



# Research Report

**Long Span Truss Installation**

**DRR No. 1506-08**

**Structural Building Components Association (SBCA)**

**Issue Date: March 31, 2017**

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## 1. Code Compliance Process Evaluated:

- 1.1. Long span truss installation
- 1.2. For the most recent version of this report, visit [drjengineering.org](http://drjengineering.org). For more detailed state professional engineering and code compliance legal requirements and references, visit [drjengineering.org/statelaw](http://drjengineering.org/statelaw). DrJ is fully compliant with all state professional engineering and code compliance laws.

## 2. Applicable Codes and Standards:<sup>1</sup>

- 2.1. *2009, 2012 and 2015 International Building Code (IBC)*
- 2.2. *2009, 2012 and 2015 International Residential Building Code (IRC)*
- 2.3. *AISI – American Iron and Steel Institute*
- 2.4. *ANSI/TPI 1 – National Design Standard for Metal Plate Connected Wood Truss Construction*

## 3. Performance Evaluation:

- 3.1. This research report evaluates specific code requirement for the design and installation of trusses longer than 60 feet.
- 3.2. The requirements discussed are considered standard in the industry and are presented only as a guide. Specific designs should be confirmed with the local building authorities, who may have unique regulations not addressed in this report. The guidelines provided are not intended to exclude alternative solutions for specific projects that have been designed by a qualified Registered Design Professional.

<sup>1</sup> Unless otherwise noted, all references in this research report are from the 2015 version of the codes and the standards referenced therein, including, but not limited to, ASCE 7, SDPWS and WFCM. This product also complies with the 2000-2012 versions of the IBC and IRC and the standards referenced therein. As required by law, where this research report is not approved, the building official shall respond in writing, stating the reasons this research report was not approved. For variations in state and local codes, if any, see [Section 8](#).

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- 3.3. This research report is a code compliance evaluation report that is intended only to provide information on the code compliance process relating to the topic listed in [Section 1](#) of this report. For the purposes of this report, DrJ is not certifying a process but rather is providing the user with information they can use to ensure code compliant installation of the process discussed. For specific details see the applicable building code or standard.
- 3.4. Any code compliance issues not specifically addressed in this section are outside the scope of this evaluation.

### 4. Applications:

#### 4.1. IRC Long-span Roof Truss Requirements

- 4.1.1. The *IRC* does not include specific language governing long-span roof trusses but does provide guidance on bracing in [Section R802.1.3](#) for wood trusses and [Section R804.3.6](#) for cold-formed steel trusses:

##### 4.1.1.1. Wood Trusses

**R802.10.2.1 Applicability limits.** The provisions of this section shall control the design of truss roof framing when snow controls for buildings, not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist, rafter or truss span...Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 140 miles per hour (63 m/s), Exposure B or C, and a maximum ground snow load of 70 psf (3352 Pa)...

**R802.10.3 Bracing.** Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practice such as the SBCA Building Component Safety Information (BCSI) Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.

##### 4.1.1.2. Cold-Formed Steel Trusses

**R804.1.1 Applicability limits.** The provisions of this section shall control the construction of cold-formed steel roof framing for buildings not greater than 60 feet (18 288 mm) perpendicular to the joist, rafter or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist span or truss...Cold-formed steel roof framing constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 139 miles per hour (62 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3350 Pa).

**R804.3.6 Roof trusses.** Cold-formed steel trusses shall be designed and installed in accordance with AISI S100, Section D4<sup>2</sup>. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as the SBCA Cold-Formed Steel Building Component Safety Information (CFSBCSI) Guide to Good Practice for Handling, Installing & Bracing of Cold-Formed Steel Trusses...

#### 4.2. IBC Long-span Roof Truss Requirements

- 4.2.1. The *IBC* includes more direct language and requires truss design drawings as specified in [Section 2303.4.1.1](#), registered design professional input on trusses longer than 60 feet as specified in [Section 2303.4.1.3](#) and special inspector verification as specified in [Section 1705.5.2](#):

##### 4.2.2. Wood Trusses

**2303.4.1.1 Truss design drawings.** The written, graphic and pictorial depiction of each individual truss shall be provided to the building official for approval prior to installation. Truss design drawings shall also be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the information specified below:

13. Maximum axial tension and compression forces in the truss members;

14. Required permanent individual truss member restraint location and the method and details of restraint/bracing to be used in accordance with Section 2303.4.1.2.

