



Approved Methods

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Introduction to the Roofing Section

Cabarrus HFH normally sub contracts the installation of the trusses and the roofing to sub-contractors. This section is here as a reference.

This Section Includes

Safety Review

Tool, Equipment and Material List

Material Description

Construction Details and Drawings

Roofing SafetyGuidelines

Review these guidelines with each crew member at the start of the day or as they arrive on site.

"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

Speak up if something looks unsafe. An observer can spot danger quicker than a worker.

Know where water & first aid kit are located. Tell the site supervisor about any injury immediately.

It is critical to **brace the gable trusses** properly.

Habitat requires safety glasses not just when using power saws, but at all times.

Habitat requires hard hats be worn by everyone on site during framing.

Utility knives - keep your hand out of the blade's path. Retract blade when not in immediate use. A sharp blade is safer than a dull one. Safely dispose of used blades.

Power Saws:

- Only crew members with power saw **experience** can use them. A busy work day is not the time to teach saw skills nor is it the time to learn saw skills.
- Habitat requires that **ear and eye protection** be used when using power saws. Don't bind the blade of any saw listen for it. Back off and re-support lumber. Keep electric cords out of the way of the saw and out from underfoot.
- Don't cross hands over to stabilize material on the miter saw. Find another way or get help.
- **Guards** on saws must be in place & operating.

Keep the entire work area, inside and out, free of trip and fall hazards.

Keep **tools not in use in your tool belt at all times**. Select the correct tool for your work. Carry only those you need.

Remove nails before discarding lumber. Discarded material must be placed in the designated area.

Keep tools not in use in your tool belt at all times. Select the correct tool for your work. Carry only those you need.

No loose clothing or hair that can get caught in power tools.

Wear appropriate clothing for the task including work boots that protect from falling objects, have a nonskid sole & resist nail penetrations. No open toed shoes allowed.

Tools must be in a safe condition (meet OSHA standards, i.e. no nicks in cords or missing grounding prongs.)

Think & concentrate on your task. If you are uncertain about how to do a task, or how to operate a power tool, ask your crew leader.

Additional Ladder, Scaffolding & Roof Safety

Use a **ladder** that will reach the work. An extension ladder should reach 3 feet above the step off point. Move the ladder with your work. For every 4 feet of height, move the bottom of the ladder one foot away from the wall. Place ladders on solid footing. Block extension ladders at the top to prevent sideways movement.

Scaffolding - See the site supervisor for the numerous safety requirements for scaffolding (i.e. using triple widths of walk boards, placing scaffolding on solid footing, and guardrail requirements).

Keep the entire work area, inside and out, free of trip and fall hazards.

Safety requirements for working on the roof differ according to roof pitch. See the site supervisor for specific requirements. For a 4/12 or less roof pitch, it will be necessary to have a designated and trained "safety monitor" at all times on the roof. For a 5/12 and over pitch, additional regulations will be discussed. Safety Harness and rope will be required if you are on the roof.

Keep **roof top swept** free of debris and shingle grit and never walk backwards.

Don't leave loose objects on scaffolding, ladders or roof decks.

Keep tools not in use in your tool belt at all times. Select the correct tool for your work. Carry only those you need.

If you are not comfortable working on the roof and/or climbing ladders then you should let the supervisor know and under no circumstance should you feel obligated to engage in tasks that require climbing ladders and working on the roof. There is plenty to do on the ground.

Task List - Roof Framing

Staffing

House Leader Framing Task Leader 4 Crew Leaders 15 Additional Volunteers

 Raise gable trusses and place on walls, plumb, brace & nail	3-4 crews
 Set up Guide string for interior trusses	1 crew
 Prepare bracing for interior trusses	1 crew
 Raise and place interior trusses on walls, plumb, brace & nail	2 crews
 Install rear or side door porch roof	1 crew
Install fascia boards	1 crew
Install OSB Nailing Strips	1 crew
Lay-off and install OSB roof sheathing	2 to 3 crews
Install diagonal and bottom chord truss bracing	1 crew
Construct attic floor	1 crew
 Install hurricane clips	1 crew
 Install roof felt	1 to 2 crews
 Clean up site, put away tools and equipment	All crews

Tasks to Be Completed and Crew Size

Quality Checkpoints

- _____ Trusses braced securely
- _____ Gable trusses plumb
- _____ Fascia board straight and properly nailed
- _____ OSB roof sheathing installed properly/check nailing pattern
- _____ 2" gap in sheathing at ridge
- _____ Wall sheathing installed/check nailing pattern
- _____ Drip edge pieces overlapped/locked correctly
- _____ Roof felt properly installed and nailed
- _____ All materials restacked, site cleaned, tools accounted for and put away

Task List-Roofing Staffing

House Leader Framing Task Leader 3 Crew Leaders 12 Additional Volunteers

Tasks to Be Completed and Crew Sizes

 Install Drip Edge	1 crew
 Lay-off for shingles	1 crew
 Place shingles on top of house (as needed)	2 to 3 crews
 Install roof shingles	2 to 3 crews
 Install ridge cap and ridge vent	1 crew
Remove all temporary bracing	1 crew
 Clean up site, put away tools and equipment	All crews

Quality Checkpoints

._____

Roof shingles laid off with minimum of 1 tab plus 3" at each end of roof
Visible nails on roof tarred (shingle & ridge vent nails)

Roofing Tool, Equipment & Material List

Tools Each Roofing Crew Member Will Need

Hammer (16 oz. Minimum) Nail Apron <u>Retractable</u> Utility Knife (With Extra Blades) Measuring Tape (16'Minimum) Square (Speedsquare® or Combination) Two Pencils Safety Glasses Work Gloves Hard Hat Water

