

Chapter 6 - Wall Build & Stairs

Contents

Chapter 6 - Wall Build & Stairs	6-1
Timing & Prerequisites	6-3
Wall Panel Components	6-4
Headers	6-6
Box Headers	6-6
Solid Wood Headers	6-8
Non-Load Bearing Headers	6-8
King/Jack Stud Assemblies	6-9
Framing Attachments	6-12
Setup Activities	6-13
Organize the Lumber	6-13
Set up the Cutting Station	6-13
Door and Window Frames	6-14
Build Load Bearing Door Frames	6-14
Build Load Bearing Window Frames	6-16
Build Non-Load Bearing Window Frames	6-18
Build Non-Load Bearing Door Frames	6-20
Deck Layouts	6-22
Mark the Location of the Walls	6-22
Mark the Location of the Windows and Doors	6-22
Mark the Location of the Exterior Vent	6-22
Mark the Double Exterior Walls	6-22
Plan for the Construction of the Wall Panels	6-23
Wall Layouts	6-24
Lay Out Exterior Wall Panels	6-24
Lay Out Interior Wall Panels	6-28
Lay Out Double Wall Panels	6-28
Exterior Wall Assembly	6-29
Position the Components	6-29
Install Exterior Vent Header	6-30
Add Microwave Blocking	6-31
Square Up Framed Walls	6-31
Apply OSB	6-31
Cut Out OSB at Door / Window Openings	6-33
Build Out Windows and Doors	6-34
Interior Wall Assembly	6-34

Install Tee Intersection Wall Blocking.....	6-35
Erect Exterior Walls	6-37
Assign Teams	6-37
Install Exterior Walls.....	6-37
Install Window Guardrails.....	6-39
String Exterior Walls.....	6-40
Erect Interior Walls	6-41
Install the wall panels	6-41
Reinstall Guardrails and bracing	6-41
Verify All Walls	6-41
Install Double Top Plates	6-43
Stairway Landings	6-45
Install Stairway Landings.....	6-45
Stairs.....	6-45
Planning the stair installation.....	6-45
Position the Stair Handlers.....	6-45
Lowering the Stairs to the Basement.....	6-46
Rotate and Orient the Stairs.....	6-46
Installing the Stairs	6-46
Install the Temporary Handrail	6-47
Finish Basement Framing.....	6-49
Basement Wall Layout	6-49
Basement wall blocking.....	6-50
Egress Window Framing	6-50
Additional installation tools	6-51
Basement Wall Build Techniques.....	6-51
Mechanical Chases and Soffits	6-55
Finish Exterior Sheathing	6-57
Attach OSB at overlapping joints.....	6-57
Install OSB on Floor and Rim Joists.....	6-57
Build Fire-Rated Wall Assemblies	6-58
Fire-Rated Wall Assemblies	6-58
Fire-Rated Eaves	6-61

Things to Consider

- As much as possible, the house should be built using advanced framing techniques.
- Ensure the exterior walls are plumb before installing the interior walls.
- It is important that the framing is stacked. The wall studs are placed over the floor Joists and the ceiling or roof trusses are stacked over the studs.
- The house is built mostly with 2x4 walls installed 16" on center.
- Walls are built with single bottom plates and double top plates.
- Walls or eaves which are within 5' of the property line must be wrapped with fire-rated building materials.
- A mid-wall horizontal brace must be installed where interior walls do not intersect the adjoining walls at a stud.
- *Seal cracks and gaps in the exterior wall before Dow board to prevent air penetration.*

Safety Issues

- Stairway guardrails must be in place before beginning work.
- Scaffolding or guardrails around the exterior must be in place before beginning work on the 2nd floor walls.
- If the interior stairs have not been installed, secure ladder access must be provided to the 2nd floor deck.

Timing & Prerequisites

- **First floor walls** – after:
 - the first-floor deck is complete
 - the porch caps have been poured
 - the guard railing has been installed around the stairway opening
 - the temporary stairs to the porches have been re-installed.
- **Second floor walls** - after:
 - the second-floor deck is complete
 - the hanging scaffolding is in place
 - the guard railing has been installed around the stairway opening.
- **Interior walls** - after most of the exterior walls are complete and plumbed.
- The House/Project Lead will work with the Construction Superintendent to co-ordinate these volunteer activities.

Materials Needed

Wall Framing Package

Precut Studs (92 5/8")

Linear SPF lumber for Plates, Headers, and Bracing

1/2" OSB for wall sheathing

2" Dow Styrofoam Board for headers

3/4" OSB for headers

16d Sinker Nails

10d Sinker Nails

8d Sinker Nails

Adhesive Caulk

Clear spray paint

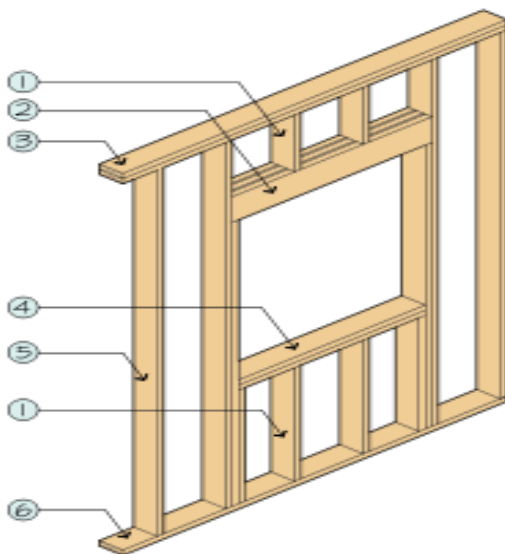
1" Roofing Nails

2x3 for headers	3" Exterior Wood Screws
Stairs	Stairway Landing
Pre-built Staircase 3" Wood Screws 16d Sinker Nails Shims	2x10s or 2x8s 2x4s 3/4" OSB Joist Hangers Hanger Nails 16d Sinker Nails 10d Sinker Nails 8d Sinker Nails Construction Glue
Fire -Rated Walls Assembly	
High Expanding Form Insulation 5/8" DensGlass/Exterior Rated Type X Drywall 2 1/2" Drywall Screws	

Wall Panel Components

Components		
Wall panels	Headers	Window and door frames
Exterior wall Covering	Wall Bracing	Stairway Landings & Stairs

Wall Panel



1. Cripple
2. Window Header
3. Top Plates
4. Window Sill
5. Stud
6. Bottom Plate

Header - A beam to create a horizontal support at the top of an opening.

Sill – A horizontal member across the bottom of a window opening.

Plates (top/bottom) – The horizontal member at the top and bottom of each wall panel.

Stud - A vertical framing member, cut to a precise length at the mill and designed to be used to frame walls with no trimming before it is set in place. Studs are most often 2x4s, but 2x3s, 2x6s, and other sizes are also included in the stud category; studs may be of wood, steel, or composite material.

Studs used to frame around window and door openings are given different names, including

- **king stud** – stud to left or right of a window or door that is continuous from the bottom plate to the top plate
- **jack stud** – stud to the left or right of a window or door that runs from the bottom plate to the underside of a lintel or header
- **cripple stud** - a stud located either above or below a framed opening, that does not run the full height of the wall

Post or Column – a group of 2, 3 or more studs nailed side by side. Posts in walls are used at point loads such as long spans near a wide window or below a load bearing beam.

