

## Safe Work Procedures for Roof Truss Installation & Sheathing in Residential Construction

<b>Organization:</b>			
<b>Written By:</b>		<b>Date Created:</b> July 20, 2007	<b>Date of Last Revision:</b> December 19, 2007
<b>Applicable Legislation / Standards / Other:</b> MR 217/06: <ul style="list-style-type: none"><li>• 2.1 Safe Work Procedures</li><li>• 6.1 Personal Protective Equipment</li><li>• 12.3, 12.4 Hearing Protection</li><li>• 16.4 Machine and Tool Safety</li><li>• 16.5 Safeguards Required</li><li>• CSA Standards:</li> <li>• Rescue Plan</li><li>• Western Wood Truss Association – Handling, Erection and Bracing of Wood Trusses Recommended Installation Instructions</li><li>• Engineers / designers specifications for installation of Trusses.</li></ul>			

### **Pre-job Requirements:**

Prior to utilizing this Safe Job Procedures, the supervisor **MUST** ensure:

- All workers are provided with a copy of and trained in this procedure. This includes the methods of hoisting, sequence of erection, bracing and connection details, loading limitations and any other relevant information.
- All potential hazards (people – equipment – materials – environment) are discussed and communicated to workers
- All workers are trained to control the risks in order to complete their task safely
- All workers must be trained and competent in fall protection
- This Safe Job Procedure is readily available on each jobsite that it will be used.

**PPE Requirements:** Safety Hard Hat; Safety Footwear; Gloves; Hearing Protection; Eye Protection and Personal Fall Protection equipment full body harness, lanyard, lifeline, rope grab, engineered anchor).

**Main Hazards:** Main hazards associated with roof truss installation include: falls, struck by objects, over exertion, contact with power lines, heat exhaustion, sun exposure, other workers in or near work area.

**Fall Rescue Plan:** Create rescue plan for use in the event of a fall. Distribute plan to all workers and train all workers on the rescue plan. Rescue must happen quickly to minimize the dangers of suspension trauma. Time is of the essence because the suspended worker may lose consciousness in as few as five minutes. There are two ways in which a worker may be rescued:

- **Rescue** – this is a simple rescue plan. In this situation the worker has fallen and is hanging from a fall protection system and must not have suffered any type of injury. Equipment that may be used to reach a suspended worker and get them down quickly include: nylon or rope rescue ladders, extension ladders, man-lifts, elevating work platforms, etc. Rescue plans should cover the on-site equipment, personnel, and procedures for different types of rescue. Any off-site rescue services that might be required should be contacted and arranged in advance to familiarize them with the project
- **Injured Casualty Rescue** – procedures for rescue are more complicated. In this situation the worker has fallen, is hanging from a fall protection system and has suffered an injury that makes a self-rescue impossible. These types of rescues may need specially trained and equipped personnel. This type of rescue requires a much wider selection of equipment and is much more difficult and complex to perform. In extreme cases, the fire department may use aerial ladder trucks, high-reach equipment or rappelling techniques to reach trapped workers and lift or lower them to a safe level.

Site management must ensure that: everyone on site is aware of the rescue plan, equipment and other resources are available, designated personnel are properly trained.

### **ROOF TRUSS INSTALLATION:**

Builders and truss installers must familiarize themselves with all written instructions, drawings and documents provided by the truss manufacturer and building designers. Before truss installation begins, builders and truss installers need to:

- Know the truss layout
- Review individual truss drawings that contain information for placing, erecting, bracing and connecting trusses
- Check markings on trusses to ensure proper placement according to design.

### **Preparing For Truss Erection:**

1. Ensure that all documents, drawings, and instructions related to the safe installation of trusses are available on site
2. Instruct workers on safe truss installation
3. Use a competent worker, experienced, knowledgeable and trained, in safe truss installation.
4. Ensure that the installation will be supervised by someone experienced and knowledgeable and trained in proper truss erection procedures.
5. Check that the interior and exterior walls are properly aligned and adequately braced.
6. Prepare a clear access to the worksite and designate a level area for storage of the trusses. Make sure that there is no chance of damage to the trusses by other work activity or weather conditions. Be aware of over-head power line restrictions when unloading and hoisting the trusses. Keep trusses strapped together until the start of erection.
7. Check trusses to ensure that none have been broken or damaged during delivery
8. Confirm that the correct number and types of trusses have been delivered
9. Measure trusses to ensure that they are built to required pitch and span, and are constructed to include any special details such as cantilevers, etc.
10. Inform other workers not involved in truss installations to keep clear of the area when trusses are being handled and positioned.
11. Ensure that there will be a worker, properly trained in crane signals, directing the unloading and placement of the trusses
12. Determine and implement a fall protection system for truss installation and bracing
13. Ensure that proper personal protective equipment is used by workers and that workers have been trained in the use of PPE.

