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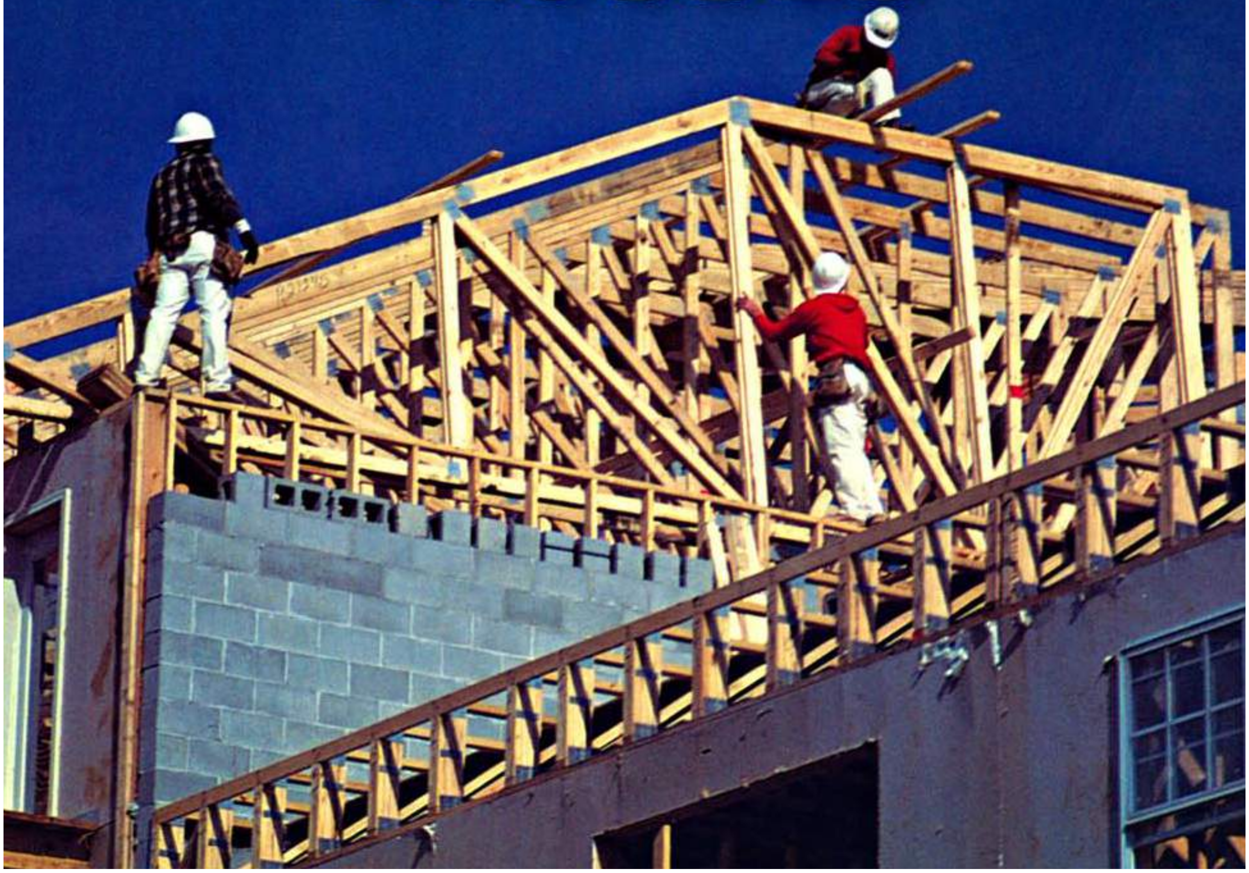
ITW Building Components Group

ENCYCLOPEDIA OF TRUSSES



A GUIDE TO USING TRUSSES

Compliments of Turkstra Lumber

Since 1966 architects and builders have specified millions of roof and floor trusses engineered by the staff of Alpine Engineered Products, Inc. These trusses, manufactured by truss plants in every state and province, are used in one of every five homes built in the U.S. and Canada today, as well as in many commercial, institutional and agricultural buildings.

Alpine maintains a leadership position in the industry through research, development, technical knowledge and customer oriented service. Our truss manufacturers are supported by more than 30 professional engineers in the U.S. representing all 50 states and the 10 provinces in Canada, and more than one hundred other design and computer technicians.

Alpine's truss design methodology is in accordance with national standards and is backed by extensive research and testing.

Truss manufacturers in the United States, Canada, the United Kingdom, and South Africa depend on Alpine for truss assembly equipment, metal connector plates, truss design service, design software, connectors and anchors, and other truss related products.

The Encyclopedia of Trusses is intended as a guide to architects, engineers, building designers and contractors for suggested uses of trusses. The building code of jurisdiction and a truss design professional should be consulted before incorporating information from this publication into any structure. The contents herein are for the exclusive use of component manufacturers who use products from Alpine Engineered Products, Inc. in the sale and promotion of trusses.

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Special Benefits for Architects and Engineers

- Using Alpine's proprietary software, truss designers can produce engineered shapes that satisfy virtually any aesthetic and functional specification by the building design professional.
- Trusses offer simple solutions to complex designs and unusual conditions without inhibiting building design freedom.
- Nationally recognized standards for truss design and manufacturing of metal plate connected wood trusses have been adopted by major model building codes. This ensures a quality product.
- Truss manufacturers that use Alpine software are available for consultation when special framing situations arise.
- Alpine professional engineers are committed to providing the highest quality, cost efficient structural products for your clients.
- Wood trusses connected with Alpine metal plates enjoy an outstanding record of more than 35 years of proven performance and durability.

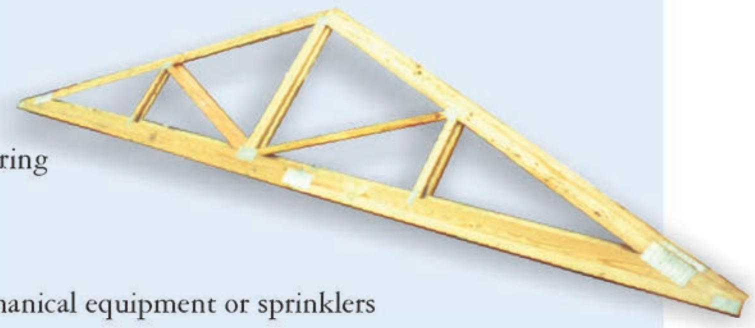
Special Benefits for Contractors

- The use of preassembled components generates less waste at the jobsite. This improves safety and reduces cleanup costs.
- Trusses are built in a computer-aided manufacturing environment to assure accuracy and quality.
- Industry standards for manufacturing and handling assure code-compliance.
- Trusses are lightweight and easy to install, requiring only normal construction tools.
- The wide nailing surface of 4x2 floor trusses safely speeds deck and flooring installation.
- Expenses are accurately controlled because truss costs can be predetermined. On-site losses from miscutting, theft and damage are virtually eliminated.
- Open web design allows easy installation of plumbing, electrical wiring and heating/cooling duct work.
- Trusses are available locally for fast delivery. More than 550 truss manufacturers throughout the United States and Canada are backed by the expertise of Alpine Engineered Products, Inc.

Special Benefits for the Owner

- The owner can enjoy peace of mind, knowing that the trusses have been professionally engineered and quality manufactured for the specific job.
- The resiliency of wood provides a floor system that is comfortable.
- Wood is a natural insulator because it is composed of thousands of individual cells, making it a poor conductor of heat and cold.
- Roof truss details such as tray, vaulted or studio ceilings improve the appearance and comfort of homes, offices, churches and commercial buildings.
- Floor trusses can conceal mechanical services, leaving a clear plane for ceiling installations. This is ideal for finished rooms in a lower level.
- Trusses provide clear spans so interior walls can be moved easily during remodeling or when making additions.

Checklist of Information Needed by Truss Manufacturers to Design and Manufacture an Order of Trusses



- ❑ Building Code of Jurisdiction
- ❑ Building use
- ❑ Geometry
- ❑ Location and size of all points of bearing
- ❑ Center-to-center spacing of trusses
- ❑ Design loads
  - Uniform live and dead loads
  - Concentrated loads such as mechanical equipment or sprinklers
  - Special load cases
  - Environmental loads (wind, snow and seismic)
- ❑ Special conditions
  - Corrosive environments, etc.

A discussion of each item follows:

Building Code of Jurisdiction

Generally, local building codes are based on one of the national model codes. However, many local jurisdictions have variances that can have an impact on truss design. It is therefore important that the truss designer be informed of all codes of jurisdiction. The model codes referred to are: The IBC *International Building Code* and the IRC *International Residential Code*, published by the International Code Council (ICC), the BOCA *National Building Code*, published by the Building Officials Conference of America International (BOCA); the *Uniform Building Code*, published by the International Conference of Building Officials (ICBO); and the *Standard Building Code*, published by the Southern Building Code Congress International (SBCCI) and in Canada, the *National Building Code of Canada* (NBCC) as adopted by the various Provincial Authorities.

Building Use

Building regulations differ for various types of use and occupancy. Specify classification of use, such as single family residential, multi-family residential, offices, retail, manufacturing, churches, institutional (long-term care, nursing homes, schools, hospitals, jails, etc.) or agricultural (non-human occupancy).

Geometry

Furnish span (out-to-out of bearings, plus cantilevers, if any), slope, overhang conditions, etc., that form the profiles or external geometry of the trusses. Web configuration need not be furnished, as it is determined by the overall truss design. Also furnish any minimum lumber size requirements.

Bearings

Specify all exterior and interior points of bearing, showing location by dimension and size. Reaction forces at point of bearing may affect the required size of bearing surface to prevent crushing.

Spacing

Give center-to-center spacing of trusses. If trusses are spaced greater than 24 inches center-to-center, it is necessary to indicate the purlin spacing and method of attachment to the trusses.

Design (Specified) Loads

Truss design (specified) loads include both live and dead loads which may be uniformly distributed or may be concentrated at various locations.

LIVE LOADS: Live loads are non-permanent loads. Environmental loads produced by snow, wind, rain, or seismic forces are live loads. The weight of temporary construction materials and occupant floor loads are live loads. Live loads are usually uniform in their application and are set by building codes or building designer. Live loads will vary by location and use and should be furnished in pounds-per-square-foot, or other clearly defined format.

DEAD LOADS: Dead loads are the weight of the materials in the structure and any items permanently placed on the structure.

SPECIAL LOADS: Special loads can be live or dead. Examples of special loads might include mechanical units, poultry cages, cranes, sprinkler systems, moveable partition walls, etc. The weight, location and method of attachment must be provided to the truss designer.

Multiple load cases may be required in truss design.

Special Conditions

Some of the special conditions that are important to truss design include:

1) Jobsite conditions that may cause rough handling of the trusses.
2) High moisture or temperature conditions.
3) Use of trusses to transfer wind loads.
4) Fire resistance requirements.
5) Higher adjacent roofs that may discharge snow onto lower roofs.
6) Location from coastline, exposure and height above ground for wind.
7) Parapets, signage or other obstructions that may cause snow drifting, or prevent the free runoff of water from the roof.
8) Any other condition that affects the load carrying ability of the roof or floor framing.
9) Floor trusses, office loads or ceramic tiles require special considerations during the building and truss design process.

Lack of information about any of these conditions could adversely affect the performance of the trusses.

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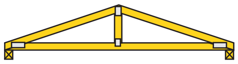
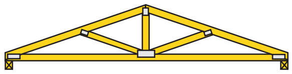
Truss Configurations

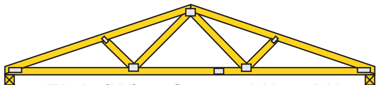
Wood trusses are pre-built components that function as structural support members. A truss commonly employs one or more triangles in its construction. The wood truss configurations illustrated here are a representative sampling.



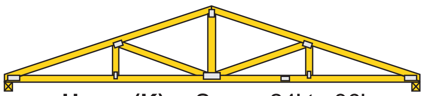
King Post -- Span Up to 16'



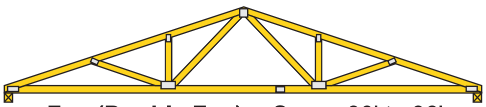
Queen Post (Fan) -- Spans 10' to 22'



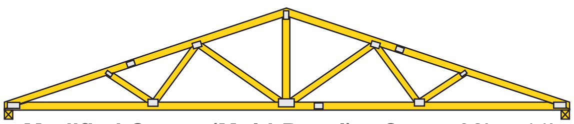
Fink (W) -- Spans 16' to 33'



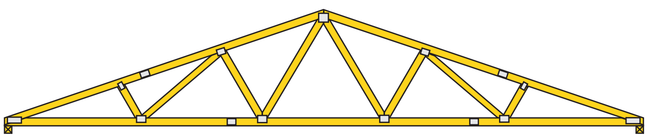
Howe (K) -- Spans 24' to 36'



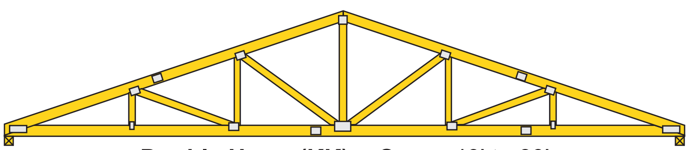
Fan (Double Fan) -- Spans 30' to 36'



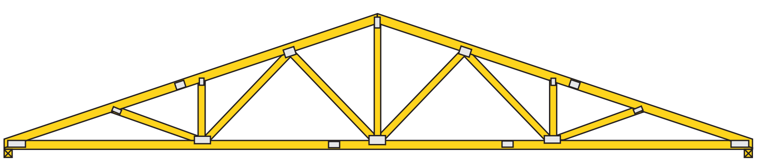
Modified Queen (Multi-Panel) -- Spans 32' to 44'



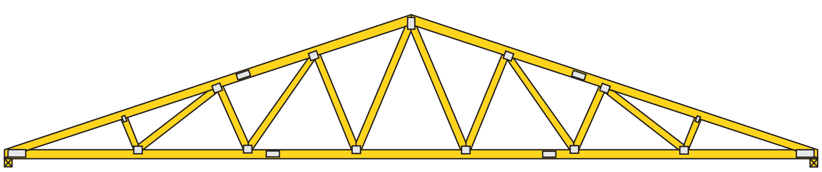
Double Fink (WW) -- Spans 40' to 60'



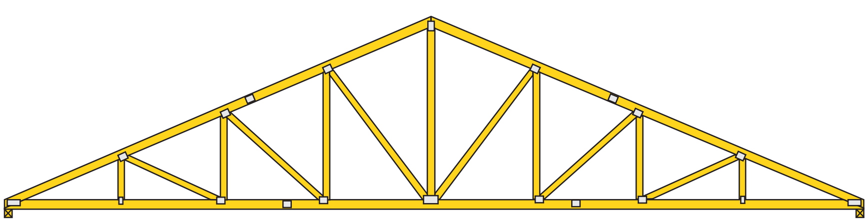
Double Howe (KK) -- Spans 40' to 60'



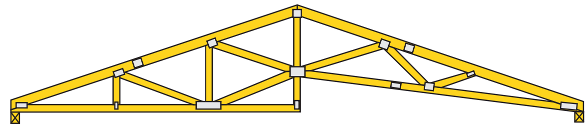
Modified Fan (Triple Fan) -- Spans 44' to 60'



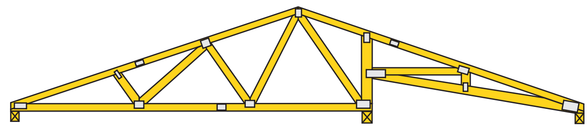
Triple Fink (WWW) -- Spans 54' to 80'



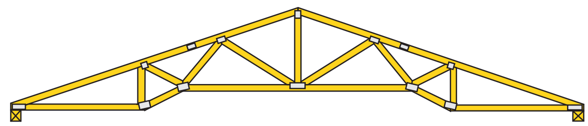
Triple Howe (KKK) -- Spans 54' to 80'



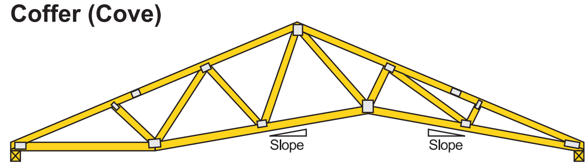
Vault - Two Bearing Points



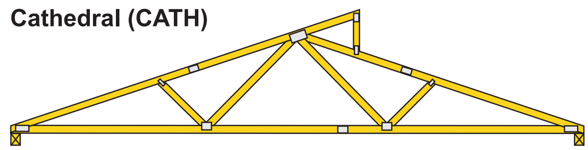
Vault - Three Bearing Points



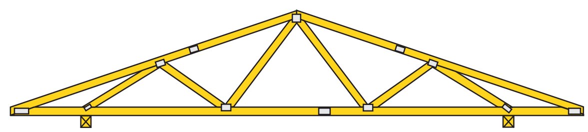
Coffer (Cove)



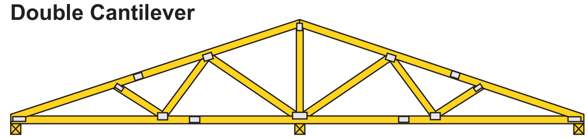
Cathedral (CATH)



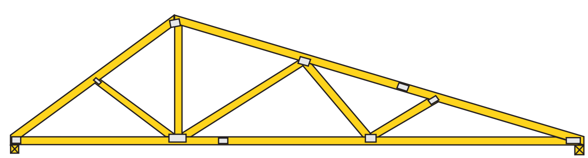
Clear Story



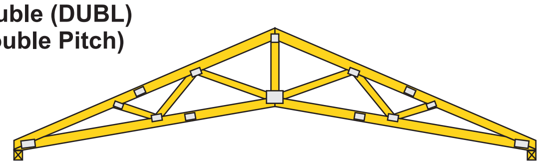
Double Cantilever



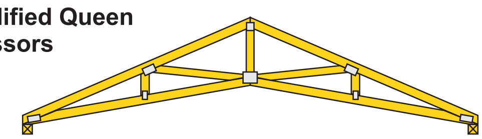
Tri-Bearing



Double (DUBL)
(Double Pitch)

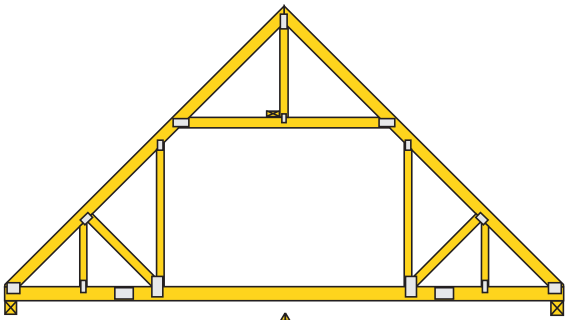


Modified Queen
Scissors

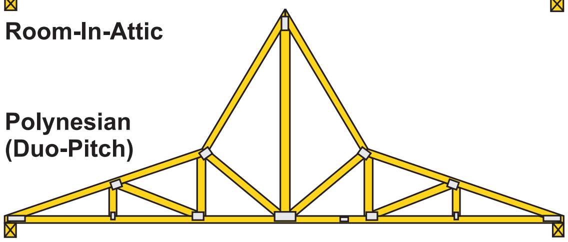


Howe Scissors

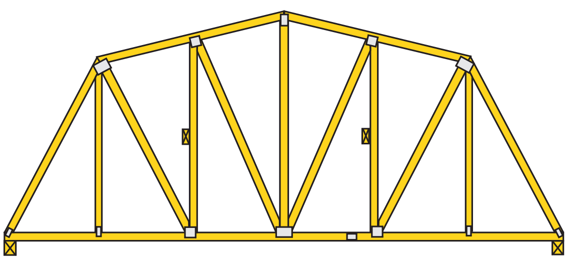
The number of panels, configuration of webs and allowable length of spans will vary according to given applications, building materials and regional conditions. Always refer to an engineered drawing for the actual truss design.