Exterior Wall Covering – Solid sheathing which is added to the exterior of the wall panels to provide strength, air sealing and fire rating. Typically, walls are covered with ½” OSB sheets. In some cases, an extra layer of 5/8” Type X Exterior or exterior fire-rated drywall must be added.

Wall Bracing – Diagonal bracing added during installation of the walls to provide temporary support.

Headers

Critical Issues

- ♦ **Components must be cut accurately and assembled with top and bottom edges flush.**
- ♦ **Load Bearing Headers must be glued and nailed securely.**

Box Headers

Box door and window headers are constructed with $\frac{3}{4}$ " OSB for the sides and 2x3s ripped to $1\frac{1}{2}$ "x2" for the top, bottom and ends. The center of the header will be filled with 2" Dow board.

1. Determine the header size.

Door Headers

- The rough opening size for most doors is the size of the door plus 2".
- The length of the header is the door's rough opening size plus 3" (3" is the size of the 2 jack studs which the header sits on).
- Therefore, the length of the header is 5" larger than the door size.

Window Headers

- The rough opening size of most windows is the size of the window.
- The length of the header is the window's rough opening size plus 3" (3" is the size of the 2 jack studs that the header sits on).
- For double windows, the length of the header is the rough opening plus 6" (double jack studs are required.)

2. Cut pieces for box headers.

- Rip and cut 2x3s into 4 pieces
 - i. Two which are $1\frac{1}{2}$ " x 2" x $8\frac{1}{2}$ " for sides of the header
 - ii. Two which are $1\frac{1}{2}$ " x 2" x (header length) for the top and bottom.
- Rip 4x8 sheets of $\frac{3}{4}$ " OSB into two strips - $11\frac{1}{2}$ " x (header length). Each header unit is built with 2 strips; 1 on each side.

3. Assemble the box headers. (See figure 6.1).

- Assemble the 2x3s into a rectangle as shown in figure 6.1 and 6.2. Attach the pieces together with 8d sinkers.
- Glue and nail one of the OSB strips to the 2x3 rectangle. Attach the OSB with glue and 8d sinkers placed every 3" OC.
- Cut 2" Dow Styrofoam board to fit into the header using a hand saw and insert it into the assembly.
- Attach the 2nd $\frac{3}{4}$ " OSB strip to the assembly to complete the box header. Attach the OSB with glue and 8d sinkers.

- ❖ To ensure the proper size and construction of the header the Header Jig can be used. (see figure 6.2a).

Figure 6.1 – Box Header Frame

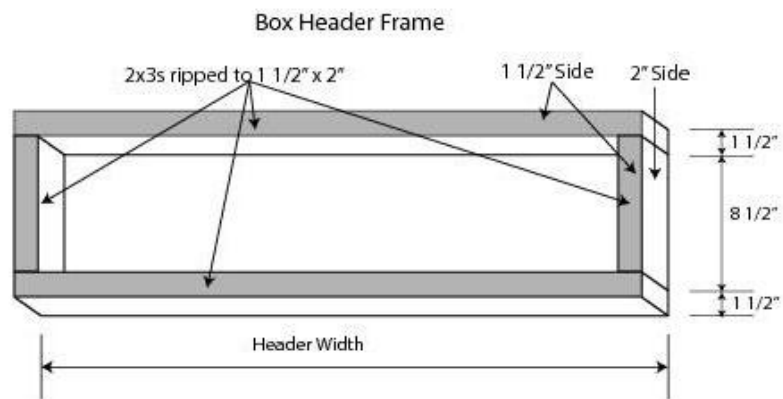


Figure 6.2 – Box Header

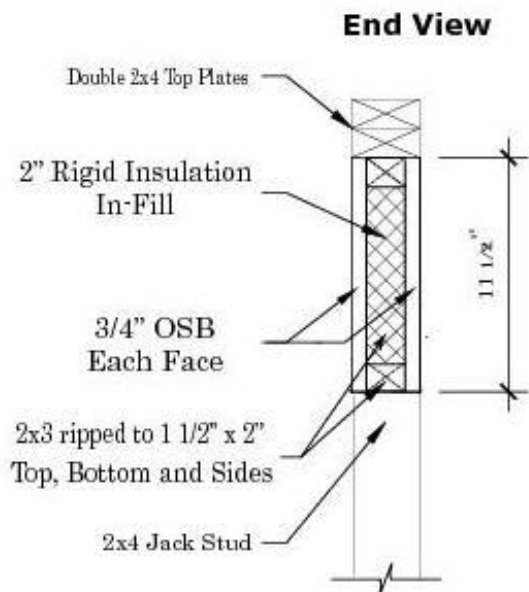


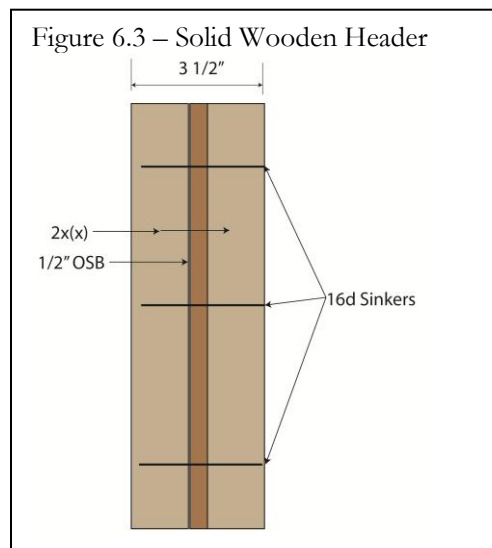
Figure 6.2a – Header Jig



Solid Wood Headers

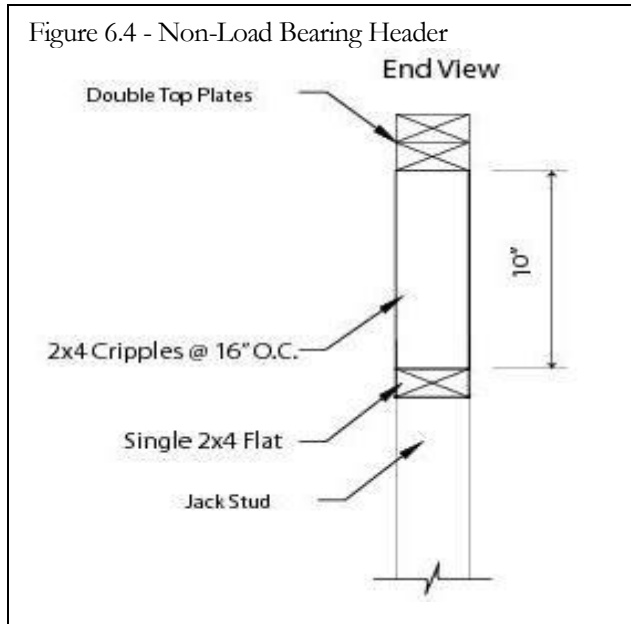
Solid wood door and window headers are constructed with $\frac{1}{2}$ " OSB sandwiched between 2x12 SPF lumber. Solid wood headers are less energy efficient and should only be used where the extra bearing strength is needed.