### **Wood Scaffolding or Engineered Bracket System:**

No work shall be performed by a worker while standing on the top plate of the exterior walls of the structure. Wood scaffolding can be installed along the inside or outside of the exterior wall, 36 inches below the area where the trusses / rafters will be located. Workers will work from this walkway to lift and toe nails the trusses into the top plates. **If at any time the wood scaffolding is installed in a location over 10 feet from the floor a guard rail system must also be installed.** The guard rail system must consist of a mid rail and top rail. Alternate types of scaffolding may be used for erection of trusses, e.g. Metal sliding wall scaffolds, ladders, etc.

#### **Wood Scaffolding:**

1. Wood scaffolding must be constructed using No. 2 or better lumber (Douglas fir-larch, hemlock-fir, spruce – pine – fir or other spruce species). To eliminate split, warped or otherwise defective lumber, scaffold materials should be hand-selected.
2. Make sure there is firm contact between bearer blocks, bearers, wall scabs, and ledgers to provide maximum strength at connecting points.
3. The number and size of nails and nailing patterns at connections should be consistent with good practices. Where holding power is critical or the scaffold will be used for an extended length of time, dip-galvanized nails or spiral nails should be used. When scaffold components are intended to be dismantled and reused, double headed nails may be used. Do not use the same nail holes on re-assembly.
4. Bearers should be composed of 2x4 for maximum of 3 foot span and 2x6 for 5 foot spans.
5. Attach bearers to bearer block and wall scab with nails.
6. Progressively brace the scaffold as it is being erected. Attach 1x6 or 2x4 braces to the ends of each bearer. Braces should extend at a 45 degree angle back to the bearer block and wall scab.
7. Bearers shall span no greater than 8 feet apart.
8. Securely attach 1- 2x10 wood scaffold plank to the bearers. All scaffold planks must be inspected for cracks and deficiencies before use.
9. Wood scaffolding that is greater than 3m from the floor must have guardrails installed. The guard rail must be at least 36in. high and not more than 42 in above the working surface, with an intermediate rail at between 17in. and 21 in above the working surface. The top rail and mid rail must be constructed of 2x4 wood with posts constructed of 2x4 wood and spaced not more than 8ft. apart.

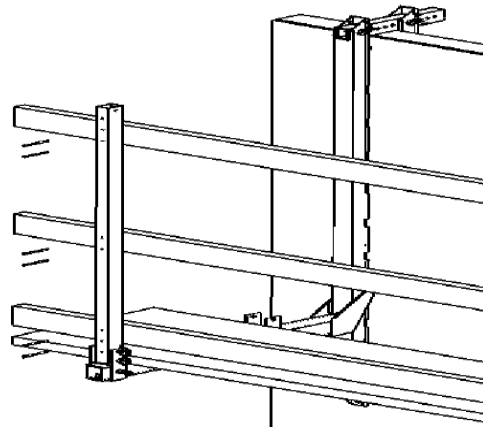
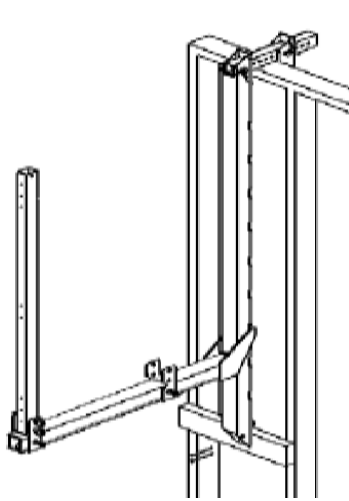
### Examples:



### Engineered Bracket Systems:

The bracket scaffold system hangs off the top plate of the wall and extends down approximately 36 -42 inches from the wall, leaving working room to do layout, set joists and trusses, cut rafter tails, install fascia boards, and set the first row of roof sheathing. They are easy to transport and store, the brackets can be hung inside or outside, and won't get in the way even when installing rim boards or blocking. Handrail posts support top-rail, mid-rail, and toe boards, and depending on the system plank height can be adjusted without removing the plank.

- 1) Inspect the bracket scaffolding unit and parts.
- 2) Ensure you have all parts required by the manufacturer.
- 3) Ensure that the wall or structure that will be supporting the bracket scaffolding is properly braced.
- 4) Place the bracket scaffolding so that it hooks over the top of the wall or opening in the structure. The vertical beam will rest on the sheeted wall, beam or stud. The bracket scaffolding can be hung on the inside or outside wall.
- 5) Secure the bracket scaffold to the wall or stud according to the manufacturers instructions. This may be done with 16D Nails or comparable fasteners. This will help with undesired movement of the bracket scaffolding while setting the Planks or walk boards. (**\*Note – A 2x4 or other acceptable material should be attached to the base of the bracket Scaffolding and rest on at least two studs so that the load may be adequately distributed.**)
- 6) Place planking (either aluminum manufactured planks or 2x10 planks that will ensure a 500mm platform width) onto the horizontal beams of the bracket scaffolding between the plank brackets. Secure the planks to the bracket scaffolding.
- 7) Insert and secure the 2x4 lumber posts to the outer plank bracket.
- 8) Secure 2x4 lumber with 16D nails, or other comparable fasteners, to secure top rails, midrails, and toe boards where Required. Install end gates to provided fall protection at the end of each bracket scaffold. End gates can be made by Securing a 2x4 top rail and mid-rail at the end of the scaffolding.



