



Exterior/Interior Framing

Approved Methods

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Introduction to the Framing Section

This chapter covers the framing process for exterior and interior walls. **A separate chapter is devoted to the process of installing the roofing including the trusses, roof covering and the gable build and install.**

Please note that some of the photos in this chapter are out dated and will be replaced in the future.

This phase of the house build is probably one of the more complex part of the construction phase. Below is an outline to give the reader a higher level view with more details spelled out in the sections below.

Framing

Build walls. Install OSB on exterior walls. Cut out for windows and doors

Raise; Plumb; make sure exterior walls are straight and brace all walls

Finish OSB sheeting

Cripples added where needed

Cap plates installed- two 16d nails at studs/ends and four at each joint.

(In crawlspace house) straps Each stud (32" OC max) from mudsill up 18"

(Exterior wall in Slab house) Install bolts on porch walls every 6' and 12" from doors and corners.

(Exterior walls in Slab house) Nail Simpson floor straps 4 nail min 1 ½ "galvanized

Styrofoam board installed + seams taped

Install front porch beams

Install side porch beams

Level / square porch beams

Straps - top plates at porch beams on any break closer than 2'

Install galvanized metal flashing where wood meets with masonry (porches)

Kitchen Cabinet blocking 14" OC (On Center) down 34" OC up

Bathroom Blocking - 34" OC up for vanity

Bathroom Blocking - 24" OC up for toilet paper if not on vanity

Bathroom Blocking - 54" OC up on all non-tub walls

Tub studs - 2x6 vertical

Interior door headers - Cut bottom plates for headers and add 10" blocking

Install batt insulation, glue OSB behind tub and install Thermo ply- after inspection

Windowsill pans - Caulk each layer and tape sides and seams

Install Doors – caulk - on floor and on side + top flanges

Tape door flanges– sides then top

Install Doorknobs and locks

Install windows – caulk side and top flanges

Tape window flanges – sides first then top

OSB Gables - ¾" gap for sheeting on double gables.

Fill in gables - OSB and blue board or Tyvek

Gable ladders – Use 2x6; 10 ¾ deep 7 ¾ blocks 2' OC. Two 16 penny nails and a screw

Bird boxes (also referred to as boxing returns) installed

Cut gable holes for crane

Catwalk – doubled 2x4s above living room for truss safety

Outer Strong backs for trusses

After Trusses are installed

Fascia board installed

Install attic bracing

Hurricane hangers installed

Rat Runs

Attic Floor - spanning 13 trusses unless specified

Attic access W/ hangers 54 ½ " x 22 ½ "

Attic Floor blocking

Deadwood

Attach loose wall tops

Build side porches if needed
fill in strips below gables - OSB and Styrofoam board ~1 ¼" strips
fill in strips along top plates - OSB and Styrofoam board ~1 ¼" strips
Baffles at front and side porches
Patch gable holes
2x OSB and fire foam dead spaces
Inner Strong backs
Take down braces
Air seal – great stuff studs to OSB and gaps, caulk small seams

After Roof

Diagonal Bracing
Take Down Outer Strong Backs

After Sheeting inspection

Insulate behind tub

Framing Inspection

After HVAC installation

Attic railings installed 18" 34"

After Electrical wiring is done

Great stuff/Air seal any electrical work boxes and wire conduits on exterior walls as well as anywhere a wire passes from an interior wall to an exterior wall..

This Section Includes

- Recommended schedule and crew assignment
- Task Lists Safety Review
- Tool, Equipment and Material List
- Material Description
- Construction Details and Drawings

Schedule: Framing Days 1, 2

The Framing Tasks begin with the floor slab (or wood floor) in place, lines for the walls chalked off, and wall plates cut, marked, tacked and laid in place. The primary task for the first day of Framing is to construct, erect, plumb, straighten, sheet, and brace the exterior walls of the house. The primary tasks for the second day of Framing are to erect the interior walls of the house, plumb and brace these, the Styrofoam board is installed on the exterior of the house and any miscellaneous blocking are completed. The roughing in of the porch beams is also completed. The windows and exterior doors can also be installed.

When the framing portion of the job is finished and the roof trusses are in place, the house is completely “dried-in” and ready for the framing inspection and all subcontractor work (plumbers, electricians, HVAC).

Crew Assignments

It is suggested that approximately 20 volunteers, including one task leader and 4 crew leaders, be recruited for Framing. Divide the crews up by distributing the experience level among the crew leaders. Each crew is then assigned to certain tasks. For example, all of the assigned crews can begin the first day by assembling and erecting the exterior walls. Later, one crew can be assigned to the task of trimming out the gable trusses while the others complete the interior wall framing.

As the work progresses, the Task Leader can better determine the skill and energy levels of the various crews and can assign future tasks accordingly. The most important consideration is to keep all of the crews safe and actively involved by dividing the tasks as evenly as possible and monitoring the progress of each group.

Framing Safety Guidelines

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:

- 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 resupport 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 walkboards, placing scaffolding on solid footing, and guardrail requirements).
- Don't leave loose objects on scaffolding, ladders or **roof decks**.



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

Task List -Wall Framing

Staffing

House Leader
Framing Task Leader
4 Crew Leaders
15 Additional Volunteers

Tasks to Be Completed and Crew Sizes

_____	Crown wall studs	2 to 3 people
_____	Flash porches	1 crew
_____	Assemble exterior walls per wall plan	All crews
_____	Install OSB sheeting and cut out for windows and exterior doors.	1 person
_____	Set braces; raise Exterior Walls; plumb	2-3 Crews
_____	Fill with cripples under windows at OSB seam	1-2 people
_____	Square and brace exterior wall corners	1 crew
_____	Set Bathtub(s) in Bathrooms & Protect	1 crew
_____	Build and Raise interior walls	2 to 3 crews
_____	Install wall cap plates	1 to 2 crews
_____	Straighten and brace all walls	1 crew
_____	Construct and install porch beam w. temp support	1 crew
_____	Trim-out gable trusses including boxing returns	1 crew
_____	Confirm layoff for roof trusses	1 crew
_____	Install deadwood for gables to be nailed into	1 crew
_____	Install safety system to provide for roofing truss installation.	1-2 crews
_____	Install dead wood for drywall after trusses are in place	1 crew
_____	Wood floor -install straps between sill plate and wall. Slab floor – anchor bolts, washers and nuts installed; install straps over bottom plate	2-3 people
_____	Attic Floor	1 crew
_____	Blocking installed for kitchen wall and base cabinets; bathroom vanity; bathroom accessories	2-3 people
_____	Styrofoam board sheeting on exterior	1 crew
_____	Install vinyl window pans	1 crew
_____	Install windows	<u>1 to 2 crews</u>
_____	Install layer of Window Flashing on exterior Styrofoam.	1 crew
_____	Install exterior doors -caulk under exterior flanges on top and sides; under door threshold	1 crew
_____	Tape exterior to Styrofoam board – sides then top.	1 crew

_____	Install exterior door locks;	1 person
_____	Insulate , OSB glued and Thermo ply behind the bathtub(s) - after sheeting inspection	1 person
_____	Cut interior door bottom plates, install these as the door headers against the cripple blocks.	2-3 people
_____	Remove all temporary bracing (after roof is on and safety system is taken down)	1 crew
_____	Clean up Site, put away tools and equipment	All crews

Quality Checkpoints

- _____ Wall stud crowns all turned the same way
- _____ Bottom plates nailed with two nails between each stud; use treated studs for plates on based floors.
- _____ Bottom of exterior walls are faced with foam sill sealer on subfloor homes. Sill sealers is used on all walls when house is on a concrete slab.
- _____ Two nails on each side of door openings in bottom plates
- _____ Windows, doors, tees, ladder tees, and cali corners located according to plan
- _____ Bathtub(s) placed inside bathrooms
- _____ Bathtub completely protected with cardboard and poly
- _____ Exterior and interior walls plumbed, straightened and braced
- _____ OSB installed on all exterior walls and nailed per specifications
- _____ Porch beams level and straight, supported in wall pocket with jack studs and temporary porch beam support.
- _____ Cap plates installed flush with top plates, joints staggered minimum of 4', nailed as directed
- _____ Temporary beam (to support trusses across living area) installed if required
- _____ Styrofoam board sheeting installed and all joints taped
- _____ Wall sheeting installed/check nailing pattern
- _____ All blocking installed flush with front of studs in correct locations
- _____ Attic floor framing and decking properly installed and nailed
- _____ Blocking for bathrooms (towel bars, toilet paper holder, bathtub(s), medicine cabinet, mirror), attic stairs, handicap rails.
- _____ All windows installed and properly caulked, taped on exterior to Styrofoam board
- _____ All exterior doors installed, caulked, properly taped on exterior to Styrofoam board
- _____ All interior doors with headers and end cripples. No cripples inside the header opening as these are used for HVAC air returns.
- _____ All materials restacked, site cleaned, tools accounted for and put away

Framing Tool, Equipment & Material List

Tools Each Framing Crew Member Will Need

- Hammer (16 oz. Minimum)
- Nail Apron
- Retractable Utility Knife (With Extra Blades)
- Measuring Tape (16'Minimum)
- Square (Speed square® or Combination)

Two Pencils
Safety Glasses
Work Gloves
Hard Hat
Water

Tools Each Framing Crew Will Need

Circular Saw (7 $\frac{1}{4}$ " with extra blade)
50' Grounded Drop Cord
30' Measuring Tape
4' Level (& 6' if available)
Framing Square
Hand Saw
Two Chalk Boxes (Blue and Red)
Cats Paw (Nail Puller)
Wood Chisel
Two Red Lumber Marking Crayons
Hook Blades for Utility Knives (5 blades)
Nail guns, compressor and air hoses, and proper nails for use of nail gun

Framing 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
8# Sledge Hammer
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

2x4s and 2x6s
Porch Beams
OSB (Walls)
OSB $\frac{3}{4}$ " or use 2 layers of $\frac{1}{2}$ " OSB (for attic floor)
2x6 Fascia board for gable ladders and eaves
2x4x12 Attic Bracing
Shims for Exterior Doors
2x4 Attic Stair Blocking
2x8 Attic Flooring "joists"

Components

Ladder Tees
California corners
Hollow corners
Standard Tees (4x6x4, 6x4x6, 6x6x6)
Door & Window Frames
Trusses
Boxing Returns and extensions if needed
Beam pockets

Nails/Screws/Bolts

16d Nails
8d Nails
10d Nails
Roof Nails 1"
1" button caps
1 $\frac{1}{2}$ " Siding Nails (Wall Sheeting)
Cut Nails
 $\frac{5}{8}$ " 8" Bolts, Washers, & Nuts
16d Galvanized Nails
10d hurricane clip nails
Anchor bolt washers & nuts

Other

Approved Mending Plate (if necessary)
Caulk (Exterior)
Exterior Sheeting (Styrofoam Board)
Black Plastic Flashing
Tape Flashing
Windows and Exterior Doors
Galvanized Flashing (Porches, Doors)
Shims ($\frac{1}{2}$ " and tapered)
Locks and Deadbolts
Temporary or Permanent Steps
Hurricane Clips
Step Flashing and straight flashing if needed

Wall Insulation (tub)

Thermo ply vapor barrier (tub) (1/4" foil sheeting)

Bathtub Unit

Tyvek wrap for gables not in line with house walls

Great Stuff for air sealing

Plastic windows sill pans (left and right components)

Styrofoam tape

Homeowner Sign

Framing Material Description

Top and Bottom Wall Plates

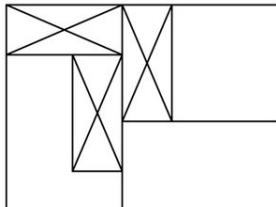
2x4s cut to length and marked off for locations of studs, tees and ladder tees, corners, window and door units, etc. These are typically tack nailed together for marking and then the nails are pulled out to install the studs and the wall components.

Wall Studs

2x4x93" and 2x6x93" framing lumber which has been pre-cut and end trimmed. All are crowned on site.

California corner posts

Typically, these are corner studs 2x4 nailed perpendicular to one another such that the interior side is 5" and it provides a surface for nailing the back/front exterior walls and for nailing drywall.



Interior Wall Corner Posts "Hollow Corners"

Two 2x4 studs nailed together with scrap 2x4s in between them to form a post measuring 3½"x4½"x93" long. To be used on interior corners.

Ladder "Tees"

Pre-built "ladders" made of studs and "rungs" used to join two perpendicular wall sections at exterior walls.

Regular Tees

Three 2x4 studs nailed together to form a "U" shaped framing member used to join two perpendicular wall sections (There are also 2x6 "tees" needed for some plans)

Exterior Door Frames

Pre-assembled framing units consisting of studs, jacks and headers, which are sized for each exterior door opening

Window Frames (2 sizes)

Pre-assembled framing units consisting of studs, jacks, headers, sills and cripples which are sized for each window opening

Misc. 2x4 Lumber

2x4s in 10, 12, 14 or 16 foot lengths to be used for cap plates, and bracing

Mending Plate

An approved metal connector used to strengthen and stiffen lumber that has been weakened or spliced.

OSB Sheeting Boards

4' by 8' by $\frac{1}{2}$ " oriented strand board used to sheet roofs, house corners, around doors and on the middle of long walls (over 40')

Foam Insulating Sheeting (Styrofoam board)

4' by 8' by $\frac{1}{2}$ " polystyrene sheathing panels

Porch Beam Material

Either doubled up Microlam based wood product or a beam fabricated from 2x8 or 2x10 or 2x12 lumber nailed together with an OSB sandwiched between; also includes fabricated box beams.

Bathtub Units

Combination fiberglass bathtub and shower units. These may include a complete one-piece unit or it may be comprised of a base unit and a wall surround.

Hurricane Clips

Metal Ties used to strengthen the connection between the roof trusses and the exterior walls

OSB Baffle Strips

Pieces of OSB placed between the interior of the house and the porches where they also keep the insulation from falling into the soffit area of the porch.

Exterior Doors

Steel clad doors with flanges on the jambs and aluminum sills/threshold (36" front and rear door)

Window Units

Pre-finished window units with insulated glass and external nailing flange. The windows are constructed with built in J channels for siding installation.

Shims

Cedar or spruce shimming shingles to be used as spacers around doors, etc.

Fiberglass Wall Insulation

3 $\frac{1}{2}$ "x 22.5" unfaced batts for insulating behind the tubs

Thermo ply

$\frac{1}{4}$ " thick foil sheathing used as an air barrier behind the bathtub unit(s), where there is no drywall

Exterior Door Locks

3 locksets with matching keys for the front, back and shed doors.

Window sill pan

Sill Pan is a translucent, molded polymer sill pan for flashing the base of windows. A two-piece construction can be adjusted to fit most window sill widths, providing a continuous shield against water infiltration, even in sill corners.

Rat Runs

These are 2 x 4's, laid on the flat, on TOP of the BOTTOM truss chord. These can be pieced from 2x4 of various lengths (8',10',12'). Be sure that when you piece the runs that you overlap one of the 2x4 by at least a truss width. These runs are used to brace the house and keep the trusses on 24" OC layout.

Catwalk

A temporary brace consisting of two 2x4s nailed together and erected near the top of walls in any open area where trusses would endanger workers if they fell during installation.

Outer Strong backs

A temporary brace made of 2x4s that are screwed to the exterior of a wall that lines up with a gable to keep the gable upright during installation and prevent it from falling off the house. These are removed after the gable has been nailed to the framing (securing the bottom edge) and the roof has been completed (securing the top).

Inner strong backs

Each of the gables require additional 2x4s to be added to the inside for wind resistance. Measure and cut 2x4s and nail them to vertical chord of the gable using 16D nails. These 2x4s should be nailed to the chord to they create an L. Most gables require 5 strong backs, though half sheathed midlevel gables may need fewer.

General Instructions for Framing

Habitat uses a framing package to match the drawing for the house plans. Your site supervisor will advise you as to which type of house is being constructed as well as share with you the house blue prints.

Key points of the house plans are:

- Vinyl cedar shakes may be on the front gable
- Porch beams tops may be capped in painted aluminum material
- Porches may have hand and guard rails,
- Straight columns on rear/side porches
- Columns on front porch differ by house plan
- Side/rear porches steps are brick if possible and are based on zoning and land layout.
- Porch rails and picket are treated wood.

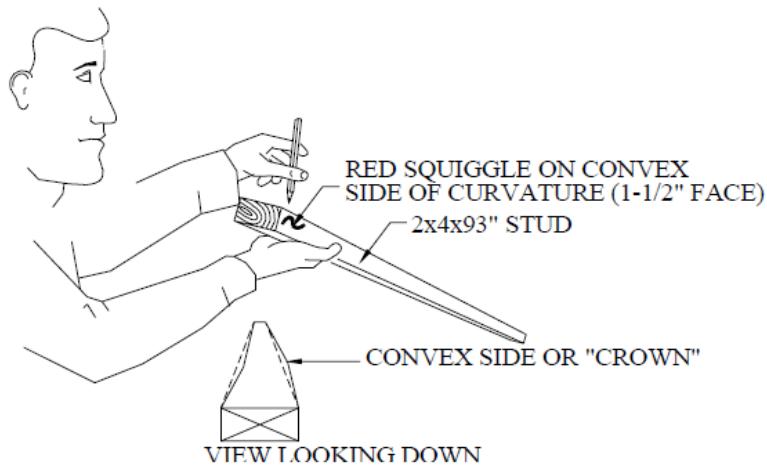


Construction Details - Wall Framing

Crown Studs

Since most 2x4 lumber is not perfectly straight (some deflection in the 3½" dimension), it is necessary to "crown" all the studs that will be used for wall framing. To crown a stud, simply sight down the length of the board and mark the convex side (crown side) with a red squiggle line. When the wall is being assembled, turn all the crowns face up. If the crown determination is not clear, pick one side and mark it.

- 1 PICK UP PRECUT 2x4x93" STUD. HOLD WITH WIDE SIDE PARALLEL TO GROUND.
- 2 LOOK DOWN LENGTH OF STUD IDENTIFY DIRECTION IN WHICH IT IS BOWED, I.E. LEFT OR RIGHT.
- 3 MARK A RED SQUIGGLE (~) ON OUTSIDE OF CURVATURE OF STUD (1-1/2" FACE).
- 4 DISCARD STUDS BOWED MORE THAN 3/8".
- 5 ROTATE STUD 90 DEGREES SO NARROW FACE IS PARALLEL TO GROUND. SIGHT DOWN THE LENGTH OF THE STUD. DISCARD ANY STUDS BOWED MORE THAN 3/4" TO EITHER SIDE.