1. Accurately cut pieces for solid wood headers.
 - Cut two (2) 2x12s to the header width.
 - Cut a piece of $\frac{1}{2}$ " OSB to 11" x (header width – $\frac{1}{2}$ ")
2. Assemble the solid wood headers. (see figure 6.3).
 - Apply construction adhesive to one side of each of the 2x12 pieces.
 - Place the OSB between the 2x12s and clamp together with the edges of the 2x12 flush and the OSB's edges slightly inside the assembly.
 - Nail the boards together with 16d sinkers. Nail together with Three (3) rows of nails; 1 nail every 16" in each row.



Non-Load Bearing Headers

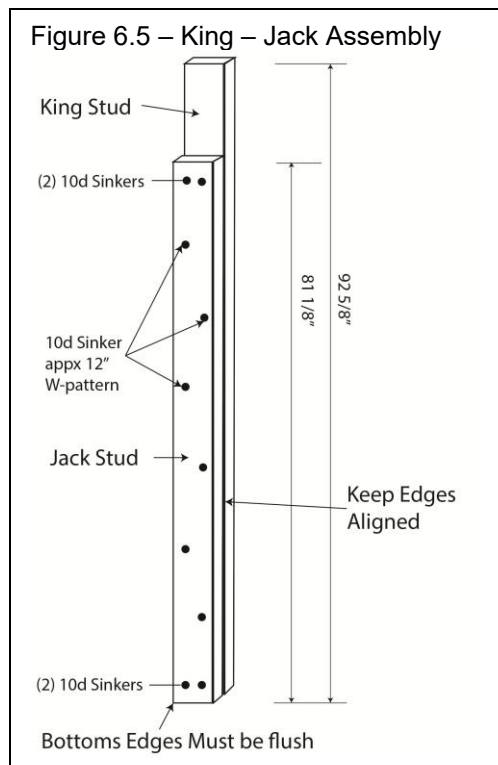
Non-Load Bearing headers are constructed with a single 2x4 header and 2x4 cripples. (See Figure 6.4).



King/Jack Stud Assemblies

King/Jack stud assemblies are used to support the headers in the windows and doors. Each one is built with one (1) king stud; 92 5/8"; and one (1) jack stud; 81 1/8". (see figure 6.5). Windows over 5' in width will require two (2) jack studs.

1. Select two (2) fairly straight pre-cut studs; 92 5/8".
2. Cut one of the pre-cut studs to length for the jack stud.
 - Window and hinged doors = 81 1/8"
3. Position the jack stud on top of the king stud with their bottom edges flush.
4. Assemble the pair of studs together with 10d sinkers (or 16d sinkers at a slight angle).
 - Hold the bottoms together and flush; then attach the studs together with two 10d sinkers. 16d sinkers can be used but they must be installed at a slight angle to prevent the tips from protruding through the back side.
 - Work your way up the studs placing 1 nail approximately every 12" in a "W" formation.
 - Nail the top edges together with two 10d sinkers.



5. Count the number of windows and exterior doors then prepare two (2) king/jack stud assemblies for each.

Framing Attachments

Attaching Studs to Plates	2 – 16d Sinkers	The studs must be tight to the plates
Attaching Jack to King Studs	10d sinkers; 1 nail spaced approximately 12” apart and spread across the face of the jack stud in a “W” formation	Bottom and side edges of studs must be held flush

Setup Activities

Organize the Lumber

Critical Issues

1. Keep lumber flat and dry to prevent warping.
2. Ensure the lumber delivered matches the delivery slip.

Safety Issues

- **Keep walkways clear.**

1. Based on the cut sheets provided by the Construction Superintendent, separate the lumber into stacks of:
 - 2x4s for plates.
 - 2x6s for plumbing wall studs and plates.
 - 2x4s - 92 5/8" precuts for studs.
 - 2x4s for jack studs.
 - 2x4s for non-bearing door headers; cripples; window sills; and blocking.
 - 2x4s for temporary wall bracing.
2. Crown all of the lumber as described in the "Framing Techniques" in "Framing Materials, Tools, and Techniques".
3. Report any unusable lumber to the Construction Superintendent.

Set up the Cutting Station

Safety Issues

- **Good housekeeping is important to prevent tripping hazards.**
- **All guards must be installed when the saws are in use.**
- **Do not place the cutting station in a main traffic area.**

1. Identify a 10'x10' area to be used for cutting lumber which will be used in building the walls. This area should be fairly level, dry, out of the main traffic areas and has easy access to electrical power.
2. Set up saw horses, saw stands and saws as needed. Table saws and miter saws must be set up on stable work surfaces. Miter saw stands are available and provide the best support for miter saws.
3. Set up extension cords from the temporary power pole, generator or other source to the work area. Electrical cords must not be strung across walkways, through doorways, up stairways or through muddy and wet areas.
4. Set up a trash can for collecting lumber scraps. Cut off pieces of lumber are a trip hazard and must be stored properly.

Door and Window Frames

Build Load Bearing Door Frames

Critical Issues

- ♦ *Make sure the bottom edge of the header is snug against the tops of the jack studs.*
- ♦ *Make sure the front edge of the header is flush with the king studs.*

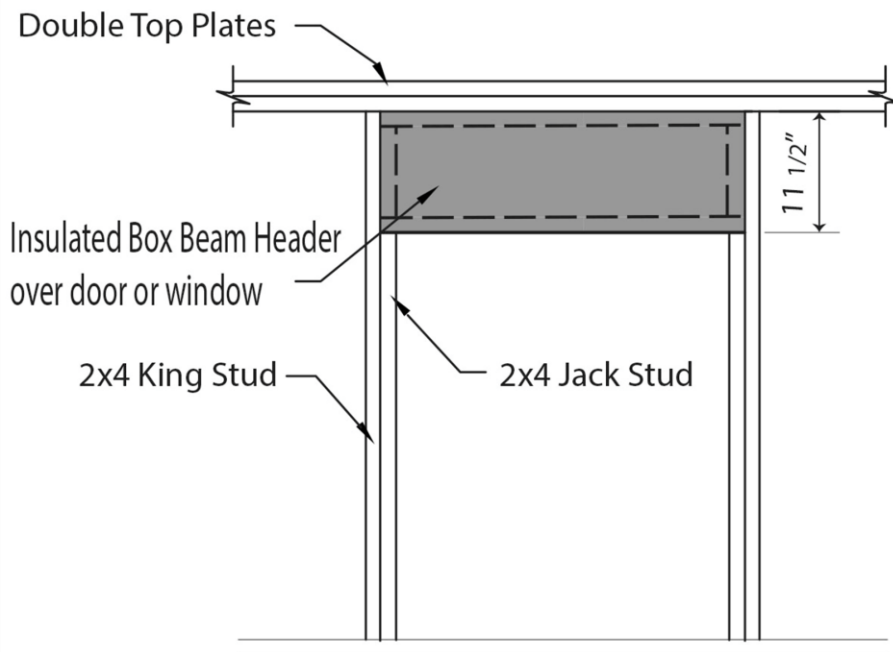
1. Refer to prints and identify the number and size of bearing door frames needed. Bearing door frames will be used on exterior walls where the wall is supporting a second floor or roof trusses. Most exterior doors will be bearing. If a non-bearing door is needed, refer to “Build Non-Load Bearing Door Frames” below.
2. Cut and assemble box headers. (See “Box Headers” above.)
3. Cut and assemble two (2) king/jack stud assemblies. (See “King/Jack Stud Assemblies” above).

