

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC**Disciplines:**

Structural

History:

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Division of the State Architect (DSA) documents referenced within this publication are available on the [DSA Forms](#) or [DSA Publications](#) webpages.

Purpose: This Interpretation of Regulations (IR) clarifies the process and criteria under which DSA will evaluate, accept for use and inspect the use of open web steel joists (OWSJ) on projects under DSA jurisdiction. For projects submitted for review under the 2010 California Building Code (CBC), see *IR 22-3.10: Open Web Steel Joists and Joist Girders*. For projects reviewed under the 2007 CBC, see *IR 22-3: Open Web Steel Joists and Joist Girders*.

* Indicates alternative CBC sections that may be used by community colleges, per CBC Section 1.9.2.2.

Note: Frequently used terms are defined in the glossary, Section 9, of this IR.

1. Qualified Manufacturers: The OWSJ manufacturer must be a current member in good standing with the Steel Joist Institute (SJI) and currently certified as an approved fabricator by one of the following organizations:

- International Accreditation Service, Inc.
- City of Los Angeles

2. Approval Process: The approval of OWSJ for use on a specific project is a four-phase process. There are specific requirements and responsibilities for the joist manufacturers and architect or structural engineer in general responsible charge (project design professional) in each phase. The four phases and the key players involved are as follows:

- **Review and Approval of Construction Documents:** Project Design Professional, and DSA.
- **Review and Approval of Joist Documents:** Project Design Professional, Manufacturer, and DSA.
- **Manufacturing of Joists:** Manufacturer and Fabrication Special Inspector.
- **Field Installation:** Project Inspector and Field Welding Special Inspector.

3. Review and Approval of Construction Documents. This phase occurs before a project construction contract is awarded to a qualified joist manufacturer. The steps and requirements for this phase are as follows:

3.1 Project design professional prepares construction documents (plans and specifications) for the project. In addition to the requirements in the CBC Section 2207A.2, the portion of the construction documents pertaining to OWSJ shall also include the following:

- Structural framing plan including layout of OWSJ and all supporting elements.
- Details of construction for the joist-to-structure connections.
- Details of construction for joist bridging-to-building structure connections.
- Details of construction for joist-to-joist girder connections.

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC

- Loading diagrams for all OWSJ in accordance with CBC Section 2207A.2 (2207.2*), Item 1 and any deflection requirement.
 - Specify the SJI joist designation for each joist. The designation shall comply with CBC Section 2207A.2 (2207.2*).
 - Project specifications shall require that OWSJ manufacturer(s) comply with Section 1 of this IR. The project design professional should closely coordinate OWSJ design (including all connections, non-standard products, and details) with a qualified OWSJ manufacturer prior to the submittal of contract documents for DSA review.
 - Project specifications and Statement of Special Inspections (CBC Sections 1704A.2.3 and 1704A.3) shall include testing and inspection requirements for OWSJ per Section 7 of this IR.
 - The following note shall be shown on the plans:

“Mechanical, electrical, and plumbing units and systems shall be coordinated with the manufacturer’s joist document prior to field installation. Field modification of OWSJ is prohibited without the prior approval of DSA.”
 - As an option, joist documents as described in Section 4 below may be included with the construction documents. Otherwise, they are submitted as a deferred submittal per Section 4 below and the California Administrative Code (CAC), Section 4-317(g).
- 3.2** Project design professional submits application and construction documents to DSA for review.
- 3.3** After the DSA plan review process is completed, the approved construction documents will bear the DSA identification stamp with the initials of the plan reviewer.
- 4. Review and Approval of Joist documents.** This phase occurs after the project has been bid and the contract for the fabrication of the OWSJ has been awarded to a qualified manufacturer as defined in Section 1 of this IR. The steps and requirements for this phase are as follows:
- 4.1 Submittal Preparation:** Manufacturer prepares joist documents for DSA approval, in accordance with the requirements of DSA approved project construction documents and working in a fully coordinated effort with the project design professional.
- 4.1.1** If the requirements in the approved construction documents (see Section 3 above) were altered by the manufacturer during the preparation of the joist document, the project design professional must prepare and submit Construction Change Documents (CCD) to DSA for review in accordance with *IR A-6: Construction Change Document Submittal and Approval Process*. These changes may include joist designation, joist depths, layout, framing plans, loads, joist anchorage, etc.
- 4.2 Submittal Documents:** As applicable, the joist manufacturer’s submittal shall include the following:
1. Calculations per CBC Section 2207A.3 (2207.3*), signed and stamped by the manufacturer’s California registered professional engineer per CBC Section 2207A.4.1.
 2. Joist placement plans per CBC Section 2207A.4 (2207.4*). Joist placement plans shall show the joist layout as a direct overlay of the framing plans shown on the