Crowning Studs

Verify that studs are cut to length and crown them

Confirm that wall framing material has been cut to stud length. Studs are as specified in the house plan. Crown the studs and stack them on the house floor. Keep the best studs for use in the kitchen and bath walls. Set aside any studs that are badly bowed or twisted as these will be used for short pieces or blocking. See "Appendix" for setting up a circular saw jig for this purpose. Another solution is to secure a stop block on a miter saw table 93" from the saw blade. Taper or rabbet the stop block as shown in the appendix. Make test cuts before proceeding with the entire framing order.

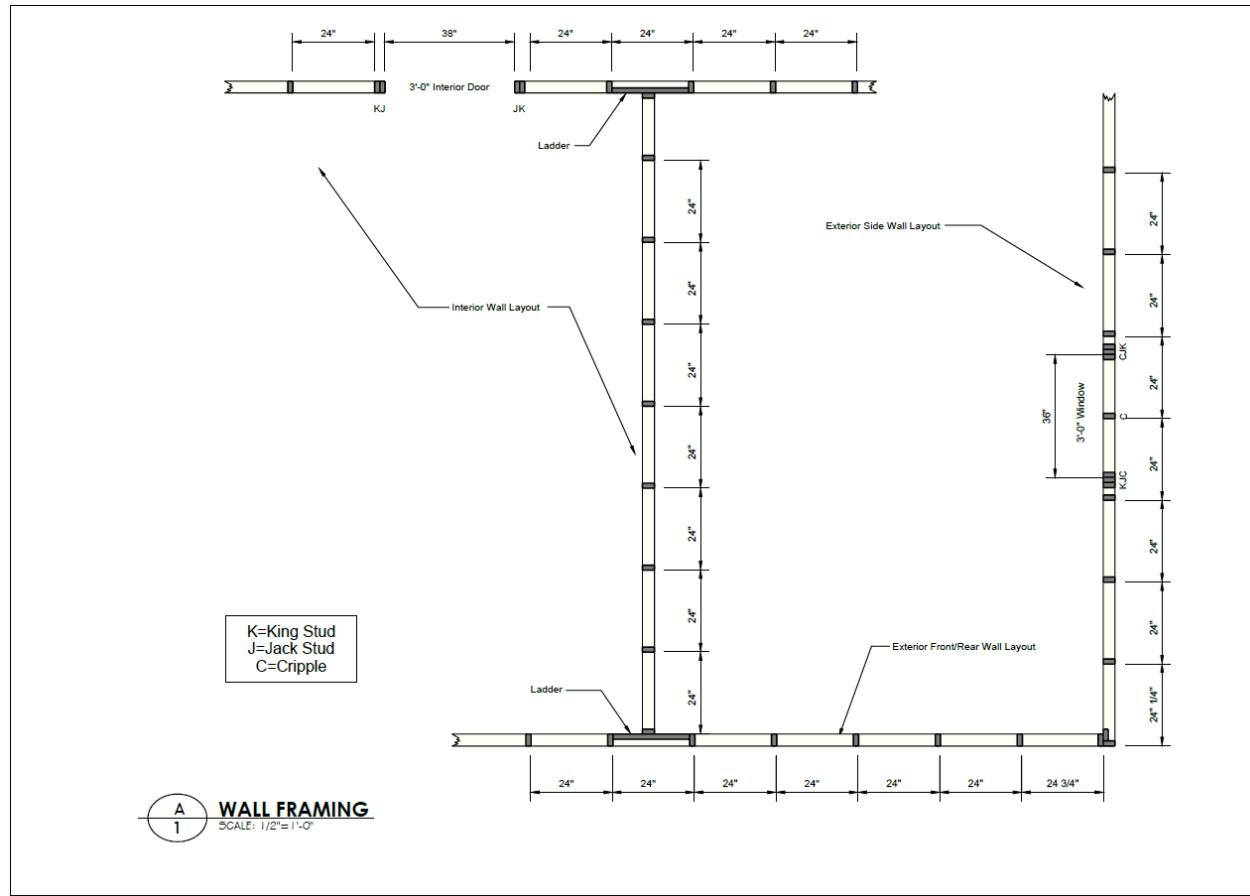
"NO JOB IS SO IMPORTANT THAT IT CAN'T BE DONE SAFELY"

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 resupport lumber.
- Keep electric cords out of the way of the saw and not 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.

Wall Layout

Use the following drawings as guides when the walls are laid out.



Exterior Walls

Preparation

Before the walls are constructed, be sure that the locations of the exterior and interior walls are clearly marked on the floor (wood or concrete slab). The marks should have been coated with a spray to preserve these from the effect of the weather.

As a general rule, the inside of the exterior walls are set back 3.5" from the edge of the band joist on wood floors and 4" from the edge of the concrete slab floor. This will allow the wall with the $\frac{1}{2}$ " OSB sheeting to line up with the $\frac{1}{2}$ " OSB that covers the band joist for wood floors and with the edge of the concrete slab.

Additionally, the top and bottom wall plates have already been cut to length and tack nailed together. The plates will be on site and marked for placement on the floor where they will be set. Marks will show the locations for all the studs and components. Identify with lettering the bottom and top plates.

The floor will also be labelled where walls intersect to help with generating the cap plates. The general rule is that the wall that run from the front to the back of the house (starting on the left side when facing the back) are denoted by a letter (A,B,C,D,E,,) while the walls that run from the left side to the right side are denoted by a number (1,2,3,4,5..).

The process is the same for constructing and raising the exterior walls. The long exterior walls are constructed and raised, one at a time. Then the front and back exterior walls are constructed and raised.

Photos and drawings are embedded in the narrative to help the reader with the assembling of the exterior walls.





Assemble Exterior Walls

The long side exterior walls (they run from front to back) are assembled and raised first. These walls sit flush with the outside band joist, allowing the front and back exterior walls to sit tucked in between them and to be braced by the OSB sheeting that will overlap the side walls by 3.5".

Beginning with the longest walls first, each crew should separate the plates for the walls they are assigned to build. To separate the plates, pull the temporary tack nails and move plates apart about eight feet. The nearer the wall is built to where it will be finally positioned, the better.

Keep in mind that on long exterior walls the difficulty of raising such a long wall may require separating the length into sections. The separation will usually break over window or ladder component. Double up studs at the plate section seams.

Top plates can break over a window header or on stud.

Place the wall components exactly as marked on the plates.

- Exterior door components are pre built and set in place on the top and bottom plates.
- Ladders are pre built can be assembled between the plates.
- All window components are pre built and can be assembled between the plates. The styrofoam board spacer on the window header faces the exterior of the house.
- On long side walls, use California corners (referred to as Cali corners) on ends to allow for mounting of the drywall, attaching the intersecting wall and allowing insulation into the corner.

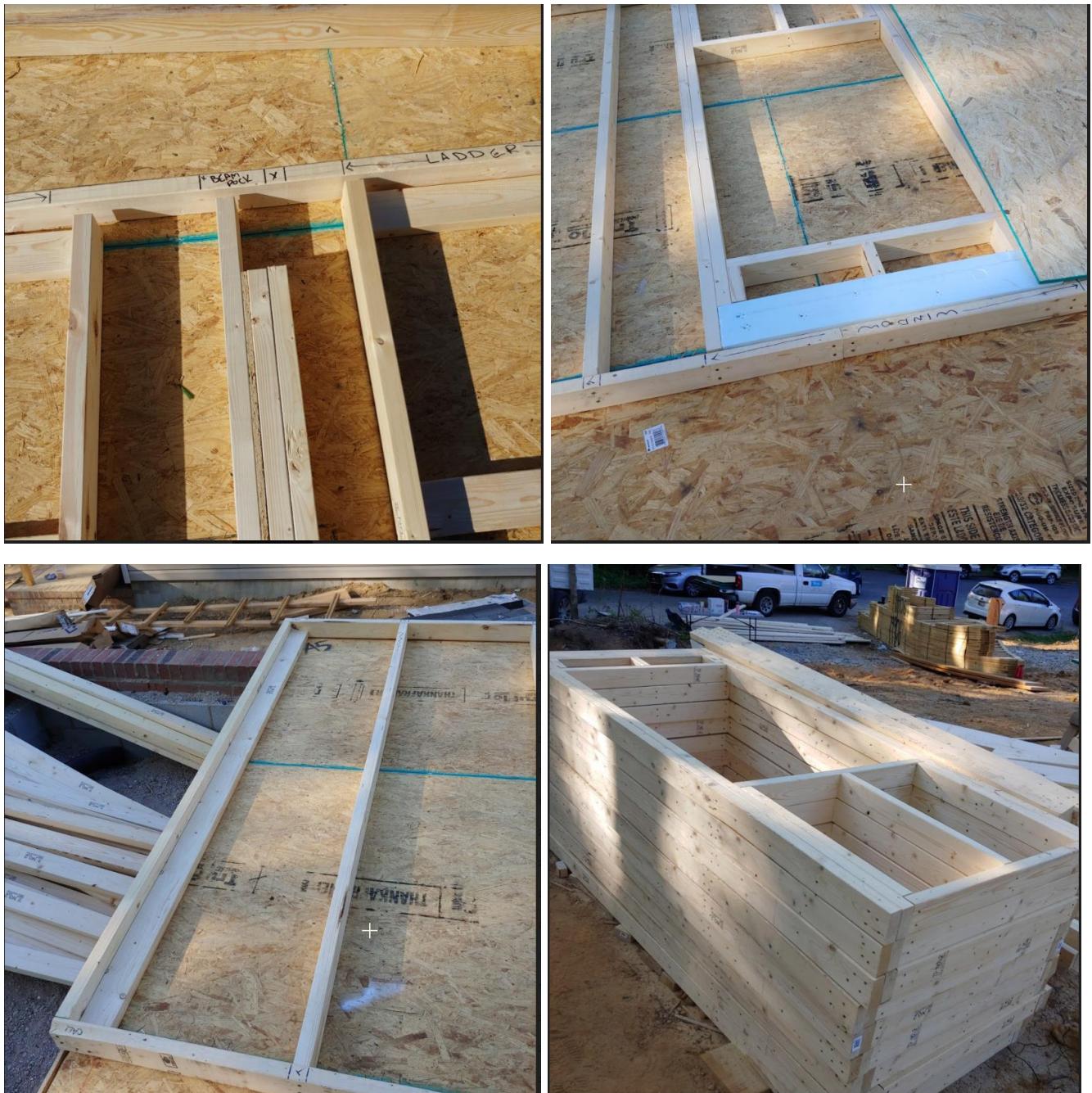
Before nailing the components into the plates, check the direction of ladders and tees and confirm that the "crown" marks on the studs are visible to ensure that the crowns are facing in the same direction. Nail each stud with two 16d common nails through both the top and bottom plates.

Keep studs and components flush with the plates. Likewise, nail each wall component with two 16d common nails into all of its 2x4s. Make sure that the stud is square to the plate prior to nailing.

Bottom plates will be of treated lumber if the house is built on a slab. All nails penetrating treated lumber must be galvanized.

Hint: Use the floor plan or check the chalk lines on the actual floor to see which direction a tee or ladder should face.

If not already on the site, make the porch corner post components that are used to create the beam pocket. Nail together two jack studs and a filler $\frac{1}{2} \times 3.5$ " OSB, which is shortened by the width of the porch beam. This post will provide support the porch beam. Check with the site supervisor to confirm these dimensions. The porch beams will bear on the beam pocket. (Cap plates are used, which is why there is a difference in the notch depth.) (The beams are typically made from doubled up 2x8 or 2x10 or 2x12 with a $\frac{1}{2}$ " OSB in the middle - See "Porch Beams").





Sheeting and Squaring the wall

After you install all the studs, window components and door components it is time to square the exterior wall while it is laying on the floor. Use a full sheet of OSB and apply from the rear of the long exterior side wall. Tack the OSB into the bottom rear corner of the wall and use the OSB to help you square the wall (you may need to use a sledge hammer to get the wall moved so it is square). Once you are satisfied that the wall is square nail the OSB into the top and bottom plates and the 2 wall studs. Use 8d nails (ring based is best) at the marks on the OSB or every 12" on center but every 6" on edges. Nails penetrating treated lumber must be galvanized (i.e. into treated band joists or treated bottom plates).

Be sure that the seam where two sheets of OSB will join is sitting over the middle a stud. If necessary or if it will help, snap a chalk lines between the locations of the studs on the OSB surface, as indicated by the nails in the top and bottom plates. When you nail through the OSB it should feel like your nail is hitting the stud and not empty space. If you miss the stud, take the nail out and nail another one so it hits the stud. It is easier to do this while the wall is being built and is laying on the floor instead of when it is in its upright position later on. Continue this process of nailing the next OSB sheeting but be sure to place 2 8d spacer nails between each OSB sheet (the OSB is not quite 48" so these spacer nails at the top and bottom plates compensate for this). The last OSB sheeting may need to be cut to size. While the wall is on the floor, the window and exterior door openings are cut out from the OSB with a router for a clean smooth finish.

In assembling walls over a wood floor the OSB should extend from the top plate (not the cap plate) down to the bottom plate. OSB filler will be used to cover the balance of the bottom band joist and floor board.

You can leave the nailing of the OSB on the ends of the front and rear walls over the corners for after these walls are raised and in place. If it is feasible, install the OSB so that it overhangs 3.5" off the sides to cover the longwall.

After the roof trusses are installed, OSB filler of 1.25" will be used to fill in from the bottom of the cap plate upwards. These strips will be covered with Styrofoam strips. This will serve as a uniform surface for the siding.



Key point to remember:

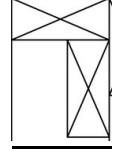
- a. Layout walls to be: Exterior Walls -24" On Center; Interior Walls – 24" On Center.
- b. Studs layout should be marked so that OSB will break on stud pattern without being cut (on long walls mark the first stud at 23 1/4" on center from edge of wall; on front and rear walls, mark the first stud at 23 1/4" on center placing the tape at 3.5" on the edge of the wall)
- c. Door openings should be marked so that Rough Opening is 2" larger than the door size (36" door = 38" Rough Opening). This allows for fitting the door jamb and shims to plumb the door in
- d. Window Openings should be marked to fall on stud pattern, if possible, and should be marked so that the Rough Opening is the same as the window size. (a 3'0"x5'0" window fits in a Rough Opening of 3'0"x5'0")
- e. Label Top Plate, Bottom Plate on **ALL** wall sections so that when tack nails are removed you can easily identify where each wall should be placed.
- f. Using the markings on the bottom and top plates, install with 16D nails all wall studs, window opening , door openings and blocking for intersecting interior walls (crown side up).

Framing parts – cut sheet

Site Location:

QUAN-TITY	ITEM	LENGTH	EXAMPLE
_____.	LADDER WALL TEE	<p>_____. 2"x 4"x93"</p> <p>_____. 2"x 4"x14 ½" Spacer</p> <p>_____. 2"x 8"x14 ½" Spacer</p> <p>On 8' high walls: center down from top plate: 24", 48", 72";</p>	
_____.	INTERIOR WALL TEE	<p>_____. 2"x 4"x93"</p> <p>_____. 2"x4"x16" Spacers</p>	

_____.	BEAM POCKET	_____. 2"x 4"x93" _____. 2"x 4"x 83 1/2" _____. ,5"x83 1/2" OSB	
_____.	INTERIOR CORNER (HOLLOW CORNER)	_____. 2"x 4"x93" _____. 2"x 4"x16" Spacer	
_____.	EXTERIOR DOOR	_____. 2"x 4"x93" or King *2 _____. 2"x 4"x 80 3/4"	

_____.	EXTERIOR WINDOW REGULAR	_____. 2" x 4" x 36" for 3'x5' window _____. 2" x 4" x 24" for 2'x3' window	
_____.	EXTERIOR WINDOW SMALL	Measure cripples for top of header and under sill after assembly of other components.	
_____.	INTERIOR DOOR KING STUDS	_____. 2"x4"x 93" x4	
_____.	CALIFORNIA CORNERS	_____. 2"x4"x 93" x2	

Raise Exterior Walls

After all the studs and components are nailed in place, the OSB sheeting is installed and the edges of all boards are flush and checked by the Crew Leader, the long exterior wall is ready to be raised into position. Before raising the wall, be sure to:

- a. Staple on the bottom plate the sill plate foam sealer. This will seal any air infiltration pockets when the wall rests on the floor.
- b. With the guidance of a single leader, use plenty of people to raise the walls, especially long walls.
Key point to make sure that raising the wall is safe:
 - On a concrete slab, there should be a line that has been marked 4" in from the perimeter of the floor system and chalk a line all the way around the floor (to mark where the inside of the walls will be). On a wood floor, the inside line is 3.5" from the edge of the band joist.
 - Have ready floor scabs and 2x4 12' for bracing the wall to the interior of the house (after it is plumbed). If that is not feasible, place wood staked into the outside soil (deep enough to be solidly anchored in the ground) and screw the 2x4 10' bracing into these wooden stakes after the wall is raised and is plumbed.
 - Nail a 12' 2x4 at about 6" below the top of each end of the long wall with one 16d nail. This will be the pivot nail, For wood floors the other end will be nailed to the band joists when the wall is up and plumbed. For concrete slabs the brace will be screwed into a wood stake on the outside of the house.
 - Raise the top plate a few inches with a flat bar and slip a scrap 2x4 under it in a few spots so that volunteers can put their hands under the top part of the wall. It also gives the volunteers leverage to heft the wall up.
 - On a house with a wood floor and a crawl space we need to take sure that wall does not slip off the floor when it is being raised and we want it to be in position with the intersecting exterior wall. To prevent the wall from slipping off the floor cut 3 scraps of 16" 2x4 braces and using deck screws (3") secure these to the outside of the band joist so that it acts as a stop when the wall is raised. When the wall is secured you can unscrew the deck screws and use these braces for the next wall.
 - On a concrete slab you will have to raise the exterior wall over anchor bolts or plumbing (the bottom plates of these walls should have been pre-drilled or pre-cut), positions the wall so the bottom plate is on the chalk line and then raise it up to go over the bolts and let it drop down gently on the concrete slab.

After raising the wall, position it precisely on the chalked line, taking into account not just the end of the wall, but the intersecting wall locations as well. The goal is to get as many intersecting walls to match up as possible which means the bottom plates must be brought tight to one another. On exterior walls, take note as to which wall goes long to the corner.

When the crew leader is satisfied that the wall is accurately in place, it is time for the crew to “nail it”.

For concrete floors, nail the bottom plate to the floor by staggering two galvanized cut masonry nails between each stud. (At a minimum, one nail is necessary on exterior walls.) You will need to place the washers and nuts over the anchor bolts and tighten these with a wrench so the plate and wall is secured.