Bearing Door Frame Component Sizes

Door Size	Rough Opening		Header Length	King Stud Length	Jack Stud Length
	W	H			
2-0	26"	82 5/8"	29"	92 5/8"	81 1/8"
2-4	30"	82 5/8"	33"	92 5/8"	81 1/8"
2-6	32"	82 5/8"	35"	92 5/8"	81 1/8"
2-8	34"	82 5/8"	37"	92 5/8"	81 1/8"
2-10	36"	82 5/8"	39"	92 5/8"	81 1/8"
3-0	38"	82 5/8"	41"	92 5/8"	81 1/8"

4. Assemble the door frames. (See Figure 6.6).
 - Position the header between the king/jack assemblies. Hold the header flush with the inside edge of the king studs and tight against the tops of the jack studs.
 - Nail through the king studs into the header using 16d sinkers; 2 nails through the king stud into both the top and bottom 2x3.
5. Set the door frames aside for use later in wall assembly.

Figure 6.6 – Load Bearing Door Frame



Build Load Bearing Window Frames

Critical Issues

- *Make sure to keep the bottom edge of the header snug against the tops of the jack studs.*
- *Make sure the front edge of the header is flush with the king studs.*
- **Verify the Rough Opening with the Manufacturer's specifications. The new windows will need a 36"x62" rough opening.**

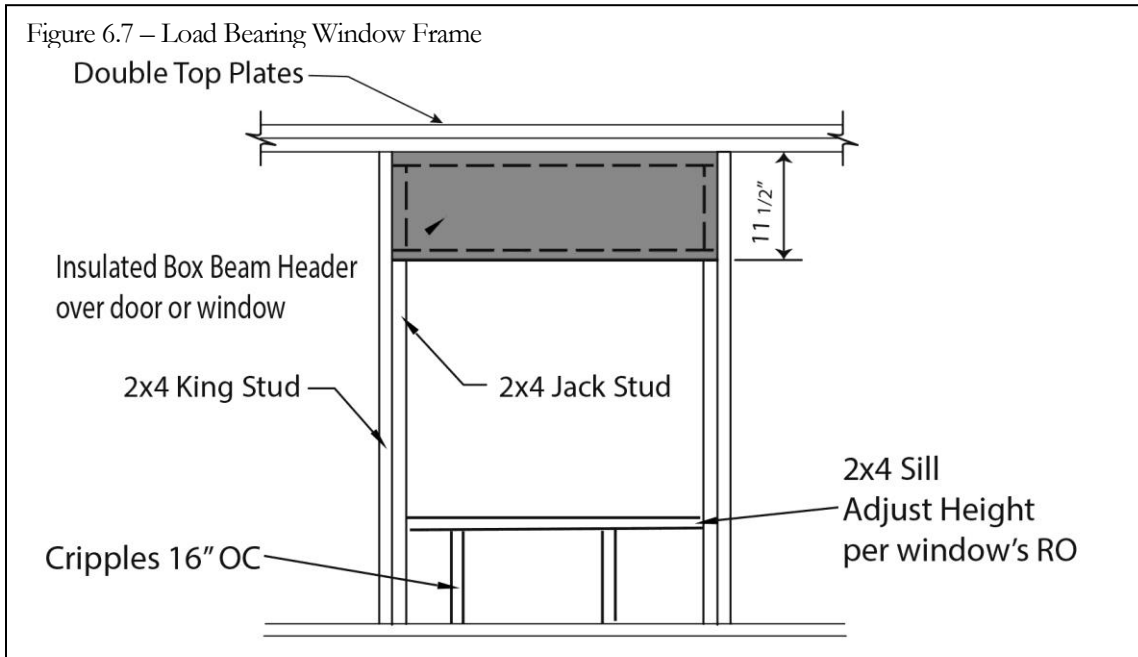
1. Refer to prints and identify the number of window frames needed.
2. Refer to the Manufacturer's specifications for window rough openings.
3. Cut and assemble box headers (see "Door and Window Headers" above).
4. Cut and assemble two (2) king/jack assemblies (see "king/jack stud assemblies" above). Add a second jack stud for 6-0 windows; attach similarly to the first jack stud.
5. Cut the parts for each window frame. (See chart below for lengths.)
 - Cut four (4) bottom cripple studs for each window frame. See the chart below for sizes.
 - Cut a 2x4 sill plate for the bottom of the window. The length of the sill plate is equal to the width of the window.

Bearing Window Frame Component Sizes

Window Size	Header Length	Sill Length	King Stud Length	Jack Stud Length	Bottom Cripples
3-0 x 5-2 62" RO	39"	36"	92 5/8"	81 1/8"	17 5/8"
3-0 x 3-0	39"	36"	92 5/8"	81 1/8"	43 5/8"
6-0 x 5-0	78"	72"	92 5/8"	81 1/8"	19 5/8"

6. Assemble the window frames as shown in figure 6.7.
 - Position the header between the king and jack stud assemblies. Hold the header flush with the inside edge of the king studs and tight against the tops of the jack studs.
 - Nail through the king studs into the header using 16d sinkers; 2 nails through the king stud into both the top and bottom 2x3.
 - Mark the jack studs with the location for the window sill plate. Measure down from the bottom of the window header the distance equal to the height of the window rough opening requirement.

- Toe-nail the window sill plate into the jack studs using 16d sinkers. *Make sure the top of the sill plate is flush with the mark made above.*
7. Set the window frames aside for use later in wall assembly.
 8. Cripples will be installed once the window frame is installed in the wall unit.



Build Non-Load Bearing Window Frames

Critical Issues

- ***Make sure to keep the bottom edge of the header snug against the tops of the jack studs.***

1. Refer to prints and identify the size of window frames needed.
2. Cut and assemble two (2) king/jack stud assemblies.
3. Cut the parts for the window frame. (See chart below for lengths.)
 - Cut a 2x4 header for the window frame. The length of the header is the window's rough opening size plus 3" (the size of the 2 jack studs that the header sits on). The rough opening size of most windows is the size of the window.
 - Cut four (4) 10" 2x4s for the top cripple studs.
 - Cut four (4) 2x4 bottom cripple studs.
 - Cut a 2x4 sill plate for the bottom of the window. The length of the sill plate is equal to the width of the window.

