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How to Read Truss Documentation

Marvin Strzyzewski, P.E.

ICC PREFERRED EDUCATION PROVIDER

AIA Continuing Education Provider

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Learning Objectives

At the end of this course, you will:

1. Learn the responsibilities for each party within a project

2. Understand the basic forces that are present in metal plate connected roof and floor trusses

3. Learn and understand the information presented on truss design drawings and how to interpret them.

4. Obtain a basic understanding for the complexity of a truss design drawing.

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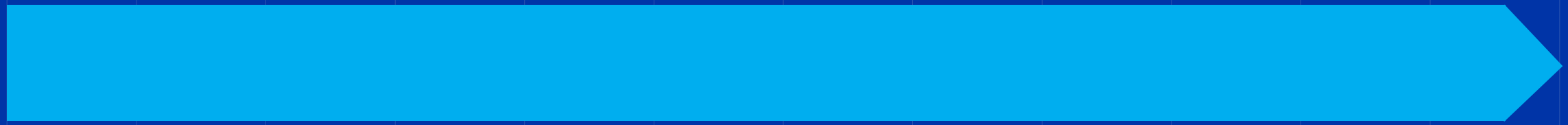
Design Responsibilities



Design Responsibilities

Chapter 2 of this ICC Referenced Standard provides the typical distribution of responsibilities when dealing with wood trusses.

Sec. 2.1 General Purposes.

The purpose of this Chapter of the Standard is to define and draw attention to the Responsibilities of the Owner, Building Designer, Truss manufacturer, and Truss Designer, with respect to the application of Trusses in the construction of a Building.

Courtesy of the Truss Plate Institute (TPI)

Design Responsibilities

Sec. 2.2 Definitions

Building Designer – Designer of the Building Structural System.

Contractor – Person who constructs the Building.

Truss Manufacturer – Person who fabricates the trusses.

Truss Designer – Person preparing the Truss Design Drawings.

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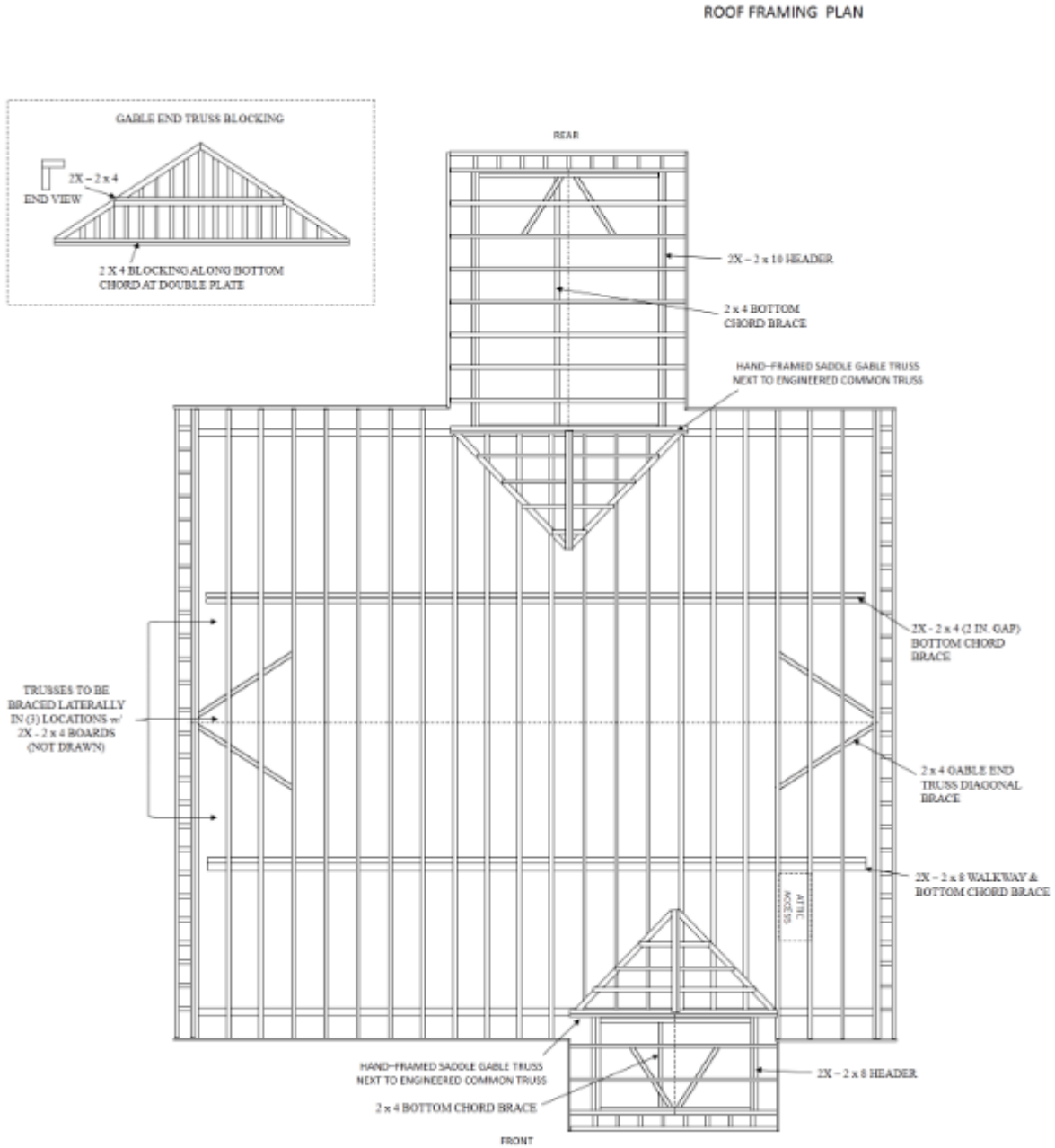
Building Designer

Sec. 2.3.2.1 Construction Documents.

Sec. 2.3.2.2 Deferred Submittals.

Sec. 2.3.2.3 Review Submittal Packages.

Sec. 2.3.2.4 Required Information in the Construction Documents. Some items are Truss orientations, Truss profile information, supports locations and bearing capacity, all loading requirements and Permanent Building Stability Bracing.



Contractor Responsibilities

Sec. 2.3.4.1 Information Provided to the Truss Manufacturer.

Sec. 2.3.4.2 Information provided to the Building Designer.

Sec. 2.3.4.3 Truss Submittal Package.

Sec. 2.3.4.4 Means and Methods.

Sec. 2.3.4.5 Truss Installation.

Sec. 2.3.4.6 Pre-Installation Check.

Sec. 2.3.4.7 Post Inspection Check.

Sec. 2.3.4.8 Truss Damage Discovery.

Sec. 2.3.4.9 Truss Damage Responsibilities.

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Truss Designer Responsibilities

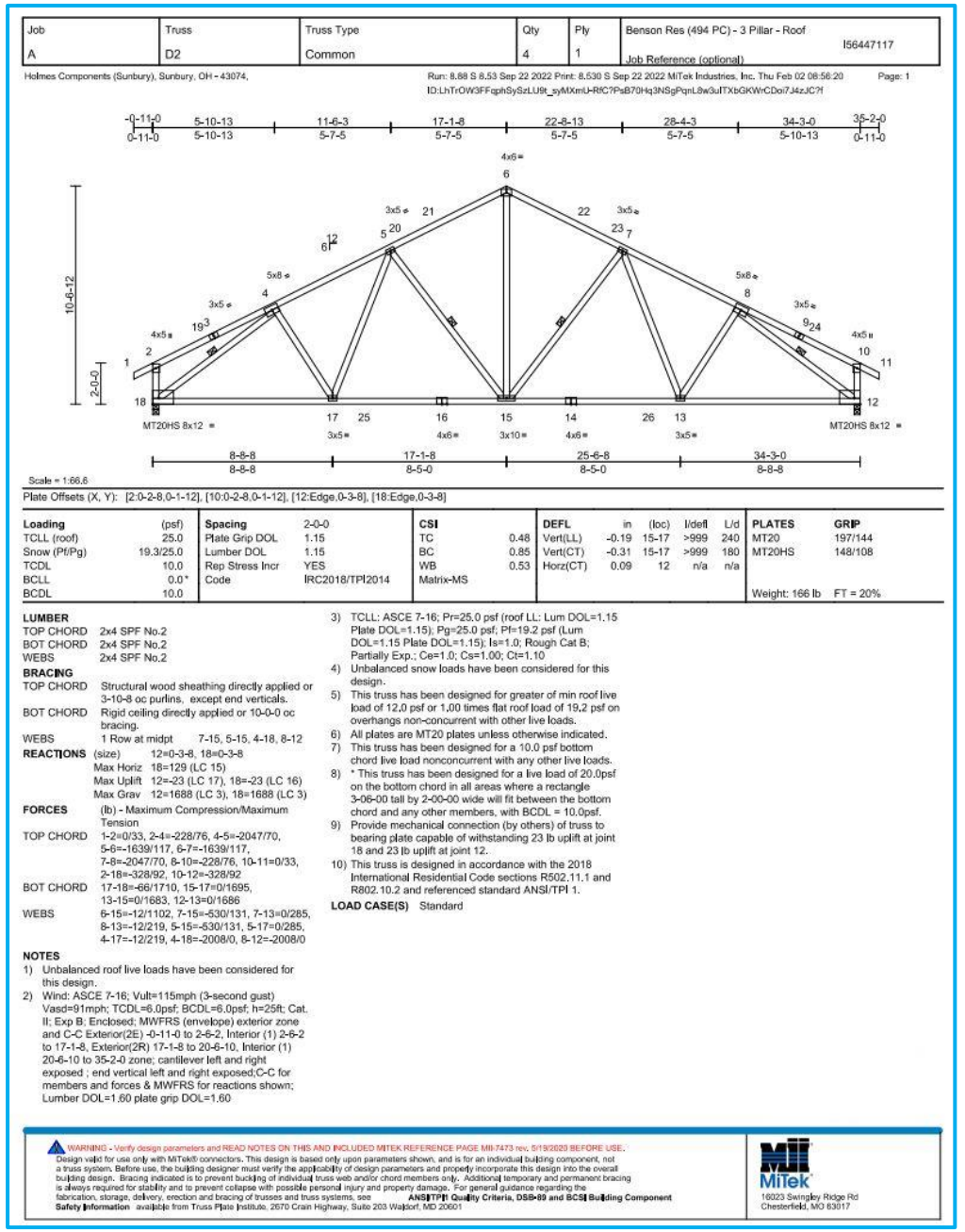
Sec. 2.3.5.1 Preparation of Truss Design Drawings.

Sec. 2.3.5.2 Single Truss Component Design.

Sec. 2.3.5.3 Truss Design Drawing Seal and Signature.

Sec. 2.3.5.4 Truss Placement Diagram.

Sec. 2.3.5.5 Information on Truss Design Drawings.



Job	Truss	Truss Type	Qty	Ply	Benson Res (494 PC) - 3 Pillar - Roof
A	D2	Common	4	1	I56447117
					Job Reference (optional)

Holmes Components (Sunbury), Sunbury, OH - 43074, Run: 8.88 S 8.53 Sep 22 2022 Print: 8.530 S Sep 22 2022 MiTek Industries, Inc. Thu Feb 02 08:56:20 Page: 1
ID:LhTrOW3FFqphSySzLU9t_syMXmU-R8C?PsB70Hq3NSgPqnL8w3ulTXbGKWrCDoi7J4zJC?H

Scale = 1:66.6

Plate Offsets (X, Y): [2:0-2-8,0-1-12], [10:0-2-8,0-1-12], [12:Edge,0-3-8], [18:Edge,0-3-8]

Loading	(psf)	Spacing	2-0-0	CSI		DEFL	in	(loc)	l/defl	L/d	PLATES	GRIP
TCLL (roof)	25.0	Plate Grip DOL	1.15	TC	0.48	Vert(LL)	-0.19	15-17	>999	240	MT20	197/144
Snow (Pf/Pg)	19.3/25.0	Lumber DOL	1.15	BC	0.85	Vert(CT)	-0.31	15-17	>999	180	MT20HS	148/108
TCDL	10.0	Rep Stress Incr	YES	WB	0.53	Horz(CT)	0.09	12	n/a	n/a		
BCLL	0.0*	Code	IRC2018/TPI2014	Matrix-MS								
BCDL	10.0										Weight: 166 lb	FT = 20%

LUMBER
TOP CHORD 2x4 SPF No.2
BOT CHORD 2x4 SPF No.2
WEBS 2x4 SPF No.2

BRACING
TOP CHORD Structural wood sheathing directly applied or 3-10-8 oc purlins, except end verticals.
BOT CHORD Rigid ceiling directly applied or 10-0-0 oc bracing.
WEBS 1 Row at midpt 7-15, 5-15, 4-18, 8-12

REACTIONS (size) 12=0-3-8, 18=0-3-8
Max Horiz 18=129 (LC 15)
Max Uplift 12=-23 (LC 17), 18=-23 (LC 16)
Max Grav 12=1688 (LC 3), 18=1688 (LC 3)

FORCES (lb) - Maximum Compression/Maximum Tension
TOP CHORD 1-2=0/33, 2-4=-228/76, 4-5=-2047/70, 5-6=-1639/117, 6-7=-1639/117, 7-8=-2047/70, 8-10=-228/76, 10-11=0/33, 2-18=-328/92, 10-12=-328/92
BOT CHORD 17-18=-66/1710, 15-17=0/1695, 13-15=0/1683, 12-13=0/1686
WEBS 6-15=-12/1102, 7-15=-530/131, 7-13=0/285, 8-13=-12/219, 5-15=-530/131, 5-17=0/285, 4-17=-12/219, 4-18=-2008/0, 8-12=-2008/0

NOTES
1) Unbalanced roof live loads have been considered for this design.
2) Wind: ASCE 7-16; Vult=115mph (3-second gust) Vasd=91mph; TCDL=6.0psf; BCDL=6.0psf; h=25ft; Cat. II; Exp B; Enclosed; MWFRS (envelope) exterior zone and C-C Exterior(2E) -0-11-0 to 2-6-2, Interior (1) 2-6-2 to 17-1-8, Exterior(2R) 17-1-8 to 20-6-10, Interior (1) 20-6-10 to 35-2-0 zone; cantilever left and right exposed ; end vertical left and right exposed;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60
3) TCLL: ASCE 7-16; Pr=25.0 psf (roof LL: Lum DOL=1.15 Plate DOL=1.15); Pg=25.0 psf; Pf=19.2 psf (Lum DOL=1.15 Plate DOL=1.15); Is=1.0; Rough Cat B; Partially Exp.; Ce=1.0; Cs=1.00; Ct=1.10
4) Unbalanced snow loads have been considered for this design.
5) This truss has been designed for greater of min roof live load of 12.0 psf or 1.00 times flat roof load of 19.2 psf on overhangs non-concurrent with other live loads.
6) All plates are MT20 plates unless otherwise indicated.
7) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
8) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-06-00 tall by 2-00-00 wide will fit between the bottom chord and any other members, with BCDL = 10.0psf.
9) Provide mechanical connection (by others) of truss to bearing plate capable of withstanding 23 lb uplift at joint 18 and 23 lb uplift at joint 12.
10) This truss is designed in accordance with the 2018 International Residential Code sections R502.11.1 and R802.10.2 and referenced standard ANSI/TPI 1.

