Special Inspections for Trusses
Released September 1, 2006

**Issue:**

The following requirement has been put into effect in the Lansing, Michigan area:

12. SPECIAL INSPECTION: In accordance with section R109.1.5 Michigan Residential Code 2003 (MRC). A special inspector shall be employed by the owner or design professional of record to inspect the installation of wood trusses greater than forty (40) feet in span and all piggyback trusses regardless of span length. The special inspector shall submit a written report to the building inspector verifying that the trusses have been installed in accordance with the truss manufacturer’s instructions and/or the design professional of record’s specifications and details; including bracing location, bracing size, bracing attachment, and connection (including special hardware if required) of the trusses to the structure to resist all lateral and uplift loads.

The following analysis is based on the current engineering laws of the state Michigan and the 2003 Michigan Building Code (MBC) and the Michigan Residential Code (MRC), which are based on the nationally recognized model building codes the 2003 International Building Code (IBC) and the International Residential Code (IRC).

**Key Definitions:**

**OWNER:** Any person, agent, firm or corporation having a legal or equitable interest in the property.

**PERMANENT BUILDING STABILITY BRACING:**
Bracing that is to be considered part of the lateral force resisting system for the entire building. The Permanent Building Stability bracing is bracing that transfers forces due to seismic, wind, collected structural member buckling or other external lateral forces into the shearwalls, foundation or other lateral force resisting systems that are provided for the building. The Permanent Building Stability Bracing also prevents rollover of the roof trusses. The design of the lateral force resisting system for the entire building is the responsibility of the Registered Design Professional or Owner when there is no contract with a Registered Design Professional for the design of the Building Structural System.

**PERMANENT INDIVIDUAL TRUSS MEMBER BRACING:**
Bracing that is required to prevent local buckling of an individual truss chord or web member due to the compression forces in the individual truss member. The Permanent Individual Truss Member Bracing is the responsibility of the Truss Designer. In the absence of specific Permanent Individual Truss Member Bracing...
requirements, trusses shall be braced in accordance with the Building Component Safety Information (BCSI 1) Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.

REGISTERED DESIGN PROFESSIONAL (RDP) (or design professional of record):
“Registered design professional” means an individual who is licensed under article 20, 1980 PA 299, MCL 339.2001.5 (see Appendix C)

TRUSS DESIGN DRAWING (TDD):
A type of construction document that includes the written, graphic and pictorial depiction of each individual truss.6

TRUSS MANUFACTURER:
An individual or organization engaged in the manufacturing of Trusses.7

Unique Definitions for Structures that require a RDP:

BUILDING DESIGNER:
The Owner of the Building contracts with a Registered Design Professional for the design of the Building Structural System and who is responsible for the Construction Documents.8

TRUSS DESIGN ENGINEER:
The individual or organization responsible for the design of Trusses. Each individual truss design drawing shall bear the seal and signature of the Truss Design Engineer.9

Unique Definitions for Structures that do not require a RDP:

BUILDING DESIGNER:
The Owner of the Building or the individual or organization that contracts with the Owner for the design of the Building Structural System and/or who produces the Construction Documents.10

TRUSS DESIGNER:
The individual or organization responsible for the design of trusses.11

Analysis:

There is great value in identifying and placing appropriate responsibility in the design and building construction process. The Lansing requirement correctly places the responsibility for installation supervision on the owner or design professional of record. This is in keeping with both the 2003 MRC (see Appendix A) and MBC (see Appendix B):

2003 MRC 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.

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5 As defined in the Section 202 of the 2003 Michigan Building Code.
6 Definitions taken from IBC 2003, ANSI/TPI 1-2002 Chapter 2, adopted by reference in IBC 2003 (See IBC 102.4, 2303.4, 2306.1, Chapter 35), or the Metal Plate Connected Wood Truss Handbook published by WTCA.
7 Definitions taken from IBC 2003, ANSI/TPI 1-2002 Chapter 2, adopted by reference in IBC 2003 (See IBC 102.4, 2303.4, 2306.1, Chapter 35), or the Metal Plate Connected Wood Truss Handbook published by WTCA.
8 Adapted from IBC section 106.1.
9 Adapted from IBC section 2303.4.
10 Adapted from IBC 106.1
11 Adapted from IBC 2303.4
2003 MRC R109.1.5 Other inspections. In addition to the called inspections above, the building official may make or require any other inspections to ascertain compliance with this code and other laws enforced by the building official.

