IMPORTANT SAFETY INFORMATION

BUILDING COMPONENT SAFETY INFORMATION

BCSI 1-03

GUIDE TO GOOD PRACTICE FOR HANDLING, INSTALLING & BRACING OF METAL PLATE CONNECTED WOOD TRUSSES

JOINTLY PRODUCED BY

WOOD TRUSS COUNCIL OF AMERICA

AND

TRUSS PLATE INSTITUTE

FIRST EDITION PUBLISHED - OCTOBER 1, 2003

HAZARD! WARNING! CAUTION! DANGER! ALERT! SAFETY!

Use of the words above in any language should tell the reader that an unsafe condition or action will greatly increase the probability of an accident occurring which could result in serious personal injury or death. Disregarding or ignoring handling, installing and bracing safety recommendations is the major cause of truss erection/installation accidents.

The erection of wood trusses is inherently dangerous and requires, above all, careful planning and communication between the Erection/Installation Contractor, installation crew and the crane operator. Depending on the experience of the Contractor, it is strongly recommended that a meeting be held with all individuals involved in the lifting/hoisting, installing and temporary bracing operations to review the provisions of the Building Component Safety Information (BCSI) booklet, the Truss Design Drawings, the Building Structural System Design Documents (BSSDD) i.e. architectural/structural plans and specifications, the Truss Placement Diagram (if/when required by BSSDD), OSHA jobsite lifting and fall protection requirements (see BCSI-B11, Fall Protection & Wood Trusses) and site specific environmental issues.

It is recommended that these procedures be followed before any lift operations are performed. This meeting should be held before the trial lift at each new jobsite and must be repeated for any individuals newly assigned to the erection/installation operation. Truss bracing requires an understanding of triangulation in the various planes perpendicular to the planes of the members of the truss. This understanding is essential for a safe installation. The Erection/Installation Contractor must be familiar with general bracing concepts as discussed in the above referenced industry publications. It is not intended that these recommendations be interpreted as superior to the project Architect's or Engineer's design specification for handling, installing and bracing wood trusses and it does not preclude the use of other equivalent methods for bracing and providing stability for the walls and columns as may be determined by the Erection/Installation Contractor.

Every project has different site conditions that can have a specific effect on the erection process. Before the first truss is erected, every individual involved needs to understand the installation plan and the intended bracing requirements for a safe, efficient and accident-free jobsite.

PRECAUTIONARY NOTE TO USERS OF BCSI

This Guide to Good Practice for Handling, Installing & Bracing Metal Plate Connected Wood Trusses (BCSI 1-03) may be edited, changed, revised or withdrawn at any time. Purchasers and users of this guide are advised to visit the Products section of www.woodtruss.com to confirm that this version is the latest available information. BCSI 1-03 is published with an Effective Date. Use only the latest version. Additionally, errata and updates are published periodically and are available on this website.

EDITORS NOTE: Capitalized terms found throughout this document are defined in the “Glossary of Terms” (see pages 113-128).

BUILDING COMPONENT SAFETY INFORMATION

BCSI 1-03

GUIDE TO GOOD PRACTICE FOR HANDLING, INSTALLING & BRACING OF METAL PLATE CONNECTED WOOD TRUSSES

JOINTLY PRODUCED BY

WOOD TRUSS COUNCIL OF AMERICA

AND

TRUSS PLATE INSTITUTE

PUBLISHED - OCTOBER 1, 2003

EFFECTIVE DATE

01/01/04

ACKNOWLEDGEMENTS

The thoughts, ideas and hard work of many have brought the Building Component Safety Information (BCSI 1-03) document to press.

Special thanks to WTCA's membership in its entirety for perspective and feedback in guiding the creation of this work, under the leadership of Scott Arquilla, WTCA 2003 President; Mike Ruede, Immediate Past President; Dan Holland, President Elect; and Kendall Hoyd, Secretary. Special thanks are also due to each of the TPI Member Companies: Alpine Engineered Products, Cherokee Metal Products, CompuTrus, Eagle Metal Products, MiTek Industries, Robbins Manufacturing Company, TeeLok Corporation, and Truswal Systems Corporation, and in particular TPI's President Charles C. Hoover, Jr., P.E., for his leadership in creating the cooperative spirit that is the key to any successful endeavor where two organizations are involved in a project as substantial as this.

Certain individuals have been especially dedicated to making this document possible: Scott Arquilla, Clyde Bartlett, David Brakeman, Steve Cabler, Steve Cramer, Bob Dayhoff, Dave Denoncourt, James Gingrich, Kirk Grundahl, Kelly Gutting, Joe Heinsman, Dan Holland, Ted Kolanko, Mike Kozlowski, Stu Lewis, Mike Magid, John Meeks, Joe Michels, Carl Schoening, Marvin Strzyzewski, Gary Sweatt, and Ken Watters II.

WTCA would like to thank those who serve on its Engineering & Technology and Marketing Committees, and TPI would like to thank those who serve on its Technical Advisory Committee (TAC) for their continued dedication to advancing our industry's work on safety and technology.

Finally, a key thank you must go to those that tended to all the details in the background, without which this document would not yet be completed. This group includes Dave Brakeman, TPI-TAC Chairman; Kelly Gutting, TPI Technical Director; Ryan Dexter, Lora Gilardi, Libby Maurer, Anita Meredith, Stan Sias, Rachel Smith, Barb Speer, and Richard Zimmermann, of WTCA staff.

PHOTO AND GRAPHIC ARTS CREDITS

Graphic art, photographs, sketches, drawings, forms, and table formats that appear in this document have come from many sources, some known and others unknown. WTCA and TPI wish to thank the following known suppliers of graphic materials for the BCSI 1-03 Booklet:

Alpine Engineered Products; Cherokee Metal Products; CompuTrus; Eagle Metal Products; MiTek Industries; Robbins Manufacturing; Simpson Strong-Tie Company; TeeLok Corporation; Truss Plate Institute; Truswal Systems Corporation; USP Structural Connectors; and Wood Truss Council of America.

INTRODUCTION

The Wood Truss Council of America (WTCA) and Truss Plate Institute (TPI) have each adopted policies to promote handling, installing and bracing guidelines for metal plate connected wood trusses that are simple, safe, proven methods consistent with good framing construction practices in the field. The intention of this Building Component Safety Information (BCSI 1-03) booklet is to implement those policies.

The methods and procedures in BCSI 1-03 are intended to ensure that the overall construction techniques employed will put floor and roof trusses safely in place in a completed structure. These recommendations for handling, installing and bracing wood trusses are based upon the collective experience of leading technical personnel in the wood truss industry, but must, due to the nature of responsibilities involved, be presented only as a guide for use by a qualified Building Designer or Erection/ Installation Contractor. It is not intended that these recommendations be interpreted as superior to the project Architect's or Engineer's design specification for handling, installing and bracing wood trusses and it does not preclude the use of other equivalent methods for bracing and providing stability for the walls and columns as may be determined by the truss Erection/Installation Contractor. Thus, the Wood Truss Council of America and the Truss Plate Institute expressly disclaim any responsibility for damages arising from the use, application, or reliance on the recommendations and information contained herein.

PUBLICATIONS BACKGROUND

The WTCA and TPI have developed the BCSI 1-03 booklet to replace the HIB-91, Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses. The BCSI 1-03 booklet was developed using DSB-89, Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; HIB-91; HIB-91 (Summary Sheet); HIB-98, Recommendations for Handling, Installing and Temporary Bracing of Metal Plate Connected Wood Trusses Used in Post-Frame Construction; and several existing bracing, warning and safety documents (for a complete list, see references on page 131-134). The consistent message throughout all of these documents is that proper truss handling, installing and bracing are crucial for consistent jobsite safety and acceptable structural performance. More information regarding the design and manufacturing of metal plate connected wood trusses can be found in ANSI/TPI 1-2002, National Design Standard for Metal Plate Connected Wood Trusses.

The eleven sections of the BCSI 1-03 booklet are available as B-Series Summary Sheets. These documents condense each section into fewer pages that emphasize the main points with graphics, less text and may be more suitable for end-users on the jobsite. The B-Series Summary Sheets include:

BCSI-B1 Summary Sheet - Guide for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses: This guide for builders features proper techniques for unloading, storing, lifting, erecting, installing, and bracing trusses. It includes specific information for protecting trusses from weather and damage at the jobsite, how to lift individual trusses by crane, bracing guidelines to prevent trusses from toppling during erection, and installation tolerances to keep the trusses in-plane and plumb. Numerous graphics with universal red warning labels accompanied by written instructions provide an easy-to-follow reference. A supplemental warning tag can be attached to individual trusses urging Erection/Installation Contractors to refer to the BCSI-B1 Summary Sheet for more bracing information.

BCSI-B2 Summary Sheet - Truss Installation and Temporary Bracing: Temporary bracing is an important, yet often overlooked, element of safe truss installation. BCSI-B2 provides options for safe temporary bracing installations and strongly emphasizes how all lateral bracing needs to be stabilized with diagonal bracing, while showing how to get the first five trusses erected and braced efficiently and safely for the benefit of the crew and the project.

BCSI-B3 Summary Sheet - Web Member Permanent Bracing/Web Reinforcement: It is crucial to the structural integrity of individual truss components that truss web member bracing is installed as indicated on the Truss Design Drawings. BCSI-B3 explains how web member permanent bracing must be installed and stabilized, by diagonal bracing or other means, in the field. It also describes the use of web reinforcements when web member braces are not practical.

BCSI-B4 Summary Sheet - Construction Loading: During construction, trusses must not support any loads from equipment or construction materials until the truss assembly is properly braced or sheathed. This document gives safe stack heights for several materials and illustrates good and bad loading practices.

BCSI-B5 Summary Sheet - Truss Damage, Jobsite Modifications and Installation Errors: Trusses are precisely engineered components. They must be inspected for any damage or alterations to lumber or plates upon delivery and again after mechanical, electrical and plumbing installations. Contact the Truss Manufacturer for detailed repair instructions if damage, modifications or installation errors are found.

The following B-series Summary Sheets were specifically created for special conditions that may be encountered during the truss installation and bracing process:

BCSI-B6 Summary Sheet - Gable End Frame Bracing: Gable style roofs require special end frame bracing, especially in high-wind areas. BCSI-B6 explains how to determine gable end bracing details and provides installation guidelines.

BCSI-B7 Summary Sheet - Temporary and Permanent Bracing for Parallel Chord Trusses: Floor trusses are more stable during installation because lumber is oriented in the flat-wise direction. Nevertheless, it is important to observe good installation and bracing practices so floor systems are installed safely and successfully, and offer better long-term floor performance.

BCSI-B8 Summary Sheet - Toe-Nailing for Uplift Reactions: Uplift reactions, most often caused by wind forces, may require special connections beyond code-prescribed toe-nailing. BCSI-B8 explains the uplift capacity of a toe-nailed connection and gives connection options when toe-nailing is not enough.

BCSI-B9 Summary Sheet - Multi-Ply Girders: Girder trusses may consist of multiple truss components that need to be attached together to act as one. BCSI-B9 discusses how to determine the proper number of plies, attachment methods, types of fasteners and standards for fastener installation.

BCSI-B10 Summary Sheet - Post Frame Truss Installation and Bracing: Recommendations for handling, installing and temporary bracing of metal plate connected wood trusses in post-frame construction. These guidelines are for Contractors handling, installing and bracing flat bottom chord MPCWT in engineered building system applications from 4' to 12' on-center.

BCSI-B11 Summary Sheet - Fall Protection and Wood Trusses: Trusses are NOT designed to be fall protection anchors. BCSI-11 presents several tips to enable framing crews to safely and efficiently install trusses while meeting OSHA's fall protection guidelines.

IMPORTANT NOTE REGARDING ON-CENTER SPACING

This BCSI Booklet is directed towards truss installations of 24" on-center maximum unless noted otherwise, namely BCSI-B10 Post Frame Truss Installation. Installations of less than 24" on-center are acceptable. 19.2", 16" and 12" on-center are occasionally specified by Building Designers and/or Truss Designers. These closer on-center spacings are acceptable using the handling, installing and bracing criteria of this booklet.

BCSI-B1

GUIDE FOR HANDLING, INSTALLING AND BRACING OF METAL PLATE CONNECTED WOOD TRUSSES

GENERAL NOTES

Familiarity with the Building Structural System Design Documents (BSSDD), Truss Design Drawings (TDD), Truss Placement Diagrams (if/when required by the BSSDD), this BCSI document and specific site conditions is required to properly receive, store, erect, brace and connect the trusses to the building system.

All of the care and quality involved in the design and manufacture of wood trusses can be jeopardized if the trusses are not properly handled, erected, and braced.

⚠ **WARNING!** The consequences of improper handling, erecting and bracing may be a collapse of the structure, which at best is a substantial loss of time and materials, and at worst is a loss of life. The majority of truss accidents occur during truss installation and not as a result of improper design or manufacture.

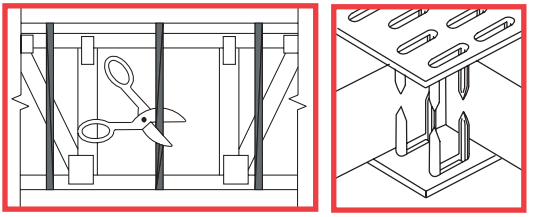
Prior to truss erection/installation, it is strongly recommended that the Erection/Installation Contractor supervisor meet with the erection/installation crew and crane operator for a safety and planning meeting; making sure each crew member understands his or her roles and responsibilities during the erection/installation process.

⚠ **GENERAL WARNING!** The consequences of improper handling, erecting, and bracing may be collapse of the structure, or worse, serious personal injury or death.

PHOTO B1-1

⚠ **WARNING!** Banding and truss plates have sharp edges! Handle with care. **WEAR GLOVES WHEN HANDLING AND SAFETY GLASSES WHEN CUTTING BANDING!**

FIGURE B1-1



TEMPORARY ERECTION BRACING

Trusses are not marked in any way to identify the frequency or location of temporary erection bracing.

⚠ **ALL TEMPORARY BRACING MUST COMPLY** with the recommendations and options as described herein and/or in the latest edition of the individual B-Series Summary Sheets that are referenced.

PERMANENT TRUSS BRACING

Design of permanent truss bracing for the roof or floor trusses is the responsibility of the Building Designer and should be shown on the BSSDD. Permanent bracing locations for individual compression members of a wood truss are shown on the TDD, and must be put in place by the Erection/Installation Contractor. If properly planned, temporary erection bracing that is applied can be used as permanent truss bracing, making the completion of the permanent truss bracing more efficient. **Permanent truss bracing is needed for the proper performance of individual trusses within the roof or floor system.** The design of the bracing and its connection to the truss and then to the overall building system is the responsibility of the Building Designer, and is in addition to the permanent truss bracing plan, which is also specified by the Building Designer. Permanent bracing should 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. In addition, permanent bracing should be designed to resist lateral forces imposed on the completed building by wind or seismic forces. If there is not a permanent truss bracing plan contact the Building Designer.

SPECIAL DESIGN REQUIREMENTS

Special design requirements, such as wind bracing, portal bracing, seismic bracing, diaphragms, shear walls, or other load transfer elements and their connections to wood trusses must be considered separately by the Building Designer, who must determine the size, location, and method of connections for all bracing as needed to resist these forces.

UNLOADING AND LIFTING

⚠ **AVOID LATERAL BENDING** (See page 6.)

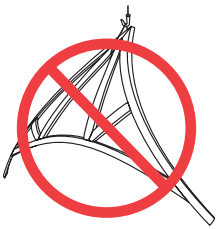


FIGURE B1-2

☑ Beginning with the unloading process, and throughout all phases of construction, **care must be taken to avoid LATERAL BENDING of trusses,** which can cause damage to the lumber and metal connector plates at the joints.

☑ Due to treatment effects, fire retardant treated trusses require special care when handling to prevent chord and web member breakage. Limit exposure to elements per manufacturer's recommendations.

⚠ **WARNING! USE SPECIAL CARE IN WINDY WEATHER.** Buildings under construction are vulnerable to high winds, and present a safety hazard. It is the responsibility of the Erection/Installation Contractor to recognize adverse weather conditions and take prompt and appropriate action to protect life.

☑ A crane should not be used in close proximity to electrical power lines. If you must use a crane in close proximity to electrical lines, contact the local power company [OSHA: 29 CFR1926.550(a)(15)(i)]. Clearance between electrical power lines and cranes.

☑ If using a crane within five miles of an airport, contact the airport 30 days prior to crane use to learn about any safety regulations that must be followed (FAA: 49 CFR Part 77).

JOBSITE HANDLING

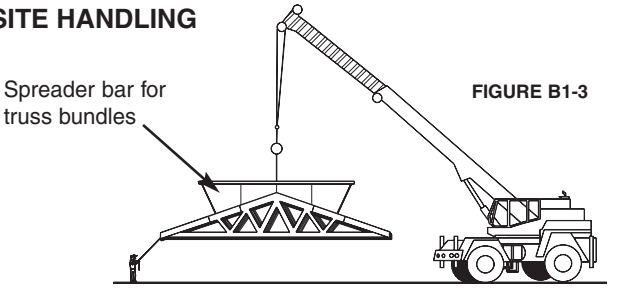


FIGURE B1-3

☑ Check bundle banding prior to moving bundles.

⊘ **DO NOT RELY ON BANDING TO SECURELY TRANSFER BUNDLES ON THE JOBSITE**

☑ Banded truss bundles, in a vertical position, should be picked up at the top chords.

PHOTO B1-2

PHOTO B1-3

☑ Proper banding and smooth ground allow for unloading of trusses without damage. This should be done as close to the building site as possible to minimize handling. Use care to not damage trusses with the forks of the forklift.

⊘ **DO NOT BREAK BANDING UNTIL ERECTION/ INSTALLATION BEGINS**

⊘ **DO NOT DRAG OR PUSH TRUSSES ALONG GROUND**

PHOTO B1-4

⊘ **DO NOT STORE UNBRACED BUNDLES UPRIGHT**

⊘ **DO NOT LIFT BANDED TRUSSES BY THE STRAPS**

PHOTO B1-5

DO NOT STORE ON UNEVEN GROUND

PHOTO B1-6

☑ If trusses are stored vertically, they must be braced in a manner that will prevent tipping or toppling.

ONE WEEK OR LESS

FIGURE B1-4

MORE THAN ONE WEEK

FIGURE B1-5

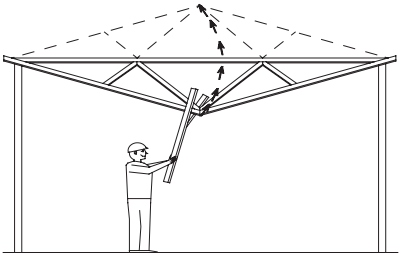
☑ If trusses are stored horizontally for more than one week, blocking of sufficient height should be used on eight to ten foot centers, (or as required to minimize lateral bending), to lessen moisture gain from the ground.

⚠ **WARNING!** Exercise care when removing banding to avoid damaging trusses and prevent personal injury. Gloves and safety glasses should be worn.

☑ During long term storage, trusses must be protected from the environment in a manner that provides for adequate ventilation of the trusses. If tarpaulins or other protective covers are used, the ends must be left open for ventilation. Plastic is not recommended, since it can trap moisture.

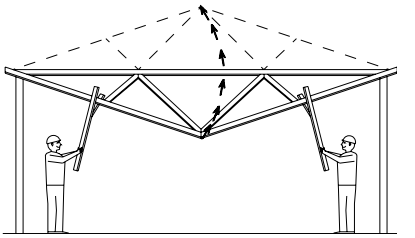
HAND ERECTION

FIGURE B1-6



☑ Trusses with spans less than or equal to 20' should be supported at the peak.

FIGURE B1-7



☑ Trusses with spans less than or equal to 30' should be supported at quarter points.

⚠ AVOID LATERAL BENDING

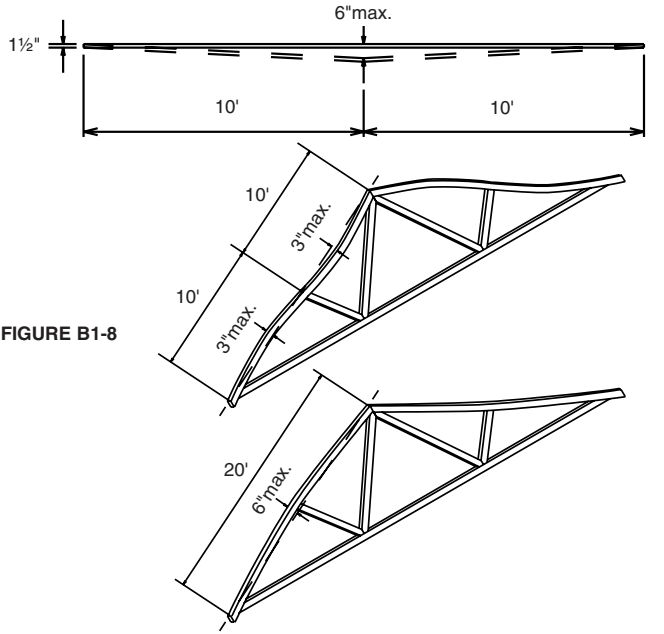


FIGURE B1-8

☑ Follow these maximum allowable deflections during handling and installation.

HOISTING

☑ Hand erection of trusses is allowed, provided excessive lateral bending is prevented (see page 6).

☑ All trusses that are erected one at a time must be held safely in position by the erection equipment until such time as all Top Chord Temporary Lateral Bracing (TCTLB) has been installed and the trusses are securely fastened to all bearing points assumed in the design.

⚠ **WARNING! DO NOT LIFT TRUSSES WITH SPANS GREATER THAN 30' BY THE PEAK**

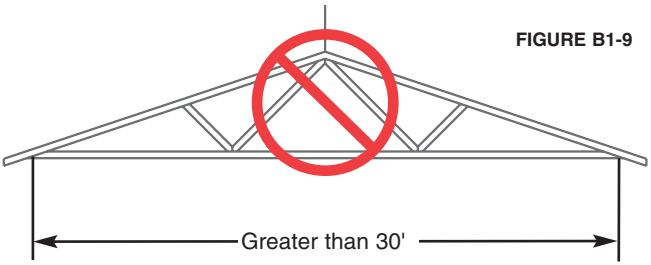


FIGURE B1-9

⚠ **WARNING!** The Erection/Installation Contractor should provide adequate rigging (crane, forklift, slings, taglines, spreader bars) for sufficient control during lifting and placement to assure safety to personnel and to prevent damage to trusses and property. Slings, taglines, and spreader bars should be used in a manner that will not cause any damage to the metal connector plates and truss lumber. Lifting devices should be connected to the truss top chord with only a closed loop attachment utilizing materials such as slings, chains, cables, and nylon straps of sufficient strength to carry the weight of the truss.

☑ Care must be taken to position truss bundles so that the supporting structure is not overloaded. Trusses which are lifted in place in banded bundles should be securely supported by temporary means which will permit the safe removal of banding and sliding of individual trusses.

⚠ **AVOID LATERAL BENDING** (See page 6.)

TRUSSES UP TO 30': For trusses up to 30' use a minimum of two pick-points at top chord joints spaced 1/2 the truss length apart. Keep line angle to 60° or less.

FIGURE B1-10A

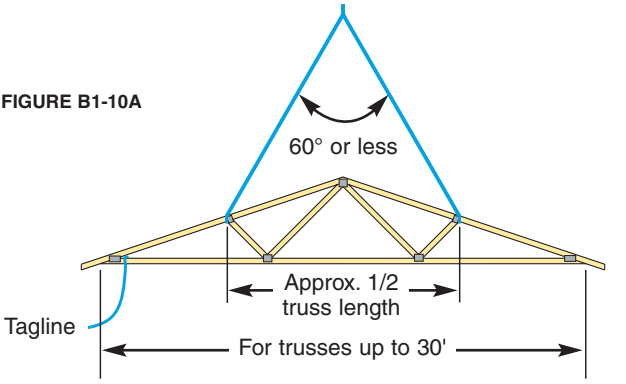
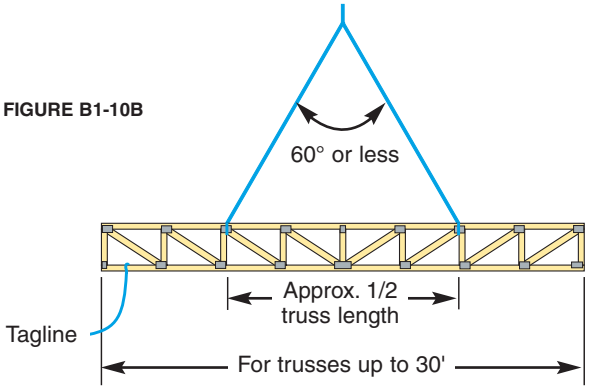


FIGURE B1-10B



☑ **TRUSSES UP TO 60':** For trusses between 30' and 60' use spreader bar 1/2 to 2/3 truss length. Attach truss to the spreader bar with lines that slope inward or “toe-in”, as shown. Lines that “toe-out” can cause the truss to buckle.

FIGURE B1-11

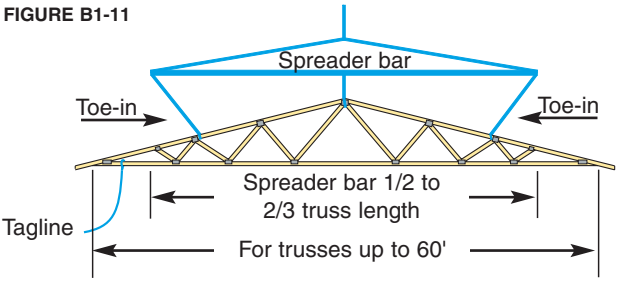
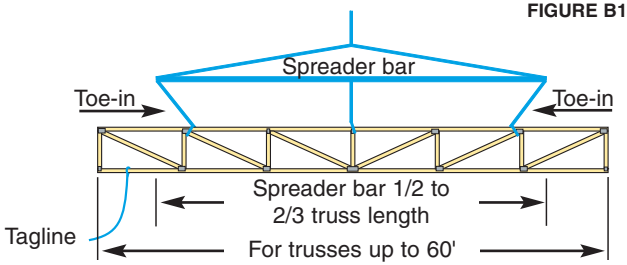


FIGURE B1-12



TRUSSES UP TO AND OVER 60': For trusses over 60' use spreader bar 2/3 to 3/4 truss length. The spreader bar prevents lateral bending and should be attached to top chords and webs at 10' intervals. Locate the spreader bar at or above mid-height of the truss to prevent overturning.

FIGURE B1-13

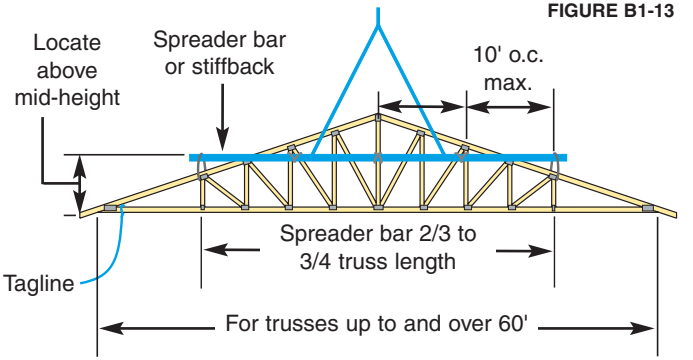
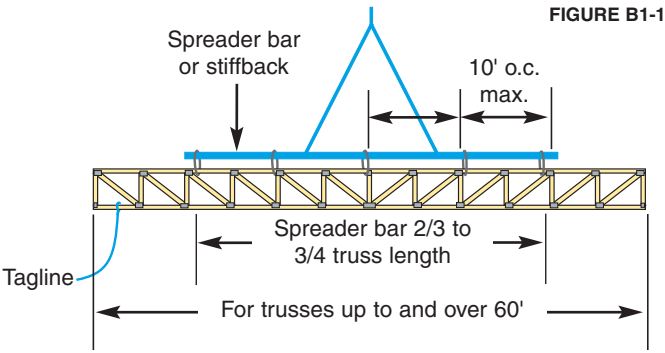


FIGURE B1-14



WARNING! DESIGN THE SPREADER BAR OF ANY MATERIAL WITH SUFFICIENT STRENGTH AND RIGIDITY TO CARRY THE WEIGHT AND TO RESIST BENDING OF THE TRUSS. IF IN DOUBT, SEEK PROFESSIONAL GUIDANCE.

BRACING MATERIAL AND CONNECTIONS

⚠ **WARNING!** Inadequate size and/or fastening of bracing material is a major cause of erection dominoing.

Minimum size bracing lumber is 2x4 stress-graded lumber unless other size is specified by the Building Designer.

Minimum Nail Size

10d (0.128x3")
12d (0.128x3.25")
16d (0.135x3.5")

TABLE B1-1

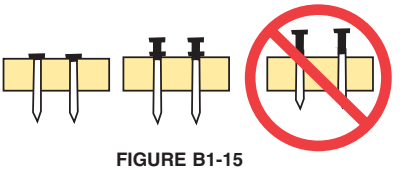


FIGURE B1-15

☑ For all bracing and spacing members (except end-grain nailed spacers which require 16d deformed-shank; ring, barb or screw nails):

- Always drive 2-10d (0.128x3"), 2-12d (0.128x3.25") or 2-16d (0.135x3.5") nails into each truss for both lateral and diagonal members.
- Drive nails flush, or use double-headed nails for easiest brace removal.

BEGINNING THE ERECTION/INSTALLATION PROCESS

☑ It is important for the Erection/Installation Contractor to provide substantial bracing for the first truss erected. Trusses making up the rest of the first set are tied to the first truss and rely upon it for stability. Likewise, after this first set of trusses is adequately diagonally braced, the remaining trusses installed rely on this first set for stability. Performance of the truss bracing system depends to a great extent on how well the first group of trusses is braced (see BCSI-B2).

GROUND BRACE - EXTERIOR (See BCSI-B2, page 26)

☑ Exterior ground bracing ties the first set of trusses off to a series of braces that are attached to stakes driven into the ground and securely anchored. The ground brace itself should be supported as shown in Figures B1-16 and 17 or it is apt to buckle. Additional ground braces in the opposite direction, inside the building, are also recommended.

☑ For ground brace design, see DSB-89, Recommended Design Specification for Temporary Bracing of MPCWT (see Ground Bracing, page 117).

☑ Locate ground braces for first truss directly in line with all rows of top chord continuous lateral bracing (temporary or permanent).

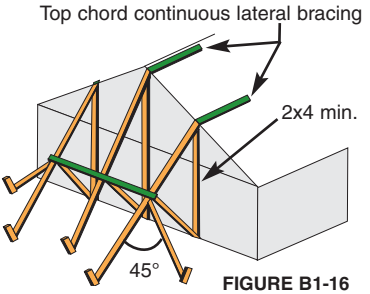


FIGURE B1-16

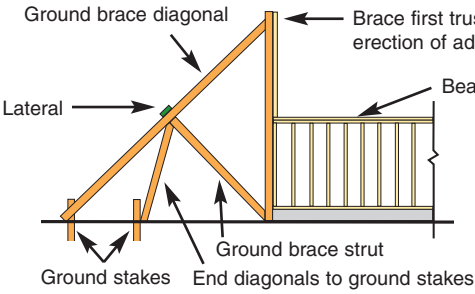


FIGURE B1-17

Ground brace connections should use a min. 2-16d (0.135x3.5") nails clinched.