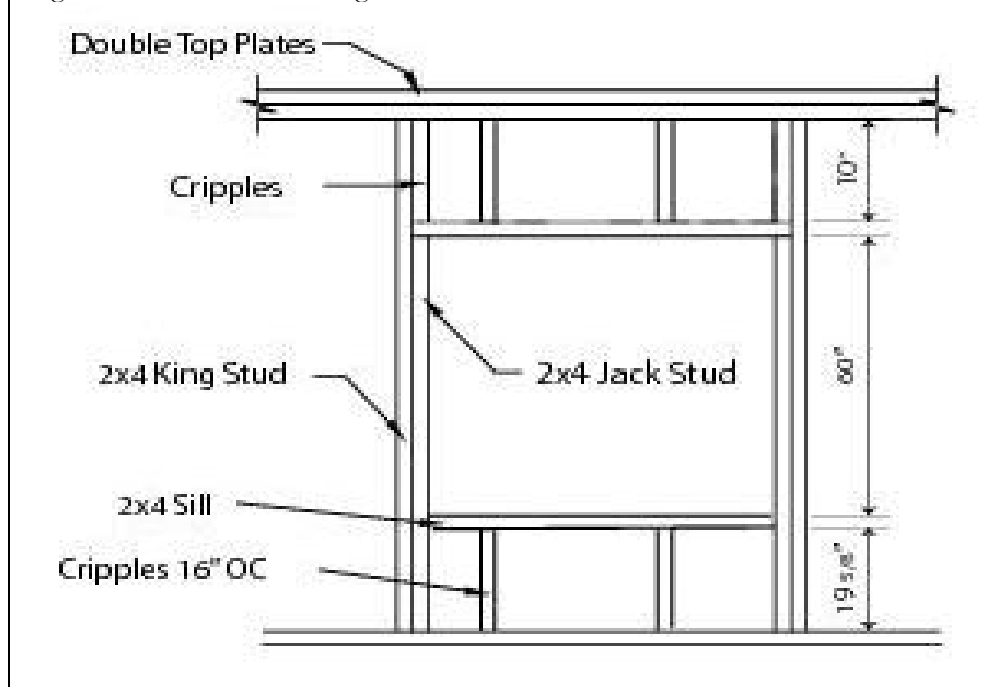
Non-Bearing Window Frame Component Sizes

Window Size	Header Length	Sill Length	King Stud Length	Jack Stud Length	Top Cripple Length	Bottom Cripple Length
3-0 x 5-2 62" RO	39"	36"	92 5/8"	81 1/8"	10"	17 5/8"
3-0 x 3-0	39"	36"	92 5/8"	81 1/8"	10"	43 5/8"
6-0 x 5-0	78"	72"	92 5/8"	81 1/8"	10"	19 5/8"

4. Assemble the window frames as shown in Figure 6.8.
 - Position the 2x4 header between the king and jack stud assemblies with the header tight to the tops of the jack studs. Hold the header flush with the inside edge of the king studs.
 - Nail through the king studs into the header using 16d sinkers. Place 2 nails through the king stud into each end of the header and 2 nails down through the header into the top of the jack stud.
 - Attach 1 cripple stud to each side of the window unit above the window header using 16d sinkers; 2 nails through the cripple into the king studs.
 - Additional cripples will be installed once the window frame is installed in the wall unit.

- Mark the jack studs with the location for the window sill plate. Measure down from the bottom of the window header the distance equal to the height of the window.
 - Toe-nail the window sill plate into the jack studs using 16d sinkers. *Make sure the top of the sill plate is flush with the mark made above.*
5. Set the window frame into the wall assembly.
 6. Cripples will be placed to continue the 16" OC layout of the studs in the wall.

Figure 6.8 – Non-Load Bearing Window Frame



Build Non-Load Bearing Door Frames

Critical Issues

- ♦ Jack and king studs should be cut from the straightest pre-cut studs. Twisting and cupping boards will distort finished opening making installation of the doors difficult.

1. Refer to prints and identify the number and size of non-bearing door frames needed.
2. Cut and assemble two (2) king/jack assemblies.
3. Cut the parts for each door frame. (See chart below for lengths.)
 - Cut a 2x4 header for each door frame. Cut four (4) 2x4 cripple studs for each door frame.

Non-Load Bearing Door Frame Component Sizes

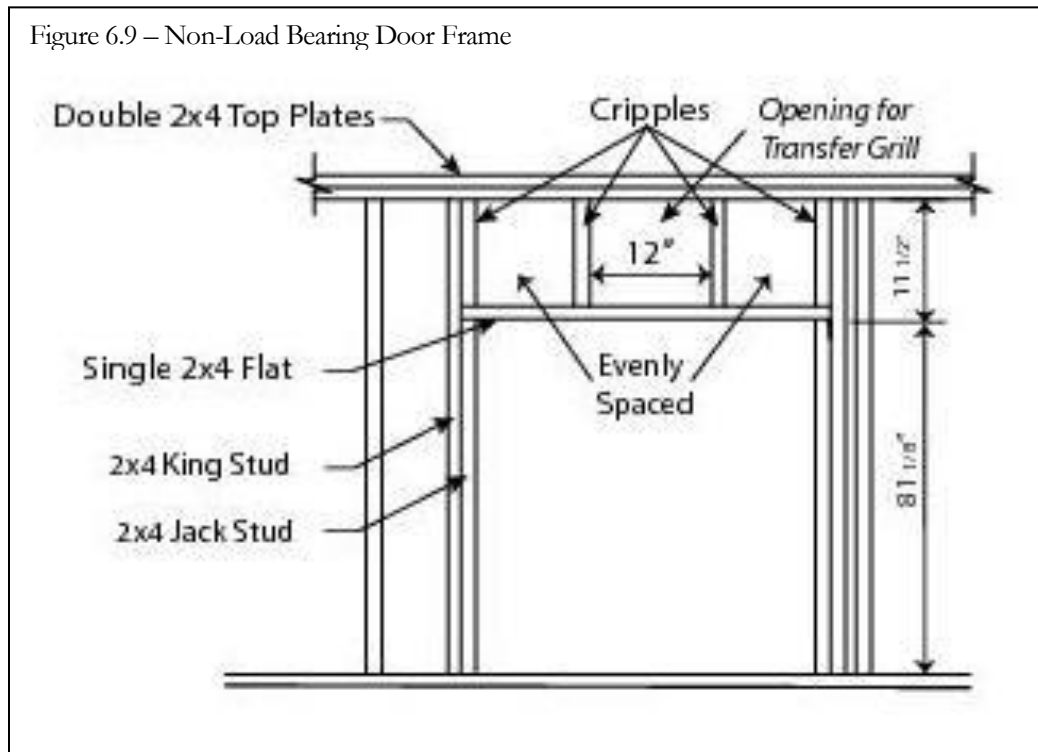
Door Size	Rough Opening		Header Length	Jack Stud Length	Cripple Length
	W	H			
Single Pre-Hung					
2-0	26"	82 5/8"	29"	81 1/8"	10"
2-4	30"	82 5/8"	33"	81 1/8"	10"
2-6	32"	82 5/8"	35"	81 1/8"	10"
2-8	34"	82 5/8"	37"	81 1/8"	10"
2-10	36"	82 5/8"	39"	81 1/8"	10"
3-0	38"	82 5/8"	41"	81 1/8"	10"
French Pre-Hung					
5-0	62"	82 5/8"	65"	81 1/8"	10"

4. Assemble the door frames similarly to the non-bearing window frames above. (See Figure 6.9)
 - Position the header between the king and jack stud assemblies across the tops of the jack studs. Hold the header flush with the inside edge of the king studs and tight against the top of the jack studs.
 - Nail through the king studs into the header using 16d sinkers. Place 2 nails through the king stud into each end of the header and 2 nails through the top of the header into the top of the jack stud.
 - Position a cripple above each of the jack studs and nail them to the king stud with 16d sinkers; 2 nails each side.
 - Two (2) additional cripples will be installed once the door frame is installed in the wall unit. The two additional cripples will be centered above the

doorway with 12" of clear space between them. This space will be used to install the passive air transfer grill.