LOAD CASE(S) Standard

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Chesterfield, MO 63017

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Truss Manufacturer Responsibilities

Sec. 2.3.6.1 Truss Design Criteria and Requirements.

Sec. 2.3.6.2 Communication to Truss Designer.

Sec. 2.3.6.3 Alternate Truss Designs.

Sec. 2.3.6.4 Truss Placement Diagram.

Sec. 2.3.6.5 Required Documents.

Sec. 2.3.6.6 Special Application Conditions.

Sec. 2.3.6.7 Truss Submittal Packages.

Sec. 2.3.6.8 Reliance on Construction Documents.

Sec. 2.3.6.9 Fabrication Tolerance.

Sec. 2.3.6.10 Manufacturer Quality Criteria.

Sec. 2.3.6.11 In-Plant Truss Inspections.

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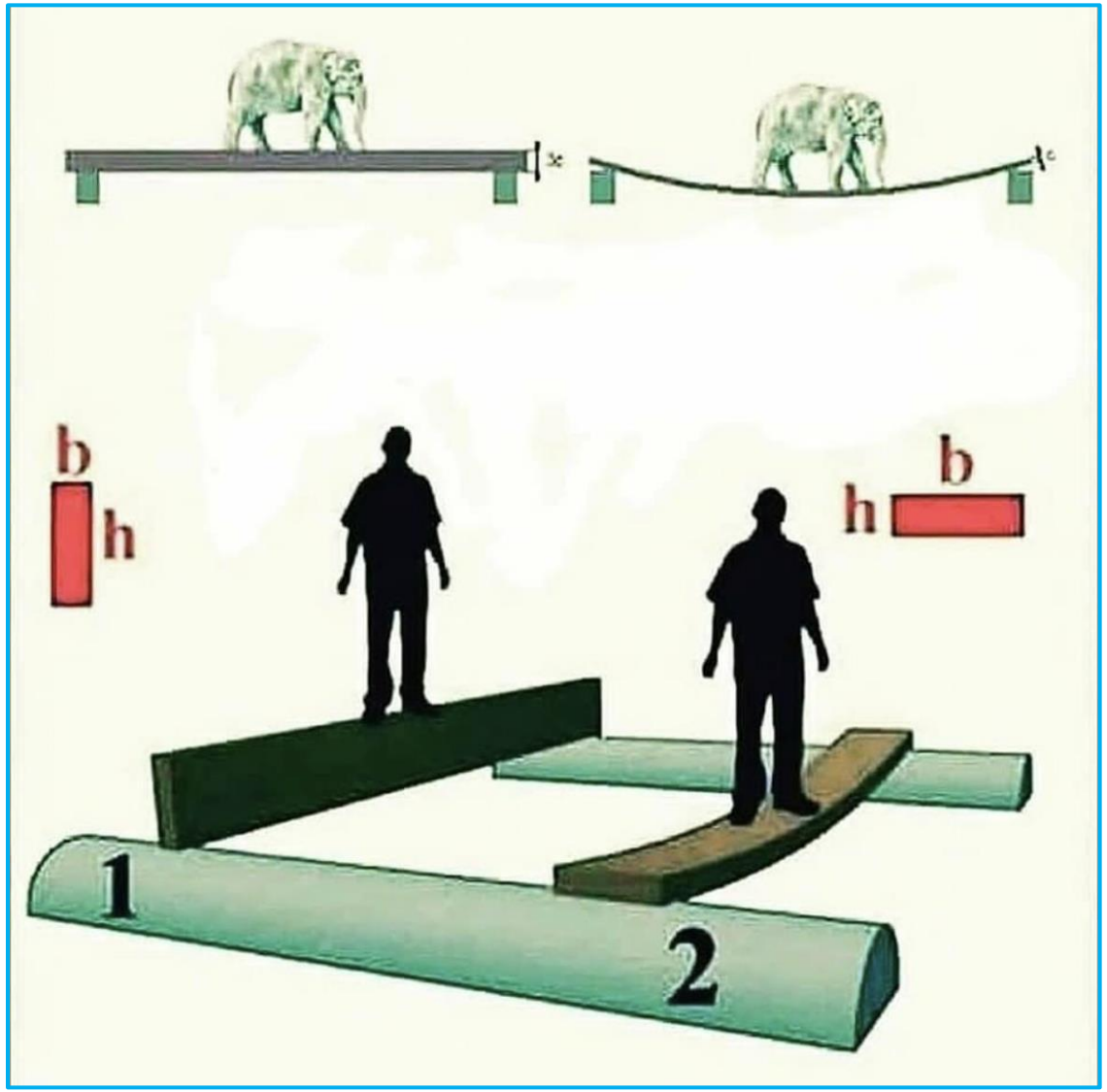
Basic Forces within Truss Members

Bending Forces

Members that have load applied directly along their lengths are under Bending. Using engineering equations, we calculate the bending stresses in theses members.



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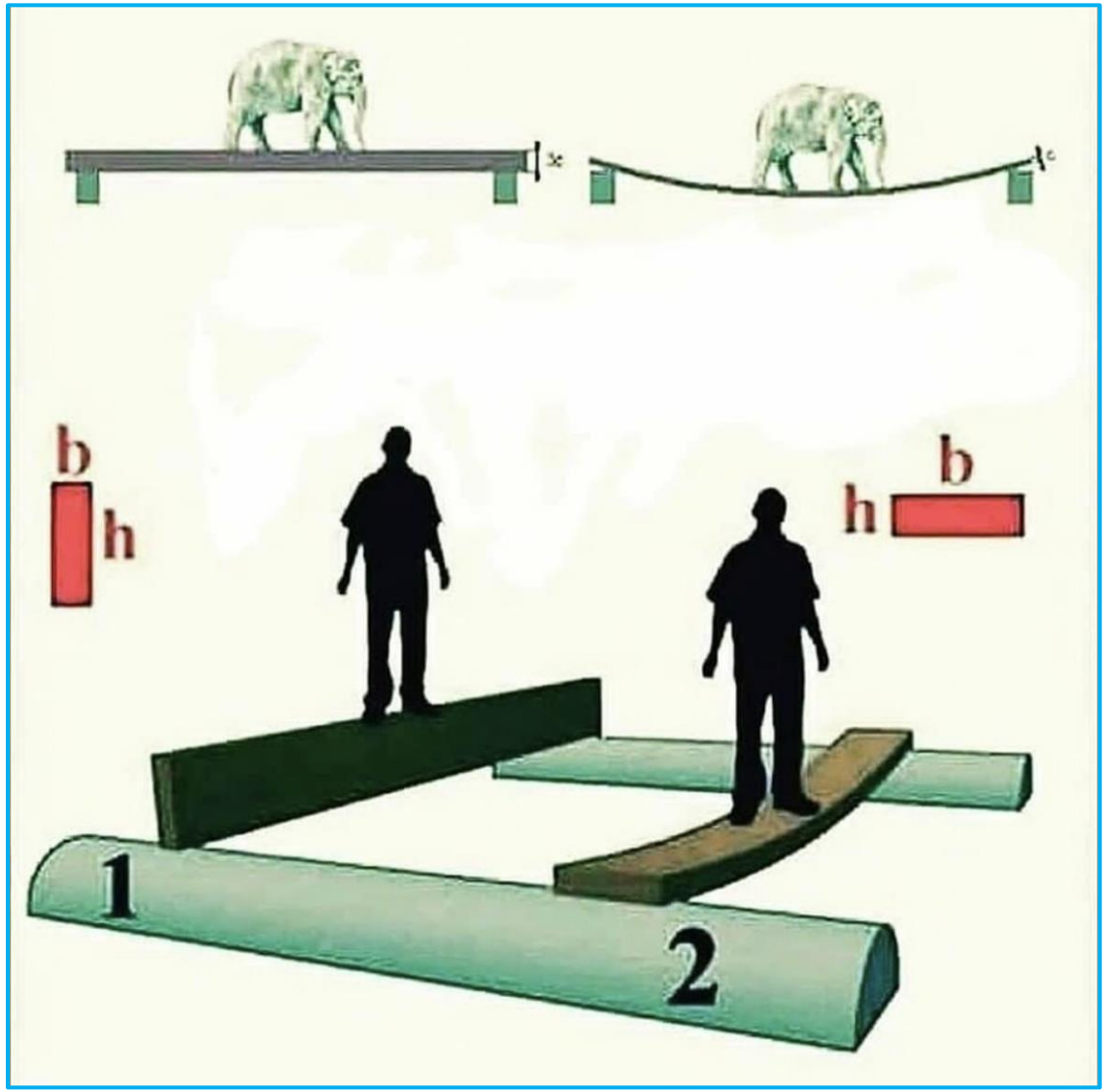
Bending Forces

Bending stresses are resisted by the members Section Modulus (S_x) and the Bending allowable for the size and grade of member.

For a rectangular shape, $S_x = (b * h^2)/6$ for load case 1 as shown.

Note $S_{2x4} = 3.06\ in^3$ and $S_{2x8} = 13.14\ in^3$



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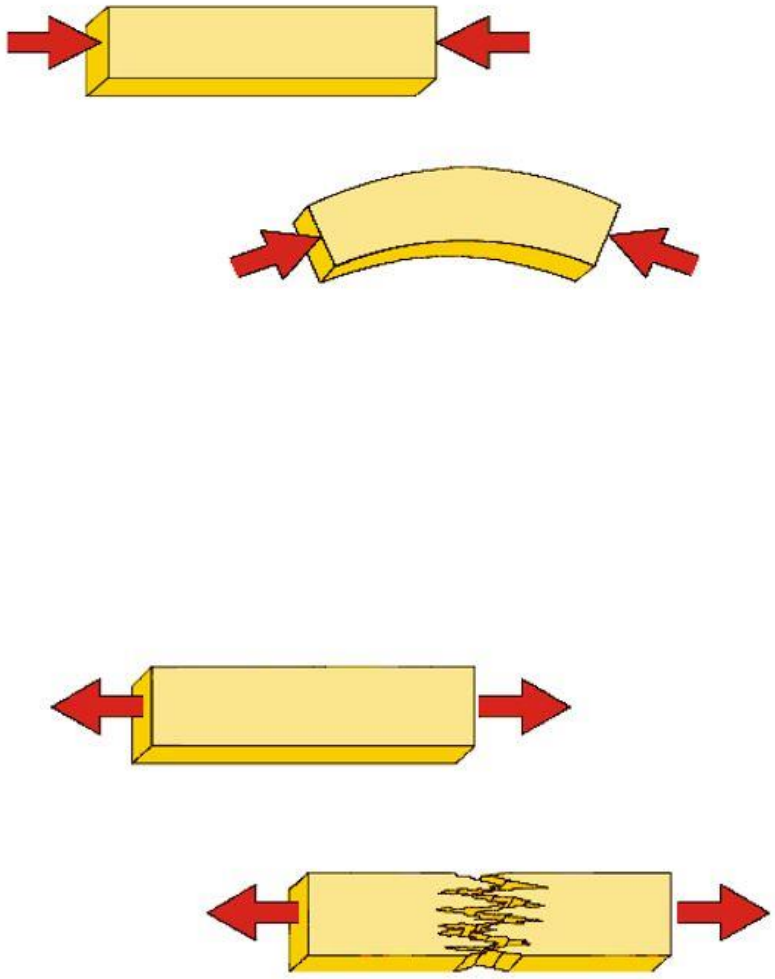
Axial Forces

All members in a truss resist axial forces, forces that are parallel with the length of the member. These forces are determined when the truss is analyzed using computer software.



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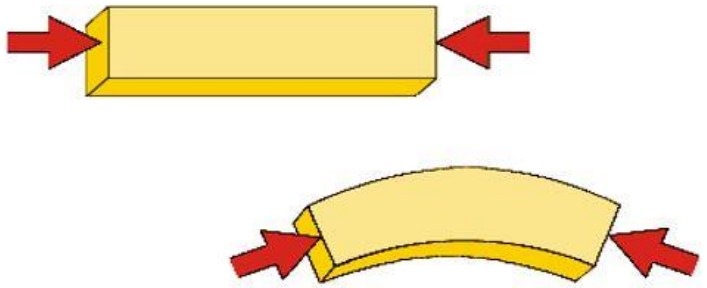
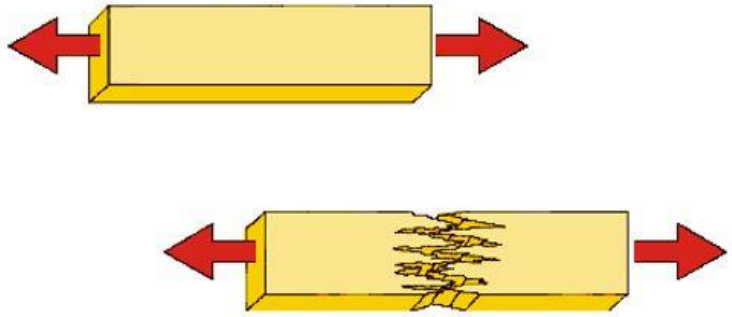
Axial Forces

These forces can be in one of two directions. Compression or pushing from each end or tension or a pulling from each end. They are resisted by the cross-sectional area (b*h) of the member and axial allowable of the size and grade of the member.



Compression, pushing at each end of the member.



Tension, pulling the member from each end.