Tools and Equipment Needed On Site

Ear Protection/Glasses/Hard Hats 100' Grounded Drop Cord Drop Light 3 or 4-Way Heavy Duty Electrical Box/Splitter Electric Miter Saw (10" or 12") Reciprocating Saw (with Extra Blades) 16' Extension Ladder Two 8' Step Ladders Two 6' Step Ladders Handy Bar/Crow Bar Siding Snips 30' (Minimum) Measuring Tape Nylon String (300 Yards) Rope Push-Sticks Broom Caulking Gun Saw Horses (Two Pair) Saw Table Stapler & staples Nail Punch

Material List

Lumber OSB (Roof) 2x4 Fascia board (Long Lengths) 2x6 Fascia board 2x4x12 Attic Bracing

Components Trusses Nails/Screws/Bolts 16d Nails 8d Nails including nails with ring shank 10d Nails Roof Nails 1 ¹/₂" 1" button caps nails 1 ¹/₂" Siding Nails (Wall Sheathing) Screw Shank Vent Nails ⁵/₈" 8" Bolts, Washers, & Nuts 16d Galvanized Finish Nails 10d hurricane clip nails Drip Edge

<u>Other</u> Plywood Clips Felt (Roof and Window/Door Flashing) Shingles Ridge Vent with Connectors Roof Tar or Caulk Rubber Roof Boots (for Vents) Step Flashing

Roofing MaterialDescription

Pre-engineered roof framing units that come in two types - Gable Trusses and Interior Trusses

Push-Sticks

Formed by cutting a "V" notch into the end of a long 2x4. Used to push trusses onto and across the walls

Plywood Clips

Metal "H" shaped clips used to support the edges of OSB sheathing between the trusses

Roofing Felt

#15 black felt used for covering the roof and for flashing around windows

Roof Shingles

#215 Fiberglass roofing shingles

Ridge Vents

Pre-finished aluminum vents in 8 or 10 foot lengths with connectors, cover straps and special aluminum nails

Step Flashing

Metal L-shaped pieces used to flash between shingles and siding on small gable roofs

Drip Edge

Pre-formed aluminum strips that waterproof the framing between the fascia and the shingles.

Preparing the Gable Trusses

The end gable trusses will need to be sheathed (skinned) with ½" OSB and ladders attached to the pitched part of the gable. Gable trusses that are exposed to the heated part of the house will need to have ½" blue board attached using button cap nails Gable trusses that cover unheated space will need to have Tyvek house wrap installed using button cap nails (do not place nails where the ladders will be installed).

Skin the Gable

The exposed exterior surfaces of the gable trusses are sheathed with OSB using 8d ring shanked nails. Drive the nails at a slight angle to keep the sharp points from coming through. The nailing pattern for each piece of OSB is 6" on the perimeter and 12" on the interior. OSB cannot extend beyond any edge of the truss. Use a router with a bit to grind off any part of the OSB that extends past the truss. It will be difficult to trim once the gable is raised. Keeping the OSB back from the edge approximately ¹/4" will avoid this problem. All seams should fall in the center of the framing.

Skin the Gable - Alternate Method

Some site supervisors overhang the OSB on the bottom of the gable by 1 to 1 ¹/₄" (anymore and it will interfere with wall sheathing). This method provides a lip that can easily be nailed into the cap plate, which strengthens the tie between the gable and the wall. If this method is used, care must be taken to plan the overhang so that it does not interfere with porch beams or porch ceilings. Do not use this method on continuous bearing gables. Check with the site supervisor as to the preferred method.



This is a continuous bearing gable truss so the sheathing should not overhang on the bottom. (Continuous bearing trusses lack diagonal webbing.)



Gable Sheathing

Gable Ladder

Construct a gable "ladder" using two 2x4s (or 2x6s) cut to match the top chord of the truss. 16 ¹/₂" blocks of 2x4 or 2x6 are nailed between the "side rails" of the ladder at 24" o.c. (This size block makes roof sheathing easier). Be sure there is a block on each end of the side rails and if you are splicing a side rail, it will need to have doubled up blocking. Attach the assembled ladder to the face of the truss using two 16d common nails every 12" by nailing through the back rail of the ladder as well as using 3" deck screws, through the OSB and into the top truss chord. Angle these nails slightly toward what will be the ground to prevent sagging.

Gable Nailing Boards

When small gable roofs join gable sidewalls it necessary to install a nailing board onto the larger gable. Do this by tracing the shape of the smaller gable into position. Hold the larger gable's ladder ³/4" back from the nailing strip to give room for sheathing and flashing.



Gable ladder stops ³/4" short of the nailing strip.



The large gable has 2x4s in place and ready to support roof's sheathing.



Another example of a nailing board.





End of ladder is cut to match roof pitch.

Boxing Returns

Attach Boxing Returns to the bottom of the gable overhang (ladder framing) with 16d common nails and toe nail to the gable wall with 8d common nails. Set the boxing return so the bottom is flush with the bottom edge of the fascia board. Use a Speedsquare[®] to get it square to the house. A typical boxing return will be 16 ¹/₂" wide from the outside of the OSB sheathing.

It is important that the boxing return be ½" shy of the edge of the porch beam framing (or ¼" past the beam's 1x trim). This can be calculated in advance or once the gable is hung, the boxing return can be built out with shims. This placement allows J-Channel to run across the porch beam on the front of the house and straight up the boxing return for an aesthetically pleasing siding job.





Boxing return priorities. The tips can be cut off.