For wood floors use pairs of 16d common nails (galvanized 16d nails if you are nailing into treated joists or band joists), nailing the bottom plate into a floor joist whenever possible. Where walls (front and back) sit over doubled up joists you should be nailing into these joists. On all floor types, do not nail the bottom plate where there is a door openings , but double nail bottom plates adjacent to these openings. These bottom plates sections at the door openings will be cut out later on and used as the door headers for interior doors.

Nail the 12' 2x4 end braces after the crew leader gets the wall plumb.

Using a single 16d nail and a 10' 2x4 as a diagonal brace, typically set from the top side of window openings running in a diagonal to the floor where you anchor a short 2x4 scab nailed into the floor. Nail the diagonal brace into the scab after the crew leader gets the wall plumb.



On concrete slab floors attach the folding bottom metal plate straps to the walls with galvanized joist hanger nails in the top of the strap and on the side - be sure to use 4 nail per strap. It will be necessary to cut a hole into the OSB at the bottom to allow the metal straps to fold in and be attached to the plate. If the strap is flush with a stud, nail it to the stud. If anchor bolts are used in lieu of straps, install and tighten the washers and nuts.

Plates are joined as follows:

- Joints over tees or studs – nail each plate into the tee or stud
- Joints over exterior door headers- both lengths of top plate are nailed into the header, taking care that the plates are tight to one another. Bottom plates are removed in doorways, so there is no need to nail there.
- Joints over window headers - both top plates are nailed into the header, taking care that the plates are tight to one another. Joints in the bottom plate are spliced at a cripple or can have a scrap of 2x4 nailed over the joint.



Plates and floors are marked. F-1 is the cap plate number (used when caps are pre-cut). F3/F4 is the name of the wall section.



Studs and a Tee marked on bottom plate.



Inside Corner Assembly



Crews coordinated and waiting to raise the first wall

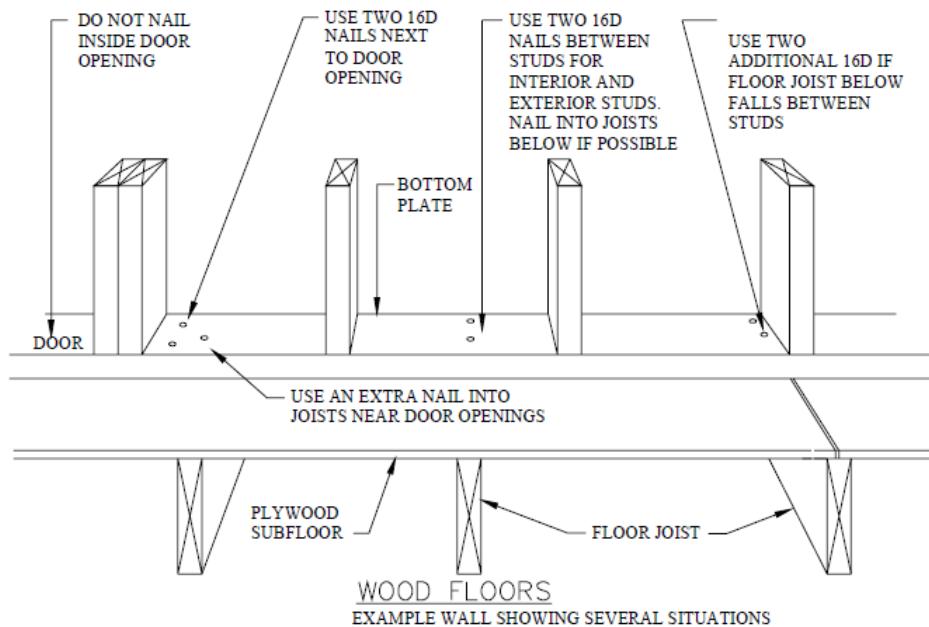
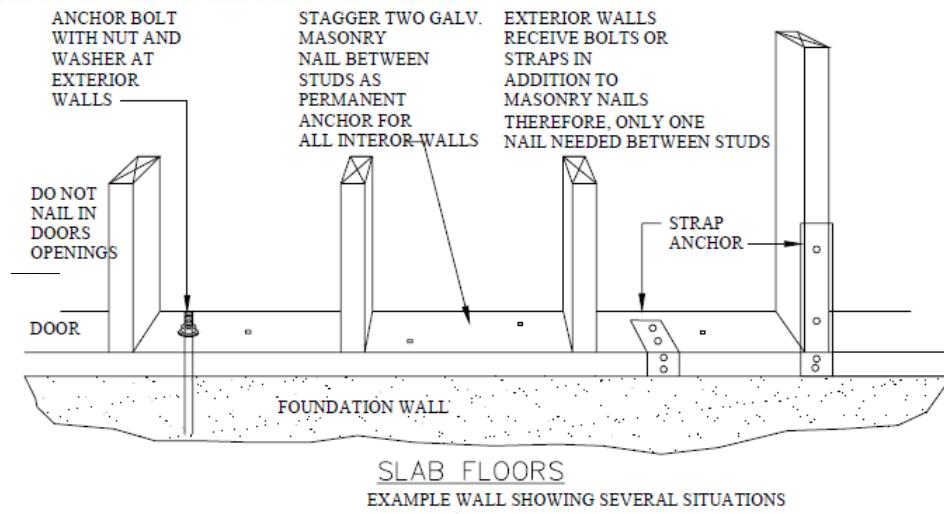


Waiting for "nail it!" Install diagonal bracing before letting go.

Typically the exterior walls will be squared by measuring the diagonals and only then nailing the OSB to the studs, flush to the bottom plate. Nails (8d) are 6-8" on center around periphery and 12" spacing in middle field. Always make sure to nail into a stud or header. OSB sheets should be separated by an 8d nail diameter since sheets are not 48" wide. This is done only if there are sufficient volunteers on site to raise the wall with OSB on it and wall is able to be squared. There are times when it is not possible to square the wall because other walls constrain it.



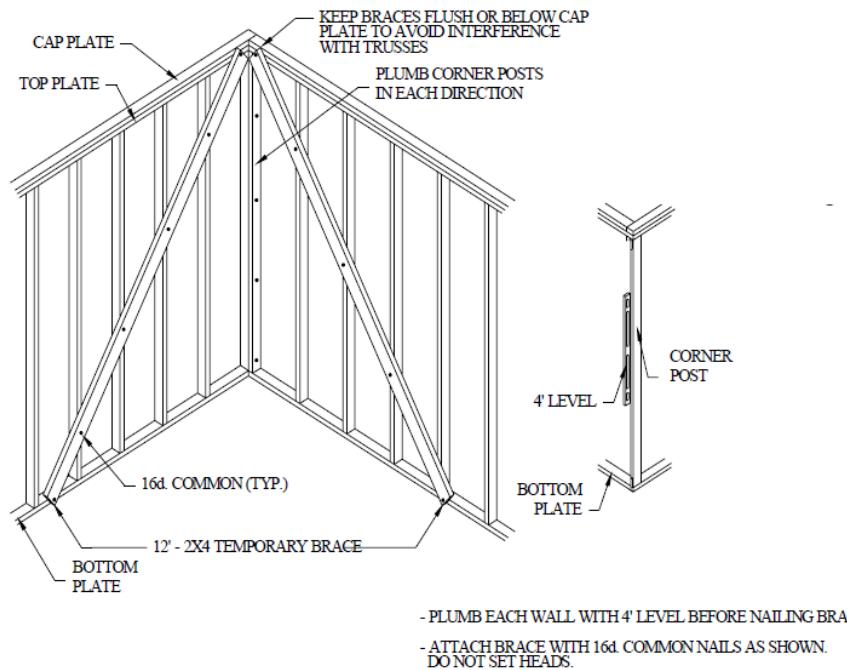
Bottom Plate Bolted to Concrete Floor



Attaching Bottom Plates to the Floor

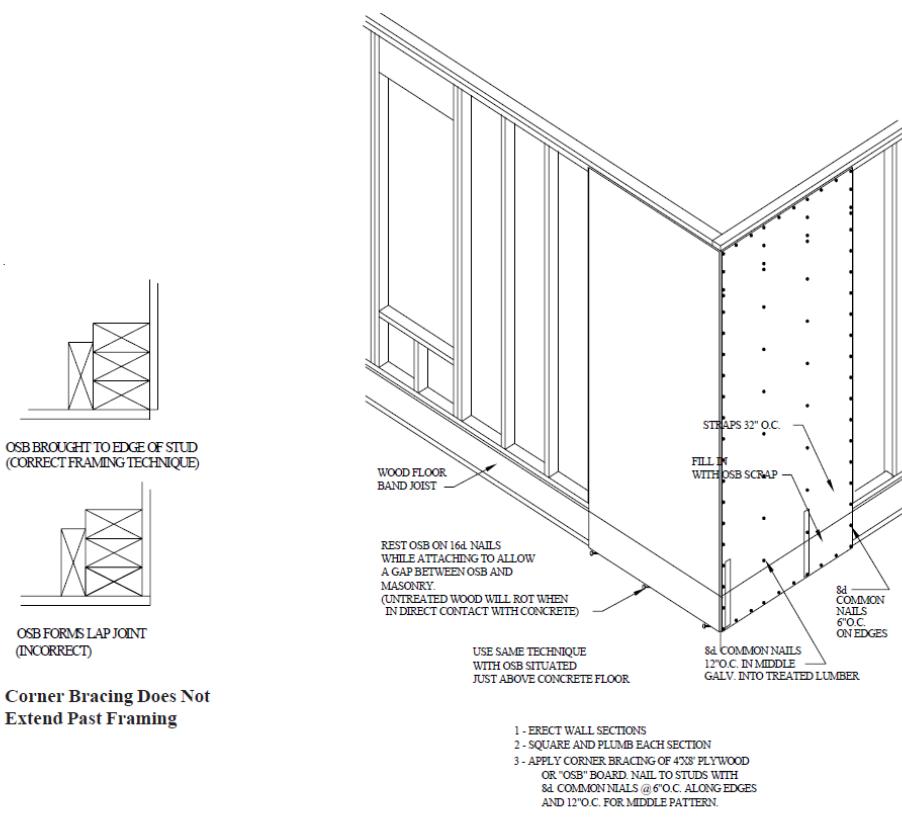
Square and Brace Exterior Corners

Using a 4' level, check each intersecting wall at an exterior corner for plumb in each direction. Nail a 12' 2x4 as a temporary brace to the inside of each intersecting wall, beginning at the top plate and extending at an angle to the bottom plate. Make sure the top of the brace does not extend more than 1½" above the top plate so that it does not interfere with your roof trusses. There is no need to check interior walls at this time.



Bracing Corners for Square

After the wall corners are plumbed and braced, 4x8 sheets of OSB sheeting are cut to size and nailed to the outside of each corner of the house in both directions as permanent bracing. This is typically applied to the front and rear walls. Attach the panels to the wall framing using 8d common nails at 6" o.c. along the edges and 12" o.c. on each interior stud. Nails penetrating treated lumber must be galvanized (i.e. into treated band joists or plates at bottom of OSB).



Corner Bracing Does Not Extend Past Framing

For wood floor houses, the top of the OSB lines up at the cap plate/top plate joint. On wood floors a smaller piece of OSB covers the band joist and hang down $\frac{1}{2}$ " from the top of the concrete blocks. Use scrap OSB to fill in this space. OSB corners should not extend past the corner framing.

OSB and masonry contact

Avoid OSB contact with any masonry surface. Before nailing the OSB against the wall place a 16d nail under the OSB to avoid contact with the masonry.



Hold OSB Up from Masonry by Spacing with a 16d nail. OSB does not extend past framing.

Finalize the exterior wall

Check for any nails that missed the studs when the OSB was nailed into the wall. Pop them out and have someone step on a ladder and nail a new 8d nail in the right spot.

Any place where the OSB has a seam visible under a window sill or at the header, cut cripple studs and nail these in using 16d nails. Nail the OSB seam from the exterior into the cripple stud.

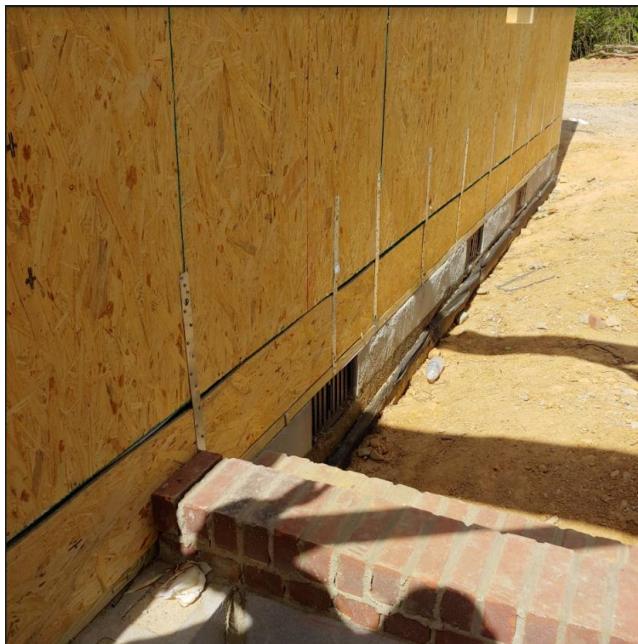


Using a Sawzall, cut the openings in the OSB for the porch beams.



On wood based flooring, nail 24" hurricane straps on the perimeter of the house exterior to tie together the long side walls and the band joists. Set these straps so they can be nailed into the studs and sit over

the sill plate (use the joist hanger galvanized nails when you are nailing into treated lumber).



Straps at 24" o.c. install from the mudsill up 18" onto the stud.

Complete the installation of all exterior OSB. Inspect for any visible nails that have been used on the outside OSB sheeting and have missed the studs. These will need to be pushed back and re-nailing will need to be done so the new nail catches the stud.

At this point, the exterior walls are erected. They are anchored to the floor. They are made plumb at multiple places along the wall with use of bracing (to interior or exterior, at corners, at window openings) and nailed along intersecting exterior walls. At this point we know that each leg of the exterior walls is straight. Some supervisors use gauge blocks on the outside of the house to make sure all the exterior walls are all straight at the top. If there is an issue, use the braces to move that part of the wall out or in to make sure it is straight at the top. When all the exterior walls have been erected, plumbed and made straight a cross diagonal bracing is installed on top of the plates at exterior corners. This forms a triangle and holds the exterior walls square.

Interior Walls

Set Bathtub(s) in Bathrooms and Protect

If installing a 1 piece bathtub unit, place the bathtub unit(s) in each bath room before the interior walls are erected. Do not fasten in place. The unit is set in the bath room because it is impossible to place a 1 unit bath tub in the room after the interior walls are in place. Cover the tub completely with cardboard or Styrofoam board and poly to keep it scratch free throughout the building process.



This unprotected tub might already be permanently damaged with scratches made from tools, ground in dirt, and work boots. Do not use it as a step ladder. Cover it with blueboard marked "No Step".



"No Step" written on blueboard is one way to adequately protect a tub.

Bath Tub Wall Framing

As a reminder (see photos below):

- The wall to accommodate the plumbing for the tub is typically constructed with 2x6 .
- 2x4 are turned sideways and nailed into the plates to provide the needed tub and drywall attachment surfaces on both ends of the tub.



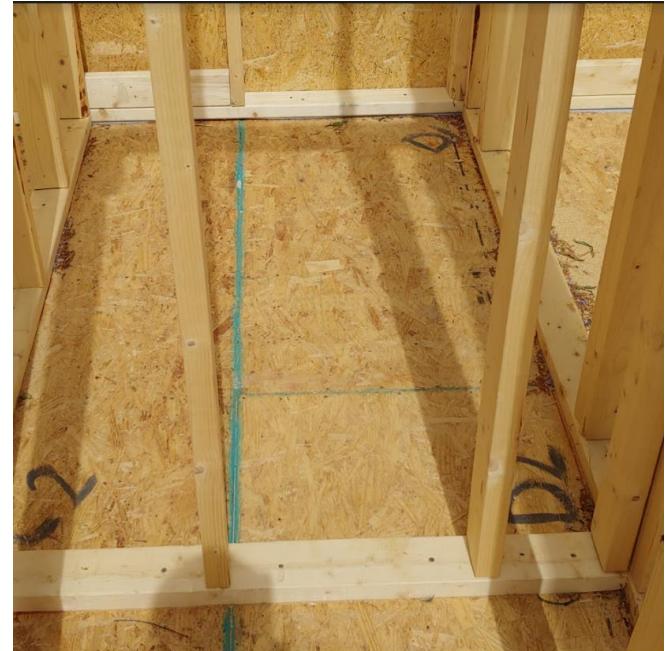
After all the framing is completed and inspected, the bath tub long wall are insulated with batt fiberglass insulation, OSB is installed on this wall and a Thermo ply barrier is applied.

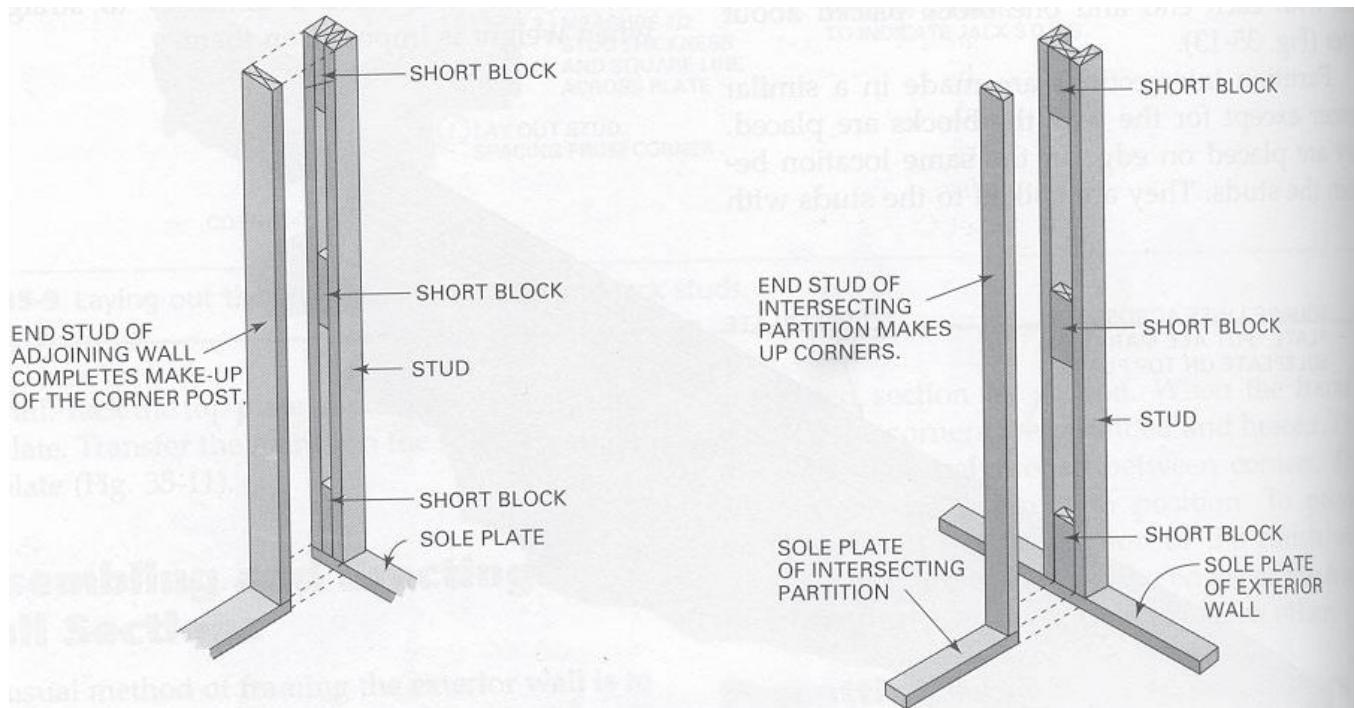
Build and Raise Interior Walls

After the exterior walls are erected and braced, construct and raise the interior walls into position, beginning with the walls adjacent to the exterior walls. Position the interior walls so that the bottom plates are lined up with the chalk lines on the floor. Position intersecting walls in line with marks found on top plates above ladders and tees. Don't drive nails tight until corners are plumb and square and walls are straightened. This will make adjustment easier should it be necessary.