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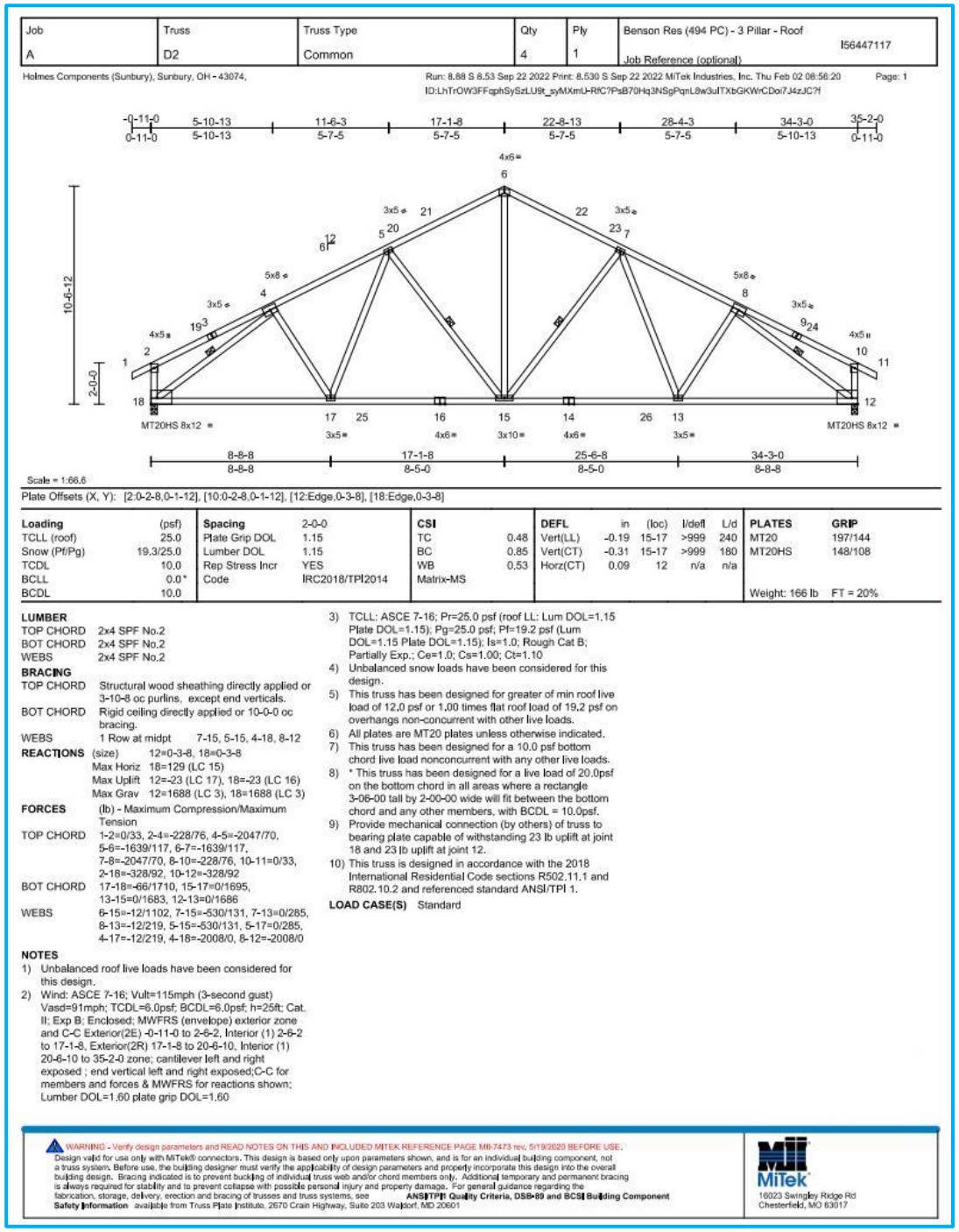
Information Required on a Truss Design

Info on a Truss Design



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BCLL	0.0*	Code	IRC2018/TPI2014	Matrix-MS								
BCDL	10.0										Weight: 166 lb	FT = 20%

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BOT CHORD 2x4 SPF No.2
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WEBS 6-15=-12/1102, 7-15=-530/131, 7-13=0/285, 8-13=-12/219, 5-15=-630/131, 5-17=0/285, 4-17=-12/219, 4-18=-2008/0, 8-12=-2008/0

NOTES
1) Unbalanced roof live loads have been considered for this design.
2) Wind: ASCE 7-16; Vult=115mph (3-second gust) Vasd=91mph; TCDL=6.0psf; BCDL=6.0psf; h=25ft; Cat. II; Exp B; Enclosed; MWFRS (envelope) exterior zone and C-C Exterior(2E) -0-11-0 to 2-6-2, Interior (1) 2-6-2 to 17-1-8, Exterior(2R) 17-1-8 to 20-6-10, Interior (1) 20-6-10 to 35-2-0 zone; cantilever left and right exposed ; end vertical left and right exposed;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60
3) TCLL: ASCE 7-16; Pr=25.0 psf (roof LL: Lum DOL=1.15 Plate DOL=1.15); Pg=25.0 psf; Pf=19.2 psf (Lum DOL=1.15 Plate DOL=1.15); Is=1.0; Rough Cat B; Partially Exp.; Ce=1.0; Cs=1.00; Ct=1.10
4) Unbalanced snow loads have been considered for this design.
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6) All plates are MT20 plates unless otherwise indicated.
7) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
8) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-06-00 tall by 2-00-00 wide will fit between the bottom chord and any other members, with BCDL = 10.0psf.
9) Provide mechanical connection (by others) of truss to bearing plate capable of withstanding 23 lb uplift at joint 18 and 23 lb uplift at joint 12.
10) This truss is designed in accordance with the 2018 International Residential Code sections R502.11.1 and R802.10.2 and referenced standard ANSI/TPI 1.

LOAD CASE(S) Standard

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Chesterfield, MO 63017

The section of TPI that contains the list or required items on a Truss Design Drawing is TPI 1-2014 Sec. 2.3.5.5.

IRC 2021 Sec. R502.11.4 and R802.10.1
IBC 2021 Sec. 2303.4.1 contain similar lists.

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Info on Truss Design

2.3.5.5 Information on Truss Design Drawings.

Truss Design Drawings shall include, at a minimum, the information specified below:

(a) Building Code used for design, unless specified on Cover/Truss Index Sheet.

(b) Slope or depth, span and spacing.

(c) Location of all joints and support locations.

(d) Number of plies if greater than one.

(e) Required bearing widths and if wane is restricted in the bearing area.

(f) Design loads as applicable, including:

(1) Top Chord controlling case of live load, reduced live load if used, snow load, or rain load;

(2) Top Chord dead load;

(3) Bottom Chord live load;

(4) Bottom Chord dead load;

(5) Additional loads and locations;

(6) Environmental load design criteria (wind speed, snow, rain, seismic, and all applicable factors as required to calculate the Truss loads); and

(7) Other lateral loads, including drag strut loads.

(g) Adjustments to Wood Member and Metal Connector Plate design values for conditions of use.

(h) Maximum reaction force and direction, including maximum uplift reaction forces where applicable.

(i) Metal Connector Plate type, manufacturer, size, and thickness or gauge, and the dimensioned location of each Metal Connector Plate except where symmetrically located relative to the joint interface.

(j) Size, species and grade for each Wood Member.

(k) Truss-to-Truss connection and Truss field assembly requirements.

(l) Calculated span to deflection ratio and/or maximum vertical and horizontal deflection for live load and for live plus dead load and K_{CR} as applicable per Section 7.6.

(m) Maximum axial tension and compression forces in the Truss members.

(n) Fabrication tolerance per Section 6.4.10.

(o) Required Permanent Individual Truss Member Restraint location.

(p) Truss Designer

(q) A note on each Truss Design Drawing to install the permanent lateral and diagonal braces in accordance with the project-specific bracing requirements when they exist, such as required by Section 2.3.1.6.1 for clear spans of 60 ft. or more, or as may otherwise be required, and with standard industry details such as *BCSI B3* in the absence of specific information by any RDP.

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Job	Truss	Truss Type	Qty	Ply	Smith Garage
23-S0105	T2	Common	15	1	I99999999
					Job Reference (optional)

Component Manufacturers Name and Address

Run: 8.61 E May 25 2022 Print: 8.610 E May 25 2022 MiTek Industries, Inc. Tue Feb 14 08:43:06

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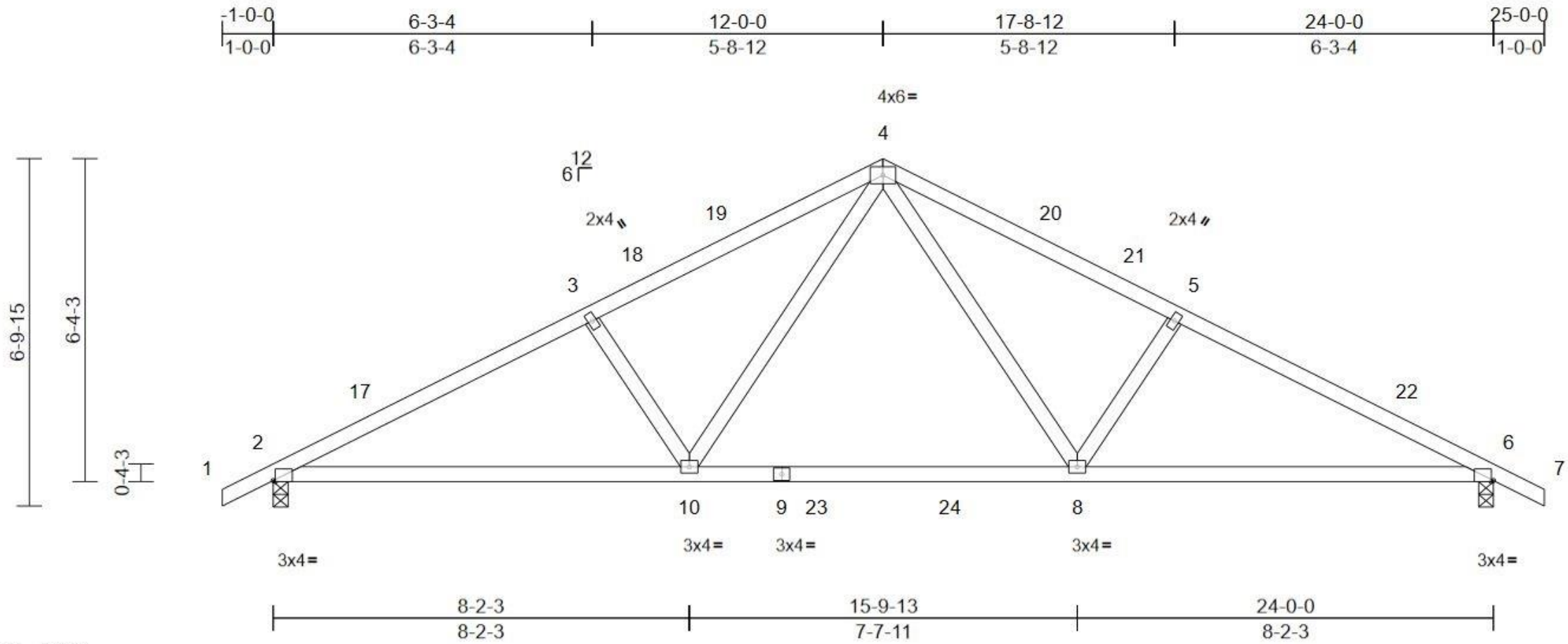

Scale = 1:48.1

Plate Offsets (X, Y): [2:0-0-8,Edge], [6:0-0-8,Edge]

Truss Design

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Title Block Info

Job	Truss	Truss Type	Qty	Ply		
23-0105	T2	Common	15	1	Smith Garage Job Reference (optional)	I99999999

Component Manufacturer Name and Address

Run: 8.61 E May 25 2022 Print: 8.610 E May 25 2022 MiTek Industries, Inc. Tue Feb 14 08:43:06 Page: 1
ID:WTtTHtNx1UROrCvhJPaqFKzvPsn-93JnuoBSyYWkvaDeY7nM4CVIHYZaNNr2aYwbKSzlHoJ

- Required by TPI 1 and the I-Codes, the number of plies.
- Important, the Truss ID and the quantity of this truss id.
- Good to Know, Truss Manufacturer name, TDD number, each engineered design should have a unique number assigned to it. Here is one example.

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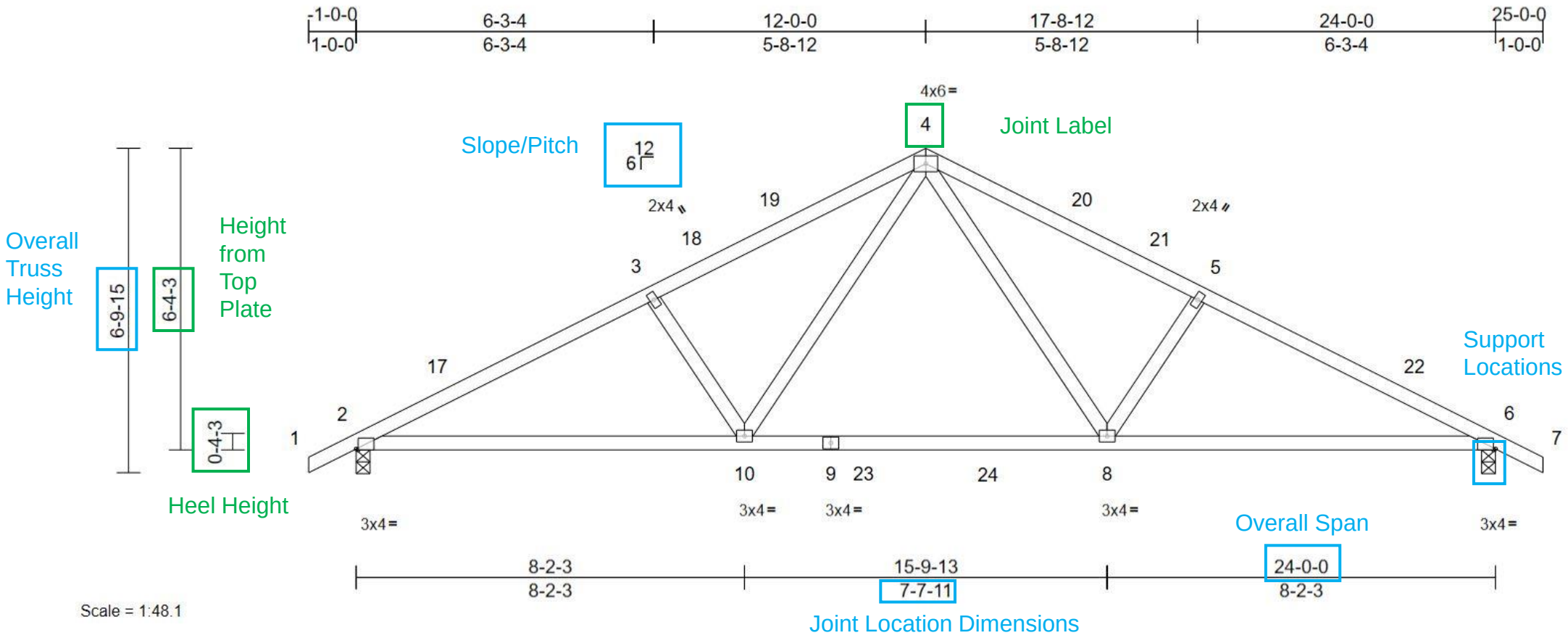
Info on a Truss Design



- Required, Pitch of Truss, Span, Joint Locations, Support Locations.
- Good to Know, height of truss from top plate, the heel height, joint label.

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Info on a Truss Design

5-8-12 Dimensioning Convention, ft – in – 16ths

12
6 ⌐ Pitch is reported as vertical rise per horizontal run. 6 units vertically for every 12 units horizontally.

3 x 4 = Plate designation, width" x length", = slot direction.

Here the plate “slots” are running horizontally.

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Truss Design

Plate Offsets (X, Y): [2:0-0-8,Edge], [6:0-0-8,Edge]

Loading	(psf)	Spacing	2-0-0	CSI		DEFL	in	(loc)	l/defl	L/d	PLATES	GRIP
TCLL (roof)	20.0	Plate Grip DOL	1.15	TC	0.43	Vert(LL)	-0.13	8-10	>999	240	MT20	244/190
Snow (Pf/Pg)	15.4/20.0	Lumber DOL	1.15	BC	0.80	Vert(CT)	-0.24	10-13	>999	180		
TCDL	10.0	Rep Stress Incr	YES	WB	0.30	Horz(CT)	0.05	6	n/a	n/a		
BCLL	0.0*	Code	IRC2018/TPI2014	Matrix-AS								
BCDL	10.0										Weight: 103 lb	FT = 20%

LUMBER
TOP CHORD 2x4 SP No.2
BOT CHORD 2x4 SP No.2
WEBS 2x4 SPF Stud

BRACING
TOP CHORD Structural wood sheathing directly applied.
BOT CHORD Rigid ceiling directly applied.