**Setting Trusses**



**Handrail Installation**



**Installing Fascia Board**

### **Roof Truss Erection:**

No work shall be performed by a worker while standing on the top plate of the exterior walls of the structure. Interior plank walk way must be installed along the interior wall, 36 inches below the exterior wall top plate as stated in the wood scaffolding

erection section of this safe work procedure. The truss erection contractor must install the trusses in accordance with the manufacturer's information and any instructions of a professional engineer. Truss erection must be under the direct supervision of a competent supervisor. Only workers directly involved in the truss erection work shall be in the work area.

1. Mark the bearing plates on both walls to the required spacing of the trusses (as per the manufacturer or engineer's plan.)
2. Lift and place truss bundles flat on the top of the walls (which are aligned and pre-braced). Take care not to bend or twist the trusses. Use a tag line when lifting the trusses into place.
3. If interior walls are available, trusses may be laid flat at roof level in the approximate position in which they are to be erected.
4. Trusses should carry marking on one end. Place trusses so that all marked ends are on the same side of the building.
5. Erect gable or end trusses - stand the first truss either by hand (slide trusses over the walls to the correct location, two workers using wood "Y" braces can lift the braces from the floor level and tip into an upright position), crane or other hoisting device. If crane or hoisting device is used, attach slings at panel points and not mid-span on truss members. Use tag lines to avoid trusses from swinging. For trusses 6m or less, a single pick up point may be used to lift the truss. Trusses up to 9m in length should be lifted using two pick up points. The distance between the two points should be one-half the length of the truss. A spreader bar and short cable sling should be used to lift trusses in the 9-18m range. Trusses above 18m in length should be lifted with a strong-back which is 2/3-3/4 the length of the truss.
6. Stand the first truss and brace it diagonally from above the mid-point on the inside web (to avoid tilting) to the floor below. As soon as the correct positioning of the trusses is determined, they may be secured to the bearing plates.
7. Brace each truss as it is erected. Install all necessary wind bracing, blocking, cross-bracing, ceiling ties, or any other engineer required bracing. Ensure that any lateral bracing specified on the truss design is installed.
8. Continue installing the trusses one by one as indicated above. Ensure trusses are plumb and properly spaced.

NOTE: If interior wall and/or the centre walkway does not span the entire length (due to an open plan section), a temporary work structure (scaffolding) may be used to reduce the fall height.

### **Roof Truss Bracing:**

The Framing Contractor must designate and provide a list of names to the Prime Contractor of the competent worker(s) that will install all bracing and roof peak work. **ONLY** these workers will be allowed to install bracing and only one worker will be allowed to install any roof peak work. These workers shall not have any other duties to perform during installation of bracing and roof peak work. These workers must follow the installation requirements of the Truss Manufacturer as approved by the Truss Design Engineer.

Prior to the use of a fall protection system, e.g. roof anchor straps, all required engineered bracing must be installed.

Bracing is used to hold a truss and its members in the intended position, in the design. Bracing falls into the following categories:

- Temporary bracing required during erection
- Permanent bracing specified by the building designer (as applicable)
- Permanent lateral bracing specified by the truss designer.
- Ridge block installation

**Note:** *All trusses are unstable laterally until properly braced. The longer the truss span, the more care required. Complete stability is not achieved until the bracing and decking is completely installed and properly fastened. Collapse can easily occur without a bracing system that will prevent both horizontal sway or roll over. The bracing system should provide support at spacing's at no farther apart than the drawings show for the bridging. Without proper bracing, trusses may not support even their own weight.*