Lay Off for Roof Trusses (if it has not been done)

Marks for roof trusses are typically added to the top plates during layout and later transferred to the cap plates. If truss layout occurs during framing, the following method is used.

Return

After all the walls are erected, plumbed, straightened and braced, and cap plates installed, lay off for the roof trusses. Beginning at the back of the house, pull a tape from the end of the house on top of the cap plate and make a mark every 24", placing an "X" or "T" on the forward side of the line.

NOTE: If truss plan is other than the normal front-to-back gable plan, refer to the manufacturer's truss plan for lay-off details.

Make a notation on the cap plate to show locations for special trusses. Check the truss order to see if this is necessary (i.e. trusses with extra load bearing qualities for front porches).



Truss Layout Mark Transferred to Cap Plate

Construction Details - Roof Trusses Prep for RaisingGables

Catwalk

On some plans a temporary cat walk needs to be constructed over the open dining room/den areas to walk on while setting trusses. The catwalk is made of (3) 2x4s or 2x6s nailed together with 16d nails 16"o.c. to form a beam. Adequate support is crucial to safety.

Scaffolding and Step Ladders

Place two sets of scaffolding along the side of the house, next to the exterior walls. Place scaffolding inside the house. Ladders alone are not adequate for inside the house.



IF TWO CORNER POSTS ARE NOT ON LINE, IT MAY BE NECESSARY TO BUILD A SUPPORT BEAM ACCROSS THE HALLWAY TO SUPPORT THE CATWALK. HOLD THIS SUPPORT BEAM LOW ENOUGH TO HAVE CATWALK 3/4" BELOW TOP OF CAP PLATE. (FOR 2x4 WALK, TOP OF SUPPORT WILL BE 4 1/4" DOWN FROM TOP OF CAP PLATE)





Catwalk Details



Catwalk in place and being used



Temporary Gable Bracing -Strongbacks

Before the first gable truss is raised and nailed to the cap plates, install a temporary brace, ("strongback"), to hold the truss in a plumb, upright position. The height of the strongback is the wall height plus the gable height less about one foot. Measure at the location the strongback will be raised. The strongback is placed against a stud. Double the stud if winds are strong or if the gable will be left for even a short time without roof sheathing. Place a layer of OSB and ½ " Foam Insulating Sheathing (blue board) as a shim behind the strongback, for the entire length of the strongback, if the wall sheathing and blue board is not installed. Install securely with 16d nails every 16". A weak strongback is very dangerous.

Temporary Gable Bracing - End Bracing

Install two shorter 2x4 temporary braces, about 3' long, near the outer edges of each end wall before the gable is put into place against the strongback. These two blocks will prevent the gable ends from slipping off the cap plate.

Strongback's Brace

This is most useful on windy days or when the gable stands without roof sheathing for an extended amount of time. Install a diagonal brace for the strongback from a stake in the ground to the top of the strongback, making sure that its end will not interfere with the raising of the gable. Overlap two long 2x4s and nail them securely together to get the needed length for the brace. Using a 4' level, check the top of the strongback for plumb and nail securely at the top.



Strongback in Place



Strongback on Rear Gable (end braces missing from photo)



Strongback Holding Gable in Place Note Box Beam Bracing and how Strongback is braced to interior wall.



Gable End Bracing (which was installed prior to raising gable)



"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

It is critical to **brace the gable trusses** properly.

Habitat requires **hardhats** be worn by everyone on site during framing.

Bracing the Strongback

Raising Gable Trusses

Stand the gable truss to an upright position. Line up the bottom chord of the truss with the outer edge of the end wall cap plate, with each end of the truss uniformly extending beyond the side wall cap plates (approximately 9 $\frac{1}{2}$). It is recommended that three people work from the top of the walls. These three people, with help from those on the floor, will raise the gable truss to a vertical position resting carefully against the strongback. People with the notched push sticks provide stability as the truss is raised into position.

The two shorter temporary braces nailed to the ends of each end wall should already be in place. These two blocks help prevent the gable ends from slipping off the cap plate. The gable is placed between the strongback and temporary end braces and the deadwood that was installed along the capplate.

Check that the overhangs are uniform and that the outside of the gable truss is flush with the end wall (sheathing to sheathing or framing member to framing member) and slip the gable into place along the edge of the cap plate. Nail from the outside of the gable truss through the 2x4 deadwood using 16d nails every 12".

Repeat this process for the remaining gable truss (es).



A temporary diagonal brace is used on the inside of the house. Place it so that it will not interfere with setting the trusses.

"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

Placing the trusses on top of the walls is a difficult and potentially dangerous task that requires the cooperation of several crews working together under the direction of very experienced crew leaders overseen by the task leader. This is particularly true of gable trusses, due to their enormous weight. It is imperative that the deadwood, strongback and end bracing be in place. Scaffolding and other prep should be in place and secure.



Interior Gable Diagonal Bracing (front gable)



Gable End Bracing

Interior Trusses

Guide String for Truss Overhangs

Before raising the interior trusses, attach a string line around the end of the front gable truss to the end of the rear gable truss. Use this string line to line up all the other trusses, being careful not to let any truss actually touch the string. Place the string opposite the side of the house where the trusses will be handed up.

Hint: Place (don't nail) a vertical 16d nail between the end of each gable truss and the string. The tension on the string will keep the nail in place. As trusses are put into place, hold them off the string using a 16d nail as a gauge. This insures that no truss will touch the string, which would create a situation of compounded errors.



Place a 16d nail between the string and each gable truss. Keep interior trusses off the line by the width of a nail. Do not let trusses touch the string.



String Line in Place. Trusses Being Set.