- Attach the cripples using 16d sinkers; 2 nails through the bottom of the header into the bottom edge of the cripple and 2 nails through the top plate into the top edge of the cripple.

Figure 6.9 – Non-Load Bearing Door Frame



5. Set the door frames aside for use later in wall assembly.

Deck Layouts

Mark the Location of the Walls

Critical Issues

- ♦ **Be sure the chalk line is held tight. For long walls hold the line in the middle and snap each side separately.**

1. Mark exterior wall placements. (See Figure 6.10)
 - Snap chalk lines which are 3 ½" (for 2x4 walls) or 5 ½" (for 2x6 walls) from the outer edges of the deck framing running the full length of the deck. These lines will be used to set the exterior walls.
2. Use 100' tape to double check the length of the deck with the prints. Use these actual measurements to adjust the length of the walls to be built.
 - Note: On the prints, the length of the exterior walls includes the ½" OSB on the adjoining walls; therefore, the exterior walls will be 1" shorter than the dimensions on the prints.
3. Mark interior walls. (See Figure 6.10)
 - Refer to the prints and mark the position of each interior wall on the deck.
 - Check prints for which walls are noted to be 2x4 framing and which walls will be 2x6 framing.
 - Snap chalk lines to identify the edges for each interior wall. These lines will be used to set the interior walls.
 - Spraying the lines with clear spray paint will protect the lines during the construction of the walls.

Mark the Location of the Windows and Doors

Refer to the prints and mark the location of the windows and doors on the deck. The dimensions on the prints indicate the midpoint of the windows and doors from the outside of the ½" OSB.

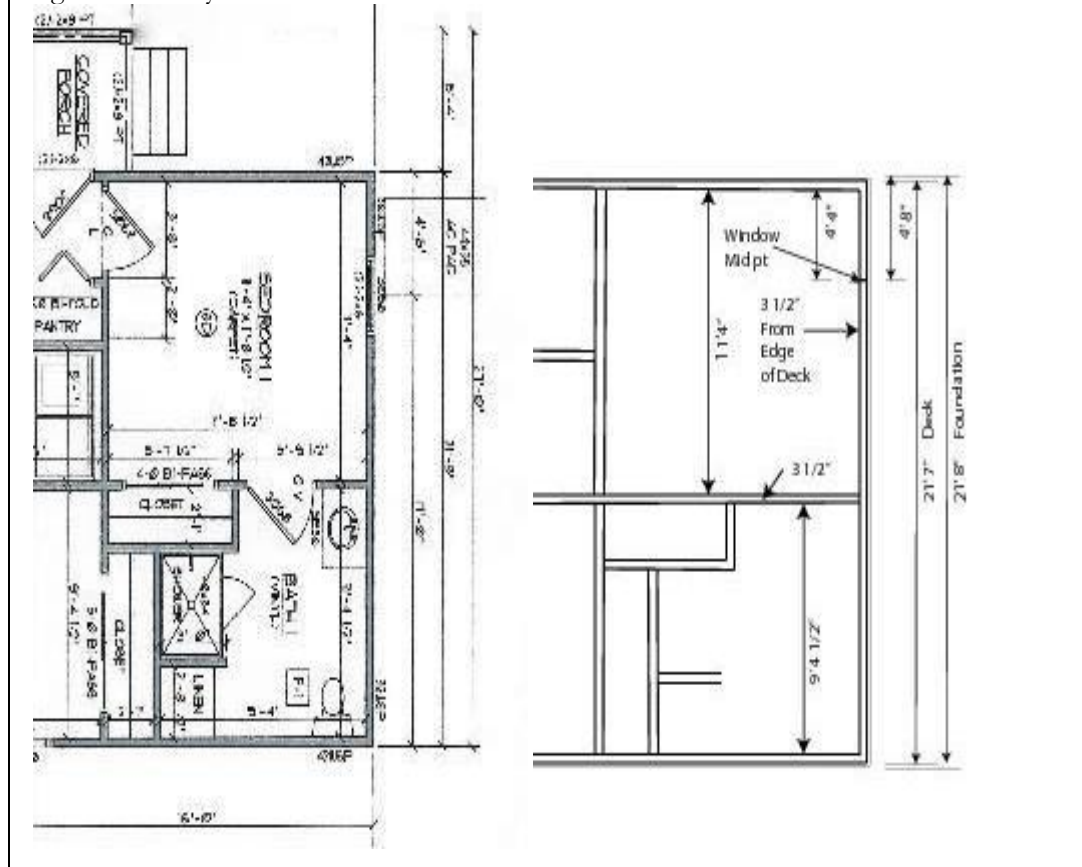
Mark the Location of the Exterior Vent

Refer to the prints and mark the location of the range and its exterior vent on the deck. Use a dot of paint to highlight the lines. These marks will be used to locate the exterior vent framing.

Mark the Double Exterior Walls

Refer to the prints and mark the location where double walls must be installed. Double walls will usually be found where laundry hook ups will be installed on an exterior wall, requiring extra air sealing. Double walls will be built separately each with only top and bottom plates with a sheet of ½" OSB between them. Mark location of both the outside and inside walls. Be sure to leave ½" between the outside and inside panel for the ½" OSB.

Figure 6.10 – Layout walls on the Deck



Plan for the Construction of the Wall Panels

Plans for the construction of the exterior and interior walls must include:

- In which order will the walls be built?
 - Exterior walls are heavier and harder to move. Build these first.
- Where will the joint between wall panels fall?
 - Exterior sheathing should span 1 bay of each wall panel at the joint.
 - If there are fewer joints, the wall panels will be longer which will require more hands to lift.
- Where will the walls be built? (on-site vs off-site)
 - On site will require flat surfaces
 - Off Site will require transportation and many hands to move them.