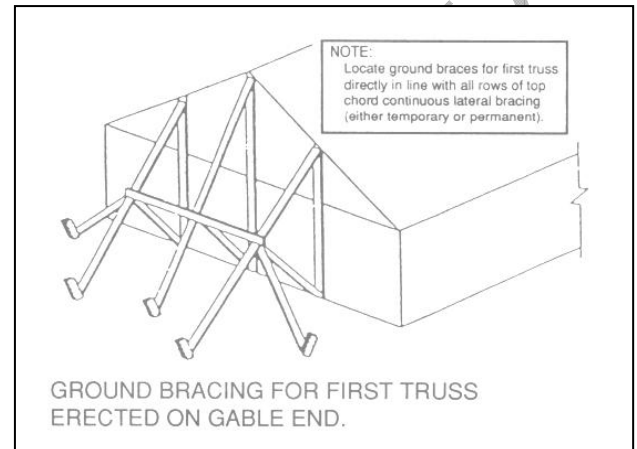
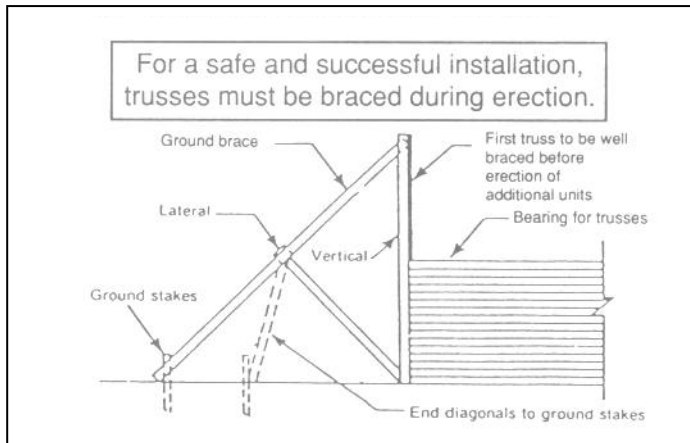
### **A. Temporary bracing required during erection:**

Ground bracing is used to provide stability for the first truss installed. The first truss must be well braced before erection of additional units. It is composed of vertical and diagonal members providing support from the installed trusses to the earth, floor, foundation or slab. The first truss being installed must have complete and substantial bracing, since all other trusses rely on support from the first truss. Ground braces must be a minimum of 2x4 construction grade lumber.

### Temporary bracing of the first truss:

1. Install lateral bracing from the ground of the structure to the top of the center of the first truss. Install additional lateral bracing mid way on either end of the truss. A minimum of 2-16d nails must be used for each truss bracing connection.
2. Locate ground braces for the first truss directly in line with all rows of top chord continuous lateral bracing. Secure the end of the brace to ground stakes. Ground braces should be in line with the top of the vertical braces.
3. Install diagonal bracing from the center of the ground brace back to the bottom of the structure. (Bracing shall be installed at a 45 degree angle to the trusses)
4. Attach horizontal bracing across all three ground braces.

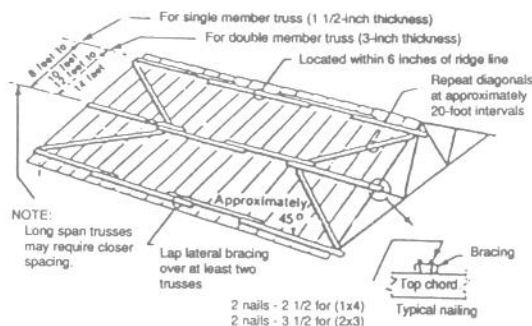
### Temporary Bracing of the first truss:



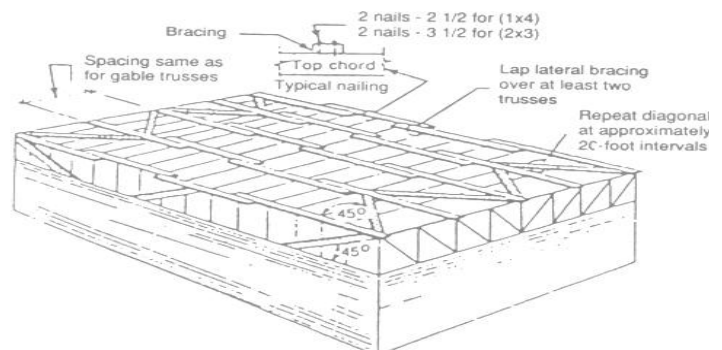
### Temporary bracing in the plane of the top cord:

1. Run a string line from heel to heel of end trusses.
2. Erect trusses using the string line to locate the heel. Ensure trusses are plumb and properly spaced according to the truss Manufacturers or engineers design requirements.
3. Each top cord should not vary more than 1/2 inch from a straight line.
4. The vertical alignment cannot be more than 1/4 inch out of plumb.
5. Install lateral bracing within approx. 6" from the ridge line. Bracing should be composed of a minimum 2x4 construction grade lumber.
6. Lap lateral bracing over at least two trusses. Secure lateral bracing with 2 nails (2 1/2 - 3 1/2 ") on each truss.
7. Repeat installation of the bracing along the mid (8-10 or 12-14 feet from the top of the truss depending on the type of truss) and lower ends of the trusses.
8. Install diagonal bracing at the ends of the structure, from within approx. 6" from the ridge line at a 45 degree angle to the mid lateral bracing. This is repeated from the mid lateral bracing back to the lower ends of the end truss. Diagonal bracing is repeated at approx. 20 foot intervals.
9. Diagonal bracing should be installed immediately after the first group (3) trusses have been braced laterally.