Setting up the String Line

Truss Bracing Prep

Mark about twelve 12' 2x4s at 24" o.c., starting with the tape at the end of the board. These will be needed on the roof as soon as the trusses start going up. Accurate marks will keep the trusses plumb until the OSB is installed and will later be used in the attic for bracing the bottom truss chords.

While the trusses are in a stack, mark a line on the top chords 9' up from their ends. Placing the braces along these marks will keep them straight and level and keep trusses plumb.





Temporary Truss Bracing

Temporary Truss Bracing

Raising Interior Trusses

After the gable trusses have been installed, the remainder of the trusses can be placed on top of the walls using the same procedure as for the gables.

CAUTION: Trusses should not be stacked directly on top of one another. They can slide or become unstable and may cause an injury. Do not let the trusses interfere with the string line. When a truss is on its side, do not walk where it does not have a wall directly beneath it for support.

Because crew situations vary crew to crew and job to job, there are several methods generally accepted for raising trusses.

- Evenly distribute all the trusses on the house before raising. Stack the trusses like a splayed deck of cards. Do not create a situation where trusses are in the way of the one needing to be raised. (Or)
- Evenly distribute a portion of the trusses on the house, raise that portion, and repeat. (Or)
- Place trusses on the house at the same pace they can be raised.

Position the first interior truss on the layout marks and check the overhang. Nail to the exterior walls, toe nailing to the cap plate with three 16d nails, two on one side and one on the other (three for each side of the house). Do not nail at the interior walls.

Temporary Truss Bracing

Temporarily brace each new truss to the previous trusses by nailing 12' 2x4s (pre-marked at 24" o.c.) across the truss top chords, along both sides of the house, using 16d common nails at each truss. Leave the heads exposed for easy removal. Nail this temporary bracing at least 9' up from the bottom edge of the trusses to allow space for two rows of OSB sheathing to be installed before the bracing is removed. Keep the bracing level and straight so the trusses will go up plumb.





Trusses Stacked and Ready to Raise

Handing Up Trusses



Toenail with two 16d nails on one side and one on the other side

Bowed Trusses

If an interior wall is un-level and causes the truss to bow, check to see if the wall framing can be tightened up with a sledge hammer. If not, it will be necessary to remove a portion of the cap plate. This is best done before the truss is nailed down. Take several passes with a skill saw set to the depth that will alleviate the bow, and then use a chisel to clean the cut. If the truss is already installed, a reciprocating saw can remove a piece of the cap plate. Nail the loose ends of the cap plate to the top plate. Never modify a truss.

Temporary Interior Diagonal Gable Brace

Immediately after the gable is raised, attach a 2x4 brace from the highest point of the gable down at an angle to an interior wall, nailing it in place when the gable is rechecked for plumb. Brace the front gable as well. Place the brace such that it will not interfere with subsequent trusses. This should insure that the gable truss, and therefore, the interior trusses, remain plumb during subsequent operations.





"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

Think & concentrate on your task.

Speak up if something looks unsafe. An observer can spot danger quicker than a worker.



Temporary Interior Brace on front gable.

Rear and Side Door Roofs

Porch Roof for Side Door

Leave a square cut on the end of four truss extenders (stud length 2x4s). Using 16d nails, attach these to the sides of the top chords of the trusses. Center the roof extension over the door. The extenders extend 25 inches from the end of the truss. The 25" extensions will insure that shingles with a 5" overlap on a 5/12 pitch will blend in with the rest of the roof.

If the truss layout does not center the porch over the door then it will be necessary to make a ladder for the end truss extension. Cut blocks to the length that centers the overhang and install them as bridging.





Side Door Porch Extension

Bridging and bracing.



Place a wedge under the additional 2x4 to give it support similar to a truss. Block next to the wedge over to the next truss.



Porch Roof for Gable End (Shed Style)

A shed style porch roof, including posts, goes over the back door if the door is on the gable end of the house. The structure is pre-built and will come as a component.

Fascia Boards

Before installing the fascia board, sight the outer edge of the truss bottom chords to insure that they are in line with the string line. If there are minor variations, use shims behind the fascia board to make an adjustment as this will affect the appearance of the aluminum fascia when it is installed later.

The fascia board is a 2x6 nailed to the outer edge of the truss bottom chords forming a continuous band along the edge of the roof. Hold 2x4 fascia boards flush with the <u>bottom</u> of the truss chord and nail to the end of each truss with two 16d common nails. All joints should occur over trusses.

When a fascia board on the front gable joins the side wall of the larger gable, leave a space ¹/8" between the wall and the fascia board. This will allow room for flashing to install between the house and the end of the fascia board.



Porch Roof at Gable End





2x6 Fascia Board installed with smaller truss heel Leave a ¹/8" gap between fascia board and side wall for siding crew to install flashing.

OSB Nailing Strips

While the scaffolding is in place for the fascia board installation, it is a good time to install OSB nailing strips between the trusses. These strips serve the purpose of nailing strips for the top piece of siding under the eaves. If time does not allow for installation, store the material on site for siding crew.

Cut scrap OSB sheathing strips between 22" wide by 3-½" tall to 22" wide by 6" tall. (Tall enough to use as a nailer, short enough to allow soffit to vent.) Count the bays, usually about forty, for an accurate count. Strips install between the trusses at the top of the exterior sidewalls of the house. 16" tall pieces, cut in widths of either 22" (between trusses), 4' and 8' pieces (for walls parallel to trusses) are for porches, where the OSB strips serve the additional role of keeping the insulation in place. (Strips on porches extend 12" above the cap plate and will serve as baffle boards for the insulation.)