GROUND BRACE - INTERIOR (See BCSI-B2, page 27)

☑ Where height of building or ground conditions prohibit bracing from the exterior, tie the first truss rigidly in place from the interior at the floor level, provided the floor is capable of supporting the ground bracing forces. Install the first truss in the middle of the building and brace similar to exterior ground bracing shown above. Diagonally brace the first set of trusses before removing ground braces and setting remaining trusses.

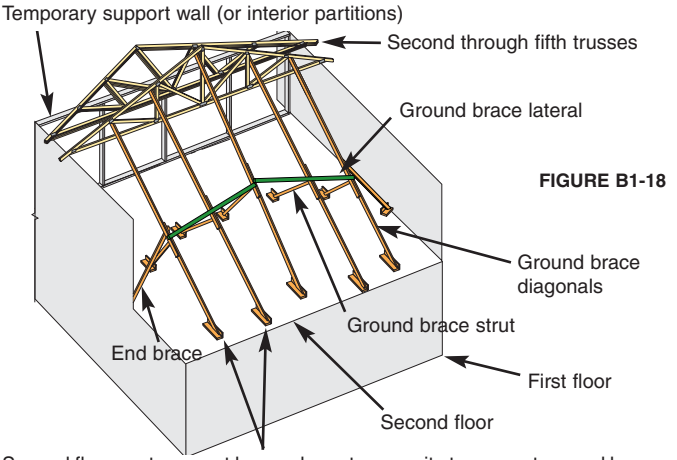
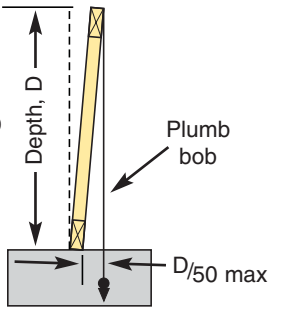


FIGURE B1-18

Second floor system must have adequate capacity to support ground braces

INSTALLATION TOLERANCES (PER ANSI/TPI 1-2002, CH. 6)

FIGURE B1-19



Out of Plumb

D/50	D (ft.)
1/4"	1'
1/2"	2'
3/4"	3'
1"	4'
1-1/4"	5'
1-1/2"	6'
1-3/4"	7'
2"	≥8'

TABLE B1-2

Out of Plane

Max. Bow	Truss Length
3/4"	12.5'
7/8"	14.6'
1"	16.7'
1-1/8"	18.8'
1-1/4"	20.8'
1-3/8"	22.9'
1-1/2"	25.0'
1-3/4"	29.2'
2"	≥33.3'

TABLE B1-3

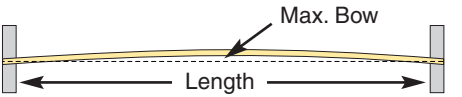


FIGURE B1-20A

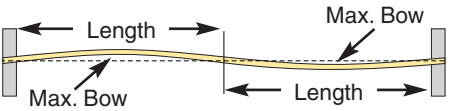


FIGURE B1-20B

- ☑ Top chord bearing flat or parallel chord trusses should have a maximum 1/2" gap between the inside edge of the bearing and the first diagonal or vertical web member (see Figure B7-3, page 75).
- ☑ Complying with installation tolerances is critical to achieving an acceptable roof or floor line, AND TO ACCOMPLISHING EFFECTIVE BRACING. Setting trusses within tolerance the first time will prevent the need for the hazardous practice of re-spacing or adjusting trusses when roof sheathing or roof purlins are installed. Trusses leaning or bowing can cause nails to miss the top chords when sheathing is applied, and create cumulative stresses on the bracing, which is a frequent cause of truss dominoing.
- ☑ The location of trusses along bearing support must be within +/- ¼" of plan dimension. Construction requirements that force placement beyond this tolerance must be reviewed and approved by the Building Designer and Truss Designer.

BRACING WARNINGS

DIAGONAL BRACING IS VERY IMPORTANT!

FIGURE B1-21

DO NOT WALK ON UNBRACED TRUSSES

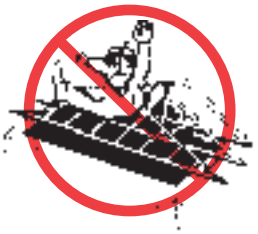


FIGURE B1-22

DO NOT WALK ON TRUSSES OR GABLE ENDS LYING FLAT

☑ All anchors, hangers, tie-downs, seats, and bearing ledgers that are part of the supporting structure must be accurately and properly placed and permanently attached before truss erection/installation begins. Trusses must not be installed on anchors or ties that have temporary connections to the supporting structure. The truss must be properly connected to each support.

THE STRUCTURE IS NOT STRUCTURALLY SOUND, STABLE OR SAFE until all the hardware and bracing is properly installed.

DIAGONAL BRACING IS VERY IMPORTANT!

SEE BCSI-B2 TRUSS INSTALLATION AND TEMPORARY BRACING (PAGES 21-50) FOR ADDITIONAL BRACING OPTIONS.

BRACING REQUIREMENTS FOR 3 PLANES OF ROOF

☑ Temporary erection bracing must be applied to three planes of the roof trusses to ensure stability:

1) Top chord (roof sheathing plane)
2) Bottom chord (ceiling plane)
3) Web member (sloping plane or vertical plane perpendicular to trusses)

☑ 1) **TOP CHORD TEMPORARY BRACING** is the most important step for the Erection/Installation Contractor. Truss top chords are susceptible to lateral buckling. See BCSI-B2 for more bracing options.

FIGURE B1-23

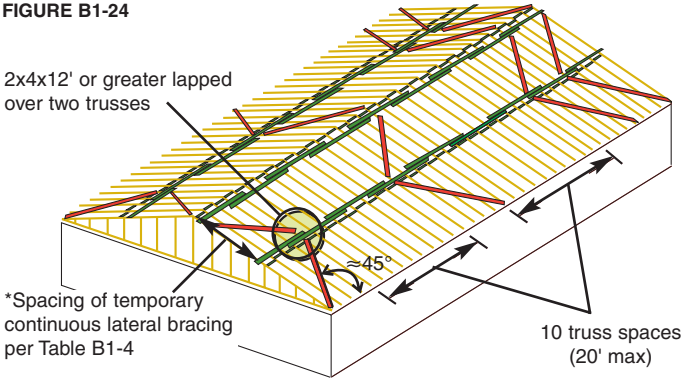
Maximum Top Chord Temporary Lateral Brace Spacing

TABLE B1- 4

Truss Span	Spacing Requirements
Up to 30'	Use 10' spacing*
30' - 45'	Use 8' spacing*
45' - 60'	No greater than 6'*
60' - 80'+	No greater than 4'*

+Consult a Professional Engineer for trusses longer than 60'

FIGURE B1-24



This top chord bracing approach applies to all sloping chord trusses, scissors trusses and 2x_ parallel chord trusses.

⚠ **EXACT SPACING BETWEEN TRUSSES SHOULD BE MAINTAINED AS BRACING IS INSTALLED** to avoid the hazardous practice of removing bracing to adjust spacing. This act of "adjusting spacing" can cause trusses to topple if connections are removed at the wrong time.

☑ 2) **BOTTOM CHORD TEMPORARY/PERMANENT BRACING** is required to hold on-center spacing for the bottom chord. Place continuous lateral braces and diagonals on top of the bottom chord as shown. They may be removed after the permanent ceiling diaphragm is in place or remain to become part of the permanent bracing system.

FIGURE B1-25

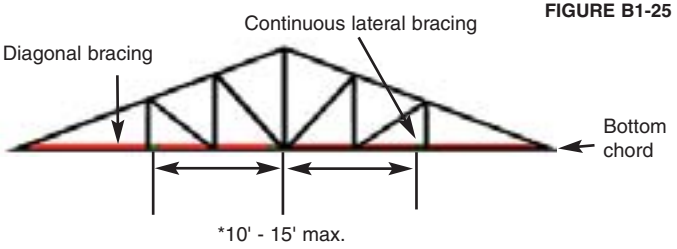
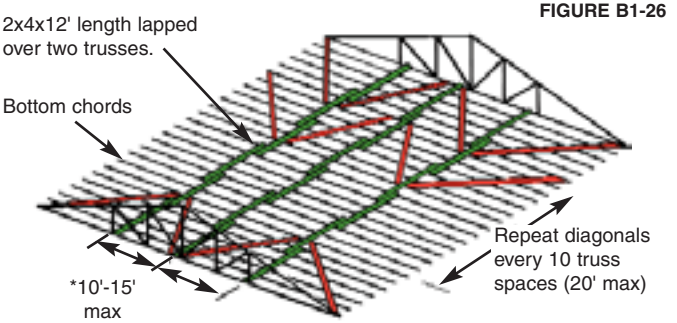


FIGURE B1-26



Some chord and web members not shown for clarity.

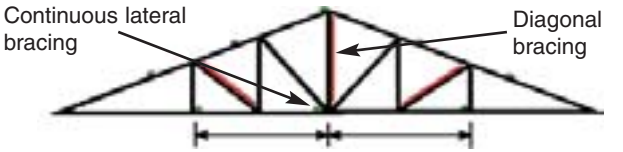
This bracing approach apples to all truss types except 3x2 and 4x2 parallel chord trusses.

***IMPORTANT NOTE:** Install bottom chord TEMPORARY lateral bracing in rows no more than 15' on-center. Install bottom chord PERMANENT lateral bracing at the locations required by the TDD and BSSDD. The maximum on-center spacing of permanent lateral braces is 10' but may be less if required by the TDD and/or Building Designer.

☑ Connect end of bracing to end wall. Add diagonal bracing at each end and every 10 truss spaces (20' maximum).

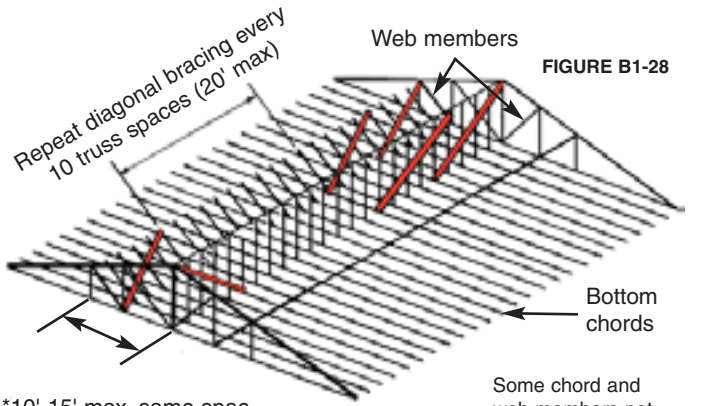
☑ 3) **WEB MEMBER PLANE** requires temporary/permanent diagonal bracing, as shown in Figure B1-28. It is critical in preventing trusses from leaning or dominoing. Install diagonal bracing on vertical web members whenever possible, at or near bottom chord lateral bracing. Rated panel sheathing may be substituted for diagonal bracing. See BCSI-B2 and B3 for more web member bracing information.

FIGURE B1-27



Locate diagonal braces at or near bottom chord lateral bracing. See Note on p. 15 for spacing.

FIGURE B1-28



*10'-15' max. same spacing as bottom chord lateral bracing (see Note page 15)

Some chord and web members not shown for clarity.

This bracing approach applies to all truss types except 3x2 and 4x2 parallel chord trusses.

☑ Webs that require permanent lateral bracing must also be diagonally braced for rigidity. With some preplanning, temporary web bracing may be used as part of the permanent bracing.

☑ Long spans, heavy loads or truss spacings greater than 2' on-center may require closer spacing of lateral bracing and of diagonals. Consult the Building Designer or BCSI-B10 Post Frame Truss Installation and Bracing.

BRACING 3x2 AND 4x2 PARALLEL CHORD TRUSSES

☑ Alternate proprietary methods of temporary bracing are available. See manufacturer's specifications.

DIAGONAL BRACING IS VERY IMPORTANT!

SEE BCSI-B2 TRUSS INSTALLATION AND TEMPORARY BRACING (PAGES 21-50) FOR ADDITIONAL BRACING OPTIONS.

☑ 3x2 and 4x2 parallel chord truss top chords can be braced as follows:

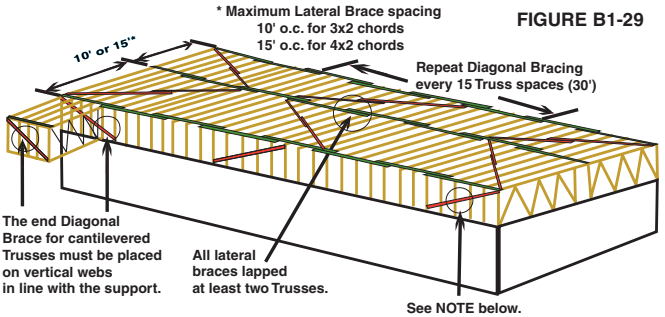
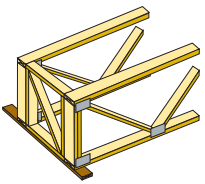


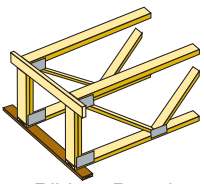
FIGURE B1-29

Top chord temporary lateral brace spacing shall be 10' o.c. max. for 3x2 chords and 15' o.c. for 4x2 chords.

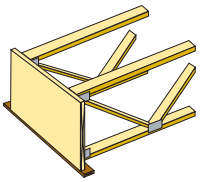
☑ NOTE: End diagonals, and/or rated panel sheathing, blocking panels, ribbon board, or rim board as specified by the Building Designer, are essential for stability and must be installed on both ends of the truss system and repeated every 15 truss spaces (30' maximum). See Figures B1-30, 31 and 32 below.



Blocking Panel
FIGURE B1-30



Ribbon Board
FIGURE B1-31



Rim Board
FIGURE B1-32

CONSTRUCTION LOADING

☑ Proper distribution of construction materials is a must during construction. See BCSI-B4 Construction Loading document for loading specifics (see pages 57-60).

DO NOT PROCEED WITH CONSTRUCTION UNTIL ALL BRACING IS SECURELY AND PROPERLY IN PLACE

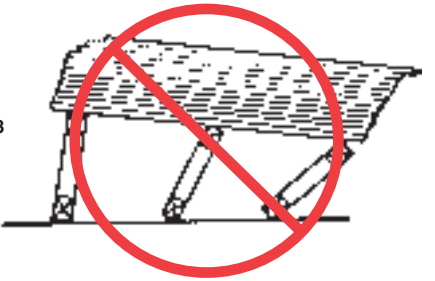


FIGURE B1-33

NEVER STACK MATERIALS ON UNBRACED OR INADEQUATELY BRACED TRUSSES

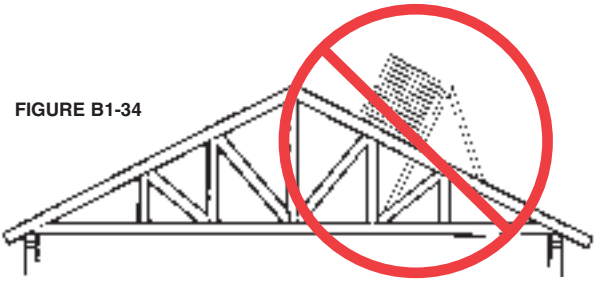


FIGURE B1-34

NEVER STACK MATERIALS NEAR A PEAK

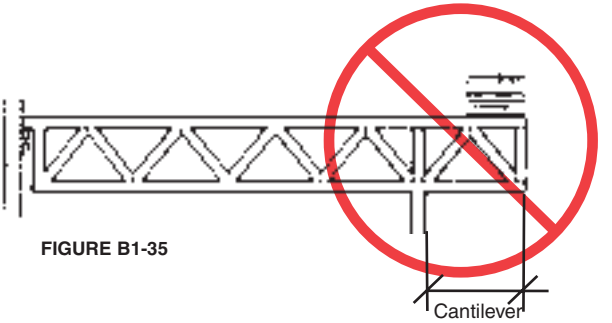


FIGURE B1-35

NEVER STACK MATERIALS ON THE CANTILEVER OF A TRUSS

☑ **ALWAYS STACK MATERIALS OVER TWO OR MORE TRUSSES**

⊘ **NEVER OVERLOAD SMALL GROUPS OR SINGLE TRUSSES. POSITION LOAD OVER AS MANY TRUSSES AS POSSIBLE. DO NOT EXCEED STACK DEPTH IN TABLE B4-1 PAGE 58.**

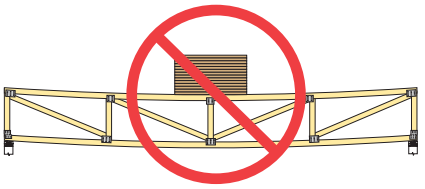


FIGURE B1-36

FIGURE B1-37

☑ Acceptable against outside load bearing wall and oriented perpendicular to truss span.

☑ Acceptable over load bearing wall laying flat only and oriented perpendicular to truss span.

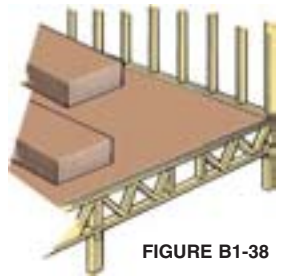


FIGURE B1-38

⊘ **NEVER CUT, ALTER OR DRILL ANY STRUCTURAL MEMBER OF A TRUSS UNLESS SPECIFICALLY PERMITTED BY THE TRUSS DESIGN DRAWING**

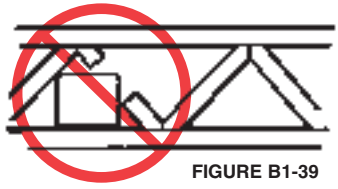


FIGURE B1-39

☑ Any field modification that involves the cutting, drilling, or relocation of any structural truss member or connector plate shall not be done without the approval of the Truss Manufacturer or a licensed Design Professional.

☑ Trimming overhangs to length is considered a part of normal erection and is permitted.

CAUTION NOTES

- ☑ Errors in building lines and/or dimensions, or errors by others (i.e., unequal plate elevations, walls not parallel, etc.), shall be corrected by the Contractor or responsible construction trade Subcontractor or Supplier BEFORE erection/installation of trusses begins.
- ☑ Non-load bearing walls may become load bearing if large construction loads are applied above them. This can cause floors below to have deflection problems.
- ☑ Under industry guidelines, trusses that have been field altered at the jobsite or overloaded during the construction phase may render your Truss Manufacturer's limited warranty null and void. Check your Truss Manufacturer's limited warranty for specific information.

DISCLAIMER: The Truss Manufacturer and Truss Designer must rely on the fact that the Contractor and crane operator are professionals and that he/she has the capability to undertake the work they have agreed to do on any given project. If the Contractor believes they need assistance in some aspect of the construction project, they should seek assistance from a competent party. The methods and procedures outlined are intended to ensure that the overall construction techniques employed will put floor and roof trusses into place SAFELY. These recommendations for handling, installing and bracing wood trusses are based upon the collective experience of leading technical personnel in the wood truss industry, but must, due to the nature of responsibilities involved, be presented only as a GUIDE for use by a qualified Building Designer or Erection/Installation Contractor. It is not intended that these recommendations be interpreted as superior to the project Architect's or Engineer's design specification for handling, installing and bracing wood trusses and it does not preclude the use of other equivalent methods for bracing and providing stability for the walls and columns as may be determined by the truss Erection/Installation Contractor. Thus, WTCA and TPI expressly disclaim any responsibility for damages arising from the use, application, or reliance on the recommendations and information contained herein.

BCSI-B2

TRUSS INSTALLATION AND TEMPORARY BRACING

COMMENTARY AND RECOMMENDATIONS

For trusses up to 2'-0" on-center and 80'-0" in length.

⚠ **WARNING!** The erection of wood trusses is inherently dangerous and requires, above all, careful planning and communication between the Erection/Installation Contractor, crane operator and installation crew. Depending on the experience of the Contractor it is strongly recommended that a meeting be held with all individuals involved in the lifting/hoisting, installing and temporary bracing operations to review the provisions of this booklet, the Truss Design Drawings (TDD), the Building Structural System Design Documents (BSSDD) (architectural/structural plans and specifications), the Truss Placement Diagram (if/when required by BSSDD), OSHA jobsite lifting and fall protection requirements (see BCSI-B11, Fall Protection and Wood Trusses) and site specific environmental issues.

⚠ **WARNING!** Disregarding handling, installing and bracing safety recommendations is the major cause of truss erection/installation accidents. Ignoring an unsafe condition or action will greatly increase the probability of an accident occurring which could easily result in property damage, but more significantly, may also cause serious personal injury or death.

Proper truss erection/installation and bracing requires an understanding of triangulation in the various planes of the truss; top chord, bottom chord and web, and in a direction perpendicular to these members. It is critical to note that all lateral bracing must be stabilized by diagonal members in the same plane. Lateral bracing by itself is not adequate without the added rigidity of triangulation from the diagonal bracing. This understanding is essential for a safe installation.

The Erection/Installation Contractor must be familiar with general bracing concepts as discussed in the

above industry publications. It is not intended that these recommendations be interpreted as superior to the project Architect's or Engineer's design specification for handling, installing and bracing wood trusses and it does not preclude the use of other equivalent methods for bracing and providing stability for the walls and columns as may be determined by the Contractor. The Contractor is also responsible for the proper and safe lifting of the trusses. See BCSI-B1 (pages 1-20) for additional commentary on handling and installing. Every project has different site conditions that can have a specific affect on the erection process. Before the first truss is erected every individual on the erection crew, including the crane operator, needs to understand the installation plan and the intended bracing requirements for a safe, efficient and accident-free jobsite.

PHOTO B2-1

WHAT NOT TO DO: No Diagonal Bracing

PHOTO B2-2

☑ **Always Diagonally Brace for Safety!**

CONSIDERATIONS BEFORE STARTING

Prior to starting the erection/installation process there are several checks that are the responsibility of the Contractor. These include:

☑ 1. Is the building the correct size? Are all actual dimensions the same as those depicted in the BSSDD? If not, corrective actions must be taken prior to the truss installation.

☑ 2. Are all the load bearing walls plumb and properly braced? Stopping in the middle of the truss installation to straighten and brace the walls is dangerous. Having an inadequately braced wall buckle during the erection process will surely cause property damage and may cause serious personal injury or death.

☑ 3. Are all special supporting structures (headers, beams, lintels) accurately and securely installed at the locations shown on the BSSDD? If not, corrective actions must be taken prior to the truss installation.

☑ 4. Are the tops of all bearing walls flat, level and at the same elevation? Are the walls straight in their length, and parallel where they should be parallel? Uneven bearing surfaces are a major cause of truss unevenness, and may cause costly delays and/or repairs. Check and correct bearing wall deficiencies prior to starting the truss erection process.

☑ 5. Are the delivered trusses the right size? Check trusses for damage and dimensions as soon as they arrive on the site to avoid possible installation delays.

☑ 6. Are all required hangers, tie-downs, and bracing materials on site and located where they will be readily accessible when needed? Missing materials or parts should be secured prior to starting the truss erection process. Do not attempt to “make do” without all required materials. Jobsite safety has no room for shortcuts.

☑ 7. Is the jobsite clean and neat with no scraps, cut-offs and trash on the floor or around the perimeter of the building? Truss erection typically involves bringing the trusses in overhead with the assistance of a crane. Worker attention is often directed upward even

while moving around. A clean jobsite will help to avoid trips and falls.

☑ 8. Are site conditions going to dictate the ground bracing techniques for the first truss? Steeply sloping lots or upper level truss installations usually warrant using an interior ground brace scheme, as exterior braces get exceedingly long and require substantial bracing of the braces.

☑ 9. Is the building configuration such that some sets of trusses can be set using the building structure itself as the ground bracing for the first truss set? Particular attention must be paid to the adequacy of the wall bracing if this technique is chosen.

☑ 10. Is the roof a hip style? Can the crane lift and hold the girder truss while the end jacks are installed to brace the girder? This could eliminate the need for ground bracing the first truss assuming all hardware and hangers are installed prior to the crane releasing the girder. Sheathing this assembly would assure a rigid framework to which subsequent trusses could be braced.

PHOTO B2-3

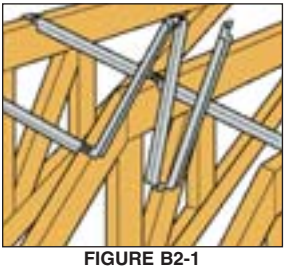


FIGURE B2-1

⚠ **WARNING!** Truss spacers are for spacing only! Never use the commercially available light weight metal fold-out/single unit spacer products for truss bracing. Truss spacers do not provide bracing of any kind and are not structural members. Failure to heed this warning is a dangerous act which could lead to a truss collapse, property damage, or worse, serious personal injury or death.

SETTING THE FIRST FIVE TRUSSES

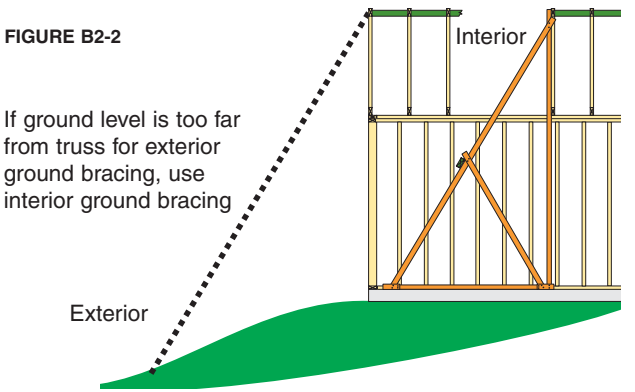
Before starting, here are some general safety practice reminders:

1. All members of the erection/installation crew should have been briefed by this time as to the installation plan and the intended bracing requirements.
2. All multi-ply trusses, including girders, should be fastened together per the TDD prior to lifting into their assumed positions on the building.
3. Check all trusses for damage (see BCSI-B5) prior to, during and after the erection/installation process. Do not install damaged trusses unless specifically instructed to do so by the Truss Manufacturer.
4. Reminder! All rows of lateral bracing must be stabilized with diagonal bracing. Lateral bracing alone is not adequate without the added rigidity of triangulation from diagonal bracing.

SUMMARY OF THE EIGHT STEPS IN THE TRUSS INSTALLATION PROCESS

☑ **STEP 1.** Establish ground bracing procedure; interior or exterior.

FIGURE B2-2



☑ **STEP 2.** Look-up on-center spacing of top chord temporary lateral braces (TCTLB) (see Table B2-1).

☑ **STEP 3.** Set first truss (or gable end frame) and fasten securely to ground braces using minimum 2-16d (0.135x3.5") nails clinched at each junction, and to the wall, or as directed by the Building Designer.

FIGURE B2-3 - EXTERIOR GROUND BRACING TO FIRST TRUSS INSTALLED (SEE GROUND BRACING PAGE 117)

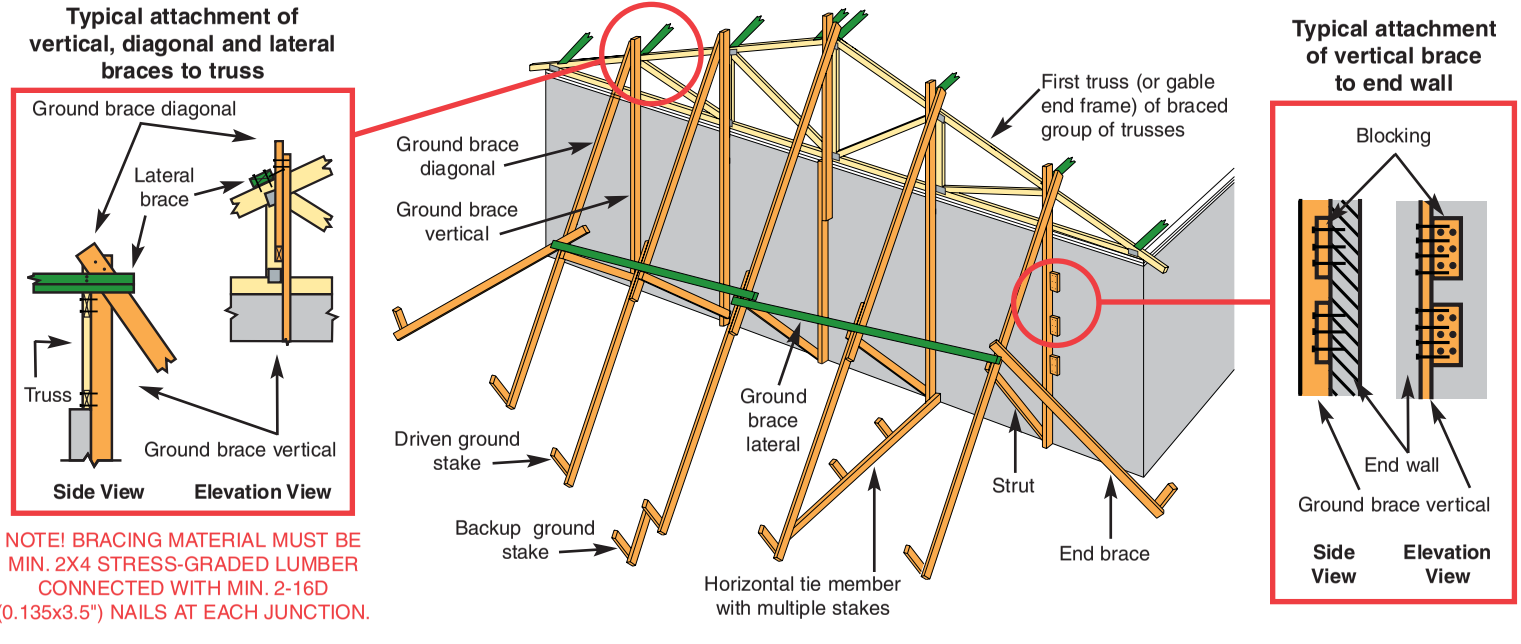
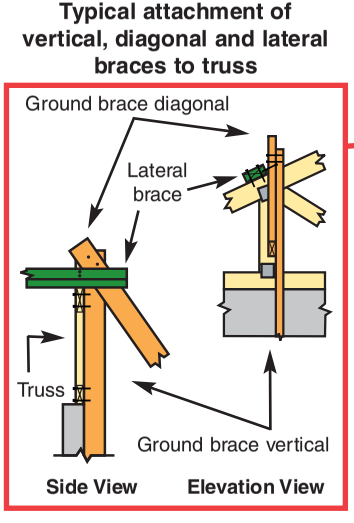
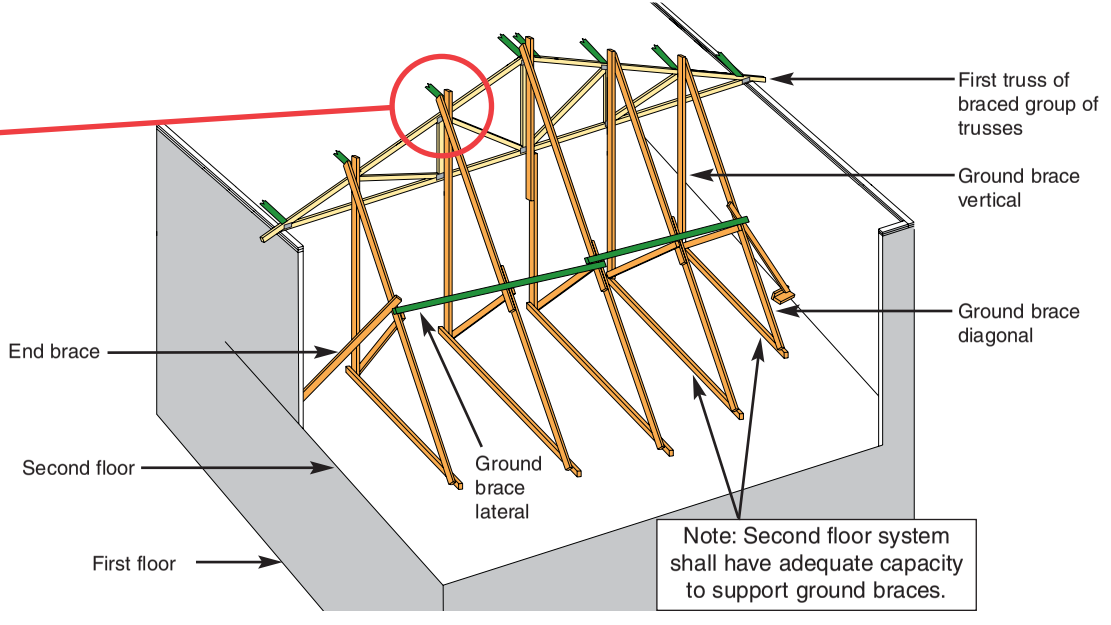


FIGURE B2-4 - INTERIOR GROUND BRACING TO FIRST TRUSS INSTALLED (SEE GROUND BRACING PAGE 117)



NOTE! BRACING MATERIAL MUST BE MIN. 2X4 STRESS-GRADED LUMBER CONNECTED WITH MIN. 2-16D (0.135x3.5") NAILS AT EACH JUNCTION.



