



DrJ Research Report

DRR 1506-08

Long Span Truss Installation

**Structural Building Components
Association (SBCA)**

**Code Compliance Process:
Long Span Truss Installation**

Issue Date:

April 3, 2017

Revision Date:

October 16, 2020



REPORT HOLDER
INFORMATION:

Structural Building Components Association
(SBCA)

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DIVISION: 05 00 00 - METALS

SECTION: *Select a section.* 05 44 00 - Cold-Formed Metal Trusses

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: *Select a section.*

1 CODE COMPLIANCE PROCESS EVALUATED¹

1.1 Long Span Truss Installation

2 APPLICABLE CODES AND STANDARDS^{2,3}

2.1 Codes

- 2.1.1 *IBC—12, 15, 18: International Building Code®*
- 2.1.2 *IRC—12, 15, 18: International Residential Code®*
- 2.1.3 *IECC—12, 15, 18: International Energy Conservation Code®*

2.2 Standards and Referenced Documents

- 2.2.1 *AISI S100: North American Specification for the Design of Cold-formed Steel Structural Members*
- 2.2.2 *AISI S214: North American Standard for Cold-Formed Steel Framing – Truss Design*
- 2.2.3 *TPI 1: National Design Standard for Metal-plate-connected Wood Truss Construction*

3 EVALUATION SCOPE

- 3.1 This research report evaluates specific code requirements 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 as a guide only. Specific designs should be confirmed with local building authorities, who may have unique regulations not addressed in

¹ Building codes require data from valid research reports be obtained from approved sources. Work of licensed registered design professionals (RDPs) meets the code requirements for approval by the building official.

Building official approval of a licensed RDP is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant jurisdiction. Therefore, the work of licensed RDPs is accepted by building officials, except when plan (i.e. peer) review finds an error with respect to a specific section of the code. Where this DRR is not approved, the building official responds in writing stating the reasons for disapproval.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit drjengineering.org or call us at 608-310-6748.

² Unless otherwise noted, all references in this DRR are from the 2018 version of the codes and the standards referenced therein (e.g., ASCE 7, NDS, ASTM). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein.

³ All terms defined in the applicable building codes are italicized.



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.

- 3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this DRR.
- 3.4 Any engineering evaluation conducted for this DRR was performed on the dates provided in this DRR and within DrJ's professional scope of work.

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 R802.10.3](#) 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 that are 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 140 miles per hour (63 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.⁴ Cold-formed steel trusses shall be designed and installed in accordance with AISI S240. 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](#) for wood trusses. Steel trusses are subject to [Section 2211.1.3](#)⁵:

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

⁴ This section in the 2015 *IRC* references *AISI S100* in place of *AISI 240*.

⁵ [2015 IBC Section 2211.3](#)



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:

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 (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.



4.2.3 Cold-Formed Steel Trusses

2211.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2211.1.3.1 through 2211.1.3.3.

2211.1.3.1 Truss design drawings.⁶ The truss design drawings shall conform to the requirements of Section I1 of AISI S202 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 I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing.

2211.1.3.2 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 1-2014 Long-span Truss Requirements

4.3.1 ANSI/TPI 1-2014 echoes both the *IBC* and *IRC* provisions and requires registered design professional 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 a Special Inspector to perform special inspections. Special Inspections shall assure that the Trusses, including the Temporary Installation Restraint/Bracing and the Permanent Individual Truss Member Restraint and Diagonal Bracing are installed in accordance with the approved Construction Documents and the approved Truss Submittal Package.

⁶ The equivalent section in the 2015 *IBC* references *AISI S214* in place of *AISI S202*.



4.4 American Iron and Steel Institute (AISI)

- 4.4.1 As referenced in the *IBC*, *AISI S202* includes the following language that governs all truss design, not just long-span trusses:

I1.2.3 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 specified below:

[...]

(14) Locations of required permanent individual truss member restraint in accordance with Section I1.6(a) or I1.6(c), if required [...]

I1.6 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 I1.3.4.

[...]

(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 I1.3.4.

5 INSTALLATION

- 5.1 Installation shall comply with the manufacturer's installation instructions and this DRR. In the event of a conflict between the manufacturer's installation instructions and this DRR, the more restrictive shall govern.

6 TEST ENGINEERING SUBSTANTIATING DATA

- 6.1 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.
- 6.2 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.
- 6.3 Some information contained herein is the result of testing and/or data analysis by other sources which conform to *IBC Section 1703* and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.
- 6.4 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IBC*, *IRC*, *NDS*®, and *SDPWS*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.



7 FINDINGS

- 7.1 For trusses spanning less than 60 feet and designed in accordance with the *IRC* or *IBC*, the guidance provided in BCSI and CFSBCSI is typically adequate.
- 7.2 For trusses spanning 60 feet or more and designed in accordance with the *IRC* or *IBC*, installation should follow the guidelines in BCSI and CFSBCSI and a registered design professional is required to design the permanent bracing.
 - 7.2.1 For wood trusses, the registered design professional must follow the provisions of *IBC Section 2303.4.1.1* items 13 and 14 to design permanent truss bracing.
 - 7.2.2 For cold-formed steel trusses, the registered design professional must follow the provisions of *AISI S202*, 11.2.3 and 11.6 to design the permanent truss bracing.
- 7.3 *IBC Section 104.11* (*IRC Section R104.11* and *IFC Section 104.9* are similar) states:

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, not less than 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*.
- 7.4 This product has been evaluated in the context of 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 applicable to this evaluation, they are listed here.
 - 7.4.1 No known variations

8 CONDITIONS OF USE

- 8.1 Inspect each truss thoroughly prior to hoisting into place and address any damaged truss members.
- 8.2 When hoisting long-span trusses into position, a spreader bar should be used to reduce truss sway and potential damage.
- 8.3 Install all permanent diagonal bottom chord and web member bracing immediately to maintain the rigidity of the entire roof system as it is being installed.
- 8.4 Use minimum 27" 2x4 lumber for truss bracing, fastened with at minimum two (2) 16d box nails in each truss member.
- 8.5 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.
- 8.6 Where required by the *building official*, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this DRR and the installation instructions shall be submitted at the time of *permit* application.
- 8.7 Any generally accepted engineering calculations needed to show compliance with this DRR shall be submitted to the AHJ for review and approval.
- 8.8 *Design loads* shall be determined in accordance with the building code adopted by the *jurisdiction* in which the project is to be constructed and/or by the Building Designer (e.g., *owner* or *registered design professional*).
- 8.9 At a minimum, this product shall be installed per Section 5, of this DRR.
- 8.10 This product is manufactured under a third-party quality control program in accordance with *IBC Section 104.4* and *110.4* and *IRC Section R104.4* and *R109.2*.
- 8.11 The actual design, suitability, and use of this DRR, for any particular building, is the responsibility of the *owner* or the owner's authorized agent. Therefore, the DRR shall be reviewed for code compliance by the *building official* for acceptance.



9 REVIEW SCHEDULE

9.1 For the most recent version or current status of this DRR, visit drjengineering.org or contact [DrJ Engineering](#).