REACTIONS (lb/size) 2=900/0-3-8, 6=900/0-3-8
Max Horiz 2=81 (LC 16)
Max Uplift 2=-23 (LC 16), 6=-23 (LC 17)
Max Grav 2=1090 (LC 3), 6=1090 (LC 3)

FORCES (lb) - Max. Comp./Max. Ten. - All forces 250 (lb) or less except when shown.
TOP CHORD 2-17=-1791/56, 3-17=-1761/84, 3-18=-1646/77, 18-19=-1583/89, 4-19=-1573/105, 4-20=-1573/105, 20-21=-1583/89, 5-21=-1646/77, 5-22=-1761/84, 6-22=-1791/56
BOT CHORD 2-10=-40/1575, 9-10=0/1043, 9-23=0/1043, 23-24=0/1043, 8-24=0/1043, 6-8=-9/1575
WEBS 4-8=-25/691, 5-8=-372/133, 4-10=-25/691, 3-10=-372/133

NOTES
1) Unbalanced roof live loads have been considered for this design.
2) Wind: ASCE 7-16; Vult=115mph (3-second gust) Vasd=91mph; TCDL=6.0psf; BCDL=6.0psf; h=25ft; Cat. II; Exp B; Enclosed; MWFRS (envelope) exterior zone and C-C Exterior(2E) -1-0-0 to 2-0-0, Interior (1) 2-0-0 to 12-0-0, Exterior(2R) 12-0-0 to 15-0-0, Interior (1) 15-0-0 to 25-0-0 zone; cantilever left and right exposed ; end vertical left and right exposed;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60
3) TCLL: ASCE 7-16; Pr=20.0 psf (roof LL: Lum DOL=1.15 Plate DOL=1.15); Pg=20.0 psf; Pf=15.4 psf (Lum DOL=1.15 Plate DOL=1.15); Is=1.0; Rough Cat B; Partially Exp.; Ce=1.0; Cs=1.00; Ct=1.10
4) Unbalanced snow loads have been considered for this design.
5) This truss has been designed for greater of min roof live load of 12.0 psf or 1.00 times flat roof load of 15.4 psf on overhangs non-concurrent with other live loads.
6) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
7) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-06-00 tall by 2-00-00 wide will fit between the bottom chord and any other members, with BCDL = 10.0psf.
8) Provide mechanical connection (by others) of truss to bearing plate capable of withstanding 23 lb uplift at joint 2 and 23 lb uplift at joint 6.
9) This truss is designed in accordance with the 2018 International Residential Code sections R502.11.1 and R802.10.2 and referenced standard ANSI/TPI 1.
10) This truss design requires that a minimum of 7/16" structural wood sheathing be applied directly to the top chord and 1/2" gypsum sheetrock be applied directly to the bottom chord.

LOAD CASE(S) Standard

MiTek®

Info on a Truss Design

Maximum Combined Stress Index (CSI),
for the top chord, bottom chord and web.

i

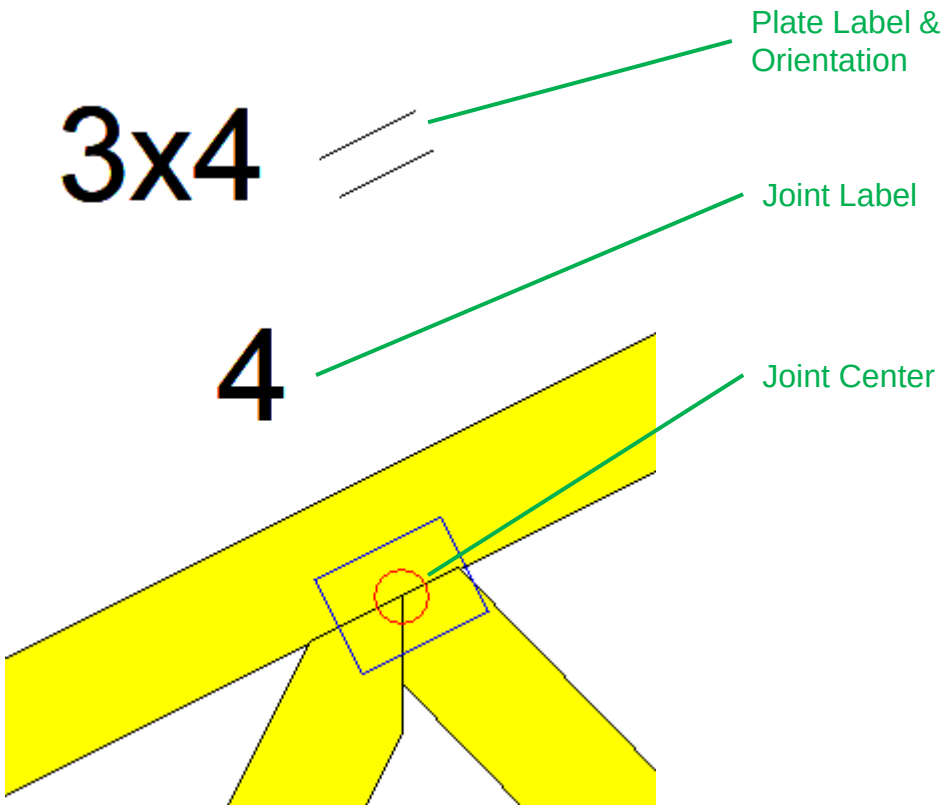
Plate Offsets (X, Y): [2:0-0-8,Edge], [6:0-0-8,Edge]

Loading	(psf)	Spacing	2-0-0 b	CSI		DEFL	in	(loc)	l/defl	L/d	PLATES	GRIP
TCLL (roof)	20.0	Plate Grip DOL	1.15	TC	0.43	Vert(LL)	-0.13	8-10	>999	240	MT20 i	244/190
Snow (Pf/Pg) f	15.4/20.0	Lumber DOL	1.15 g	BC	0.80	Vert(CT)	-0.24	10-13	>999	180		
TCDL	10.0	Rep Stress Incr	YES	WB	0.30	Horz(CT)	0.05	6	n/a	n/a		
BCLL	0.0*	Code	IRC2018/TPI2014	Matrix-AS				l				
BCDL	10.0	a									Weight: 103 lb	FT = 20% n

Required:
a) Building Code.
b) Slope or Depth, span, and spacing.
f) Design Loads as applicable.
g) Adjustments to Wood and Metal Plates.
i) Metal plate type, size, gauge, and dimensioned location for off center joints.
l) Span to deflection ratios.
n) Fabrication Tolerance.

MiTek®

Connector Plate Location

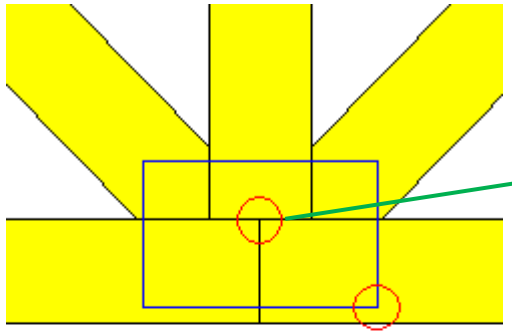


Connector Plate
Centered on the joint

MiTek®

Connector Plate Location

Plate Offsets (X,Y)-- [3:0-2-8,0-3-0], [7:0-2-8,0-3-0], [11:0-4-0,0-3-0]



Joint Label,
X and Y distance of offset
from joint center

Joint Center

Joint Label

11

Plate Label,
Orientation

5x8

Connector Plate offset from the Joint Center

MiTek®

Info on a Truss Design

Loading	(psf)
TCLL (roof)	20.0
Snow (Pf/Pg)	15.4/20.0
TCDL	10.0
BCLL	0.0 *
BCDL	10.0

- TCLL (roof) – Top Chord Live Load or minimum roof load.
- Snow (Pf/Pg) – Flat Roof Snow Load / Ground Snow Load.
- TCDL – Top Chord Dead Load.
- BCLL* – Bottom Chord Live Load.
- BCDL – Bottom Chord Dead Loads.

* This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-6-0 tall by 2-0-0 wide will fit between the bottom chord and any other members, with BCDL = 10.0psf.

Note found in the Note section of the TDD.

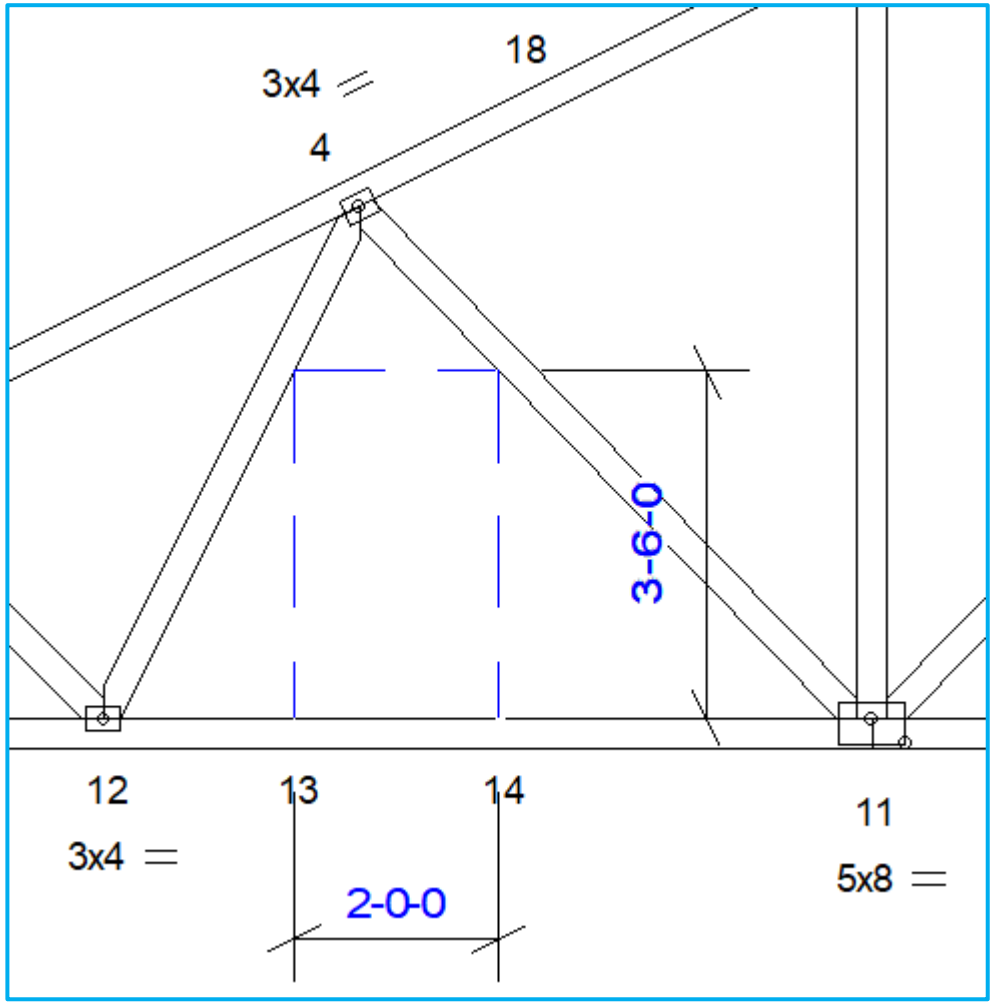
MiTek®

Info on a Truss Design

Table R301.5 footnote g:
Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with the web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.
The live load need only be applied to those portions of the joists or truss bottom chords where the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
2. The slopes of the joists or truss bottom chords are not greater than 2 units vertical in 12 units horizontal.
3. Required insulation depth is less than the joist or truss bottom chord member depth.

The remaining portions of the joists or truss bottom chord shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.

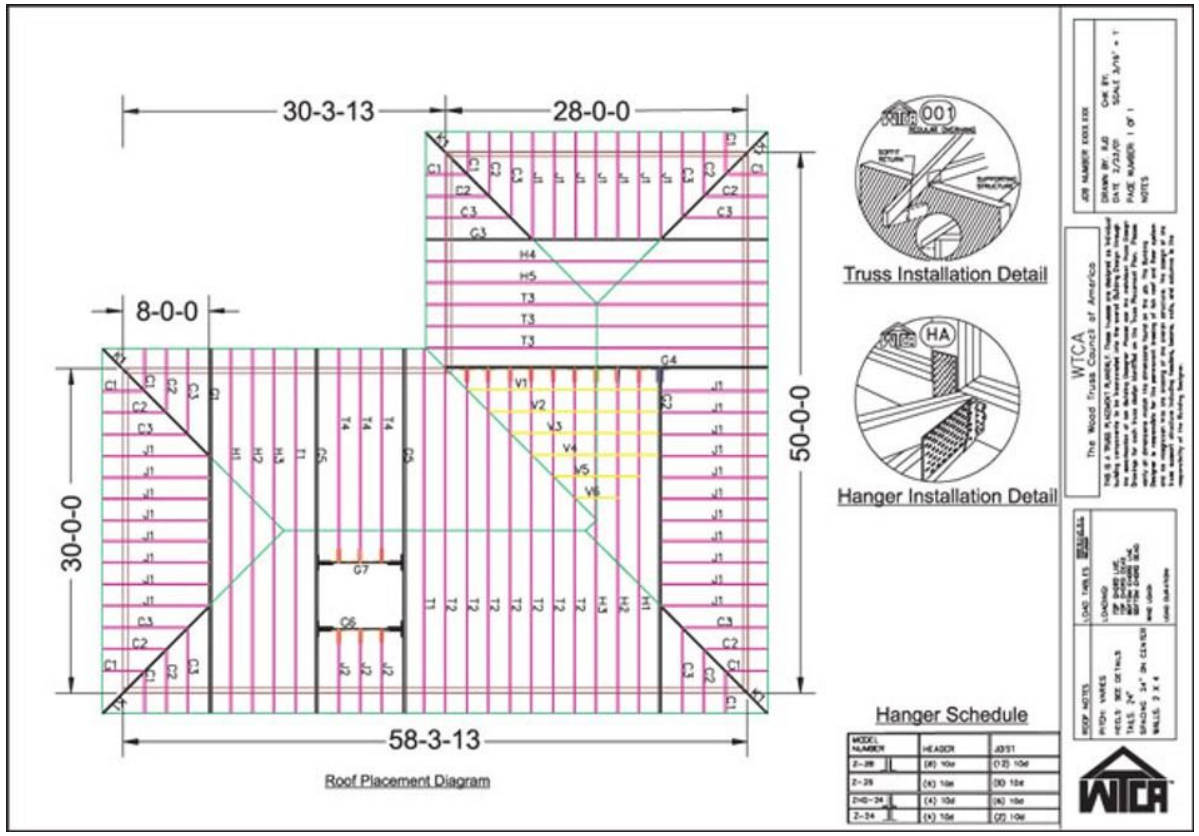


MiTek®

Info on a Truss Design

Spacing	2-0-0
Plate Grip DOL	1.15
Lumber DOL	1.15
Rep Stress Incr	YES
Code	IRC2018/TPI2014