Extension Ladder Setup



OSB Nailing Strip

"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

Use a **ladder** that will reach the work. An extension ladder should reach 3 feet above the step off point. Move the ladder with your work. For every 4 feet of height, move the bottom of the ladder one foot away from the wall. Place ladders on solid footing. Block extension ladders at the top to prevent sideways movement.

Scaffolding - See the site supervisor for the numerous safety requirements for scaffolding (i.e. using triple widths of walkboards, placing scaffolding on solid footing, and guardrail requirements).



Ladder Blocked to Protect Shingles. An Extension Ladder should reach 3' past point of step off and be secured to prevent sideways movement.

Keep the entire work area, inside and out,

Roof Sheathing

Prepare the OSB for nailing by chalking lines on the rough side of each sheet of OSB at 24" o.c. before placing them on the roof. Manufacturer's lines are often inaccurate.

<u>SAFETY NOTE</u>: Saw dust can cause the roof to become slippery; therefore all cutting must be done on the ground. One or two people from each crew should remain on the ground to cut panels and pass them up to the crew members working on the roof.

To begin each side of the house, measure up 47" from the end of the truss and strike a chalk line the full length of the house across the top chords of the trusses. (47" insures that the sheathing does not extend beyond the edge of the fascia board, which is not yet installed.)

Sheathing Basics

- Have each row of sheathing started before continuing across the roof. (See "Establishing Stagger Pattern")
- Lay off remaining 4x8 sheets of OSB so that the end or butt joints are staggered, with each full sheet of sheathing beginning on a different truss, 4' apart.
- Nail with 8d common nails at 6" o.c. on edges and 12" o.c. on interiors.
- Center every truss on the chalked 24" o.c. lines.
- Install plywood clips halfway between every truss on every row. This prevents sagging.
- Do not let any OSB extend past the ladder framing or it will interfere with the drip edge. (Do not use a saw on the roof to modify the edge but pass it down to be recut.)
- Only the first row is installed to a line, the rows above will rest on the H-clips.
- Keep a hairline joint (1/16" maximum) between adjacent pieces of sheathing. This allows for expansion and it makes the next sheet easier to adjust if necessary.
- As sheathing is installed, the 2x4 bracing is removed and passed to the attic to be used for permanent bracing.
- The first and last 3' of the top row of sheathing is solid to the ridge. The remaining sheets stop oneinch (1") below the ridge of the roof. This allows heat from the attic to escape through 2" at the ridge vent. (1-1/2" is the maximum gap on each side.)





Chalk for OSB 47" up from end of truss

H-Clip Between Trusses



Placing OSB into H-Clips



Center OSB on the truss and nail at an angle

Establishing Stagger Pattern for Each Row

Have all rows of sheathing started with the stagger pattern before continuing across the roof. This insures that the layout will go smoothly across the entire roof. Do this on both sides of the house. The more experienced crew leader(s) should be utilized for this job.

If the gable ladder width is $16 \frac{1}{2}$ and it is installed over OSB, and if the trusses are 24" o.c., the first piece of sheathing in each row will be either 41 $\frac{3}{4}$ " or 89 $\frac{3}{4}$ ".

Sheathing Square and to the Line

Set the first sheeting piece in place only after the roof crew checks it top and bottom for an accurate and square cut. Place the factory edge on the inside truss and the cut edge on the gable ladder's edge. Line the top up with the chalk line and the side square to the edge of the ladder. If adjustments have to be made due to a poor cut, either recut (if long) or make allowances for it being short when setting it on the ladder's edge. It must sit square and center on the interior truss.

Any mistake with the first of a row of sheathing will be compounded down the length of the house. This remains true for starting all rows.

Here are some tips to keeping trusses plumb and sheathing square.

Nailing Sequence for Staggered Starter Courses

- Start at the back of the house.
- Confirm that the gable is plumb as the starter rows of sheathing are installed.
- Nail the upper corner at the gable's ladder. Confirm square and to the 47" line.
- Center the opposite upper corner on the far interior truss and nail, moving the truss over if necessary.
- If not already chalked, mark OSB's top edge at 24", 48", 72", moving back from the interior truss. (Do not depend on manufacturer's markings.)
- Nail in the top edge at one truss back, again, lining up the OSBs 24" mark and the center of the truss.
- Hint: Do not nail where the next row of OSB will create a joint. Leave that truss free, so it can be adjusted with the next row of OSB. This will remain true for all sheathing in the first tworows.
- Install an adjacent 8' piece in the same manner.

Start the next row with a piece that was checked by the roof crew for an accurate and square cut. Do not nail the piece until the adjacent 8' piece is tacked into place. (Small pieces are too small to be accurately square and straight.) Set the piece in place by lining it up with the chalk line and squaring it to the edge of the ladder. Place the adjacent 8' piece square and to the line. Go back and nail the piece at its top two edges. Nail the 8' piece.

When the starter sheets are in place on the next row up, go back to the lower row and add additional nails every 12" along each interior nail line and every 6" along each edge.



Sheathing Details - Stagger Pattern



Sheathing Stagger Pattern Complete



Marking OSB for 24" o.c. before tweaking interior truss position

"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

Keep the entire work area, inside and out, **free of trip and fall hazards**.

Keep **roof top swept** free of debris and shingle grit and never walk backwards.

Don't leave loose objects on scaffolding, ladders or **roof decks**.

Keep tools not in use in your tool belt at all times. Select the correct tool for your work. Carry only those you need.

Sheath Remaining Roof

Checking 3' OSB for square

The rest of the roof can be sheathed now that there are starter sheets in place on every row. Continue along the length of the house with 8' OSB panels.