### GABLED TRUSSES



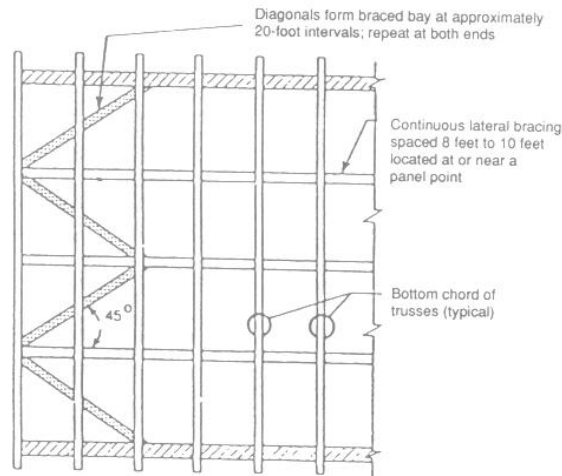
### FLAT TRUSSES



### Temporary bracing in the plane in the bottom chord:

This bracing is similar to the permanent bottom chord bracing. Therefore once installed to satisfy the needs of temporary bracing it should be left as permanent bracing. This lateral and diagonal bracing is required to maintain the proper truss spacing and to transfer force due to lateral forces into the side walls, shear walls or other resisting structural elements.

1. Install bottom chord lateral bracing ~ 8-10 feet from the truss end, located at or near a panel point. Repeat lateral bracing along the width of the structure at 8-10 feet intervals.
2. Install diagonal bracing at each end of the structure. Diagonal bracing is nailed at a 45 degree angle across 3 trusses, at 20 foot intervals.

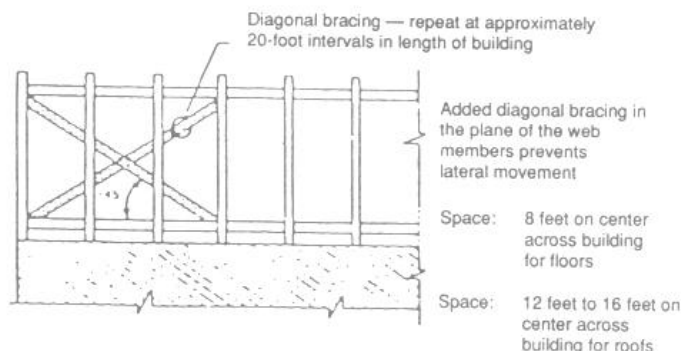


#### **Temporary bracing in the plane of the web:**

This bracing is similar to the permanent diagonal web bracing. Therefore, once installed to satisfy the needs of temporary bracing it should be left as permanent bracing. Diagonal web bracing specified by the building designer is used to hold the trusses in a vertical position, to maintain the proper spacing, to distribute unequal loading to adjacent trusses and to spread lateral forces to diaphragms or shear walls.

1. Install 2x4 web bracing at ~ 20 foot intervals along the length of the building at 45 degree angle.
2. Web bracing should be spaced ~ 12-16 feet on center across the building for roof trusses.

**Note:** temporary bracing must be removed with care and only if the permanent roofing or flooring material is being installed. The temporary bracing is removed in stages and sequentially as the permanent system is being installed.



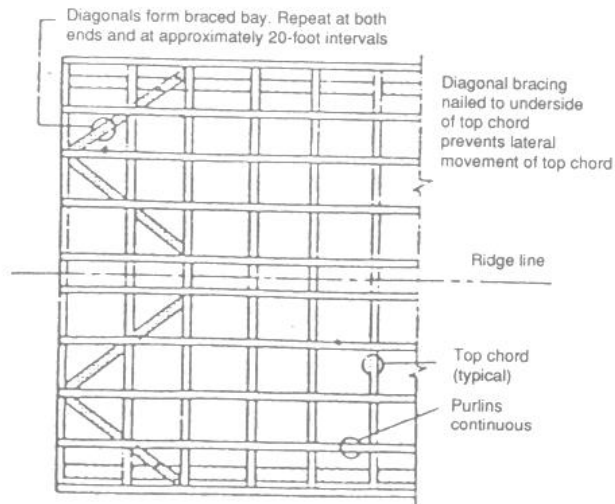
#### **B. Permanent bracing specified by the building designer:**