- Center to center truss spacing (ft-in-16ths)
- Plate and Lumber Duration of Load (DOL) allowable
- Repetitive Stress Increase/load sharing, Y/N
- Design Code and TPI Standard



Info on a Truss Design

Combined Stress Index – Ratio of (actual stress / allowable stress)

$$CSI = \frac{fa}{Fa} + \frac{fb}{Fb}$$

Shall always be less than 1.00

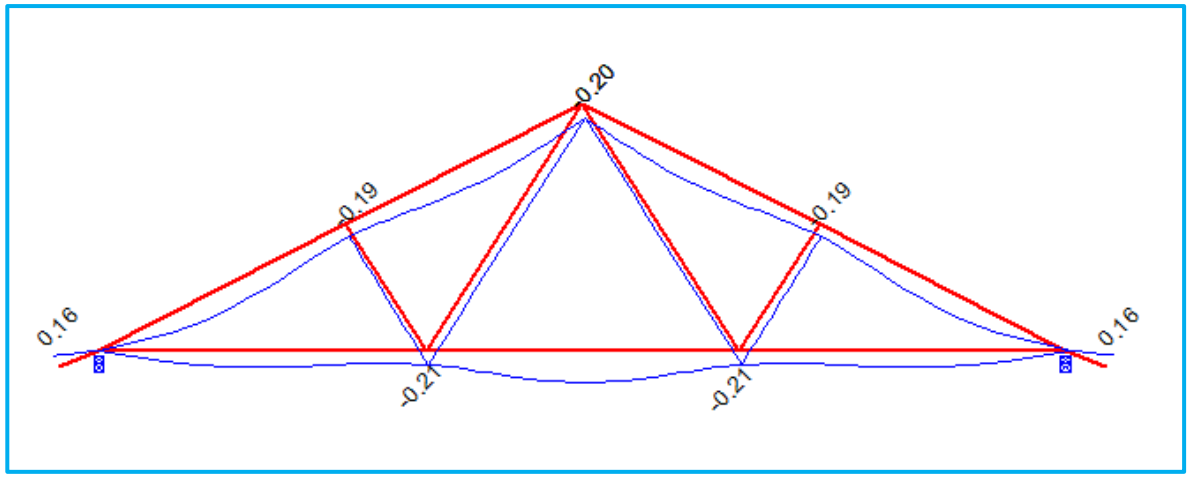
CSI	
TC	0.41
BC	0.80
WB	0.29
Matrix-AS	

- CSI – Combined Stress Index

MiTek®

Info on a Truss Design

DEFL	in	(loc)	l/defl	L/d
Vert(LL)	-0.13	8-10	>999	240
Vert(CT)	-0.24	10-13	>999	180
Horz(CT)	0.05	6	n/a	n/a



- Vert(LL)= vertical deflection due to live load
- Vert(CT)= vertical deflection due to total load + creep
- Horz(CT)= horizontal deflection due to total load + creep
- in = magnitude of deflection
- (loc) = location of reported deflection
- l/defl = span of truss divided by actual deflection

- L/d = input deflection limits per code
- Unless noted on the design the Creep factors are 2.0 for Seasoned lumber in Dry conditions or 3.0 for Green lumber or Wet Service conditions

MiTek®

Info on a Truss Design

PLATES	GRIP
MT20	244/190
Weight: 103 lb	FT = 20%

- Plate Type(s)
- “FT” is the fabrication tolerance that was used in the design.
- Estimated truss weight

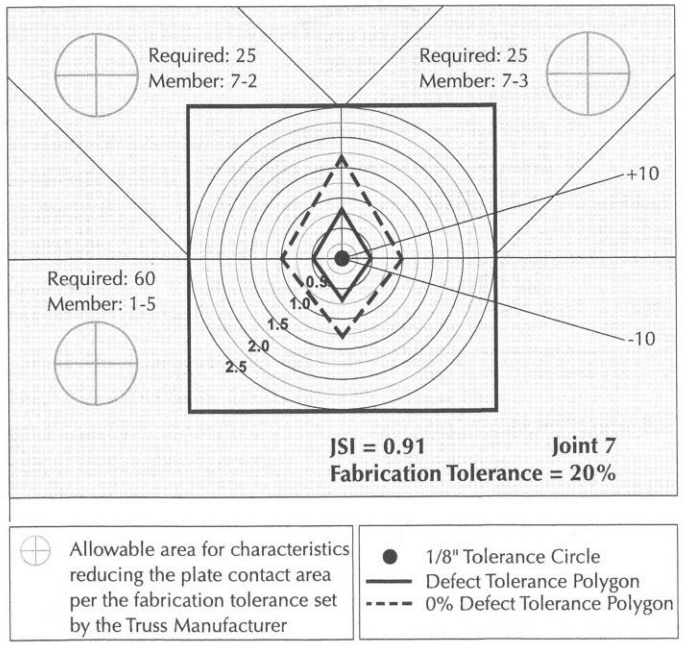
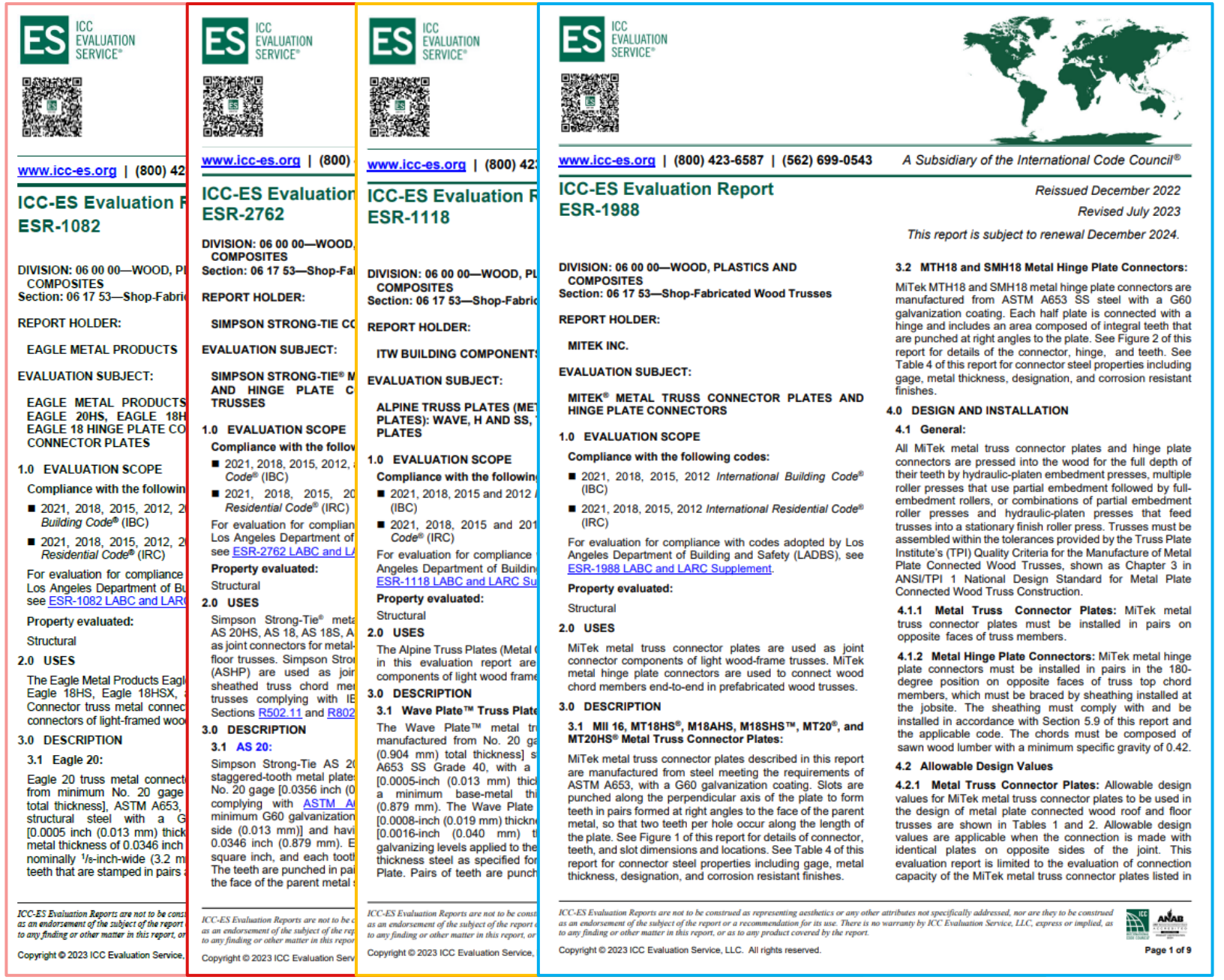


Figure 3.7-1 Example of a Joint QC Detail and Fabrication Tolerance Polygons.

ICC ESR's

Connector plate values can be found on the corresponding Evaluation Service Report (ESR).

MiTek®



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ICC-ES Evaluation R
ESR-1082

DIVISION: 06 00 00—WOOD, PL
COMPOSITES
Section: 06 17 53—Shop-Fabri

REPORT HOLDER:

EAGLE METAL PRODUCTS

EVALUATION SUBJECT:

EAGLE METAL PRODUCTS
EAGLE 20HS, EAGLE 18H
EAGLE 18 HINGE PLATE CO
CONNECTOR PLATES

1.0 EVALUATION SCOPE

Compliance with the followin

- 2021, 2018, 2015, 2012, 2
  Building Code® (IBC)
- 2021, 2018, 2015, 2012, 2
  Residential Code® (IRC)

For evaluation for compliance
Los Angeles Department of Bu
see ESR-1082 LABC and LAR

Property evaluated:

Structural

2.0 USES

The Eagle Metal Products Eagl
Eagle 18HS, Eagle 18HSX,
Connector truss metal connec
connectors of light-framed woo

3.0 DESCRIPTION

3.1 Eagle 20:

Eagle 20 truss metal connect
from minimum No. 20 gage
total thickness], ASTM A653,
structural steel with a G
[0.0005 inch (0.013 mm) thick
metal thickness of 0.0346 inch
nominally 1/8-inch-wide (3.2 m
teeth that are stamped in pairs

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ICC-ES Evaluation
ESR-2762

DIVISION: 06 00 00—WOOD,
COMPOSITES
Section: 06 17 53—Shop-Fa

REPORT HOLDER:

SIMPSON STRONG-TIE CO

EVALUATION SUBJECT:

SIMPSON STRONG-TIE® M
AND HINGE PLATE C
TRUSSES

1.0 EVALUATION SCOPE

Compliance with the follo

- 2021, 2018, 2015, 2012,
  Code® (IBC)
- 2021, 2018, 2015, 20
  Residential Code® (IRC)

For evaluation for complian
Los Angeles Department of
see ESR-2762 LABC and L

Property evaluated:

Structural

2.0 USES

Simpson Strong-Tie® meta
AS 20HS, AS 18, AS 18S, A
as joint connectors for metal-
floor trusses. Simpson Stro
(ASHP) are used as joi
sheathed truss chord me
trusses complying with IB
Sections R502.11 and R802

3.0 DESCRIPTION

3.1 AS 20:

Simpson Strong-Tie AS 2
staggered-tooth metal plate
No. 20 gage [0.0356 inch (0
complying with ASTM A
minimum G60 galvanization
side (0.013 mm)] and havi
0.0346 inch (0.879 mm). E
square inch, and each toot
The teeth are punched in pa
the face of the parent metal

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ICC-ES Evaluation R
ESR-1118

DIVISION: 06 00 00—WOOD, PL
COMPOSITES
Section: 06 17 53—Shop-Fabric

REPORT HOLDER:

ITW BUILDING COMPONENT

EVALUATION SUBJECT:

ALPINE TRUSS PLATES (MET
PLATES): WAVE, H AND SS,
PLATES

1.0 EVALUATION SCOPE

Compliance with the followin

- 2021, 2018, 2015 and 2012
  (IBC)
- 2021, 2018, 2015 and 201
  Code® (IRC)

For evaluation for compliance
Angeles Department of Buildin
ESR-1118 LABC and LARC Su

Property evaluated:

Structural

2.0 USES

The Alpine Truss Plates (Metal
in this evaluation report are
components of light wood frame

3.0 DESCRIPTION

3.1 Wave Plate™ Truss Plate

The Wave Plate™ metal tr
manufactured from No. 20 ga
(0.904 mm) total thickness] s
A653 SS Grade 40, with a
[0.0005-inch (0.013 mm) thic
a minimum base-metal thi
(0.879 mm). The Wave Plate
[0.0008-inch (0.019 mm) thickn
[0.0016-inch (0.040 mm) t
galvanizing levels applied to the
thickness steel as specified for
Plate. Pairs of teeth are punch

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ICC-ES Evaluation Report
ESR-1988

Reissued December 2022
Revised July 2023
This report is subject to renewal December 2024.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 53—Shop-Fabricated Wood Trusses

REPORT HOLDER:

MITEK INC.

EVALUATION SUBJECT:

MITEK® METAL TRUSS CONNECTOR PLATES AND HINGE PLATE CONNECTORS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012 *International Building Code*® (IBC)
- 2021, 2018, 2015, 2012 *International Residential Code*® (IRC)

For evaluation for compliance with codes adopted by Los Angeles Department of Building and Safety (LADBS), see ESR-1988 LABC and LARC Supplement.

Property evaluated:

Structural

2.0 USES

MiTek metal truss connector plates are used as joint connector components of light wood-frame trusses. MiTek metal hinge plate connectors are used to connect wood chord members end-to-end in prefabricated wood trusses.

3.0 DESCRIPTION

3.1 MII 16, MT18HS®, M18AHS, M18SHS™, MT20®, and MT20HS® Metal Truss Connector Plates:

MiTek metal truss connector plates described in this report are manufactured from steel meeting the requirements of ASTM A653, with a G60 galvanization coating. Slots are punched along the perpendicular axis of the plate to form teeth in pairs formed at right angles to the face of the parent metal, so that two teeth per hole occur along the length of the plate. See Figure 1 of this report for details of connector, teeth, and slot dimensions and locations. See Table 4 of this report for connector steel properties including gage, metal thickness, designation, and corrosion resistant finishes.

3.2 MTH18 and SMH18 Metal Hinge Plate Connectors:

MiTek MTH18 and SMH18 metal hinge plate connectors are manufactured from ASTM A653 SS steel with a G60 galvanization coating. Each half plate is connected with a hinge and includes an area composed of integral teeth that are punched at right angles to the plate. See Figure 2 of this report for details of the connector, hinge, and teeth. See Table 4 of this report for connector steel properties including gage, metal thickness, designation, and corrosion resistant finishes.

