

International Building Code/International Residential Code Inspection & Quality Assurance Requirements for Metal Plate Connected Wood Trusses

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Introduction:

WTCA has developed this *Technical Note* to provide a clear perspective on truss plant quality assurance and third party inspections as they relate to the requirements developed by the International Code Council (ICC) within the *International Building Code (IBC)* and the *International Residential Code (IRC)*. The same perspective outlined in this *Technical Note* should be applied when discussing how all structural building component third party inspections relate to Chapter 17 special inspection requirements. The analysis is based on the 2003, 2006, and 2007 supplement editions of the *IBC* and *IRC* as well as the referenced industry design standard *ANSI/TPI 1-2002 (TPI 1)*¹.

Issue:

WTCA has been involved in several markets and with several members of the code compliance/inspection community regarding confusion over exactly how the (*IBC*) requirements from Chapter 17 (Structural Tests and Special Inspection) are applied to the metal plate connected wood truss manufacturing industry. The confusion stems from an interpretation of how in-plant manufacturing quality control (QC) relates to fabricator approval (Section 1704.2.2) and the third party inspection process, which is the process that has been used by the structural building components industry as the means to comply with Building Code inspection requirements.

Analysis/Recommendation:

The *IBC* and *IRC* are designed to provide implementation language with respect to building code compliance of built construction. A significant role of all building departments is the installation inspection process.

2003/2006 IBC 109.3 Required inspections. The building official, upon notification, shall make the inspections set forth in Sections 109.3.1 through 109.3.10...

IBC 109.3.4 Frame inspection. Framing inspections shall be made after the roof deck or sheathing, all framing, fireblocking and bracing are in place...

IBC 109.4 Inspection agencies. The building official is authorized to accept reports of approved inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

2003/2006 R109.1.4 Frame and masonry inspection. Inspection of framing and masonry construction shall be made after the roof, masonry, all framing, firestopping, draftstopping and bracing are in place....

R109.2 Inspection agencies. The building official is authorized to accept reports of approved agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

¹ *TPI 1* is the National Design Standard for Metal Plate Connected Wood Trusses and has been adopted as a referenced standard in Chapter 35 of the 2003 and 2006 editions of the *IBC* and the *IRC*.

The code language and industry third party inspection concepts show that metal plate connected wood trusses explicitly comply with the *IBC* and *IRC* requirements for supplying structural building components to the building construction marketplace without falling into the special inspection requirements.

To specifically deal with the confusion on this special inspection issue, the following code change was made to Section 1702 with respect to the definition of “*Fabricated Items*” and was approved by the ICC consensus process in the 2007 *IBC* Supplement. The following language forms the basis of the current *IBC*:

CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS

Section 1702 Change the definition of “Fabricated Item” to read as shown: (S28-06/07)

FABRICATED ITEM. Structural, load-bearing or lateral load-resisting assemblies consisting of materials assembled prior to installation in a building or structure, or subjected to operations such as heat treatment, thermal cutting, cold working or reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standard specifications referenced by this code, such as rolled structural steel shapes, steel-reinforcing bars, masonry units, and wood structural panels or in accordance with a standard, listed in Chapter 35, which provides requirements for quality control done under the supervision of a third party quality control agency shall not be considered “fabricated items.”

TPI 1 is a Chapter 35 listed standard and is the design and quality control standard that is used by the structural building components industry with respect to Truss manufacturing performed under the supervision of a third party quality control agency. These relate directly back to *IBC* and *IRC* Section 109 where framing inspections are to be performed by the Building Official or an approved inspection agency.

TPI 1-2002 Chapter 3 (Quality Criteria for the Manufacture of Metal Plate Connected Wood Trusses) implements the in-plant quality control process as follows:

ANSI/TPI 1-2002 Section 3.1 GENERAL

3.1.1 Chapter 3 is the quality standard for the manufacturing processes of metal plate connected wood trusses, and shall be used in conjunction with a manufacturing quality assurance procedure and a truss design. These provisions shall be included in the quality assurance program of each Truss Manufacturer...

3.1.3 Truss Manufacturers and inspection agencies shall establish methods that document the application of these quality assurance procedures throughout the manufacturing process. The Truss Manufacturers' methods shall be subject to periodic audit for compliance with the requirements of this standard by an approved inspection agency, where required by local authorities having jurisdiction, or other means...

3.2 IN-PLANT QUALITY ASSURANCE

3.2.1 An in-plant quality control manual shall be maintained for each truss manufacturing facility, which will include the requirements for daily quality control and any audits that will be performed.

The traditional third party inspection process that has been used in the structural building components industry for the last fifty years complies with all the inspection requirements defined within the *IBC* and *IRC*.