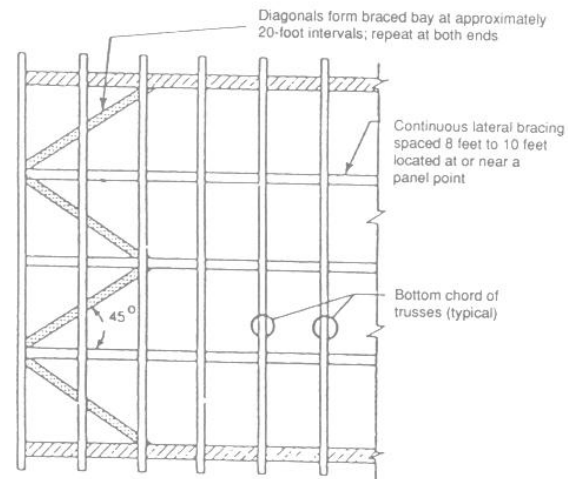
Prior to the use of a fall protection system, e.g. roof anchor straps, all required engineered bracing must be installed. Permanent bracing is designed and specified for the structural safety of the building. It is the responsibility of the truss designer to indicate the size, location and attachments for all permanent bracing. When lateral bracing is shown on the truss design drawing, it must be installed so that the truss will support the loads it has been designed for. Typical applications of permanent bracing are as follows:

- Top chord bracing – if purlins are used
- Bottom chord bracing – as described above
- Diagonal web bracing – as described above

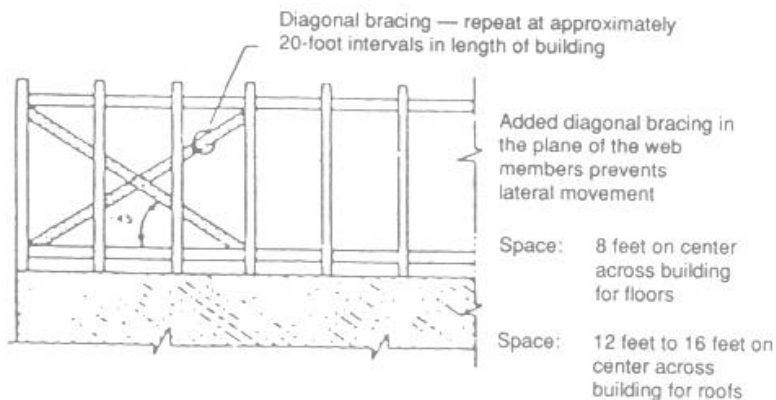
#### Top Chord Bracing:



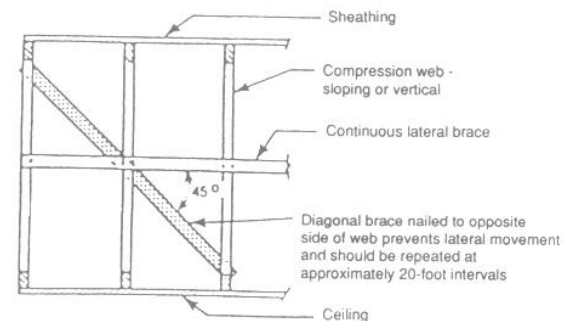
#### Bottom Chord:



#### Diagonal Web Bracing:



#### Anchoring of permanent lateral web bracing:

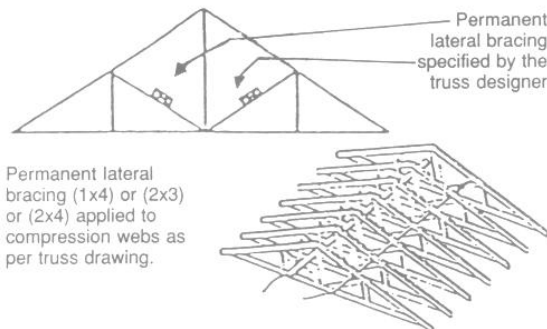




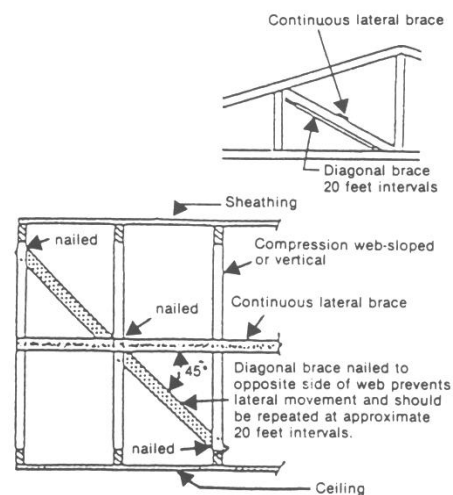
### C. Permanent lateral bracing specified by the truss designer:

This type of bracing is normally used on chords and / or webs to prevent buckling. When it is required, it is specified by the truss designer and is shown on the truss drawing.