4.0 DESIGN AND INSTALLATION

4.1 General:

All MiTek metal truss connector plates and hinge plate connectors are pressed into the wood for the full depth of their teeth by hydraulic-platen embedment presses, multiple roller presses that use partial embedment followed by full-embedment rollers, or combinations of partial embedment roller presses and hydraulic-platen presses that feed trusses into a stationary finish roller press. Trusses must be assembled within the tolerances provided by the Truss Plate Institute's (TPI) Quality Criteria for the Manufacture of Metal Plate Connected Wood Trusses, shown as Chapter 3 in ANSI/TPI 1 National Design Standard for Metal Plate Connected Wood Truss Construction.

4.1.1 Metal Truss Connector Plates: MiTek metal truss connector plates must be installed in pairs on opposite faces of truss members.

4.1.2 Metal Hinge Plate Connectors: MiTek metal hinge plate connectors must be installed in pairs in the 180-degree position on opposite faces of truss top chord members, which must be braced by sheathing installed at the jobsite. The sheathing must comply with and be installed in accordance with Section 5.9 of this report and the applicable code. The chords must be composed of sawn wood lumber with a minimum specific gravity of 0.42.

4.2 Allowable Design Values

4.2.1 Metal Truss Connector Plates: Allowable design values for MiTek metal truss connector plates to be used in the design of metal plate connected wood roof and floor trusses are shown in Tables 1 and 2. Allowable design values are applicable when the connection is made with identical plates on opposite sides of the joint. This evaluation report is limited to the evaluation of connection capacity of the MiTek metal truss connector plates listed in

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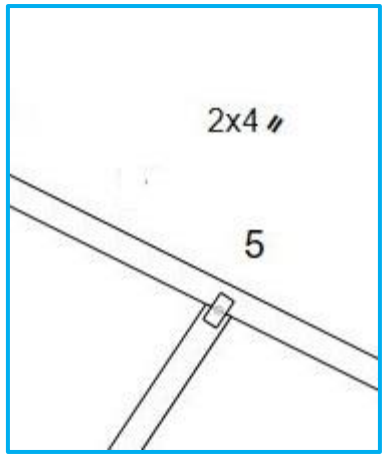
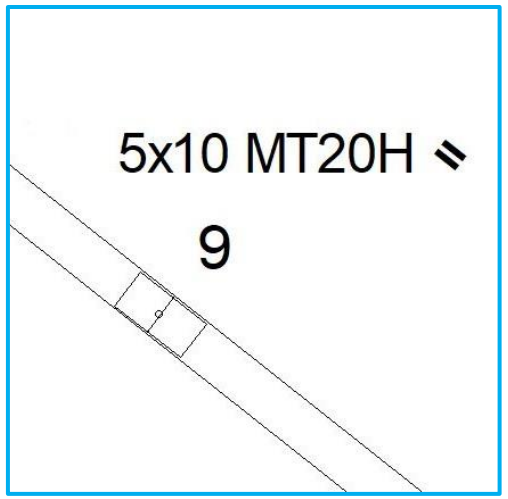
Page 1 of 9

Info on a Truss Design



2 x 4 means the dimension perpendicular to the plate slots is 2” and the dimension parallel is 4”.
Slot direction, if shown, indicated by double lines.



If a plate type differs from most of the other plates on the truss it will be indicated some where on the TDD.

MiTek®

Truss Design Info

TPI Sec. 2.3.5.5-
e) Required bearing widths.

h) Maximum reactions.

j) Size, specie, and grade of each wood member.

m) Maximum axial comp/tension force for each member.

o) Required permanent individual truss member restraint location.

LUMBER

j

TOP CHORD	2x4 SP No.2
BOT CHORD	2x4 SP No.2
WEBS	2x4 SPF Stud

BRACING

o

TOP CHORD	Structural wood sheathing directly applied.
BOT CHORD	Rigid ceiling directly applied.

REACTIONS (lb/size) 2=900/0-3-8, 6=900/0-3-8 e

h

Max Horiz	2=81 (LC 16)
Max Uplift	2=-23 (LC 16), 6=-23 (LC 17)
Max Grav	2=1090 (LC 3), 6=1090 (LC 3)

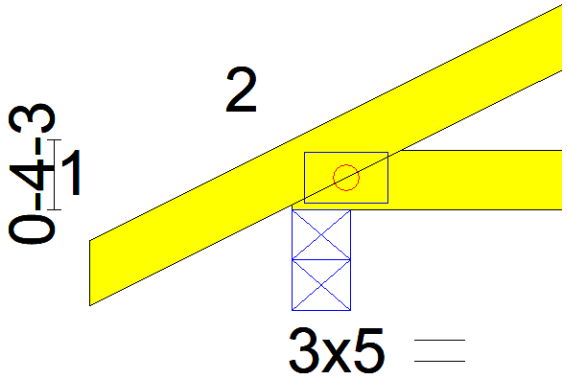
FORCES (lb) - Max. Comp./Max. Ten. - All forces 250 (lb) or less except when shown.

m

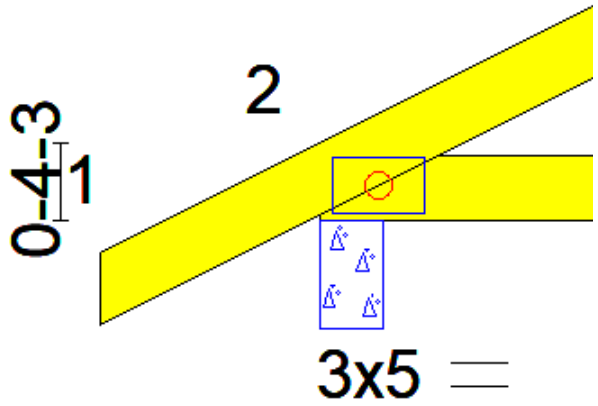
TOP CHORD	2-17=-1791/56, 3-17=-1761/84, 3-18=-1646/77, 18-19=-1583/89, 4-19=-1573/105, 4-20=-1573/105, 20-21=-1583/89, 5-21=-1646/77, 5-22=-1761/84, 6-22=-1791/56
BOT CHORD	2-10=-40/1575, 9-10=0/1043, 9-23=0/1043, 23-24=0/1043, 8-24=0/1043, 6-8=-9/1575
WEBS	4-8=-25/691, 5-8=-372/133, 4-10=-25/691, 3-10=-372/133

MiTek®

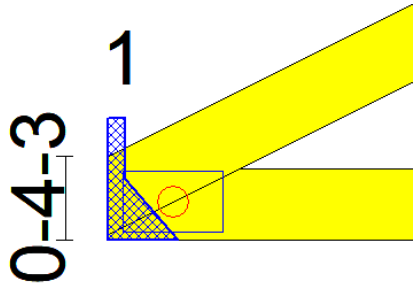
Bearing Images/Type



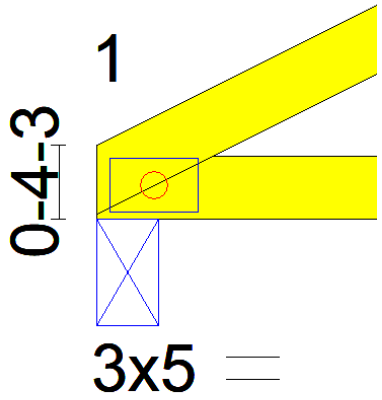
Double Top Plate



Concrete Wall



Hanger



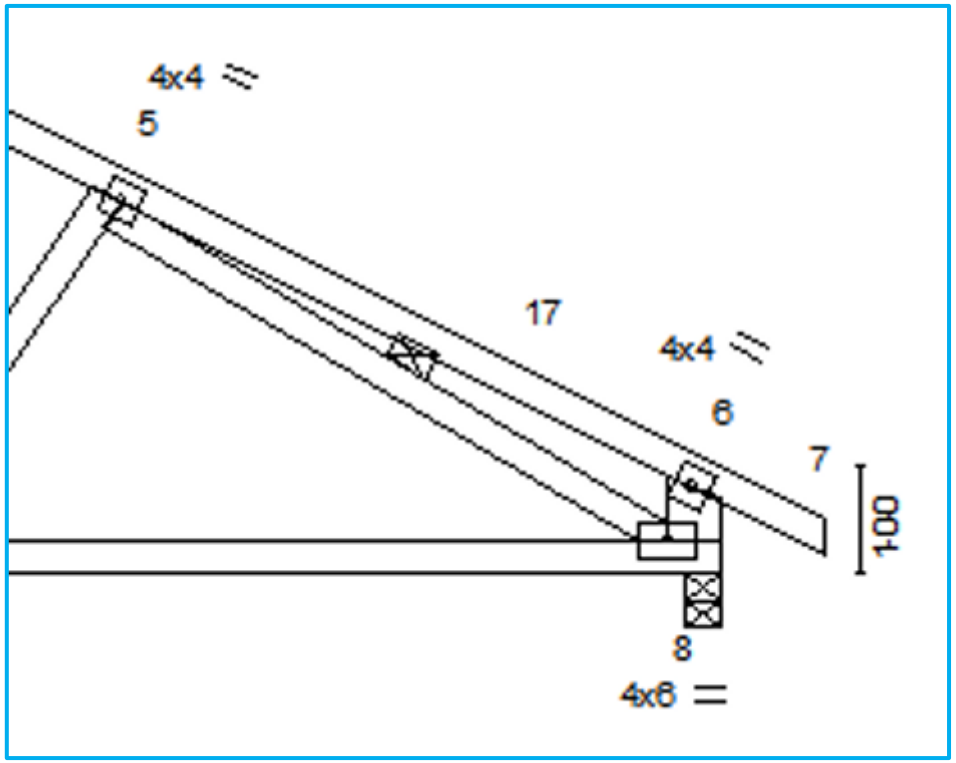
Ledger or Header

MiTek®

Info on Truss Design

When webs requires lateral restraint/bracing, it is indicated graphically on the member and in the bracing section.

BRACING		
TOP CHORD	Structural wood sheathing directly applied, except end verticals.	
BOT CHORD	Rigid ceiling directly applied or 10-0-0 oc bracing.	
WEBS	1 Row at midpt	3-12, 5-8



MiTek®

Truss Design Info on

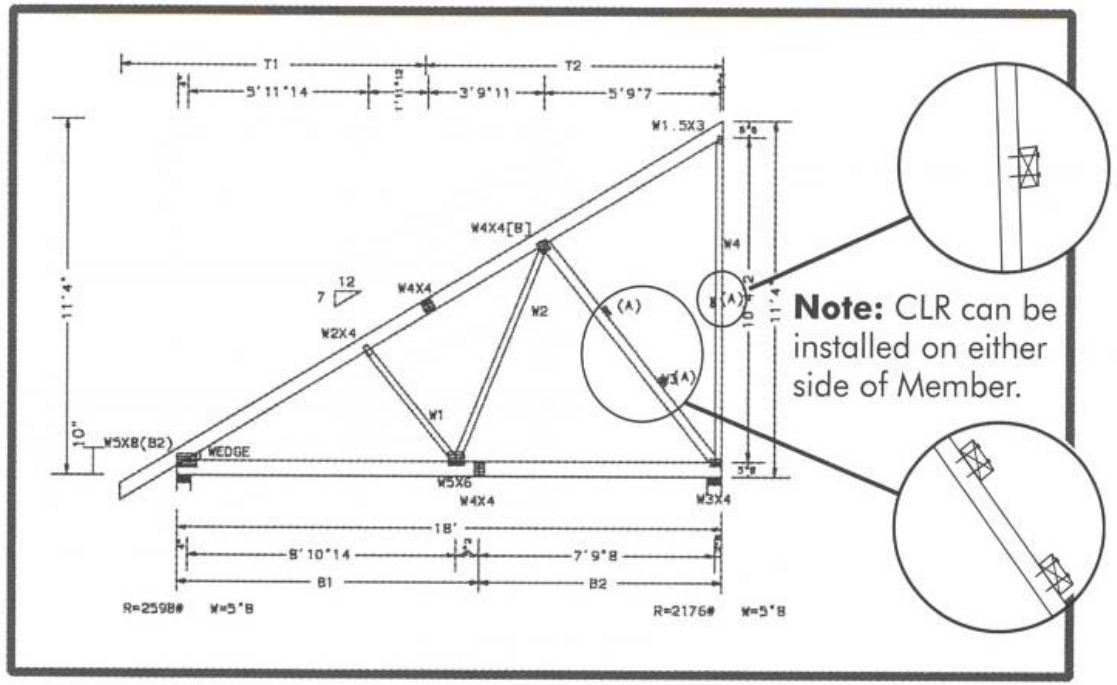


FIGURE B3-9

Courtesy of SBCA from BCSI Chapter 3

MiTek®

Truss Design Info on

Wind: ASCE 7-16; Vult=115mph (3-second gust) Vasd=91mph; TCDL=6.0psf; BCDL=6.0psf; h=25ft; Cat. II; Exp B; Enclosed; MWFRS (envelope) exterior zone and C-C Exterior(2E) -1-0-0 to 2-0-0, Interior (1) 2-0-0 to 12-0-0, Exterior(2R) 12-0-0 to 15-0-0, Interior (1) 15-0-0 to 25-0-0 zone; cantilever left and right exposed ; end vertical left and right exposed;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60

Note all the factors that are required for the correct environmental loading.