The use of ground brace verticals alone, attached to the endwall, is not considered good construction practice and is not permitted.

☑ **STEP 4**. Set trusses 2, 3, 4 and 5 with TCTLB in line with ground bracing. Attach securely at all bearings, shimming bearings as necessary. Attachments to non-bearing interior walls must allow for a floating connection. Do not shim.

⚠ **WARNING!** NEVER release the truss being installed from the lifting slings/crane until all TCTLB are installed and bearing attachments are made. Exercise caution to assure the trusses are accurately located at their proper on-center spacing while the lateral bracing is being applied. Releasing a truss early or releasing a truss to adjust spacing is an extremely dangerous act. To do so leaves the truss in an unstable condition and places the installation crew in harms way. This is an UNSAFE act that may cause the truss to topple and could cause serious personal injury or death.

☑ **STEP 5**. Install top chord diagonal bracing (see diagonal bracing options based upon TCTLB design on pages 38-39). Alternately, roof sheathing applied at this stage will act as diagonal bracing for the top chords and adequately brace the first five trusses (see Figure B2-5).

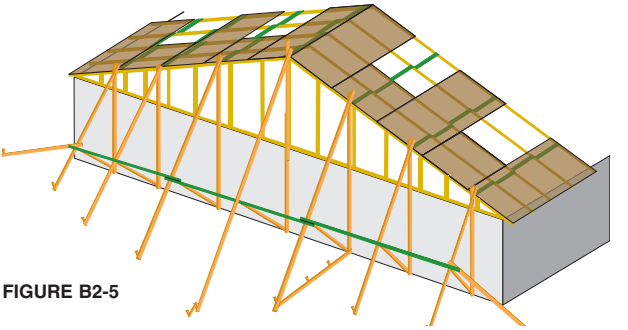


FIGURE B2-5

☑ **STEP 6**. Install web plane diagonal bracing to stabilize the first five trusses set. Web plane permanent bracing or web member permanent bracing, if required, may serve this purpose.

☑ **STEP 7**. Install the bottom chord plane temporary lateral and diagonal bracing to stabilize the bottom chord plane(s).

⊘ **DO NOT REMOVE GROUND BRACING UNTIL ALL THE TOP CHORD, BOTTOM CHORD AND WEB BRACING IS INSTALLED ON AND IN AT LEAST THE FIRST FIVE TRUSSES**

☑ Start roof sheathing immediately after securing the bracing on the web and bottom chord planes.

☑ **STEP 8**. Continue the erection/installation process by installing the next four trusses and then repeating Steps 5, 6 and 7. Repeat the process of setting four trusses then stopping and bracing them for all of the remaining trusses in the building run.

⚠ **WARNING!** This erection/installation procedure is dependent on the diagonal bracing being installed continuously. After the initial set of five trusses is set and braced, diagonal bracing must be applied every four trusses thereafter (see Option B, page 44).

DETAILS OF THE EIGHT STEP TRUSS INSTALLATION PROCESS

STEP 1. ESTABLISHING GROUND BRACING AND SETTING THE FIRST TRUSS

Ground bracing can be done on either the exterior or interior of the building, to the top of an adjacent wall, or to the structure itself. Site conditions may well dictate the most efficient procedure. The procedure selected is not as important as following the simple guidelines for locating the ground braces. Ground brace locations are determined by the requirements for TCTLB. Locations for TCTLB are determined by the overall truss length (see Table B2-1 on page 30) and the effective top chord segment length of any particular plane. It is important to note that there must be a TCTLB at EVERY top chord pitch break (i.e. change of slope). The effective top chord segment length then must be braced at intervals not exceeding the lengths given in Table B2-1 (see Figures B2-6, Figure B2-7 and Figure B2-9).

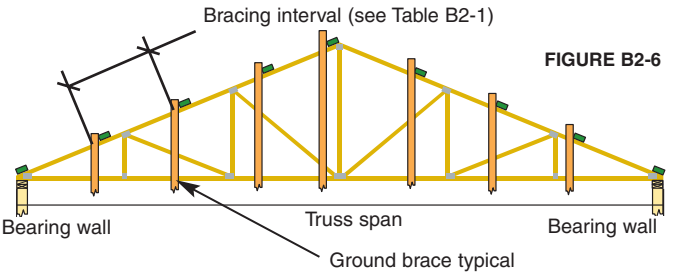


FIGURE B2-6

Set first truss into position and connect to bearing walls and ground brace verticals at top and bottom chord intersections.

STEP 2. CALCULATING GROUND BRACE LOCATION

Maximum TCTLB Spacing

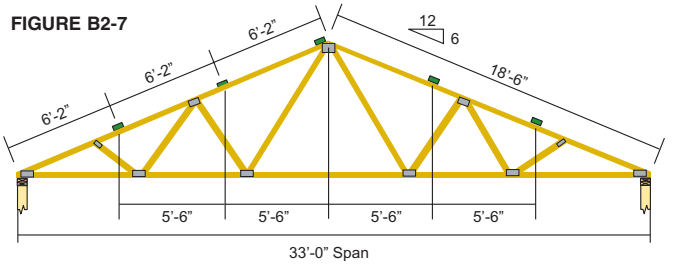
TABLE B2-1

Truss Span	TCTLB Spacing Requirements
Up to 30'	10' on-center maximum
30' to 45'	8' on-center maximum
45' to 60'	6' on-center maximum
60' to 80'+	4' on-center maximum

+Consult a Professional Engineer for trusses longer than 60'

☑ **Example 1:** 33' span 6/12 truss

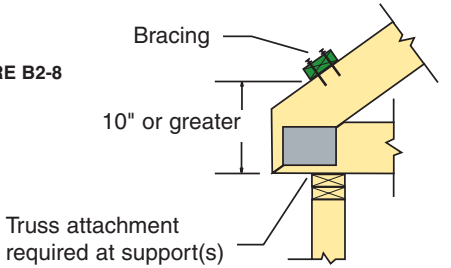
FIGURE B2-7



The 33' truss above will require TCTLB at not more than 8' on-center per Table B2-1. Measure the top chord length from the peak to truss heel. The sloping length will be roughly 18'-6". One TCTLB would divide the 18'-6" in half, or two sections. Half of 18'-6" is 9'-3" which exceeds the 8' on-center maximum in Table B2-1. Therefore, the chord segment needs to be divided into three sections 18'-6"÷3 = 6'-2". TCTLB will be 6'-2" on-center along the slope.

☑ Continuous TCTLB required over bearing if the height is 10" or greater as shown.

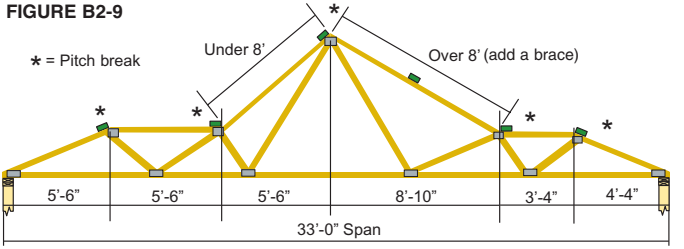
FIGURE B2-8



☑ Locating TCTLB and ground bracing for hip trusses, specials, etc.

TCTLB must be located at each pitch break along the top chord. Additional braces are required according to the maximum on-center spacing in Table B2-1, page 30.

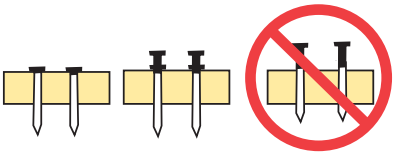
FIGURE B2-9



☑ For all bracing and spacing members nail as follows (except end-grain nailed spacer blocks which require 16d deformed shank; ring, barb or screw nails):

- Always drive 2-10d (0.128x3"), 2-12d (0.128x3.25") or 2-16d (0.135x3.5") nails into each truss for both lateral and diagonal members (see Table B1-1, page 10).

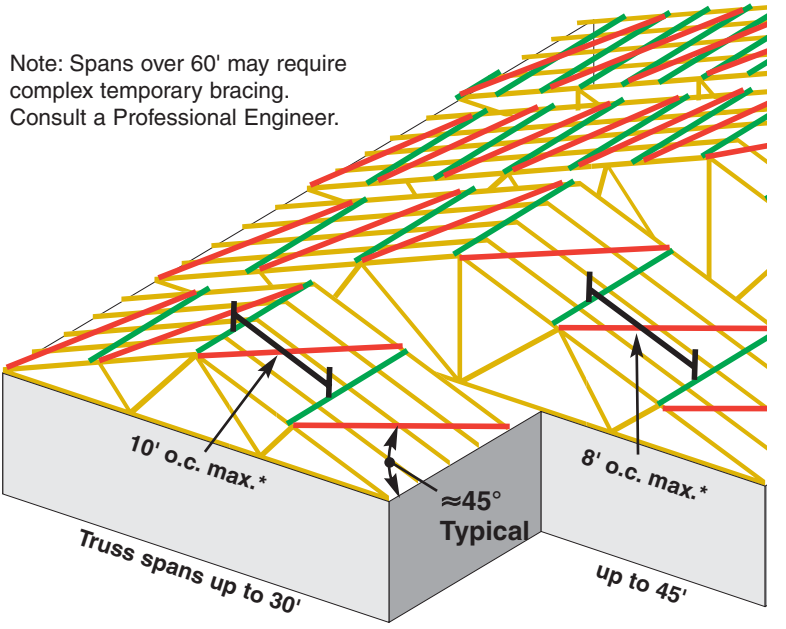
FIGURE B2-10



- Minimum size bracing material is 2x4 stress-graded lumber unless otherwise specified by the Building Designer.
- Drive nails flush, or use double-headed (duplex) nails for easiest brace removal.

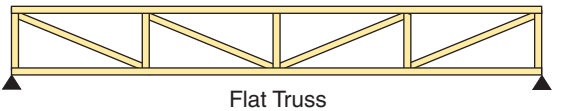
☑ The graphic below depicts the maximum on-center spacing of TCTLB per Table B2-1, page 30.

- Ground bracing not shown for clarity.
- All bracing is at least 2x4 stress-graded lumber.
- Use 2 nails minimum in each brace at each truss.



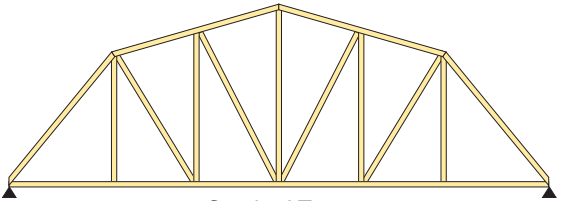
***MAXIMUM TOP CHORD TEMPORARY LATERAL BRACING SPACING**

These TCTLB options apply to all 2x_oriented sloped and flat chord trusses.



Flat Truss

FIGURE B2-12



Gambrel Truss

FIGURE B2-13

Apply diagonal bracing or sheathing immediately. For spans over 60', sheathing immediately is the preferred method (see Step 5, page 28).

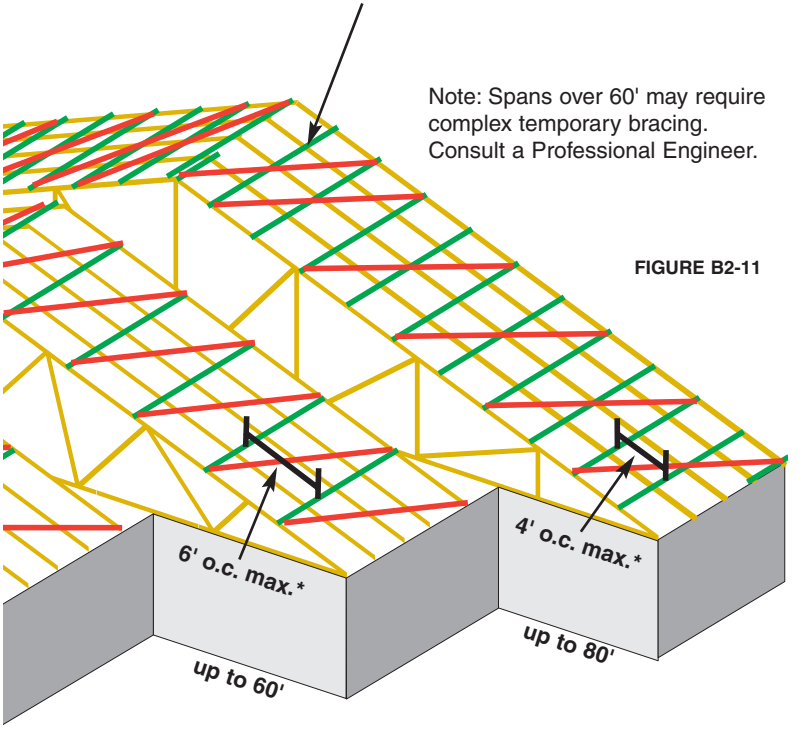
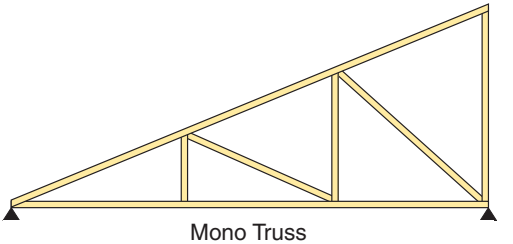


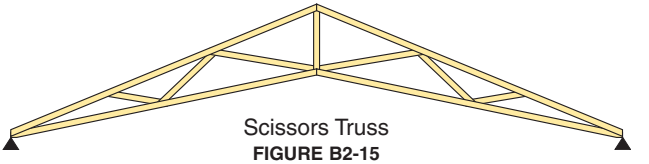
FIGURE B2-11

***MAXIMUM TOP CHORD TEMPORARY LATERAL BRACING SPACING**



Mono Truss

FIGURE B2-14



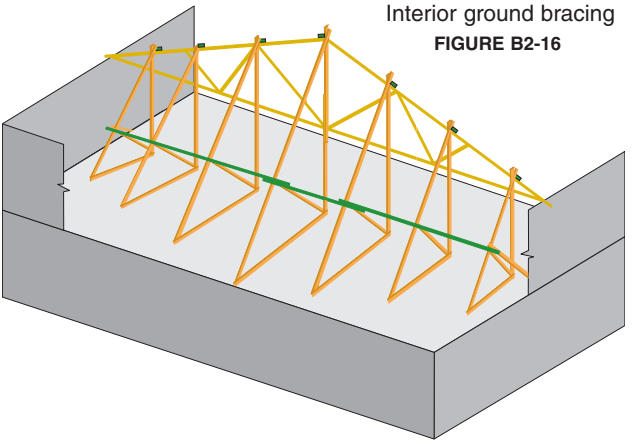
Scissors Truss

FIGURE B2-15

STEP 3. SET FIRST TRUSS AND FASTEN SECURELY TO GROUND BRACES

☑ Set up the ground bracing for the first truss from the building interior or exterior.

☑ Example of first truss installed with interior ground bracing:

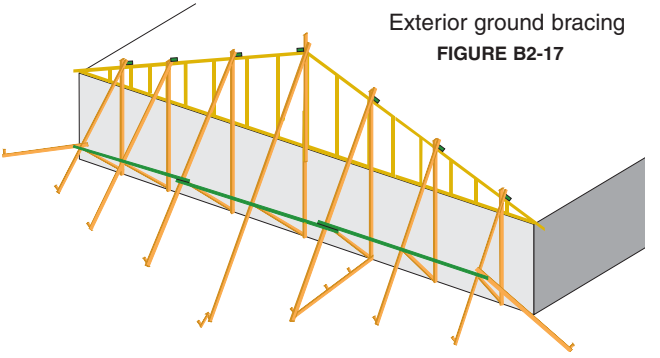


Interior ground bracing
FIGURE B2-16

IMPORTANT SAFETY WARNING!

First truss must be attached securely to all required ground braces prior to removing the hoisting supports.

☑ Example of first truss installed with exterior ground bracing:



Exterior ground bracing
FIGURE B2-17

- ☑ Example of first truss installed with interior ground bracing to top of wall and back to floor.
- ☑ X = wall setback = truss height rounded to next full truss spacing, or girder truss set back in hip end framing.

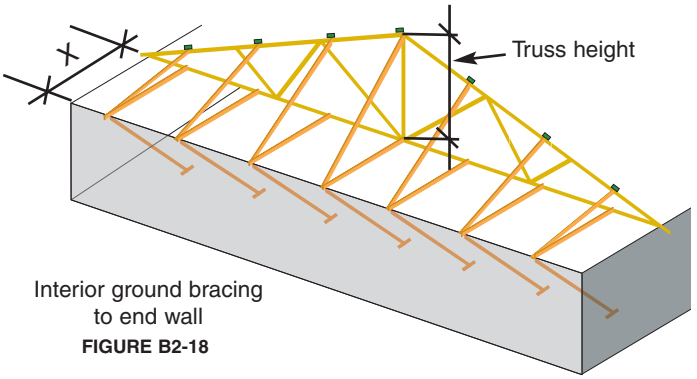


FIGURE B2-18

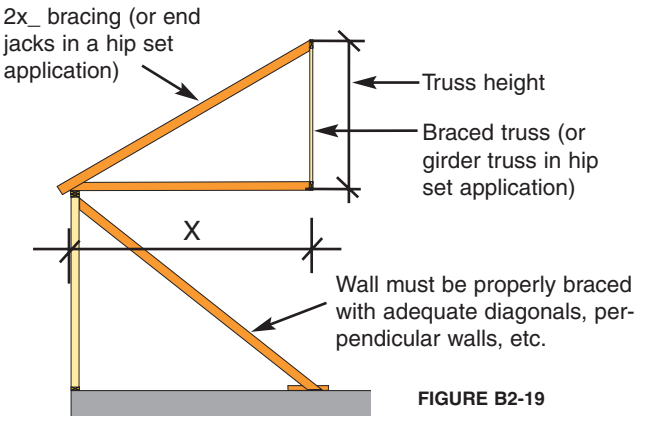


FIGURE B2-19

To maintain adequate bracing angles, establish "X" at approximately the overall height of the trusses being erected.

IMPORTANT SAFETY WARNING!

First truss must be attached securely to all required ground braces prior to removing the hoisting supports.

STEP 4. SET TRUSSES 2, 3, 4 AND 5 WITH TCTLB IN LINE WITH GROUND BRACING

☑ Example of first five trusses with interior ground bracing:

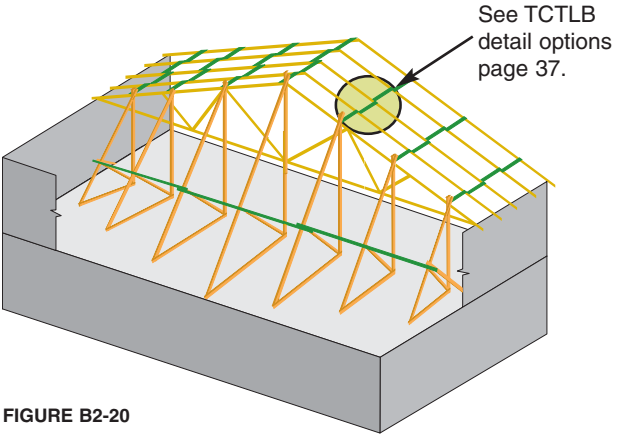


FIGURE B2-20

☑ Example of first five trusses with exterior ground bracing:

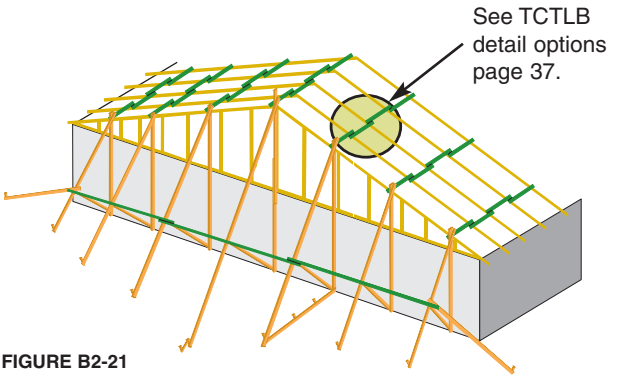


FIGURE B2-21

☑ Example of first five trusses with interior ground bracing to top of wall and back to floor:

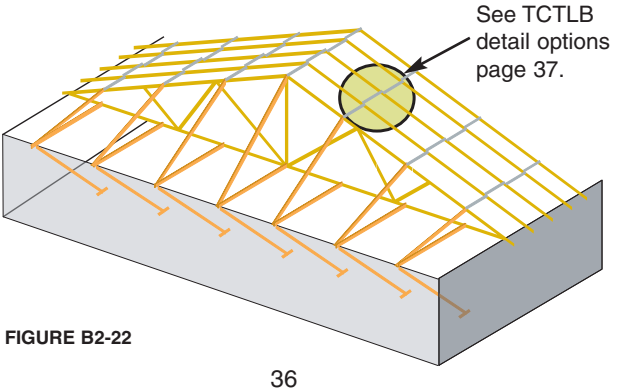
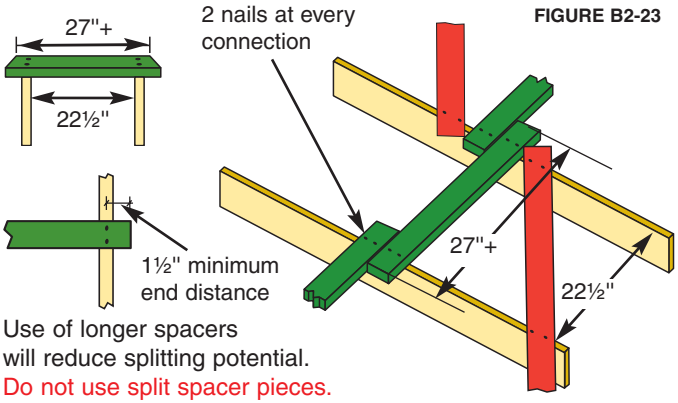


FIGURE B2-22

☑ Set trusses 2,3,4 and 5 using the short piece temporary spacers (on top or between trusses) in line with the ground braces.

TCTLB OPTION 1 - DETAIL

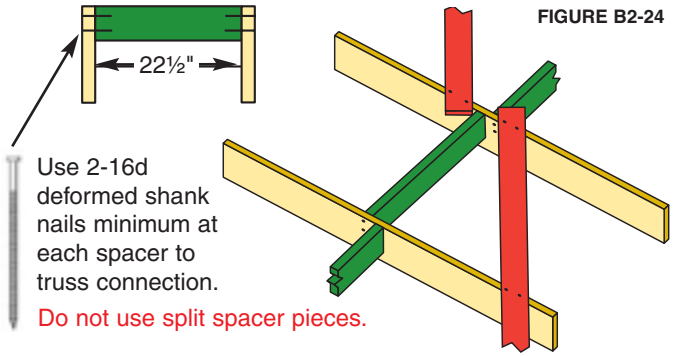
FIGURE B2-23



Use of longer spacers will reduce splitting potential.
Do not use split spacer pieces.

TCTLB OPTION 2 - DETAIL

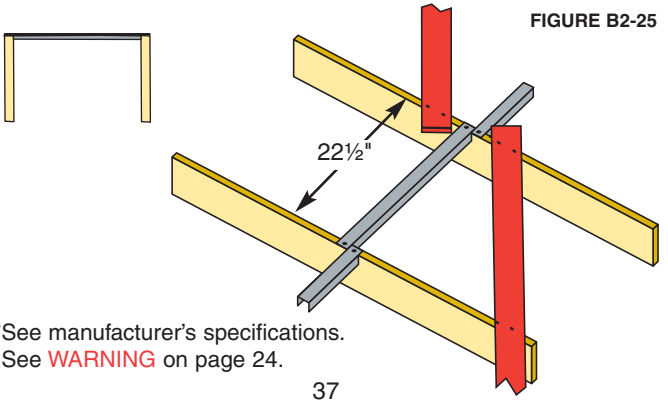
FIGURE B2-24



Use 2-16d deformed shank nails minimum at each spacer to truss connection.
Do not use split spacer pieces.

TCTLB OPTION 3 - PROPRIETARY METAL BRACING PRODUCTS*

FIGURE B2-25

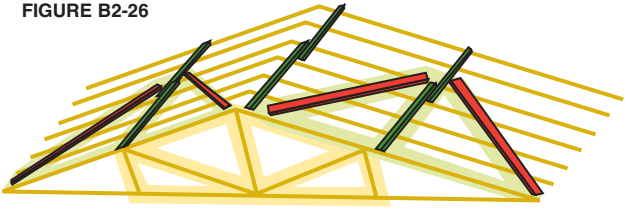


*See manufacturer's specifications.
See WARNING on page 24.

STEP 5. INSTALL TOP CHORD DIAGONAL BRACING

☑ Triangles make trusses strong. Triangles make bracing strong.

FIGURE B2-26



☑ Some Truss Manufacturers attach supplemental warning tags, containing the same message, to the trusses.

FIGURE B2-27

PHOTO B2-4

PHOTO B2-5

☑ Example of diagonal bracing on first five trusses with interior ground bracing:

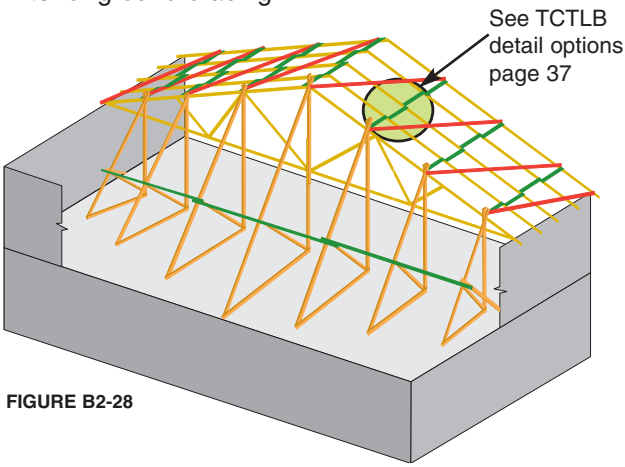


FIGURE B2-28

☑ Example of diagonal bracing on first five trusses with exterior ground bracing:

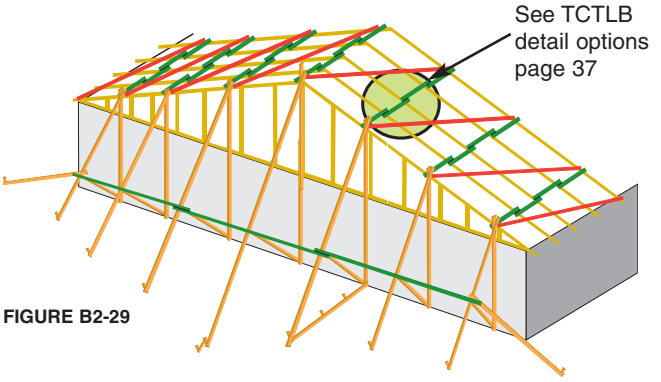


FIGURE B2-29

☑ Example of diagonal bracing on first five trusses with ground bracing to top of building wall and back to floor:

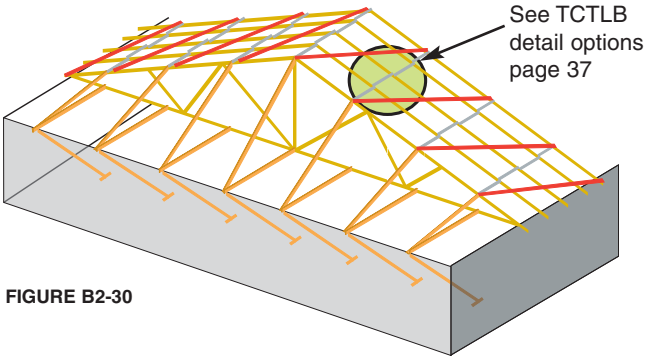


FIGURE B2-30

STEP 6. INSTALL WEB MEMBER PLANE BRACING (LATERAL AND DIAGONAL/TEMPORARY AND PERMANENT)

Diagonal bracing should also be installed as temporary installation bracing perpendicular to the plane of the trusses and attached to similar web members.

- ☑ Permanent lateral web bracing requirements will be specified on the TDD (see BCSI-B3).
- ☑ Diagonal bracing must be installed on web members (verticals whenever possible), located at or near bottom chord lateral bracing. Properly attached rated panel sheathing may be substituted for diagonal bracing.
- ☑ Web diagonal braces must be installed so that they cross the web members at about 45° and should be nailed with a minimum of 2-16d (0.135x3.5") nails at each end and each intermediate truss web.
- ☑ Web lateral and diagonal braces for installation purposes may be installed at the locations specified for permanent bracing and may become part of the permanent bracing system.
- ☑ Web diagonal braces should be no less than 2x4 stress-graded lumber.
- ☑ The web diagonal braces, acting together with the top chord and bottom chord temporary lateral bracing, form triangulation perpendicular to the plane of the truss, thus creating additional lateral stability for the braced trusses.

(See Web Member Plane Bracing BCSI-B1, page 16.)

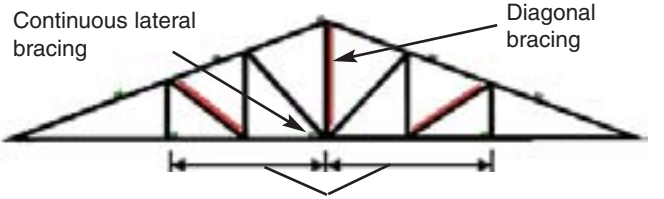
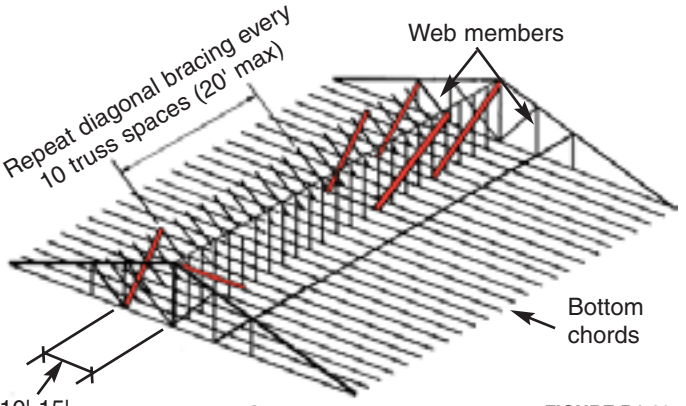


FIGURE B2-31

☑ This bracing approach applies to all truss types except 3x2 and 4x2 parallel chord trusses.