2003 MBC 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.

2003 MBC 109.3 Required Inspections. The building official...shall make the inspections set forth in Sections 109.3.1 through 109.3.10.

2003 MBC 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.

2003 MBC 109.3.8 Other inspections. In addition to the inspections specified above, the building official is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by the department of building safety.

2003 MBC 109.3.9 Special inspections. For special inspections, see Section 1704.

2003 MBC 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.

Additionally, the Michigan Statutes\(^\text{12}\) (see Appendix C) state the following about inspection responsibilities:

399.2001 Definitions "Person in responsible charge" means a person licensed under this article who determines technical questions of design and policy; advises the client; supervises and is in responsible charge of the work of subordinates; is the person whose professional skill and judgment are embodied in the plans, designs, plats, surveys, and advice involved in the services; and who supervises the review of material and completed phases of construction.

The special inspection requirement in Lansing for any trusses that are greater than 40 feet long or any time there are piggyback trusses also correctly identifies that there may be two sources for installation information:
1. The Truss Manufacturer's instructions and/or
2. The design professional of record (Building Designer)

The Lansing requirement also identifies some of the known problem areas regarding truss installation:
1. Bracing locations.
2. Bracing sizes.
4. Piggyback truss connections.
5. Connections of the trusses to the structure to resist lateral and uplift loads.
6. The instability of longer span trusses.

The structural building component industry has long recognized that there is some differentiation in installation requirements as trusses get longer. This is addressed in the information provided in Building Component Safety Information (BCSI 1) Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses (www.sbcindustry.com/bcsi.php), which has been jointly produced by WTCA and the Truss Plate Institute (TPI). BCSI I-03 includes specific recommendations for lifting or bracing based upon truss lengths. A note is provided on Figure B2-11 that professional guidance should be provided by a Professional Engineer for temporary bracing when trusses exceed 60 feet (see Figure 1).

\(^{12}\) For the latest professional engineering law see the following website: www.michigan.gov/engineers
Our industry has always stressed that trusses over 60 feet may require complex temporary bracing and that the services of a Professional Engineer should be obtained.

Regarding piggyback truss installation, industry recommendations outlined in BCSI 1 (BCSI –B2) warn installers that “the supporting truss must be completely installed with all permanent bracing and/or sheathing as required before installing the cap.” BCSI-B2 continues to state that “during the erection/installation of the supporting trusses, temporary bracing per the minimum requirements of BCSI-B2 is required until the full permanent bracing and/or sheathing is installed”.

As defined in Michigan law, the design professional of record is responsible for the overall design and flow of loads through the building. This includes what is called the “Permanent Building Stability Bracing” for the trusses. This bracing resists forces out of the plane of the individual truss and is generally part of the seismic or wind or other external lateral force resisting system.

399.2001 Definitions "Person in responsible charge" means a person licensed under this article who determines technical questions of design and policy; advises the client; supervises and is in responsible charge of the work of subordinates; is the person whose professional skill and judgment are embodied in the plans, designs, plats, surveys, and advice involved in the services; and who supervises the review of material and completed phases of construction.
The correct design and installation of permanent bracing is crucial to the long term performance and safety of any structure. Permanent bracing must provide sufficient support at right angles to the plane of the truss to hold every truss member in the position assumed for it in the design.

2003 MBC 2303.4.1 Truss design drawings. …18. Required permanent truss member bracing location. (Note, this is also known as the “permanent individual truss member bracing.”)

Note: The stability of each individual Truss member and how that is achieved is the responsibility of the Truss Designer, as the Truss Designer is most intimately familiar with the configuration and flow of loads through each individual Truss and is the one who can use this knowledge to ensure proper permanent individual truss member bracing location(s) and therefore overall individual Truss stability.

In the 2006 IBC, clarification was made to help with the implementation of item 18 (see Appendix D) as follows:

2006 IBC 2303.4.1 Truss design drawings. These shall include, at a minimum: …18. Required permanent individual truss member bracing and method per Section 2303.4.1.5, unless a specific truss member permanent bracing plan for the roof or floor structural system is provided by a registered design professional.