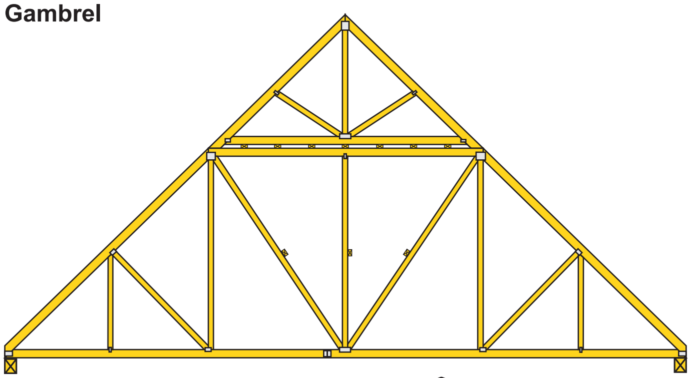
Room-In-Attic



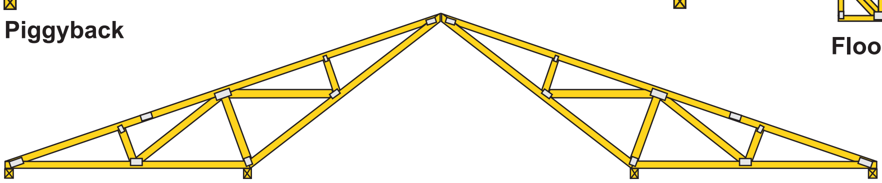
Polynesian (Duo-Pitch)



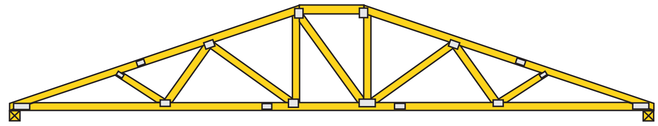
Gambrel



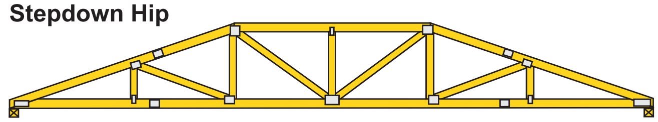
Piggyback



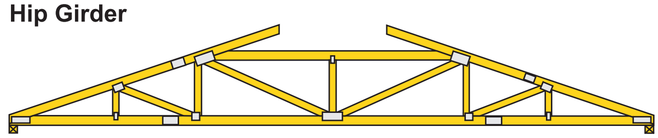
Double Inverted -- Lengths 50' to 80'



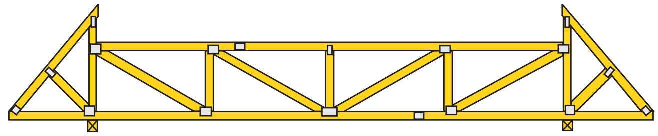
Stepdown Hip



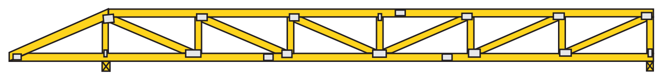
Hip Girder



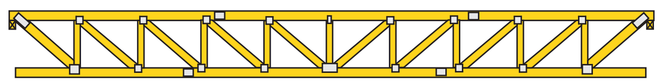
California Hip



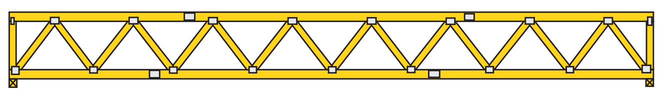
Double Cantilever With Parapets



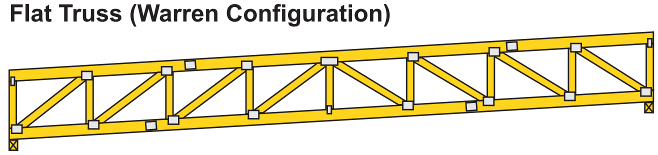
Flat Truss With Cantilever (Pratt Configuration)



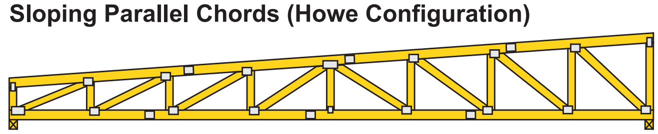
Top Chord Bearing Flat Truss (Pratt Configuration)



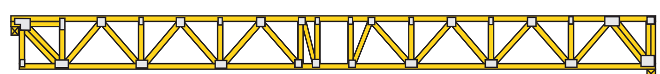
Flat Truss (Warren Configuration)



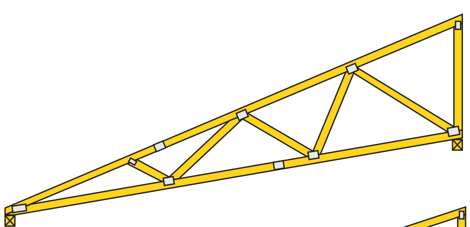
Sloping Parallel Chords (Howe Configuration)



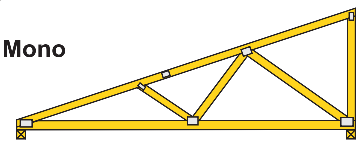
Sloping Top Chord (Howe Configuration)



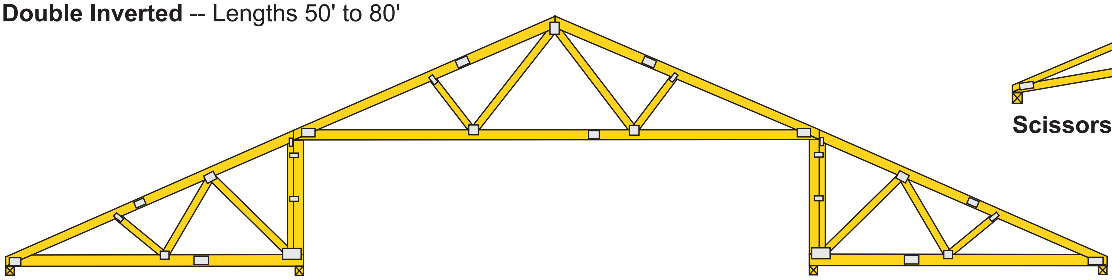
Floor Truss (System 42 - Modified Warren Configuration)



Scissors Mono

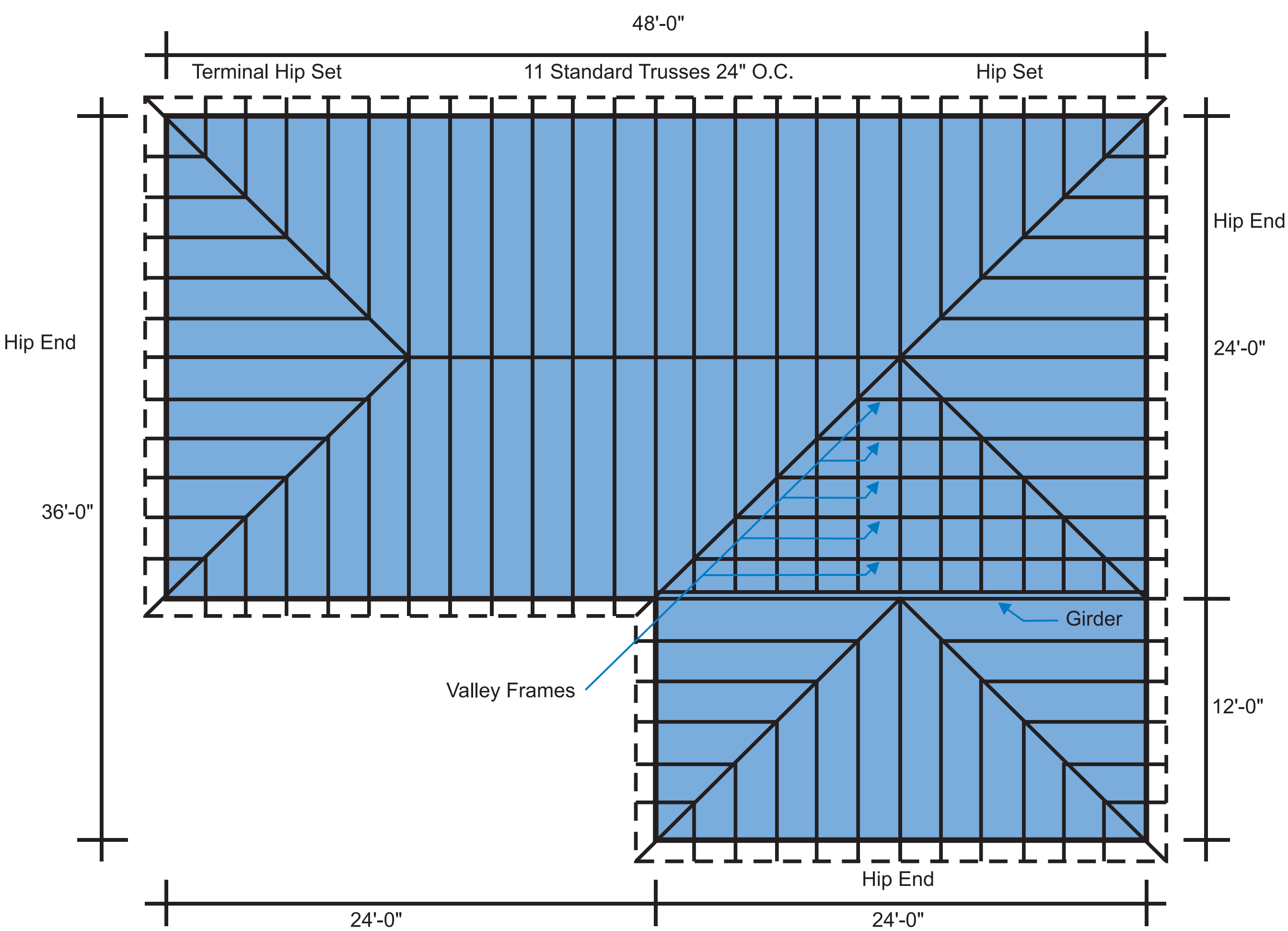


Mono



Three Piece Raised Center Bay -- Lengths 50' to 100'+

To Figure Truss Requirements	Calculations	Truss Order
1 Determine the part of the larger rectangle requiring common trusses (distance from peak point to peak point) by subtracting the width or span from the length	48'-0" - 24'-0" = 24'-0" Distance requiring. Standard Trusses.	**FOR LARGE RECTANGLE** 5 Standard 24'-0" trusses overhang on both ends.
2 Divide this distance by 2 (trusses are set 24" on center) and subtract one truss.	24'-0" ÷ 2 = 12 Trusses. 12 - 1 = 11.	6 Standard 24'-0" Trusses clipped on one end. 1 Terminal Hip Set 24'-0" overhang both ends.
3 Add the number of Hip Ends required.	2 Hip Ends.	1 Terminal Hip Set 24'-0" overhang one end.
4 No overhang on trusses to be carried by the girder.		**FOR SMALLER RECTANGLE** 1 Girder 24'-0" Span.
5 Determine the Multi-Ply Girder.	24'-0" Span Girder carrying 24-0" Span Trusses.	1 Terminal Hip Set, 24'-0" span, overhang on both ends.
6 Add one Hip End for the Projection.	1 Hip End.	1 Set of 5 Valley Frames.
7 Determine the number of Valley Frames.	Valleys for 24'-0" Span.	



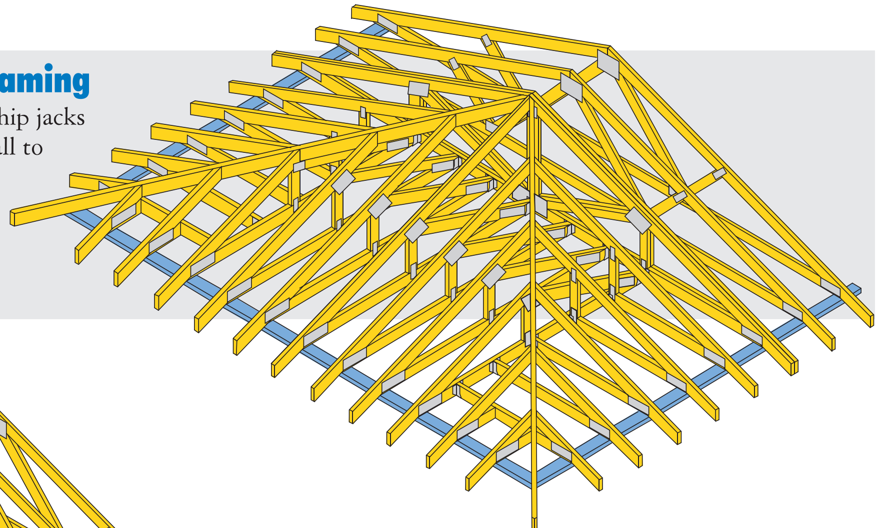
Framing With Trusses: Roofs

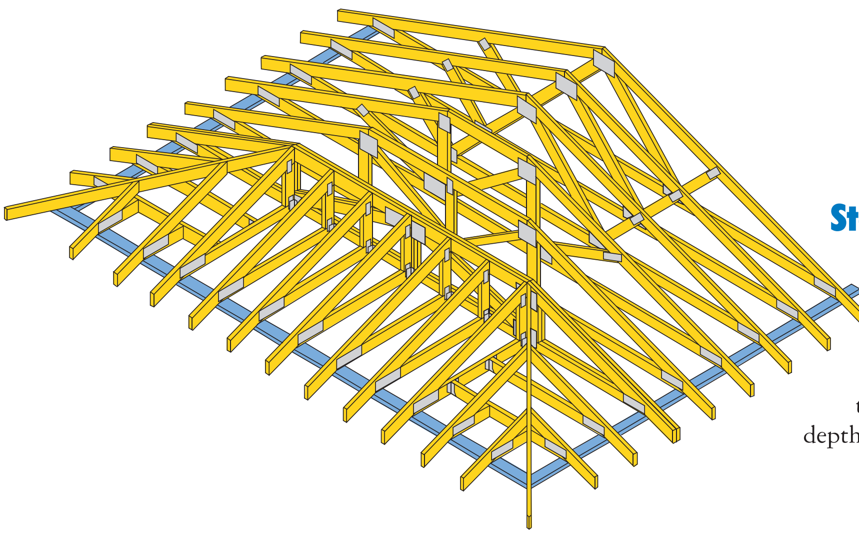
Hip Framing

Trussed hip framing offers the advantage of clear span, an eave or fascia line at the same elevation around the building, and the speed of pre-built components. The end slope may be equal to or different from the side slope. The ceiling line may be flat or sloped. Sloped ceilings have limitations, therefore, consult the truss designer.

Terminal Hip Framing

Best suited for relatively short spans of 26'-0" or less, the hip jacks extend directly to the peak. The distance from the end wall to the face of the girder is equal to one half the span, provided the slopes are equal. The last standard truss is designed as a girder to carry the loads transferred by the hip jack.



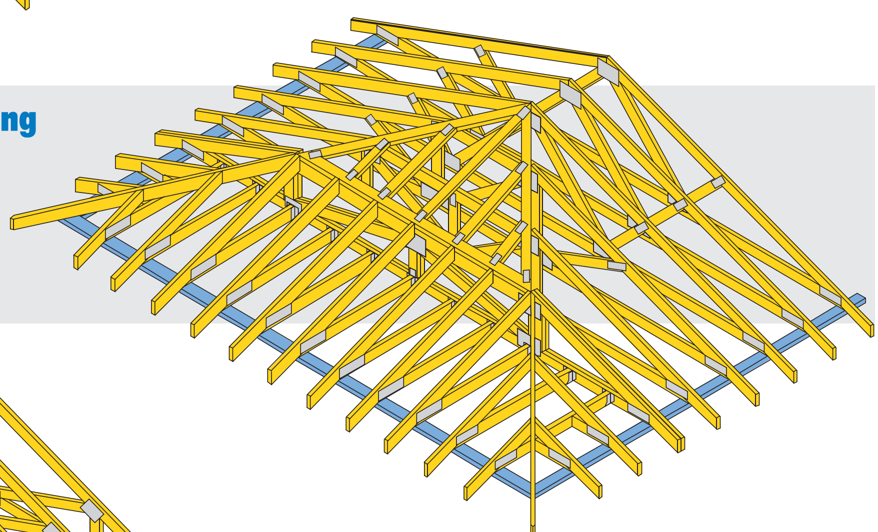


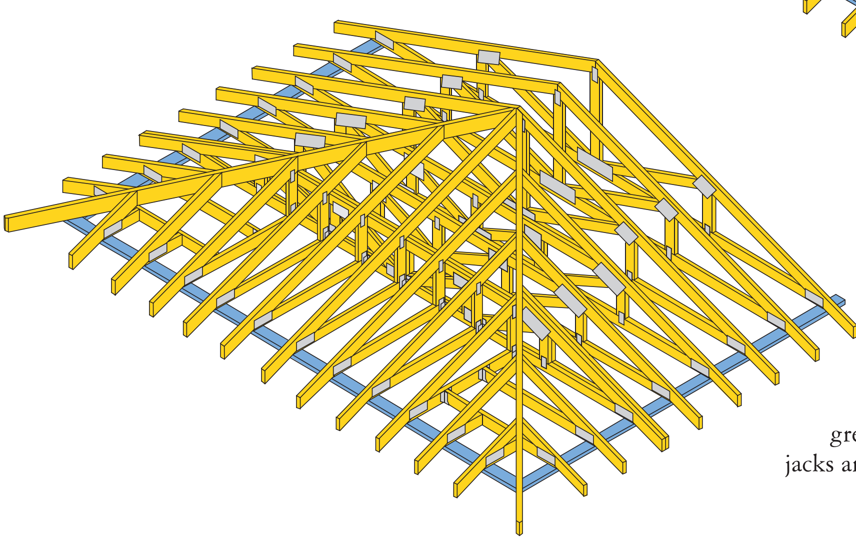
Step Down Hip Framing

Better suited for longer spans, the Step Down hip is the most versatile of all hip types. Each of the “step down” trusses is the same span and has the same overhang as the adjacent standard trusses, but decrease in height to form the end slope. The girder location is generally from 8 to 12 feet from the end wall and is determined by the span to depth ratio. The corner and end jacks are normally pre-built.