Appendix A

Additional Background and Analysis:

TPI 1 Requirements

The 2003 and 2006 editions of the *IBC* and *IRC* include the following language regarding the use of Trusses:

2003 IBC 2303.4 Trusses. Metal-plate-connected wood trusses shall be manufactured as required by TPI 1. Each manufacturer of trusses using metal plate connectors shall retain an approved agency to make unscheduled inspections of truss manufacturing and delivery operations. The inspection shall cover all phases of truss operations, including lumber storage, handling, cutting fixtures, passes or rollers, manufacturing, bundling and banding.

2006 IBC 2303.4.2 Metal-plate-connected trusses. In addition to Sections 2303.4.1 through 2303.4.1.7, the design, manufacture and quality assurance of metal-plate-connected wood trusses shall be in accordance with TPI 1.....

2003/2006 IRC R502.11.1 Design. Wood trusses shall be designed in accordance with approved engineering practice. The design and manufacture of metal plate connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a registered professional where required by the statutes of the jurisdiction in which the project is to be constructed in accordance with Section R106.1.

2003/2006 IRC R802.10.2 Design. Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a registered professional where required by the statutes of the jurisdiction in which the project is to be constructed in accordance with Section R106.1.

Chapter 3 (Quality Criteria for the Manufacture of Metal Plate Connected Wood Trusses) of *TPI 1-2002* implements the in-plant quality control process as follows:

ANSI/TPI 1-2002 Section 3.1 GENERAL

3.1.1 Chapter 3 is the quality standard for the manufacturing processes of metal plate connected wood trusses, and shall be used in conjunction with a manufacturing quality assurance procedure and a truss design. These provisions shall be included in the quality assurance program of each Truss Manufacturer.

3.1.2 Metal plate connected wood trusses shall meet the minimum manufacturing quality requirements specified in this chapter, so that design assumptions are met.

3.1.3 Truss Manufacturers and inspection agencies shall establish methods that document the application of these quality assurance procedures throughout the manufacturing process. The Truss Manufacturers' methods shall be subject to periodic audit for compliance with the requirements of this standard by an approved inspection agency, where required by local authorities having jurisdiction, or other means.

3.1.4 Manufacturing inaccuracies exceeding the allowable tolerances described in this section are acceptable upon approval and follow-up documentation by a Truss Designer. Any necessary repair authorization shall be prepared by a Truss Designer.

3.2 IN-PLANT QUALITY ASSURANCE

3.2.1 An in-plant quality control manual shall be maintained for each truss manufacturing facility, which will include the requirements for daily quality control and any audits that will be performed.

The 2007 edition of *TPI 1* added the following language to clarify that metal plate connected wood Trusses conform to the Building Code requirements through *IBC* Section 109 and *IRC* Section R109:

ANSI/TPI 1-2007 Section 3.1.3 Documentation. Truss Manufacturers and inspection agencies shall establish methods that document the application of these quality assurance procedures throughout the manufacturing process. The Truss Manufacturer's methods shall be subject to periodic audit for compliance with the requirements of this Standard by an approved inspection agency per Section R109 *Inspections* of the International Residential Code / Section 109 *Inspections* of the International Building Code, where required by local authorities having Jurisdiction, or other means.

Finally, in-plant inspection process has been clarified in the 2007 edition of *ANSI/TPI 1*, which will be referenced by the 2009 editions of both the *IBC* and *IRC* as follows:

ANSI/TPI 1-2007 Sections 2.3.6.11 & 2.4.6.11 In-Plant Truss Inspections. Truss inspections, as required by the Jurisdiction, shall be performed at the manufacturer's facility using the manufacturer's In-Plant Quality Assurance Program (see Section 3.2) monitored by an inspection agency approved by the Jurisdiction, and shall satisfy any quality control/quality assurance requirements for the Trusses, and shall satisfy any designated in-plant special inspection requirements for the Trusses.

In-Plant Quality Control Manual

AC-10 is the Acceptance Criteria that the ICC-ES has created to provide a template for what is reasonable to include in a manufactured product's quality control manual as follows:

Acceptance Criteria for Quality Control Manuals (AC 10) Cover Page: This acceptance criteria has been issued to provide all interested parties with guidelines for demonstrating compliance with performance features of the applicable codes referenced in the acceptance criteria.

AC-10 is a tool or guide to help the manufacturer meet the Building Code and inspection agency requirements that each plant have a quality control program and an accompanying quality control process. All the requirements of *AC-10* have been incorporated into the latest version of the *In-Plant WTCA QC* program so that any component manufacturer that desires to use *In-Plant WTCA QC* as its in-plant quality control manual as well as its quality management information system will meet the requirements of *AC-10*. For more information on *In-Plant WTCA QC* please visit: www.sbcindustry.com/wtcaqc.php.