2006 IBC 2303.4.1.5 Truss member permanent bracing. Where permanent bracing of truss members is required on the truss design drawings, it shall be accomplished by one of the following methods:
1. The trusses shall be designed so that the buckling of any individual truss member can be resisted internally by the structure (e.g., buckling member T-bracing, L-bracing, etc.) of the individual truss. The truss individual member buckling reinforcement shall be installed as shown on the truss design drawing or on supplemental truss member buckling reinforcement diagrams provided by the truss designer.
2. Permanent bracing shall be installed using standard industry bracing details that conform with generally accepted engineering practice. Individual truss member continuous lateral bracing location(s) shall be shown on the truss design drawing.

The proposed 2009 IBC language provides the following enhancement to the 2006 IBC language listed above:

Proposed 2009 IBC 2303.4.1.2 Truss member permanent bracing. …In the absence of specific bracing requirements, trusses shall be braced in accordance with the Building Component Safety Information (BCSI 1) Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.

BCSI-B2: “Truss Installation and Temporary Bracing”, BCSI B3: “Permanent Bracing/Reinforcement of Chords and Web Members” and WTCA’s website will contain standard industry bracing details that conform to generally accepted engineering practice.

All of the foregoing information has been provided to aid in the design of the “permanent building stability bracing” and so that the RDP has the information needed to generate the appropriate engineering calculations.

Finally, Michigan also requires residential contractors to be licensed (Michigan Act 299 Chapter 24) and that a residential contractor pass an exam (399.2404).

339.2404 Evidence of good moral character and financial stability; payment under construction lien act; examination; issuance of residential maintenance and alteration contractor's license; scope of crafts and trades; place of business; branch office license. ...(2) The department shall require an applicant for a license to pass an examination establishing that the applicant has a fair knowledge of the obligations of a residential builder or residential maintenance and alteration contractor to the public and the applicant's principal, and the statutes relating to the applicant's licensure. ...
**Conclusion:**

The Lansing requirement:

1. Reinforces the importance of permanent bracing.
2. Provides clear guidance regarding the need for the owner or design professional of record to provide permanent bracing special inspections.
3. Identifies bracing locations, bracing size, bracing attachment, piggyback bracing, connection of the trusses to the structure to resist lateral and uplift loads and long span truss instability as known problem areas regarding truss installation:
4. Requires a special inspector to be hired to by the owner or design professional of record to inspect the installation of wood trusses greater than forty (40) feet in span.
5. Requires a special inspector to be hired to by the owner or design professional of record to inspect the installation of all piggyback trusses.

The structural building component industry has always believed that trusses over 60 feet may require complex temporary bracing and that the services of a RDP should be obtained. The Lansing requirement has elevated this concern and requires special inspections to be performed on a far greater number of residential and light commercial structures.
Appendix A

The language in RED signifies sections of the code or law that have been used in the foregoing document to make it easier for the reader to see the language in context.

Michigan Department of Labor and Economic Growth
Bureau of Construction Codes & Fire Safety
2003 Michigan Residential Code (MRC)
Chapter 1 ADMINISTRATION

SECTION R104: DUTIES AND POWERS OF THE BUILDING OFFICIAL

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.

SECTION R109: INSPECTIONS

R109.1.5 Other Inspections. In addition to the called inspections above, the building official may make or require any other inspections to ascertain compliance with this code and other laws enforced by the building official.
Appendix B

Michigan Department of Labor and Economic Growth
Bureau of Construction Codes & Fire Safety
2003 Michigan Building Code (MBC)
Chapter 1 ADMINISTRATION

SECTION 104: DUTIES AND POWERS OF BUILDING OFFICIAL

2003 MBC 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.

SECTION 109: INSPECTIONS

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

109.3.1 Footing and foundation inspection. ...

109.3.2 Concrete slab and under-floor inspection. ...

109.3.3 Lowest floor elevation. ...

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.

109.3.5 Lath and gypsum board inspection. ...

109.3.6 Fire-resistant penetrations. ...

109.3.7 Energy efficiency inspections. ...

109.3.8 Other inspections. In addition to the inspections specified above, the building official is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by the department of building safety.

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

109.3.10 Final inspection. The final inspection shall be made after all work required by the building permit is completed.

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.