The underlined factors are most often input **incorrectly.**

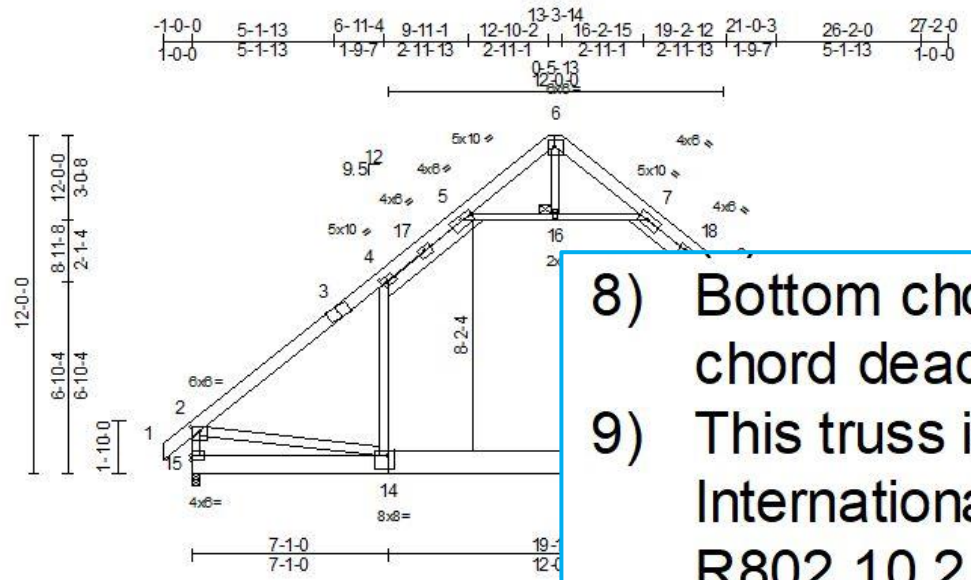
TCLL: ASCE 7-16; Pr=20.0 psf (roof LL: Lum DOL=1.15 Plate DOL=1.15); Pg=20.0 psf; Pf=15.4 psf (Lum DOL=1.15 Plate DOL=1.15); Is=1.0; Rough Cat B; Partially Exp.; Ce=1.0; Cs=1.00; Ct=1.10

MiTek®

Attic Truss

Job	Truss	Truss Type	Qty	Ply	Miller Residence - Mitchell	I56447032
2300293A	B2	Attic	3	1	Job Reference (optional)	

Run: 8.63 S Nov 19 2022 Print: 8.630 S Nov 19 2022 MiTek Industries, Inc. Thu Feb 02 08:52:05 Page: 1
ID:aKJXvUzQhqJ?4hPrrXnNVzw8r6-RfC?Ps B?0Hq3NSgPqrL8w3ulTXbGKWrCDci7J4zJC?f



Scale = 1:75

Plate Offsets (X, Y): [2:0-3-4,0-2-0], [4:0-2-12,0-2-0], [8:0-2-12,0-2-0], [10:0-3-4,0-2-0], [12:Edge,0-2-4],

Loading	(psf)	Spacing	2-0-0	CSI					
TCLL (roof)	20.0	Plate Grip DOL	1.15	TC	0.8				
Snow (Pf/Pg)	13.9/20.0	Lumber DOL	1.15	BC	0.9				
TCDL	10.0	Rep Stress Incr	NO	WB	0.28	Horz(CT)	0.01	12	n/a	n/a
BCLL	0.0*	Code	IRC2018/TPI2014	Matrix-MS		Wind(LL)	0.11	13-14	>999	240
BCDL	10.0									

Weight: 250 lb FT = 20%

LUMBER
TOP CHORD 2x6 SP No.1 *Except* 3-6,6-9:2x6 SP DSS
BOT CHORD 2x8 SP No.1 *Except* 14-13:2x10 SP No.1
WEBS 2x4 SP No.2

BRACING
TOP CHORD Sheathed or 3-11-11 oc purlins, except end verticals.
BOT CHORD Rigid ceiling directly applied or 8-10-3 oc bracing.
JOINTS 1 Brace at Jt(s): 16

REACTIONS (size) 12=0-3-8, 15=0-3-8
Max Horiz 15=-275 (LC 12)
Max Grav 12=1730 (LC 28), 15=1730 (LC 27)

FORCES (lb) - Maximum Compression/Maximum Tension
TOP CHORD 1-2=0/54, 2-4=-2028/0, 4-5=-1394/0, 5-6=0/323, 6-7=0/323, 7-8=-1394/0, 8-10=-2028/0, 10-11=0/54, 2-15=-1712/0, 10-12=-1713/0
BOT CHORD 12-15=-244/1489
WEBS 8-13=0/792, 4-14=0/792, 5-16=-1807/0, 7-16=-1807/0, 6-16=0/131, 2-14=0/1257, 10-13=0/1261

NOTES
1) Unbalanced roof live loads have been considered for this design.
2) Wind: ASCE 7-16; Vult=120mph (3-second gust) Vasd=95mph; TCDL=6.0psf; BCDL=6.0psf; h=30ft; Cat. II; Exp B; Enclosed; MWFRS (envelope) exterior zone and C-C Exterior(2E) -1-0-0 to 4-0-0, Interior (1) 4-0-0 to 13-1-0, Exterior(2R) 13-1-0 to 18-1-0, Interior (1) 18-1-0 to 27-2-0 zone; cantilever left and right exposed ; end vertical left and right exposed;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60
3) TCLL: ASCE 7-16; Pr=20.0 psf (roof LL: Lum DOL=1.15 Plate DOL=1.15); Pg=20.0 psf; Pf=13.9 psf (Lum DOL=1.15 Plate DOL=1.15); Is=1.0; Rough Cat B; Fully Exp.; Ce=0.9; Cs=1.00; Ct=1.10
4) This truss has been designed for greater of min roof live load of 12.0 psf or 2.00 times flat roof load of 13.9 psf on overhangs non-concurrent with other live loads.
5) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
6) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-06-00 tall by 2-00-00 wide will fit between the bottom chord and any other members.
7) Ceiling dead load (10.0 psf) on member(s). 4-5, 7-8, 5-16, 7-16; Wall dead load (10.0psf) on member(s). 8-13, 4-14
8) Bottom chord live load (40.0 psf) and additional bottom chord dead load (10.0 psf) applied only to room. 13-14
9) This truss is designed in accordance with the 2018 International Residential Code sections R502.11.1 and R802.10.2 and referenced standard ANSI/TPI 1.
10) Attic room checked for L/360 deflection.

LOAD CASE(S) Standard

8) Bottom chord live load (40.0 psf) and additional bottom chord dead load (10.0 psf) applied only to room. 13-14
9) This truss is designed in accordance with the 2018 International Residential Code sections R502.11.1 and R802.10.2 and referenced standard ANSI/TPI 1.
10) Attic room checked for L/360 deflection.

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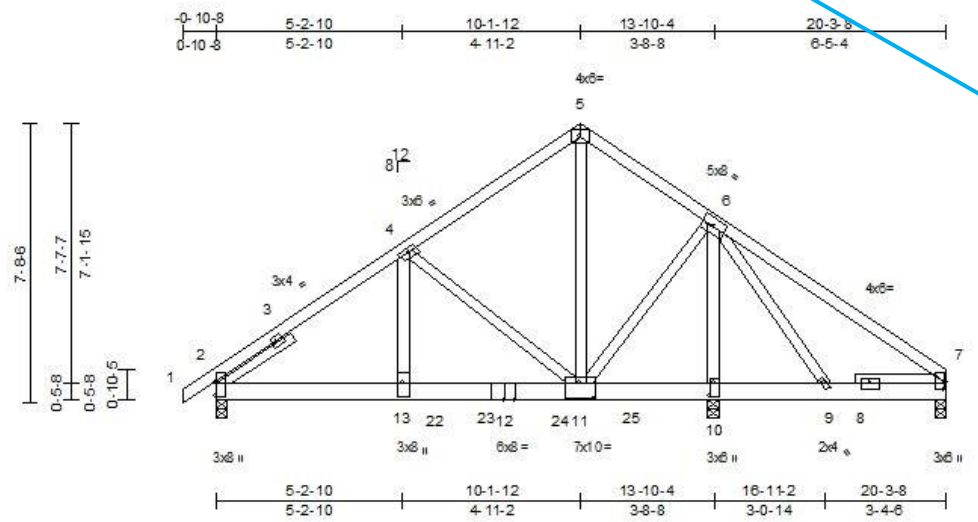
Multi-Ply Truss

Job	Truss	Truss Type	Qty	Ply	Lot 16 / Wildwood
3376097	B03	Common Girder	1	2	I56446595

Job Reference (optional)

Run: 8.53 S Sep 22 2022 Print: 8.530 S Sep 22 2022 MiTek Industries, Inc. Thu Feb 02 08:46:33 Page: 1
ID:2AxS3zc7sLr8M?YBIStk6TzhtZ3-RfC?PsB70Hq8NSgPqrL8w3uITXbGKWrCDbi7J4zJC?f



Scale = 1:53.7

Plate Offsets (X, Y): [7:0-1-12,0-0-11], [10:0-4-4,0-1-8], [11:0-5-0,0-4-12]

Loading	(psf)	Spacing	2-0-0	CSI		DEFL	in	(loc)	l/defl
TCLL (roof)	20.0	Plate Grip DOL	1.15	TC	0.47	Vert(LL)	-0.07	11-13	>999
TCDL	10.0	Lumber DOL	1.15	BC	0.84	Vert(CT)	-0.14	11-13	>999
BCLL	0.0*	Rep Stress Incr	NO	WB	0.37	Horz(CT)	0.02	2	n/a
BCDL	10.0	Code	IRC2015/TPI2014	Matrix-MS		Wind(LL)	0.16	11-13	>999

LUMBER
TOP CHORD 2x4 SP No.2
BOT CHORD 2x6 SP No.1
WEBS 2x4 SP No.2
SLIDER Left 2x4 SP No.2 -- 2-6-0, Right 2x4 SP No.2 -- 2-6-0

BRACING
TOP CHORD Structural wood sheathing directly applied or 6-0-0 oc purlins.
BOT CHORD Rigid ceiling directly applied or 6-0-0 oc bracing.

REACTIONS (size) 2=0-3-8, 7=0-3-8, 10=0-3-8
Max Horiz 2=318 (LC 5)
Max Uplift 2=-1773 (LC 8), 7=-384 (LC 26), 10=-3332 (LC 9)
Max Grav 2=2266 (LC 1), 7=409 (LC 5), 10=5072 (LC 1)

FORCES (lb) - Maximum Compression/Maximum Tension
TOP CHORD 1-2=0/29, 2-4=-3445/2844, 4-5=-1710/1315, 5-6=-1727/1351, 6-7=-768/667
BOT CHORD 2-13=-2385/2950, 11-13=-2385/2950, 10-11=-482/547, 9-10=-482/547, 7-9=-436/469
WEBS 4-13=-1843/2050, 4-11=-2021/1911, 5-11=-1293/1583, 6-11=-2240/2927, 6-10=-3852/2952, 6-9=-183/185

NOTES
1) 2-ply truss to be connected together with 10d (0.131"x3") nails as follows:
Top chords connected as follows: 2x4 - 1 row at 0-9-0 oc.
Bottom chords connected as follows: 2x6 - 2 rows staggered at 0-6-0 oc.
Web connected as follows: 2x4 - 1 row at 0-9-0 oc.
2) All loads are considered equally applied to all plies, except if noted as front (F) or back (B) face in the LOAD CASE(S) section. Ply to ply connections have been provided to distribute only loads noted as (F) or (B), unless otherwise indicated.
3) Unbalanced roof live loads have been considered for this design.
4) Wind: ASCE 7-10; Vult=150mph (3-second gust) Vasd=119mph; TCDL=6.0psf; BCDL=6.0psf; h=25ft; Cat. II; Exp C; Enclosed; MWFRS (envelope) exterior zone; cantilever left and right exposed; end vertical left and right exposed; Lumber DOL=1.60 plate grip DOL=1.60
5) This truss has been designed for a 10.0 psf bottom chord live load nonconcurrent with any other live loads.
6) * This truss has been designed for a live load of 20.0psf on the bottom chord in all areas where a rectangle 3-06-00 tall by 2-00-00 wide will fit between the bottom chord and any other members.
7) Provide me... bearing plat... joint 7, 177... 10.
8) This truss is... International... R802.10.2 a...
9) Hanger(s) o... provided s... lb down and... lb up at 7-6... and 977 lb d... down and 5... design/sele... responsibil...

LOAD CASE(S) ...
1) Dead + Roof Live (balanced): Lumber Increase=1.15, Plate Increase=1.15
Uniform Loads (lb/ft)
Vert: 1-5=-60, 5-7=-60, 14-18=-20
Concentrated Loads (lb)
Vert: 10=-955 (B), 22=-1621 (B), 23=-1004 (B), 24=-993 (B), 25=-977 (B)

Ply

2

1) 2-ply truss to be connected together with 10d (0.131"x3") nails as follows:
Top chords connected as follows: 2x4 - 1 row at 0-9-0 oc.
Bottom chords connected as follows: 2x6 - 2 rows staggered at 0-6-0 oc.
Web connected as follows: 2x4 - 1 row at 0-9-0 oc.

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Info on a Truss Design - k

Nailed ply-to-ply connection detail. Typically, the first note in the note section will be the ply-to-ply connection. Includes fastener(s) type and spacing in all required members.

NAIL FASTENERS

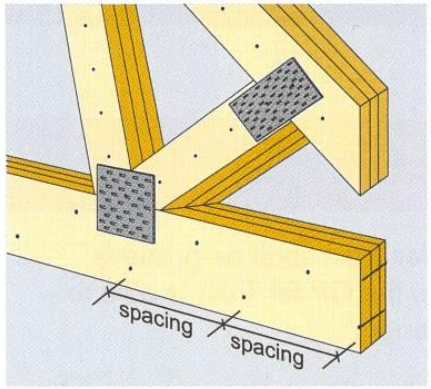

FIGURE B9-4

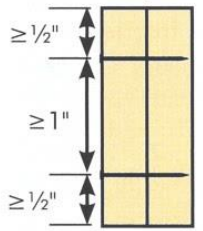

FIGURE B9-5

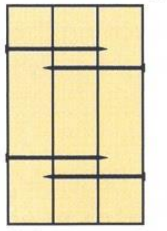

FIGURE B9-6

Note: Multi-ply Girder Trusses that are fastened together with nails at the jobsite shall have the nail heads visible for inspection. This is not required if the multi-ply girder is fastened by the Truss Manufacturer at the manufacturing plant, as the in-plant QC program and third-party inspection process assures that the fastening is performed per the requirements of the TDD.

Courtesy of SBCA from BCSI Chapter 9

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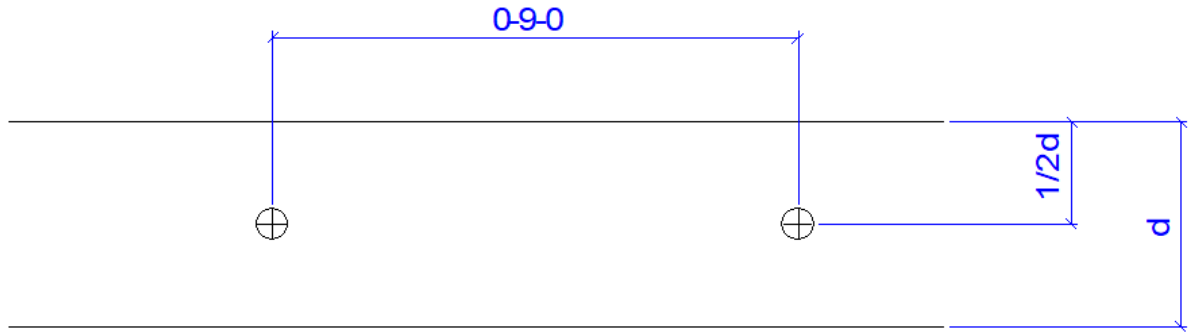
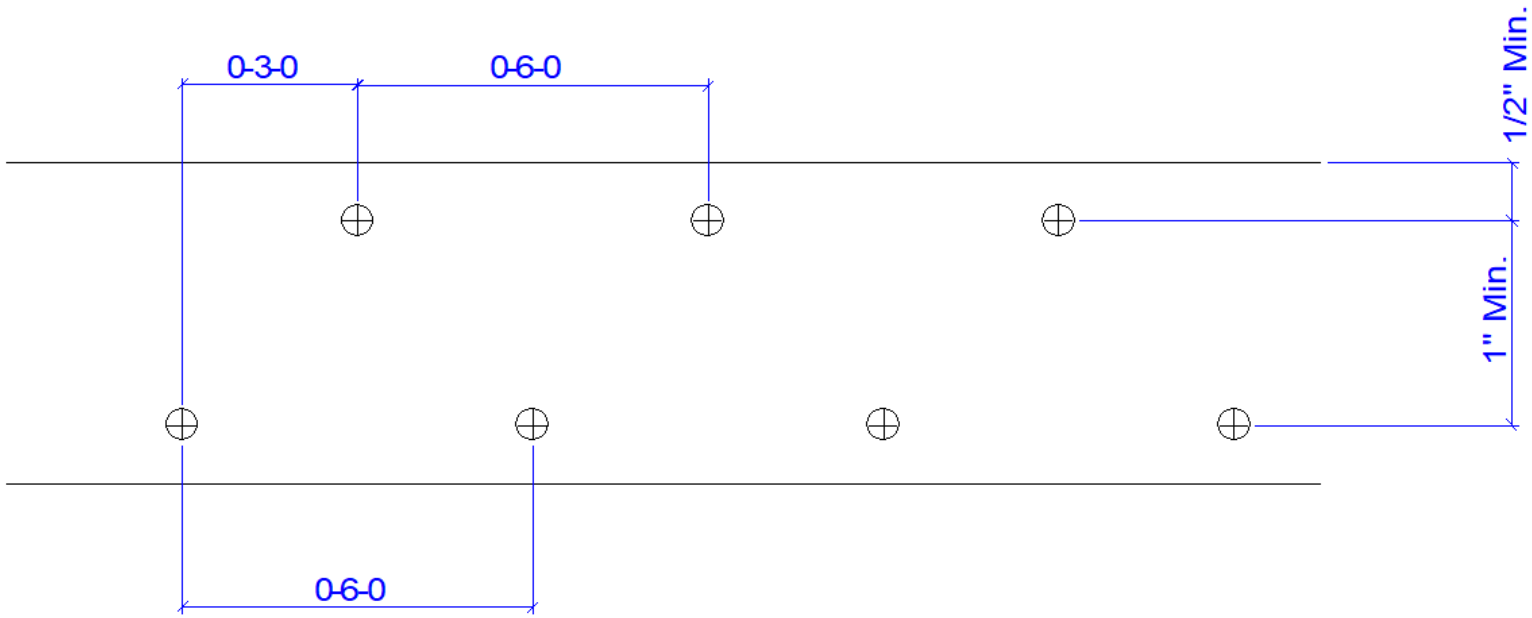
Info on a Truss Design - k