Interior walls nailed into blocks

Nail newly raised walls to intersecting interior wall sections with nailing blocks (i.e. through ladder blocks or blocks of a component) . Before you nail the newly raised wall to any blocks be sure it is straight (plumb) on its 1.5" side of the studs. The 3.5" side of the studs will automatically be straight after the exterior wall is straightened between corners. Below are drawings and photos depicting the interior walls. Please note that in bathrooms the walls for the plumbing are 2x6 and not 2x4.





Typical Wall intersections. Ladders (not shown) work much the same way as Tees (right drawing).

Straighten and Brace All Walls

As you are erecting the interior walls, you are also making sure that they are plumb. When the interior walls are all erected it is time to straighten the walls. Beginning with the longest exterior walls, attach a gauge block to the side of the cap plate at each end of the house and stretch a string line along the length of the house.

Use another gauge block to check the wall against the string line at least every 10' and at each

intersecting interior wall. Push the wall in or out to bring it in line with the string and brace it in this position using 12' 2x4 braces. Nail braces along each perpendicular interior wall, beginning at the top plate of the exterior wall and extending at an angle to the bottom plate of the interior wall. Nail into each stud. If a brace is needed where there is no nearby interior wall, nail the brace to the side of a stud near the top of the wall (or inside a window frame) and to the side of a 2x4 block nailed to the floor. On concrete floors use masonry nails to secure the floor block.

If all the interior walls were attached as marked on the plates of the exterior wall, they should be plumbed automatically when the exterior walls are plumbed and straightened to the string line. Some free standing walls may require additional bracing to hold them plumb while the trusses are being installed. Plumb and brace these as necessary, using the same methodology as used for the exterior walls.

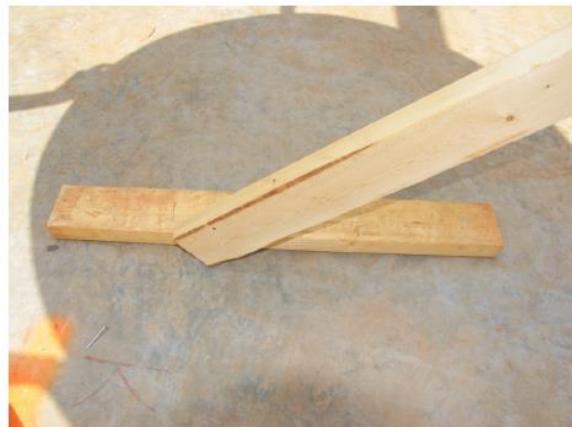
It is necessary to check interior walls for plumb. Check at a rough door opening within the wall. An unlevel floor will make it almost impossible to plumb all walls. Additionally, some walls might not be sitting exactly on their layout lines and plates in long walls might not be tight to one another. If all the walls are not brought into a plumb position when the outside walls are straightened, see the site supervisor for the best possible resolution. It will be necessary to take into account and prioritize such choices as plumb door jambs vs. soffit width consistency.



Straighten and then brace exterior walls.



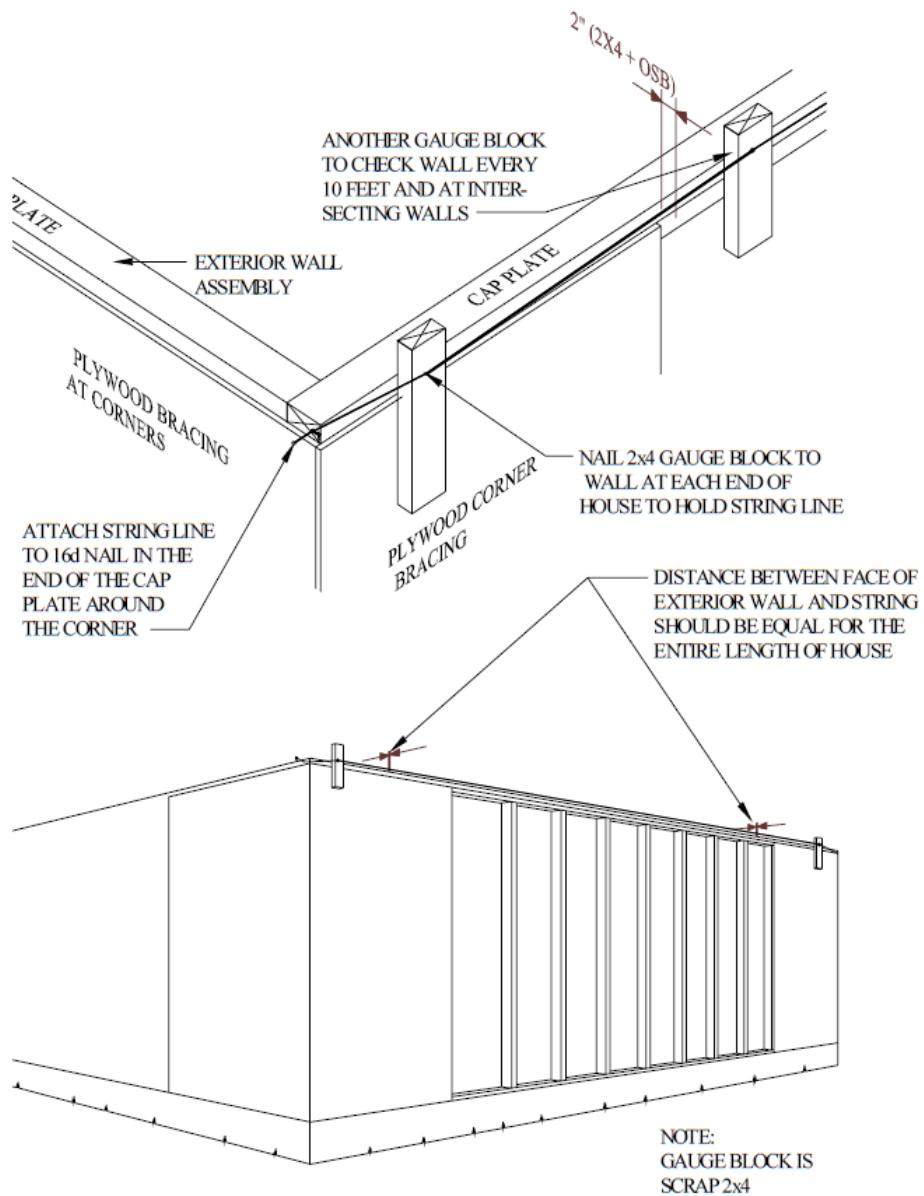
Shown is an interior wall intersecting a ladder with a diagonal brace holding the exterior wall straight.



For long exterior walls, temporarily nail a block to the floor where there are no interior walls to brace.



After exterior walls are plumbed and straightened, walls are checked with a level to determine if adjustments are necessary.



STRAIGHTENING EXTERIOR WALLS

Straighten Exterior Walls with the Aid of a String and Gauge Block

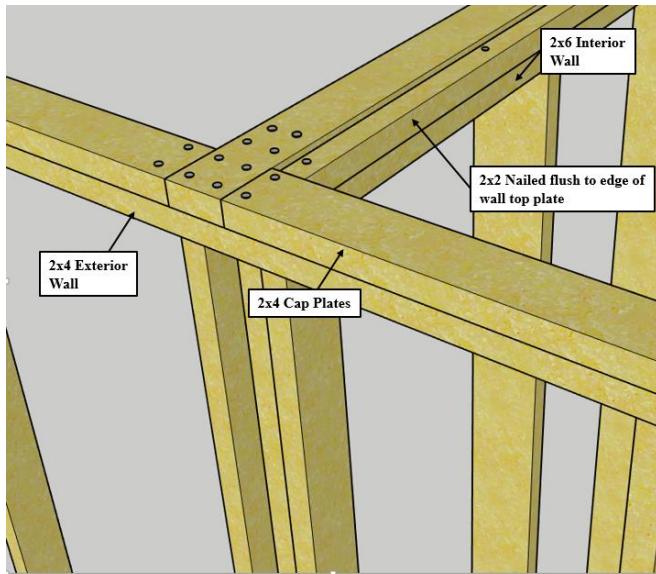
Cap Plates

Ideally cap plates are cut and marked during layout, when top and bottom plates are marked. They can also be made during framing.

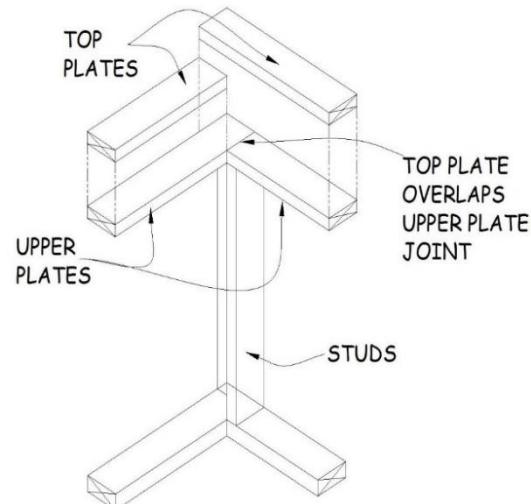
Cap plates should be installed after the exterior walls are straightened and all interior walls are plumb. Beginning with the exterior walls and continuing with the interior walls, cut 2x4 cap plates to fit on top of all the wall top plates. Overlap any inline (or splice) joints in the top plates a minimum of 4'. Lap the corners and intersections in the opposite direction from the top plates. Nail cap plates to the top plate using 16d common nails, two at each end and two above each stud. Remember, joints in the cap plate

and top plate CAN NOT be directly above one another and must be staggered by 4'.

Use a 2x6 cap plate to overlap the 2x4 walls when a 2x6 plumbing wall contacts 2x4 walls. Use a 2x4 cap plate and fill over the 2x6 top plate with a 2x2 when a 2x6 is not available.



Method to complete cap plates from a 2x6 inter wall when additional 2x6 is not available



Lap the joints in Cap Plates and Top Plates.



Cap Plates get two 16d nails over every stud and at each end. Use four nails over wall joints.



Cap plate for wall is marked F1

Remove Bottom Plates at Door Openings

Remove the portion of the bottom wall plate that extends into all interior and exterior door openings by sawing through the plate along each side of the opening with a reciprocating saw or hand saw. These

door bottom plates will be used for the interior door headers.

Interior Door Blocking

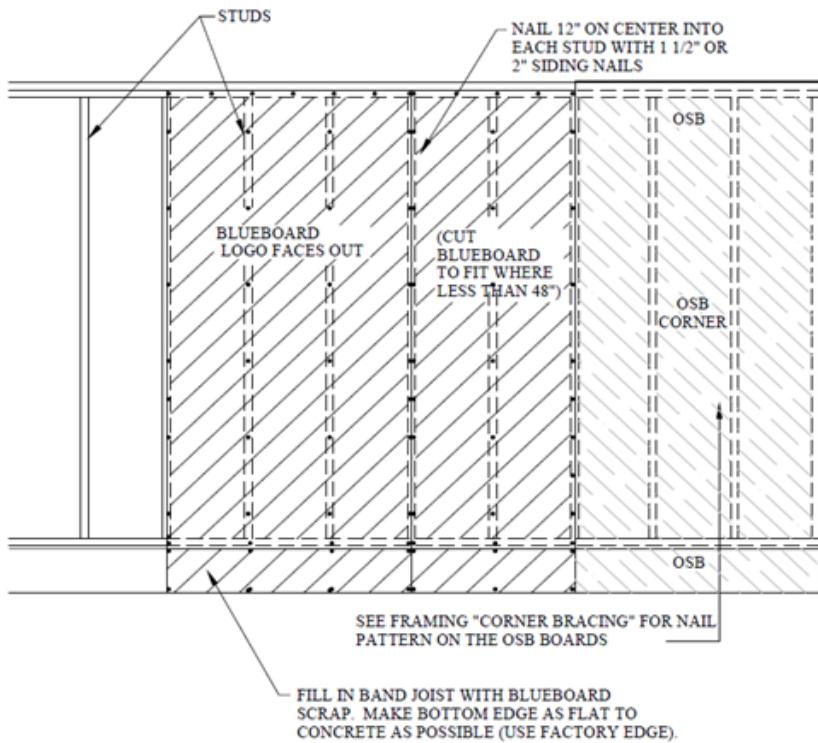
Install 10" blocks at the top of either side of all interior door openings while the walls are being assembled. Door headers will consist of the bottom plates that will later be removed between each door stud. We do not nail a block in the center of standard doorways as this will be in the way of the HVAC air return vent. Below is a photo showing the typical interior door framing:



Styrofoam Board Sheeting on Exterior

Nail foam sheeting to the outside of all exterior walls using $1\frac{3}{4}$ " electro galvanized siding nails spaced every 12" along each stud. Use full sheets whenever possible, extending over any window or door openings. (These areas are easily cut out later with a utility knife.) The wall studs should have been laid-out so that the edges of the sheeting panels will fall on the middle of a stud when the panels are laid out from back to front for the side walls and from left to right for the end walls. Add cripples to window components continuing at 24" o.c. for Styrofoam board support.

Tape all seams with 3" Weathermate™ Construction tape.



Blocking

Intersecting walls blocking

Install 2x4 blocking wherever two interior walls intersect and there is no stud at the point of intersection. Place the 2x4 blocking with the wide side flush with the interior surface of the studs of the wall being intersected and the top edge 50" off the floor. HAND NAIL with two 16d nails or two 2½" deck screws through the side of each stud into the ends of the 2x4 blocking.

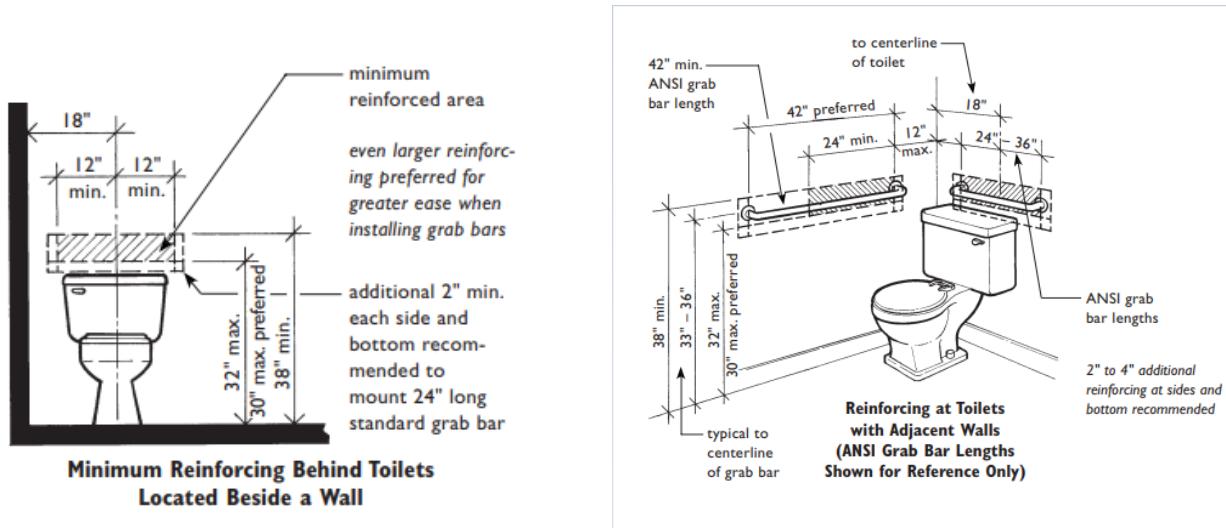
Bathroom Blocking

Habitat Charlotte provide the needed blocking for support of grab bars if it is needed.

In the bathroom add 2x4 blocking at 34" OC above the floor centered where the vanity will be installed.

Install block behind the toilet, 34" OC.

Below are illustrations of the blocking in a typical bathroom:



Habitat install the fiberglass batt insulation behind the tub or shower. The Thermo ply barrier is applied over the insulation batts (from the top to the bottom of the long bath tub wall). OSB sheeting is then installed to permit installation of grab bars in the future. A piece of $\frac{1}{2}$ " OSB is measured and cut to fit into the long wall tub surround. This OSB can be glued to the back of the long tub wall or it can be nailed into the wall (over the Thermo ply) to accommodate the long wall of the tub surround. See illustration and photos.





Kitchen Blocking

Measure 14" down from the bottom of the trusses to centerline of the 2x4 upper cabinet blocking.
Measure 34" up from the floor to the centerline of the 2x4 blocking for lower cabinets.