Midwest Hip Framing

The Midwest type hip framing was developed to create a more uniform configuration of each of the trusses in the hip. This hip type also provides for a more uniform structure for attaching the decking. Span capability is the same as the step down hip.



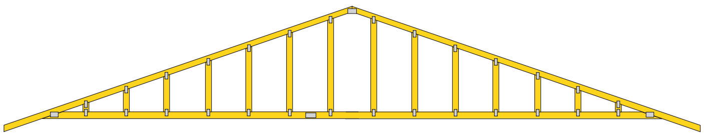


California Hip Framing

Although this type hip framing is used as an alternative to the step down hip, the California hip is similar in span capability and field installation. The base portion of each truss inside the girder is the same, except that the sloping top chord of each successive truss is extended upward greater amounts to form the slope intersection. Corner and end jacks are used to form the area outside the girder.

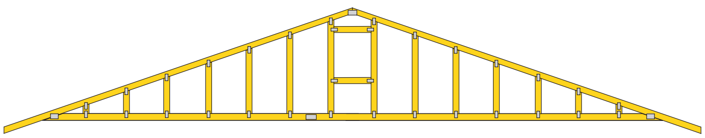
Gable Framing

Gable ends when not configured in triangles as a truss, are more related to stud walls. However, they are structural elements and are analyzed to resist wind and seismic loads as noted on the truss design. The web design or framing pattern is determined by the type of siding, either horizontal or vertical, and the need for a louver in the end of the building. The type of gable required is controlled by the end overhang and the need to match a soffit line.

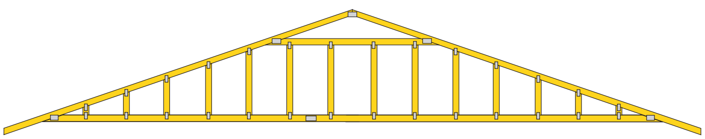


Standard Gable

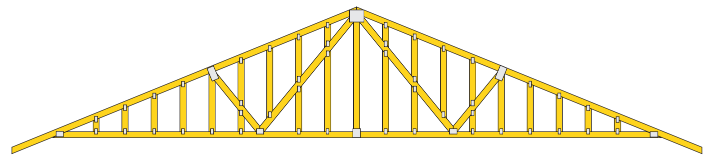
Stud spacing as necessary to support siding.



Standard Gable Framed For Rectangular Louver

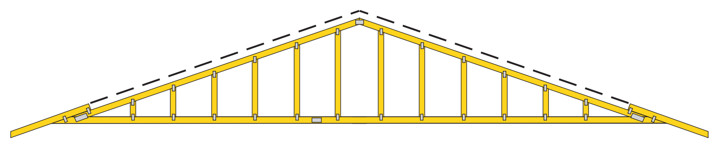


Standard Gable Framed For Triangular Louver



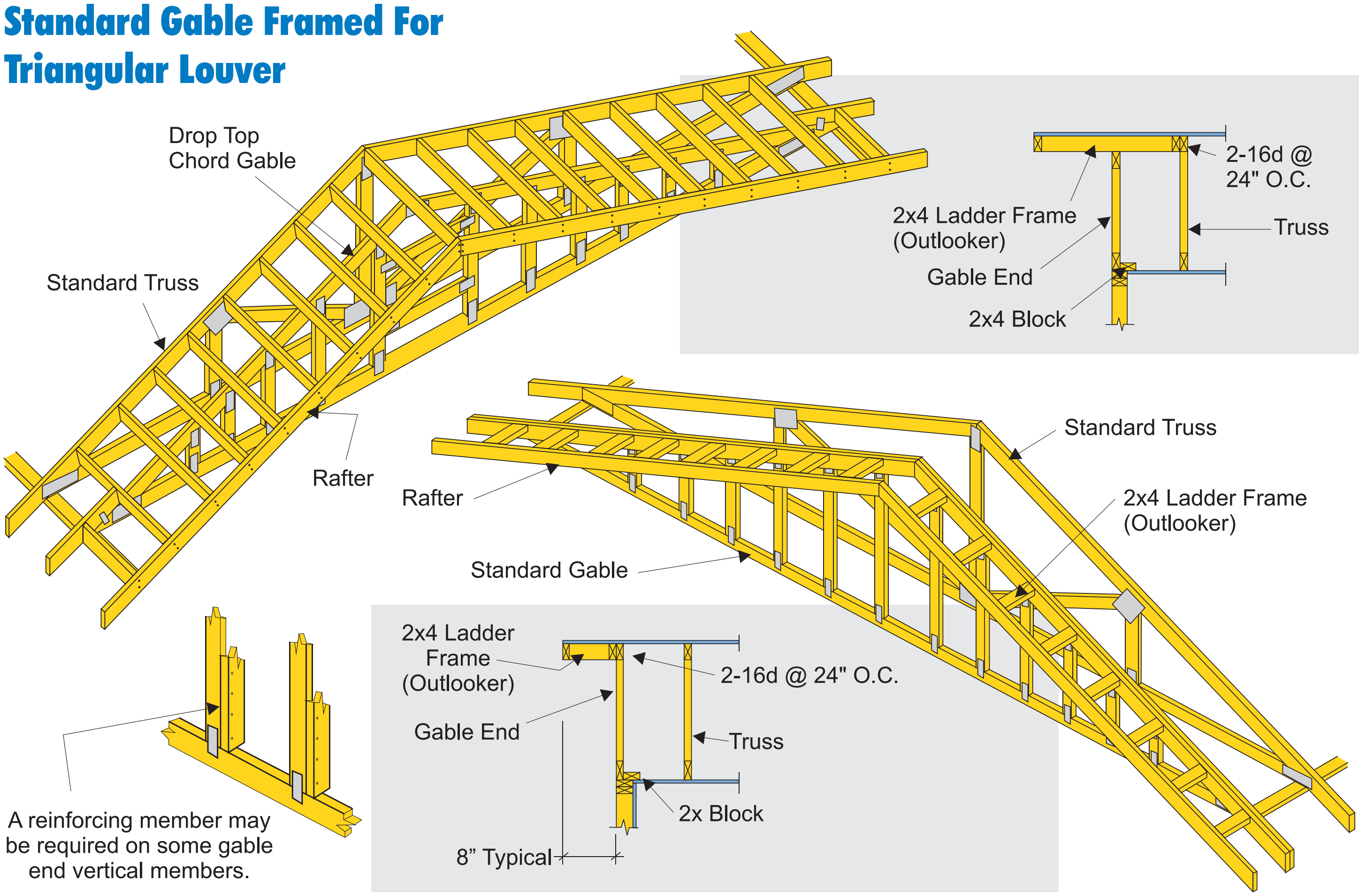
Clearspan Gable

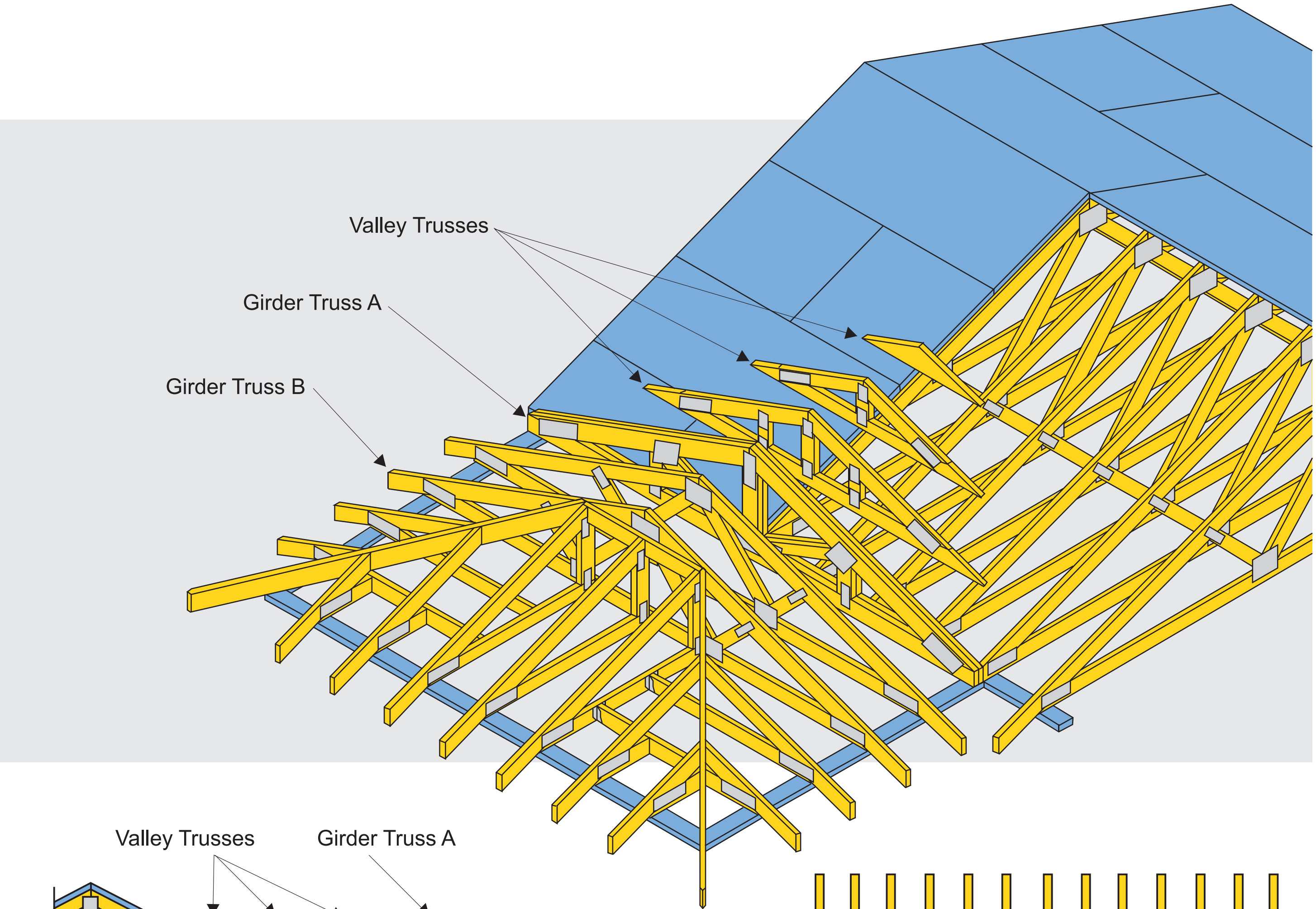
Used when the gable wall does not provide continuous bearing support for the gable framing.

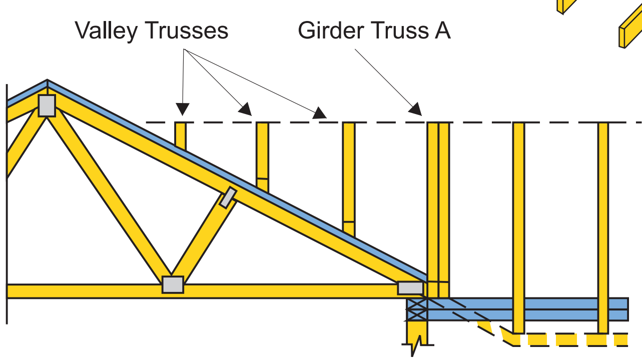


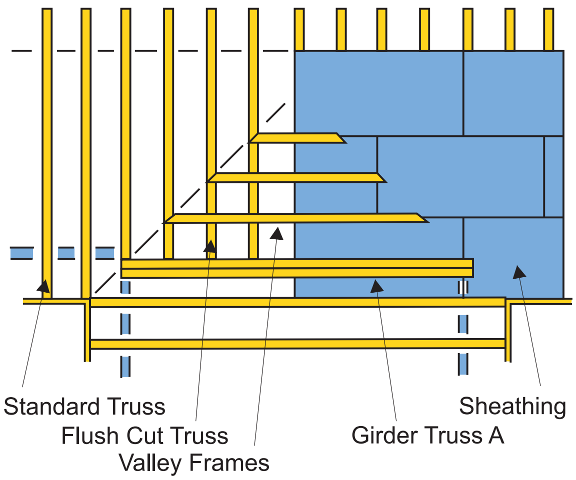
Dropped Top Chord Gable

Illustrated with studs. Also available with framing for rectangular, square or triangular louver.









Girder Trusses

Girder trusses have two main purposes. The first (Girder Truss A) exists in L, T, H and U shaped buildings to eliminate the need for an interior load-bearing wall. The girder is used to support one end of the intersecting trusses. The trusses are carried on the bottom chord of the girder by hangers.

The second use of a girder truss (Girder Truss B) is to support perpendicular framing in hip roofs. In some plans girder truss A and B may be one in the same. The hip framing is carried on both the top and bottom chords of the girder truss by nailing or by hangers.

Girder trusses, because of the heavy loads they support, are generally multiple units with larger chord members than the adjacent trusses. Generally, because of the construction of girders, overhangs are not used.

The girder truss may also be designed for “drag strut” loads which are calculated and specified by the building designer.

Valley Framing Sets

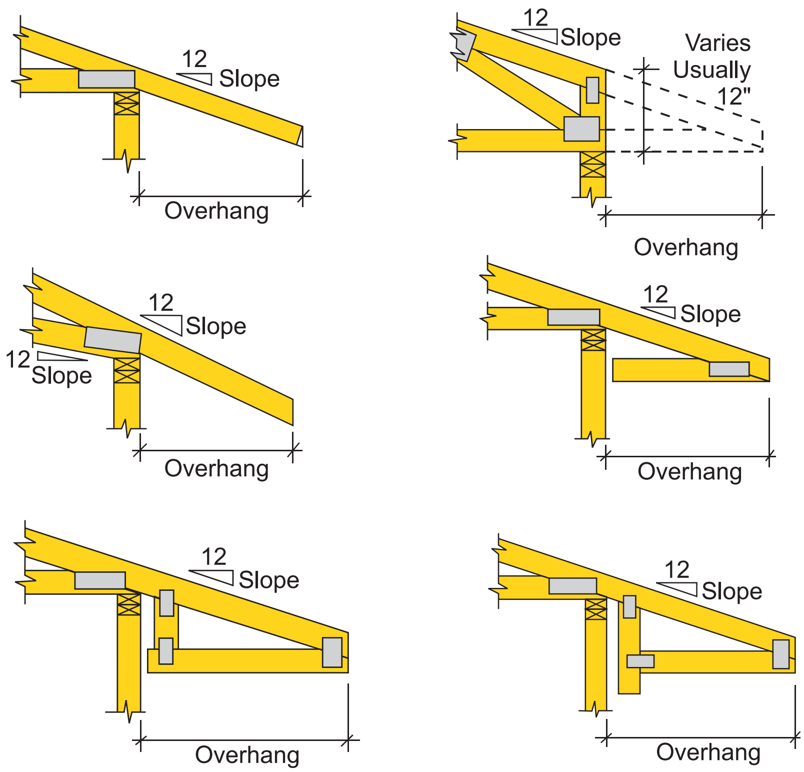
Valley framing sets are primarily used to form a ridge line by framing over the main roof where perpendicular building sections intersect.

Valley trusses are set directly on the main trusses. Sheathing is required for main trusses with 2x4 top chords, and is recommended for other top chord sizes, under valley frames to continue the lateral bracing of the main truss top chords. The bottom chords of the valley trusses are generally beveled to match the slope of the roof below.

Cantilevers and Overhangs

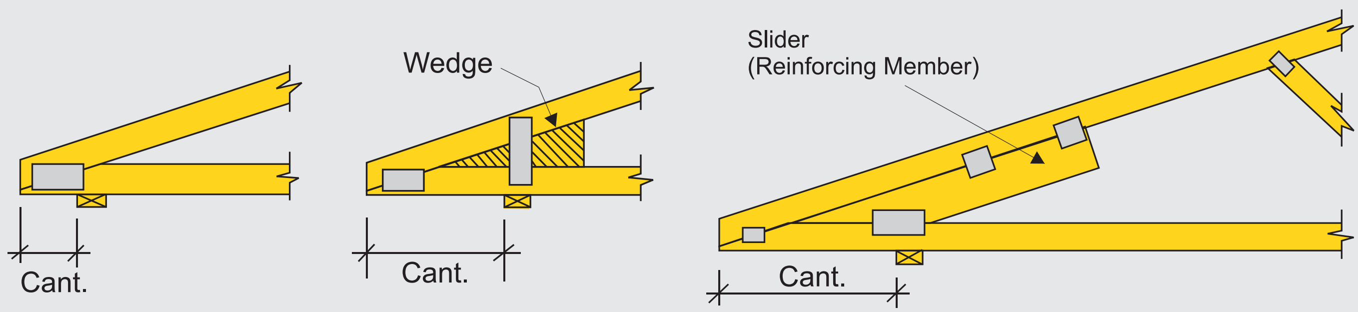
Cantilever conditions are common in truss designs. A cantilever exists when the bearing wall occurs inside of the truss overall length, excluding overhangs, such as to form a porch or entrance way.