1. Workers positioned in the webs of trusses **MUST** ensure they have a Stable Work Position:
  - They must either sit on a ridge seat (or the equivalent) or:
  - Position themselves in previously stabilized trusses/rafters and lean into, and reach through, the trusses/rafters.
2. Install permanent lateral bracing (1x4, 2x3, 2x4) through the compression web of the trusses along the length of the building.
3. Anchor the lateral bracing (specified by the building designer). Typically the diagonal brace spans 3 trusses at a 45 degree angle and is nailed to the opposite side of the web and is repeated at ~ 20 foot intervals



It must be emphasized that when lateral bracing is shown on the truss design drawing, it must be installed so that the truss will support the loads it has been designed for.



### D. Ridge block installation:

1. Workers may be stationed on the top of the ridge where that is the only feasible way to secure rafters and install the ridge blocking.
2. Prior to beginning ridge block installation, all workers, debris, materials and tools must be cleared from the area beneath where the work will occur.
3. Where ridge block installation occurs over an area that is greater than one story, temporary scaffolding must be installed below the work area to reduce the fall distance.
4. Workers positioned at the peaks **MUST** ensure they have a Stable Work Position:
  - i. They must either sit on a ridge seat (or the equivalent) or:
  - ii. Position themselves in previously stabilized trusses/rafters and lean into, and reach through, the trusses/rafters.
5. Install the ridge block along the top of the trusses. Carefully work your way along the top and secure each truss to the ridge block according to the design or manufacturers specifications. Workers must not remain on or in the peak/ridge any longer than necessary to complete the task safely.
6. **Installation of the Safety Strap fall protection anchor must be completed as per the manufacturer instructions.**

### Fascia Board Installation:

#### Overhang Projections Up To a Maximum of 2 Feet

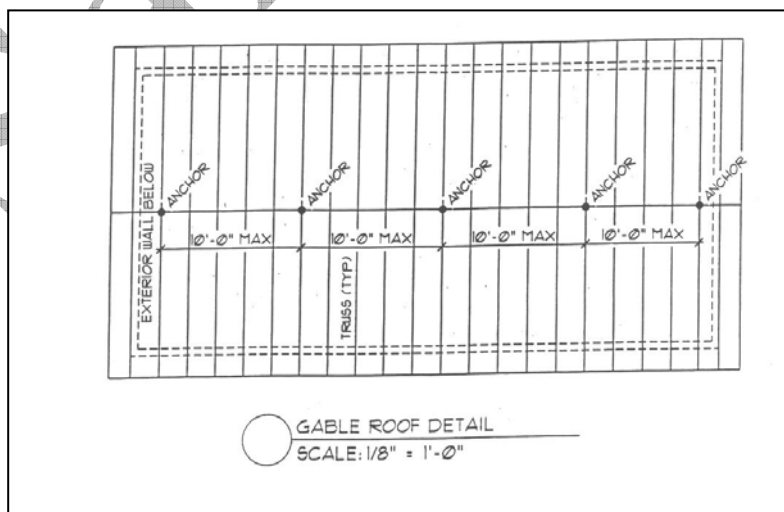
1. The plank walk way must be installed along the interior or exterior wall, 36 inches below the exterior wall top plate as stated in the wood scaffolding erection section of this safe work procedure.
2. Workers are **NOT** allowed to install fascia board(s) from the exterior wall top plate (i.e.: no standing; kneeling, walking, etc. on the exterior wall plate)
3. Secure fascia board(s) along the ends of the trusses.
4. When this procedure is not practical due to larger projections of the overhang (over 2 feet) an alternative safe method must be followed using a ladder or scaffold.

### Installation of Anchor Slings on Roof Trusses:

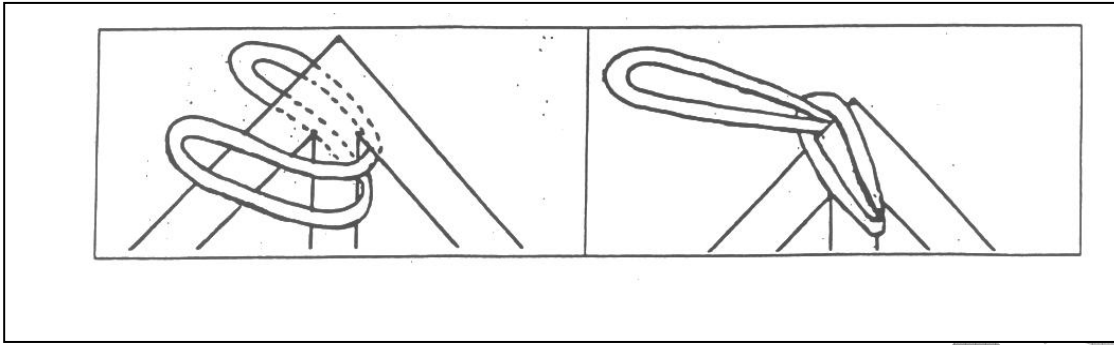
Anchor slings are intended to be used anchorage connectors for fall arrest and travel restraint applications. **The slings must be used in accordance with proper fall protection methods and are designed for personnel fall arresting only.** The anchor sling is made from 2" webbing which has been manufactured with woven loops at each end.