**2303.4.1.2 Permanent individual truss member restraint.** Where permanent restraint of truss members is required on the truss design drawings, it shall be accomplished by one of the following methods:

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<sup>2</sup> AISI S100, Section D4 in the 2012 edition references S214.

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1. Permanent individual truss member restraint/bracing shall be installed using standard industry lateral restraint/bracing details in accordance with generally accepted engineering practice. Locations for lateral restraint shall be identified on the truss design drawing.
2. The trusses shall be designed so that the buckling of any individual truss member is resisted internally by the individual truss through suitable means (i.e., buckling reinforcement by T-reinforcement or L-reinforcement, proprietary reinforcement, etc.). The buckling reinforcement of individual members of the trusses shall be installed as shown on the truss design drawing or on supplemental truss member buckling reinforcement details provided by the truss designer.
3. A project-specific permanent individual truss member restraint/bracing design shall be permitted to be specified by any registered design professional.

**2303.4.1.3 Trusses spanning 60 feet or greater.** The owner or the owner's authorized agent shall contract with any qualified registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for all trusses with clear spans 60 feet (18 288 mm) or greater.

**1705.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater.** Where a truss clear span is 60 feet (18288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

### 4.2.3. Cold-Formed Steel Trusses

**2211.3 Truss design.** Cold-formed steel trusses shall be designed in accordance with AISI S214, Sections 2211.3.1 through 2211.3.4 and accepted engineering practice.

**2211.3.1 Truss design drawings.** The truss design drawings shall conform to the requirements of Section B2.3 of AISI S214 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section B6(a) or B 6(c) of AISI S214 where these methods are utilized to provide restraint/bracing.

**2211.3.3 Trusses spanning 60 feet or greater.** The owner or the owner's authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705.2.

**1705.2.4 Cold-formed steel trusses spanning 60 feet or greater.** Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

### 4.3. ANSI/TPI 1 Long-span Truss Requirements

- 4.3.1.** ANSI/TPI 1 echoes both the *IBC* and *IRC* provisions and requires RDP involvement in both bracing design and special inspections as follows:

#### 2.3.1.6 Long Span Truss Requirements

**2.3.1.6.1 Restraint/Bracing Design.** In all cases where a Truss clear span is 60 ft. (18 m) or greater, the Owner shall contract with any Registered Design Professional for the design of the Temporary Installation Restraint/Bracing and the Permanent Individual Truss Member Restraint and Diagonal Bracing.

**2.3.1.6.2 Special Inspection.** In all cases where a Truss clear span is 60 ft. (18 m) or greater, the Owner shall contract with any Registered Design Professional to provide special inspections to assure that the Temporary Installation Restraint/Bracing and the Permanent Individual Truss Member Restraint and Diagonal Bracing are installed properly.

### 4.4. American Iron and Steel Institute (AISI)

- 4.4.1.** As referenced in both the *IRC* and *IBC*, AISI includes the following language that governs all truss design, not just long-span trusses:

**4.4.1.1. B2.3 Truss Design Drawings.** The truss design drawings shall consist of the individual truss design drawings and referenced details, if any. The truss design drawings shall be part of the truss submittal package and include, at a minimum, the information included below:

14. Locations of required permanent individual truss member restraint in accordance with Section B6(a) or B6(c), if required, and

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### 4.4.1.2. B6 Design of Permanent Individual Truss Member Restraint/Bracing

Where permanent individual truss member restraint/bracing is required, it shall be accomplished by one of the following methods:

(a) Standard Industry Details. Standard industry permanent individual truss member restraint/bracing details supplied in accordance with B3.4.

(c) Project-Specific Design. A project-specific permanent individual truss member restraint/bracing design by any registered design professional, as specified in the contracts or construction documents, and supplied in accordance with B3.4.