109.5 Inspection requests. It shall be the duty of the holder of the building permit or their duly authorized agent to notify the building official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.
Chapter 23 WOOD
SECTION 2303: MINIMUM STANDARDS AND QUALITY

2303.4.1 Truss design drawings. Truss construction documents shall be prepared by a registered design professional and shall be provided to the building official and approved prior to installation. These construction documents shall include, at a minimum, the following information. Truss shop drawings shall be provided with the shipment of trusses delivered to the job site.

1. Slope or depth, span and spacing.
2. Location of joints.
3. Required bearing widths.
4. Design loads as applicable.
5. Top chord live load (including snow loads).
6. Top chord dead load.
7. Bottom chord live load.
8. Bottom chord dead load.
9. Concentrated loads and their points of application.
10. Controlling wind and earthquake loads.
11. Adjustments to lumber and metal connector plate design value for conditions of use.
12. Each reaction force and direction.
13. Metal connector plate type, size, thickness or gage, and the dimensioned location of each metal connector plate except where symmetrically located relative to the joint interface.
14. Lumber size, species and grade for each member.
15. Connection requirements are required for all of the following:
   a. Truss to truss girder.
   b. Truss ply to ply.
   c. Field splices.
16. Calculated deflection ratio or maximum deflection for live and total load.
17. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections, and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss construction documents or on supplemental documents.

18. Required permanent truss member bracing location.
Appendix C

Michigan Statutes – Act 299 of the 1980 Occupational Code
Article 20
339.2001 Definitions.

Sec. 2001. As used in this article:
(a) “Architect” means a person who, by reason of knowledge of mathematics, the physical sciences, and the principles of architectural design, acquired by professional education and practical experience, is qualified to engage in the practice of architecture.

(b) “Firm” means a sole proprietorship, partnership, corporation, or limited liability company through which a person licensed under this article offers or provides a service to the public.

(c) “Person” means a natural person notwithstanding section 105(5).

(d) “Person in responsible charge” means a person licensed under this article who determines technical questions of design and policy; advises the client; supervises and is in responsible charge of the work of subordinates; is the person whose professional skill and judgment are embodied in the plans, designs, plats, surveys, and advice involved in the services; and who supervises the review of material and completed phases of construction.

(e) “Practice of architecture” means professional services, such as consultation, investigation, evaluation, planning, design, or review of material and completed phases of work in construction, alteration, or repair in connection with a public or private structure, building, equipment, works, or project if the professional service requires the application of a principle of architecture or architectural design.

(f) “Practice of professional surveying” means providing professional services such as consultation, investigation, testimony, evaluation, planning, mapping, assembling, and interpreting reliable scientific measurements and information relative to the location, size, shape, or physical features of the earth, improvements on the earth, the space above the earth, or any part of the earth, and the utilization and development of these facts and interpretations into an orderly survey map, plan, report, description, or project. The practice of professional surveying includes all of the following:

(i) Land surveying that is the surveying of an area for its correct determination or description for its conveyance, or for the establishment or reestablishment of a land boundary and the designing or design coordination of the plotting of land and the subdivision of land.

(ii) Geodetic surveying that includes surveying for determination of the size and shape of the earth both horizontally and vertically and the precise positioning of points on the earth utilizing angular and linear measurements through spatially oriented spherical geometry.

(iii) Utilizing and managing land information systems through establishment of datums and local coordinate systems and points of reference.

(iv) Engineering and architectural surveying for design and construction layout of infrastructure.

(v) Cartographic surveying for making maps, including topographic and hydrographic mapping.

(g) “Practice of professional engineering” means professional services, such as consultation, investigation, evaluation, planning, design, or review of material and completed phases of work in construction, alteration, or repair in connection with a public or private utility, structure, building, machine, equipment, process, work, or project, if the professional service requires the application of engineering principles or data.

(h) “Principal” means a sole proprietor, partner, the president, vice-president, secretary, treasurer, or director of a corporation, or a member or manager of a limited liability company.
(i) “Professional engineer” means a person who, by reason of knowledge of mathematics, the physical sciences, and the principles of engineering, acquired by professional education and practical experience, is qualified to engage in the practice of professional engineering.

(j) “Professional surveyor” means a person who, by reason of knowledge of law, mathematics, physical sciences, and techniques of measuring acquired by professional education and practical experience, is qualified to engage in the practice of professional surveying.

(k) “Services” means professional service offered or provided by an architect in the practice of architecture, a professional engineer in the practice of professional engineering, or a professional surveyor in the practice of professional surveying.