Kitchen Upper Cabinet Blocking



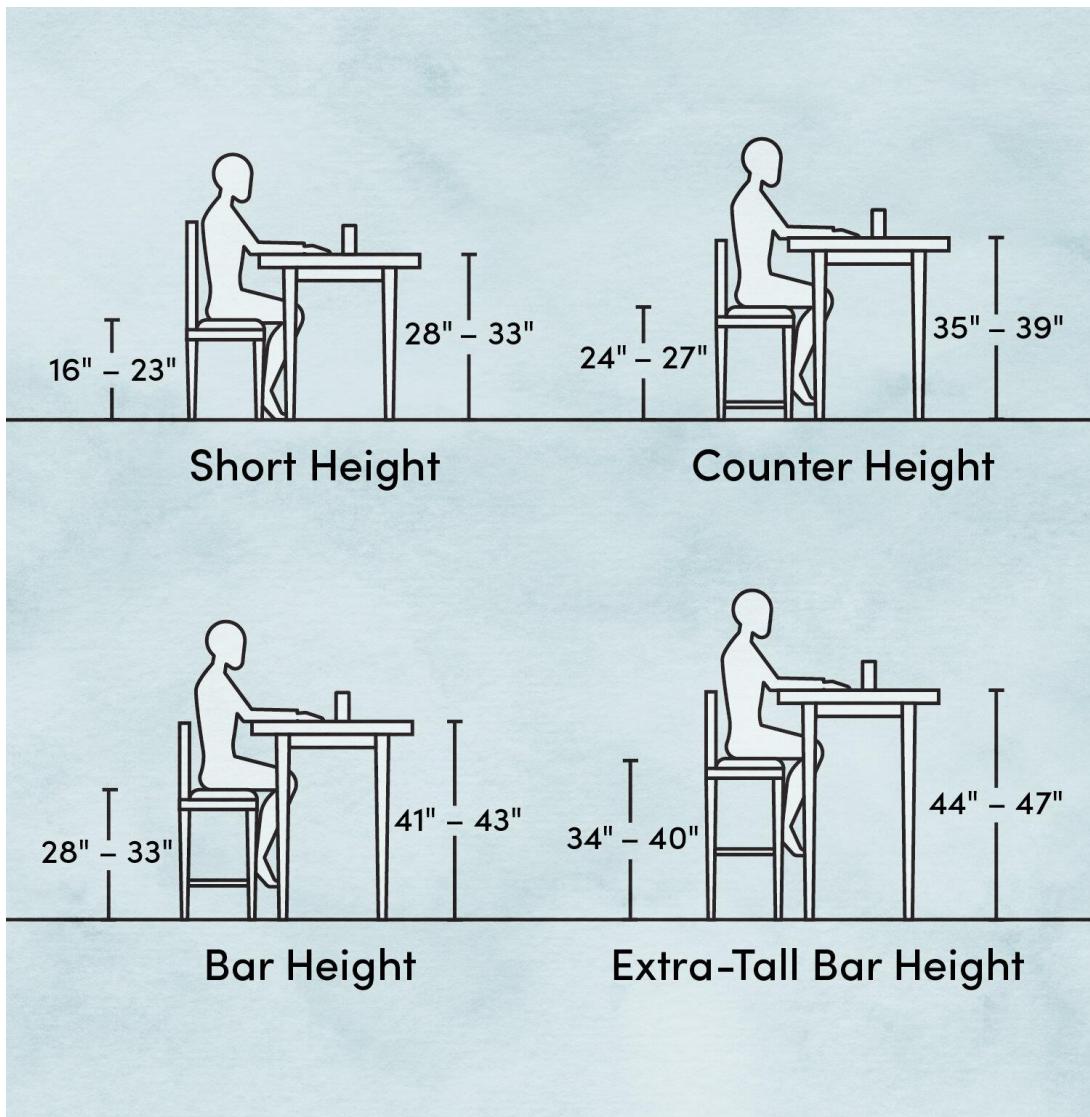
Kitchen Lower Cabinet Blocking



Two 2x4s set on bottom plates are used as a temporary jig to support blocking while it is nailed into place.
Kitchen supports are cut at 30^{3/4}" and bathroom blocks at 50^{3/4}" (for 40" and 54" centers).

Short walls for open kitchen style

Short walls that accommodate the open concept to support the kitchen sink base cabinets, dishwasher and a bar stool height countertop are erected with a top and bottom plate that are 42" in height. With a 1" counter top above this wall the height rises to about 43". The figure below illustrates the typical bar height guides. These short walls will also accommodate horizontally placed electrical outlets above the countertop.



Cabinet Blocking Guidelines:

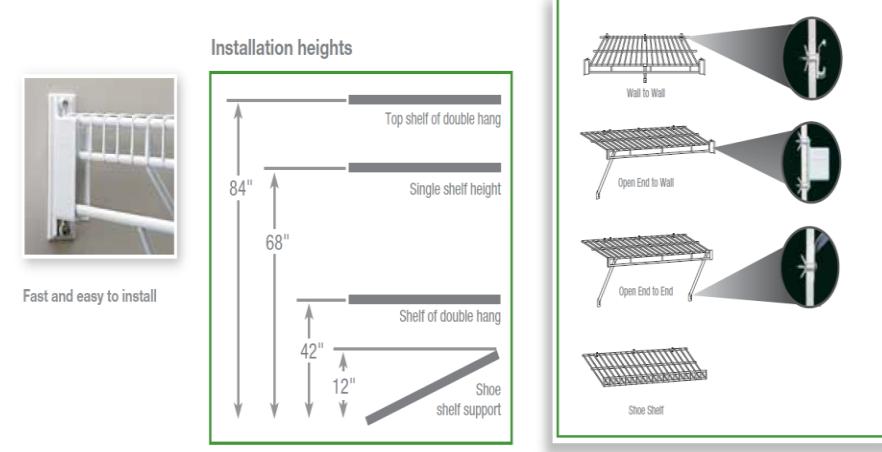
1. Measure and mark block locations, at centerline, at 34", 54" and 84" according to size and style of the cabinet.
2. Nail the 2x4 or 2x6 blocks into the wall system according to the previously marked locations, trying to keep blocking flush with the inside edge of studs.
3. Install blocking at the top of all base cabinets, and at the top and bottom of all wall cabinets.



Closet shelving blocking

Closets typically will get the wire shelving system installed. A closet with one shelf is secured with clips at the back and with end brackets. A set of support braces will be installed to provide additional support for the shelf. The wire shelf is typically installed at 68" from the floor. Additional closed blocking using 2x4 and 16d nails should be installed as follows:

1. In the back of the shelf unit 68" from the floor.
2. On the side of the shelving to support the end brackets.



Windows – preparation of the framing

Windows require two layers of flashing. The first is an approved sealant membrane installed after framing for the window but before the window is installed. The second layer is waterproof membrane tape installed on the exterior of the window after the window is in place.

Before the windows are installed, install the window sill pans and then install an approved sealant membrane around the top and sides of the window framing. This sealant membrane should wrap around by about 2" around the Styrofoam. The purpose of this sealant is to keep water off the window framing.

See the photo below.



Window Installation

The windows are sized to fit into the frame openings. Check the fit before applying caulk to the flange. Use a liberal or double bead of caulk under the nailing flange. (If the window must be removed and repositioned, apply a fresh bead of caulk.)

Attach each window by nailing through the nailing flange according to the window manufacturer specification. Nail at the top and side flanges but do not nail through the bottom window flange (you do not want to puncture the plastic sill pan). Use 1½" or 2" galvanized siding nails. Install the window plumb and level, and equally spaced between the sides of the rough opening.

The window can sit directly on a level sill. If it is not level, plumb and level the window as you work. The easiest way to do this is for two crew members, one on each side of the window, to position the window in the opening from the outside. The third member of the crew, standing inside the house, can hold the window while one of the outside crew members plumbs it using a 4' level and another nails it in place. Finish nailing the window securely to the house being careful not to bend or dent the flange. Remove any nails that do not hit solid wood.

To prevent air infiltration, run another heavy bead of caulk on the inside between the window and the sealant tape.



On double windows, plumb the first window but then use a tape measure to set the second one parallel to the first.

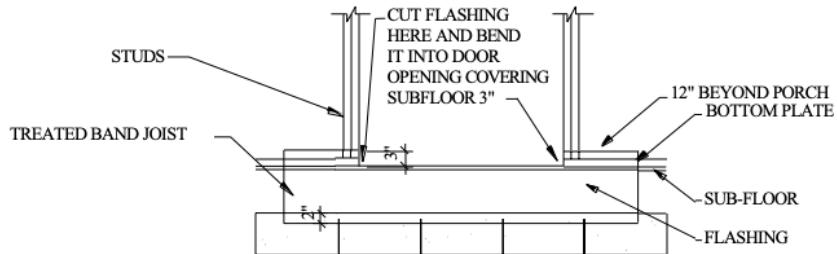
Flash Windows on Exterior with Flashing Tape

After the window is installed, a layer of flashing is installed on the outside. First cover the side nailing flange, then the top extending past the tape on the sides. See photo.

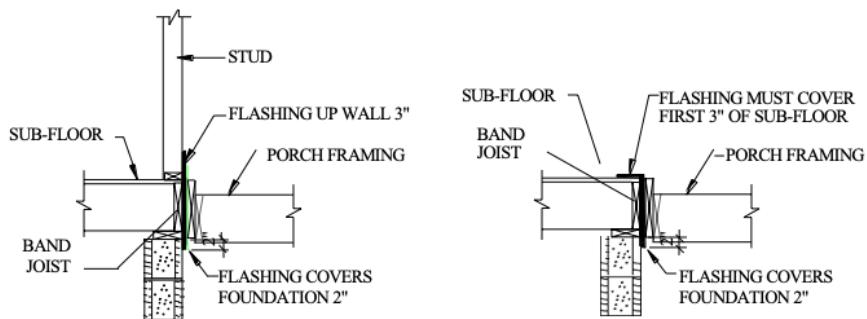


Flash Porches

Wood floors need to be flashed with metal flashing at exterior doors and wherever the porches/steps will abut the band joist of the floor. Flashing should cover the concrete block by two inches and extend up onto the floor three inches. Overlap the bottom piece with another piece if the flashing is not wide enough. Use as few galvanized siding nails as possible to hold in place.

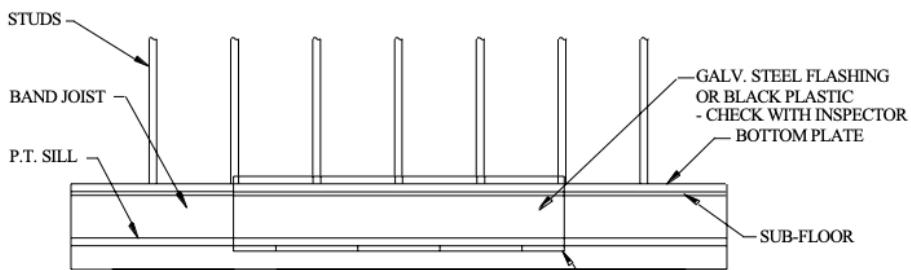


FLASHING DETAIL - DOORS
ELEVATION VIEW



WALLS (CROSS SECTION)

DOORS (CROSS SECTION)



NOTE!
FLASHING CAN BE BENT UNDER WALLS IF
INSTALLED BEFORE WALLS ARE ERECTED

PORCH FLASHING DETAIL

ELEVATION VIEW

Exterior Doors

Exterior metal doors are complete, pre-hung units which are sized to fit easily into the frame openings. The exterior doors come with nailing flanges. First, remove any packing materials around the door unit, and any temporary wood strips nailed across the bottom of the door frame. Without removing the nails or aluminum clips that hold the door in the door frame, position the door in the opening to make sure it will fit.

Check to make sure that the top of the door unit is not more than 1" below the header. If necessary, remove the unit and install additional blocking.

Typically door panels are secured to the frame for shipping. Remove the shipping nails by opening the door and pulling the nails. If a clip is used, it can be removed after the door is installed.

- Make sure the metal flashing has been installed on all wood floor houses. Caulk heavily under the threshold.
- If the hinge side of the opening is plumb, the door can be placed directly against this side. If not, use shims and a 4' level to plumb the hinge side.
- Re-check for plumb and raise either the hinge side or lock side jamb so that the margin is the same across the top of the door. The door sweep should close snuggly but smoothly and should not bind on the threshold. (An unlevel floor can be the cause of binding.)
- Nail near the bottom of the nailing flange on the same side. Verify that the door hits the weather strip around the entire perimeter of the door. If the wall is not plumb across the plane of the rough opening, it will not contact the weather-strip, and will need to be adjusted. Consult the site supervisor for troubleshooting if this should occur.
- Finish nailing the door securely to the frame of the house using siding nails through the nailing flanges.
- Once the door is nailed in place, check the margins again and shim between the door jambs and the rough framing at each hinge location and at four locations on the lock side of the door (see note below).
- Use decking screws ($2\frac{1}{2}$ " – 3") through the jambs (and shims) into the framing at each shim location. Peel back the weather stripping to hide the screws.
- If the door is pre-drilled for the knob set and deadbolt, shim directly above and below the holes and between the deadbolt and knob.
- On some exterior doors, the outside casing has a J-channel built in to the casing.

NOTE: For doors that are not pre-drilled for deadbolts: Shims or nails CANNOT be placed between 33" and 43" from the floor or they will interfere with the deadbolt installation. They must be located just below the 33" mark and just above the 44" mark to support the lock.

The exterior doors also get flashing applied as shown. First cover the side nailing flange, then the top extending past the tape on the sides. See the following photos:



Exterior Door Locks

Install a lock on the front door and on the rear door following manufacturer's instructions included with the lock. (Give all keys to the Site Supervisor.)

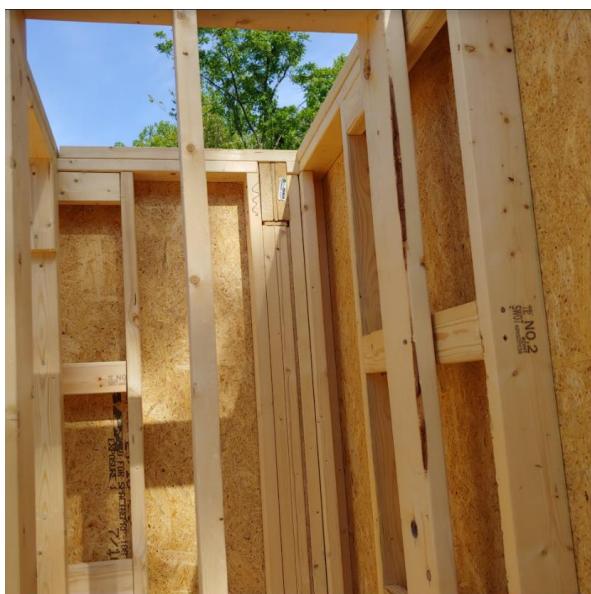
Porch Beams

All Habitat plans include a covered front porch. Front porches are supported by three beams.

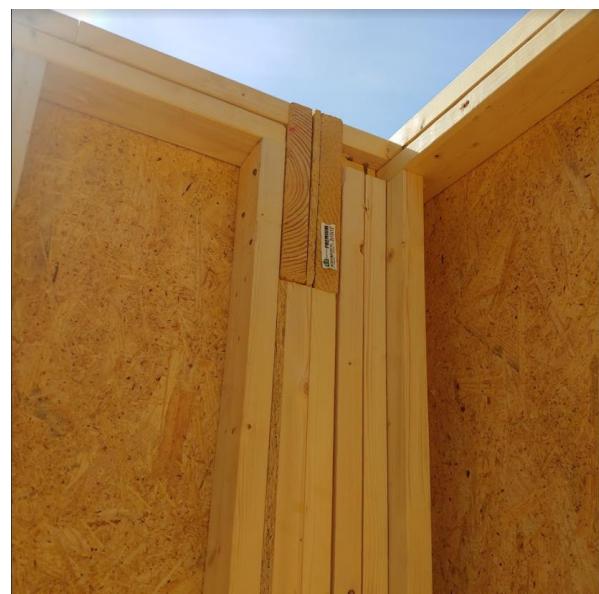
- Both short beams are constructed on site from **2x10 load bearing short beam** and extends from the house wall to the box beam. In some cases the beam between the 2 short beams is constructed from doubled up microlam beams. A $\frac{1}{2}$ " OSB is placed between the two 2x10s (creating a beam that is 3.5" wide). This beam sits on jack studs in a pocket in the wall. The beam will be $9\frac{1}{4}$ " after it is installed and the cap plate butts into it. See photo below.
- Back or side porches usually use porch beams made of 2x8s. The cap plate will run over these.
- If a pre-manufactured $9\frac{1}{4}$ " **microlam beam** (two @ $1\frac{3}{4}$ " wide) is placed on the side of the house and carries the truss load. It too sits on jack studs in a pocket in the wall. It has no cap plate. See photo below.
- On hip roofs the microlam beam is typically the large front porch beam.

The beam pockets, consisting of jack studs, a king stud and $\frac{1}{2}$ " OSB are pre-manufactured as components and are on site.

The photos below illustrate how the rear porch beam is supported in the beam pocket of the exterior wall and the support is built for the front porch beam in the exterior wall.



Beam Pocket for back/side porch

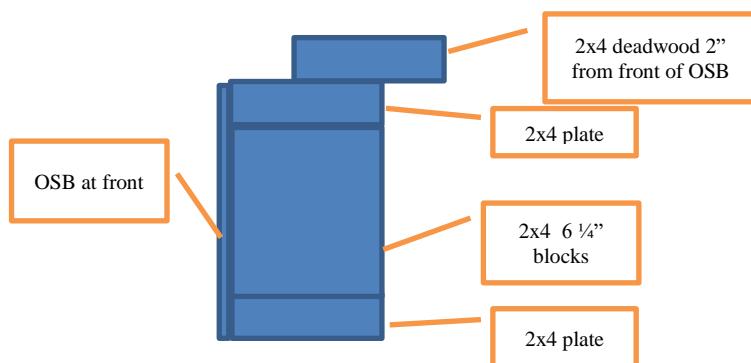


Beam pocket for front porch

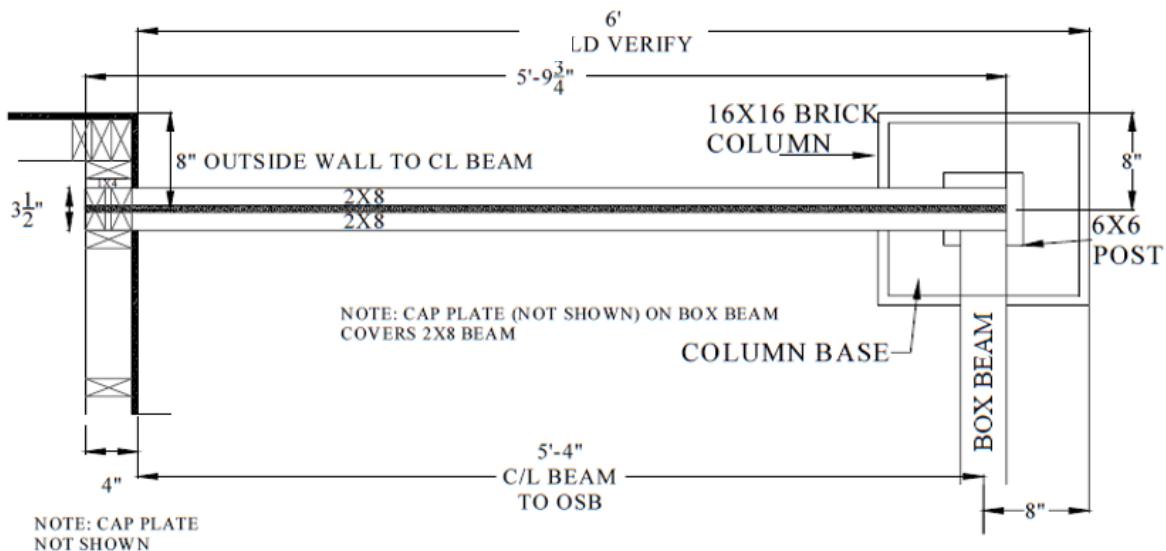
Building a box beam

A box beam is not load bearing so it is constructed on site as follows:

- It will be the length as measured between two “short” beams. This distance will be different with every house so it needs to be measured.
- Build this beam using long 2x4 for a bottom and top plate. If you need to piece these 2x4 plates because of the needed length, make sure you put the top and bottom seams at least 4' apart. Nail 6 $\frac{1}{4}$ " 2x4 blocks spaced 16" on center between the top and bottom plates. The ends of the plates need to have blocks. Be sure the blocks are nailed perpendicular to the plates. The goal is to make sure that the beam is a rectangle. Double up the blocks at the plate seams. The completed box beam is typically light enough to lift into place, so add $\frac{1}{2}$ " OSB sheeting to the exterior side and a 2x4 deadwood on the top of the top plate. The drawing below shows a side view of the box beam framework.