Note: Some chord and web members not shown for clarity.

FIGURE B1-32

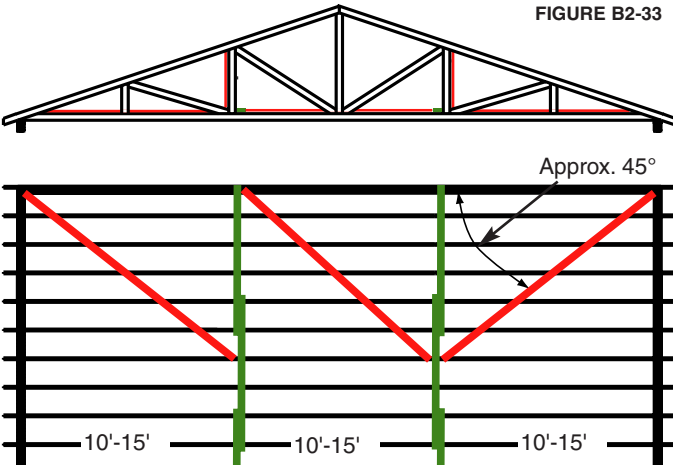
☑ **IMPORTANT NOTE: TEMPORARY/PERMANENT DIAGONAL BRACING,** as shown, is critical in preventing trusses from leaning or dominoing. Repeat as shown to create a succession of rigid units. Mono trusses, deep flat trusses and similar high end type trusses will also need temporary lateral and diagonal bracing at the ends.

☑ The Building Designer should be consulted during the pre-erection/installation meeting if the bracing requirements are not perfectly clear.

STEP 7. BRACING THE BOTTOM CHORD PLANE

Step 7a. Bottom chord temporary lateral bracing (BCTLB) is used to stabilize the bottom chords during installation and to maintain proper spacing between trusses. It may also be used as permanent bracing. Therefore, most installation lateral bracing is placed on the top edge of the bottom chords and fastened with a minimum of 2-16d (0.135x3.5") nails at each truss intersection, at the locations specified for the permanent bracing and becomes a part of the permanent bracing system.

FIGURE B2-33



Plan view of bottom chord lateral and diagonal bracing

☑ Bottom chord TEMPORARY lateral bracing must be continuous and installed at no more than 15' on-center and may only be removed (if desired) after the permanent ceiling diaphragm is in place.

☑ Bottom chord PERMANENT lateral bracing must be installed at no more than 10' on-center (but may be less if required by the specific truss design and/or the Building Designer). Temporary lateral bracing may be installed at the required locations of the PERMANENT lateral bracing (see TDD for locations) and remain to become part of the permanent bracing system.

Step 7b. The Building Designer should specify how the bottom chord lateral bracing is to be anchored or restrained to prevent lateral movement. This may be accomplished by:

☑ Diagonal bracing in the plane of the bottom chord repeated at the same intervals as the top chord diagonal bracing (see BCSI-B1, pages 14-15); or other means as determined by the Building Designer.

☑ Temporary diagonal bracing which is installed in the plane of the bottom chord may become part of the permanent bracing system.

STEP 8. CONTINUE THE INSTALLATION AND REPEAT THE BRACING ROUTINES

OPTION A: Top chord temporary continuous lateral braces must have diagonal braces a maximum of every 20'. See detail below:

⚠ **WARNING!** This diagonal bracing option can only be used if the Contractor has installed long length Top Chord Temporary Continuous Lateral Braces.

Step A: Install trusses 1 through 5 using TCTLB Options 1-3 from page 37.

Step B: Add long length (min. 2x4x12') continuous lateral braces to tie all trusses together.

Step C: Add diagonal bracing (at ≈45°) as indicated in Figure B2-34 below:

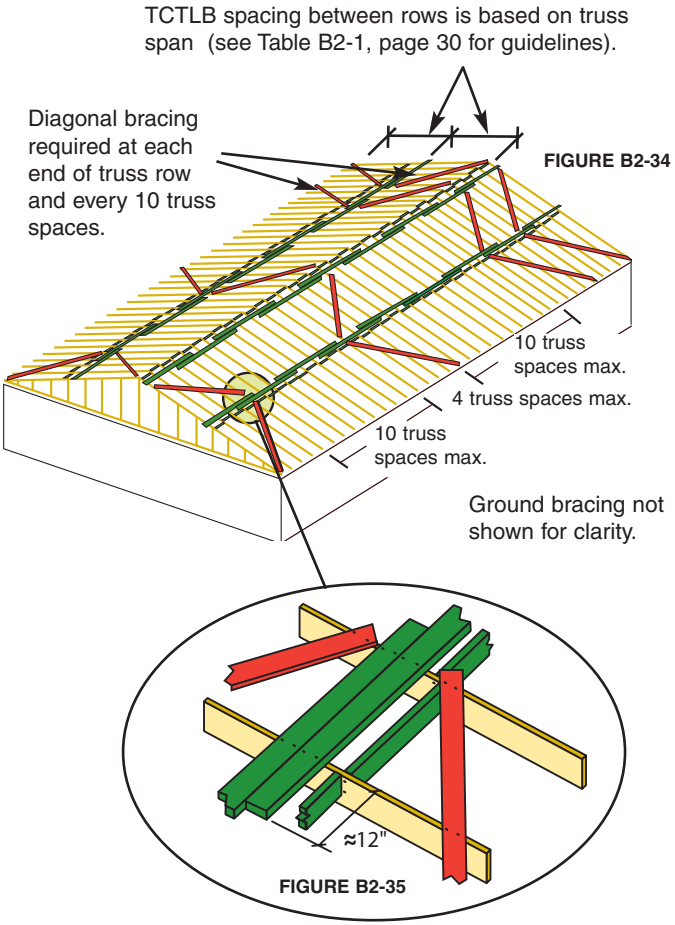


FIGURE B2-34

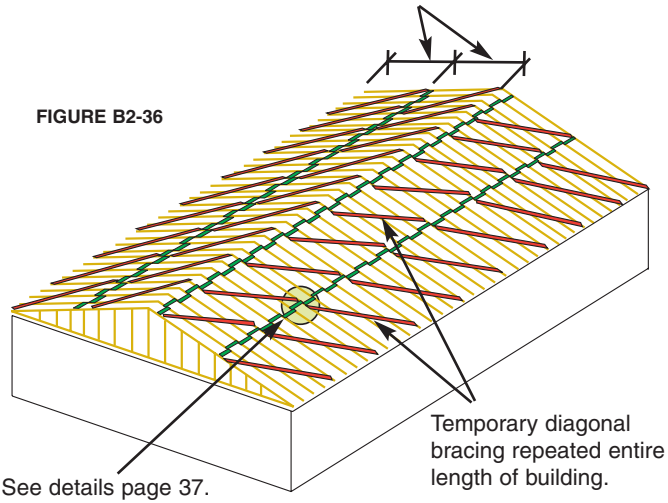
FIGURE B2-35

OPTION B: Top chord temporary spacer pieces must have diagonal braces attached to all trusses. See details below:

⚠ **WARNING!** After the initial set of five trusses are installed and braced, DO NOT set more than four trusses when using temporary spacer pieces before you STOP, and diagonally brace as shown. This approach WILL NOT work without diagonal bracing applied early and often.

TCTLB spacing between rows is based on truss span (see Table B2-1, page 30 for guidelines).

FIGURE B2-36



⚠ **WARNING! DO NOT** use TCTLB, either continuous or short spacers alone. ALWAYS include diagonal bracing!

Above: Inadequate bracing - What Not To Do
PHOTO B2-6

Above: Illustrates use of adequate bracing
PHOTO B2-7

ENSURE THAT ALL TRUSSES ARE PROPERLY DIAGONALLY BRACED AT THE END OF EACH DAY'S WORK

Sheath early... sheath often. Do not wait until all trusses are set to apply sheathing.

⚠ **WARNING!** Remove only as much 2x4 bracing as is necessary to nail down the next sheet.

⚠ **DO NOT EXCEED TRUSS DESIGN LOAD WITH CONSTRUCTION LOADS (SEE BCSI-B4)**

PHOTO B2-8

ALTERNATE INSTALLATION METHOD:

Build it on the ground and lift it into place.

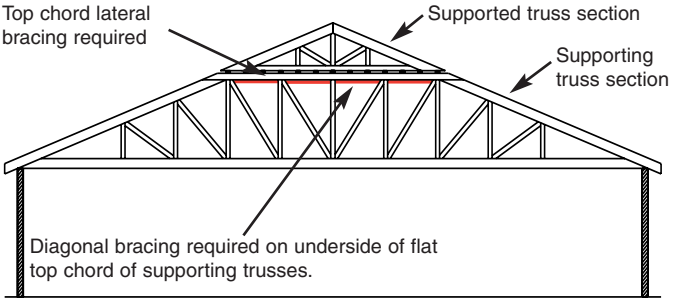
- ☑ Build it on the ground.
- ☑ Sheath it for stability.
- ☑ Install web and bottom chord bracing as required by the building designer.
- ☑ Pick it up and — set it in place.
- ☑ Be sure to get the proper professional engineering guidance to lift the entire system into place safely and efficiently.

PHOTO B2-9

PHOTO B2-10

FIELD ASSEMBLY AND OTHER SPECIAL CONDITIONS

☑ In some cases, the size or shape of wood trusses is such that some field assembly is required. The requirements for field assembly should be specified on the TDD supplied by the Truss Manufacturer unless otherwise agreed. The Erection/Installation Contractor is responsible for proper field assembly.

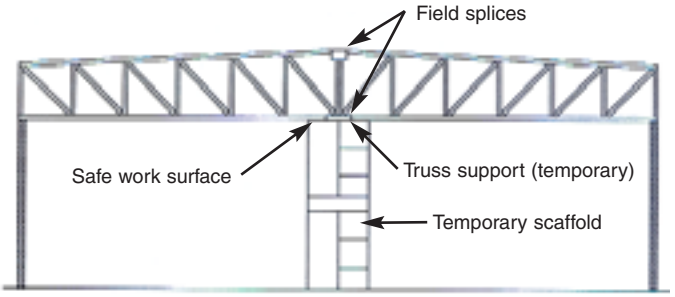


Typical Piggyback Truss System

FIGURE B2-37

☑ Trusses which are too high for delivery to the jobsite in one piece may be manufactured in two or more sections and “piggybacked” at the jobsite. The Erection/Installation Contractor must install all temporary and permanent bracing shown on the TDD and/or the BSSDD.

⚠ **WARNING!** The supporting trusses must be completely installed with all permanent bracing and/or sheathing as required BEFORE installing the cap. During the erection/installation of the supporting trusses, temporary bracing per the minimum requirements of BCSI-B2, Truss Installation and Temporary Bracing, is required until the full permanent bracing and/or sheathing is installed.



Field Spliced Truss (Special design required)

FIGURE B2-38

☑ Trusses which are too long for delivery to the jobsite in one piece may be designed to be delivered in two or more parts, and then field spliced together at the jobsite. The Erection/Installation Contractor should carefully follow the splicing specifications shown on the TDD(s) and/or BSSDD. Splicing may be performed on the ground before installation, or the truss sections may be supported by temporary shoring and splices installed from a safe working surface (see Figure B2-38). All temporary and permanent bracing, and/or sheathing, per BCSI-B2 and/or the BSSDD, must be applied as the erection/installation progresses.

☑ For buildings with large open spans, such as large warehouses, shopping centers, churches, and gymnasiums, it is recommended that temporary supports be set up at interior locations during the erection/installation process. This will provide greater erection stability and increased safety at the jobsite. Temporary interior supports should be left in place until all temporary and permanent bracing is installed.

☑ Some buildings may be designed to have open ends (no end walls) or large door openings in the end walls. Diagonal bracing should be applied to the bottom chords between the bottom chord lateral braces and at about 45° to the laterals (see Figure B2-33). This diagonal bracing should be applied at both ends of an open end building, and repeated along the length of the building at the same spacing as calculated for the top chord diagonal braces. Such buildings may also require additional bottom chord permanent bracing to resist buckling of the bottom chord due to compression caused by wind uplift. Consult the Building Designer.

MULTI-PLY TRUSSES AND GIRDER TRUSSES

⚠ **WARNING!** The proper attachment of truss plies in multi-ply trusses is required along the entire lengths of the truss top and bottom chords and web members. The Truss Designer specifies the specific ply-to-ply connections required for chords and webs on the TDD. If possible, multi-ply trusses should be connected together in accordance with the TDD prior to erection/installation.

⚠ **WARNING!** Girder truss plies must be completely and securely attached together prior to attaching the supported trusses to the girder (see BCSI-B9, Multi-Ply Girders).

VALLEY SET FRAME INSTALLATION

☑ A valley set is a group of truss frames designed to sit on top of other trusses to change the direction of the roof planes.

☑ The top chord of the supporting trusses needs to be laterally and diagonally braced by either roof sheathing or other alternate bracing methods as specified by the Building Designer. The supporting trusses should be designed either for the application of sheathing or purlin spacing from the bottom chord of the valley set frames.

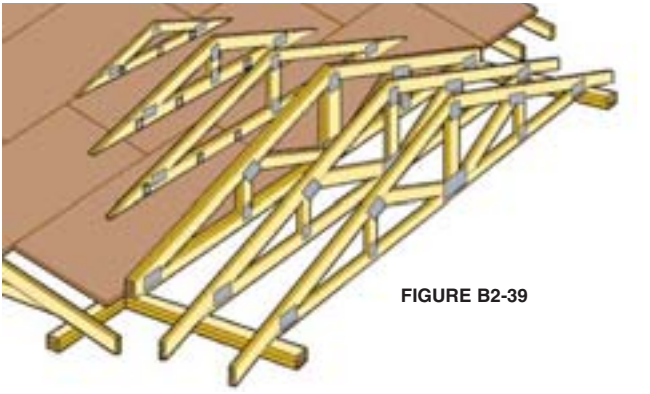


FIGURE B2-39

SPECIAL APPLICATIONS USING TRUSSES

⚠ **CAUTION!** Trusses that are installed for ornamental purposes or other special applications, and which are not intended to carry roof loads, floor loads, or exterior environmental loads such as snow or wind loads, still require bracing to prevent lateral buckling due to incidental material loads (e.g., from lattice work or other finished framing) and installation forces. Even very small loads may cause lateral buckling in members that do not have adequate bracing. The Erection/Installation Contractor is advised to adhere to the lateral bracing requirements specified on the TDD, or consult with the Truss Manufacturer on lateral bracing spacing requirements.

OTHER APPLICATIONS REQUIRING SPECIAL BRACING

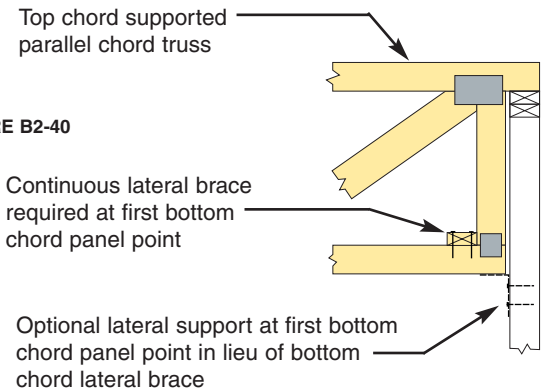


FIGURE B2-40

☑ For top chord supported parallel chord trusses, the lateral bracing should be applied at the first bottom chord panel point to prevent torsional overturning under load, (see Figure B2-40). This may not be a requirement for trusses with lumber oriented in the horizontal direction.

☑ Where a parallel chord truss is supported on the bottom chord at each end of the truss and is properly anchored to the supports, no bottom chord lateral brace is required at the bearing location.

BCSI-B3

WEB MEMBER PERMANENT BRACING/WEB REINFORCEMENT

☑ Often web members within the plane of the truss will require some type of "bracing" to eliminate buckling under design loads.

☑ These members need either lateral support to reduce their buckling length or some other means of reinforcement to increase the web member net section properties to offset the compression forces.

☑ **PRIMARY OPTIONS INCLUDE:**

- Continuous Lateral Bracing (CLB)
- T-reinforcement
- L-reinforcement
- Scab reinforcement
- Stacked web reinforcement
- Proprietary metal reinforcement products

☑ The Truss Design Drawing (TDD) will depict which web bracing/reinforcement option has been assumed in the design.

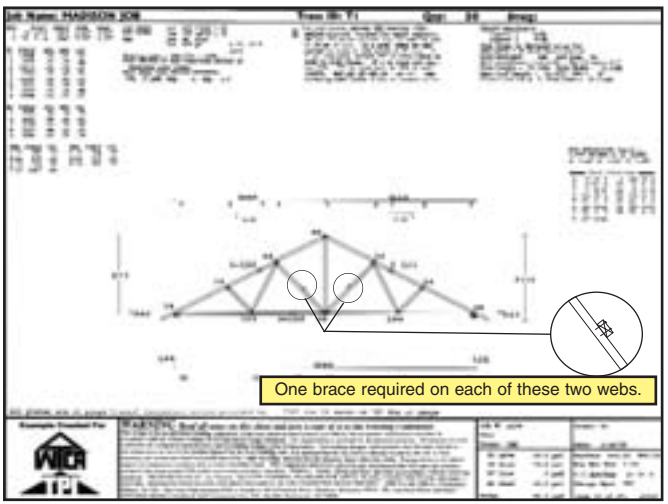


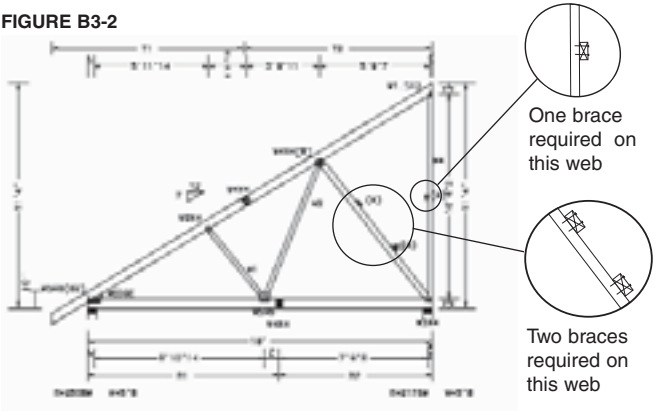
FIGURE B3-1

CONTINUOUS LATERAL BRACING (CLB)

- ☑ If web bracing is required on a particular truss design, CLBs are most frequently specified.
- ☑ Webs may require one or more CLBs. The TDD will specify the number and location of braces.

Important Note: CLB must always be diagonally braced for rigidity. CLBs alone DO NOT prevent all similar webs from buckling together.

FIGURE B3-2



- ☑ CLBs work most efficiently when applied to three or more similar trusses and must always be diagonally braced.
- ☑ Some Truss Manufacturers will mark web member permanent bracing locations on the truss itself. One supplemental marking example is the truss tag shown below.

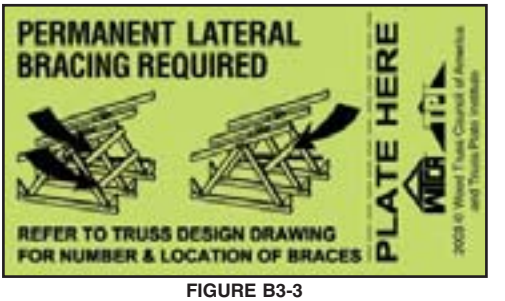


FIGURE B3-3

WARNING! It is the responsibility of the Building Designer to adequately stabilize the lateral bracing using diagonal bracing or some other means. Further, the Building Designer should specify the frequency that this diagonal bracing must be placed to transfer the loads adequately into the diaphragms.

☑ Unless otherwise specified by the Building Designer, the diagonal brace must be at least 2x4 stress-grade lumber. Fasten to each truss with 2-10d (0.128x3"), 2-12d (0.128x3.25"), or 2-16d (0.135x3.5") nails. Proprietary metal diagonal bracing products can also be used.

FIGURE B3-4

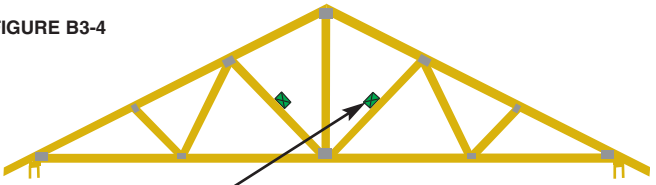
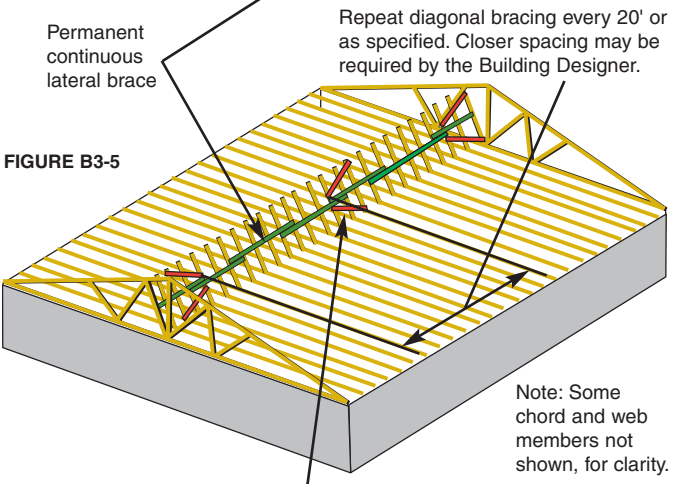


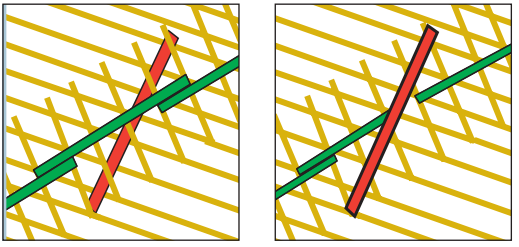
FIGURE B3-5



Always Diagonally Brace the Permanent Continuous Lateral Bracing!

ALTERNATIVE DIAGONAL BRACING OPTIONS

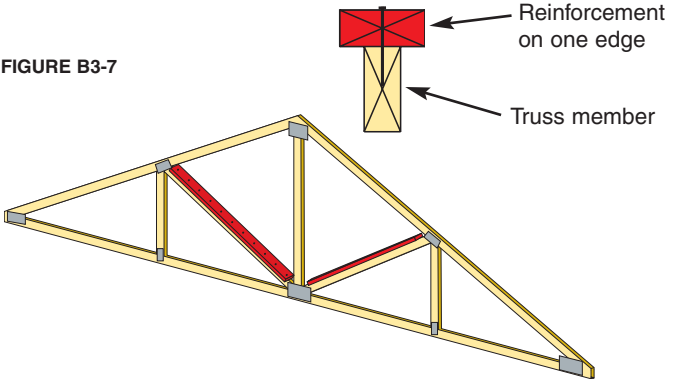
FIGURE B3-6



INDIVIDUAL WEB REINFORCEMENT (JOBSITE APPLIED)

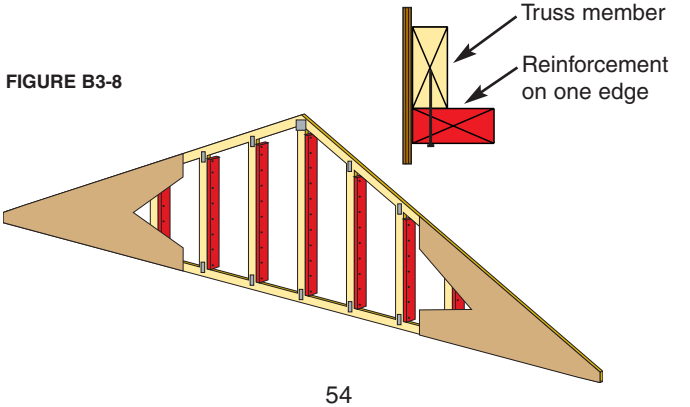
- ☑ T, L or scab reinforcements are three options that use the principle of adding a member to increase the web's section properties, therefore requiring no further bracing for stability. They also use commonly available materials and fasteners with the size, grade and nailing schedule specified by the Truss Designer. Refer to the TDD to get specific installation instructions.
- ☑ All reinforcing lumber or proprietary metal reinforcing products are specified on the TDD or by the Building Designer.
- ☑ T-reinforcement typically provides the greatest increase in buckling strength for a given size of reinforcing material.

FIGURE B3-7



- ☑ L-reinforcement is similar to T-reinforcement, but creates a flat surface on one face of the truss for the application of sheathing material.

FIGURE B3-8



☑ Scab reinforcement is installed on one face of the web. It can be more structurally efficient for multiple-ply webs and provides easier nailing due to the wider lap area on the web.

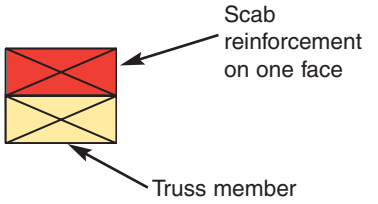
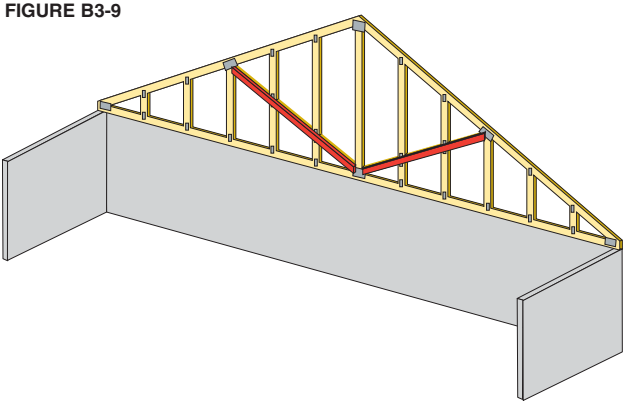


FIGURE B3-9



☑ Some Truss Manufacturers mark permanent web member reinforcement locations on the truss itself. One marking example is the truss tag shown below.

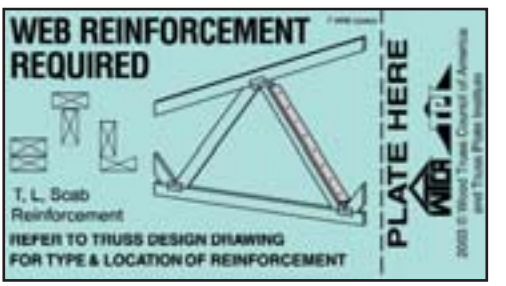


FIGURE B3-10

INDIVIDUAL WEB REINFORCEMENT (SHOP APPLIED)

☑ Proprietary metal reinforcement products or stacked web reinforcements are installed in-plant and eliminate the need for additional jobsite reinforcement of the webs.

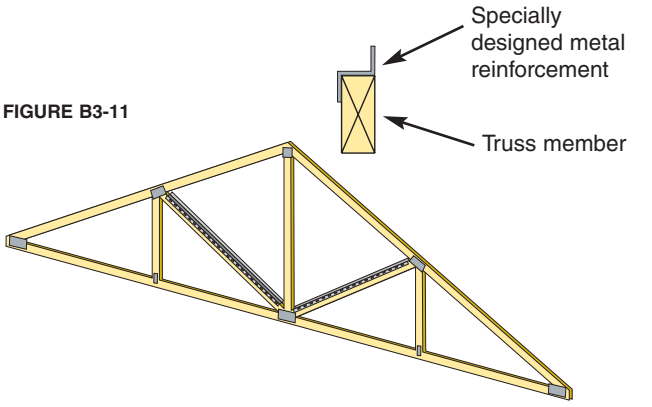


FIGURE B3-11

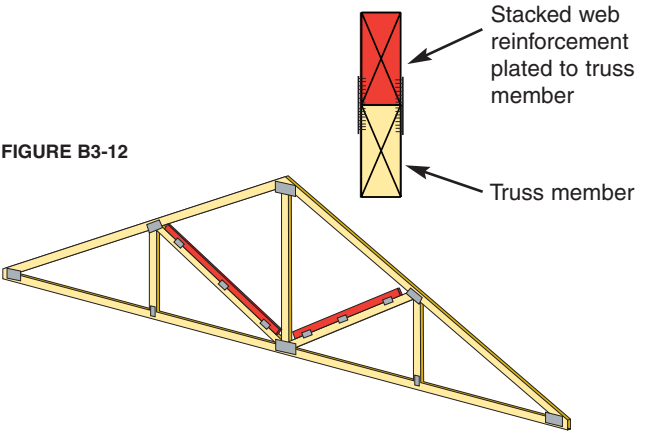


FIGURE B3-12

☑ Permanent bracing for wind, seismic and/or other lateral loads perpendicular to the plane of the trusses will always be needed in every building; however, field applied permanent web member reinforcement could be designed out of the truss in most cases with careful design consideration and contracting.

BCSI-B4
CONSTRUCTION LOADING

The term “construction loading” is used to describe loads from workers and building materials on an unfinished structure; for example, when builders stack bundles of panel sheathing or gypsum board on trusses for temporary storage.

☑ Construction loads should be placed only on fully braced or sheathed structures.

☑ Use extreme caution when placing construction loads and only stack reasonable amounts of materials (see Table B4-1, page 58).

⚠ **WARNING!** Stacking excessive construction loads on floor or roof trusses is an unsafe act.

☑ Trusses that have been over-stressed due to excessive construction loading will usually show excessive sagging (deflection), or in more severe cases may show broken webs and/or chord members or web members that have pulled out of the plated joints.

⚠ **WARNING!** Trusses are very unstable and have NO CAPACITY to carry load until they are properly braced and/or sheathed. Placing loads on unbraced truss assemblies is a hazardous act that is prohibited. Failure to heed this warning could cause property damage, or worse, severe personal injury or death.

☑ Make sure that the truss assembly is properly braced according to the guidelines in BCSI-B1 and BCSI-B2.

CONSTRUCTION LOADING DOS AND DON’TS

🚫 **DON’T** stack materials on unbraced trusses.

☑ **DO** stack a reasonable amount of material that will not overload the trusses.

FIGURE B4-1

Maximum Stack Height for Material on Floor Trusses

Material	Height (h)
Gypsum Board	12"
Plywood or OSB	16"
Asphalt Shingles	2 bundles
Concrete Block	8"
Clay Tile	3-4 tiles high

TABLE B4-1

1. This table is based on trusses designed with a live load of 40 psf or greater.

2. Stack heights assume short term duration of load. Material stacks should not sit on trusses for more than seven days.

DON'T exceed stack heights listed in Table B4-1

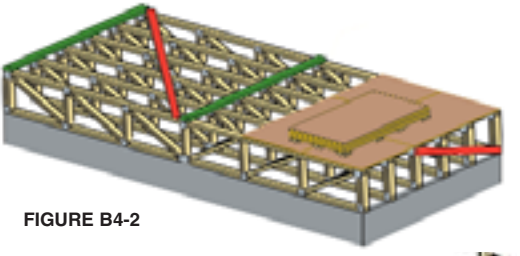


FIGURE B4-2

DON'T allow the stack to lean against walls, or stack materials so that they overload single or small groups of trusses.