When the bearing is located under the scarf line of the truss, no heel joint modification is needed. Wedge blocks or sliders (reinforcing members) are used to stiffen the heel panel when the bearing is moved inside the scarf line. Wedge blocks act to stiffen the heel joint and are connected to the top and bottom chord with connector plates located over or just inside the bearing. Sliders allow longer cantilevers by stiffening the top and bottom chords in the heel panel. Correct plating of sliders varies from normal heel joints.

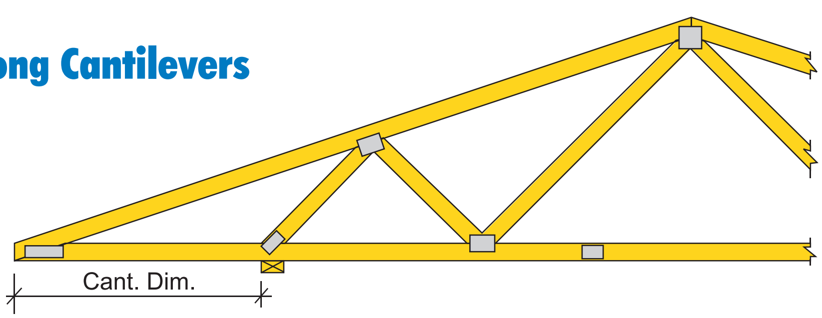


Typical Methods Used In Cantilever Conditions

Exact Method Subject To Final Truss Design

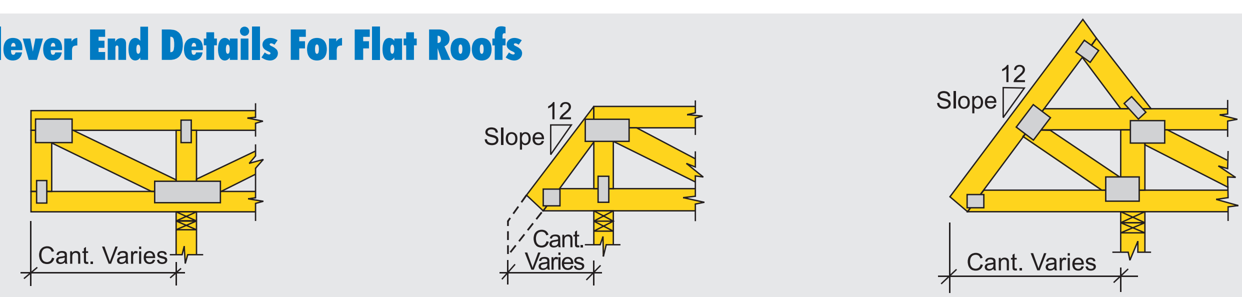


Long Cantilevers

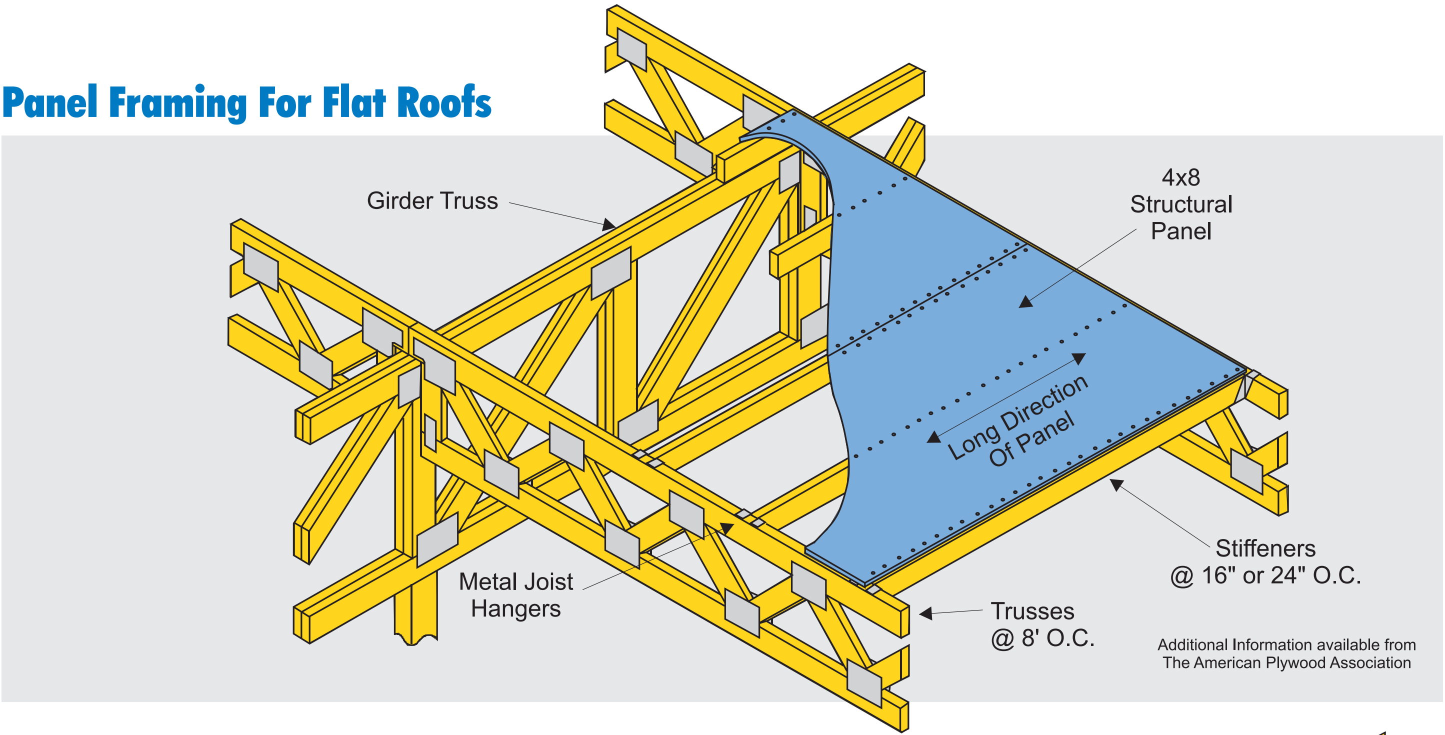


The additional web (strut) is added when the cantilever distance is too long for use with the wedge block or reinforcing member. This member often requires continuous lateral bracing (CLB).

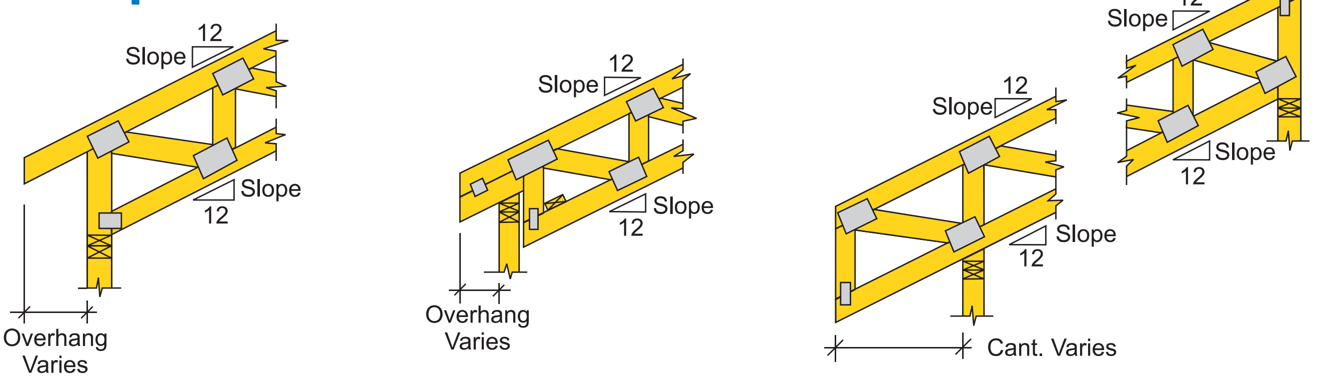
Cantilever End Details For Flat Roofs

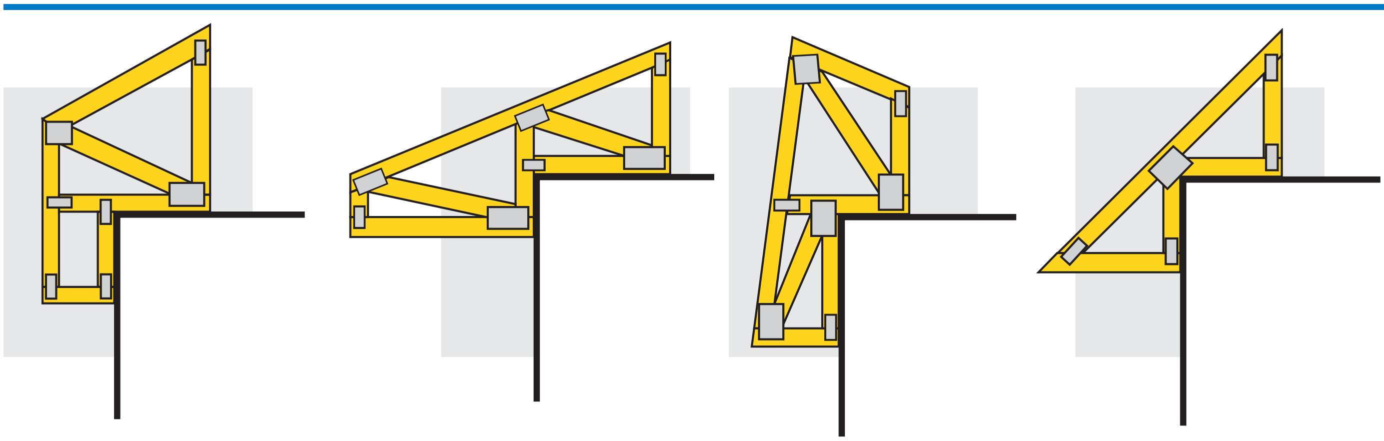


Panel Framing For Flat Roofs



Typical Sloped Flat Truss End Conditions

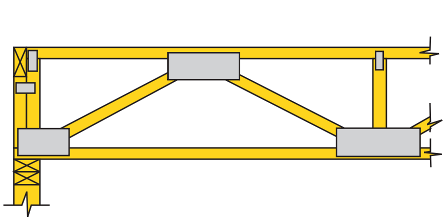




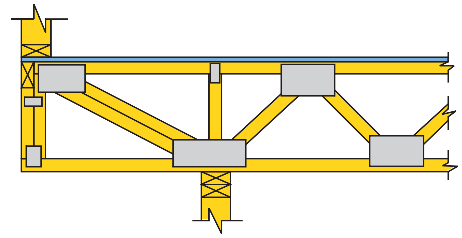
Mansard Frames

Mansard details are normally built onto the truss. However, there are design situations where it is more appropriate to have the mansard frame installed independent of the roof framing. Those occasions might be when the use of the building dictates a construction type requiring masonry exterior walls and a non-combustible roof, difficult erection and handling situations or remodeling. Building codes may require special load cases.

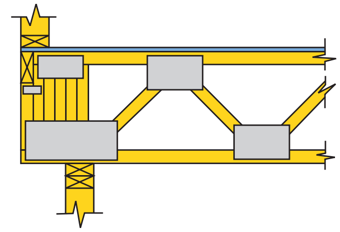
Framing With Trusses: Floors



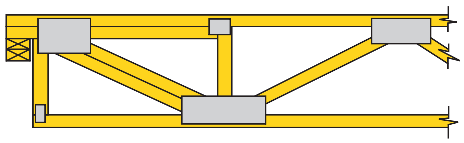
Bottom chord bearing on a stud wall.



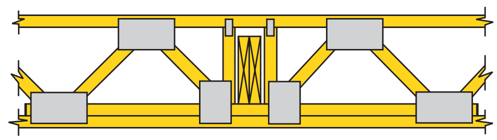
Cantilever with an exterior wall on the end.



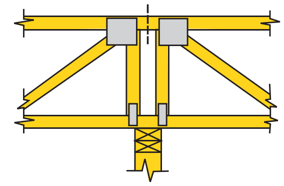
Bottom chord bearing with short cantilever and exterior wall.



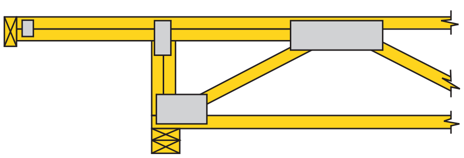
Top chord bearing on stud wall.



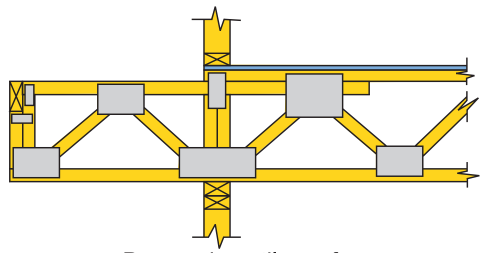
Floor truss designed to carry an interior header.



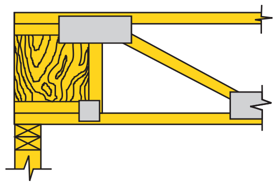
Interior bearing on wall



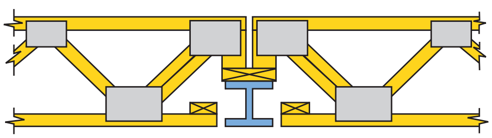
Overhang on a floor truss used on a roof.



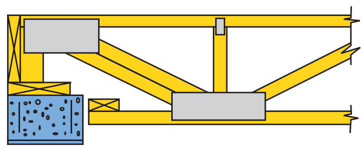
Dropped cantilever for use on exterior balconies.



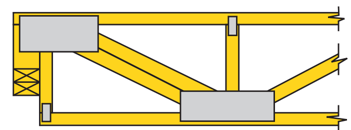
Trimmable end condition with I-Joist insert.



Interior top chord bearing with a variable end height.

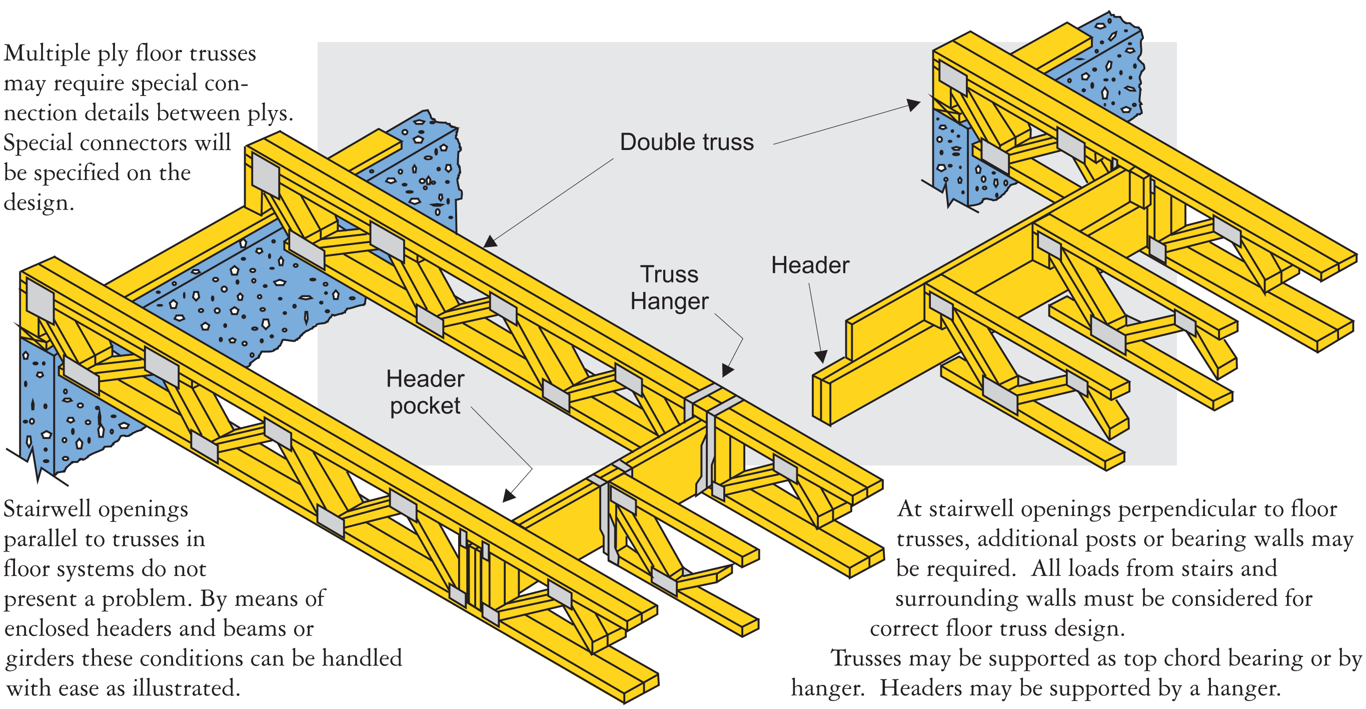


Top chord bearing with a variable end height.



Top chord bearing on stud wall with variable end height.

Multiple ply floor trusses may require special connection details between plys. Special connectors will be specified on the design.

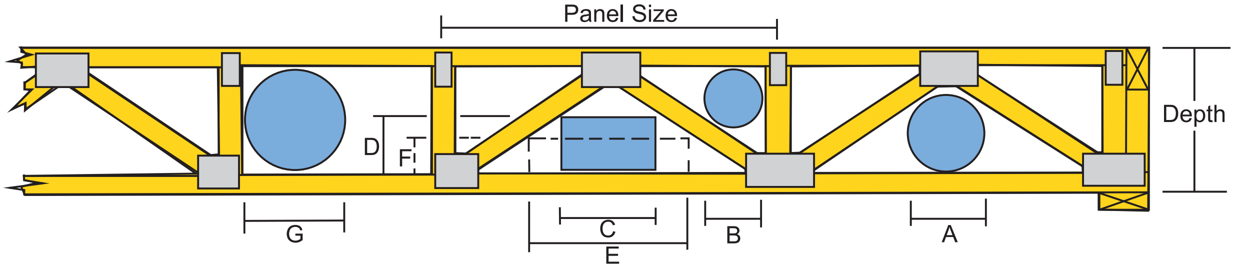


Stairwell openings parallel to trusses in floor systems do not present a problem. By means of enclosed headers and beams or girders these conditions can be handled with ease as illustrated.