To determine beam lengths for a porch, measure from the inside of the wall's framing to the center where the porch columns will be installed. The column will either be round or square and will be typically built on top of a brick base. In other cases the column will be built on top of the porch floor and all you have is the porch brick wall. Determine the type of column to be used from the house plans. Draw diagonal lines on the top of the masonry base. The intersection of these diagonals is the center point of the column. Keep in mind that the outside edge between the side beams and the long front beam of the porch will sit centered on the intersection of these diagonals that you marked on the base. Do this in both directions. Measuring from the inside of the wall takes into consideration that the beam sits on jack studs. See drawings below:



2x8 Beam/Box Beam Intersection Detail



(H) 2x10 Short Beam in Wall Pocket with Temporary Support



(H) Microlam Beam in Wall Pocket



(H) Microlam/Box Beam Intersection

Temporary Support for Load Bearing Beams

Use temporary posts (two 2x4s nailed together) in from the outside corners of each porch beam to support and hold it in a level position. Apply diagonal bracing to each support, starting on the post and extended about 3' out on the beam.



The Microlam Beam (H) sits in a wall pocket. The cap plate does not go over the beam. (Deadwood for a gable is shown in above photo.)



Two directional diagonal bracing holds temporary posts stable on active job sites such Habitat's. (H&S)



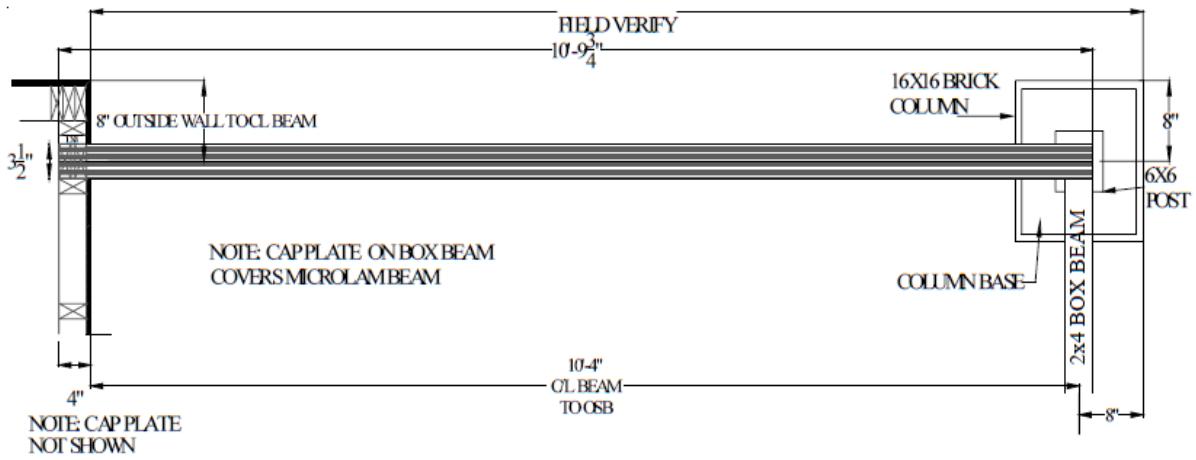
A 2x Beam seen from inside the house. (In this case the cap plate was not run over the beam.)



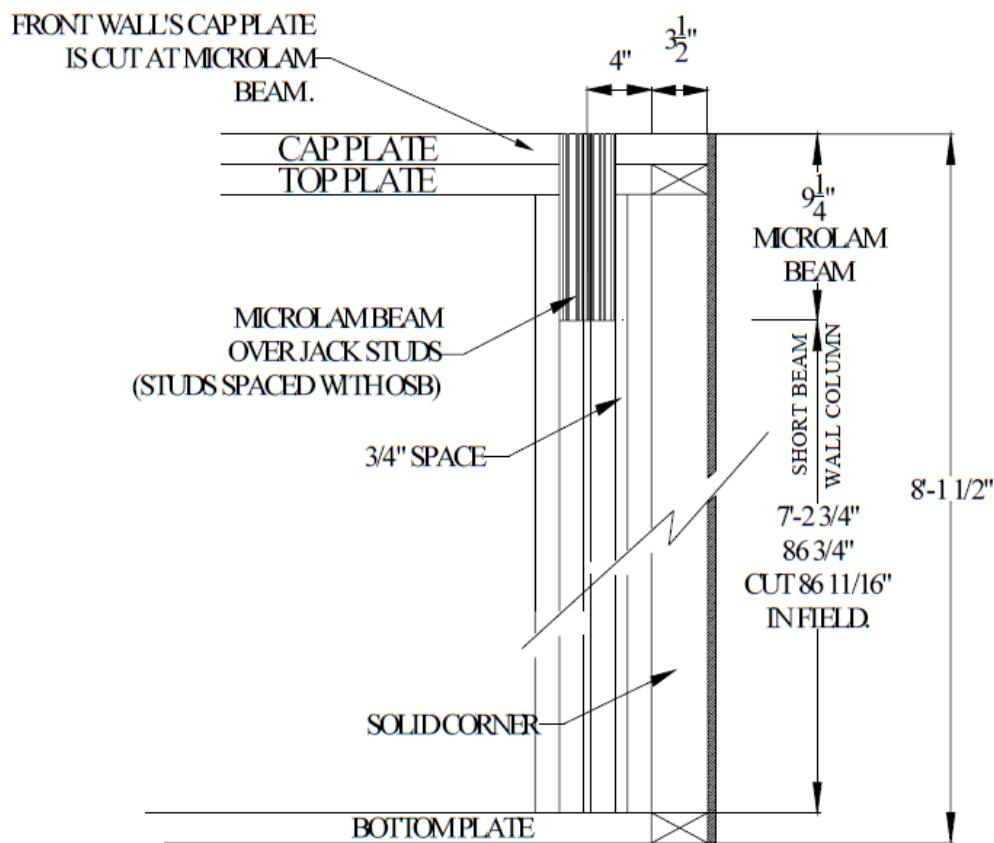
The Microlam Beam (right) holds the weight of the roof. The Box Beam (front) is not load bearing. (H)

Every porch beam will also need to be secured to the framing on the inside of the exterior wall with 2 steel straps using 10d joist hanger nails. See below.

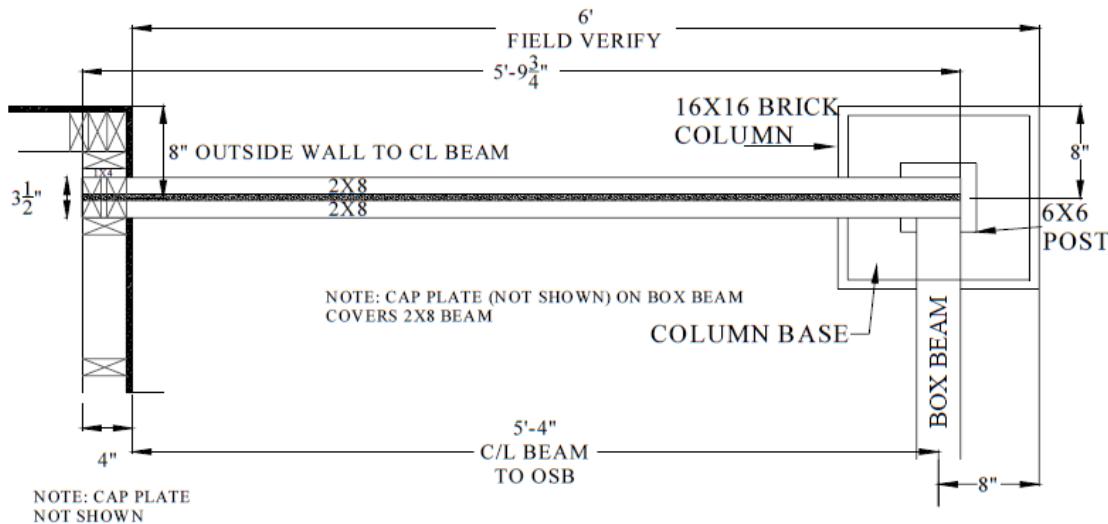




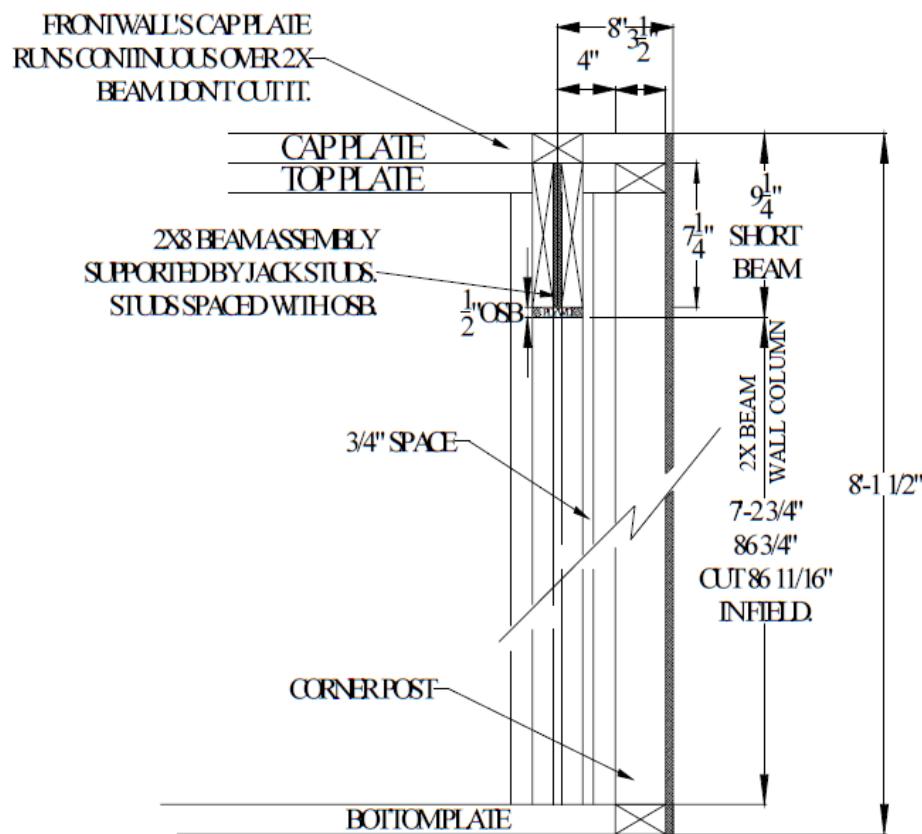
Microlam Plan View



Microlam Beam/Front Wall Detail



2x8 Beam/Box Beam Intersection Detail



2x8 Beam/Front Wall Intersection

Bracing the Box Beam

The Box Beam has a tendency to sag. Use temporary braces under the beam to remove any sag. A tight string line on the beam's lower edge can be used to check for straightness.

The Box Beam has a tendency to bow out or in. Use temporary braces from the front wall to the box beam to straighten the beam. A tight string line on the outside face of the beam and a tape measure, used to check the margin along the length of the string, can be used. This is typically done when the cat walks are in place. This is similar to straightening and bracing exterior walls.

If for any reason the box beam was not sheathed with OSB when it was constructed on the ground, skin the outside of the box beam with OSB using 8d common nails at 6" o.c..



This Box Beam is well braced and ready for the Gable Truss to be set. Strongback is in place, beam is straight in both directions.

To straighten the Box Beam, keep the same margin between the string and the beam along the entire beam length.



Front and rear porch and porch roofs

The front and rear porches and roofs are built out as shown in the following photos. Different 2 story house plans have different porches and porch roofs. The front porch in this example has a hip roof with a front gable. The roof structure is built with doubled up trusses that are attached to the front wall (Using 6" long timber screws over the Styrofoam and through the OSB and anchored into the wall studs). The 2 hip trusses are attached to the mounted wall truss and to the corners of porch beam. Once in place the other trusses are mounted (which are precut and sized by the manufacturer) spaced as per the house plan. Notice that some of the trusses will mount to the back wall truss and others will attach to the hip trusses. A wrap around fascia board of 2x6 is attached to the ends of all the trusses. A cover of OSB sheeting is attached to the trusses spanning the center area so that a small gable front can be attached. The centered small gable, sheeted with OSB and built with initially only the inner 2x6 base for the ladders. This gable is attached to the sheeting a distance that when the outer base for the ladders is attached it will be in line with the front fascia board around the hip roof.





Preparing for the Trusses

Gable Truss Preparation

The front and rear gable trusses should be prepared on the ground so that they are ready to be raised over the walls and sit as an integral part of the roof. The site supervisor will identify these gable trusses and mark them as to where they will be located on the roof. Look for plenty of space and support horses to support the preparation of the gable truss. When the trusses are completed they will be heavy and will need to be raised and placed on scrap lumber so that the next gable truss can be prepared. In the simple gable truss preparation you skin the outside of the gable truss with OSB and then build and install the gable ladders (described later). All OSB seams must meet over the gable truss components. Those gable trusses that are over interior area of the house will need to be skinned with $\frac{1}{2}$ " Styrofoam. This gable trusses that are over none interiors areas, such as porches will be skinned with Tyvek and the Tyvek will extend about 12" down from bottom of the gable truss. In many cases the gable trusses that accommodate smaller trusses (such as those over a front porch) will not have a full ladder on the side that accommodates the smaller truss.

Gable Deadwood

On walls that receive a gable truss, install a row of solid deadwood (full lengths of 2x4 or 2x6) that will fit tight against the bottom chord of the gable truss once it is installed. Leave room for the gable by positioning the deadwood in $1\frac{1}{2}$ " from the outside of the cap plate by using a 12" scrap of 2x4 turned on edge. Nail the deadwood securely to the cap plate above each stud using 16d nails.

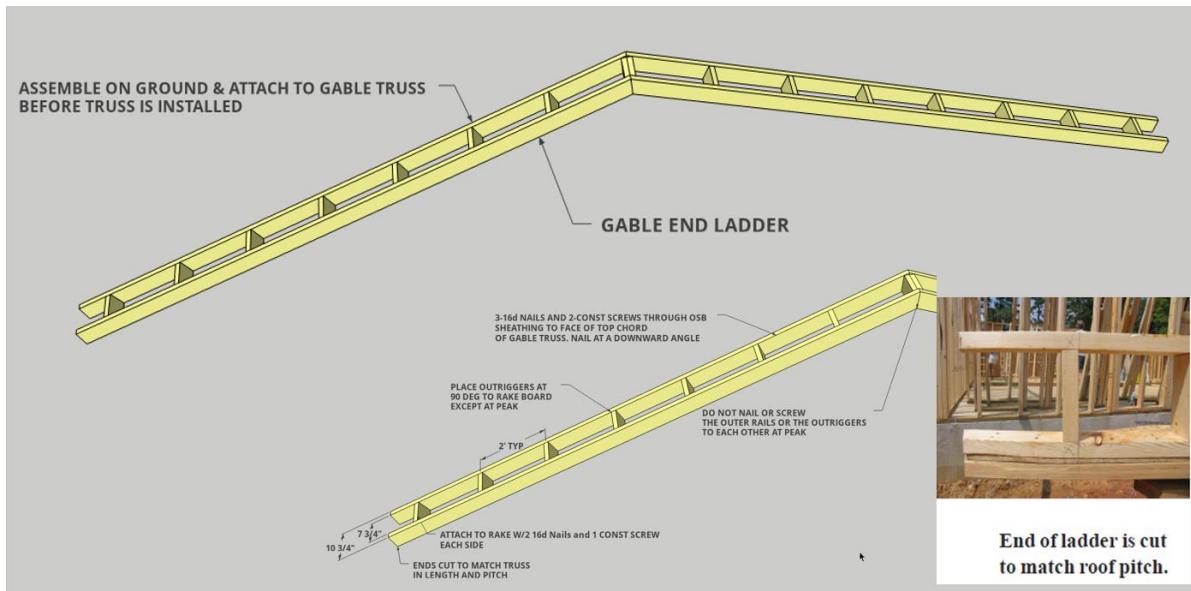


Gable Deadwood (shown here with gable in place). It secures the gable as well as provides deadwood for the ceilings.

Gable Ladders

Charlotte uses 7.75" blocks (typically 2x6) between the each of the gable ladder runs at 24" on center. This give a 10.75" wide overhang from the OSB sheeting. Use 2 16D nails and a deck screw to secure the blocks and the ladder. Build the inside of the gable ladder with the rungs and attach it to the gable truss (be sure to catch the truss framing underneath the OSB). When both left and right inside part of the ladder are installed you can attach the top pieces to the rungs, using 16d nails and screws.

The gable over a heated area will get the foam board installed over the OSB. A gable over unheated space (a porch) will get Tyvek applied to the OSB.



Boxing Returns (Bird Boxes)

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 10 ¾" wide from the OSB (using 7 ¾" blocks plus the 3" for the 2 sides of the ladder).

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.

**Boxing
Return**



Lay Off for Roof Trusses

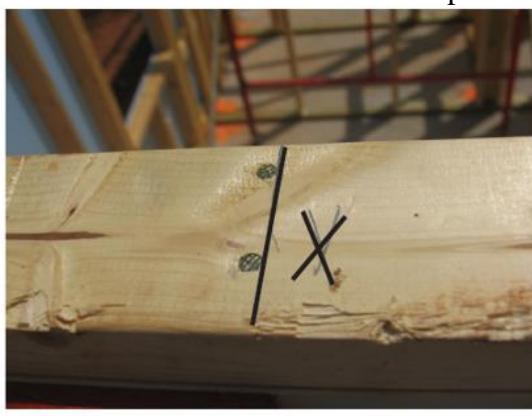
If truss layout occurs during framing, the following method is used.