Wall Layouts

Lay Out Exterior Wall Panels

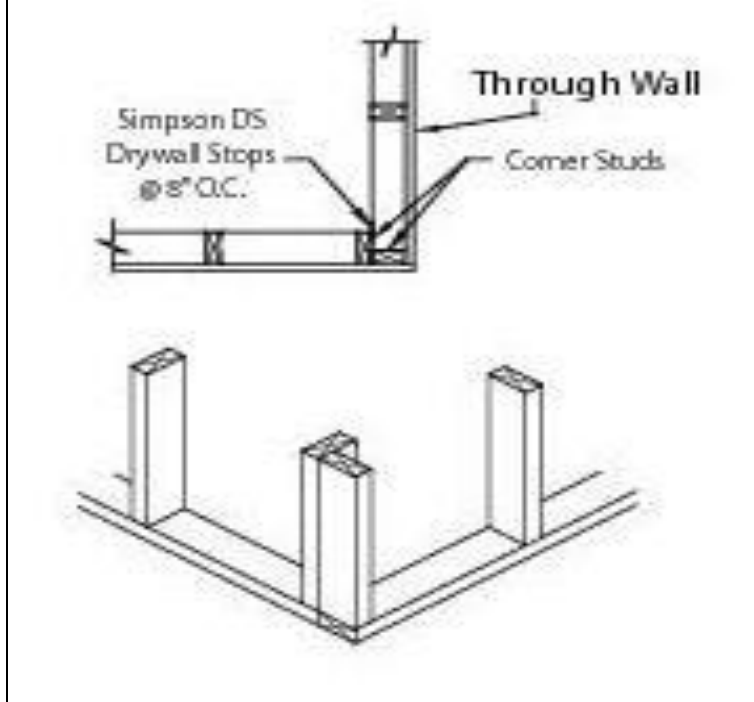
Critical Issues

- ♦ Be sure to mark the orientation of the top and bottom plates; top/bottom; front/back; inside/outside.
- ♦ Exterior Walls will be built using 2 stud corners. (See Figure 6.11).
- ♦ As much as possible align the studs with the floor trusses below.

Cut and Lay Out Top and Bottom Plates

1. Cut two (2) 2x4 or 2x6 to the length of the wall panels; one for the top and one for the bottom plate. Both plates must be cut to the exact same lengths or the house will be out of plumb. Refer to the prints to determine the lengths of the wall panels, but adjust the length based on the actual size of the deck.
2. The length of the plates of non-through walls of a two-stud corner will also need to be shortened to allow for the overlapping wall joint. (See figure 6.11)
3. Mark the plates with an identifier as to which wall panel they belong; which plate is top; which end is North/South/East/West; and which side is exterior.
4. Temporarily tack the top plate to the bottom plate using 8d nails so that both plates can be marked at the same time. Use a single 8d sinker in each end to hold the plates together. Use a speed square to mark lines on both plates to indicate where the studs, windows, and doors will be located.

Figure 6.11 – Two Stud Corner



Mark Top and Bottom Plates with the Wall Layout

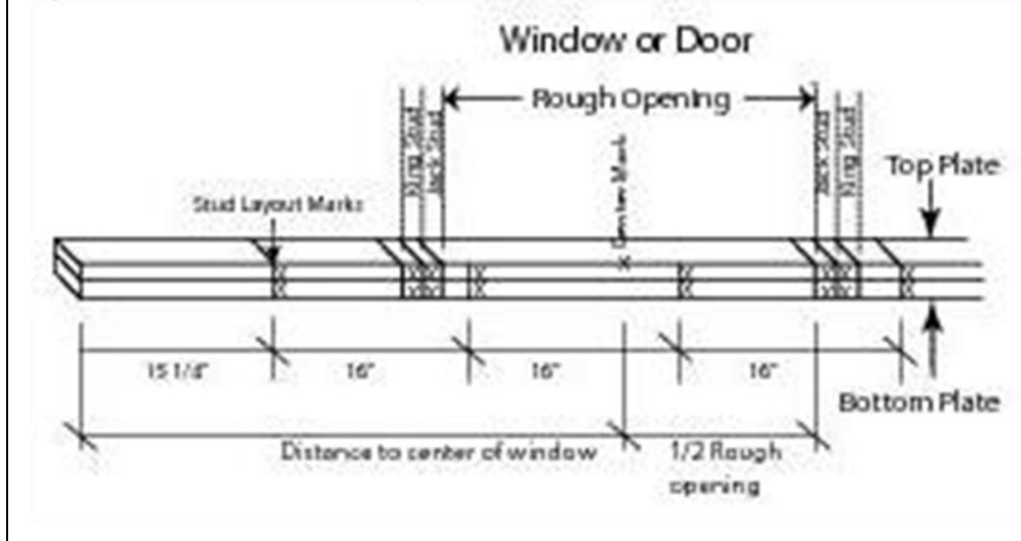
1. Mark the top and bottom plates with the location where the window and door frames will be installed.
 - Refer to the prints for the location of any window or door in the wall and make a mark indicating the center of any windows or doors.
 - Be sure to orient the plates to the prints.
 - Be sure to adjust measurements to account for overlapping wall joints.

Note: The location of the windows and doors on the prints are measured from the corner of the house including the ½" OSB.

 - From the center mark, measure back ½ the rough opening size on both sides of the center mark and place a mark.
 - Then mark the location of the jack and king studs outside of these marks. (See Figure 6.12)
2. Mark the location of the exterior vent.
 - If this wall will contain the exterior vent, identify its location using the cabinet layout in the prints. If wall studs fall within the area for the exterior vent, a header will need to be installed. (See "Install Exterior Vent Header" below).

3. Mark the location of the beam support blocking.
 - If the wall will support a porch beam, identify the bay in which the blocking will be added to attach the beam bracket.

Figure 6.12 – Window and Door Layout

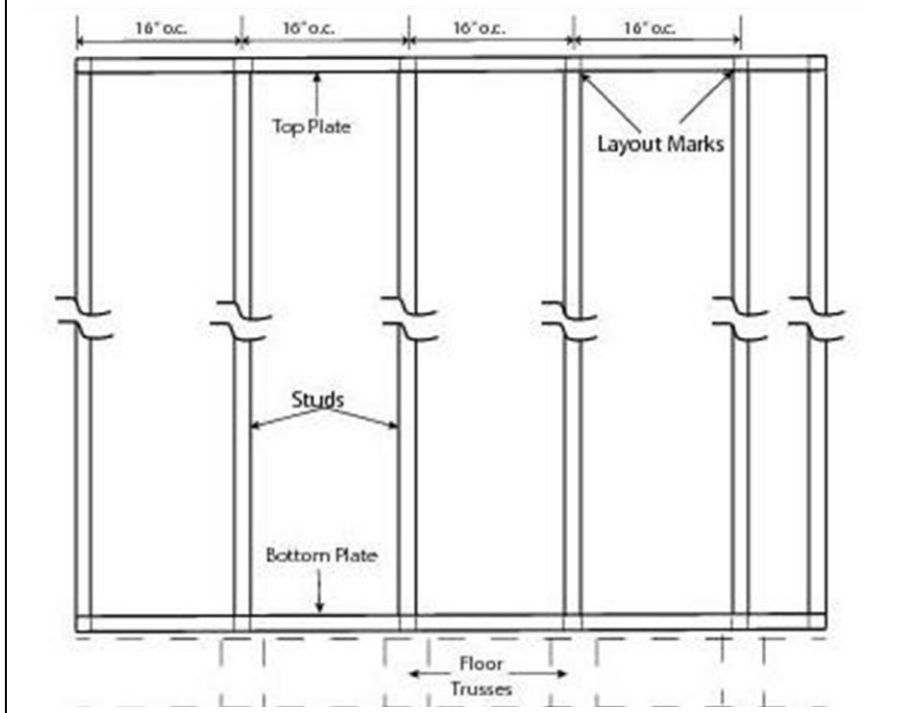


Wall Studs

1. 2x4 or 2x6 studs provide the support for the house and must align with the framing members above and below. The studs are spaced in the wall at 16" on center (OC). The studs must align with the floor joists below.
2. Starting at the same end of the deck from which the floor joists are laid out, mark the plates at 16" intervals down the entire length. Continue the same layout for each panel in the wall. Draw a line $\frac{3}{4}"$ to each side of your marks. These marks indicate where the studs will be attached. (See Figure 6.13)
 - a. If the wall is a through wall, start the marks at the end of the deck framing.
 - b. If the wall is not a through wall, the first mark will be $12\frac{1}{2}"$ from the end of the deck framing.
 - c. If the wall is an exterior wall which runs perpendicular to the floor Joists, the studs must stack over the center of the floor Joists. If the marks are not over the floor Joists, adjust the marks.