1. Inspect the webbing on both sides from end to end. Look for signs of wear or damage while bending and flexing it over your fingers.
2. Look for cuts, broken fibers, damaged threads in the stitching, hard spots, fused fibers, discoloration or visible signs of damage from heat, which will weaken the anchor's performance. Measure the sling from end to end to ensure that significant stretching has not occurred. If it has stretched by more than 5%, remove it from service and destroy.
3. To install the anchor sling, wrap the sling around the top of the truss (king post and one chord), pass one end through the loop of the other and pulled tight to secure. Choke the sling in a secure manner making sure that the overlapped material is positioned in front of the king post, avoiding any sharp edges or obstructions. Ensure the sling does not come into contact with the gang nails or gang plates.
4. **Anchor slings shall be installed no more than 4 feet in from the fascia board and not more than 10 feet (or 5 trusses) apart thereafter.** Do not install anchor slings on the ridge board spacers in between the trusses. Keep installing anchors in this manor until you reach the other end of the roof.
5. When installing the roof sheathing near the anchor sling be sure to pull the anchor sling to the top side of the roof sheathing. This will ensure protection for the trades to follow.
6. The anchor sling should pass through the area where the roof sheathing meets at the peak and at the hip.
7. Attach lifeline to anchor sling using a carabineer. Allow lifeline to extend and flow over the outside wall of the structure to the ground.
8. **The anchor is not to be used until the first row of roof sheathing is completely installed. (Note: the roof is not stable until the first row of sheathing is installed and the manufacturers required bracing is complete.**

Example of placement of anchors on a gabled roof:



Securement of web sling:



#### ROOF SHEATHING INSTALLATION:

1. Set up extension ladders to access the top of the trusses according to the safe work procedure for ladder setup. (inspect the ladder before use; ensure the ground is level; place the ladder at a 4:1 ratio; secure at top and bottom of the ladder; ensure the top of the ladder extends 1m over the top of the work surface; always maintain 3 point contact and always face the ladder; only 1 worker is allowed at a time on the ladder.
2. Ensure all workers that will be sheathing the roof have been given fall protection equipment and have been trained on maintenance and use of the equipment and are competent in the use of the equipment.
3. Workers not involved in roof sheathing **shall not stand or walk below or adjacent to the roof opening or exterior walls** where they could be struck by falling objects. The supervisor may order a brief halt to the sheathing work to allow other workers to pass through the restricted area, as long as suspending work does not create a greater hazard.
4. The Roof Sheathing Contractor must remove slip hazards before walking on sheathing. Such measures include removing mud from boots.
5. When icy weather is present, roof sheathing shall be suspended unless safe footing can be assured.
6. If winds exceed **35 Km per hour**, sheathing operations are to be suspended.
7. Materials must be staged so that workers on the roof have quick and safe access to them. A toe board is an example of allowable method to secured material.
8. Install the first row of roof sheathing either from the wall scaffold, or from ladders.
9. **When the first row of sheathing and permanent bracing has been completely installed, the roof system is stable enough to support a conventional fall protection system.**
10. Ensure each roof worker is trained and competent in the use of fall protection and receives a full body harness and lanyard. Put on the full body harness and lanyard and attach the end of the lanyard to the connection point on the rope grab.
11. Climb the ladder and connect the rope grab to the lifeline.
12. Once the first row of sheathing, anchors and lifelines have been attached, begin to install the second row of sheathing using the first row of sheathing as a work platform. Work from left to right or right to left across the length of the roof. An alternate way to sheath is to work in block sections from the bottom to the top, then proceed to the next block. Always keep the lifeline behind you as you work. If you do not work in an organized manner (left to right across the entire length of the roof) the lines may become entangled. Always work in one direction across the entire length of the structure or as far as the anchor and lifeline will permit, 10 degrees. Ideally, work should be performed directly below the anchor point. The further a worker is away from this ideal position, the greater the potential for the worker to swing like a pendulum into objects if the worker falls. In situations where swinging cannot be avoided, but where several equally good anchor points are available, the anchor point selected should direct the swing fall away from objects rather than into them. Where there is a choice among anchor points, the one offering the least amount of swing should be selected.

13. Keep the sheathing in front of you. This prevents a forward fall through the webbing of the trusses.
14. As work progresses along the roof you will approach the next sequential anchor. Approach the lifeline of the next anchor, un-attach the rope grab from the first life line and reattach to the next lifeline (attached to the second anchor). Continue sheathing
15. When installing the roof sheathing near the anchor sling be sure to pull the anchor sling to the top side of the roof sheathing. This will ensure protection for the trades to follow.
16. Ideally anchor slings should be left in place until all work on the structure has been completed or as long as the manufacturer will allow the anchor to be left in place.

**Signature caption statement**