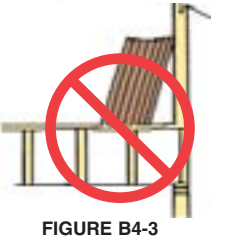


FIGURE B4-3

☑ **DO** stack materials along outside supports or directly over inside supports of properly braced structures.

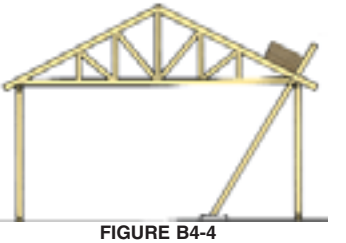
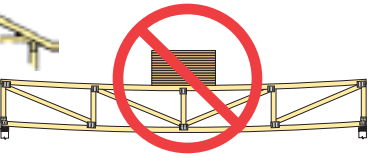


FIGURE B4-4

DON'T overstack materials midway between supports. Never exceed stack heights per Table B4-1.

FIGURE B4-5



☑ **DO** distribute loads over as many trusses as possible. Position sheets flat with the longest edge perpendicular to the trusses as shown.

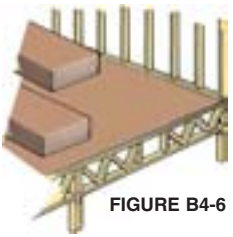
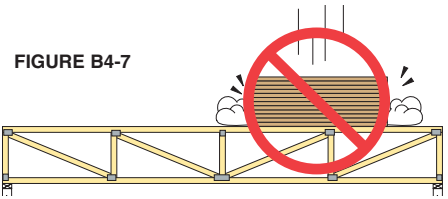


FIGURE B4-6

⊘ **DON'T** drop loads on trusses. The impact can damage the trusses even if the load is small.

FIGURE B4-7



☑ **DO** leave construction materials on lifting equipment until installation, if possible.

PHOTO B4-1

⊘ **DON'T** stack materials at locations that will produce instability, such as on cantilevers or near truss-to-girder connections.

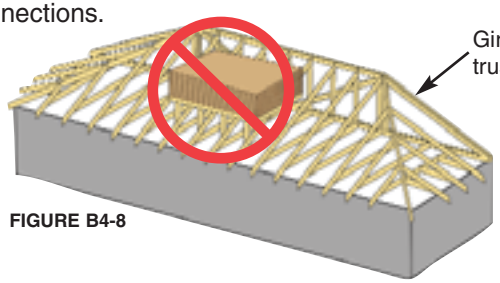


FIGURE B4-8

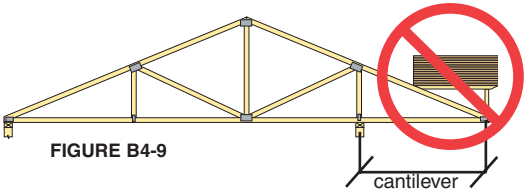


FIGURE B4-9

⚠ **WARNING!** Stacking excessive construction loads on floor or roof trusses is an unsafe act. Failure to follow these recommendations could lead to property damage, or worse, serious personal injury or death.

BCSI-B5

TRUSS DAMAGE, JOBSITE MODIFICATIONS AND INSTALLATION ERRORS

- ☑ Every truss is made up of lumber, connector plates and carefully executed engineering design and manufacturing.
- ☑ Damage, jobsite modifications or improper installation will reduce the strength of a truss. Seek professional assistance (the Truss Manufacturer or a Design Professional) to remedy the condition.
- ☑ Some Truss Manufacturers will mark the trusses with warnings against jobsite modifications. One supplemental marking example is the truss tag shown below:

FIGURE B5-1

PHOTO B5-2

Do not cut truss webs. This condition needs a repair.

- ☑ Care must be exercised at all times to avoid damage through handling during storage, delivery, unloading, and erection of trusses. The Contractor must ensure that handling and installation procedures do not reduce the load carrying capacity of the truss (ANSI/TPI 1-2002 Section 2.3.3).

FOLLOW THESE STEPS TO CORRECT DAMAGE, JOBSITE MODIFICATIONS OR INSTALLATION ERRORS:

☑ If a truss is damaged, altered or improperly installed:

1. Report damage, alterations or installation errors to the Truss Manufacturer immediately. Failure to report may void any warranties.
2. Do not attempt to repair the truss without a repair detail from the Truss Manufacturer or a Design Professional. The Truss Designers' expertise allows them to properly specify the size of the scab, plate or gusset, and the number, size, type and spacing of fasteners.
3. Follow the Repair Truss Design Drawing (RTDD) exactly. If anything is unclear, seek professional guidance.
4. Keep the RTDD; the Building Official, Building Designer or Owner may ask for this document.
5. If a RTDD is not for the exact field condition do not use it. Always follow the RTDD specifically prepared for each repair.
6. If the designed repair cannot be accomplished, call the Truss Manufacturer or a Design Professional.

COMMON REPAIR TECHNIQUES

☑ There are no "standard" repair details available that cover every situation. Trusses and the type of damage can vary greatly so each repair detail is generated on a case-by-case basis. Truss Designers most often specify:

- Plywood or oriented strand board (OSB) gussets over damaged plates or joints.
- Metal nail-on plates.
- Lumber scabs or repair frames over broken chords or webs.
- Truss plates applied by a portable press.

COMMON EXAMPLES OF DAMAGE, MODIFICATIONS OR INSTALLATION ERRORS

If you see one of the conditions detailed below (or anything unusual), follow these steps:

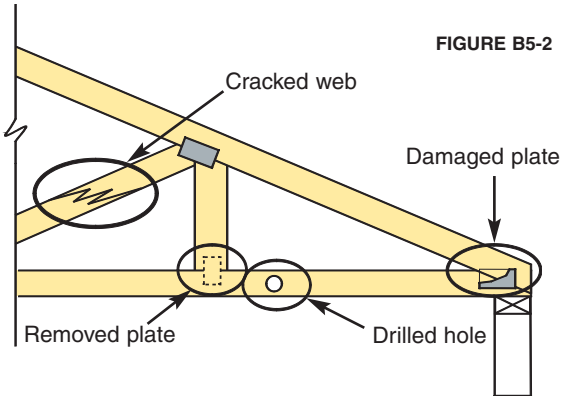


FIGURE B5-2

☑ Describe the damage directly on the original Truss Design Drawing included in the jobsite package.

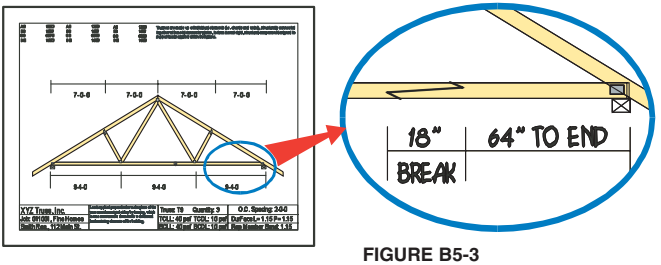


FIGURE B5-3

☑ A great help to starting the repair process is to draw a picture of the damage on the original TDD and fax, email or deliver it to the Truss Manufacturer. Be prepared to supply the Truss Manufacturer with the following information:

☑ Truss ID mark.

☑ Location of the truss on the Truss Placement Diagram.

☑ Is the truss installed or is it still in the stack?

☑ Is the **lumber damaged?** If so, provide:

- Location of damaged web or chord.
- Type of lumber damage (e.g. crack, break, cut or drilled hole).
- Dimension of the damaged area (e.g. 4" break or 2" drill hole). Note exact location of defect.
- Location of damage on the web or chord from a panel point or bearing location.

☑ Is the **plate damaged?** If so, provide:

- Location or number of the damaged plate or joint.
- Type of plate damage (e.g. loose, gaps, peeling, cut or drilled).
- Is there damage to one or both faces of the joint?

☑ Digital photographs of lumber or plate damage, job-site modifications or installation errors transmitted to the Truss Manufacturer and the Truss Designer could save significant time in trying to explain the site situation or circumstances.

☑ Example below of a properly repaired truss after it was shortened four inches.

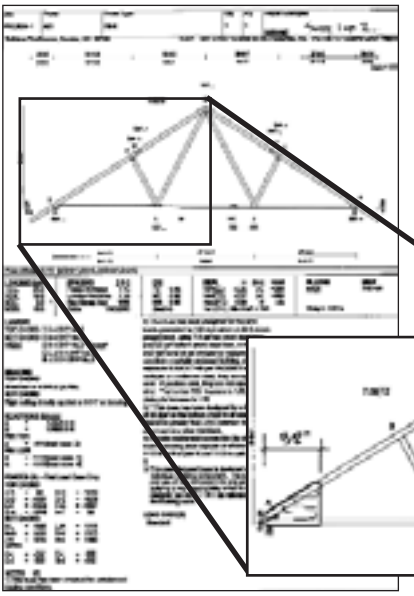


PHOTO B5-2

FIGURE B5-4

BCSI-B6
GABLE END FRAME BRACING

Most manufactured gable end frames contain only flat vertical “studs”, not triangles. Gable end frames are part of the Truss Designers’ responsibilities and will be included with the other Truss Design Drawings (TDD). Gable end frames are designed to transfer vertical loads from the roof down to the continuous bearing wall below. In service, gable end frames also experience loads perpendicular to their plane from wind or seismic events.

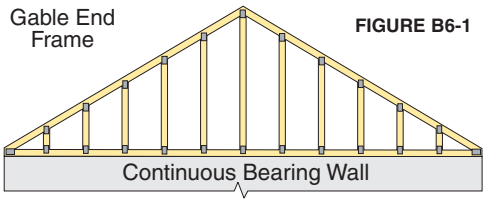


FIGURE B6-1

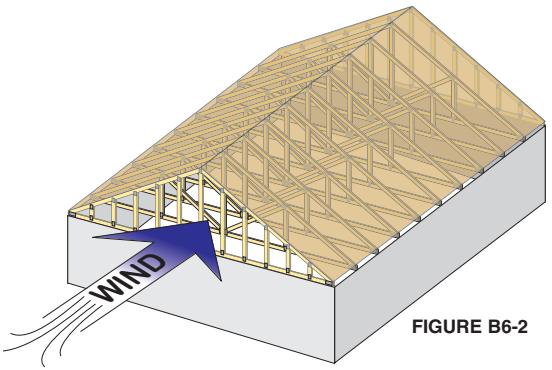


FIGURE B6-2

☑ The sheathed gable end frame is intended to transfer the wind/seismic loads to the roof and ceiling diaphragms. In order to do this, the gable end frame relies upon properly designed and installed sheathing, bracing, and connections to the bearing wall and roof and ceiling plane diaphragms.

☑ The Building Designer, Truss Designer and Erection/Installation Contractor all play a vital role in gable end frame bracing.

BUILDING DESIGNER RESPONSIBILITIES FOR GABLE END FRAME BRACING

☑ The Building Designer, knowing the intended flow of loads for the entire building, is responsible for taking the resultant loads from the gable end frame and transferring the loads to the footings. This may involve transferring the loads through additional bracing from the gable end frame to the roof and ceiling diaphragms (e.g. roof sheathing and gypsum ceiling).

☑ The gable end frame design requirements depend on a number of factors:

- The length, spacing, species and size of the flat gable studs
- Structural loads
- Wind force, which depends on:
  - Wind speed
  - Mean roof height
  - Building category
  - Exposure
  - Internal pressure
  - Topographic factors

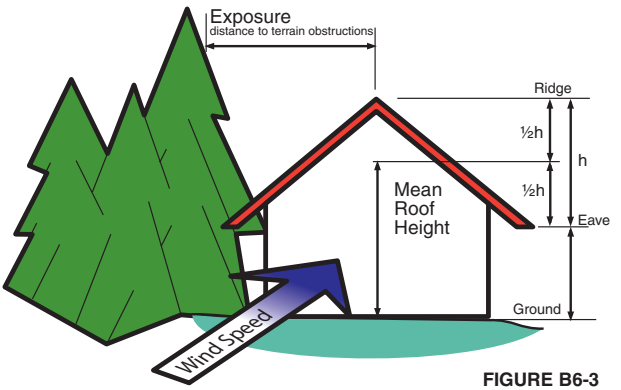


FIGURE B6-3

☑ The Building Designer, through the Building Structural System Design Documents (BSSDD), is responsible for all gable end frame bracing, including the bracing member size and locations, attachment to trusses, gable end sheathing, and fastener size and locations including any mechanical connectors required.

☑ Other factors the Building Designer must consider are:

- Thickness and type of roof, wall and ceiling sheathing
- Attachment of sheathing to the wall/gable end frame interface and attachment of wall to foundation to resist uplift, lateral wind, and diaphragm loads
- Transfer of load between wall and gable end frame bottom chord.

TRUSS DESIGNER RESPONSIBILITIES FOR GABLE END FRAME REINFORCEMENT

☑ The Truss Designer must note on the gable end frame TDD the type and location of permanent web member reinforcement requirements assumed in the design. This could be in the form of a single or double L, T, scab, horizontal L or any other means of reinforcement deemed appropriate to reduce the bowing/buckling of the "flat studs".

☑ The Truss Designer is responsible for indicating the loading and environmental design assumptions that were made in the design of the gable end frame as defined in the BSSDD.

☑ Many Truss Designers have simplified this design process by producing standard design tables and details based on the typical design assumptions used by Building Designers.

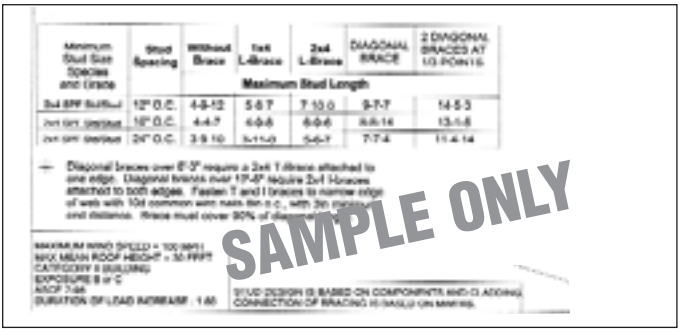


FIGURE B6-4

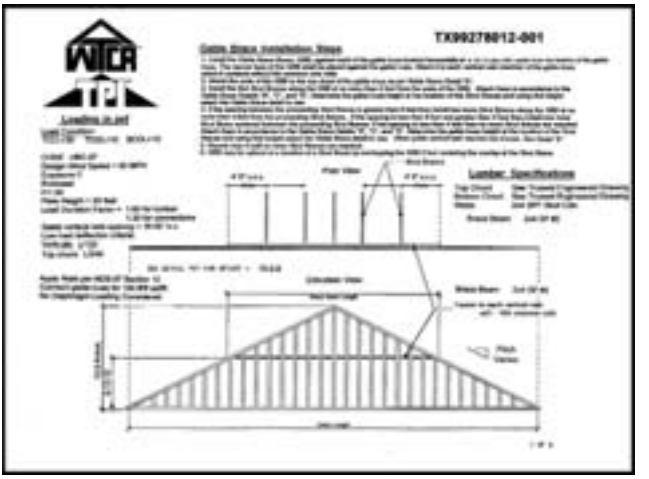


FIGURE B6-5

☑ These tables do some of the work of the Building Designer with respect to incorporating the gable end frame into the overall structural design, but they do not take the place of a full analysis by the Building Designer.

ERECTION/INSTALLATION CONTRACTOR RESPONSIBILITIES FOR GABLE END FRAME BRACING

☑ The Erection/Installation Contractor is responsible for properly installing the gable end frame as detailed in the BSSDD combined with the gable end frame TDD. The installation process includes installing the sheathing, bracing and all specified fasteners and connections.

GABLE END FRAME BRACING CONSIDERATIONS

☑ If the wind load is high enough, and the vertical studs are long enough, the frame may also require perpendicular reinforcement to prevent it from rotating at the gable end frame/wall interface and/or the verticals from buckling. Serviceability failures may occur if the gable end frame is not properly reinforced.

Load transfer through roof and ceiling diaphragms

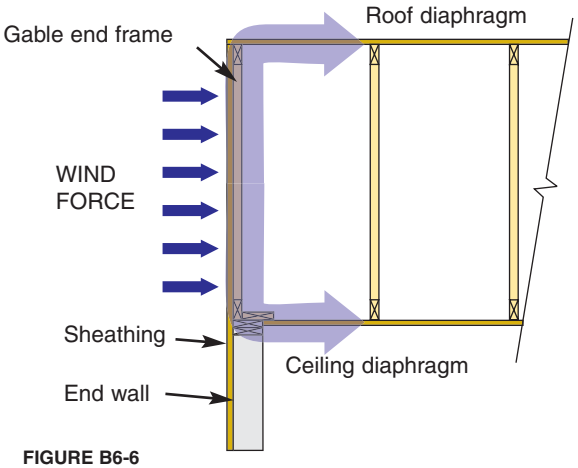


FIGURE B6-6

Potential Failure Types

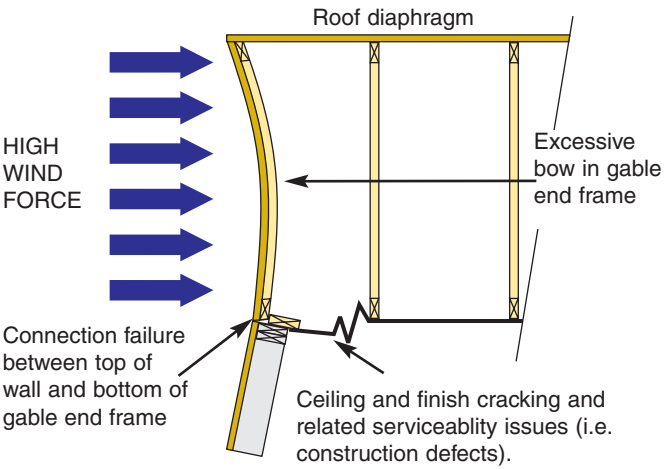


FIGURE B6-7

☑ Gable end frame reinforcement helps prevent these types of serviceability failures and safely transfers forces from the gable end frame into the associated diaphragms.

☑ Gable end frame reinforcement may include blocking at the ceiling and roof level diaphragms, gable stud reinforcement, lateral and diagonal bracing, mechanical connectors/straps and specific fastener size and frequency schedules.

GABLE END FRAME WEB BRACING/REINFORCEMENT

☑ Gable frame web reinforcement types

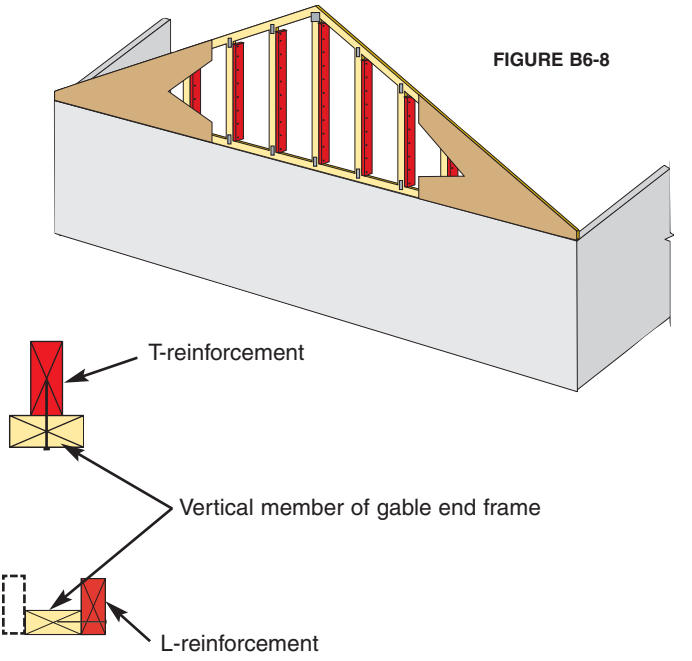


FIGURE B6-8

☑ Scab reinforcement on structural gable end frame

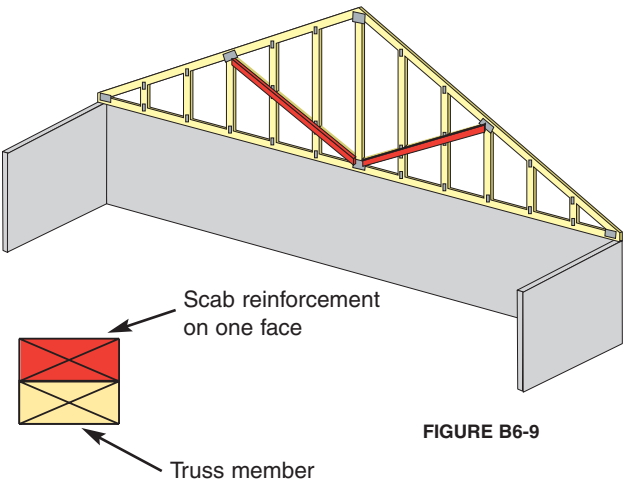
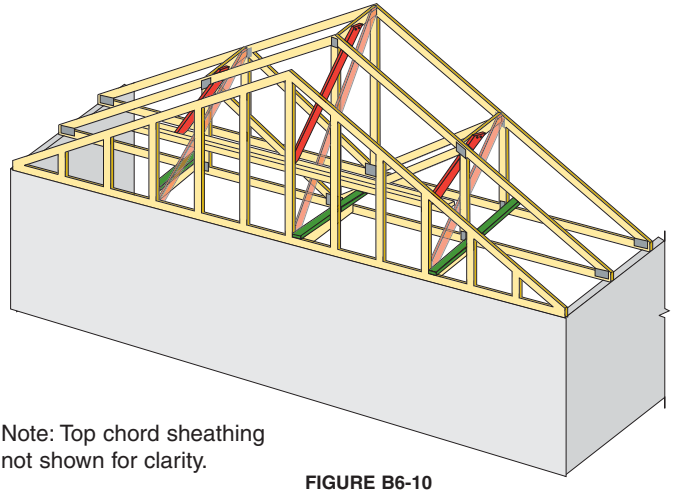


FIGURE B6-9

☑ Gable end frame bracing



Note: Top chord sheathing not shown for clarity.

FIGURE B6-10

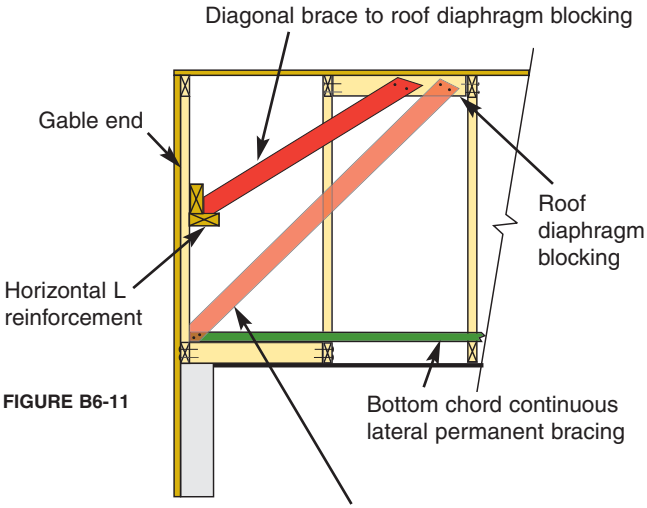


FIGURE B6-11

☑ Sample detail gable end bracing (as provided by the Building Designer)

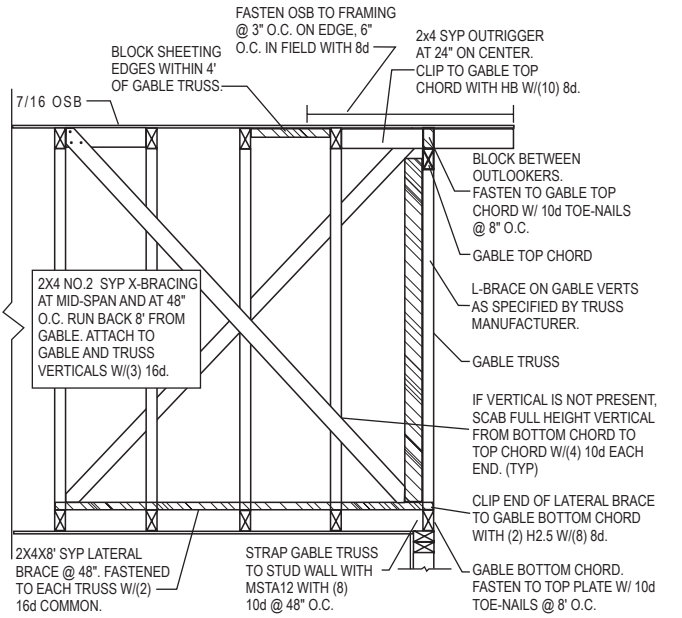


FIGURE B6-12

☑ Sample "Standard Gable End Detail" (as provided by Truss Designer)

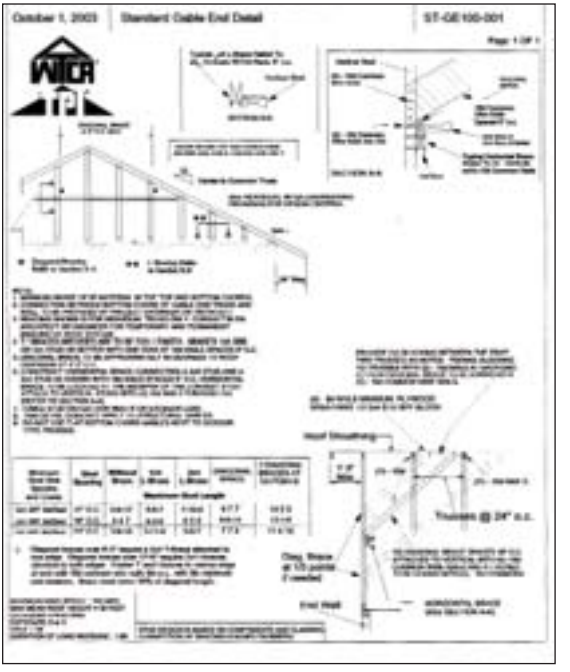
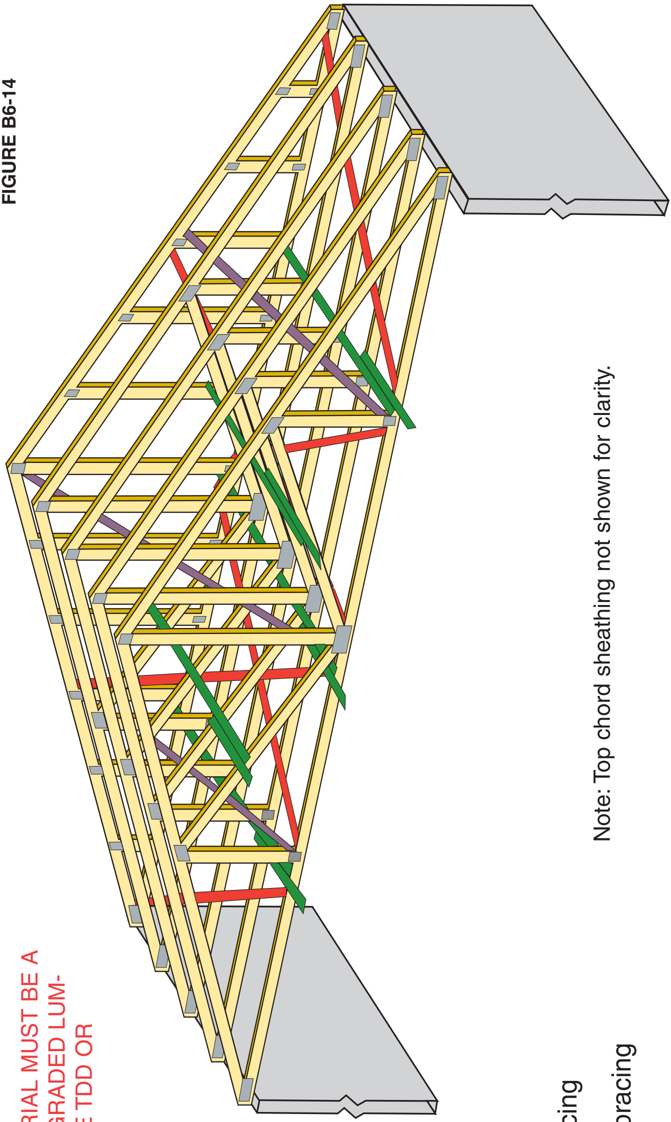


FIGURE B6-13

☑ Sample detail permanent bracing configurations

FIGURE B6-14



Note: Top chord sheathing not shown for clarity.

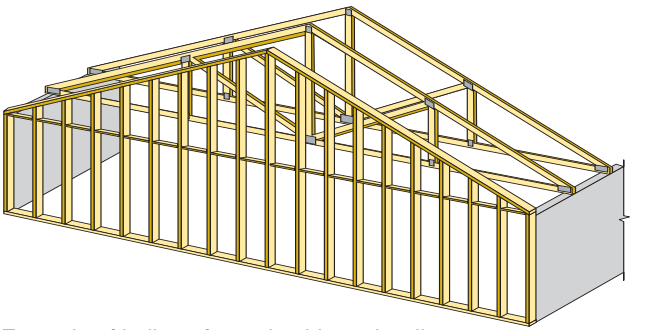
NOTE! ALL BRACING MATERIAL MUST BE A MINIMUM OF 2x4 STRESS-GRADED LUMBER (AS SPECIFIED BY THE TDD OR BUILDING DESIGNER).

LEGEND:

- Diagonal bracing
- Continuous lateral bracing
- Vertical web diagonal bracing

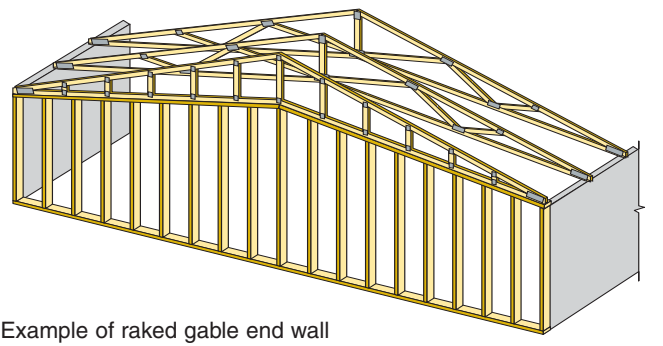
BALLOON FRAMED GABLE END WALLS AND SCISSOR TRUSS GABLE END FRAMES

☑ In some cases, the applied loads will exceed the capacity of the gable end frame, end wall studs, or ceiling diaphragm. The Building Designer may decide to design a balloon-framed end wall instead, which eliminates the need for a gable end frame. Scissor truss applications are a good example. The scissor truss gable end frame must match the profile of the scissor trusses adjacent to it for proper bottom chord plane bracing to be installed.



Example of balloon-framed gable end wall (with optional fire blocking at ceiling line)

FIGURE B6-15



Example of raked gable end wall (with scissor gable end frame)

FIGURE B6-16

☑ Important Note: Scissor truss applications must not be framed with flat bottom chord gable end frames as this creates a hinge in the wall/gable interface that is below the bottom chord plane diaphragm. Adequate bracing of this condition is difficult and sometimes impossible.