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC

DSA approved construction documents. Joist placement plans shall not include details or other information that would otherwise require the signature and stamp of a design professional, so these plans are not required to be signed and stamped by the joist manufacturer's California registered design professional. **Note:** The joist placement plan is only intended to be a vehicle used by the joist manufacturer to communicate (for field installation) where specific joists, designed by the joist manufacturer's registered design professional, are located on the DSA approved framing plans.

3. Joist profiles with member sizes and joist member connection details, signed and stamped by the manufacturer's California registered professional engineer per CBC Section 2207A.4.1 (2212.4.1*), *Design Approval*. It is permitted to include the joist profiles with the calculation package provided each joist profile with member sizes and joist member connection details bear the signature and stamp of the joist manufacturer's California registered design professional. Alternatively, the joist manufacturer can submit larger drawing sheets which include multiple joist profiles with member sizes and joist member connection details. Each drawing sheet will only require one signature and stamp by the joist manufacturer's California registered design professional.
4. Details of construction for joist chord bridging and the bridging connections to the joist chords per CBC Section 2207A.4 (2207.4*), signed and stamped by the manufacturer's California registered professional engineer.
5. Details of construction for Joist Chord Bracing per CBC Section 2207A.6 (2212.4.2*), signed and stamped by the manufacturer's California registered professional engineer.
6. Composite joists (CJ) shear stud installation plans with sizes, quantity, and locations of all shear connectors on the composite steel joists. Composite joist plans shall be stamped and signed by the joist manufacturer's California registered design professional.
7. Details of construction for joist chord splices, signed and stamped by the manufacturer's California registered professional engineer.
8. When alternate design substitutions (ADS) are anticipated during the manufacturing process, the manufacturer may specify alternate member thickness or weld sizes that may be substituted during manufacturing.

If the joist documents with ADS are approved by DSA, the manufacturer will not be subject to the provisions of Section 8 of this IR if ADS were used during the manufacturing.

4.3 Design Professional Review of Submittal Documents: The manufacturer submits the joist documents to the project design professional for review and approval. This step may take multiple exchanges between the project design professional and the OWSJ manufacturer to finalize the joist documents for submittal to DSA. The project design professional and the OWSJ manufacturer, working together, shall coordinate the joist documents with the following:

- Mechanical, electrical, and plumbing (MEP) plans that include locations and sizes of roof top or floor units, ducts, pipes, conduits, etc.
- Roof pitch or slopes.

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC

- Top elevations of support elements to insure proper seating of OWSJ, i.e. top of steel girders, concrete or CMU pilasters or walls.

4.4 Submittal to DSA: When the project design professional approves the joist documents, they shall provide a signed and stamped statement of general conformance and submit it to DSA for approval in accordance with CAC Section 4-317(g). For additional information on the Statement of General Conformance, see *IR A-18: Use of Construction Document by Other Professionals*.

The project design professional shall submit two sets of joist documents to DSA for review.