Concluding Thoughts

- The traditional third party inspection process that the structural building components industry has used for the last 50 years to comply with code requirements satisfies both the *IBC* and *IRC* requirements. The structural building components industry has voluntarily set up these QC procedures in order for the products to receive the recognition they deserve.
- Truss manufacturing falls outside the definition of *Fabricated Item* for which Chapter 17 applies and rather must conform to *TPI 1*, which is a Chapter 35 listed design and quality control standard used by the structural building components industry with respect to Truss manufacturing.
- *TPI 1* has followed the *IBC* and *IRC* requirements for third party inspections, thus requiring Truss Manufacturers to have third party inspection agencies regularly audit and inspect their manufacturing process in order to evaluate their compliance with *TPI 1*. There is no requirement to have an on-site "special inspection" of the Trusses.

Appendix B

Key Issues – Fabricated Items, Reference Codes, Fabricator Approval and Compliance with the IBC/IRC:

The *IBC* and *IRC* use reference codes and standards to provide specific information that would be impossible to fully include in the Building Code without making it unwieldy. The intent of the Building Code is to move toward referencing ANSI-based consensus codes and standards for all material interests, trusses included. The following is the implementing language in the *IBC* and *IRC* for the use of the referenced standard, *TPI 1*.

2003/2006 IBC 102.4 & IRC R102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference. Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

Chapter 35 of the *IBC* and Chapter 43 of the *IRC* provide a list of the standards referenced by these sections.

The Building Official (authority having Jurisdiction) is responsible for all the required inspections of Buildings or this role can be delegated to approved agencies or individuals. This is the first reference to the third party inspection process. Ultimately, the Building Official or their delegate is responsible for inspecting the structural framing for each Building which includes all of the Trusses.

2003/2006 IBC 104.4 Inspections. The building official shall make all of the required inspections, or the building official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.

2003/2006 IRC R104.4 Inspections. The building official is authorized to make all of the required inspections, or the building official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.

What follows is the first time in the Building Code that “special inspections” are referred to and references the permitting process and that the Registered Design Professional (RDP), if required, is to submit a list of the required inspections. If requested, this would implement Chapter 17 of the *IBC*. But based on the information contained in this *Technical Note*, Trusses should not be listed as requiring “special inspections.”

2003/2006 IBC 106.1 Submittal documents. Construction documents, statement of special inspections and other data shall be submitted in one or more sets with each permit application. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

2003/2006 IRC R106.1 Submittal documents. Construction documents, special inspection and structural observation programs and other data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required

by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

This is the first time that the “structural observation requirements” of Chapter 17 of Building Code are referenced.

2003/2006 IBC 106.3.4.1 General. When it is required that documents be prepared by a registered design professional, the building official shall be authorized to require the owner to engage and designate on the building permit application a registered design professional who shall act as the registered design professional in responsible charge...

Where structural observation is required by Section 1709, the statement of special inspections shall name the individual or firms who are to perform structural observation and describe the stages of construction at which structural observation is to occur (see also duties specified in Section 1704).

The special inspections are generally intended to be applied to special occupancies and circumstances that fall under critical seismic and wind conditions where the application of any Structural Element is deemed critical from a life safety perspective.

2003/2006 IBC 1709.1 General. Where required by the provisions of Section 1709.2 or 1709.3 the owner shall employ a registered design professional to perform structural observations as defined in Section 1702. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer’s knowledge, have not been resolved.

IBC 1709.2 Structural observations for seismic resistance.

Structural observations shall be provided for those structures included in Seismic Design Category D, E or F, as determined in Section 1613, where one or more of the following conditions exist:...

IBC 1709.3 Structural observations for wind requirements.

Structural observations shall be provided for those structures sited where the basic wind speed exceeds 110 mph (49 m/s), determined from Figure 1609, where one or more of the following conditions exist:...

IBC Section 1704 provides additional special inspection focus as it lists all the inspections required for structural steel and concrete applications under the critical seismic and wind conditions defined in Section 1709. There are no special inspections required for metal plate connected wood Trusses or structural building components in Section 1709. There is also an exemption for all R-3 single family permanent residential occupancies, which is the majority of construction that metal plate connected wood Trusses and other structural building components are deployed in.

2003/2006 IBC 1704.1 General. Where application is made for construction as described in this section, the owner or the registered design professional in responsible charge acting as the owner’s agent shall employ one or more special inspectors to provide inspections during construction on the types of work listed under Section 1704. The special inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the building official, for inspection of the particular type of construction or operation requiring special inspection. These inspections are in addition to the inspections specified in Section 109.

Exceptions:

1. Special inspections are not required for work of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
2. Special inspections are not required for building components unless the design involves the practice of professional engineering or architecture as defined by applicable state statutes and regulations governing the professional registration and certification of engineers or architects.

3. Unless otherwise required by the building official, special inspections are not required for occupancies in Group R-3 as applicable in Section 101.2 and occupancies in Group U that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.