Check the front gable for plumb as the first two rows reach the end. Measure at the bottom corner of the sheet and a square cut piece will help plumb the gable if the house is square. Measure for sheathing to be flush with the outside edge of the gable ladder.

Except on end pieces, hold the OSB sheathing 1" from ridge for venting.

Bottom Chord Bracing

After the sheathing has been completely nailed, and the used temporary braces passed to the attic, install two rows of permanent truss bracing on the bottom chords of the trusses. Place bracing on either side of the center bay of the truss, within a few inches of the webbing.

Install the first brace by nailing a 2x4 across the top of the bottom chord of the trusses for the full length of the house, making sure that the trusses maintain 24" o.c. and that the joints of these braces overlap by one truss bay (no butt joints). This ties the truss chords together and to the end walls and becomes part of the attic floor. Keep the trusses at 24" o.c. for strength, to accommodate drywall, and to frame the attic floor.

A strong connection between bottom chord bracing and the gable truss is very important.



Brace Gable per Truss Manufacturer

The truss manufacturer may require additional bracing of the gable truss. See the site supervisor for details. A common requirement is to add a permanent strongback to the gable's vertical members. In this example, 3 of the longest vertical members need to be made into strongbacks with 90% of the each vertical member braced.



Gable bracing per manufacturer. See site supervisor.



Bottom Chord Bracing on each side of attic bay

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Habitat requires that **safety glasses** be used at all times.

Keep tools not in use in your tool belt at all times. Select the correct tool for your work. Carry only those you need.

Diagonal Bracing

A second type of bracing is a 2x4x10 that is nailed to the bottom or top side of the truss webbing. It is sometimes referred to as "Wind Bracing", "Web Bracing" or "Diagonal Bracing". (Webbing is an integral part of the truss system used to tie the bottom and top truss chords together.)

Each piece of diagonal bracing starts at the top of the gable and runs down the webbings at a 45- degree diagonal, ending near the bottom chord and spanning at least four trusses. Each side of the truss receives this bracing at each end of the house for a total of 4 boards (plus those in the center of a house for those with three gable trusses). Be careful that it does not interfere with the disappearing attic stair opening or the attic floor. (See house plan for stair location.)

It is important to have a strong tie between the interior trusses and the gable. To do this, connect the gable truss to the first interior truss near the peak by using a 2x4 approximately 26" long securely nailed to the underneath side of both top chords. Proceed with diagonal bracing starting on the first interior truss.



If gable and truss webbing does not match it will be impossible to tie them together with diagonal bracing. Secure the gable to the first interior truss as shown above. If in doubt, add this short brace.



Diagonal Bracing



There must be a firm connection between diagonal bracing and Gable Truss. Do this by mitering the end of the 2x4 for full contact with the webbing (flush with sheathing).



Diagonal Bracing in Place

Roofing Felt

Roll the felt out along the lower edge of the sheathing. Nail securely to the roof sheathing using 1" button caps. So that drip edge can be slipped under the felt, place the lowest nail 3" up from the bottom of the roof. However, drip edge installs over the felt up the rake.

Use a pattern of at least four button caps vertically at 24" o.c. plus nail every 6" at the ends and 12" along the bottom to prevent the wind from getting under the felt and blowing it off before the shingles are installed. Care should be taken to insure that felt is laid-out as flat as possible, without wrinkles, since they will show after the shingles are installed.

Cut each end of the felt so that none of the material extends beyond the OSB sheathing. Continue rolling out strips of felt until the roof is completely covered. When rolling out the felt, take care to make the necessary adjustments that will keep it free of wrinkles. Lap each succeeding piece a minimum of 4" over the previous piece and nail securely along the lap. Insure that code's 2" minimum is met should the rows become uneven.

CAUTION: Crews working on the roof should be careful walking on the newly installed felt in case it works loose, in which case re-nail.



Button Caps - For drip edge installation, keep them up from edge 3".



Felt Securely Nailed, Straight, No Wrinkles

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Don't leave loose objects on scaffolding, ladders or **roof decks**.

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FELT NAILING PATTERN



Roofing Felt Diagram

Construction Details – Shingles

Drip Edge

Install metal drip-edge by nailing the wide flange to the roof sheathing using roofing nails or siding nails at 24" o.c. The narrow flange extends over the edge of the roof sheathing and the gutter board. Each piece of the material is designed to overlap and lock into the preceding piece. At each corner of the roof the ends of the drip-edge are mitered and lapped to form a 90 degree joint. Bend a single piece of drip edge at the ridge. Do this by making a single cut, only through the face of the material, at the roof's pitch (i.e. 5/12).

To divert water away from the roof, drip edge is placed under the felt along the bottom of the roof and over the felt up the rake. The logic behind this method is that water blown in from the rake side is channeled over the drip edge onto the felt. Any water on the felt can escape over the drip edge.



Drip Edge at Ridge



Drip edge installs <u>over</u> the felt up the rake, and <u>under</u> the felt along the bottom edge of the roof. Water blown under the shingles is channeled onto the paper up the rake, and over the drip edge and off the roof at the bottom.



Example of Drip Edge Cut for a Corner



Drip Edge around Corners at bottom edge of the roof.

Extension Ladder SetUp



Ladder Blocked to Protect Shingles. An Extension Ladder should reach 3' past point of step off and be secured to prevent sideways movement.

"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

Use a **ladder** that will reach the work. An extension ladder should reach 3 feet above the step off point. Move the ladder with your work. For every 4 feet of height, move the bottom of the ladder one foot away from the wall. Place ladders on solid footing. Block extension ladders at the top to prevent sideways movement.