BCSI-B7

TEMPORARY AND PERMANENT BRACING FOR PARALLEL CHORD TRUSSES

The bracing recommendations discussed in this document will address parallel chord trusses (PCT) built with the major cross-sectional axis of the lumber oriented horizontally. (For bracing recommendations on PCT with the lumber oriented vertically, typically called “flat trusses”, see BCSI-B2, Truss Installation and Temporary Bracing.)

- ☑ PCT are used primarily in floor and flat roof applications.
- ☑ Both 3x2 and 4x2 lumber are widely used in PCT construction.

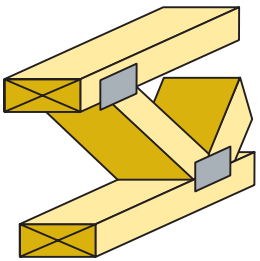


FIGURE B7-1

- ☑ The wider bearing surface (2.5" for 3x2 and 3.5" for 4x2), shallow depths (typically 24" or less) and relatively short spans (40' or less) make PCT easier to handle and much more stable during the erection/installation process.
- ☑ Top chord bearing PCT are more stable than bottom chord bearing trusses during the erection/installation process due to their center of gravity being below the bearing surface.

STANDARD FLOOR DETAILS

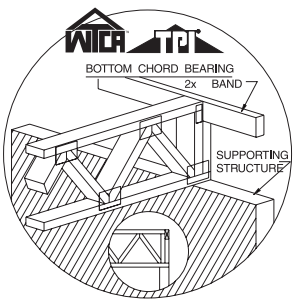


FIGURE B7-2

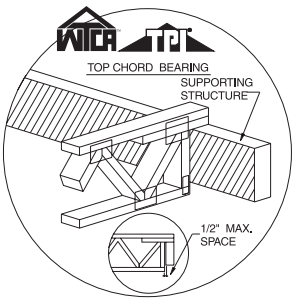


FIGURE B7-3

COMMON INSTALLATION ERRORS

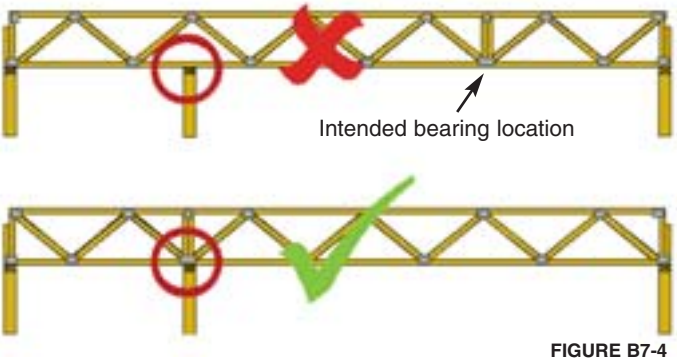


FIGURE B7-4

☑ It is critically important that bottom chord bearing PCT be installed right-side-up and right end-to-end. Many Truss Manufacturers will use supplemental tags (as shown below) to instruct and warn the Contractor to correctly position trusses during erection/installation.

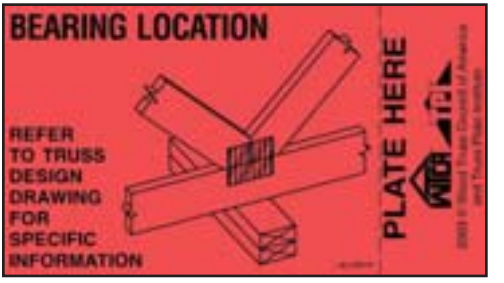


FIGURE B7-5

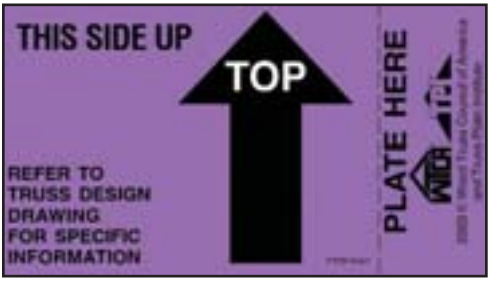


FIGURE B7-6

☑ Lateral and diagonal bracing of PCT are extremely important. Top chord temporary lateral bracing must not exceed 10' on-center for 3x2 chords, and must not exceed 15' on-center for 4x2 chords.

INSTALLATION BRACING REQUIREMENTS

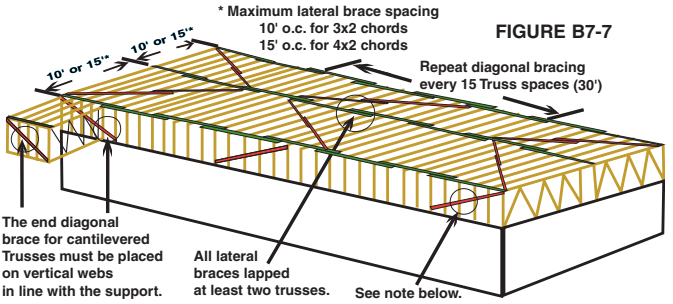
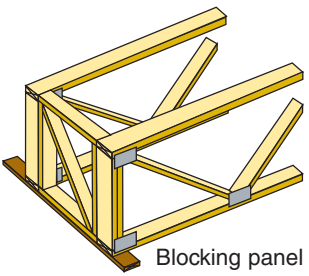
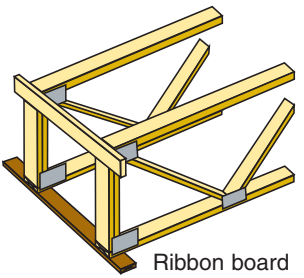


FIGURE B7-7

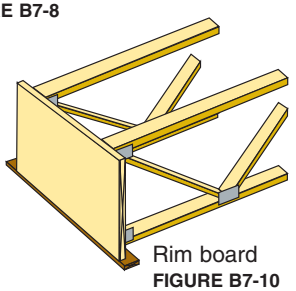
☑ Note: End diagonals, and/or rated panel sheathing, ribbon board, blocking panels, or rim board as specified by the Building Designer, are essential for stability and must be installed on both ends of the truss system and repeated every fifteen truss spaces (30' maximum). See detail Figures B7-8, 9 and 10 below.



Blocking panel
FIGURE B7-8



Ribbon board
FIGURE B7-9



Rim board
FIGURE B7-10

☑ CLB at truss ends can be eliminated with the use of the blocking panel, ribbon board or rim board details above.

☑ Bottom chord permanent lateral bracing must be installed at locations not exceeding 10' on-center or as directed by the Building Structural System Design Documents or Building Designer.

STRONGBACK BRIDGING REQUIREMENTS

☑ 2x_ dimension lumber strongback bridging must be installed at locations indicated on the Truss Design Drawing (TDD) and/or Truss Placement Diagram to enhance the performance of the truss by helping to limit deflection and/or vibration. This application is most common with floor trusses where strongback bridging is attached to vertical webs or scabs near the bottom chord of the truss at specified intervals. Section 7.5 of ANSI/TPI 1-2002 has specific provisions for using strongbacks to reduce deflection and vibration, including: minimum size (2x6), orientation, spacing and attachment to the truss.

☑ Strongbacks should be attached to walls at their outer ends or restrained by other means.

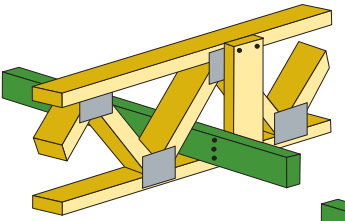


FIGURE B7-11

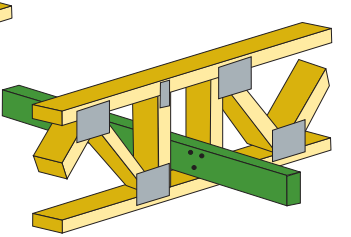


FIGURE B7-12

☑ In addition, many Truss Manufacturers will also include a supplemental tag, such as the one shown below, to further assist the Erection/Installation Contractor in correctly installing strongback bridging.

FIGURE B7-13

LATERAL AND DIAGONAL BRACING ARE VERY IMPORTANT!

FIGURE B7-14

DO NOT WALK ON UNBRACED TRUSSES

CONSTRUCTION LOADING

- ☑ Proper distribution of construction materials is a must during construction. See BCSI-B4 Construction Loading, for loading specifics.
- ☑ Always stack materials over two or more trusses.

NEVER OVERLOAD SMALL GROUPS OR SINGLE TRUSSES. DO NOT LEAN AGAINST WALL

- ☑ Position load over as many trusses as possible with longest edge perpendicular to trusses.

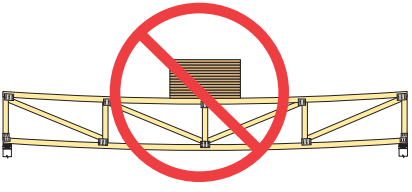


FIGURE B7-15

FIGURE B7-16

- ☑ Acceptable against outside load bearing wall and oriented perpendicular to truss span.
- ☑ Acceptable over load bearing wall laying flat only and oriented perpendicular to truss span.

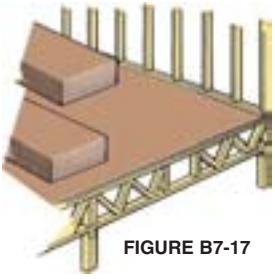


FIGURE B7-17

BCSI-B8
TOE-NAILING FOR UPLIFT REACTIONS

☑ Conditions like wind loads or cantilevers can produce uplift reactions at truss bearing supports. When this is the case, the truss-to-bearing connection is required to resist the uplift reaction.

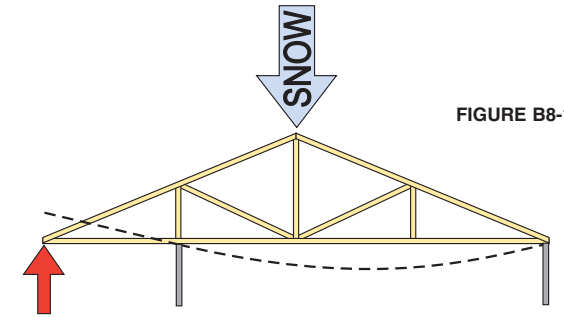


FIGURE B8-1

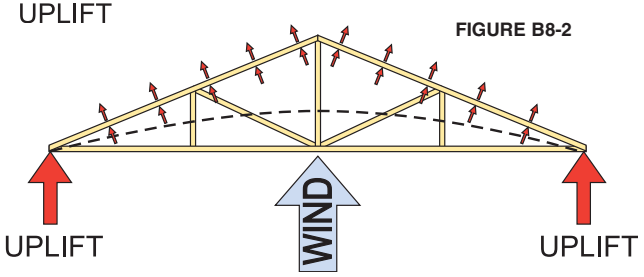
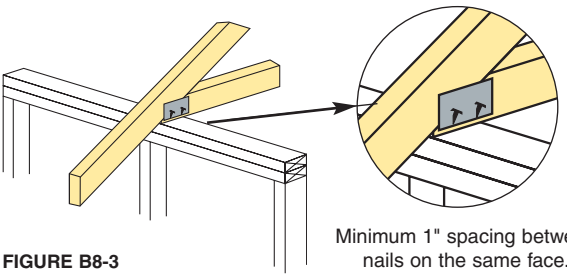


FIGURE B8-2

INSTALLATION GUIDELINES

☑ Wood trusses are commonly attached to the top plates of bearing walls using a toe-nailing detail like the one shown below. Is this toe-nailed connection sufficient? It depends; the uplift resistance of toe-nailed connections is governed by three factors:



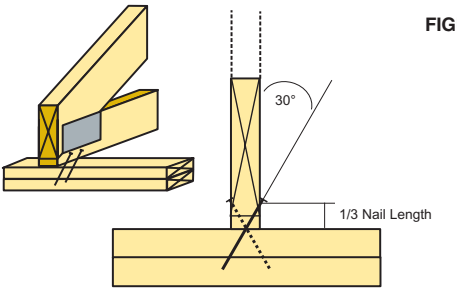
Minimum 1" spacing between nails on the same face.

FIGURE B8-3

☑ 1. Proper Installation

To get the most out of a toe-nailed connection, it is important to toe-nail correctly. The figure below illustrates proper toe-nailing. The dimensions shown are only meant to serve as a rough guide. Toe-nailing through truss plates does not affect the uplift capacity of the connection provided the truss plate is not damaged during installation.

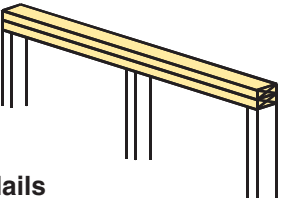
FIGURE B8-4



☑ 2. Grade and Species of Top Plate Lumber

The grade and species of the top plate also affect the amount of uplift resistance obtained from a toe-nailed connection. For example, a toe-nailed connection using a Southern Pine top plate will provide greater resistance than the same connection using a Spruce-Pine-Fir top plate.

FIGURE B8-5



☑ 3. Type of Nails

The type of nail used in a toe-nailed connection also influences its uplift capacity. When installing toe-nails, use care to avoid splitting of bottom chord lumber. The Building Designer should provide nail spacing and minimum end and edge distances. In lieu of such guidance, a rule-of-thumb is to limit the total number of toe-nails to three for a 2x4 top plate and five for a 2x6 top plate.

☑ 4. Non-Bearing Wall Considerations

Attachments to non-bearing interior walls must allow for a floating connection (see page 117). Do not shim.

IS TOE-NAILING ENOUGH OR IS A MECHANICAL FASTENER REQUIRED?

☑ Use Table B8-1 on page 84 to estimate the uplift capacity of a toe-nailed connection. For example, three 16d common nails toe-nailed into a Southern Pine top plate will provide 216 lbs. (3 x 72 lbs.) of nominal uplift resistance. For wind load cases, multiply the nominal uplift by the wind load duration factor as described in Footnote 1 and Table B8-2 (page 84). This factored uplift resistance for the toe-nailed connection must be equal to or greater than the uplift reaction listed on the Truss Design Drawing (TDD).

MECHANICAL UPLIFT CONNECTIONS

If the toe-nail uplift resistance is less than the uplift reaction on the TDD, it is necessary to use a mechanical uplift connection like those shown below. See hardware manufacturer's literature for uplift values and fastener schedule.

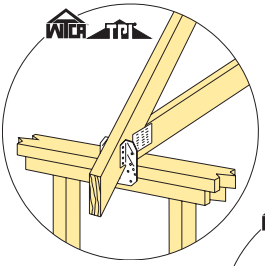


FIGURE B8-7

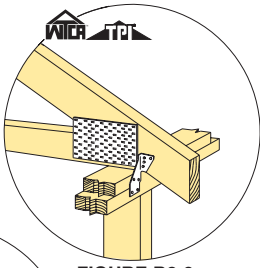


FIGURE B8-6

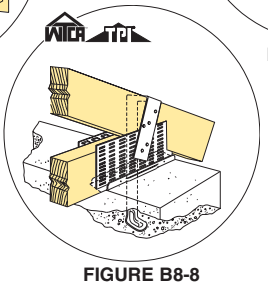


FIGURE B8-8

☑ Building codes can also specify minimum connections between the truss and the bearing surface. For instance, the 2003 International Residential Code, Section R802.10.5 states (in part):

"Truss to wall connection. Trusses shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 175 pounds (79.45kg) and shall be installed in accordance with the manufacturer's specifications."

NOMINAL UPLIFT DESIGN CAPACITY PER TOE-NAIL

Based on NDS-97 & NER-272

			Value for Top Plate Species				
	Inches		Pounds				
Nail Type	Diam.	Len.	SP	DF-L	HF	SPF	SPFs
16d Gun Nail	0.131	3.5	58	46	32	30	20
12d Gun Nail	0.120	3.25	50	39	27	25	17
10d Gun Nail	0.120	3.0	46	36	25	23	16
16d Common	0.162	3.5	72	57	39	37	25
16d Box	0.135	3.5	60	47	33	31	21
16d Sinker	0.148	3.25	56	44	30	29	19
12d Common	0.148	3.25	61	48	33	31	21
12d Box	0.128	3.25	53	42	29	27	18
12d Sinker	0.135	3.125	59	46	32	30	20
10d Common	0.148	3.0	57	45	31	29	20
10d Box	0.128	3.0	49	39	26	25	17
10d Sinker	0.120	2.875	44	35	24	22	15

TABLE B8-1

Footnotes:

1. Nominal design values shall be multiplied by all applicable adjustment factors to determine allowable design values per NDS®.
2. Uplift capacities for pneumatically driven nails are similar to box nails of the same length and diameter.
3. For nail capacities not shown here, consult a design professional.
4. Table values are based on the wood species of the top plate.
5. Wet use factors should be applied per NDS®.
6. Apply fire retardant treated lumber factors per manufacturer's specifications.
7. SP: Southern Pine DF-L: Doug Fir Larch HF: Hem-Fir SPF: Spruce-Pine-Fir SPFs: Spruce-Pine-Fir, South

LOAD DURATION FACTOR, C_D (FOR CONNECTIONS)

LOAD DURATION	C_D	TYPICAL DESIGN LOAD
Permanent	0.9	Dead Loads
10 Years (Normal)	1.0	Floor Live Loads
2 Months	1.15	Snow Loads
7 Days	1.25	Construction Loads
10 Minutes/Impact	1.33/1.6*	Wind/Earthquake

*Check with local code.

TABLE B8-2

BCSI-B9
MULTI-PLY GIRDERS

Girders are trusses specially designed to carry extra loads from framing and equipment. Girder trusses may be from one ply up to six plies. The Truss Designer will specify the number of members in a multi-ply girder. In the photo below the girder is made of similar trusses built and fastened together to act as one unit to support the load.

PHOTO B9-1

PLY-TO-PLY CONNECTION REQUIREMENTS

☑ Multi-ply girders can perform according to the design only if all plies are properly attached together.

⚠ **WARNING!** Girder truss plies must be completely and securely attached prior to attaching the supported trusses to the girder. Where it is possible to do so, multi-ply girder trusses should be connected together in accordance with the Truss Design Drawing (TDD) prior to erection/installation.

☑ Always check the TDD for the girder ply-to-ply connection requirements. They are listed in the fastener schedule and will specify the type, size and on center spacing of fasteners to use with that particular multi-ply girder.

☑ Check the TDD for the nailing schedule for each multi-ply girder.

For example, the nailing schedule for this three-ply girder is:

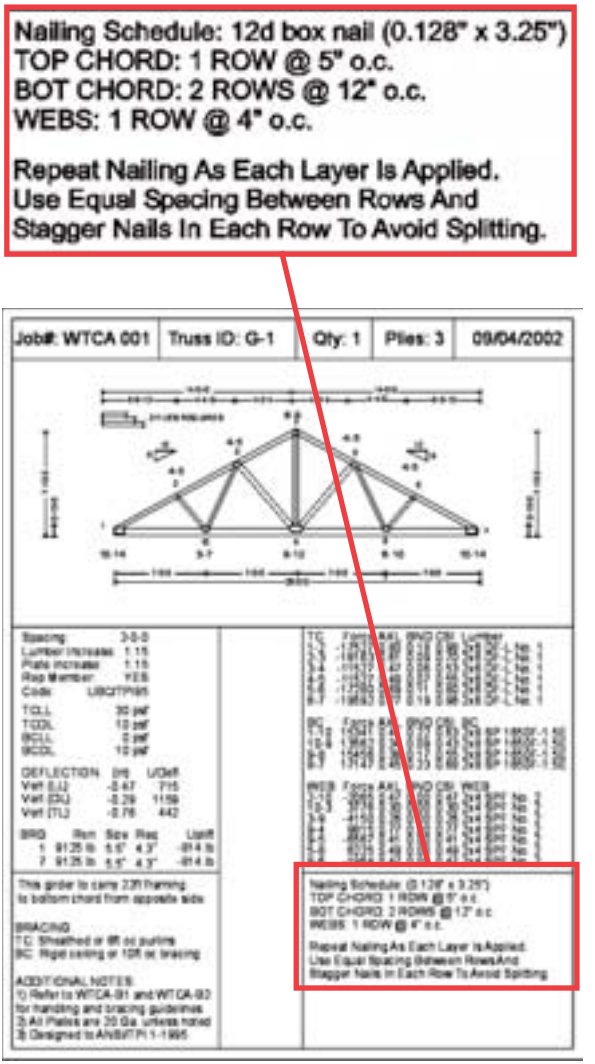


FIGURE B9-1

☑ Nail clusters may be required at concentrated load locations. Check TDD carefully for additional fastening requirements.

GOOD INSTALLATION PRACTICES

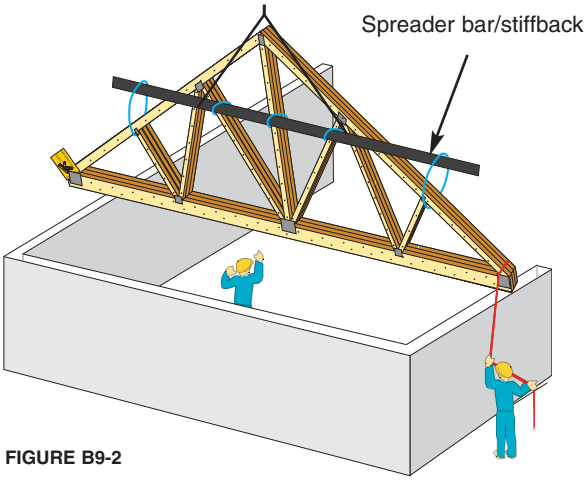


FIGURE B9-2

☑ Some Truss Manufacturers mark girder trusses with supplemental tags, calling attention to the number of plies and fastening schedule on the TDD. One marking example is the truss tag shown below.

FIGURE B9-3

☑ **If at all possible, fasten girder plies together per TDD before lifting into place.**

☑ Attach framing members or loads only after all girder plies are in place and properly fastened together, and the girder truss is properly braced to prevent lateral displacement. This avoids overloading the girder ply closest to the carried load.

☑ Truss-to-girder connection information will be on the TTD of the carried truss, girder truss or the Truss Placement Diagram.

FASTENER GUIDELINES

- ☑ Fasteners may be nails, bolts or other approved fasteners depending on the amount of load and number of girder plies.
- ☑ Follow AF&PA's National Design Specification® for Wood Construction (NDS®) for fastener end and edge distance requirements to prevent splitting of lumber.
- ☑ Ply-to-ply connection guidelines for girder trusses are included in ANSI/TPI 1, National Design Standard for Metal Plate Connected Wood Truss Construction.

NAIL FASTENERS

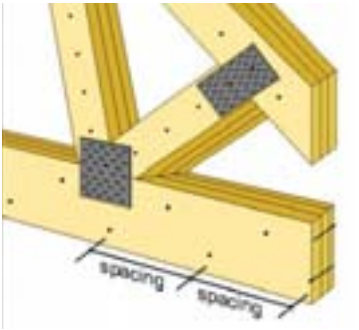
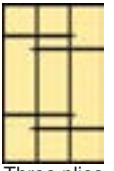


FIGURE B9-4

Two plies
FIGURE B9-5



Three plies
(Note: Nail heads must be visible for inspection)
FIGURE B9-6

Girder trusses up to three plies can be fastened together with nails. Nail each additional ply with the specified schedule.

SCREW FASTENERS

Install per screw manufacturer and Truss Designer requirements and specifications.

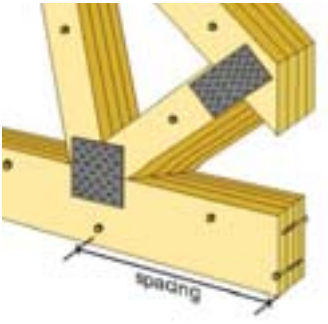


FIGURE B9-7

FIGURE B9-8

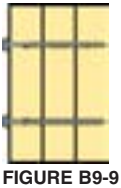


FIGURE B9-9

FIGURE B9-10

☑ Girders up to four plies can be connected with specially designed high strength screws. Install screws so heads are on the same side as the carried load in two or three ply applications. Pre-drilling may be required in structural composite lumber.

☑ Multi-ply parallel chord trusses must be joined together according to the Truss Designer's specifications on the TDD. Options include metal framing anchors, rated sheathing, metal gussets and proprietary high strength screws.

Two-ply floor trusses may also be attached with screws.

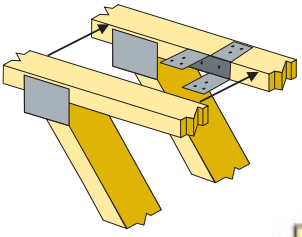


FIGURE B9-11

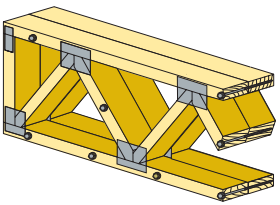


FIGURE B9-13

FIGURE B9-12

BOLT FASTENERS

☑ Bolt locations must not interfere with hardware or framing. Pre-drill all bolt holes. Do not oversize the hole! Use washers at bolt head and nut. Nails may also be required.

FIGURE B9-14

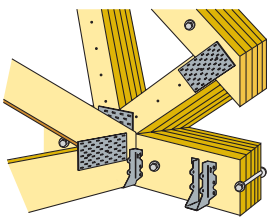


FIGURE B9-15

FIGURE B9-16

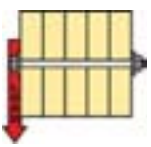


FIGURE B9-17

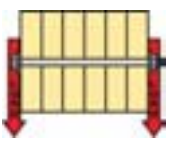


FIGURE B9-18

- Bolt girders with four or more plies.
- Maximum five plies for girders supporting loads on one side.
- Maximum six plies for girders supporting loads on both sides.

BCSI-B10

POST FRAME TRUSS INSTALLATION AND BRACING

Recommendations for Handling, Installing and Temporary Bracing of Metal Plate Connected Wood Trusses in Post-Frame Construction

PHOTO B10-1

⚠ **WARNING, CAUTION, DANGER;** these words designate an UNSAFE CONDITION OR OPERATING PROCEDURE where personal safety is involved. When you see this symbol ⚠ become alert and heed the message.

FAILURE TO FOLLOW INSTRUCTIONS OR HEED THE WARNING COULD RESULT IN PROPERTY DAMAGE OR WORSE — SERIOUS PERSONAL INJURY OR DEATH.

⚠ **See BCSI-B1 for information on truss unloading, jobsite handling, jobsite storage, hoisting and lifting. Heed all warnings and caution notes.**

TRUSS STORAGE

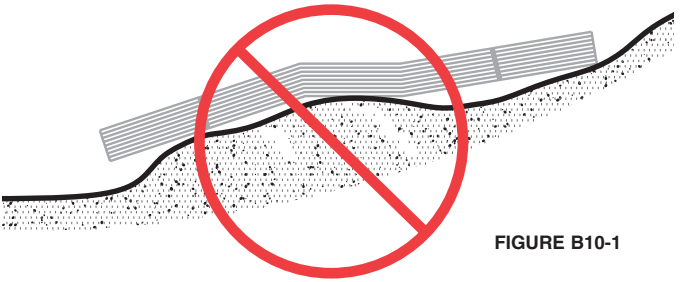


FIGURE B10-1

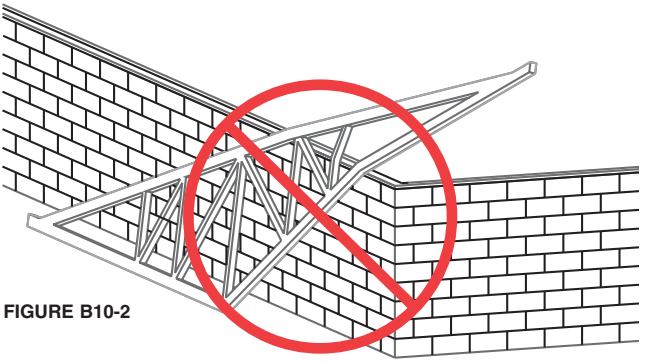


FIGURE B10-2

- Do not unload trusses on rough terrain or uneven surfaces which could cause damage to the truss.
- Walking on trusses which are lying flat is extremely dangerous and should be strictly prohibited.

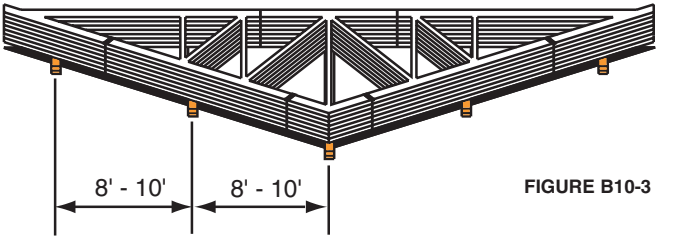
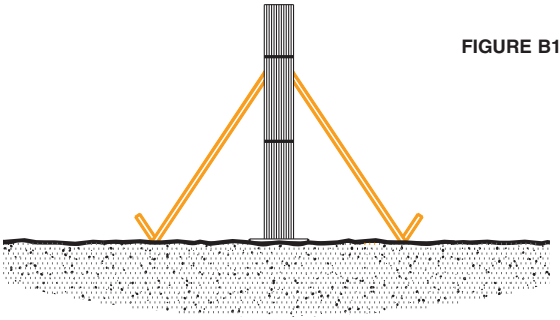


FIGURE B10-3

- ☑ Trusses stored horizontally should be blocked up off the ground to prevent excessive lateral bending and lessen moisture gain from the ground.
- Do not break banding on truss bundles until installation begins. Care should be exercised in banding removal to avoid shifting of individual trusses.
- ☑ Always wear gloves and safety glasses when cutting and/or handling banding.
- Do not lift bundled trusses by the banding.
- Do not use damaged Trusses without consulting with the Truss Manufacturer and/or Design Professional.

FIGURE B10-4



Do not store bundles upright (vertical) unless properly braced to prevent toppling.

Do not break banding until bundles are placed in a stable horizontal position.

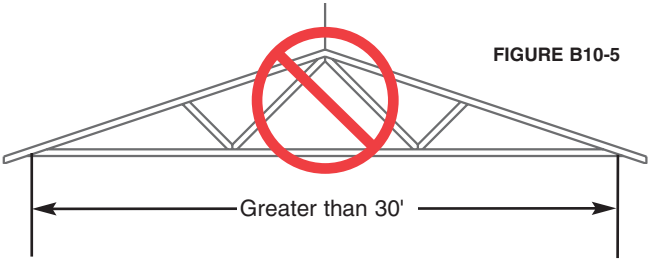
MECHANICAL INSTALLATION

WARNING! Buildings under construction are vulnerable to high winds, and present a safety hazard. It is the responsibility of the Erection/Installation Contractor to recognize adverse weather conditions and take prompt and appropriate action to protect life and property.

WARNING! Do not lift bundled trusses by the bands. Do not use damaged trusses. Do not attach cables, chains, or hooks to the web members.

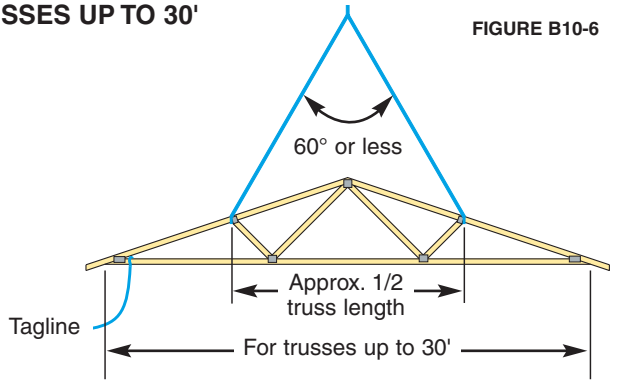
WARNING! Do not lift trusses with spans greater than 30' by the peak.