One Row Nails



Two Rows Staggered Nailing

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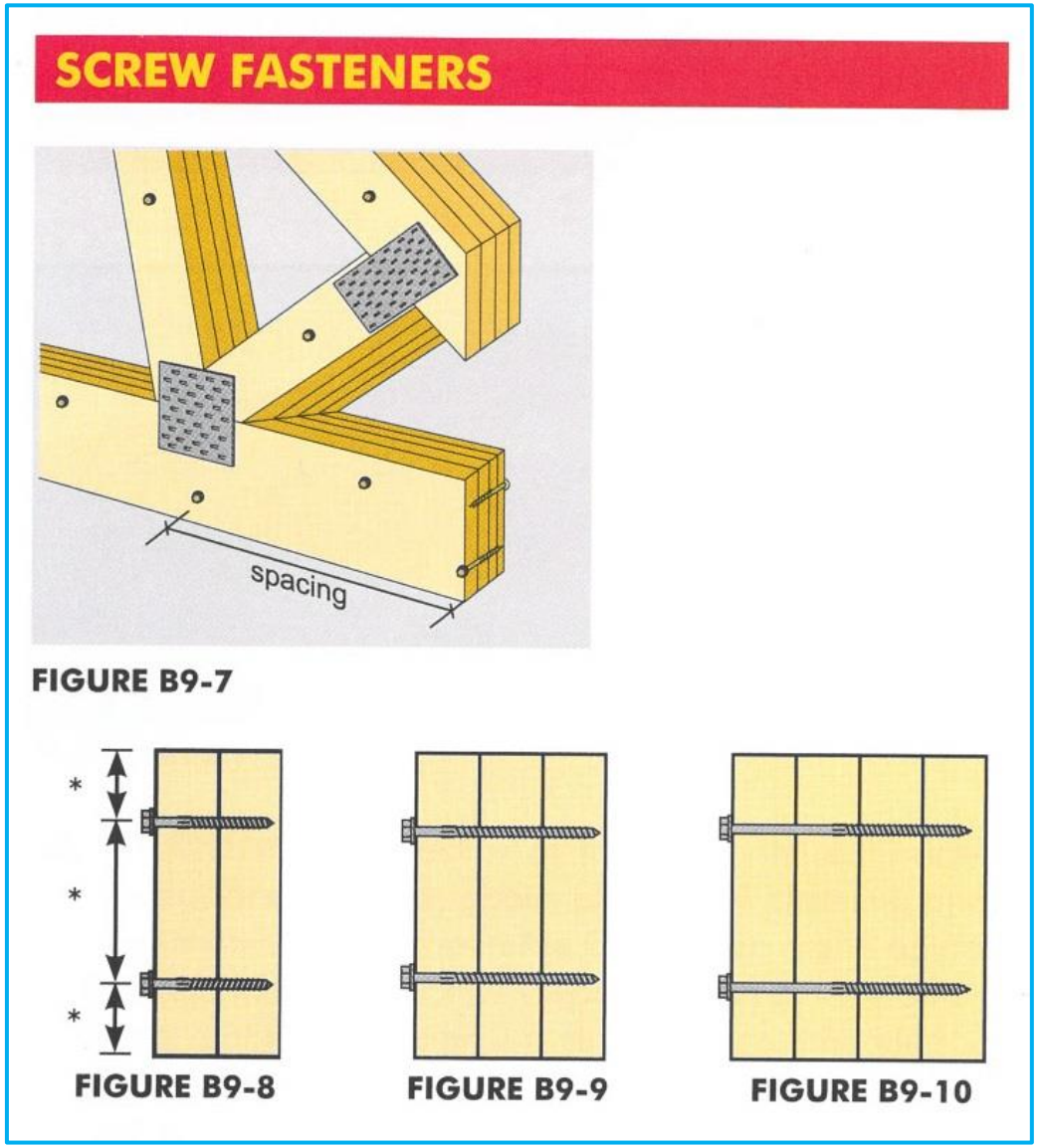
Info on a Truss Design - k

Engineered Screw ply-to-ply connection detail. Screws from loaded face unless otherwise specified by manufacturer.

* Screw pattern and spacing per NDS or Manufacturers specifications.



Courtesy of SBCA from BCSI Chapter 9

Design Engineering Results

Environmental Loads

Loading - Snow	
Consider Snow Load	Yes
Design Method	ASCE 7-16
Snow Load Location	Ground (Pg)
Snow Load	20.0 lb/ft²
Roof Exposure Category	Partially Exposed
Windswept	No
Exposure Factor Ce	1.0
Surface Condition	All others
Overhang Snow Load Factor	1.00
Thermal Condition	Ct=1.1 Structures kept just above freezing
Building Lu	50-00-00
Apply Slope Reduction Factor (Ps)	Yes
Unbalanced snow load	Do For Any Geometry

TCLL: ASCE 7-16; Pr=20.0 psf (roof LL: Lum DOL=1.15 Plate DOL=1.15); Pg=20.0 psf; Pf=15.4 psf (Lum DOL=1.15 Plate DOL=1.15); Is=1.0; Rough Cat B; Partially Exp.; Ce=1.0; Cs=1.00; Ct=1.10

Environmental Loads

Loading - Wind	
Consider Wind Load	Yes
Wind Design Method	MWFRS (Envelope)/C-C hybrid Wind ASCE 7-16
Directions	Four
Ground Elevation	0-00
Ground Elevation Factor, Ke	1.00
Building Rigidity	Rigid
Occupancy/Risk Category	II> All buildings except those listed below...
MWFRS Roof Zone	Exterior
C-C Roof	Automatic
Wind Velocity	115 mph
Directionality Factor	0.85
Opening Conditions	Enclosed Bldg.(Cond.I)
Height Above Ground	25-00-00
Run Components and Cladding Load Cases	No
Number of CC load cases	Directional Envelope
Max Top Chord Dead Load	6.0 lb/ft²
Max Bottom Chord Dead Load	6.0 lb/ft²
Building Width	24-00-00
Truss Category	Common

Wind: ASCE 7-16; Vult=115mph (3-second gust) Vasd=91mph; TCDL=6.0psf; BCDL=6.0psf; h=25ft; Cat. II; Exp B; Enclosed; MWFRS (envelope) exterior zone and C-C Exterior(2E) -1-0-0 to 2-0-0, Interior (1) 2-0-0 to 12-0-0, Exterior(2R) 12-0-0 to 15-0-0, Interior (1) 15-0-0 to 25-0-0 zone; cantilever left and right exposed ; end vertical left and right exposed;C-C for members and forces & MWFRS for reactions shown; Lumber DOL=1.60 plate grip DOL=1.60

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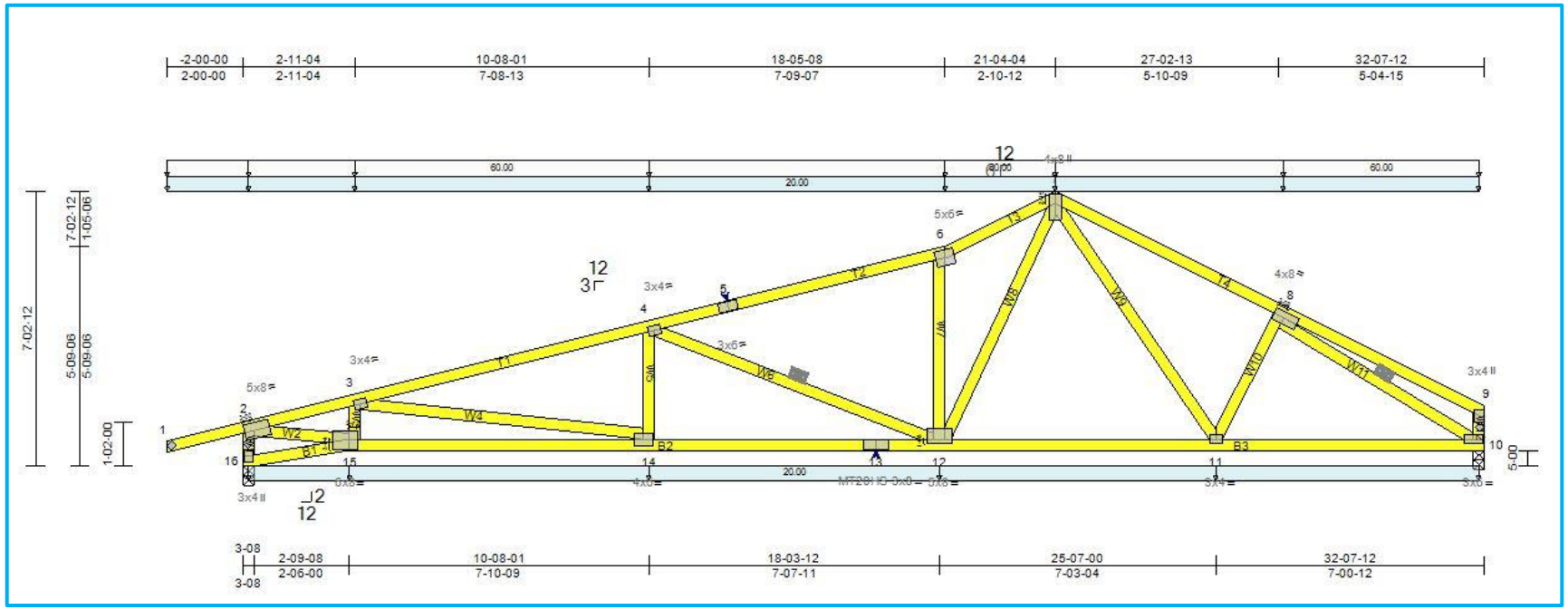
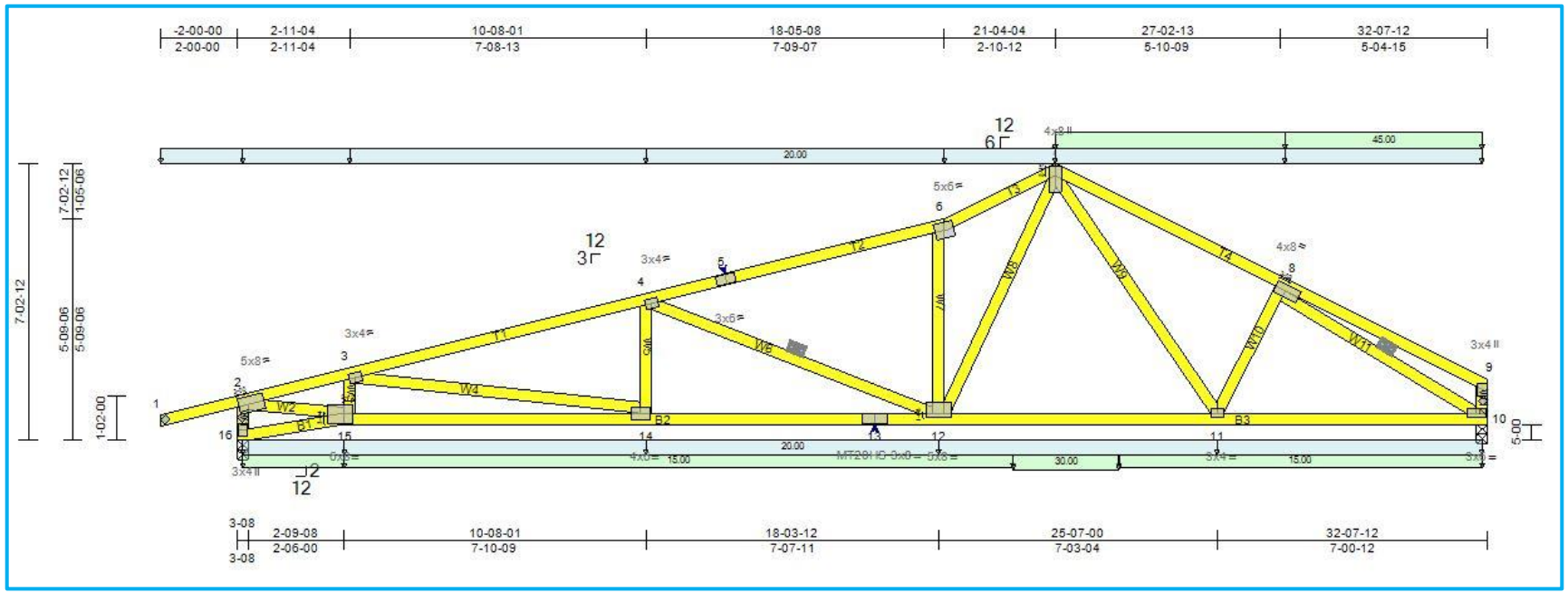
Load Case Results



Load Case #1, Balanced Snow Load



Load Case #49, Unbalance Load with Attic Storage

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THANK YOU FOR YOUR TIME!

ANY QUESTIONS/COMMENTS?

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How to Read Truss Documentation
Course ID ICC #9773 0.1 CEU
AIA LU|HSW MII001-2025, 1 hr

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