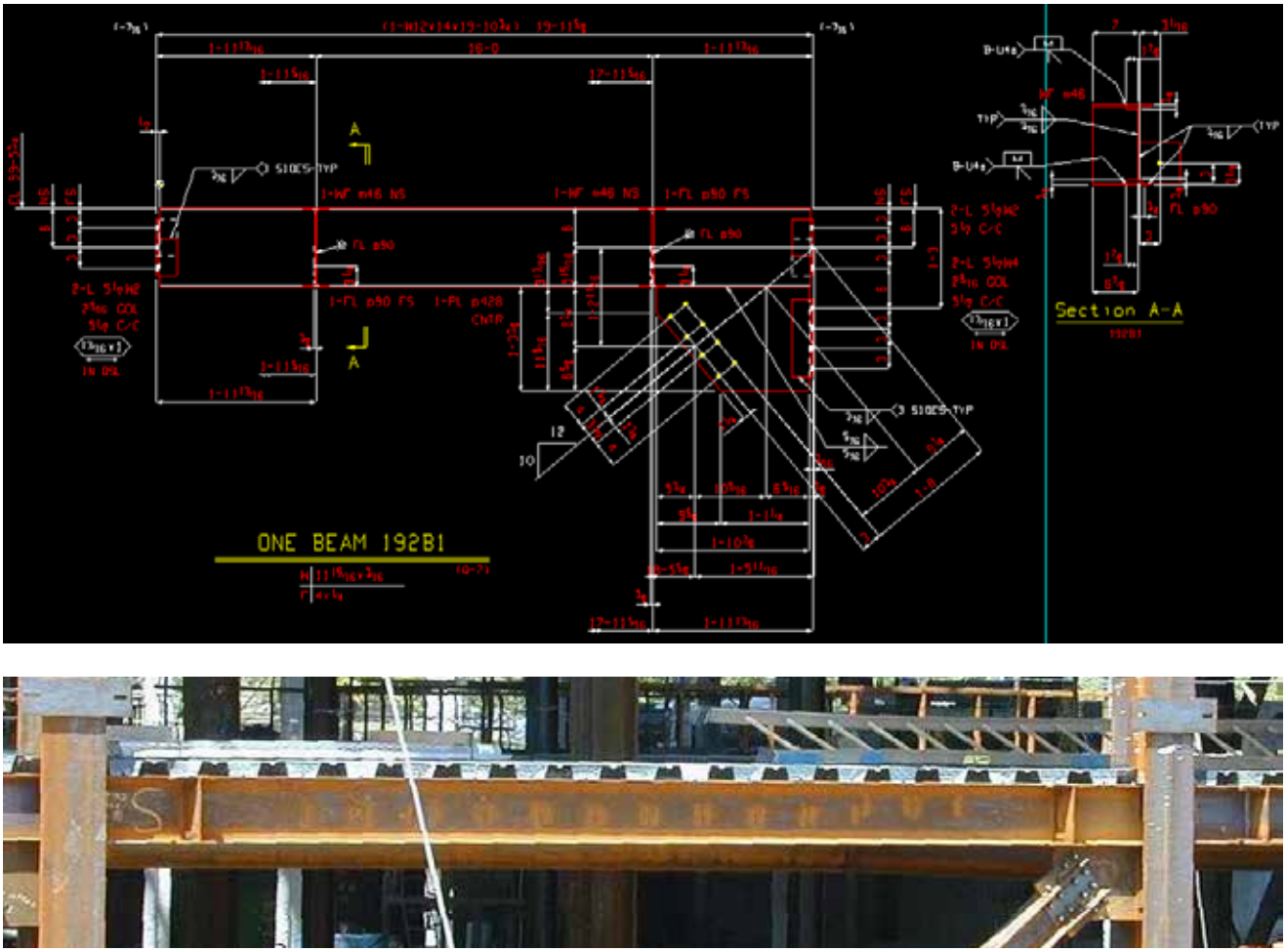
- *erection documents*. The *erection drawings*, or where the parties have agreed in the *contract documents* to provide digital model(s), the *erection model*. A combination of drawings and digital models also may be provided
- *erection model*. A dimensionally accurate 3D digital model produced to convey the information necessary to erect the structural steel. This may be the same digital model as the *fabrication model*, but it is not required to be

Many engineers and architects have discovered the advantages of reviewing 3D models of fabrication documents rather than 2D drawings. Using 3D models for approval enables the approving party to see the structure as it will be fabricated and also how it will look when it is completely erected. This process can result in a more accurate and shorter approval process as opposed to the traditional 2D process. As such, the following term has been added:

- *approval documents*. The structural steel *shop drawings*, *erection drawings* and *embedment drawings*, or where the parties have agreed in the contract documents to provide digital model(s), the *fabrication model* and *erection model*. A combination of drawings and digital models also may be provided

Document Responsibility

Section 4.3 addresses the ownership and risks of using design documents. Subsection (a) of Section 4.3 states: "All information contained in the digital files or copies of the design documents shall be considered instruments of service of the owner's designated representative for design and shall not be used for other projects, additions to the project or the completion of the project by others. Digital files or copies of the design documents shall remain the property of the owner's designated representative for design and in no case shall the transfer of these copies of the design documents be considered a sale, or unrestricted license." From this language, it is clear that design documents should be used strictly for completing projects and for no other reason.



▲ A 2D drawing of a beam, and the same beam, as built.

In addition, Subsection (d) states: "Any party or entity that creates a copy of the design model does so at their own risk." If a design document is used to complete fabrication and erection documents, the fabricator/erector is still responsible for the accuracy of these documents. Errors that occur in the electronic transfer are the responsibility of the party using the design document and not the originator of the design document.

Revisions and Maintenance

Section 3.5 addresses revisions to design documents and specifications, with the following new language: "When revisions are communicated using design models, revisions shall be made evident in the revised design model submitted by identifying within the design model which items are changed. Alternatively, the changes shall be submitted with a written document describing in explicit detail the items that are changed. A historic tracking of changes must either be present in the revised design model or maintained in the written record of changes." Presently, it is difficult to identify changes in design models. For this reason, it is permitted to communicate these changes via sketches or a written document. As technology evolves, this language in the *Code* will accommodate newer methods of identifying these changes within the model.

Section 4.6 has added the following language: "When a design model is used as the design documents, the changes and/or clarifications made in response to RFIs shall be incorporated into the design model." Even though answers to RFIs may be issued in the form of a written document or sketches, the original design document, whether it consist of drawings or a model, must be brought up to date to reflect the answer to the RFIs.

While this new terminology may seem extensive, it will in no way restrict the continued use of drawings, nor will it make communicating construction information via 3D models an exception. On the contrary, it offers more flexibility for the design community and steel construction industry to continue leading the way together in adopting new, innovative technology to better our projects. ■