FIGURE B10-5



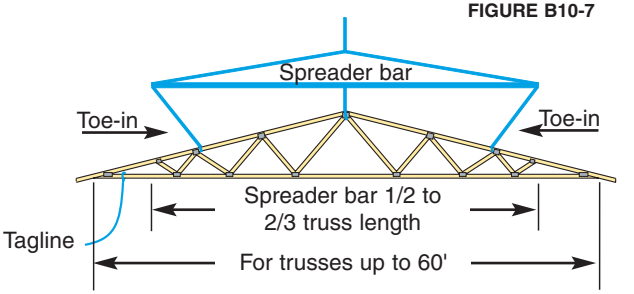
TRUSSES UP TO 30'

FIGURE B10-6



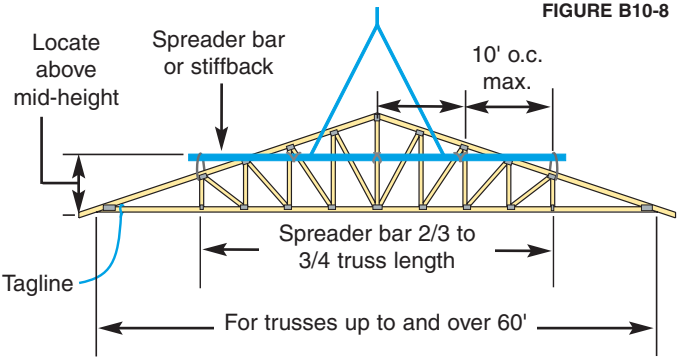
TRUSSES UP TO 60'

FIGURE B10-7



TRUSSES UP TO AND OVER 60'

FIGURE B10-8



DANGER! Lifting devices should be connected to the truss top chord with a closed-loop attachment utilizing materials such as slings, chains, cables, or nylon strapping of sufficient strength to carry the weight of the truss. Each truss should be set in proper position per the Building Designer's framing plan and held with the lifting device until the ends of the truss are securely fastened and all temporary bracing is installed.

⚠ IMPORTANT NOTES ON LIMITATIONS OF RECOMMENDATIONS

☑ The recommendations and guidelines presented for temporary bracing are limited to post-frame buildings using metal plate connected wood trusses with the following characteristics:

1. **Trusses are used in an engineered building system.**
2. Columns (laminated columns, posts) are embedded in the ground or attached to a foundation using the method specified by the Building Designer.
3. End-walls have columns which extend to the top chord of the gable end truss with adequate contact between the top chord and column for a structural connection.
4. End trusses are stabilized against rollover by connecting the top and bottom chords to the endwall columns or engineered bracing system.
5. Side-wall columns extend above the mid-height of the truss heel at the connection of the column and the truss.
6. Truss heels are connected to columns or headers (beams, girders) to resist rollover at the heel.
7. Trusses have flat bottom chords and are spaced 4' to 12' on-center.
8. Purlins are attached directly to the top chord.

TEMPORARY BRACING PRINCIPLES

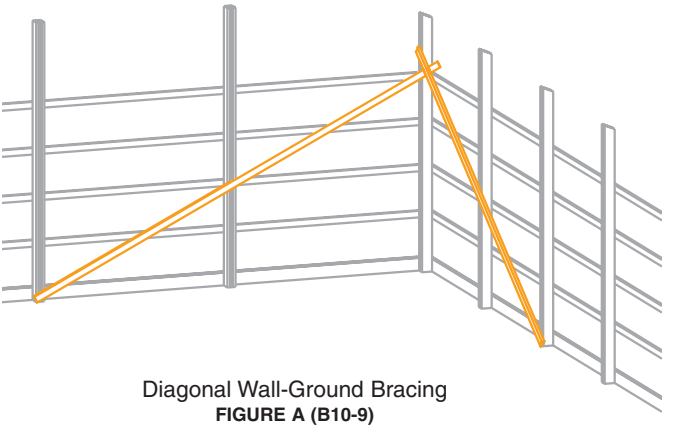
The following chronological steps should be taken to provide temporary bracing for truss installation.

⚠ **WARNING!** Until the building is completely erected in accordance with the plans of the Building Designer, the trusses are unstable, and may present a safety hazard. Truss instability may increase with building width, height and length.

1. **ENSURE STABLE SIDE-WALL AND END-WALL COLUMNS:**

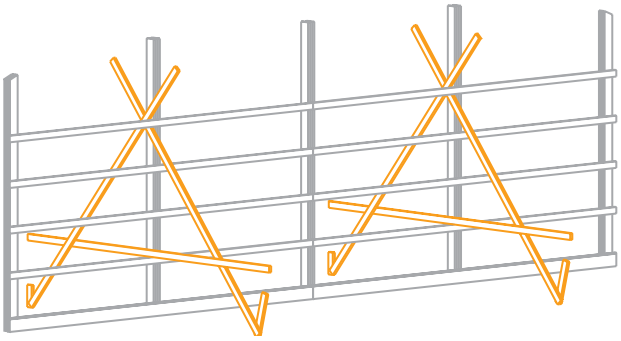
   1.1 Embedded columns shall be backfilled with concrete or compacted fill.

      a) Attach girts, splash board or temporary lateral bracing, and install a system of wood temporary diagonal ground bracing to provide support in the plane of the wall (Figure A, B10-9) and perpendicular to it (Figure B, B10-10).



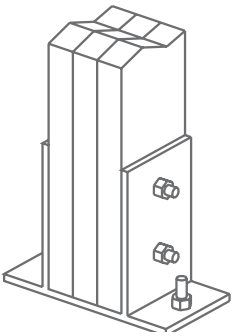
Diagonal Wall-Ground Bracing
FIGURE A (B10-9)

   1.2 Columns bearing on concrete: Columns bearing on a concrete foundation must be attached to prevent horizontal movement of column base as specified by the Building Designer (Figure C, B10-11).



A-Frame Ground Bracing
FIGURE B (B10-10)

a) Attach girts, splash board or temporary lateral bracing and install a system of wood temporary diagonal ground bracing to provide support in the plane of the wall (Figure A, B10-9) and perpendicular to it (Figure B, B10-10).

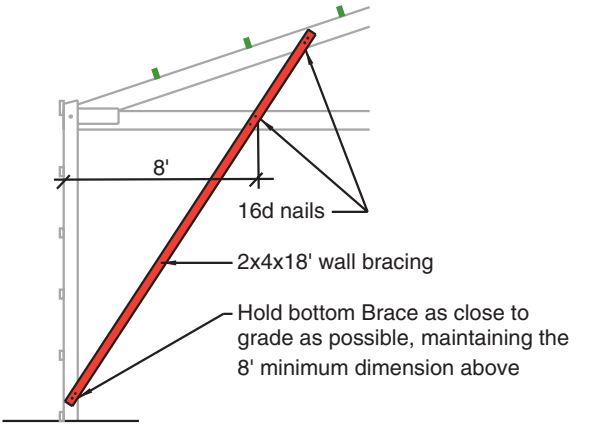


Column Connection
FIGURE C (B10-11)

2. **PROVIDE A STABLE BASE UNIT UPON WHICH TO BUILD:**

2.1 Install trusses on side wall columns or header system in sufficient quantities (usually 16' - 24' of sidewall) to establish a stable base unit. See Sections 3.1, 3.2, 3.3 for bracing requirements.

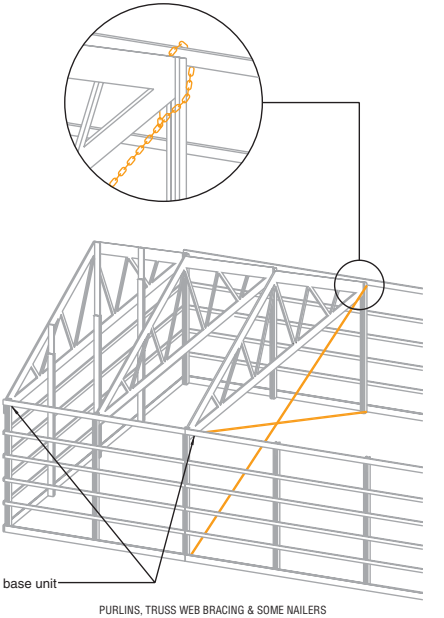
2.2 Use one or more of the following methods to resist movement of the base unit parallel to the endwall:



Column-Truss Bracing
FIGURE D (B10-12)

a) Diagonal wood braces (Figure D, B10-12) and/or

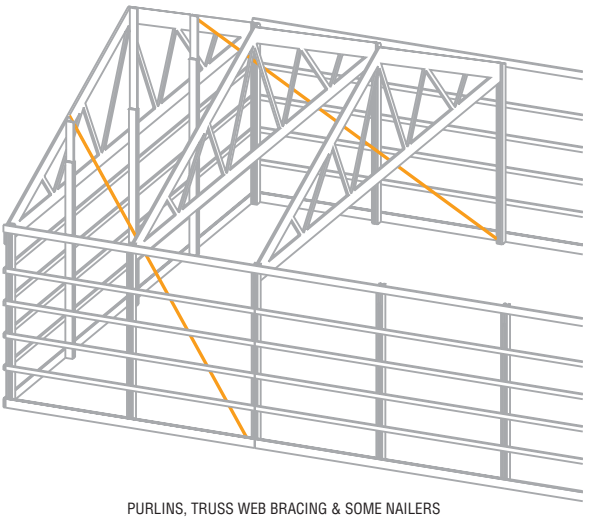
b) Chains or cables (Figure E, B10-13) together with turnbuckles, or come-alongs of sufficient strength (min. 2,000 lbs. capacity).



Column Chaining
FIGURE E (B10-13)

2.3 Use one or more of the following methods to resist movement of the base unit perpendicular to the endwall:

a) Temporary diagonal ground bracing (Figure F, B10-14) or



PURLINS, TRUSS WEB BRACING & SOME NAILERS OMITTED FOR CLARITY, SEE SECTION 3 FOR BRACING REQUIREMENTS!!

End Wall Chaining
FIGURE F (B10-14)

b) Chains or cables (Figure E, B10-13) together with turnbuckles, or come-alongs of sufficient strength (min. 2,000 lbs. capacity).

2.4 Stable base unit is now ready.

3. TEMPORARY TRUSS BRACING OF THE BASE UNIT

3.1 Provide a mechanical connection to resist truss rollover at the heel (Figure G, B10-15). This may include the use of nails, bolts, lag screws, metal straps, or connectors.

3.2 Brace truss top chords with temporary lateral braces as indicated in Table 1, B10-1 and shown in Figure G, B10-15 and H, B10-16.

IMPORTANT NOTE: Temporary bracing connections must be made with a minimum of 2-16d (0.135x3.5") nails or equivalent to a lateral holding design capacity of 200 lbs. or permanent connection as specified by the Building Designer.

TEMPORARY TOP CHORD LATERAL BRACING SCHEDULE

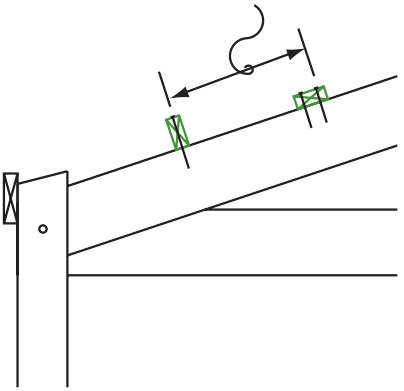
Maximum truss spans for chord size, grade and brace spaces shown.

Top Chord Size	Top Chord Grades								
	No 1 Southern Pine			MSR 1950f 1.5E			MSR 2400f 1.8E		
	Max. Brace Spaces			Max. Brace Spaces			Max. Brace Spaces		
	10'	8'	6'	10'	8'	6'	10'	8'	6'
2x6	n/a	n/a	62'	n/a	25'	81'	n/a	42'	81'
2x8	n/a	27'	81'	n/a	43'	81'	22'	61'	81'
2x10	n/a	40'	81'	24'	57'	81'	35'	78'	81'
2x12	21'	53'	81'	34'	74'	81'	48'	81'	81'

TABLE 1, (B10-1)

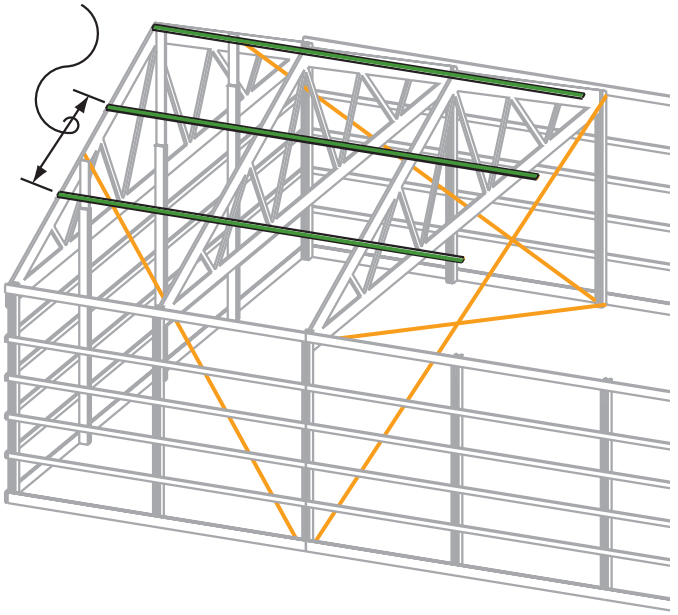
IMPORTANT NOTE: Table 1, B10-1 was developed solely for symmetrical triangular metal plate connected wood trusses with pitched top chords of 3:12 or greater and flat bottom chord. Other truss types are expressly excluded from the scope of Table 1, B10-1. Spans listed in Table 1, B10-1 are the maximum truss spans that can be safely braced for the top chord size and lumber species/grade (or better) in the corresponding column heading, using the maximum temporary top chord lateral brace spacing. For truss configurations, spans and/or top chord grades not covered by Table 1, B10-1, consult a registered Professional Engineer.

10', 8' or 6' spacing per Table 1, B10-1



Mechanical Connection at Heel
and Top Chord Bracing
FIGURE G (B10-15)

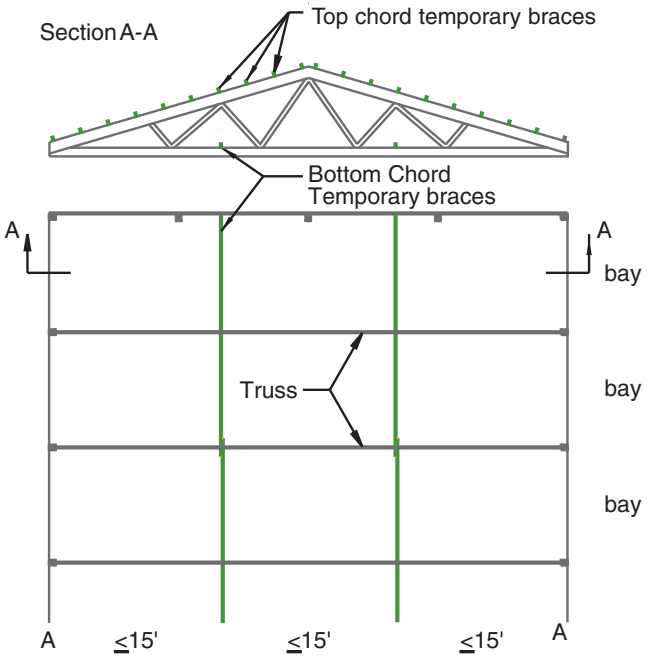
10', 8' or 6' spacing per Table 1, B10-1



PURLINS, TRUSS WEB BRACING & SOME NAILERS
OMITTED FOR CLARITY, SEE SECTION 3 FOR
BRACING REQUIREMENTS!!

Top Chord Bracing
FIGURE H (B10-16)

3.3. Brace truss bottom chord with bottom chord lateral bracing a maximum of 15' on-center (Figure I, B10-17)



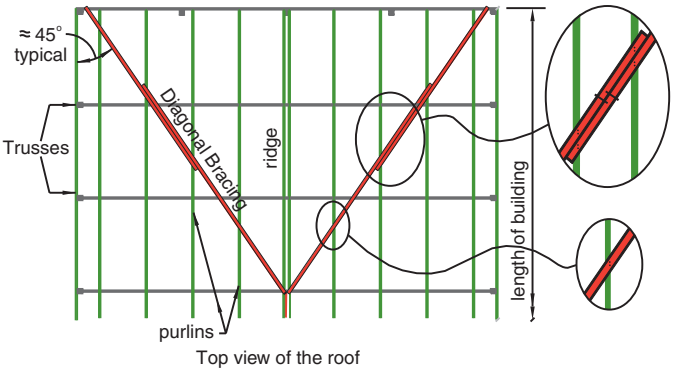
Bottom Chord Bracing
FIGURE I (B10-17)

3.4 Install diagonal bracing in the plane of the roof using one of the following:

a) Diagonal bracing with 2x4 lumber, minimum grade of S-P-F #2 (Figure J, B10-18), or

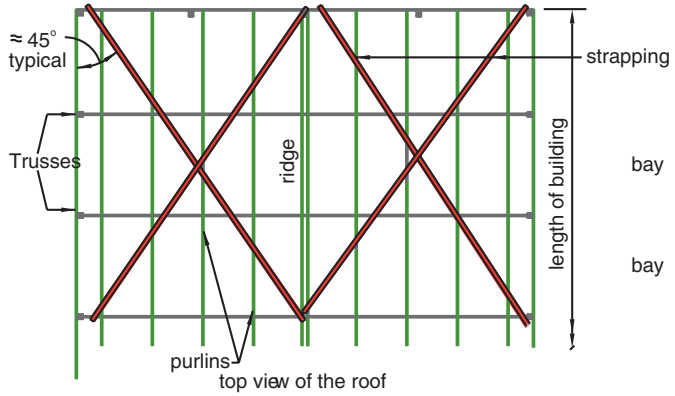
b) Metal strap cross bracing (Figure K, B10-19), or

c) The permanent roof decking material (plywood, OSB, corrugated steel, corrugated aluminum) or permanent roof bracing in accordance with product manufacturer's instructions or building plans and specifications.



Note: Diagonal braces run to the fourth truss on 48' & wider buildings. Braces lap two purlins if diagonal brace is spliced. Use 2-16d (0.135x3.5") nails at each diagonal brace to purlin connection.

Diagonal Wood Bracing
FIGURE J B10-18



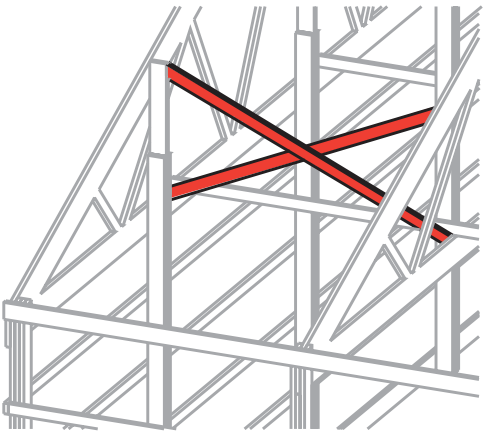
Note: Metal strap cross bracing is typically used when purlins are mounted flush between trusses.

Metal Strap Cross Bracing
FIGURE K B10-19

3.5 Brace trusses vertically to prevent "rollover", i.e. rotation using one or more of the following:

a) Truss-to-truss cross bracing at 20' on center maximum spacing (Figure L, B10-20) unless 3.4 (c) is adopted and applied to all trusses that have been set,

b) Chains or cables (Figure E, B10-13) together with turnbuckles, or come-alongs of sufficient strength (min. 2,000 lbs. capacity).



Cross Bracing
FIGURE L (B10-20)

4. ERECT THE ADDITIONAL ROOF TRUSSES

4.1 Install top chord temporary bracing at the spacings indicated in Table 1, B10-1.

4.2 Install bottom chord temporary bracing as indicated in Figure I, B10-17.

4.3 Provide additional diagonal temporary bracing in the plane of the top chord approximately equal to the bracing described in 3.4 at intervals not to exceed 100' or 12 truss spaces, whichever is less.

WARNINGS AND RESPONSIBILITIES

It is the responsibility of the Erection/Installation Contractor to properly receive, unload, store, handle, install, and brace metal plate connected wood trusses to protect life and property. The Erection/Installation Contractor must exercise the same high degree of safety awareness as with any other structural material. It is the responsibility of the Erection/Installation Contractor to determine if the installation crew has the needed equipment and training to safely erect the proposed roof construction, and to determine that the trusses to be installed are undamaged.

Temporary bracing schedules in Table 1, B10-1 were developed for an assumed load of the truss weight, plus two workers and their equipment at a given time assumed to weigh 250 lbs. each. Bracing schedules do not provide for wind loads or for accidental overload, materials stacked on trusses during erection, or loads due to misuse or negligence.

These recommendations are based upon the collective experience of leading technical personnel in the wood truss and post frame industry, but must, due to the nature of responsibilities involved, be presented only as a guide for use by a qualified Building Designer or Erection/Installation Contractor. It is not intended that these recommendations be interpreted as superior to the project Architect's or Engineer's design specification for handling, installing and bracing wood trusses and it does not preclude the use of other equivalent methods for bracing and providing stability for the walls and columns as may be determined by the Contractor. Thus, WTCA and TPI expressly disclaim any responsibility for damages arising from the use, application, or reliance on the recommendations and information contained herein.

BCSI-B11
FALL PROTECTION AND WOOD TRUSSES

☑ The current regulation governing fall protection is the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Standard 29 CFR Subpart M.

☑ Important information pertaining to the erection/installation of trusses in residential construction is contained in this OSHA Standard. Erection/installation of trusses is considered “leading edge” work that often can use a “Fall Protection Plan” [see 1926.502(k)] in place of more conventional fall protection equipment. The Fall Protection Plan must conform to section [1926.502(k)(1-10)].

☑ Choosing fall protection equipment, or a plan, that effectively protects workers from jobsite hazards while remaining in compliance with current government regulations can be an intimidating task. To provide optimum protection, any fall protection system should be designed by a licensed Professional Engineer experienced in the elimination/control of fall hazards. The government standard most commonly associated with fall protection guidelines is the OSHA 1926.501(b)(1) Construction Standard. It states in part:

“Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems”.

For sample Fall Protection Plans for residential construction refer to Section 1926 Subpart M of the Construction Resource Manual online at: http://www.osha.gov/Publications/Const_Res_Man/index.html.

FALL PROTECTION DOS AND DON'TS

⚠ **WARNING!** Trusses alone are **NOT** designed to **SUPPORT** fall protection anchors.

☑ Fall protection and safety measures are jobsite and building specific. The appropriate fall protection method for a given job must be determined by a person who is qualified to design, install, and use fall protection systems and authorized to have any problems corrected.

WARNING!

Use of a single truss as anchorage point for any type of personal fall arrest system

IS DANGEROUS

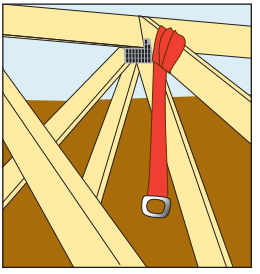


FIGURE B11-1

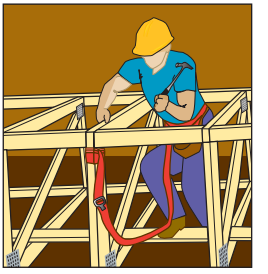


FIGURE B11-2

PHOTO B11-1

⚠ Attaching to a single truss will increase risk of serious injury or death to workers.

PHOTO B11-2

☑ Trusses are designed to support loads like this:

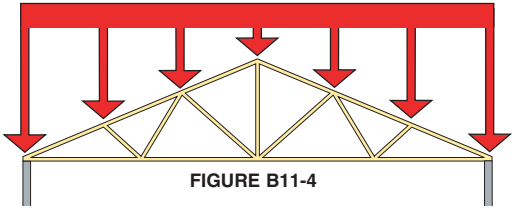


FIGURE B11-4

🚫 NOT lateral impact loads

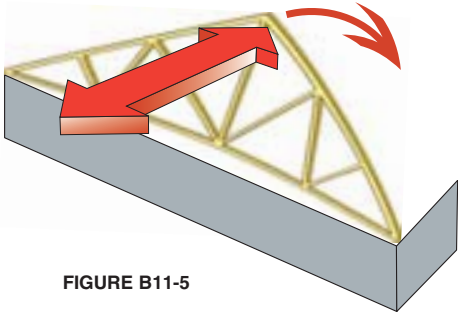


FIGURE B11-5

⚠ A falling worker attached to a single truss could cause all the trusses on the structure to collapse in a domino effect.

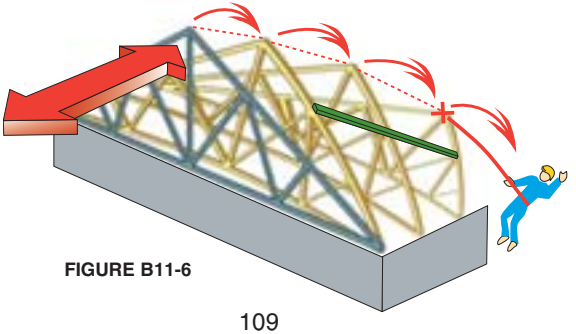


FIGURE B11-6

SAFE INSTALLATION OPTIONS

Here are a few suggestions...

☑ Option 1: Scaffolding

Use a scaffolding system with personal fall arrest system, following OSHA's guidelines.

PHOTO B11-3

PHOTO B11-4

☑ Option 2: Use a Roof Peak Anchor

Sheath and brace a portion of the roof (Per BCSI-B1 and B2) and use a roof anchor and personal fall arrest system, following OSHA's guidelines (CFR29 - 1926.500 - 503).

FIGURE B11-7

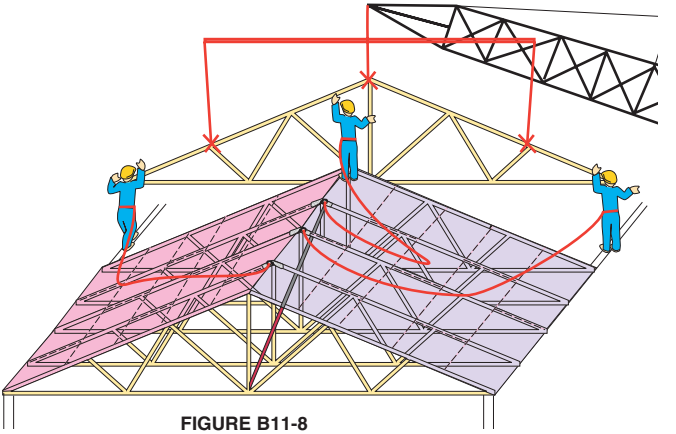


FIGURE B11-8

☑ **Option 3: Ground Assembly**

- Pre-assemble the roof truss system on the ground.
- Sheath and brace for stability.
- Lift and set in place. This pre-assembled section can then be used as a tie-off point as necessary.

PHOTO B11-5

PHOTO B11-6

⚠ WARNING SUMMARY:

⚠ A single truss is NOT designed to withstand loads from a falling person.

⚠ A single truss, if used as an anchorage point, can pull all the trusses on top of the falling person.

⚠ Depending on how the entire building is braced, incorrect fall protection attachments could cause an entire building collapse.

⚠ In all cases, the person faces the increased risk of causing a serious truss collapse, WHICH COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

🚫 **NOT LIKE THIS!**

PHOTO B11-7

☑ If you are uncertain, contact OSHA or a Design Professional for assistance.

Below is a glossary of terms that are intended to assist the reader. All capitalized terms contained within BCSI-03 shall have the meaning set forth in this Glossary of Terms.

⚠ **HAZARD! WARNING! CAUTION! DANGER! ALERT! SAFETY!** The use of this symbol and any of these words is intended to indicate to the reader that an unsafe condition or action will greatly increase the probability of an accident occurring which could easily result in serious personal injury or death.

Anchorage: Connection between the roof or floor framing members (e.g., trusses, bracing, etc.) and the building structure, which is required to transfer the forces from these members into the building.

ANSI/TPI 1-2002: National Design Standard for Metal Plate Connected Wood Truss Construction (revision of ANSI/TPI 1-1995), which covers design responsibilities, quality criteria for trusses, metal connector plate manufacturing, performance evaluation of metal connector plated connections, materials and general design considerations, member design procedures, and metal connector plate joint design.

Architect: Any Registered Design Professional practicing architecture who designs all or a part of the Building Structural System and/or who produces all or part of the Construction Documents and which may include all or part of the Building Structural System Design Documents.

B-Series Summary Sheets: A comprehensive set of building safety and bracing documents created by the Wood Truss Council of America (WTCA) and the Truss Plate Institute (TPI) to educate metal plate connected wood truss (MPCWT) users of the inherent dangers associated with the handling, installing and bracing of these products, and to train on how to install MPCWTs safely.

Bottom Chord: The horizontal or pitched member that defines the lower edge of a truss, usually carrying combined tension and bending stresses.

Bottom Chord Bearing: Bearing condition of a truss that is supported on its bottom chord (see example Figure B7-2).

Bottom Chord Plane: The two-dimensional area formed by the top or bottom edge of adjacent similar bottom

chords allowing for the connection of a diaphragm, or bracing members in a linear fashion.

Bracing: Providing stability against unintended movement or motion.

Bridging and Blocking: Cross bracing or a solid member placed between structural members to provide lateral support.

Building: Any structure used or intended for supporting or sheltering any use or occupancy.

Building Component Safety Information (BCSI): The jointly produced WTCA/TPI "Guide to Good Practice for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses." BCSI fulfills the policies of the two associations to promote handling, installing and bracing guidelines for metal plate connected wood trusses (MPCWT) that are simple, safe, proven methods consistent with good framing construction practices in the field.

Building Designer: The Owner of the building or the individual or organization (including either an Architect or Engineer or Contractor) who contracts with the Owner for the design of the Building Structural System and/or who produces the Building Structural System Design Documents.

Building Official: The officer or other designated authority charged with the administration and enforcement of the applicable building code, or a duly authorized representative, who in accordance with the Legal Requirements may impose requirements on Truss Manufacturers and Truss Designers relating to the trusses and the Truss Submittal.

Building Structural System: The completed combination of Structural Elements, trusses, connections and systems, which serve to support the building's self weight, the applicable live load(s), and environmental loads.

Building Structural System Design Documents: Written, graphic and pictorial architectural or structural documents, specifications and addenda prepared or assembled for the overall structural design of the Building Structural System, which are part of the Construction Documents.

Ceiling Diaphragm: The horizontal or sloped structural system defined by the ceiling plane acting to transmit lateral forces to the vertical resisting elements.

Clinched Nail: A nail selected to be longer than the member it is driven through and which is bent back the dimension of its excess length.

Connectors and Connections: Fasteners that join two or more members together, including: nails, metal plates or truss plates, truss and joist hangers, screws, and bolts.

Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project, which are necessary for obtaining a building permit.

Construction Loading: The loads from workers and building materials on an unfinished structure, for example, when builders stack bundles of panel sheathing or gypsum board on trusses for temporary storage.

Continuous Lateral Bracing (CLB): Members installed at right angles to a chord or web member of a truss to provide stability to the truss. They must be properly restrained to prevent the simultaneous buckling of the truss members due to laterally imposed loads and the accumulation of buckling forces. See Lateral Bracing.

Contract: A legally recognized document between two or more parties, which includes the agreement between the Truss Manufacturer and its customer which sets forth the terms and conditions (and scope of responsibilities) applicable to the Truss Manufacturer.