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 back-to_front 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).

Note that when the trusses are placed over the walls, you may need to cut out or chisel a cap plate if it interferes with the bottom truss chord. See photo below.



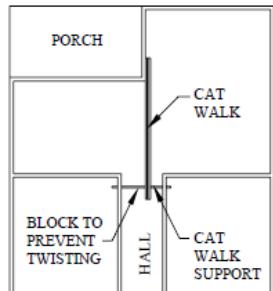
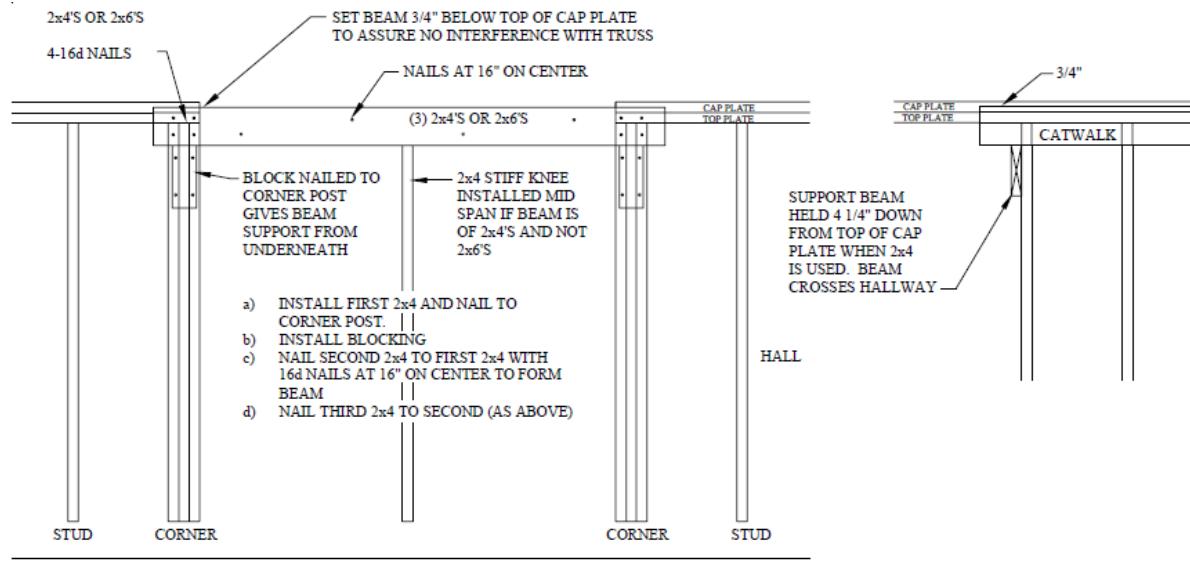
Truss Layout Mark Transferred to Cap Plate



Relieve a bowed truss already installed by removing cap plate. If not installed, chisel out only a portion of the plate.

Install catwalk

On some plans a temporary cat walk needs to be constructed over the open dining room/den areas. These provide additional safety feature and are not for walkin on while setting trusses. Install these temporary braces consisting of two 2x4s nailed together and erected near the top of walls in any open area (such as a living room) where trusses would endanger workers if they fell during installation.



Catwalk Details

Install outer strong backs on exterior of gable ends

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 $\frac{1}{2}$ " Styro Foam Insulating Sheathing as a shim behind the strongback, for the entire length of the strongback, if the wall sheathing and Styrofoam board is not installed. Install securely with 16d nails every 16". A weak strongback is very dangerous.

A temporary brace made of 2x4s that are screwed to the exterior of a wall that lines up with a gable to keep the gable upright during installation and prevent it from falling off the house. These are removed

after the gable has been nailed to the framing (securing the bottom edge) and the roof has been completed (securing the top).

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 (Note Box)



Strongback on Rear Gable (end braces missing from photo)



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



Bracing the Strongback



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

After the trusses are in place

Install inner strong backs on interior of gable ends

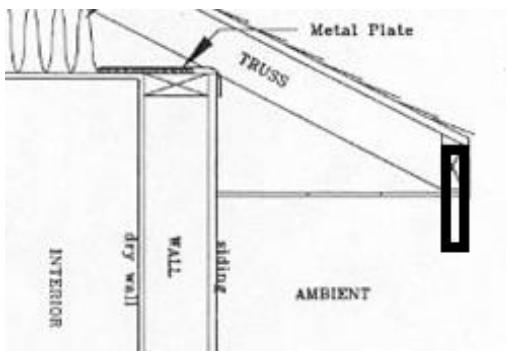
Each of the gables require additional 2x4s to be added to the inside for wind resistance. Measure and cut 2x4s and nail them to vertical chord of the gable using 16D nails. These 2x4s should be nailed to the chord so they create an L. Most gables require 5 strong backs, though half sheathed midlevel gables may need fewer.



Install the Fascia Boards on the ends of the trusses

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 2x6 fascia boards flush with the bottom of the roof OSB sheathing and nail to the end of each truss with two 16d common nails. All joints should occur over trusses. See drawing below.



When a fascia board on the front gable joins the side wall of the larger gable, leave a space $\frac{1}{8}$ " 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.

A fascia board is also attached to the rafters if a side porch as shown below.



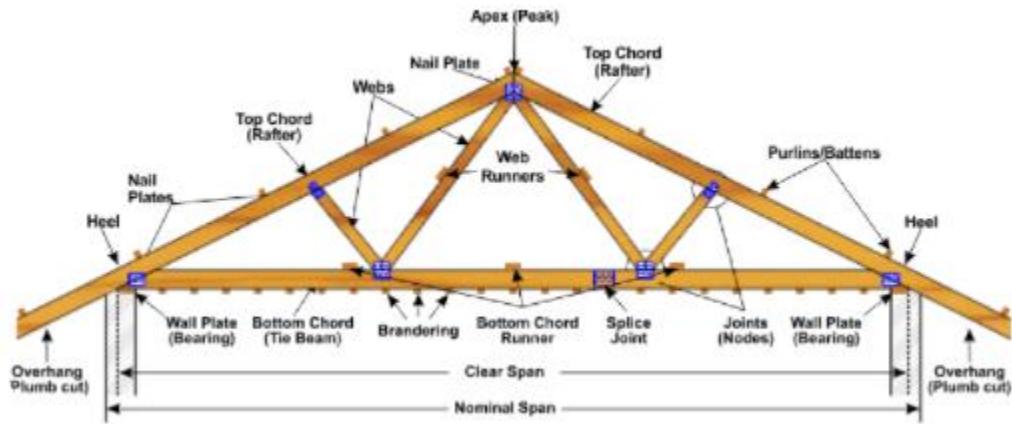
Porch baffles in the attic

OSB based sheeting is installed between the unheated porch and the heated attic space. These strips of OSB are cut to 18" in height and are nailed with 8d nails from outside the house into truss components over exterior wall. Be sure that OSB joints meet over a truss component. These baffles serve as attic insulation barriers. See photos below.

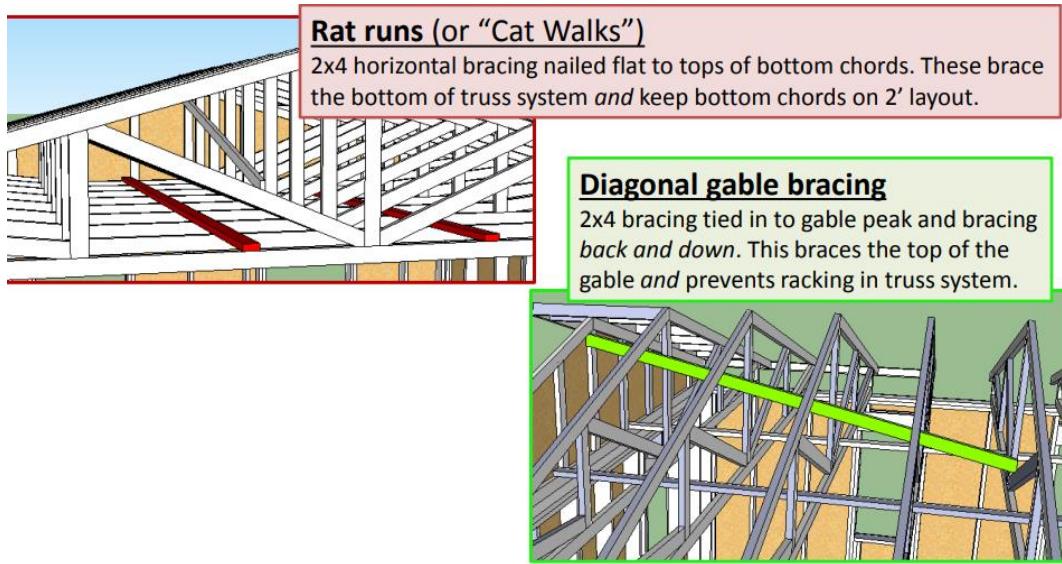


Bracing in the Attic

The following roofing/trusses terminology will help:



The attic and trusses get braced via diagonal braces and rat runs based on the following drawing:

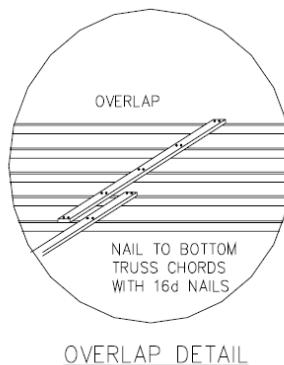


Rat Runs

Rat runs are 2 x 4's, laid on the flat, on TOP of the BOTTOM truss chord. These can be pieced from 2x4 of various lengths (8',10',12'). Be sure that when you piece the runs that you overlap one of the 2x4 by at least a truss width. These runs are used to brace the house and keep the trusses on 24" OC layout. See photo below.



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.

To make sure that the bottom of the trusses are spaced apart the same distance, use the rat runs.

- Starting at the rear of the house, measure the distance between the Gable truss and the 1st truss, AT THE OUTSIDE WALL, on each side of the house. It will be less than 24".
- Nail the end of the 2 x 4 into the bottom chord of the Gable truss with 2-16d nails.
- Measure over the distance from the previous step. That will be the BACK edge of the 1st truss. Nail the 2x4 into the 1st truss with 2-16d nails.
- Hook your tape on the 1st truss and continue towards the front of the house, 24"OC. This means that from the right edge of truss 1 to the right edge of truss 2 is 24".
- Keep the rat runs parallel to the chalk line.

Cut out the holes for the rat runs in the baffles when you reach the gable end where there is a porch and baffles are installed.

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 multiple 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. Proceed with diagonal bracing starting on the first interior truss.



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



Diagonal Bracing in Place

Attic Floor and Safety Rails

The attic flooring consists of $\frac{3}{4}$ " 4'x8' OSB (or doubled $\frac{1}{2}$ " OSB) sheeting supported by 2"x8"x10' joist framing. The floored attic area is installed in the center of the house over the rat runs. It takes thirteen 2x8's to create joists for 24' of attic floor. The joists are nailed on each end to the truss webbing with four 16d common nails and they are supported by the rat runs.

In the attic access bay, add a block to support the floor at the landing.

After the attic floor framing is installed, install 4'x8' pieces of OSB with the long edge perpendicular to the trusses. Add a ripped strip to complete the floor. Nail the sheeting in place using 8d common nails at 8" o.c. on the edges and 12" o.c. in the interior.

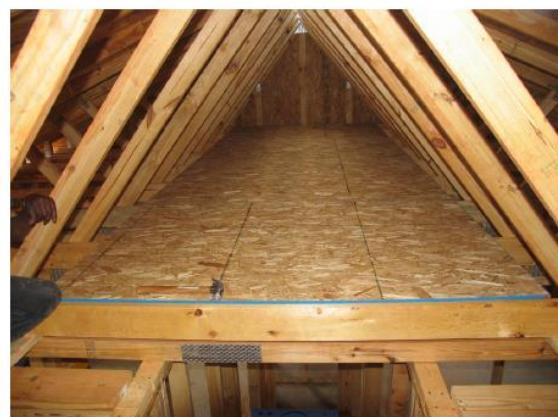
Install blocking of 2x4 nailed between the joists at all the end edges where the OSB will sit. Use 16d nails

The attic floor also requires permanent safety rails. These are installed after the HVAC work is completed. These consist of rails that are 18" and 34" from the attic floor on the truss web. Use 2x4s and nail with 16d nails. These railings will be nailed to the truss web runs that are above the floor. Mark one of the truss web at one end of the floor at the 18" and 34" above the floor and do the same on the end of the floor. You can use a 24" level, marked at 18" to get the point that is 18" above the floor. Use a 36" level to do the same for a 34" point above the floor. Then snap a chalk line between the 2 point you marked on the truss web to help you line up the safety rails 2x4 on each side of the floor. See photos below.

Note: Check with the truss manufacturer before installing attic floors.

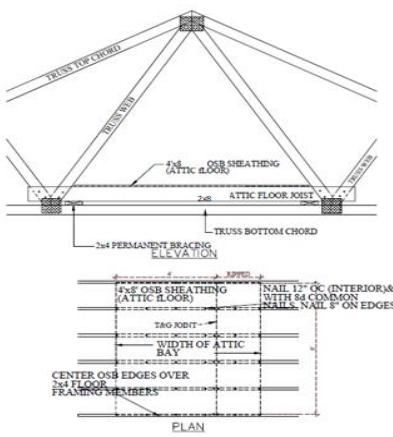


2x8s are placed on the bottom chord bracing to form joists for the attic floor



Secure attic floor joists to truss webbing with 16d nails

Attic Floor in Place



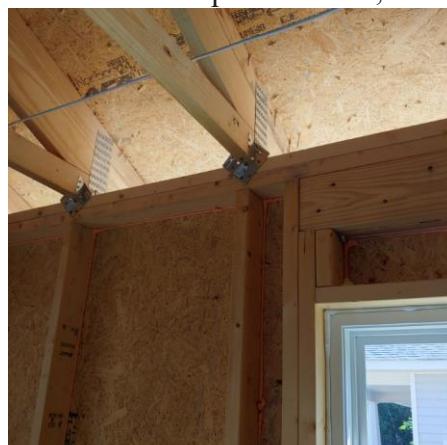


Hurricane Clips

One hurricane clip is used to tie each end of each truss to the top plate. Use 10d joist hanger nails for this job. Position the clips high enough to avoid interfering with the drywall installation. By manufacturer's specifications, each hole requires a nail.



Hurricane Clip installed with 10d nails



Attic Floor Blocking

When you installed the attic floor joists (see earlier section) you also had to install 2x4 blocking between the floor joists at the edges where the OSB floor ends.

Attic Stair Blocking

Blocking for the attic stairs consists of one 2x4 (hinge side) and one 2x4 (each 22½" long) which are nailed, using joist hangers, between two adjacent bottom chords of the roof trusses, creating a box in which the attic stairway can be installed. The rough opening needed for the stairway is 22½" x 54½". See floor plan for location.

4 joist hangers for 2x4s are required where the attic stairs blocks meet the trusses – attached with 10d joist hanger nails at the straight holes and with 16d nails at the slant side holes on the joist hanger.

Before the insulation is installed in the attic, the area around this stair opening will need to be blocked so insulation does not fall into the living area. Additionally, an access door with insulation on top of it will sit on top of this door.



Deadwood for Drywall

As necessary, install deadwood on wall ceilings that are parallel with the trusses. Deadwood is needed only where there is a gap between the wall and truss. Use 2x4 for the deadwood.



**There was a gap between this truss and the closet wall.
Deadwood was added above the wall's cap plate.**

Miscellaneous tasks

- You will need to fill in with ~1 ¼" OSB and Styrofoam strips below gables on the exterior – the first layer is OSB and then the Styrofoam board strips. Be sure to tape the Styrofoam seam.
- You will need to fill in ~1 ¼" OSB and Styrofoam strips along the top plates on the exterior - the first layer is OSB and then the Styrofoam board strips. Be sure to tape the Styrofoam seam.
- Be sure to patch gable holes that were introduced to enable the lifting of the gable truss.
- Sealing attic dead spaces
If the house plans contain a “dead space” seal the top of it from the unconditioned attic space by attaching two layers of 1/2" OSB to the trusses and seal around the OSB using fire-rated great stuff foam.

Porch Roof for Side Door

If the house model does not have a built in side porch (such as the Jones or Lowry plans) you will need to construct a side porch overhang. This is easily done during the truss/roofing phase but can be added after if needed. See the house plans for details.

Leave a square cut on the end of four truss extenders (stud length 2x6s). 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.



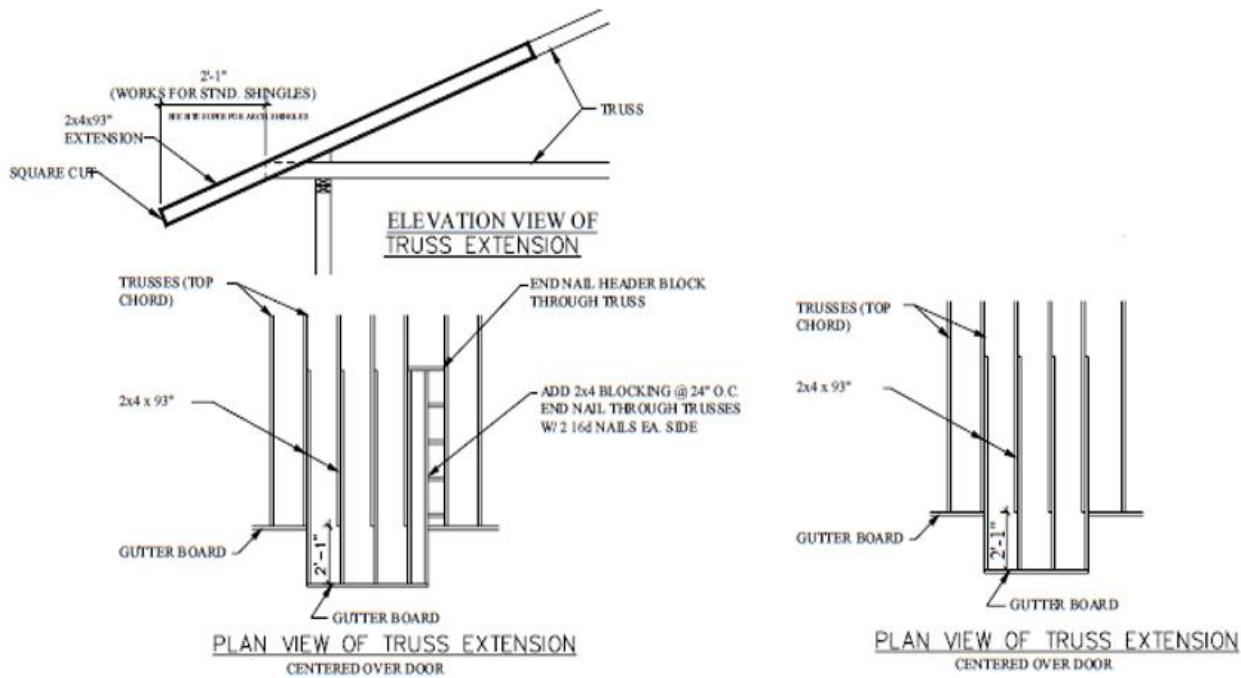
Bridging and bracing.