Scaffolding - See the site supervisor for the numerous safety requirements for scaffolding (i.e. using triple widths of walkboards, placing scaffolding on solid footing, and guardrail requirements).

Keep the entire work area, inside and out, **free of trip and fall hazards**.

Prep for 3-Tab Shingles

Starter Shingle Lines

After the felt and drip edge is installed and securely nailed, install the starter course of shingles around the perimeter of the roof. Use a chalk line to establish a line 11" from the edge of the drip edge and gable ladder along the entire perimeter of the roof. The chalk line can be snapped 10" up from edge of the fascia board but don't install starter shingles before the drip edge is in place.



Edge Starter Shingles in Place against chalk line. Parallel Starter Lines (18" apart this example) also in place.



Starter Shingle Detail



Shingle Details - Parallel Starter Lines

Next, chalk two lines, perpendicular to the edge of the roof and 6" (or 18" -) apart, through the porch roof overhang (if the plan has an overhang) and up to the ridge, see chart. You can determine the location of these lines mathematically or you can use the trial and error method. The purpose of these lines is twofold. First, two roofing crews can work toward each end of the house, starting in the middle, as well as on both sides of the house. Second, it insures that at least one full 12" tab plus 3" of the adjacent tab remain on each end shingle. Lining up each row of shingles on alternate lines automatically positions the tab slots in the center of the 12" tab on the previous row of shingles.

Determining Parallel Starter Lines

- 1. Find width of roof (edge of starter strip to edge of starter strip) in YARDS and remaining inches. ("Starter shingles" same as "starter strip") If the starter strip is not yet in place, then take the width of the roof, edge of OSB to edge of OSB and add 4".
- 2. Locate a place on the roof that is an even number of yards from the left edge (left, facing the ridge). Try to place this mark above a porch overhang if present, otherwise, anywhere near the center of the roof.
- 3. Refer to the chart, which shows all possible starting positions to achieve desirable end shingle widths (no shingle narrower than 1 full tab plus 3"). (Other numbers may work, and there will be exceptions, but this method has been designed to be as simple as possible for simple roofs.)
- 4. If the total roof width is 10 yards and 13 inches, look at the 13" row of the chart (12" to 15"). From the mark placed near the center of the roof, move to the left 3" and mark. MOVE THE SAME DIRECTION FROM WHICH THE TAPE WAS PULLED IN STEP TWO. Marks this as the "X" row of shingles (See Figure 32). Move 9" to the left of that first mark (not the X mark). Mark this as it gives the Y vertical line location. This corresponds to the "Y" rows of shingles. These two rows will be 6" apart and should be placed parallel to each other and the rake and should extend to the ridge.

Shingle Layout Chart INCHES LEFT OVER	Х	Y
0" to 3"	15	21
3" to 6"	12	18
6" to 9"	9	15
9" to 12"	6	12
12" to 15"	3	9
15" to 18"	0	6
18" to 21"	3	9
21" to 24"	0	6
24" to 27"	3	9
27" to 30"	0	6
30" to 33"*	21	3
33" to 36"*	0	18

*X and Y lines will be 18" apart, not 6".

Place Shingles on Top of the House

When all the felt has been securely nailed and all of the layout lines chalked, carry the shingles up to the roof. Lay the bundles of shingles across the ridge of the roof to prevent them from sliding off the house, and over a truss to prevent damaging the OSB sheathing. Dropping a bundle of shingles across the ridge between trusses will break the OSB sheathing. Place no more than three bundles at eachtruss.

SAFETY NOTE: Each bundle of shingles weighs 80 lbs. so care should be taken to avoid back injuries. The safest way to handle shingles is to carry one bundle up the ladder at a time.

Place the bundle on the shoulder and balance it with one hand, leaving the other hand free to hold onto the ladder. Carrying less than a full bundle is an alternative.

Starter Shingles

Starter shingles are placed with their tabs turned away from the edge of the roof (it will seem upside down). Place the first starter shingle with its end on the "x" parallel starter line and its top lined up on the chalk line that goes around the perimeter of the roof. The starter shingle extends <u>1</u>" beyond the drip edge providing an unbroken line of shingles (no tab gaps showing) along the edge of the roof. The gap between tabs will only be visible from above. Nail the starter shingles in the tar strip. Continue installing starter shingles around the entire perimeter of the house.

Shingle Exposure

Lay off regular shingles so the bottom five inches (5") of each row of shingles is exposed. You can do this by chalking a line every five inches (5") beginning at the top of the starter shingle and continuing to the ridge of the roof. The first row of shingles lies directly on top of the starter shingles with the joints staggered 6".

As the manufacturer suggests, nail just below the tar strip with 4 nails. Be sure the nails are going into the shingle below. Each shingle should end up with two rows of nails in it.



Looking Down at vertical starter lines - Ready for a crew in each direction

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Think & concentrate on your task.

Speak up if something looks unsafe. An observer can spot danger quicker than a worker.



Starter Shingle Properly Positioned

Architectural Shingles

Different architectural/shadow shingles require different layouts, and often with a different exposure (i.e. 4 ³/4"). Read the manufactures recommendations from the package and review with the site superintendent before commencing shingle layout.

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Don't leave loose objects on scaffolding, ladders or **roof decks**.

Roof Shingles

Set Up Roofing Crew

Six to eight people can be used effectively on each side of the roof installing shingles. If more people are available for this task, it is better to rotate crews than to have a crowded roof. One to two hour shifts per crew allow some to be working on less strenuous tasks on the ground while others are on the roof.

Cut ends of shingles should always be placed at the edge of the roof, unless a full tab is cut off. Factory edge to factory edge is a good way to remember this.