At stairwell openings perpendicular to floor trusses, additional posts or bearing walls may be required. All loads from stairs and surrounding walls must be considered for correct floor truss design.

Trusses may be supported as top chord bearing or by hanger. Headers may be supported by a hanger.

Duct Openings For Fan Style Floor Trusses With 4x2 or 3x2 Chords & Webs



Typical Duct Opening Sizes For 4x2 Fan Style Floor Trusses

Depth	Panel Size	A	B	C	D	E	F	G
10	60	4 1/2	4 1/4	11	4 1/2	16	4	7
11	60	5 1/4	5 1/4	12	5 1/2	15	5	8
11 7/8	60	7 3/4	6 3/4	10	6 1/4	14	5 1/2	8 3/4
12	60	6 1/4	6 1/4	14	6	20	5	9
13	60	7 1/4	7 1/4	12	7	18 1/2	6	10
14	60	8 1/4	8 1/4	17	7	22	6	11
15	60	9 1/4	8 1/2	15	8	25	6	12
16	60	10 1/4	9 1/2	14	9	27	6	13
18	60	12 1/4	10 1/2	14 1/2	10 1/2	26	7	15
20	60	14	11 1/2	14 1/2	12	26	8	17
22	60	16	12 1/2	15	13	30	8	19
24	60	18	13 1/2	16	14	32	8	21
26	60	19	14 1/2	18	15	34	8	23
30	60	22	16	20	17	32	10	24
36	60	25	17 1/2	22	19 1/2	36	10	24

All Dimensions In Inches

Typical Duct Opening Sizes For 3x2 Fan Style Floor Trusses

Depth	Panel Size	A	B	C	D	E	F	G
9 1/2	36	5 1/2	4 1/2	8	3 1/2	10	3	6 1/2
11 7/8	60	7 3/4	6 3/4	10	6 1/4	14	5 1/2	8 3/4
11 7/8	54	7 3/4	6 1/2	10	6 1/4	14	5 1/2	8 3/4
12	54	7 3/4	6 3/4	10	6 1/2	14	5 3/4	9
13	54	8 3/4	7 1/2	12	7	16	6	10
14	54	9 3/4	8	13	7 1/4	16	6 3/4	11
15	54	10 1/2	8 1/2	14	7 3/4	17	7 1/4	12
16	54	11 1/2	9 1/4	15	8 1/4	18	7 3/4	13
18	54	13	10 1/4	16	9 1/2	20	8 1/4	15
20	54	14 1/2	11 1/4	17	10 1/2	22	8 1/2	17
22	54	16	12	18	11	24	9	19
24	54	17 1/2	13	20	12	26	9 1/2	21

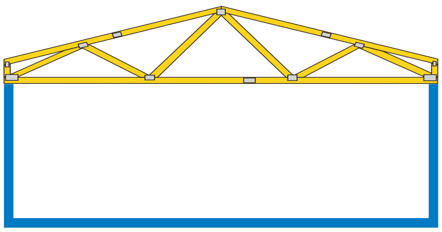
All Dimensions In Inches

Maximum duct dimensions are based on a truss plate width of 4 inches. Larger plate widths may cause a reduction in duct sizes. Chase sizes are maximum possible for centered openings.

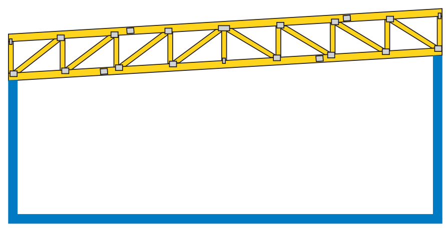
Trusses are reliable and versatile structural building components when used with certain considerations. Following are some of the more frequently overlooked considerations.

Drainage of Low-Sloping, Flat or Parapet Roofs

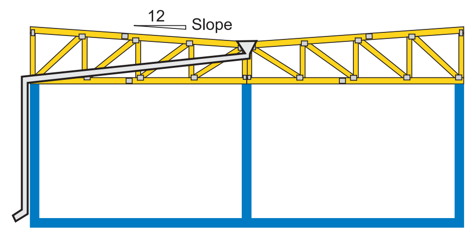
Wood trusses, when used as the structural element on flat or relatively flat roofs must have provisions for adequate drainage so as to avoid ponding. Some suggested methods of preventing ponding are illustrated below.



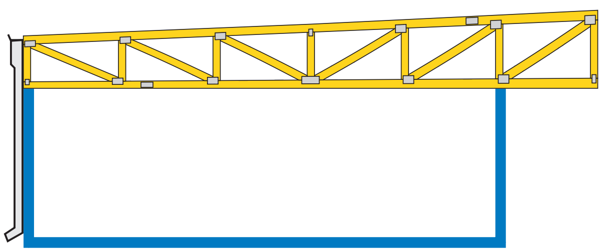
Sloped Top Chord



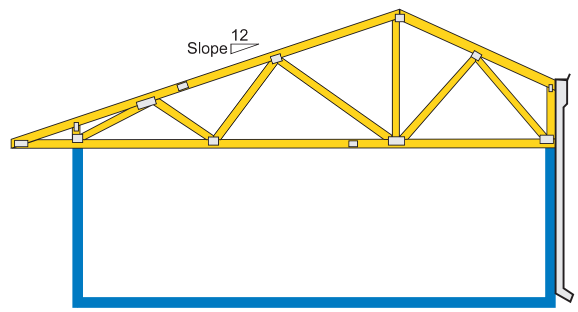
Elevated Bearing



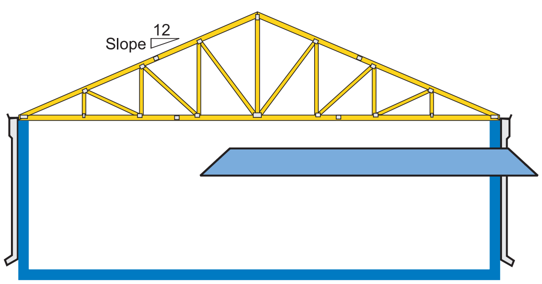
Internal Drain



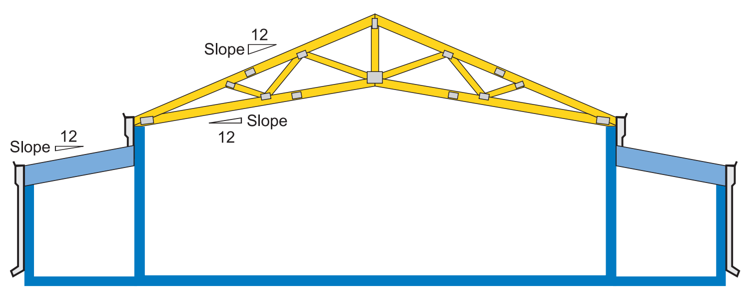
Sloping top chord cantilevered



Dual slope top chord cantilevered



Peaked top chord combined with flat mansard



Scissors trusses combined with low slope

Positive Ventilation

When trusses are used in humid or corrosive environments, or when fire resistant wood is required, additional ventilation may be necessary. Any of these conditions may require additional methods to protect the light gauge metal connector plates. Refer to Chapter 6 of ANSI/TPI 2002 for any adjustments to design values and for methods for plate protection.

Sound Control

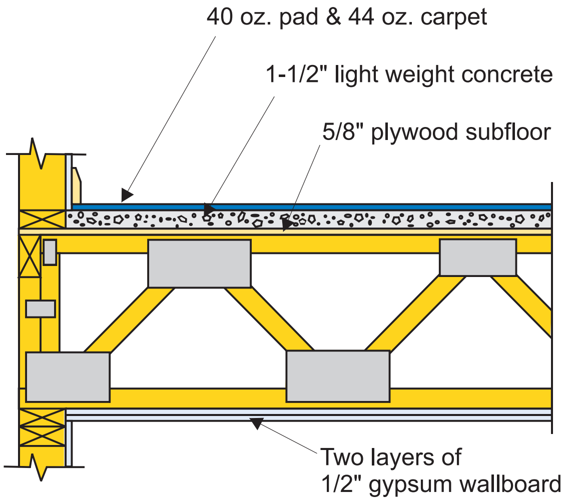
Ratings of floor-ceiling assemblies are determined by two methods. The Impact Insulation Class (IIC) is measured in accordance with ASTM Standard E-492. Airborne noise Sound Transmission Class (STC) is measured in accordance with ASTM Standard E-90.

Impact Noise

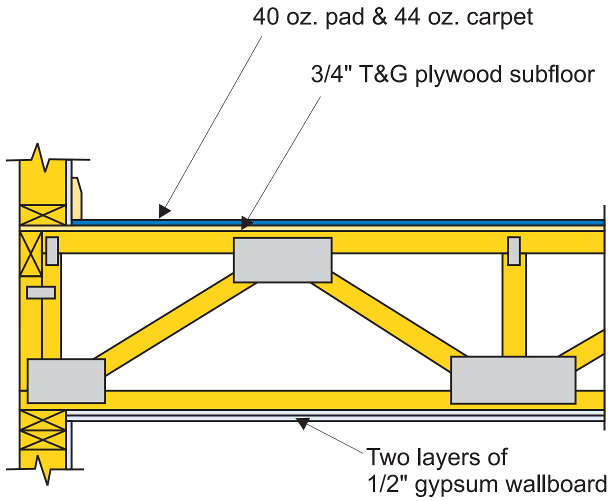
The IIC listing for floor-ceiling assemblies are generally shown for bare floors and for floors with carpet and pad. Although any carpet, with or without pad, will improve the IIC, a heavy wool carpet over a good quality pad will make a significant improvement. According to most tests, the addition of a 44 oz. Carpet over a 40 oz hair felt pad increases the IIC from 38 to 63.

Airborne Noise

ASTM Standard E-413 is used to determine the sound transmission class, STC. Some values listed for assemblies tested in 1970 or before were done under a different standard, however, the resulting STC will generally fall in the same range. Airborne sound control is most effective when air leaks and flanking paths in the assemblies are closed off. Assemblies should be airtight. Recessed fixtures should not be back-to-back in the same cavity. ASTM Recommended Practice E-497 provides good guidance for sound control.



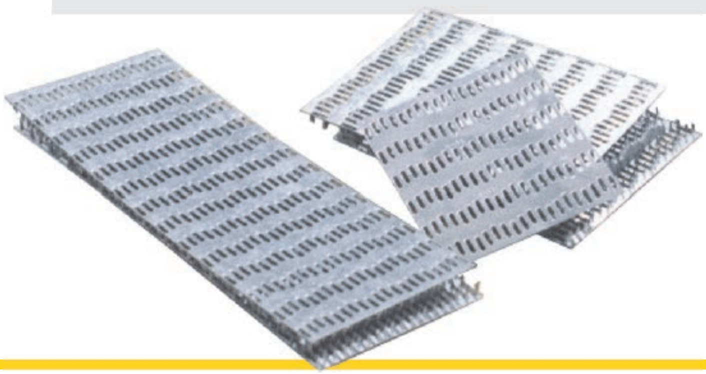
Sound Transmission Class STC=46
Impact Insulation Class IIC=72
Intest No. 5-425-1



Sound Transmission Class STC=47
Impact Insulation Class IIC=72
Intest No. 5-425-3

Assembly Test	STC	IIC
Intest		
5-425-1	46	72
5-425-3	47	72
6-442-5	58 FSTC	---
6-442-2	---	53
6-442-3	---	74
87-729-13	59 FSTC	---
87-729-7	---	83 FIIC

Component materials of floor-ceiling assemblies vary greatly causing difficulty in assigning sound ratings. Contributing to the variations are such factors as depth of openings between members, weight of carpet, pads, or other floor coverings thickness of gypsum board etc.



Builder's And Contractor's Reference Section

Responsibility

According to the publication *National Standard and Recommended Guidelines on Responsibilities for Construction Using Metal Plate Connected Wood Trusses - ANSI/TPI/WTCA 4-2002*, published jointly by the Wood Truss Council of America (WTCA) and the Truss Plate Institute *(TPIC)*, responsibility for wood trusses is divided among the owner, building designer, the truss designer, contractor or builder (installer) and the truss manufacturer.

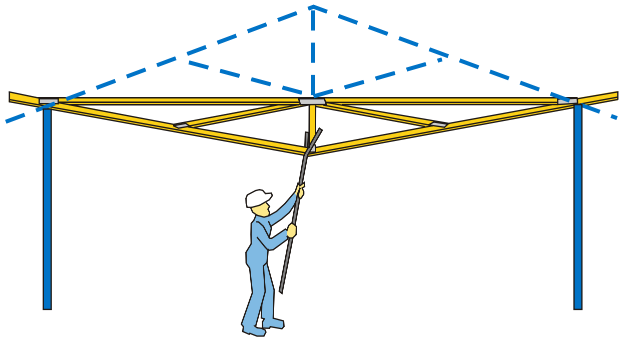
- The building designer is responsible for design of the building's structural system. This includes specifying truss profiles and all truss loading requirements, permanent bracing design and design of the structure supporting the trusses.
- The truss designer is responsible for the design of the individual truss components in accordance with the owner's or building designer's written specifications.
- The truss manufacturer is responsible for manufacturing the trusses in accordance with the approved design drawings and the quality criteria in *TPIC*.
- The builder and truss installer are responsible for the safe handling and installation of trusses after they reach the jobsite. They are also responsible for installing both the temporary and permanent bracing per the building designer's bracing design or the prescriptive requirements of BCSI 1-03.

A good guide for these areas of responsibility is *Guide to Good Practice for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses, by WTCA and TPIC.* The publication is also available in a summary form for use as a jobsite reference. It is recommended that all persons associated with the installation process read and adhere to the recommendations of this publication to help prevent injury to themselves, other workers and property.

A good publication for guidance in the design of a temporary bracing system is the publication *Recommended Design Specifications for Temporary Bracing of Metal Plate Connected Wood Trusses, DSB-89*, published by the Truss Plate Institute Canada.

WARNING:
Do not cut or notch any truss member without permission of the truss designer. Do not use or repair damaged trusses without professional consultation with the Architect, Engineer or Truss Designer.

Installing



Manual Installation

Trusses may be installed manually, by crane, or by forklift, depending on truss size, wall height and job conditions. Individual trusses should always be carried vertically to avoid lateral strain and damage to joints and members.

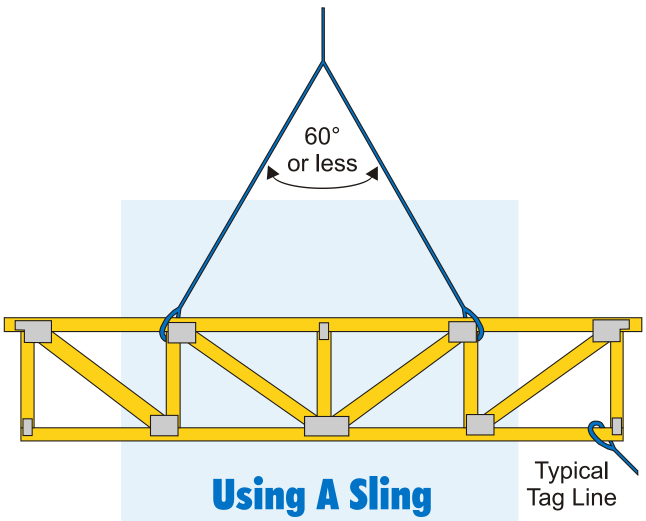
Trusses installed manually are slid into position over the sidewall and rotated into place using poles. The longer the span, the more workers are needed to avoid excessive lateral strain on the trusses. Trusses should be supported at joints and the peak while being raised.

Large trusses should be installed by a crane or forklift employing chokers, slings, spreader bars and strongbacks to prevent lateral bending. Trusses may be lifted singly, in banded groups, or preassembled in groups.

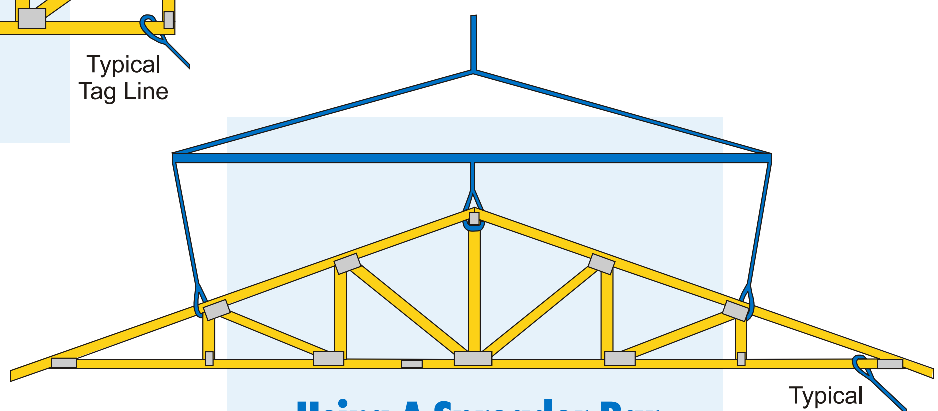
Tag lines should always be used to control movement of trusses during lifting and placement.

Refer to *Guide to Good Practice for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses (BCSI 1-03)* by WTCA and *TPIC* or *Wood Truss Erection* poster by the Wood Truss Council of *Canada* for proper methods of installation.

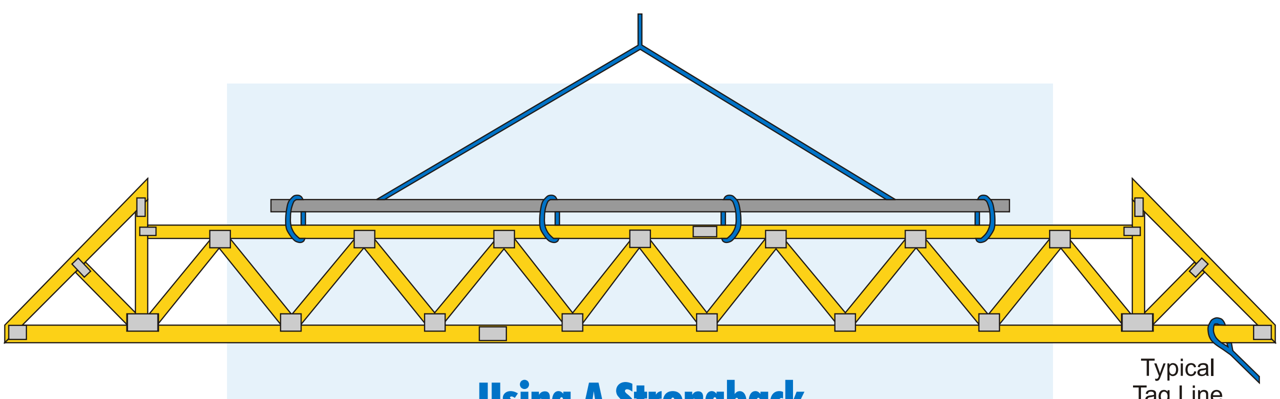
Installation procedures are the responsibility of the installer. Job conditions and procedures vary considerably. These are only guidelines and may not be proper under all conditions.