ARTICLE 24

339.2404 Evidence of good moral character and financial stability; payment under construction lien act; examination; issuance of residential maintenance and alteration contractor's license; scope of crafts and trades; place of business; branch office license.

Sec. 2404. (1) The department may require an applicant, licensee, or each partner, trustee, director, officer, member, or shareholder to submit evidence of good moral character and financial stability. Before the issuance of a license, an applicant shall submit any amount required to be paid under the construction lien act, Act No. 497 of the Public Acts of 1980, being sections 570.1101 to 570.1305 of the Michigan Compiled Laws.

(2) The department shall require an applicant for a license to pass an examination establishing that the applicant has a fair knowledge of the obligations of a residential builder or residential maintenance and alteration contractor to the public and the applicant's principal, and the statutes relating to the applicant's licensure.

(3) The department, upon application, may issue a residential maintenance and alteration contractor's license to an applicant who, upon examination, qualifies for a license, which shall authorize the licensee according to the applicant's qualifications, crafts, and trades to engage in the activities of a residential maintenance and alteration contractor. A license shall include the following crafts and trades: carpentry; concrete; swimming pool installation; waterproofing a basement; excavation; insulation work; masonry work; painting and decorating; roofing; siding and gutters; screen or storm sash installation; tile and marble work; and house wrecking. The license shall specify the particular craft or trade for which the licensee has qualified. This subsection shall not prohibit a specialty contractor from taking and executing a contract involving the use of 2 or more crafts or trades if the performance of the work in the craft or trade, other than in which the person is licensed, is incidental and supplemental to the performance of work in the craft for which the specialty contractor is licensed.

(4) A residential builder or residential maintenance and alteration contractor shall maintain a place of business in this state. If a residential builder or residential maintenance and alteration contractor maintains more than 1 place of business within this state, a branch office license shall be issued to the builder or contractor for each place of business so maintained.
2006 International Building Code (IBC)
Chapter 23 WOOD
SECTION 2303: MINIMUM STANDARDS AND QUALITY

2303.4 Trusses.

2303.4.1 Design. Wood trusses shall be designed in accordance with the provisions of this code and accepted engineering practice. Members are permitted to be joined by nails, glue, bolts, timber connectors, metal connector plates or other approved framing devices.

2303.4.1.1 Truss designer. The individual or organization responsible for the design of trusses.

2303.4.1.2 Truss design drawings. The written, graphic and pictorial depiction of each individual truss shall be provided to the building official and approved 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:

1. Slope or depth, span and spacing;
2. Location of joints;
3. Required bearing widths;
4. Design loads as applicable;
5. Top chord live load (including snow loads);
6. Top chord dead load;
7. Bottom chord live load;
8. Bottom chord dead load;
9. Concentrated loads and their points of application as applicable;
10. Controlling wind and earthquake loads as applicable;
11. Adjustments to lumber and metal connector plate design value for conditions of use;
12. Each reaction force and direction;
13. Metal connector plate type, size, thickness or gage, and the dimensioned location of each metal connector plate except where symmetrically located relative to the joint interface;
14. Lumber size, species and grade for each member;
15. Connection requirements for:
   15.1. Truss to truss;
   15.2. Truss ply to ply; and
   15.3. Field splices.
16. Calculated deflection ratio and maximum vertical and horizontal deflection for live and total load as applicable;
17. Maximum axial tensile and compression forces in the truss members; and
18. Required permanent individual truss member bracing and method per Section 2303.4.1.5, unless a specific truss member permanent bracing plan for the roof or floor structural system is provided by a registered design professional.

2006 IBC 2303.4.1.5 Truss member permanent bracing. Where permanent bracing of truss members is required on the truss design drawings, it shall be accomplished by one of the following methods:
1. The trusses shall be designed so that the buckling of any individual truss member can be resisted internally by the structure (e.g., buckling member T-bracing, L-bracing, etc.) of the individual truss. The truss individual member buckling reinforcement shall be installed as shown on the truss design drawing or on supplemental truss member buckling reinforcement diagrams provided by the truss designer.
2. Permanent bracing shall be installed using standard industry bracing details that conform with generally accepted engineering practice. Individual truss member continuous lateral bracing location(s) shall be shown on the truss design drawing.