To clarify this further, the following code change was made to Section 1702 with respect to the definition of *Fabricated Items* and was approved by the ICC consensus process in the 2007 *IBC* Supplement. This language forms the basis of the current *IBC*.

CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS

Section 1702 Change the definition of "Fabricated Item" to read as shown: (S28-06/07)

FABRICATED ITEM. Structural, load-bearing or lateral load-resisting assemblies consisting of materials assembled prior to installation in a building or structure, or subjected to operations such as heat treatment, thermal cutting, cold working or reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standard specifications referenced by this code, such as rolled structural steel shapes, steel-reinforcing bars, masonry units, and wood structural panels or in accordance with a standard, listed in Chapter 35, which provides requirements for quality control done under the supervision of a third party quality control agency shall not be considered "fabricated items."

TPI 1 is a Chapter 35 listed standard and is the design and quality control standard that is used by the structural building components industry with respect to Truss manufacturing that is performed under the supervision of a third party quality control agency. The third party QC process that many Truss Manufacturer's employ is done at the manufacturing facility and per *IBC* Section 1704.2.2 takes the place of any special inspection requirements.

2003/2006 IBC 1704.2.2 Fabricator approval. Special inspections required by this code are not required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices by an approved special inspection agency. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the building official stating that the work was performed in accordance with the approved construction documents.

Finally, the entire inspection process for metal plate connected wood Trusses goes back to *IBC* Section 109 where the framing inspections are to be performed by the Building Official. If the Trusses are manufactured in a manufacturing facility, the inspection process needs to be performed by an approved inspection agency.

2003/2006 IBC 109.1 General. Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the building official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection...

IBC 109.3 Required inspections. The building official, upon notification, shall make the inspections set forth in Sections 109.3.1 through 109.3.10...

IBC 109.3.4 Frame inspection. Framing inspections shall be made after the roof deck or sheathing, all framing, fireblocking and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved.

IBC 109.3.9 Special inspections. For special inspections, see Section 1704...

IBC 109.4 Inspection agencies. The building official is authorized to accept reports of approved inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

IRC R109.1 Types of inspections. For onsite construction, from time to time the building official, upon notification from the permit holder or his agent, shall make or cause to be made any necessary inspections and shall either approve that portion of the construction as completed or shall notify the permit holder or his or her agent wherein the same fails to comply with this code...

R109.1.4 Frame and masonry inspection. Inspection of framing and masonry construction shall be made after the roof, masonry, all framing, firestopping, draftstopping and bracing are in place and after the plumbing, mechanical and electrical rough inspections are approved...

R109.2 Inspection agencies. The building official is authorized to accept reports of approved agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

Appendix C

Key Definitions:²

BUILDING:

Structure used or intended for supporting or sheltering any use or occupancy.

BUILDING CODE:

As it applies to a Building, any set of standards set forth and enforced by a Jurisdiction for the protection of public safety.

BUILDING OFFICIAL:

Officer or other designated authority charged with the administration and enforcement of the Building Code, or a duly authorized representative.³

BUILDING PERMIT:

Certificate of permission issued by a Jurisdiction to an Owner to construct, enlarge, or alter a Building.

FRAMING STRUCTURAL SYSTEM:

Completed combination of Structural Elements, Trusses, connections and other systems, which serve to support the Building's self-weight and the specified loads.

CONSTRUCTION DOCUMENTS:

Written, graphic and pictorial documents prepared or assembled for describing the design (including the Framing Structural System), location and physical characteristics of the elements of a Building necessary to obtain a Building Permit and construct a Building.

JURISDICTION:

Governmental unit that is responsible for adopting and enforcing the Building Code.

LEGAL REQUIREMENTS:

Any applicable provisions of all statutes, laws, rules, regulations, ordinances, codes, or orders of the governing Jurisdiction.

REGISTERED DESIGN PROFESSIONAL (RDP):

Architect or engineer, who is licensed to practice their respective design profession as defined by the Legal Requirements of the Jurisdiction in which the Building is to be constructed.⁴

STRUCTURAL ELEMENT:

Single structural member (other than a Truss) that is specified in the Construction Documents.

TRUSS:

Individual metal-plate-connected wood component manufactured for the construction of a Building.

TRUSS MANUFACTURER:

Person engaged in the fabrication of Trusses.

² Definitions taken from *IBC 2006, ANSI/TPI 1-2002* Chapter 2, adopted by reference in *IBC 2006* (See IBC 102.4, 2303.4, 2306.1, Chapter 35), or the *Metal Plate Connected Wood Truss Handbook* published by WTCA.

³ IBC Section 104 for definition of a Building Official's responsibilities in the context of the code.

⁴ IBC Section 106.3.4.1 for definition of a Registered Design Professional's responsibilities in the context of the code.