Using A Sling



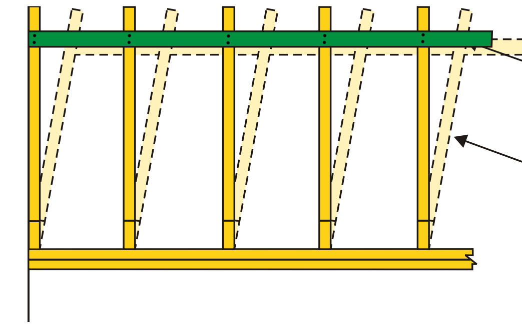
Using A Spreader Bar



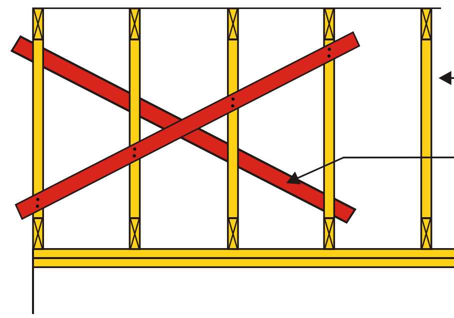
Using A Strongback

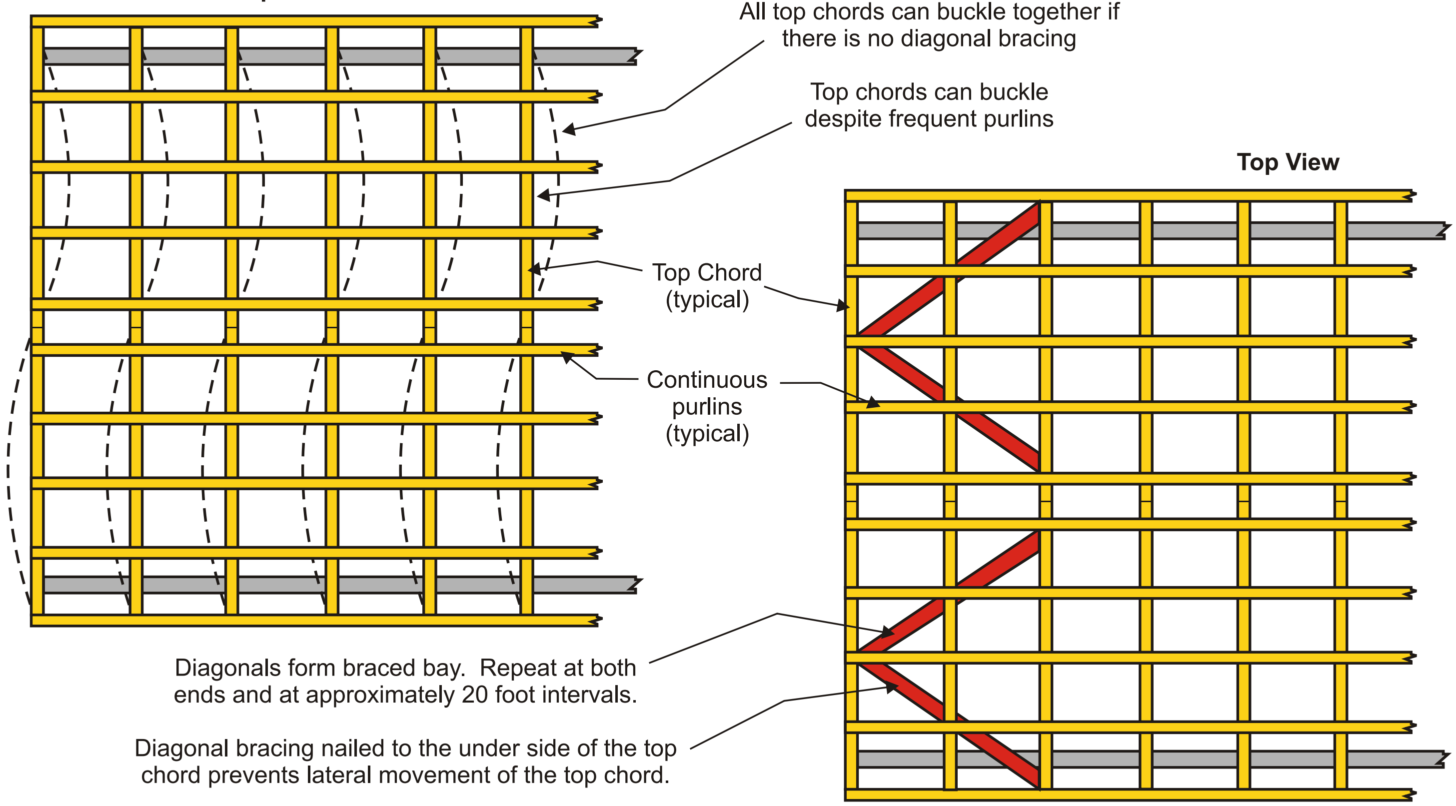
Temporary Bracing

Temporary bracing should be 2x4 dimension lumber or larger and should be 8 feet minimum in length. Continuous lateral bracing maintains spacing, but without cross bracing, permits trusses to move laterally. See BCSI 1-03.



To prevent dominoing, cross bracing should be installed in the plane of the webs as the trusses are installed. See BCSI 1-03.





Full bundles of sheathing should not be placed on the trusses. They should be limited to 8 sheets to a pair of trusses. Likewise, other heavy concentrated loads should be evenly distributed. Inadequate bracing is the reason for most wood truss installation failures. Proper installation is a vital step for a safe and quality roof structure.

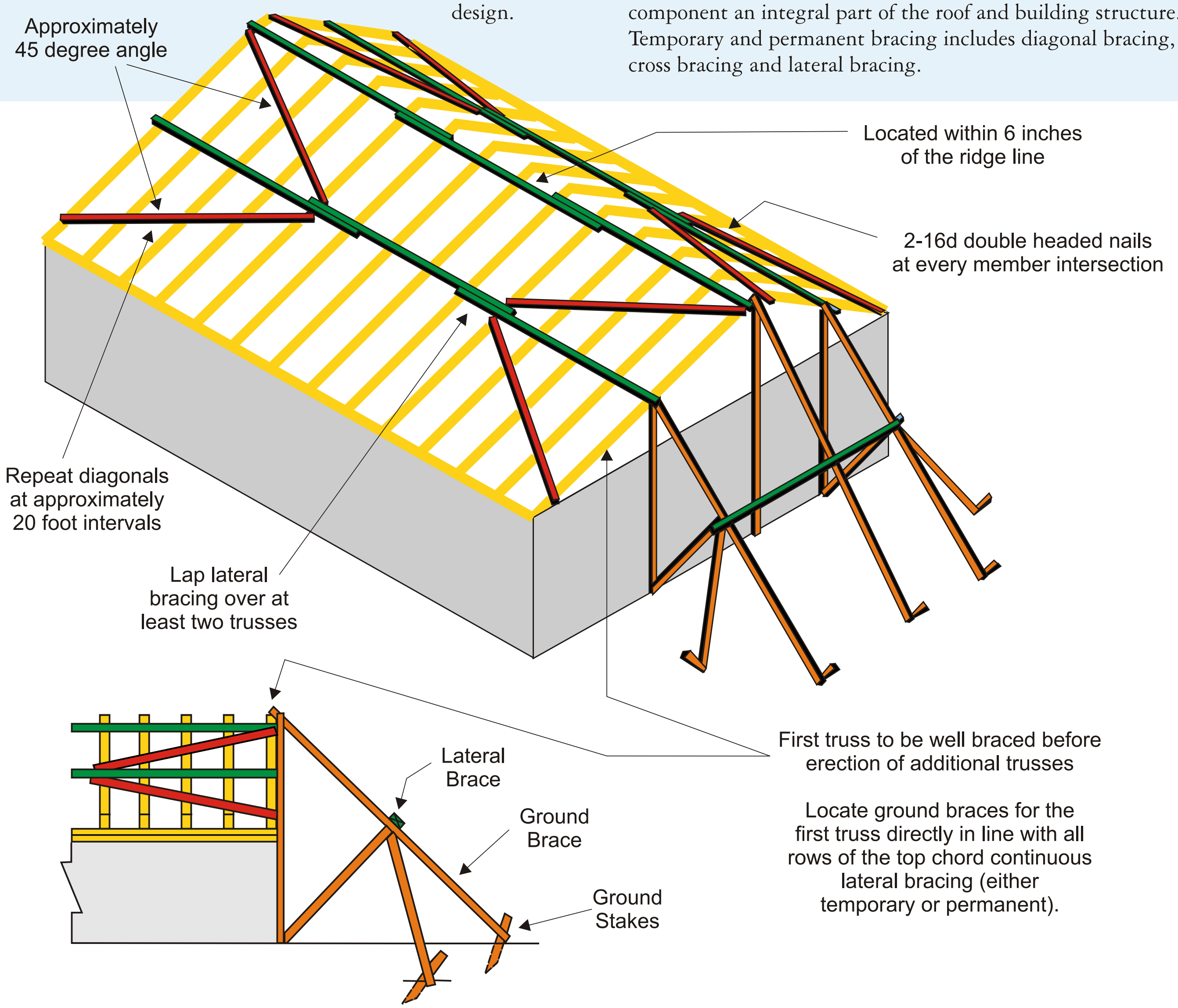
These recommendations are offered only as a guide. Refer to *Recommended Design Specifications for Temporary Bracing of Metal Plate Connected Wood Trusses (DSB-89)* by the Truss Plate Institute (TPI), or *Guide to Good Practice for Handling, Installing and Bracing or Metal Plate Connected Wood Trusses (BCSI 1-03)* by WTCA and TPI.

Guidelines For Installation Of Bracing From BCSI 1-03

All trusses must be securely braced, both during erection and after permanent installation. Individual wood trusses are designed only as structural components. Responsibility for proper bracing always lies with the building designer and contractor for they are familiar with local and job-site conditions and overall building design.

All trusses should be installed straight, plumb and aligned at the specified spacing. Trusses should also be inspected for structural damage.

There are two types of bracing. Temporary bracing is used during erection to hold the trusses until permanent bracing, sheathing and ceilings are in place. Permanent bracing makes the truss component an integral part of the roof and building structure. Temporary and permanent bracing includes diagonal bracing, cross bracing and lateral bracing.



Permanent lateral bracing, as may be required by truss design to reduce the buckling length of individual truss members, is part of the wood truss design and is the only bracing specified on the design drawing. This bracing must be sufficiently anchored or restrained by diagonal bracing to prevent its movement. Most truss designs assume continuous top and bottom chord lateral support from sheathing and ceilings. Extra lateral and diagonal bracing is required if this is not the case.

Bracing members should be 2x4 nailed with two 16d nails at each cross member unless specified otherwise on the design drawing. Lateral braces should be at least 10 feet long. Cross and diagonal braces should run on an approximate 45 degree angle.

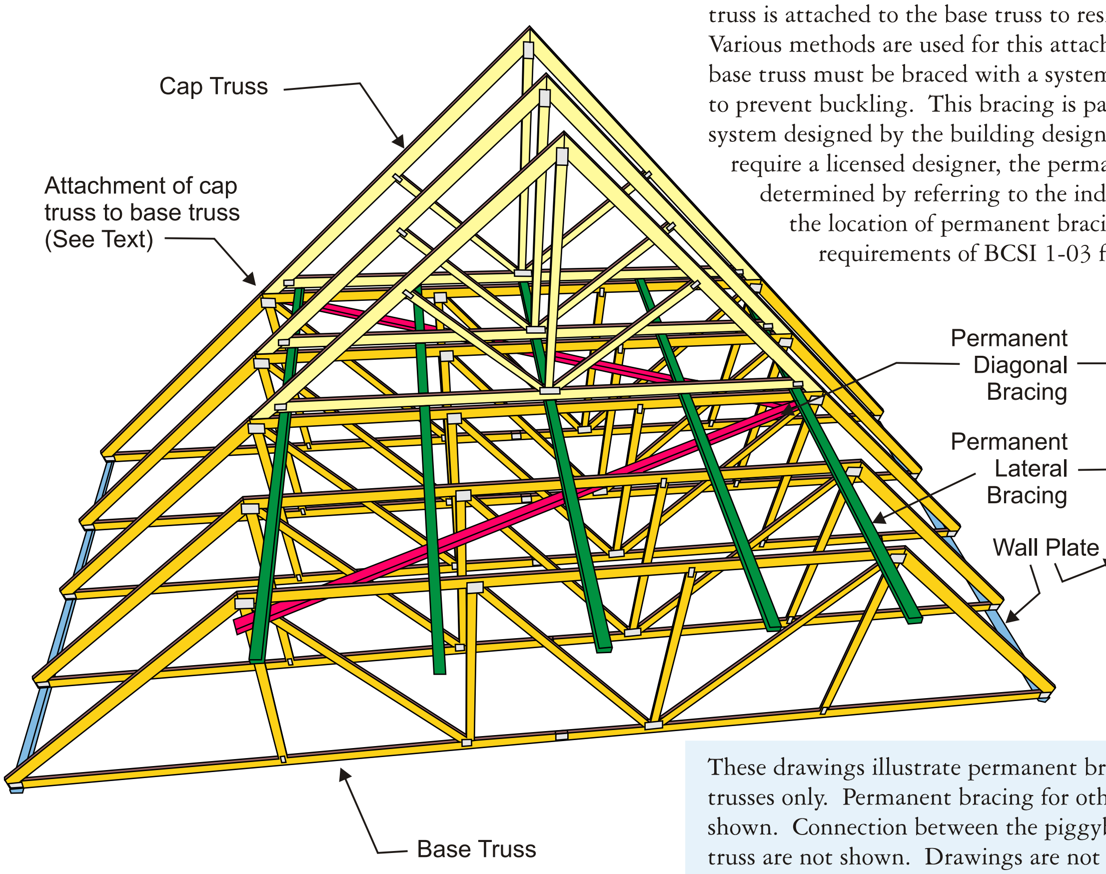
It is important to temporarily brace the first truss at the end of the building. One method calls for the top chord to be braced by ground braces that are secured by stakes driven in the ground, preferably outside and inside. The bottom chord is to be securely anchored to the end wall.

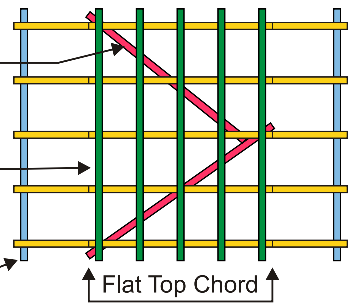
Adjacent trusses are now set connecting each to continuous lateral bracing on the top chord. These are typically spaced at 4', 6', 8' or 10 feet on centers along the length of the truss. Refer to BCSI 1-03 for diagonal spacing.

This top chord bracing will be removed as the sheathing is applied after the other bracing is completed.

Typical Bracing for Piggyback Trusses

If a truss is too tall to build and/or haul in one piece, a cap truss can be used on top of a base truss to form the overall height required. The cap truss is attached to the base truss to resist lateral and uplift forces. Various methods are used for this attachment. The flat top chord of the base truss must be braced with a system of lateral AND diagonal braces to prevent buckling. This bracing is part of the permanent bracing system designed by the building designer. For structures that do not require a licensed designer, the permanent bracing can also be determined by referring to the individual truss design drawings for the location of permanent bracing and following the prescriptive requirements of BCSI 1-03 for lateral and diagonal bracing.





These drawings illustrate permanent bracing for the top chord of base trusses only. Permanent bracing for other chords and webs are not shown. Connection between the piggyback cap truss and the base truss are not shown. Drawings are not to scale.

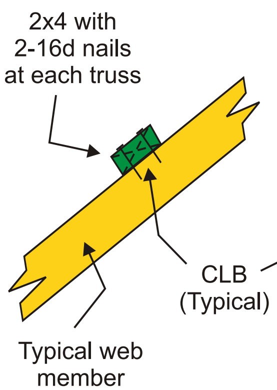
Pride in Quality Workmanship.
Rest assured that our trusses meet the high standard of Turkstra craftsmanship.

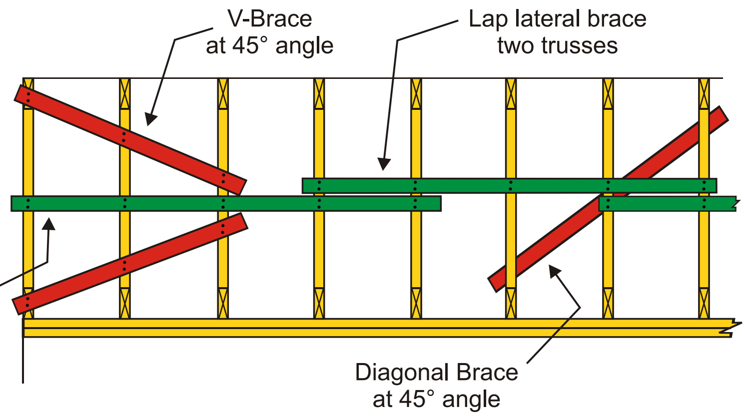
<u>Our teams of skilled designers and builders are committed and proud to produce a superior product including:</u>
Wood Roof Trusses, Steel Roof Trusses, Engineered Floor Systems, Engineered Wood Beams, Wall Panels

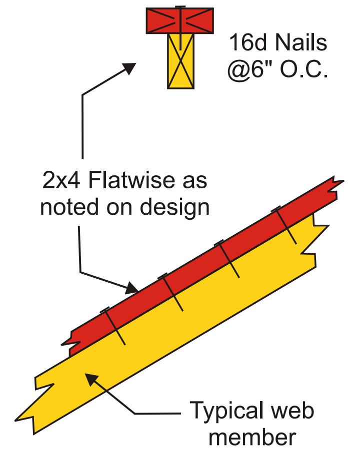
Our engineered wood roof trusses have proven to be the product of choice when framing roofs over residential, light commercial and farm buildings.