4.5 DSA Review: DSA review of the calculations typically includes verification of input and output. This step will involve a back-check review if the documents are not approved on the initial submission. Each of the following conditions must be met:

- The manufacturer is licensed by SJI to manufacture the joist series (which includes SJI certification of joist design software).
- The composite joist (CJ) designation is specified in accordance with the SJI 1st Edition of Composite Steel Joist Catalog (containing the Standard Specifications, weight tables, and bridging tables) such that the design loads are not greater than the safe factored uniformly distributed joist loads listed in the catalog.
- The joist designation K, LH, DLH, or Joist Girder (JG) listed in the SJI 43rd Edition Catalog (2013 CBC, SJI 42nd Edition Catalog) containing the Standard Specifications and the design loads are not greater than those listed in the load tables of the SJI 43rd Edition Catalog (2013 CBC, SJI 42nd Edition Catalog).
- The effect of eccentricity on LH/DLH series joists and joist girders is permitted to be neglected if the eccentricity is within the allowable tolerance specified in Section 103.5(d) (2013 CBC, Section 103.4(d)) and 1003.5(d) (2013 CBC, 1003.4(d)) respectively of the SJI Standard Specifications.

The project design professional shall coordinate with the manufacturer to resolve DSA plan check comments (as noted on the mark-up set of joist documents) and schedule a back-check appointment with DSA. Bring one set of revised joist documents to the back-check appointment.

4.6 DSA Approval: After DSA reviews the submitted joist documents and determines that they are in conformance, DSA stamps the joist documents as approved. **Note:** Provided the content of the joist placement plan meets the requirements of Section 4.2, DSA will approve the joist placement plan despite the fact it is not stamped and signed by the joist manufacturer’s California registered design professional. The stamped set of joist documents will be scanned into the DSA database and then returned to the project design professional who shall forward a copy to the manufacturer and the fabrication special inspector. Additional copies of DSA stamped joist documents may be made available to the project design professional by arrangement with the DSA regional office.

5. Manufacturing of Joists: The steps and requirements for this phase are as follows:

5.1 Manufacturer prepares shop orders or shop drawings from DSA approved construction documents and joist documents. Other than the approved alternate design substitutions described in Section 4.2 above, changes to the approved joist documents must be reviewed and approved prior to manufacturing in accordance with Section 8 of this IR.

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC

- 5.2 Manufacturer notifies the project design professional, project inspector, and fabrication special inspector of the fabrication schedule. Manufacturing may not start without the presence of fabrication special inspector.
- 5.3 A fabrication special inspector must be approved by DSA for each project prior to manufacturing. The fabrication special inspector provides inspection during OWSJ manufacturing in accordance with Section 7 of this IR.
- 5.4 At the end of fabrication, the manufacturer shall submit a certificate of compliance per CBC Section 2207A.5 (2207.5*) to DSA, the owner, and the project design professional.
- 6. **Field Installation:** The steps and requirements for this phase are as follows:
 - 6.1 Working from the DSA approved construction documents and DSA approved joist documents (and joist revision documents as may be needed per Section 8 of this IR), the project inspector shall verify joist size, fabrication special inspector’s ID tag or mark, and placement in the field.
 - 6.2 Working from the DSA approved documents listed above the field welding special inspector provides continuous inspection for field welding of attachments of the OWSJ.
- 7. **Testing and Inspection:** Testing and inspection shall comply with CBC Section 1705A.2, and shall be performed in accordance with CAC Sections 4-333 and 4-335, and *IR 17-3: Structural Welding Inspection*.
 - 7.1 **Unidentified Steel.** All steel shall be identified by the fabrication special inspector per CBC Section 1705A.2.3.1 (CBC 2013 Section 1705A.2.2.3). Unidentified steel shall be tested per CBC Section 2203A.1 (2203.1*).
 - 7.2 **Composite Joists.** Shear studs shall conform to the requirements of AISC 360 Section A3.6, and shall be sampled and tested per CBC Section 2213A.2 (2212.6.2*).
 - 7.3 **Shop Fabrication.** Inspection of shop fabrication shall comply with CBC Section 1705A.2.3.1 (CBC 2013 Section 1705A.2.2.3).
 - 7.3.1 **Marking:** The special inspector shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process. At a minimum the “distinguishing mark” shall include the special inspector’s initials and date.
 - 7.4 **Welding:** Inspection of shop and field welding shall comply with CBC Section 1705A.2.3.1 (CBC 2013 Section 1705A.2.2.3) and *IR 17-2: Nondestructive Testing (NDT) of Structural Welds* and IR 17-3. Additional requirements for welding inspections are listed below:
 - 7.4.1 The cost of inspection shall be paid by the owner (which is usually the school district.)
 - 7.4.2 Fabrication special inspectors and field welding special inspectors shall hold current certification as an AWS CWI, in accordance with AWS QC1.
 - 7.4.3 Welding procedure specification shall be pre-qualified or qualified by test per AWS D1.1/D1.1M Sections 3 and 4 respectively and SJI Specifications.
- 8. **Revisions During Manufacturing:** This section is not applicable to the approved alternate design substitutions described in Section 4.2 above. If revisions to the approved joist document are necessary, the manufacturer shall obtain DSA approval of the revisions prior to



OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC

the manufacturing of the affected joists. The steps and requirements for making revisions are as follows:

- 8.1** Manufacturer notifies the fabrication special inspector of changes being proposed.
- 8.2** Manufacturer submits joist revision documents to the project design professional for approval. The joist revision documents shall include all the items listed in Section 4.1 of this IR for the affected joists.
- 8.3** The project design professional approves the joist manufacturer's revision documents and places a signed and stamped statement of general conformance on the documents.
- 8.4** The project design professional submits the revised documents, as a CCD, to DSA for approval.
- 8.5** DSA reviews the CCD and stamps it with approval. **Note:** This step will require a resubmittal if the initial submittal documents are not approved.
- 8.6** The manufacturer starts the manufacturing of the joists in accordance with the DSA approved CCD following the procedures in Section 5 of this IR.
- 9. Glossary:** For clarity and reference, some frequently used terms in this IR are defined below:
 - 9.1 Alternate Design Substitutions (ADS)**

DSA approved alternate member(s) or components that may be substituted during manufacturing. The ADS are shown in the joist documents, and they are equal or greater in load carrying capacity than the component(s) being substituted, and they can be readily verified by the fabrication special inspector.
 - 9.2 Construction Documents**

Project documents pertaining to the construction of the project and submitted to DSA for review prior to construction. These documents may include drawings and specifications for site, architectural, structural, mechanical, electrical and energy features.
 - 9.3 Fabrication Special Inspector**

An AWS certified welding inspector who provides continuous inspection during the manufacturing of OWSJ. The inspector may be employed by the school district and approved for the project by DSA, or the inspector may be employed by the laboratory of record. (CAC Section 4-335).
 - 9.4 Field Welding Special Inspector**

A welding inspector who provides continuous inspection of field welding. The inspector may be employed by the school district and approved for the project by DSA, or the inspector may be employed by the laboratory of record. (CAC Section 4-335).
 - 9.5 Joist Documents**

The joist placement drawings, calculations, joist profiles with member sizes and connection details prepared by the manufacturer. (CBC Sections 2207A.3 (2207.3*) and 2207A.4 (2207.4*)). The joist documents may be submitted to DSA as a deferred submittal. (CAC Section 4-317(g)).
 - 9.6 Joist Manufacturer**

An OWSJ manufacturer who manufactures the members and components of OWSJ and uses those members and components to fabricate on a continuing basis joists of the K-, LH-, DLH-Series, and/or Joist Girders conforming to the Steel Joist Institute's Standard Specifications and Load Tables of latest adoption.

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2016 & 2013 CBC

9.7 Joist Revision Documents

The revised joist documents for joists that are affected by changes to the DSA approved joist documents during fabrication.

9.8 Project Design Professional

The architect or structural engineer in “general responsible charge” of a project. (CAC Section 4-316(a)).

9.9 Project Inspector

A DSA certified inspector who is in general responsible charge of inspection for the project. They are employed by the school district and approved by DSA for the project. (CAC Section 4-333(b)).

9.10 Shop Order/Drawings

Fabrication plans and details develop by manufacturer to facilitate the fabrication of OWSJ.

REFERENCES:

California Code of Regulations (CCR) Title 24

Part 1, 2016 and 2013 California Administrative Code.

Part 2, 2016 and 2013 California Building Code, Sections 2207A and 2207*

This IR is intended for use by DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K–12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

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