With six to eight people working on each side of the roof, it is best to spread out across the length of the house. One shingle installer should be positioned at the parallel starter lines (see note on laying off shingles) to insure that each alternate row of shingles is started on opposite lines. From this center column of shingles one, two or three people can lay out and nail shingles in both directions until they reach the edge of the roof.

When starting the first row, make sure the shingle joints are offset from the starter strip joints. Starting on the "Y" line should accomplish this.

Cut End Shingles

Station another person at each end of the roof to trim the end shingles with a utility knife (a hook blade may be helpful). Trim the shingles prior to installation and leave 15/16" overhanging the rake's drip edge. (From below you want to see the factory edge of the starter shingles and not the cut shingles. Keep them back from edge of starter shingles 1/16".)

It is easiest to cut a shingle from the backside with a utility knife and straight edge. Do not cut after nailing shingles as this gives a rough edge to the shingles.

Shingles

Position each shingle so it butts the edge of the preceding shingle and so the top of the shingle lies on the next 5" chalk line. Nail each shingle with four 1" roofing tacks, one at each end (approx. ³/₄" from the end of the shingle) and one above each of the tab slots. All nails should be between the tar and the cut out. To avoid "wrinkling" the shingles, begin nailing at the end touching the preceding shingle, then nail, in order, across the shingle, flattening the shingle as you go.

Continue installing shingles, moving up toward the ridge of the roof until the entire roof is covered.



Nail three tab strip shingles between the tar strip and the notch.



Remind crew members to nail only as fast as they can nail properly. Crooked nails are Habitat's second largest service issue.

Quality Checkpoints for Shingling

- Drive Roofing Nails Straight! Extra care should be taken to drive roofing nails straight into the roof so that the heads sit squarely on the shingles. Crooked nails slice through shingles when they are driven in, and if not then, in 6 months to a year after the sun and weather has softened them. Crooked roofing nails are Habitat's second largest service issue.
- Check occasionally to insure that the tab slots on every other row are in line and that the 5" exposure has been maintained.
- Check to ensure that no roofing nails are exposed in the tab slots.
- Request that the crew not twist on the balls of their feet or walk on the roof more than necessary as this significantly reduces the life of the shingles.

Roofing in Hot Weather

Be cautious in very warm weather that the shingles are not damaged from crews walking on them. In hot weather it will be necessary to start earlier in the morning, before the shingles are hot and soft. It may be necessary to end the day early. Instruct the crew members not to "twist" on the balls of their feet, which will damage the shingles. Once the shingles have heated up, ask the crew to work "from above". If scuff marks are visible on the shingles, then they have taken too much abuse.

Step Flashing

If shingles come into contact with the sidewall of the house, install step flashing. Weave the flashing and the shingles into the corner created by the roof and the wall. Step flashing has a narrow and wide side. The wide side goes against the roof, the narrow side against the wall. Place one siding nail through the flashing at its upper corner into the sidewall of the house. The next piece of flashing will cover the nail head. The top of the step flashing installs flush with the top of the shingle.



Step Flashing - ready for next piece

Step Flashing - ready for next shingle

Vent Boots

Set the rubber boot in place after the shingles have reached the pipe. Caulk under its top and sides, but not the bottom. Nail the boot in place along the top and sides so weather will not cause it to curl and lift. As courses run into the boot, lay them over the base and cut them tight to the molded part. Tar the edges of the overlaying shingles. If installed correctly, any water getting on the boot will run out of the bottom and over the shingles.



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Vent Boot installed

Ridge Vent and Ridge Cap

Ridge vent typically comes to within 4' of the edge of the roof. The exact location can be determined only after the ridge vent is measured.

Strike a chalk line on both sides of the roof 6" down (for a 12" tab) from the point of the ridge to help keep the vent and cap shingles straight. Mark for trusses before the ridge vent is installed.

Beginning at each end of the roof, install cap shingles to a point one foot underneath where the ridge vent

will be installed. Ridge caps consist of modified 12" shingle tabs laid perpendicular to the other shingles, lapping over the ridge of the roof. The cap shingles also overlap each other, leaving a 5" exposure. Nail with 1½" siding nails. Then, cut away the remaining top portion of the several rows of shingles and paper to expose the 2" opening at the ridge of the roof.

Lay each section of the metal ridge vent in line, making connections as you go. The ridge vent will consist of several pieces of vent that overlap 6-12". Try to get the pre-drilled holes to line up with the trusses. Center the ridge vent on the roof by placing it on the chalked line. Both ends of the vent overlap the ridge cap by at least one foot.

As soon as all the pieces have been connected, begin nailing from one end of the roof using screw shank vent nails that have rubber seals. Nail only into the trusses, regardless of where the pre-drilled holes occur (ideally it would be both). If these nails are not available, use siding nails and roofing tar to seal all the nails completely. When the ridge work is complete, tar should be used to cover any visible nails on the entire roof.



CARRY CAP SHINGLES 12" UNDER RIDGE VENT



└_ TAR STRIP

Ridge Cap Shingles

Weaving Valleys

- A. Begin woven valley by centering 36" wide mineral surface roll roofing in the valley. NOTE: Fasten only with enough nails to hold in place. DO NOT nail within 6" of center of valley. Press roll roofing firmly into valley to put it in firm contact with the roof.
- B. Lay first course across valley joint extending 12" onto adjoining roof surface.
- C. Lay first course from adjacent roof 12" over the valley joint on top of previously applied course.
- D. Repeat steps b & c up the valley
- E. To keep the shingle splice out of the valley, it may be necessary to add 12" tabs earlier in the row.



Roofs