TURKSTRA LUMBER

Web Bracing Installation







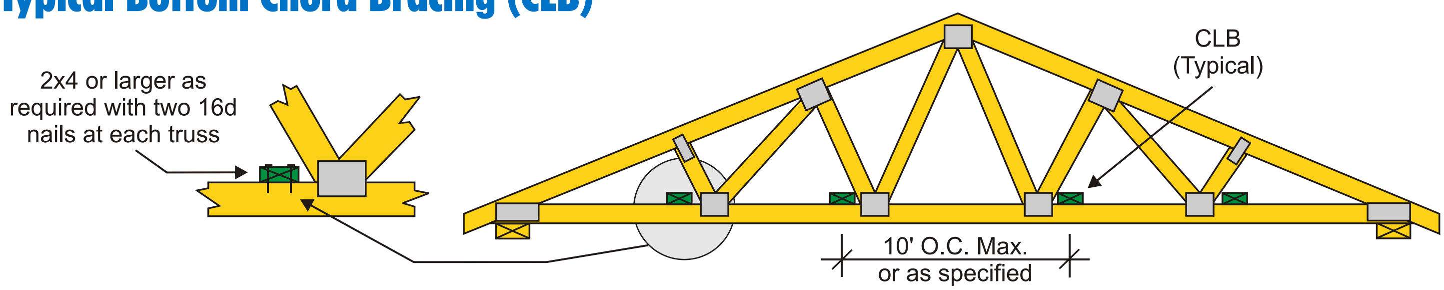
Continuous Lateral Bracing

When continuous lateral bracing (CLB) is specified on the design drawing, the CLB shall be installed and connected to each end of the building and cross-braced at intervals determined by the building designer.

T-Brace

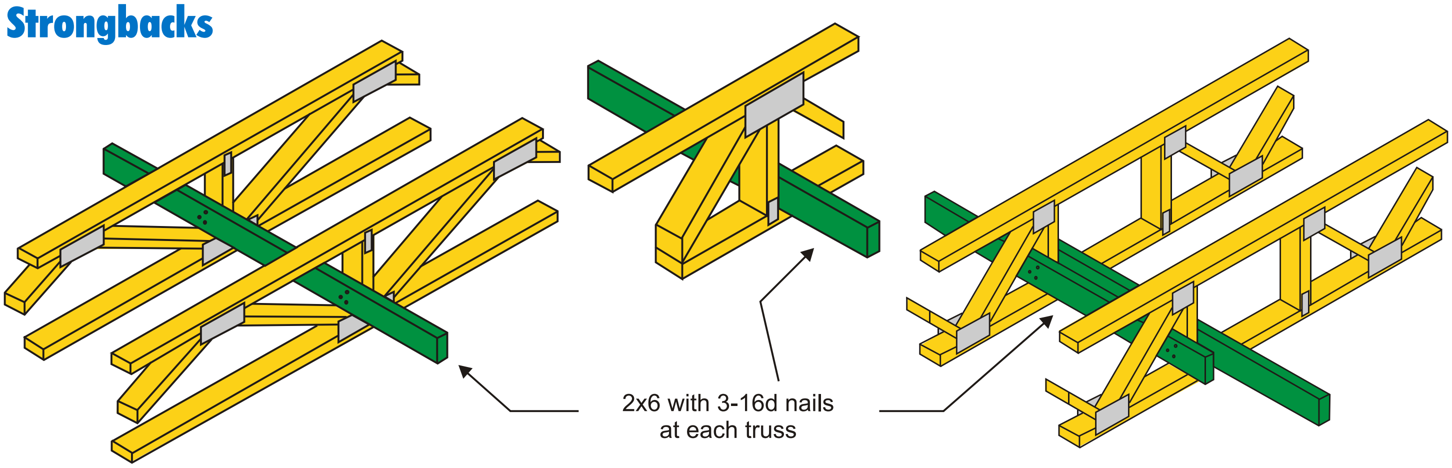
The T-Brace is typically used with hip trusses.

Typical Bottom Chord Bracing (CLB)



Where the building design does not provide for a ceiling diaphragm or other means of continuous lateral bracing of the bottom chord of the truss, the truss design will specify the spacing of the continuous lateral bracing of the bottom chord. NOTE: The building designer is responsible for the design of the roof, floor and building bracing.

Strongbacks



Strongbacks, 2x6 minimum, should be secured to a vertical member with 3-16d nails on floor trusses. For spans less than 20 feet, one row of strongbacking at the centerline is sufficient. For spans greater than 20 feet and less than 30 feet, use two rows of strongbacking equally spaced. In general, use one strongback row for each 10 feet of truss span. Blocking behind the vertical is recommended while nailing the strongback in place. Strongback lumber should be at least 14 feet in length and lapped two feet at their ends over two adjacent trusses.

The Importance of Proper Bracing in Structural Performance

The structural performance of a frame building depends on continuous paths for all loads to eventually be transferred to the ground. In the specific instance of pre-engineered trusses, there are several types of bracing, which are sometimes confused. Each of these types of bracing is important to the construction process and ultimately to the structural integrity of the building.

There are two distinct types of bracing. Temporary or construction bracing is the first type, and permanent bracing is the second type.

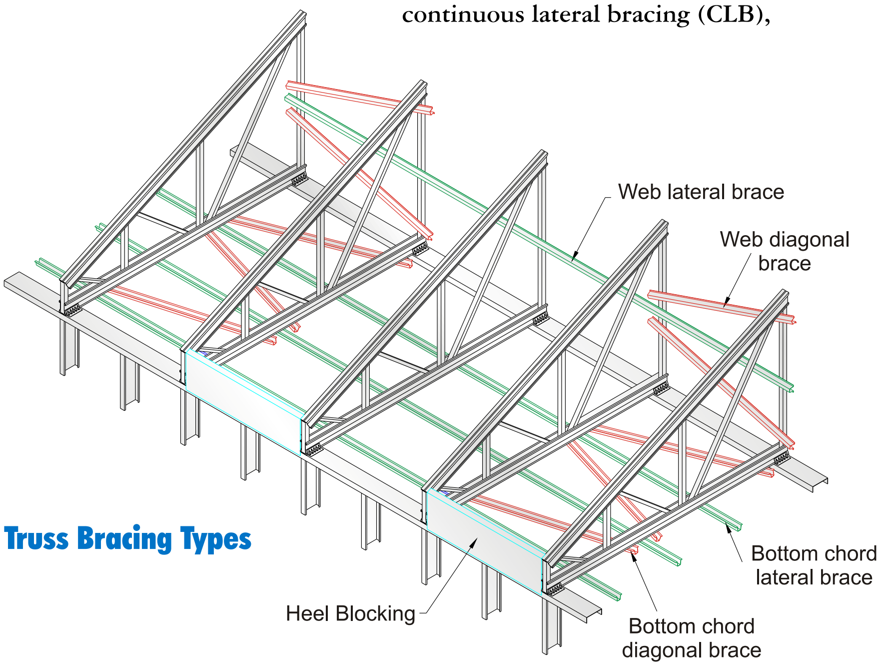
Temporary or Construction Bracing:

This is the proper bracing of the trusses during the erection phase of the structure. Much like walls are braced until the completion of the framing process, when trusses are placed on the plate line, they must be braced to hold them safely and securely in place and to resist environmental influences such as wind gusts during the framing process. Temporary bracing guidelines are available through truss industry documents for truss spans up to 60 ft. For spans over 60 ft. a professional engineer should be consulted for the temporary bracing plan.

Permanent Bracing

Permanent bracing typically includes continuous lateral bracing (CLB), diagonal bracing, bridging and blocking at the heels and ends of the trusses. This bracing functions to strengthen and stabilize the truss chords and webs which may be particularly long or highly stressed. The required locations of the continuous lateral bracing are typically called out on the shop drawings supplied by the truss engineering company. These lateral braces must be stabilized at regular intervals with diagonal bracing. This extremely important bracing system creates the continuous path through which all loads applied to the roof are transferred, from the truss system into the walls and eventually to the ground.

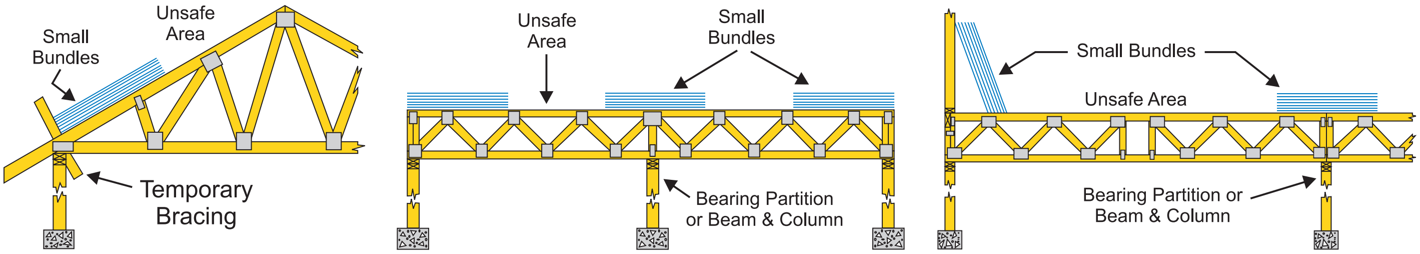
Because of the component nature of our fast track building process, permanent bracing design is not supplied by the wall panel designer, or by the truss fabricator, because neither party controls the design process of the other component. To bridge this gap in the information process, a number of engineering firms are beginning to provide permanent bracing design based on their review of the wall and truss layouts supplied by separate parties.



Truss Bracing Types

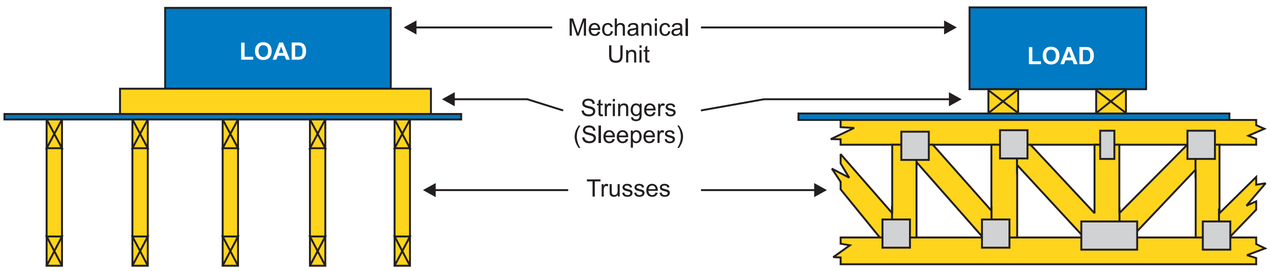
Alpine Systems Corporation

Storage of Materials During Installation



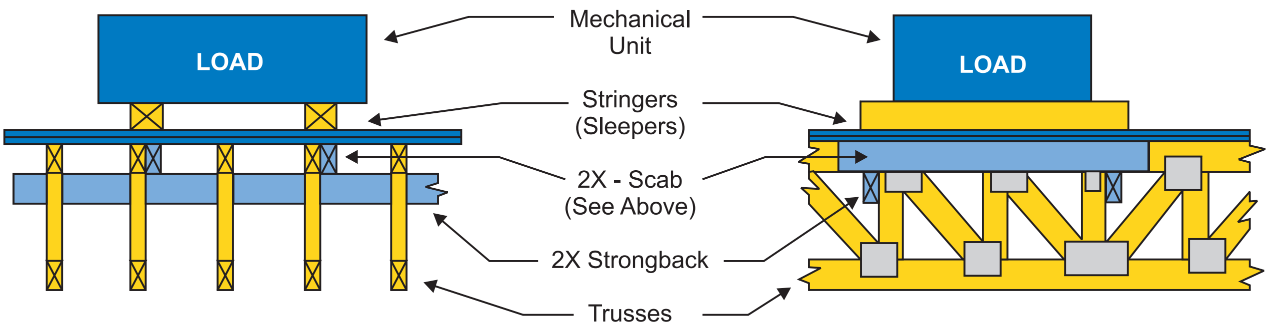
Mechanical Equipment

Platform Stringers Perpendicular To Trusses

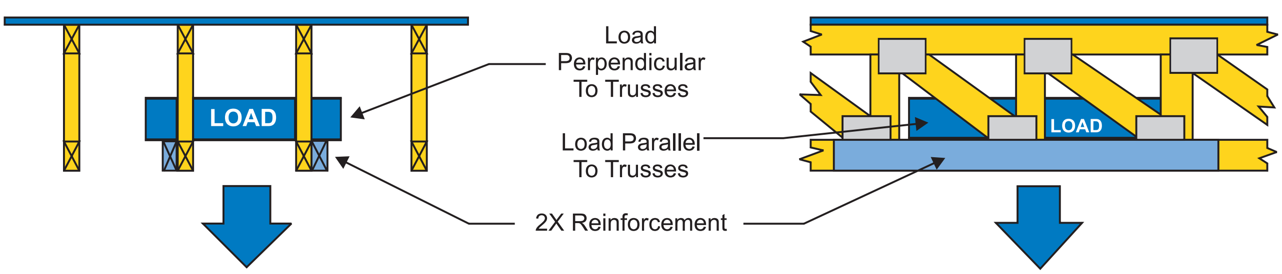


Trusses under mechanical units must be specifically designed and may be doubled. Stringers (sleepers) shall be placed directly over truss joints or a scab of the same size, grade and species of lumber as the top chord shall be nailed to the top chord @ 6" o.c. Scab shall cover joints on each side adjacent to the stringers (sleepers). If building designer is relying on the sheathing to support the mechanical load or other heavy load, it is important that the building designer verify the sheathing thickness and capability.

Platform Stringers Parallel To Trusses



Loads Suspended From Bottom Chords



When the load is perpendicular to trusses, reinforcement of bottom chord as well as other parts of truss may be necessary. When the load is parallel to trusses, reinforcement of bottom chord may be necessary.

NOTE: Mechanical loads may produce sufficient vibration to be considered in the truss design. Such loads may require additional trusses or custom design.

Evolution of Metal Plate Connected Wood Trusses

The highly engineered metal plate connected wood truss as we know it today is the evolution from a principle known to building designers for centuries. Architectural trussing was a late Roman invention, although it didn't really become popular until the early Gothic period in Northern France around 1100. Church construction began to feature pointed arches and vaults, and an overall feeling of height. The latter was not always just an impression - some ceilings towered 150 feet above the faithful.

By the 15th century, Leonardo Da Vinci's notebooks contained numerous drawings and comments about the strengths of framing members arranged in triangular configurations.

The practice of binding, or connecting, structural members in triangular configurations results in a product known as a truss. Prior to the 1940's most trusses in the building industry were constructed of heavy steel. The use of wood as members was primarily limited to timbers with bolted connections in large buildings and bridges.

The early days of World War II created a demand for the hurried construction of a large amount of military housing. To satisfy this demand, engineers in many cases chose dimensional lumber, connected with glued and nailed plywood gussets, or simply nailed joints, to form "wood trusses" to speed the jobsite time for framing roofs.

Alpine's Wave Connector Plate

This practice was continued following the end of the war to fulfill a pent-up demand for single family housing.

To shorten the labor intensive process of cutting the plywood gussets and glue/nailing them to the dimensional lumber, a light gauge metal plate was devised. The early plates were predrilled to receive nails - still somewhat labor intensive, but an improvement.

Looking to reduce the labor and increase truss production, Carol Sanford invented a light gauge metal plate with "teeth" punched from the base metal. These plates could then be imbedded into the lumber by a mechanical device. His metal connector became a forerunner of today's modern, highly engineered and tested quality connector.

Lumber used in manufacturing trusses has also changed drastically. In the early days, ordinary construction lumber was used. Much of the lumber now used in trusses is machine stress rated or visually graded lumber whose stress rating is based on rules established by years of testing. The reliability of lumber today is more predictable.

Adding to these improvements are the methods used to cut and assemble the wooden members of the truss. Widespread use of saws with computer controlled angle and length settings assure more accurate fitting of pieces and joints than with older hand set saws. Computer aided controls are also used to set the jigging points during the truss assembly and manufacturing process, further assuring more accurate fit of members and joints.

The wood truss is now a highly engineered product utilizing two excellent materials; wood, an energy efficient, renewable resource and steel, a recyclable resource.

The Industry

Wood Truss Council of America

TRUSS PLATE INSTITUTE

The Truss Plate Institute Of Canada

The Canadian Wood Truss Association
L'Association Canadienne des Fabricants de Fermes de Bois

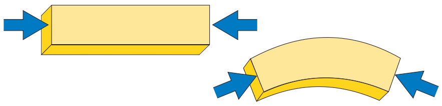
The metal plate connected wood truss industry is represented by two trade associations. In the U.S.A., connector plate manufacturers are organized in an association known as the Truss Plate Institute (TPI), and the truss manufacturers association is named the Wood Truss Council of America (WTCA). Both organizations are located in Madison, Wisconsin.

TPI is responsible for developing and publishing the design and testing methodology for wood trusses and is accredited by the American National Standards Institute (ANSI) as a consensus based standards writing organization. A listing of the standards and recommended practices of TPI is contained in Appendix B. WTCA, is an association of wood truss manufacturers, and works closely with TPI on many projects. WTCA promotes high standards in the manufacture and delivery of trusses by its member firms and is active in the marketing of and education about trusses. WTCA publishes the *Metal Plate Connected Wood Truss Handbook*, a complete guide to the design, manufacturing and use of wood trusses and other publications (see Appendix B). WTCA produces educational video presentations to train in the proper installation of trusses. WTCA and TPI is the voice of the industry in government and code matters.

In Canada, the metal plate connected wood truss industry is similarly represented by two trade associations. The Truss Plate Institute of Canada (TPIC) and The Canadian Wood Truss Association (CWTA).

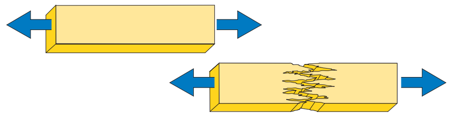
Truss Design Considerations

Types Of Stresses To Be Considered In The Design Of Trusses



Compressive Stress Parallel To Grain

Truss top chords are generally in compression. When subjected to compressive stress, wood members can buckle. The longer and more slender the member is, the less compressive force it takes to buckle. In lumber, the compressive strength is measured by the F_c value.

