

OPEN WEB STEEL JOISTS AND JOIST GIRDERS: 2010 CBC

IR 22-3.10

References:

California Code of Regulations (CCR), Title 24, Part 2: California Building Code (CBC)
2010 CBC, Sections 1604A.3.3, 1604.3.3*,
2203A.2, 2203.2*, 2206A, 2206*, and 1704A.3

DSA IR 17-2 and 17-3

Steel Joist Institute

Specifications SJI K-1.1, SJI LH/DLH-1.1, SJI JG-1.1, and SJI CJ-1.0
42nd Edition Catalog and 1st Edition Composite Steel Joist Catalog

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Discipline: Structural

This Interpretation of Regulations (IR) is intended for use by the Division of the State Architect (DSA) staff, and as a resource for design professionals, to promote more uniform statewide criteria for plan review and construction inspection of projects within the jurisdiction of DSA which includes State of California public elementary and secondary schools (grade 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.

This IR is reviewed on a regular basis and is subject to revision at any time. Please check the DSA web site for currently effective IRs. Only IRs listed in the document at <http://www.dgs.ca.gov/dsa/Resources/IRManual.aspx> at the time of plan submittal to DSA are considered applicable.

* Indicates alternative 2010 CBC sections that may be used by community colleges, per 2010 CBC, Section 1.9.2.2.

Purpose: This Interpretation of Regulations (IR) clarifies the process and criteria under which the Division of the State Architect (DSA) will evaluate, accept for use and inspect the use of open web steel joists (OWSJ) on projects under DSA jurisdiction. This IR is applicable to projects submitted to DSA for review under the 2010 California Building Code (CBC). For projects submitted for review under the 2007 CBC, see IR 22-3.

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 CBC Section 2206A.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
- Loading diagrams for all OWSJ in accordance with CBC Section 2206A.2 (2206.2*), Item 1 and any deflection requirement.
- Specify the SJI joist designation for each joist. The designation shall comply with CBC Section 2206A.2 (2206.2*).
- 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.1.1 and 1705A) 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 elements shall be coordinated with 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 deferred approval per Section 4 below and Title 24, Part 1, 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 to 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 Field Change Documents to DSA for review in accordance with [IR A-6](#). These changes may include joist designation, joist depths, layout, framing plans, loads, joist anchorage, etc.

4.2 Submittal Documents: The manufacturer's joist documents shall include:

- Placement drawings per CBC Section 2206A.4 (2206.4*), including bridging for joist chord per CBC Section 2206A.6 (2211.2.2*), and for composite joists (CJ),

shear stud installation plans with sizes, quantity, and locations of all shear connectors on the composite steel joists.

- Calculations per CBC Section 2206A.3 (2206.3*), signed and stamped by the manufacturer's California registered professional engineer per CBC Section 2206A.4 (2206.4*).
- Joist profiles with member sizes and connection details, signed and stamped by the manufacturer's California registered professional engineer per CBC Section 2206.A.4.1 (2211.2.1*), *Design Approval*. This information may be included with the calculation package.
- 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
- 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, he/she shall provide a signed and stamped statement of general conformance and submit it to DSA for approval in accordance with Title 24, Part 1, Section 4-317(g). For additional information on the Statement of General Conformance, see DSA [IR A-18](#).

The project design professional shall submit two sets of joist documents to DSA. One set will be used for marking up DSA review comments if there are any. The other set will be used for DSA stamping.

4.5 DSA Review This step may involve a back-check review if the documents were not approved. 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 two sets of revised joist documents to the back-check appointment.

DSA review of the calculations typically includes verification of input and output. 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 joist designation CJ listed in the SJI 1st Edition of Composite Steel Joist Catalog, containing the Standard Specifications, the design guides, weight tables, bridging tables, and safe factored uniform joist loads.

- The joist designation K, LH, DLH, or Joist Girder (JG) listed in the 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 42nd Edition Catalog.
- Effects 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 103.4(d) and 1003.4(d) respectively of the SJI Standard Specifications.

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. The stamped set of joist plans 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 manufacturing of OWSJ occurs in this phase.

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.

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 2206A.5 (2206.5*) to DSA, the owner, and the project design professional.

6. Field Installation: During this phase, the OWSJ arrive at the construction site and are ready to be installed. 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 1704A.3 and shall be performed in accordance with Sections 4-333(c) and 4-335, Title 24, Part 1, and DSA [IR 17-3](#).

7.1 Unidentified Steel. All steel shall be identified by the fabrication special inspector per 2010 CBC Section 1704A.3.2.1. Unidentified steel shall be tested per 2010 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 2212A.2 (2211.5.2*).

7.3 Shop Fabrication. Inspection of shop fabrication shall comply with 2010 CBC Section 1704A.3.2.1.

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 2010 CBC Section 1704A.3.2.1 and DSA IR's [17-2](#) and [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/D1.1 M 2006 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 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 the 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 When the project design professional approves joist revision documents, he/she shall provide a signed and stamped statement of general conformance on these documents and submit to DSA for approval.

8.4 DSA reviews the joist revision documents and the statement of general conformance. DSA approves and stamps the joist revision documents.

8.5 The manufacturer starts the manufacturing of the joists with the approved joist revision documents 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 components(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. He/she is employed by the school district and approved by DSA for the project, *Title 24, Part 1, Section 4-333(c)*

9.4 Field Welding Special Inspector

A welding inspector who provides continuous inspection of field welding. He/she is employed by the school district, *Title 24, Part 1, Section 4-333(c)*, and approved by DSA for the project.

9.5 Joist Documents (CBC 2206A.4 - Design Approval)

The joist placement drawings, calculations, joist profiles with member sizes and connection details prepared by the manufacturer. The joist documents usually are submitted to DSA for deferred approval, *CBC Sections 2206A.3 (2206.3*) and 2206A.4 (2206.4*)*

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.

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, *Title 24, Part 1, Section 4-316(a)*

9.9 Project Inspector

A DSA certified inspector who is in general responsible charge of inspection for the project. He/she is employed by the school district and approved by DSA for the project, *Title 24, Part 1, Section 4-333(b)*

9.10 Shop Order/Drawings

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