Contractor: The Owner of the building or the individual or organization who contracts with the Owner and is responsible for the construction of the Building Structural System in accordance with all legal requirements. The term Contractor shall include those subcontractors who have a direct contract with the Contractor to perform all or a portion of the storage, handling, installation, and bracing (temporary and permanent) of the trusses.

Conventional Framing: Framing with conventional joists, rafters and wall studs.

Conventional Light-Frame Wood Construction: A type of construction whose primary structural elements are formed by a system of repetitive wood-framing members. This includes wood truss construction.

Cross Bracing: Bracing installed in the web member plane of trusses to transfer lateral loads out of the truss system and up into the roof and down into the ceiling diaphragms. See Diagonal Bracing.

Cross Bridging: Wood or metal members that are placed between trusses or joists in an angled position intended to spread the load and stabilize the members.

Deformed Shank Nails: Ring, barb or screw shaped configuration of a nail shank.

Diagonal Bracing: Members installed at an angle to a chord or web member of a truss to create rigid units to prevent trusses from leaning or dominoing. Used in conjunction with lateral bracing to transfer brace forces into the supporting structure. Diagonal braces are installed in the same plane as lateral bracing but at an angle of approximately 45° to the lateral brace.

DSB-89: Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses. A publication of the TPI developed for use by architects and engineers to provide guidance for designing structural bracing.

Duration of Load: Total length of time during which a load acts on a member. In wood, a design consideration for modifying allowable stresses, based on the accumulated loadings anticipated in the life of a structure.

Engineer: Any Registered Design Professional practicing engineering who designs all or a part of the Building Structural System and/or who produces all or a part of the Building Structural System Design Documents.

Engineered Building System: See Building Structural System.

Erection/Installation Bracing: See Temporary Erection Bracing.

Erection/Installation Contractor: See Contractor.

Exterior Ground Brace: See Ground Bracing and Figures B2-3 and B2-4.

Fall Protection System: Any means used to protect a worker from a fall or minimize the risk of falling. Options include: guards or railings; personal fall arrest system; safety net; control zone; safety monitor with a control zone; and other procedures acceptable to OSHA. See Personal Fall Arrest System.

Floating Connection: A connection between trusses or Structural Elements and non-load bearing interior walls that allows for seasonal movement. Wood blocking or specially designed slotted metal clips can be used to hold the truss in alignment and allow for this movement.

Gable End Frame: A component manufactured to complete the end wall of a building. The bottom chord of the gable end frame has continuous vertical support by the end bearing wall. Vertical members between the top and bottom chords are typically spaced at 24" on-center. The vertical members function as load carrying members and as attachment members for sheathing or other end wall coverings. The gable end frame must be incorporated into the end shear wall by the Building Designer.

Gambrel: Roof having two slopes on each side of the peak, the lower slope usually steeper than the upper one (see Figure B2-13).

Girder Truss: Truss designed to carry heavy loads from other structural members framing into it. Usually a multiple-ply truss.

Ground Brace Diagonal: See Ground Bracing and Figures B2-3 and B2-4.

Ground Bracing: Used to provide stability for the first truss or group of trusses installed. It is composed of vertical and diagonal members providing support for the installed trusses from the earth, floor, foundation or slab. Ground bracing should be located in line with the top chord lateral bracing. Proper ground bracing also requires lateral and strut bracing to ensure stability and support (see Figures B2-3 and B2-4).

Ground Bracing Components: See Ground Bracing and Figures B2-3 and B2-4.

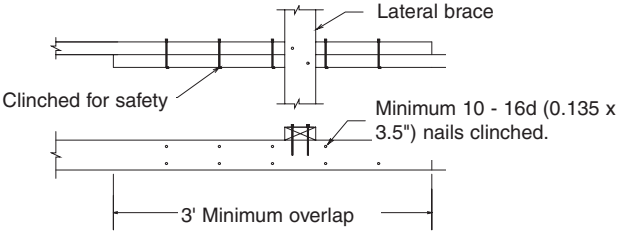
- Backup Ground Stake
- Driven Ground Stake
- End Brace

- Ground Brace Diagonal
- Ground Brace Laterals
- Ground Brace Verticals
- Horizontal Tie Member

Commentary from DSB-89 on Ground Bracing:

Diagonals: Ground brace diagonals should be continuous from the point at which the ground brace vertical is attached at the top chord of the braced truss down at about a 45° angle to a ground stake. The diagonal should be connected to the ground stake and to the vertical with adequate connections.

Splices: Splices for ground bracing should occur only at a point that is laterally braced. Splices for ground bracing, if constructed with wood members, should have a minimum three-foot overlap nailed with a minimum of ten 16d (0.135x3.5") nails, nailed in accordance with NDS specifications and clinched for safety. (See figure below.)



Splices for ground bracing

Ground Stakes: If soil conditions are poor, it may be necessary to add a horizontal tie member at ground level to connect the lower end of the ground brace vertical and the lower end of the ground brace diagonal. Then, it is possible to drive multiple stakes along the length of this horizontal tie member as needed to develop the required lateral resistance by the earth. A backup ground stake is an alternate method of reinforcement in poor soil conditions (see Figure B2-3).

The proper placements and capacities of all ground stakes are the responsibility of the installer.

The ground stake should be driven to a capacity which will resist one and one half times the cumulative lateral bracing force (P) as determined from DSB-89.

Struts: Ground brace struts, where needed, should be connected between the midpoint of the ground brace diagonal and the lower end of the ground brace vertical. Ground brace struts should be no less than 2x4 stress-graded lumber and should be nailed with a minimum of 2-16d (0.135 x 3.5") nails clinched at each connection.

Lateral Braces: When ground brace diagonals require lateral braces the ground brace diagonals at each end of the ground brace system should be braced laterally from the midpoint of the ground brace diagonal down at about 45° to a driven stake and denoted as end braces (see Figure B2-3 and B2-4).

Responsibility: The installer is responsible for the proper selection of lumber sizes, connections and installation of the ground bracing system.

Connections: The installer should provide adequate connections between the ground brace system and the first braced truss to resist the cumulative brace force (P) as determined in Section 4 and Appendix A of DSB-89. A minimum of 2-16d nails nailed in accordance with NDS criteria should be used for each connection in the ground brace system.

HIB-91 Booklet: Commentary & Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses - A 4"x7" hip pocket manual (110 pgs) developed primarily for use by truss installers, contractors, and builders of record, but also a useful tool for building officials and truss manufacturers. Covers handling, loading/shipping, receiving, unloading, storage, lifting, installation tolerances, discussion/ recommendations for ground bracing and temporary bracing for the top chord, bottom chord, and webs. Additionally, discusses the function of permanent bracing for the top chord, bottom chord, and webs and suggests minimum requirements. In the absence of specific bracing

requirements from the Building Designer, trusses can be braced in accordance with HIB-91, which is widely referenced on truss design drawings. HIB-91 is referenced in some model codes. The HIB-91 Booklet has been replaced with the BCSI document published October 1, 2003.

HIB-91 Summary Sheet: Commentary & Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses - A six-page (8-1/2"x11" foldout pamphlet), summarized version of the HIB-91 booklet that typically accompanies the truss order to caution/warn/inform about truss storage, mechanical installation, installation tolerances, and recommended temporary bracing schedules for the safe installation of the trusses. Limited to trusses spaced no greater than 2' on-center. The HIB-91 “Summary Sheet” has been replaced with the BCSI and B-Series Summary Sheets.

HIB-98: Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses Used in Post-Frame Construction - A publication of the TPI providing recommendations and guidelines to contractors for handling, installing and bracing flat bottom chord metal plate connected wood trusses in engineered building systems for applications from 4' to 12' on-center. HIB-98 has been replaced with the BCSI and B-Series Summary Sheets.

Hip Set: Series of trusses of the same span and overhang that decrease in height to form the end slope of a hip roof system. Also called a step-down truss system.

Interior Ground Brace: See Ground Bracing and Figures B2-3 and B2-4.

Jurisdiction: The governmental unit that has adopted this Guide under due legislative authority.

Knee Brace: Brace positioned between a column and truss panel points when trusses are supported by columns lacking transverse bracing.

Load: Forces or other actions that arise on structural systems from the weight of all permanent construction, occupants and their possessions, environmental effects, differential settlement and restrained dimensional changes.

L-Reinforcement: A piece of stress-rated lumber attached to a web as reinforcement against buckling instability. The wide face of the reinforcing member is attached to the narrow face of the web forming an L shape.

Lateral Bending: Bending out of the plane of the truss.

Lateral Bracing: Members installed at right angles to a chord or web member of a truss to provide stability to the truss.

Legal Requirements: Applicable provisions of all statutes, laws, rules, regulations, ordinances, codes, or orders of any governmental authority or Jurisdiction of the United States of America, any state, and any political subdivision or quasi-governmental authority or Jurisdiction of any, of the same, including, but not limited to, departments, commissions, boards, bureaus, agencies, counties, municipalities, and other instrumentalities.

Lift: The act of mechanically or manually hoisting.

Local Building Official: See Building Official.

Long Span Trusses: Trusses over sixty feet (60') in length.

Machine-Stress Rated Lumber (MSR): Type of machine-graded lumber designated by the design bending stress, Fb, and modulus of elasticity, MOE or E, values. For example, an MSR grade of 1650f-1.5E designates the bending stress of 1650 psi and an MOE of 1.5 million psi. Other design properties are listed in the National Design Specification® (NDS®).

Mean Roof Height: The elevation of the roof mid-way between the eave and the ridge (see Figure B6-3).

Metal Connector Plate: See Truss Plate.

Monopitch Truss: Truss that has a single top chord, and a slope greater than 1.5/12.

MPCWT: Metal Plate Connected Wood Truss(es). Engineered, pre-fabricated structural component, assembled from wood members and metal connector plates, and designed to carry superimposed dead and live loads. The truss members form a rigid, planar, structural component and are usually assembled such that the members form triangles.

Multi-Ply Truss: A truss designed to be installed as an assembly of two or more individual trusses fastened together to act as one. Ply-to-ply connections of multiply trusses are specified on the Truss Design Drawing.

Nail-On Plate: Light-gauge cold-formed steel metal connector plates with pre-punched holes or, if cut to size, without holes but having identifying marks through which nails are driven by hand or power means into the lumber. They are typically used in repairs.

National Design Specification® (NDS ®) For Wood Construction: A publication of the American Forest & Paper Association (AF&PA), this Standard is referenced by model building codes for structural design of wood buildings. Also includes a supplement of lumber sizes, grades, species and allowable stresses.

Overhang: Extension of the top chord of a truss past the bottom chord to form the eave/soffit framing of the roof.

Owner: The individual or organization who owns the building, and: (a) either designs and prepares, or retains a Building Designer to design and prepare, the Building's Structural System and the Building Structural System Design Documents; and (b) either constructs, or retains a Contractor to construct, the Building's Structural System.

Parallel Chord Truss (PCT): Truss with top and bottom chords with equal slopes.

Permanent Bracing: Bracing installed to provide support at right angles to the plane of the truss to hold it in its assumed design position. Permanent bracing stays in place for the life of the structure. The Building Designer may design the permanent bracing to resist lateral forces imposed on the completed building by wind load or seismic load.

Permanent Lateral Bracing: Bracing installed to provide support at right angles to the plane of the truss to hold it in its assumed design position. Permanent bracing stays in place for the life of the structure. The Building Designer may design the permanent bracing to resist lateral forces imposed on the completed building by wind load or seismic load. See Lateral Bracing.

Permanent Truss Bracing: Trusses require permanent bracing along three planes: the top chord or roof sheathing plane, the bottom chord or ceiling plane, and the web planes. The lateral rigidity of the entire truss system is a critical consideration. This bracing must be integrated with the other structural parts of the building to achieve total structural integrity.

Personal Fall Arrest System: An individual worker's fall protection system, composed of a safety belt or full body harness, and lanyard, lifeline, and any other connecting equipment that is used to secure the worker to an individual anchor or to a horizontal lifeline system; designed to stop a worker's fall before the worker hits the surface below.

Piggyback Truss: Truss made in two pieces usually consisting of a hip type truss with a triangular cap fastened to it. Used when shipping or manufacturing limitations are affected by overall truss height.

Professional Engineer (PE): Registered Professional Engineer holding a current license in each state in which he or she conducts business.

Proprietary Metal Bracing Products: Diagonal bracing, lateral bracing, bridging and web reinforcement products, which are available from a number of manufacturers as alternatives to wood products.

Registered Design Professional: An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or Jurisdiction in which the project is to be constructed.

Repair Detail: A written, graphic or pictorial depiction of the required fix to an altered or damaged component or part.

Rim Joist: Framing member installed on the edge of the exterior perimeter, usually tying the ends of floor trusses together. Also called ribbon or band board.

Roof Purlins: Horizontal members attached perpendicular to the truss top chord for support of the roofing system (e.g., corrugated roofing or plywood and shingles).

Roof Diaphragm: The horizontal or sloped system defined by the roof plane acting to transmit lateral forces to the vertical resisting elements (e.g., walls).

Roof Sheathing: The structural covering used directly over the roof framing members that transfers perpendicular loads to the framing material. Any of the various coverings or supporting elements that are applied to or cover the top and bottom of trusses or joists and rafters, (e.g., plywood, oriented strand board). Properly placed and nailed sheathing acts as lateral/diagonal/cross bracing.

Scab: Member fastened by nails to another member for reinforcement.

Scab Web Reinforcement: A piece of stress-graded lumber attached to a web as reinforcement against buckling instability. The wide face of the reinforcing member is attached to the wide face of the web.

Scissors Truss: Dual pitch, triangular truss with dual pitched bottom chords (see Figure B2-15).

Seismic Load: Assumed lateral load acting in any horizontal direction on the structural frame due to the dynamic action of earthquakes.

Sheathing: The structural covering used directly over the framing members that transfers perpendicular loads to the framing material. Any of the various coverings or supporting elements that are applied to or cover the top and bottom of trusses, studs or joists and rafters (e.g., plywood, oriented strand board). Properly placed and nailed sheathing acts as lateral/diagonal/cross bracing.

Spreader Bar: A specifically designed lifting device that enables the lifting cables to hang straight or toe-in to their points of connection so as not to induce buckling forces in the truss being lifted.

Stacked Web Reinforcement: Reinforcement member plated to the narrow face of a web in the truss plant to avoid the need for field-installed bracing or reinforcement.

Stiffback: The spreader bar when it is brought down along side, and attached directly to the truss being lifted to provide sufficient rigidity to adequately resist out-of-plane bending of the truss. See Spreader Bar.

Stress-Graded Lumber: Lumber of any thickness and width that is graded for its mechanical properties.

Strongback Bracing/Bridging: Nominal 2x_ dimensional framing member attached perpendicular to floor trusses, often through the chase opening, and placed vertically against a vertical web, or vertical block attached to the side of the truss.

Structural Building Components: Specialized structural building products designed, engineered and manufactured under controlled conditions for a specific application. They are incorporated into the overall Building Structural System by the Building Designer. Examples are wood or steel roof trusses, floor trusses, floor panels, wall panels, I-joists, or engineered beams and headers.

Structural Composite Lumber (SCL): Composite of wood veneer sheets, wafers, or wood strand elements, joined with an adhesive with wood fibers primarily oriented along the length of the member. These materials are intended for structural use. Examples include LVL and PSL.

Structural Element: A single joist, rafter, beam, or other structural member (not including the trusses) designed by others and supplied for the Building Structural System by either the Truss Manufacturer or others.

Structural Element Submittal: Documentation relating to the Structural Elements that is supplied by the Truss Manufacturer, and if required by the Contract, submitted by the Truss Manufacturer to the Local Building Official, Owner, Building Designer and/or Contractor for their review and/or approval.

System: A group of interacting elements under the influence of related forces (e.g., common trusses, girder trusses, headers, walls and foundations).

T-Reinforcement: A piece of stress-graded lumber attached to a web as reinforcement against buckling instability. The wide face of the reinforcing member is attached to the narrow face of the web forming a T shape.

Temporary Erection Bracing: Bracing installed for the purpose of holding trusses true to line, dimension and plumb. In addition, temporary bracing holds

trusses in a stable condition until permanent truss bracing and other permanent components that contribute to the overall rigidity of the roof or floor are in place. Temporary bracing may consist of ground bracing, continuous lateral bracing, sheathing, diagonal bracing, cross bracing or similar items.

Temporary Spacer Pieces: Short blocks of 2x4 or larger material fastened between or on top of truss chords. This procedure requires continuous diagonal bracing.

Toenail: Nail driven at an angle to the member.

Top Chord: Inclined or horizontal member that establishes the top edge of a truss, usually carrying combined compression and bending stresses.

Top Chord Bearing: Bearing condition of a truss that bears on its top chord extension (see Figure B7-3).

Trial Lift: The act of mechanically or manually hoisting an object to assure that the load being hoisted is balanced and stable during the lift.

Triangulation: The act of forming rigid triangles with objects adequately fastened together (see Figure B2-26).

Truss: An individual metal plate connected wood element manufactured by the Truss Manufacturer, and supplied for the Building Structural System. See also MPCWT.

Truss Designer: The individual or organization responsible for the design of trusses in accordance with the ANSI/TPI 1 Design Standard and all Legal Requirements.

Truss Design Drawing: The written, graphic and pictorial depiction of an individual truss. A Truss Design Drawing is a substitute for the building code based prescriptive span tables used to select and apply Structural Elements in conventional light-frame wood construction.

Truss Manufacturer: An individual or organization regularly engaged in the manufacturing of trusses and who may supply Structural Elements for the Building Structural System.

Truss Panel Point: Location on a truss where the web members and top or bottom chords intersect and are connected by metal connector plates.

Truss Placement Diagram: The illustration supplied by the Truss Manufacturer identifying the location assumed for each truss, which references each individually designated Truss Design Drawing.

Truss Plate: Individual metal connector plate manufactured from ASTM A446, A591, A792 or A167 structural quality steel protected with zinc or zinc-aluminum alloy coatings or their stainless steel equivalent. The metal connector plate has integral teeth and is manufactured in various sizes (i.e. lengths and widths) and thickness or gages and is designed to laterally transmit loads when embedded in wood members.

Truss Spaces: The distance or void between two adjacent trusses in a row of trusses.

Truss Submittal: The Truss Design Drawings, and the Truss Placement Diagram, if required by the Contract, that is submitted by the Truss Manufacturer to the Local Building Official, Owner, Building Designer and/or Contractor for their review and/or approval.

Web Plane: The two-dimensional area formed by the top or bottom edge of adjacent similar web members allowing for the connection of lateral and/or diagonal bracing members.

Web Reinforcement: A piece of stress-graded lumber attached to a web as reinforcement against buckling instability. Types of web reinforcement include T, L, scab and metal reinforcement.

Webs: Members that join the top and bottom chords to form the triangular patterns typical of trusses. These members typically carry axial forces.

Wind Force: The load created by the wind as determined for design purposes, usually described in pounds per square foot of the area being affected.

Wind Speed: Is the design wind speed for the structure. The value is determined by the Building Designer, with the minimum determined by the building code in effect in the Jurisdiction where the structure is built.

INDUSTRY ASSOCIATIONS AND GOVERNMENTAL AGENCIES

AF&PA/American Wood Council
1111 19th St NW Ste 800 • Washington, DC 20036
202/463-4713 • 202/463-2791 fax
www.awc.org

American Institute of Architects (AIA)
1735 New York Ave NW • Washington, DC 20006-5292
202/626-7300 • 202/626-7547 fax
www.aia.org

American National Standards Institute (ANSI)
11 W 42nd St • New York, NY 10036
212/642-4900 • 212/398-0023 fax
www.ansi.org

American Society of Agricultural Engineers (ASAE)
2950 Niles Rd • St Joseph, MI 49085-9659
616/429-0300 • 616/429-3852 fax
www.asae.org

American Society of Civil Engineers (ASCE)
1801 Alexander Bell Dr • Reston, VA 20191
703/295-6000 • 703/295-6333 fax
www.asce.org

Association of Crane & Rigging Professionals
P.O. Box 87907 • Vancouver, WA 98687-7907
800-690-3921 • Voice: 360-834-3805 • 360-834-3507 fax
www.arcp.net

National Association of Home Builders (NAHB)
15th & M St NW • Washington, DC 20005
202/822-0401 • 202/822-0374 fax
www.nahb.org

National Frame Builders Association (NFBA)
4840 W 15th St Ste 1000 • Lawrence, KS 66049-3876
800/557-6957 • 785/843-7555 fax
www.nfba.org

Occupational Safety and Health Administration (OSHA)
US Department of Labor
200 Constitution Ave NW • Washington, DC 20210
202/523-1452 • 202/523-3573 fax
www.osha.gov

Truss Plate Institute (TPI)
583 D'Onofrio Dr Ste 200 • Madison, WI 53719
608/833-5900 • 608/833-4360 fax
www.tpinst.org

Wood Truss Council of America (WTCA)
One WTCA Center
6300 Enterprise Lane • Madison, WI 53719
608/274-4849 • 608/274-3329 fax
www.woodtruss.com

INDUSTRY STANDARDS, GUIDELINES AND RECOMMENDATIONS

Always Diagonally Brace For Safety: This four-page color document emphasizes how all lateral bracing needs to be stabilized with diagonal bracing. This is probably one of the most overlooked elements of safe temporary bracing. Educate the Contractor with these clear and concise temporary bracing do's and don'ts. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B2.]

ANSI/TPI 1: American National Standard, National Design Standard for Metal Plate Connected Wood Truss Construction - Publication of TPI developed under the American National Standards Institute (ANSI) consensus process. Provides the analysis, design and manufacturing criteria for the metal plate connected wood truss industry.

ANSI/TPI/WTCA 4: American National Standard, National Standard and Recommended Guidelines on Responsibilities for Construction Using Metal Plate Connected Wood Trusses - Publication of WTCA and TPI developed under the ANSI consensus process. The purpose of this document is to: (a) define as a Standard the usual duties and responsibilities of the Truss Manufacturer and Truss Designer for the benefit of the Owner, Building Designer and Contractor (referred to as the "Standard"); and (b) to provide recommended guidelines to the Owner, Building Designer and Contractor on matters related to the use of trusses (referred to as the "Guidelines"). A proper recognition of the Standard and Guidelines involving trusses will result in better understanding of the expectations of all involved in construction using trusses, more effective and efficient use of trusses, and safer and more economic structures.

Commentary for Permanent Bracing of Metal Plate Connected Wood Trusses by John Meeks, P.E. (1999): This document is intended to provide guidelines for Building Designers to use in designing and specifying permanent bracing for metal plate connected wood truss systems.

Construction Loading: How much is too much? This document answers the question by giving safe and reasonable stack heights for plywood, OSB, gypsum board, asphalt shingles and concrete block. It gives

recommendations for good load placement on flat and pitched trusses, what sort of construction loading practices to avoid, and urges the user to make absolutely sure that no loads are placed unless the truss assembly is properly braced or sheathed. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B4.]

DSB-89: Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses - Publication of TPI developed for use by Architects and Engineers to provide guidance for designing structural bracing.

Fall Protection: This four-page color document explains graphically how trusses are NOT designed to be fall protection anchors. It then presents several tips for framing crews to safely and efficiently install trusses while meeting OSHA's Fall Protection Guidelines. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B11.]

HIB-91 Booklet: Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses - Publication of TPI providing recommendations and guidelines to Contractors for handling, installing and bracing metal plate connected wood trusses for applications up to 2' on center.

HIB-91 Summary Sheet: Commentary & Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses - A six-page (8-1/2"x11" foldout pamphlet), summarized version of the HIB-91 Booklet that typically accompanies the truss order to caution/warn/inform about truss storage, mechanical installation, installation tolerances, and recommended temporary bracing schedules for the safe installation of the trusses. Limited to trusses spaced no greater than 2' on center.

HIB-98: Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses Used in Post-Frame Construction - Publication of TPI providing recommendations and guidelines to Contractors for handling, installing and bracing flat bottom chord metal plate connected wood trusses in engineered building systems for applications from 4' to 12' on center.

Metal Plate Connected Wood Truss Handbook - Third Edition: Publication of WTCA, this reference book on metal plate connected wood trusses has been updated with the most current industry standards and building codes, history, design, fabrication, testing, quality assurance, connection details, fire resistance assemblies and much more. Also included are appendices containing roof and floor span tables, design aids, specifications, a glossary, industry associations, and a list of WTCA members.

Multi-Ply Girders: This document discusses why ply-to-ply attachments are crucial for proper structural performance of multiple ply girders. It directs the user to the fastener schedule on the truss design drawings and recommends some good installation practices. It also discusses the types of fasteners that may be specified and provides the ANSI/TPI 1 guidelines for fastener installation. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B9.]

National Design Specification® (NDS ®) For Wood Construction: A publication of the American Forest & Paper Association (AF&PA), this standard is referenced by model building codes for structural design of wood buildings. Also includes a supplement of lumber sizes, grades, species and allowable stresses.

Toe-Nailing For Uplift Reactions: This document provides guidance to builders on the correct usage of toe-nailing as a means of uplift connection. In a simple yet effective format, the following is addressed: 1) What is the correct way to toe-nail? 2) What is the uplift capacity of a toe-nailed connection? 3) How many nails can be used without damaging the truss? 4) What types of connection options are available when toe-nailing is not enough? [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B8.]

Truss Repair: This two-page document describes how truss damage, alterations and installation errors must be repaired according to an approved truss repair detail. It provides information on types of repairs but is clear that a qualified professional must generate the repair detail. The document lists the information that the field crew must provide in order to secure an accurate repair detail from the Truss

Manufacturer. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B5.]

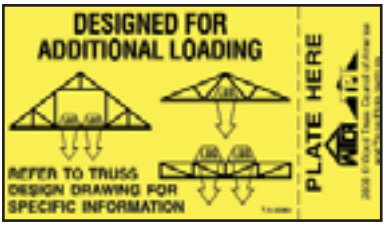
Web Member Permanent Bracing: Brace It For Stability: Avoid misunderstandings on site by providing this two-page document that explains how important web bracing is to the structural integrity of individual components. The colorful graphics and photos help installers understand the correlation between information provided on Truss Design Drawings and the web member permanent bracing that must be installed in the field. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B3.]

Web Reinforcement: T-bracing, which is more correctly termed T-reinforcement, is one of the types of web reinforcing discussed in this document. L-reinforcement, scab reinforcement and metal reinforcement are also included. It explains when and why specific types of web reinforcement are necessary, provides graphics for each and instructs the user to refer to the Truss Design Drawing for web reinforcement installation details. [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B3.]

WTCA Job Site Warning Poster: The “do's and don'ts” of wood truss erection and bracing are detailed in this poster for builders, featuring illustrations instructing the builder on proper techniques for unloading, storing, lifting, erecting, and bracing trusses. Drawings with universal red warning labels accompanied by written instructions provide an easy-to-follow reference. Poster contents are based on HIB-91 [Note: This document was part of the Truss Technology in Building series of documents. It has been replaced by BCSI-B1.]

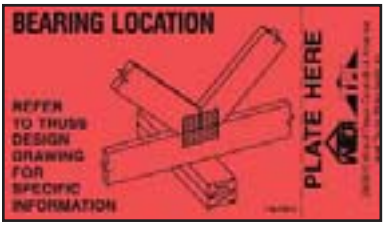
SUPPLEMENTAL INFORMATION TAGS

AL-T: DESIGNED FOR ADDITIONAL LOADING:



This tag informs that the truss has been designed to support heavier loads in this particular area (e.g. attic frame floor loads, rooftop mechanical units, storage loads, etc.)

BL-T: BEARING LOCATION:



Place this tag at points where additional or interior bearing supports should be located under the truss.

CL-T: CONCENTRATED LOAD HERE:

Place this tag at the spot where a truss is to support a concentrated or point load.

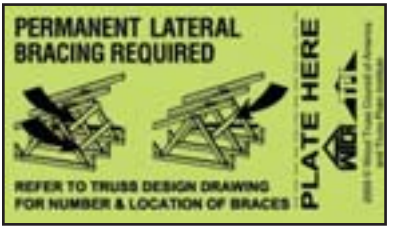
DRIL-T: DO NOT CUT, DRILL, OR ALTER TRUSS MEMBERS:

This tag emphasizes that trusses should not be cut or modified in any way.

MPT-T: THIS IS A MULTI-PLY TRUSS:

This tag emphasizes that the truss is not to be used singly and refers the installer to the truss design drawing for multi-ply laminating instructions.

PLB-T: PERMANENT LATERAL BRACING REQUIRED:

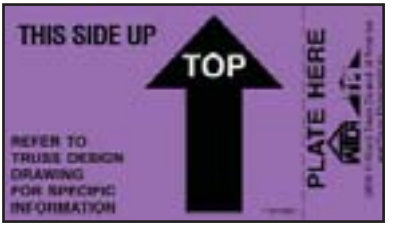


This tag indicates that one or two lateral braces may be required on the tagged member and instructs the installer to look for more information on the truss design drawing.

SBR-T: STRONGBACK BRACING RECOMMENDED:

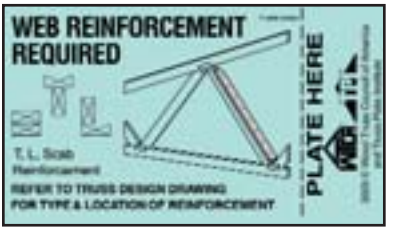
This tag recommends the use of 2x6 strongbacks at 10' o.c. It tells the installer to check the truss design drawing for more specific information.

TOP-T: THIS SIDE UP:



This tag reduces the chance that parallel chord trusses will be inadvertently installed upside down.

WEBREINF-T: WEB REINFORCEMENT:



This tag identifies particular webs that require web reinforcement such as T-bracing.

WTCAB1-T: WARNING TAG:

Place this tag on trusses to indicate the need for temporary bracing. This tag will assist you in providing safety information to your customers, and draws attention to the poster, which gives detailed information on how to perform temporary bracing.

IMPORTANT SAFETY INFORMATION

QUICK REFERENCE GUIDE TO BCSI B-SERIES SUMMARY SHEETS

BCSI-B1	**GUIDE FOR HANDLING, INSTALLING AND BRACING OF METAL PLATE CONNECTED WOOD TRUSSES**
BCSI-B2	**TRUSS INSTALLATION AND TEMPORARY BRACING**
BCSI-B3	**WEB MEMBER PERMANENT BRACING/WEB REINFORCEMENT**
BCSI-B4	**CONSTRUCTION LOADING**
BCSI-B5	**TRUSS DAMAGE, JOBSITE MODIFICATIONS AND INSTALLATION ERRORS**
BCSI-B6	**GABLE END FRAME BRACING**
BCSI-B7	**TEMPORARY AND PERMANENT BRACING FOR PARALLEL CHORD TRUSSES**
BCSI-B8	**TOE-NAILING FOR UPLIFT REACTIONS**
BCSI-B9	**MULTI-PLY GIRDERS**
BCSI-B10	**POST FRAME TRUSS INSTALLATION AND BRACING**
BCSI-B11	**FALL PROTECTION AND WOOD TRUSSES**

TRUSS PLATE INSTITUTE
583 D'ONOFRIO DR., SUITE 200 • MADISON, WI 53719
608/833-5900 • www.tpinst.org

WOOD TRUSS COUNCIL OF AMERICA
ONE WTCA CENTER • 6300 ENTERPRISE LANE • MADISON, WI 53719
608/274-4849 • www.woodtruss.com

Disclaimer