## 5. Test and Engineering Substantiating Data:

- 5.1. The code compliance process evaluated by this report falls within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this report is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.
- 5.2. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineered alternative means of compliance. This report assesses compliance with defined standards, generally accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.
- 5.3. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.
- 5.4. DrJ has reviewed and found the data provided by other professional sources are credible. This information has been approved in accordance with DrJ's procedure for acceptance of data from approved sources.
- 5.5. DrJ's responsibility for data provided by approved sources is in accordance with professional engineering law.
- 5.6. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IBC*, *WFCM*, *IBC*, *SDPWS*, etc.). This includes review of code provisions and any related test data that helps with comparative analysis or provides support for equivalency to an intended end-use application.

## 6. Findings:

- 6.1. For trusses spanning less than 60 feet and designed in accordance with the *IBC* or *IRC*, the guidance provided in BCSI and CFSBCSI is typically adequate.
- 6.2. When trusses span 60 feet or more and designed in accordance with the *IBC* or *IRC*, a registered design professional is required to design the permanent bracing.
  - 6.2.1. For wood trusses, an RDP must follow the provisions of [IBC Section 2303.4.1.1](#), items 13 & 14 to design permanent truss bracing.
  - 6.2.2. For cold-formed steel trusses, an RDP must follow the provisions of AISI S214, B2.3 and B6, to design the permanent truss bracing.
- 6.3. Installation of long-span trusses should follow the guidelines in BCSI and CFSBCSI.
- 6.4. [IBC Section 104.11](#) and [IRC Section R104.11](#) ([IFC Section 104.9](#) is similar) state:

**104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. ... Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.<sup>3</sup>

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<sup>3</sup> The last sentence is adopted language in the 2015 codes.

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**6.5.** This product has been evaluated with the codes listed in [Section 2](#), and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:

**6.5.1.** No known variations

**6.6.** This report uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

## 7. Conditions of Use:

- 7.1.** Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this report and the installation instructions shall be submitted at the time of permit application.
- 7.2.** Any generally accepted engineering calculations needed to show compliance with this report shall be submitted to the code official for review and approval.
- 7.3.** Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.
- 7.4.** Inspect each truss thoroughly prior to hoisting into place and address any damaged truss members.
- 7.5.** When hoisting long-span trusses into position, a spreader bar should be used to reduce truss sway and potential damage.
- 7.6.** Install all permanent diagonal bottom chord and web member bracing immediately to maintain the rigidity of the entire roof system as it's being installed.
- 7.7.** Use minimum 27" 2x4 lumber for truss bracing, fastened with minimum two (2) 16d box nails into each truss member.
- 7.8.** Bottom chord permanent lateral bracing shall be installed every ten feet with web bracing installed laterally and diagonally where required by the truss design drawing.
- 7.9.** Design
- 7.9.1.** Building Designer Responsibility
- 7.9.1.1.** Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer (e.g., Owner, Registered Design Professional, etc.) for the Building and shall be in accordance with [IRC Section R106](#) and [IBC Section 107](#).
- 7.9.1.2.** The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with [IRC Section R301](#) and [IBC Section 1603](#).
- 7.9.2.** Construction Documents
- 7.9.2.1.** Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.
- 7.10.** Responsibilities
- 7.10.1.** The information contained herein is a product, engineering or building code compliance research report performed in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering procedures, experience and good technical judgment.
- 7.10.2.** DrJ research reports provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated section.
- 7.10.3.** The engineering evaluation was performed on the dates provided in this report, within DrJ's professional scope of work.
- 7.10.4.** The actual design, suitability and use of this research report for any particular building is the responsibility of the Owner or the Owner's authorized agent, and the report shall be reviewed for code compliance by the Building Official.

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**7.10.5.** The use of this research report is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party inspection process, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to assure accurate compliance with the applicable building code.

### **8. Review Schedule:**

- 8.1.** This research report is subject to periodic review and revision. For the most recent version of this report, visit [drjengineering.org](http://drjengineering.org).
- 8.2.** For information on the current status of this report, contact [DrJ Engineering](#).