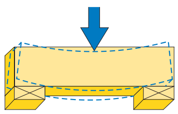


Tensile Stress

When subjected to tensile stress, wood members can elongate. Truss bottom chords are normally in tension. In lumber, tension strength is measured by the F_t value.

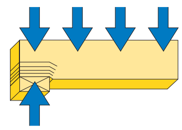
Horizontal Shear

Horizontal shear occurs along the grain, causing fibers to slide over each other. In lumber, horizontal shear strength is measured by the F_v value.



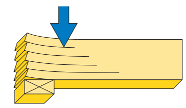
Bending

Bending occurs between supports when lumber is subjected to loads. Bending strength is measured by the F_b value of the lumber.



Compressive Stress Perpendicular To Grain

An example of compression perpendicular to grain is the bottom chord sitting on a support. It is necessary that the bottom chord lumber area be sufficient to prevent side grain crushing. Lumber's resistance to crushing is rated by the $F_{c\perp}$ value.

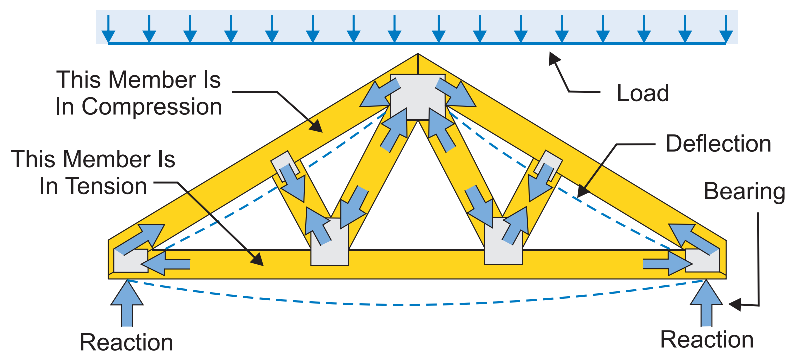


Vertical Shear

An example of vertical shear occurs at the inside of the truss support. Wood is stronger in vertical shear than horizontal shear. Since a vertical shearing force produces both vertical and horizontal shear stresses, wood will fail in horizontal shear instead of vertical shear.

Loads In Wood Trusses

This truss illustrates the action of the various stresses occurring along the wood members.
The applied loads induce stresses and movement in the truss members. A stable truss will resist these stresses.
The wood members are designed to resist the stress according to the allowable design values published in the National Design Specification For Wood Construction (NDS). NDS is published by the National Forest Products Association.
Forces at the member joints are resisted by metal connector plates that are held in place by "teeth" punched out of the base metal at right angles. The plates are rated for lateral resistance (tooth holding), shear, and tension and require review and approval by each of the model codes.



Short Term Loading

Wood has the ability of carrying a greater load for short durations than for long durations.

Duration Of Load Adjustment

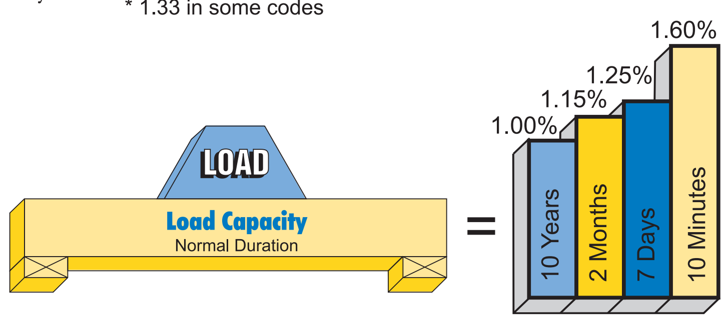
The table shows the more common types of loads, their expected accumulated duration and the factor of adjustment in the allowable lumber stresses and the lateral resistance value (tooth holding) of the connector plate. Note: the factors do not apply to shear and tension in the connector plate, nor do they apply to E and $F_c \perp$. See NDS Section 2.3 for possible exceptions.

Load Type	Duration Of Load	Adjustment Factor
Dead Load	Permanent	.90
Floor Live - Normal	10 Years	1.00
Snow Load	2 Months	1.15
Construction	7 Days	1.25
Wind/Earthquake Load*	10 Minutes	1.60
Impact	Impact	2.00

* 1.33 in some codes

Other Adjustments

Other adjustments to design values may be necessary. Consult NDS Chapter 2. The value of lumber in extreme fiber bending "F_b" may be increased when there are three or more trusses spaced not more than 24 inches on center and are joined by load-distributing elements.
In special single-member applications where deflection may be a critical factor, or where deformation must be limited, reduction of modulus of elasticity (E) value may be appropriate.



All weights are pounds per square foot (psf) unless otherwise shown.

DECKING AND INSULATION

3/8 inch thick Plywood / OSB	1.2
1/2 inch thick Plywood / OSB	1.7
5/8 inch thick Plywood / OSB	2.1
3/4 inch thick plywood / OSB	2.5
1-1/8 inch thick plywood / OSB	3.6
1 inch nominal wood	2.3
2 inch nominal wood decking	4.3
16 ga. Corrugated Steel	2.5
20 ga. Corrugated Steel	1.8
22 ga. Corrugated Steel	1.5
24 ga. Corrugated Steel	1.3
28 ga. Corrugated Steel	1.0
Rigid Fiberglass - 1 inch thick	1.5
Styrofoam - 1 inch thick	0.2
Insulrock - 1 inch thick	2.7
Poured gypsum - 1 inch thick	6.5
Rock Wool - per 1 inch of thickness	0.4
Glass Wool - per 1 inch of thickness	0.2
Vermiculite - per 1 inch of thickness	2.6

WALLS AND PARTITIONS

Masonry, per 4 inches of thickness:

Brick	38.0
Concrete Block	30.0
Stucco - 7/8 inch thick	10.0
2x4 Framing @ 16" oc with ½ inch Thick gypsum each side	6.0
2x6 Framing @ 16" oc with ½ inch Thick gypsum each side	7.0

CEILINGS

1/2 inch thick Gypsum board	2.2
5/8 inch thick Gypsum board	2.8
5/8 inch thick Type X Gypsum bd	3.0
Acoustical Fiber Tile	1.0
Metal Grid Ceiling	0.8
Plaster - 1 inch thick	8.0
Plaster on Metal Lath	8.5

ROOFING

Asphalt Shingles - Minimum (1 Layer)	2.5
Clay Tile Shingles	12.0
1/4 inch Slate Shingles	10.0
Wood Shakes - 5/8 inch thick	3.0
3 Ply & Gravel	5.6
4 Ply & Gravel	6.0
5 Ply & Gravel	6.5

FLOORING

Hardwood - 1 inch nominal	4.0
Quarry Tile 3/4 inch thick	10.0
Linoleum or Soft Tile	1.5
Vinyl Tile - 1/8 inch thick	1.4

Concrete:

Reinforced 1 ½ inch thick	17.5
Lightweight 1 ½ inch thick	12.5
Terrazzo 1 ½ inch thick	19.0

LUMBER (32 pcf)

Nominal Size:	@ 12" oc	@ 16" oc	@ 24" oc
2x4	1.4	1.1	0.7
2x6	2.2	1.7	1.1
2x8	2.9	2.2	1.5
2x10	3.7	2.8	1.9
2x12	4.4	3.3	2.2

WOOD TRUSSES - (APPROXIMATE)

Based on Southern Pine

Top Chord	Bottom Chord	PLF	24" oc.
2x4	2x4	5.2	2.6
2x6	2x4	6.1	3.1
2x6	2x6	6.9	3.5
2x8	2x6	7.8	3.9
2x8	2x8	8.5	4.3
2x10	2x8	9.3	4.7
2x10	2x10	10.1	5.2
2x12	2x10	10.9	5.5
2x12	2x12	11.6	5.8

We suggest the addition of 1.5 psf for misc. dead loads

FLOOR TRUSSES - (APPROXIMATE)

Based on Southern Pine
All members 2x4 - Weights are PLF

Depth in inches	Single Chord	Double Chord
12	5.0	
14	5.25	
16	5.5	8.4
18	5.75	8.6
20		8.9
24		9.4

SPRINKLER SYSTEMS

Pipe Size	Dry (PLF)	Wet (PLF)
1	1.7	2.1
1 1/4	2.3	3.0
1 ½	2.7	3.6
2	3.7	5.2
2 ½	5.8	7.9
3	7.6	10.8
3 ½	9.2	13.5
4	10.9	16.4
5	14.8	23.5
6	19.2	31.7
8	28.6	50.8

NOTE: The weight of wood and wood products will vary as the moisture content varies and as density of grain varies. Code of jurisdiction should be consulted for live load requirements. Weight of manufactured products should be verified with manufacturers.

Appendix B -- References

The materials listed below provide a good resource library for the design and use of wood trusses. Please contact the publisher/group directly for further information.

American Forest & Paper Association (AFPA) 202/463-2700
1111 19th St. NW, # 700 • Washington, DC 20036 www.afandpa.org
- *National Design Specification for Wood Construction (NDS)*
- *Wood Frame Construction Manual*

American National Standards Institute (ANSI) 212/642-4900
11 West 47th Street • New York, NY 10036 web.ansi.org
- *See TPI*

APA - The Engineered Wood Association 206/565-6600
1119 A Street • Tacoma, WA 98401 www.apa.wood.org
- *Use of Rated Sheathing in Roofs and Floors*
- *Fire Rated Systems*
- *Diaphragm Design*

American Society of Civil Engineers (ASCE) www.asce.org
1801 Alexander Bell Dr. • Reston, VA 20191-4400
- *Minimum Design Loads for Buildings And Other Structures, ASCE7*

American Society for Testing and Materials (ASTM) www.astm.org
1916 Rice Street • Philadelphia, PA 19103
- *Test Methods for Fire Tests for Building Construction and Materials, E-119*

Building Officials and Code Administrators International, Inc. (BOCA) 708/799-2300 www.bocaresearch.com
4051 W. Flossmoor Road • Country Club Hills, IL 60478
- *The BOCA National Building Code*

Council of American Building Officials (CABO) 703/931-4533
5203 Leesburg Pike, Suite 798 • Falls Church, VA 22041 www.cabo.org
- *One and Two Family Dwelling Code*

Forest Products Laboratory www.fpl.fs.fed.us
U.S. Department of Agriculture
One Gifford Pinchot Drive • Madison, WI 53705
- *Wood Handbook: Wood as an Engineered Material*

Gypsum Association 202/289-5440
810 First St. NE, # 510 • Washington, DC 20002 www.gypsum.org
- *Fire Resistance Design Manual, GA-600*

International Code Council (ICC) 703/931-4533
5203 Leesburg Pike, #600 • Falls Church, VA 22041 www.intlcode.org
- *International Building Code*
- *International Residential Code*

International Conference of Building Officials (ICBO) 213/699-0541
5360 S. Workman Mill Rd • Whittier, CA 90601 www.icbo.com
- *Uniform Building Code*
- *Uniform Fire Code*

NAHB Research Center 301/249-4000
400 Prince Georges Blvd. • Upper Marlboro, MD 20774 www.nahbrc.org

National Frame Builders Association (NFBA) 800/557-6957
4840 Bob Billings Pkwy, # 1000 • Lawrence, KS 66049 www.nfba.org
- *Post Frame Building Design*
- *Post Frame Comes of Age*
- *Recommended Practices-Post Frame Construction*

Southern Forest Products Association (SFPA) 504/443-4464
P. O. Box 641700 • Kenner, LA 70064 www.southernpine.com
- *Southern Pine Maximum Spans for Joists and Rafters*
- *Southern Pine Use Guide*

Southern Building Code Congress International, Inc. (SBCCI) 205/591-1853 www.sbcci.org
900 Montclair Road • Birmingham, AL 35213-1206
- *Standard Building Code*
- *Wind Design Standard, SSTD 10-93*

Truss Plate Institute (TPI) 608/833-5900
583 D'Onofrio Drive, Suite 200 • Madison, WI 53719 www.tpinst.org
- *National Design Standard for Metal Plate Connected Wood Truss Construction, ANSI/TPI 1-2002*
- *Standard for Testing Metal Plate Connected Wood Trusses, ANSI/TPI 2-1995*
- *Recommended Design Specification for Temporary Bracing of MPC Wood Trusses, DSB-89*
- *Guide to Good Practice for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses, BCSI 1-03*

Western Wood Products Association (WWPA) 503/224-3930
533 SW Fifth Ave. • Portland, OR 97204 www.wwpa.org
- *Western Lumber Product Use Manual*

Wood Truss Council of America 608/274-4849
One WTCA Center www.woodtruss.com
6300 Enterprise Ln. • Madison, WI 53719
- *Metal Plate Connected Wood Truss Handbook*
- *Job-Site Bracing Poster - TTB Series*
- *ANSI/TPI/WTCA 4-2002*

Canadian References

Alpine Systems Corporation / ITW Building Components Group
120 Travail Road Markham, ON L3S 3J1 905-417-2766
www.alpinesys.com
- *Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design), published by TPIC*

Canadian Wood Truss Association - L'Association Canadienne des Fabricants de Fermes de Bois 613/747-5544 www.cwc.ca
1400 Blair Place, Suite 210 • Ottawa, ON K1J 9B8
- *Wood Design Manual*

Canadian Standards Association 416/747-4044
178 Rexdale Boulevard • Rexdale, ON M9W 1R3 www.csa.ca
- *CSA 086.194 "Engineering Design in Wood (Limit States Design)"*
- *CSA S347-M1980 "Method of Test for Evaluation of Truss Plates Used in Lumber Joints"*

National Research Council of Canada 613/993-2463
Institute for Research in Construction www.nrc.ca/irc
1500 Montreal Road • Ottawa, ON K1A 9Z9
- *National Building Code of Canada (NBCC)*
- *National Farm Building Code of Canada (NFBCC)*

AXIAL FORCE - A push (compression) or pull (tension) acting along the length of a member. Usually measured in pounds (lbs).

AXIAL STRESS - The axial force acting along the length of a member, divided by the cross-sectional area of the member. Usually measured in pounds per square inch (psi).

BEARING - Structural support of a truss, usually walls, hangers or posts.

BENDING MOMENT - A measure of the bending effect on a member due to forces acting perpendicular to the length of the member. The bending moment at the given point along a member equals the sum of all perpendicular forces, either to the left or right of the point, times their corresponding distances from the point. Usually measured in inch-pounds.

BENDING STRESS - The force per square inch acting at a point along the length of a member, resulting from the bending moment applied at that point. Usually measured in pounds per square inch (psi).

BOTTOM CHORD - A horizontal or inclined (scissors truss) member that establishes the lower edge of a truss, usually carrying combined tension and bending stresses.

BRACING - See Lateral Bracing

BUILT-UP BEAM - A single unit composed of two or more wood members having the same thickness but not necessarily the same depth, which provides a greater load carrying capacity as well as greater resistance to deflection.

BUTT - CUT - Slight vertical cut at outside end of truss bottom chord made to insure uniform nominal span and tight joints. Usually 1/4-inch.

CAMBER - An upward vertical displacement built into a truss, usually to offset deflection due to dead load.

CANTILEVER - The part of a structural member that extends beyond its support.

CLEAR SPAN - Horizontal distance between interior edges of supports.

COMBINED STRESS - The combination of axial and bending stresses acting on a member simultaneously, such as occurs in the top chord (compression + bending) or bottom chord (tension + bending) of a truss.

CONCENTRATED LOAD - An additional load centered at a given point. An example is a crane or hoist hanging from the bottom chord at a panel point or mechanical equipment supported by the top chord.

DEAD LOAD - Permanent loads that are constantly on the truss, ie: the weight of the truss itself, purlins, sheathing, roofing, ceiling, etc.

DEFLECTION - Downward or horizontal displacement of a truss due to loads.

DIAPHRAGM - A large, thin structural element that acts as a horizontal beam to resist lateral forces on a building.

DRAG STRUT - Typically a horizontal member, such as a truss or beam, that transfers shear from a diaphragm to a shearwall.

DURATION OF LOAD FACTOR - An adjustment in the allowable stress in a wood member, based on the duration of the load causing the stress. The shorter the time duration of the load, the higher the percentage increase in allowable stress.

HEEL - Point on a truss at which the top and bottom chord intersect at the end of a truss with a sloping top chord.

LATERAL BRACING - A member installed and connected at right angles to a chord or web member of a truss to resist lateral movement.

LEVEL RETURN - Lumber filler placed horizontally from the end of an overhang to the outside wall to form soffit framing.

LIVE LOAD - Any load which is not of permanent nature, such as snow, wind, seismic, movable concentrated loads, furniture, etc. Live loads are generally of short duration.

NOMINAL SPAN - Horizontal distance between outside edges of the outermost supports.

OVERHANG - The extension of the top chord (usually) or bottom chord of a truss beyond the support.

PANEL - The chord segment defined by two successive joints.

PANEL LENGTH - The centerline distance between joints measured along the chord.

PANEL POINT - The centerline of the point of intersection in a joint where a web(s) meets a chord.

PEAK - Point on a truss where the sloped top chords meet.

PLUMB CUT - Top chord cut that is plumb to the building floor line provided for vertical installation of a fascia.

PURLIN - A horizontal member in a roof perpendicular to the truss top chord used to support the decking.

REACTION - Forces acting on a truss through its supports that are equal but opposite to the sum of the dead and live loads.

SHEARWALL - A wall element that acts as a large vertical beam, cantilevered from the foundation to resist lateral forces on the building.

SLOPE (Pitch) - The inches of vertical rise in 12 inches of horizontal run for inclined members, generally expressed as 3/12, 4/12 etc.

SPLICE POINT (Top or Bottom Chord Splice) - The point at which two chord members are joined together to form a single member.

SQUARE CUT - A cut perpendicular to the slope of the member at its end.

TOP CHORD - An inclined or horizontal member that establishes the upper edge of a truss, usually carrying combined compression and bending stresses.

TRUSS - A pre-built component that functions as a structural support member. A truss employs one or more triangles in its construction.

VIBRATION - The term associated with the serviceability of a floor. If the occupant feels the floor respond to walking or other input, it may be referred to as vibration or response to load.

WEBS - Members that join the top and bottom chords to form the triangular patterns that give truss action, usually carrying tension or compression stresses (no bending).

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