Side Door Porch Extension



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.



Attach loose wall tops

Any walls that are free standing, such as a small wall by a front door that does not connect to other walls should be leveled and braced to the trusses. Usually this is accomplished by adding a 2x4 above the cap plate and secure the truss to that.

Insulation, OSB and vapor barrier behind the Bathtub

After the sheeting inspection, install faced fiberglass insulation batts between the exterior wall studs in the area behind the bathtub. OSB is attached via glue to the tub for future attachment of handicapped brackets. Cover with Thermo-ply to provide an air/vapor barrier behind the tub.

Air Sealing

Before any insulation is installed, areas are sealed with expanding foam spray to reduce exterior air infiltration into the living area. This is typically done before the insulation is installed in the walls. This air sealing includes sealing:

- Joints of the exterior wall studs to the OSB;
- Gaps in the door jambs to door frame;
- Any holes into exterior electrical work boxes;
- Holes into exterior studs for pipes and electrical power.

See photos below:





Remove Temporary Bracing

The temporary bracing on the inside and outside of the house can be removed after the following:

- After all the trusses, bracing for the trusses are installed, including permanent diagonal bracing, rat runs in place.
- Roof sheeting is installed.
- All outside corners are braced with sheeting and interior walls are in place.
- The safety system dismantled.
- All the hurricane hangers are also installed, and any safety systems are dismantled.

Pull any nails from the bracing and restack the material

Clean up House and Site

Sweep out house, put trash and debris in a pile to be hauled out or in the onsite dumpster provided, restack all unused materials and protect from the weather. Make sure all tools and equipment are accounted for and properly stored.

Framing Appendix

Bathroom Medicine Cabinets

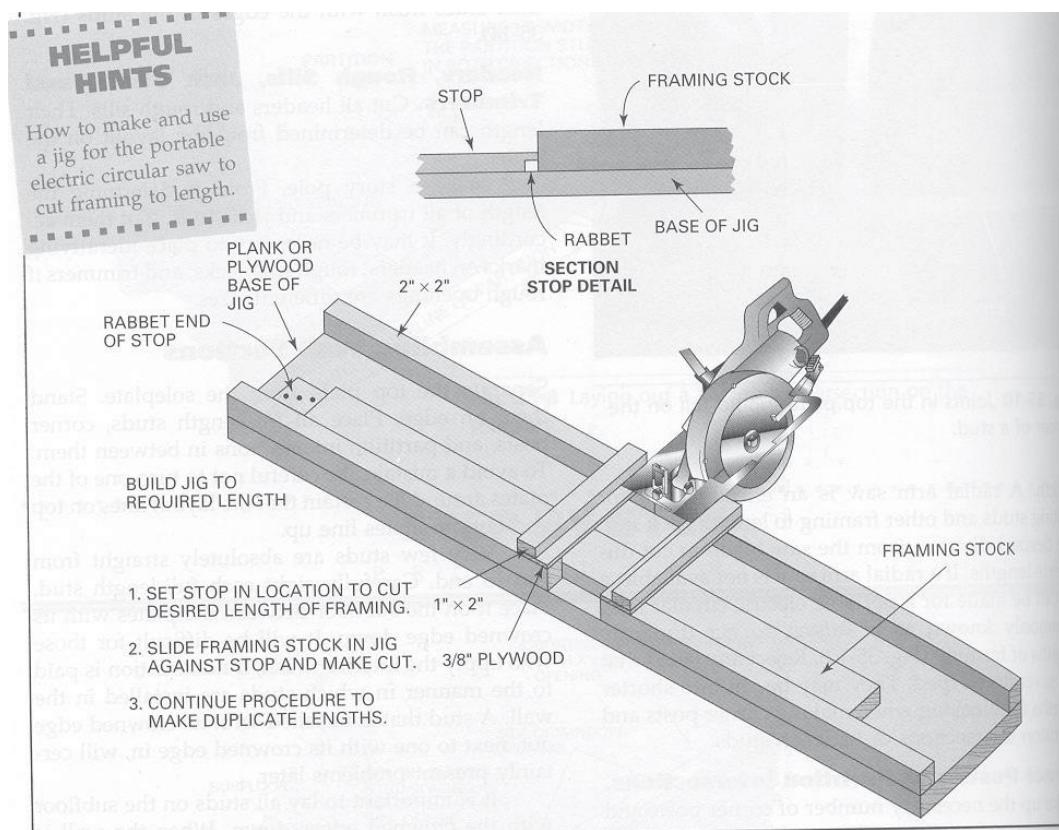
If bathroom mirrors are being provided be sure to install blocking. If requested by the site supervisor, bathroom medicine cabinet blocking can be installed for future use. It consists of two studs turned to the side (expose the face) and nailed flush with the plates on the inside of the bathroom. Leave 11" clear between these two studs. They will be the blocking for the flush mounted cabinets, soap dish, and the toothbrush holder.

Twin Windows

Metal flashing is be installed over all exposed twin windows (those not covered by a porch.) that are not flashed at the factory or installed as separate windows. Check with the site supervisor to see if flashing is necessary. Cut flashing out of fascia material and bend on the brake for neat edges. It should extend 1" beyond each side of the window edge. Pre-formed drip cap can be used if available.

Framing Jig

It may be necessary to cut framing to 93" stud length



Layout and framing of a 2 story home

These are the highlights for the layout and framing of a 2 story home.

1. Studs on exterior and interior walls are set at 16" OC. This is true for both the first and second floors.
See drawing below
2. Outside corners are produced at the warehouse and are 3 studs nailed together. During the layout this corner will be marked as solid and it is 4 $\frac{1}{2}$ " in width. See photo below.
3. The exterior doors components have an extra jack studs on each side so this adds to the layout size of the door. See photo below.
4. The windows have an extra jack stud on each side so this adds to the layout size of the window. See photo below.
5. The exterior walls for the 2nd floor are built on the floor of the second floor with the sheeting (OSB) nailed on, the window opening is cut out of the sheeting. Styrofoam is nailed on top of the sheeting and then cutout for the window opening. Finally, the windows are installed, with window sill panes, caulk the window nailing flange, nail top and sides (not bottom) of window and apply exterior flashing tape on the sides and top.
6. Strong backs are attached to the tops of those exterior walls to brace for the gable roof trusses. This avoids the effort of doing this from a ladder or from scaffolding.
7. After all the lines are marked on the flooring and all the bracing is set up, staple down the sill plate foam. Attach strong backs to the top of the outside 1st floor wall (over the Styrofoam) to prevent the exterior walls from slipping off. The wall is then raised into position.
8. A window will be designated by the supervisor to allow for the removal of the sashes so that drywall can be fitted to enter the second floor from a lift. This avoids the efforts of getting the drywall through the first floor up the stairs and into the second floor.
9. By building safety code, typically, a second story window will be designated to be made with tempered glass. This window will be next to stairs and at a landing but please refer to the house plans.
10. Fireproofing of dead space is required by building code and is house plans specific. Typically this is done at the point of transition from the 1st floor to the 2nd floor, under the stairs and landing. Consult with the supervisor.
11. Back boards for anchoring step railing is typically 34" from the bottom and the same at the first landing. 2x6 boards are cut to fit between the wall studs in an angle. See photo below.



The flooring between the 1st and second floor uses floor trusses. These are set on 19.2" OC marks on the cap plates where the floor truss ends will sit. Please refer to the house plans.

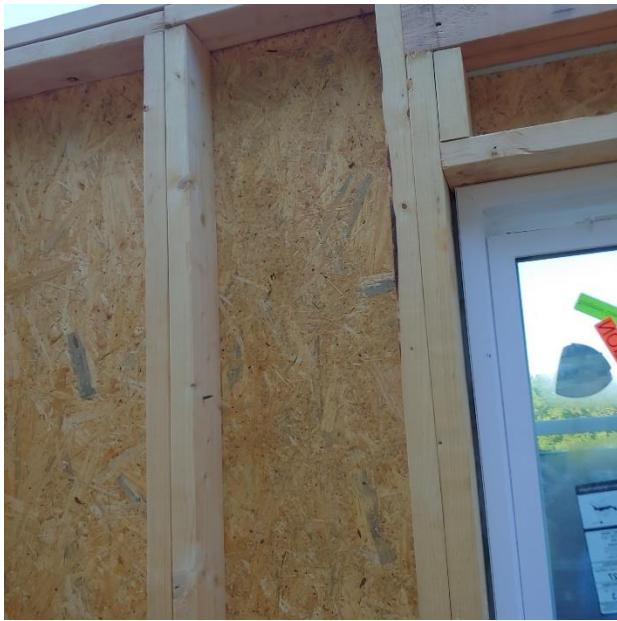
Floor trusses feature a built-in ribbon notches that can be built to receive 2x4 lumber for bracing. Bracing prevents trusses from bending, twisting, or otherwise deforming. On bottom-chord-bearing trusses, the ends are tied together with 2x4 ledgers that also serve as a nailing base for the perimeter of the plywood deck (see illustration below). Underneath, 2x6 or 2x4 strong backs, laid on edge, should run continuously through the webs of all the trusses at 10-ft. intervals (one run for a 20-ft. truss, two runs for longer trusses). These serve the same purpose as bridging in a standard floor, distributing concentrated loads over a wider area. These are marked on 19.2" to make sure that the floor trusses are properly spaced in the interior, not just on the exterior wall where there are installation marks.

When the floor trusses are installed over a load bearing interior wall, the doubled vertical 2x4 in the truss web sits on top of the wall.

Notice in the photos below how the exterior walls are constructed on the second floor:

- a. The splicing when exterior walls are split into 2 sections. Doubled up studs are deployed between the split sections



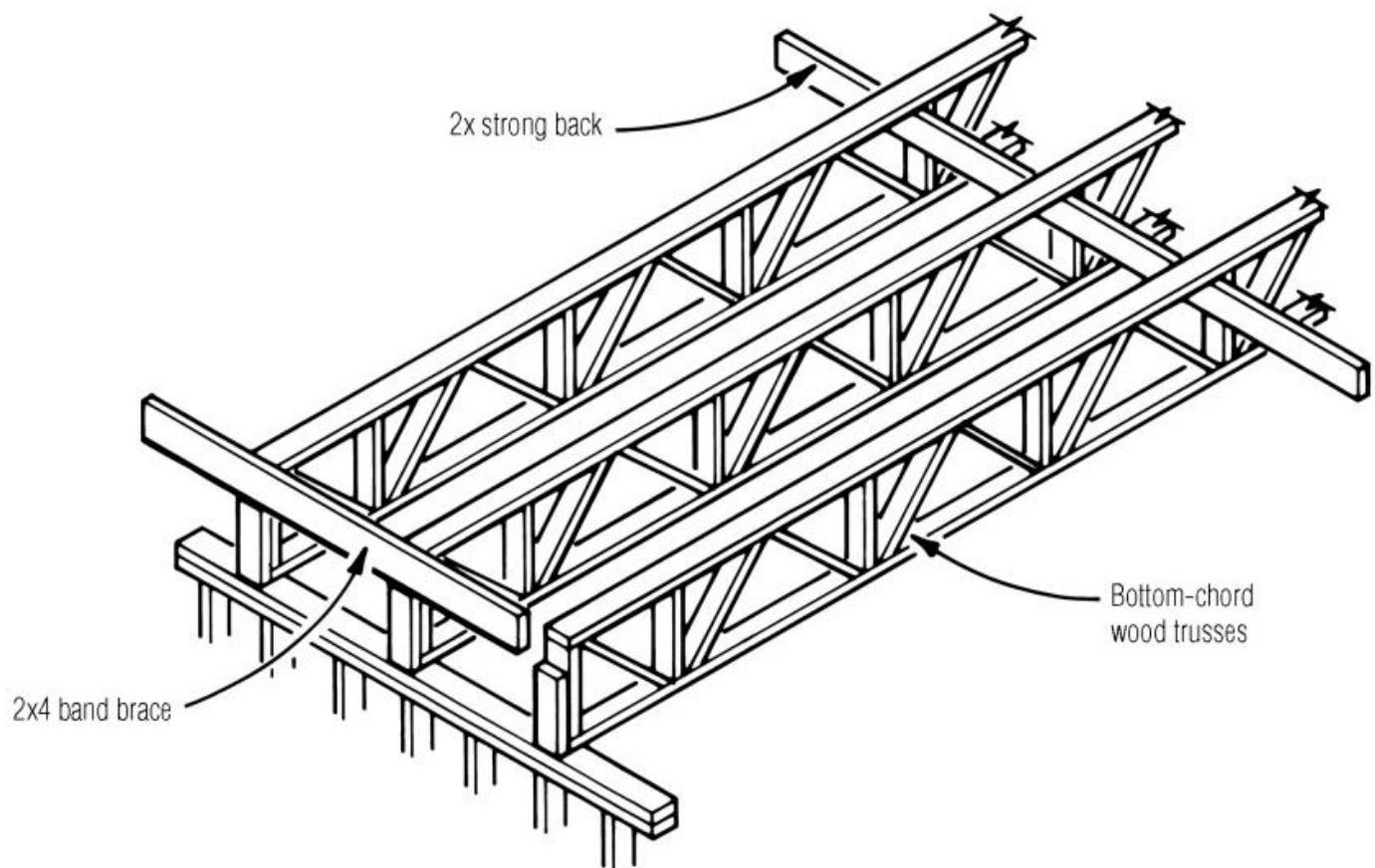


- b. When use of scaffolding on the exterior perimeter of the house is undesirable it is possible to install the OSB sheeting, the Styrofoam board and the windows on the exterior walls prior to raising them up. This saves quite a bit of time to set up and take down of the scaffolding.

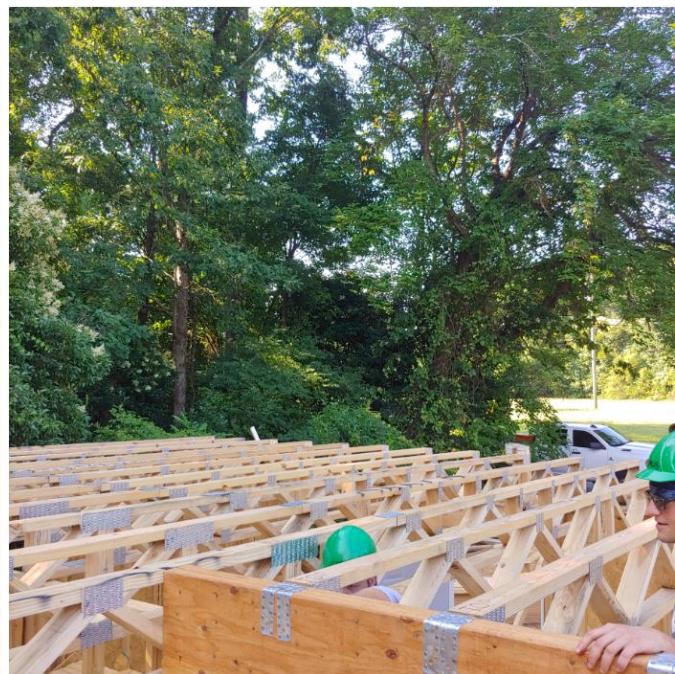




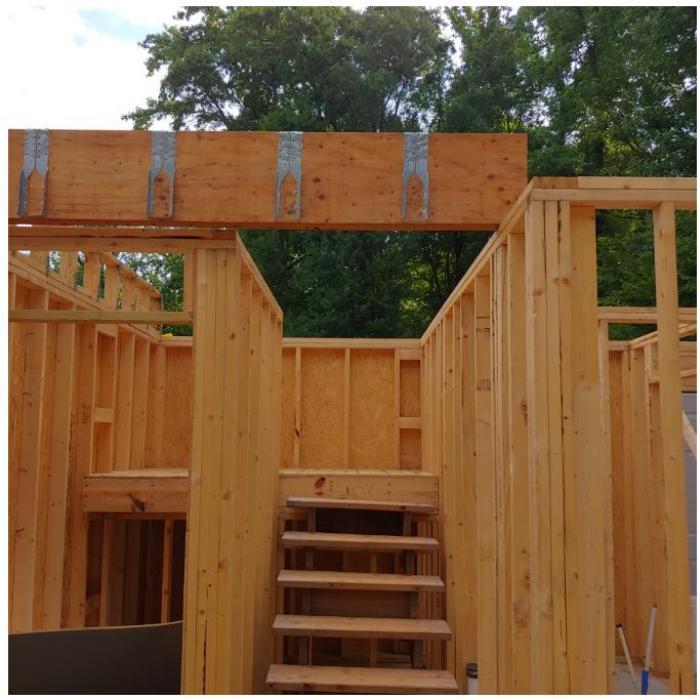




Floor trusses are installed at 19.2" OC on the cap plate. A ladder based truss is installed on the top of the side walls.



Short floor trusses are supported by joist hangers connected to a header beam.



The stair landing platform with the underneath walls supports.





A ribbon band of $\frac{1}{2}$ " OSB is attached to the outside of the flooring truss system. For safety (fall protection), rail brackets, posts and railings are attached to the ribbon board . This is done prior to installation of the flooring OSB.



After the flooring is installed on the 2nd floor, the process of building the exterior walls and interior walls begins. The process is similar to the way the walls are built on the first floor, however, the interior wall studs are 24" on center. The exterior walls are sheathed with OSB and the Styrofoam and windows are installed (as well as the plastic window sill cover and the taping of the window). Walls are raised and placed over sill plate foam that is stapled onto the floor. Strong backs are installed on the exterior walls for the gable ends of the roof trusses. See photos below.

Here is what the completed exterior walls looks like on a 2 story home.



Below are additional photos of the building components and layout for a 2 story home.







Installation of the roofing trusses is done by a crane operator and with assist from the HFH staff. The photos below show the highlights. Notice the use of metal truss spacer restraints instead of wood.





Layout diagram for a 2 story house