Note: Check the stud locations by laying the plate in place.

Figure 6.13 - Plate Layout



3. If the wall contains a window, continue making marks at 16". These will be used for cripples under window frames.
4. A stud must be installed at each end of a wall panel. If two panels will be built together, one stud can span the joint between the two panels.

Girder Support Studs

1. If the wall will support a girder or beam, then additional studs must be provided in the wall to carry the load of the beam to the foundation.
2. Mark the plates with the location of the girder or beam. Mark both the front and back edges.

Other Headers

1. If any of the wall studs will not extend from the bottom plate to the top plate, a header will be needed (e.g. the hole for the exterior vent).
2. Mark the plates with locations of the areas where headers will be installed.

Intersection Wall Support

1. Mark the plates with the locations of any ladders (intersecting walls) that are called for in the print. Horizontal supports will be added at these points to connect the walls.

Lay Out Interior Wall Panels

Critical Issues

- ◆ **Studs in interior walls must align with the joists above and below to facilitate the HVAC ducts.**

1. Refer to the prints to determine the lengths of the wall panels. Double check the lengths using the layout lines made on the floor when the exterior walls were laid out.
2. Cut 2x4s for top and bottom plates for each wall panel. The top and bottom plates must be cut to the exact same lengths.
3. Temporarily tack the top plate to the bottom plate using 8d nails so that both plates can be marked at the same time. Use a single 8d sinker in each end to hold the plates together.
4. Identify the location of the doors. Use a speed square to mark lines on both plates to indicate where the studs and doors will be located.
5. Layout the studs 16" on center (OC). Use a speed square to transfer marks across both plates.
 - If the wall is an interior wall which runs perpendicular to the floor Joists, the studs must stack over the center of the floor Joists. Adjust the marks as needed. The studs should be positioned over the floor Joists and under the ceiling Joists to allow installation of HVAC ducts.
6. Mark the location of any ladders (intersecting walls) that are called for in the print.
7. The studs in the wall which run in front of the bath tub need to be positioned to allow the installation of the shower control. Ensure there is a 12" bay centered on the front of the tub.

Lay Out Double Wall Panels

The outside panel of a double wall will be built similarly to the rest of the exterior wall panels. The inside panel of the double wall will be built similarly to the rest of the interior walls; however, the wall studs must align with the wall studs in the exterior panel.

- **Note:** The interior panel will not be installed until the exterior panel has been insulated and inspected.

Exterior Wall Assembly

Critical Issues

- ♦ The walls must be built on a flat surface large enough to contain the wall and has room for work around the outside of the frame.
- ♦ Make sure the edges of the studs are flush with the top and bottom plates.

Safety Issues

- ♦ Holes and drop offs need to be secured to prevent injury.

Position the Components

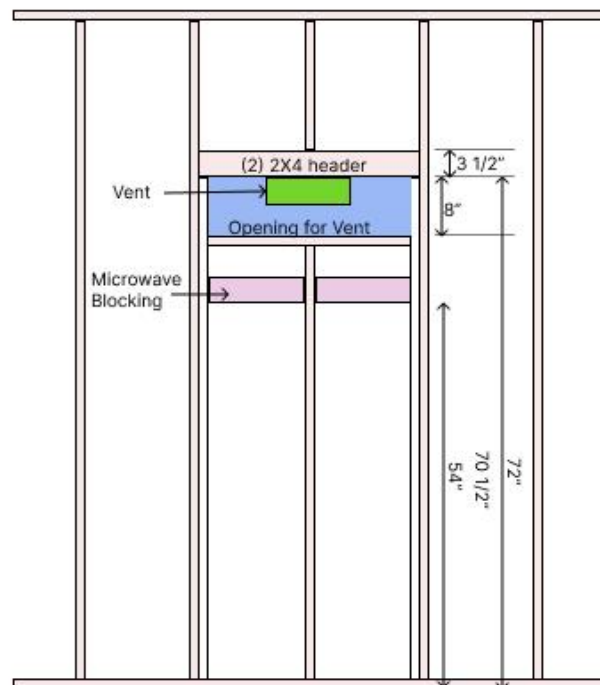
1. Set up the work area.
 - Clear an area on the deck large enough to allow construction of the wall panel. Ensure there is room to safely work on the wall panel.
 - Remove the nails from the plates which were cut and marked above.
 - Lay the plates on end and separate them by the length of a stud in the work area. *Be sure to keep the plates in the same orientation.*
 - If two wall panels will be built together, align the top and bottom plates and tack them together with 8d sinkers.
2. Position the window frames, door frames and studs.
 - Lay in any window or door frames with the header positioned to the top plate. Align the marks for the king studs with the window/door frame.
 - Lay studs into the approximate positions as defined by the marks on the plates.
3. Add additional studs to support any girders or beams.
 - Assemble wall studs needed to support the load. Girders and beams must be supported by an assembly of wall studs equal or greater than the width of the girder or beam being supported.
 - Assemble the studs similarly to assembling King/Jack studs.
 - Place the assembly at the point which will be directly below the girder or beam.
4. Attach the studs and components to the top and bottom plates.
 - Attach the window and door frames to the top and bottom plates using 16d sinkers; 2 nails through each plate into the tops and bottoms of each stud. Verify the location of the king studs before nailing. Additional 16d sinkers will be placed through the top plate into the 2x3 spacer of the box headers; 1 nail every 16".

- Attach the remaining studs to the top and bottom plates using 16d sinkers; 2 nails through each plate into the tops and bottoms of each stud. As each stud is nailed to the plates, ensure the edges of the stud are flush with the plates. If necessary, place shims under the work to align the pieces.
5. Attach additional cripples below the windows as needed.
 - Cripples will be placed continuing the 16" OC layout of the studs in the wall. Attach the cripples using 16d sinkers; 2 nails through the top of the sill plate into the cripple and 2 nails through the bottom plate into the cripples.
 6. For non-load bearing windows, attach additional cripples above the windows as needed.
 - Cripples will be placed continuing the 16" OC layout of the studs in the wall. Attach the cripples using 16d sinkers; 2 nails through the bottom of the 2x4 header into the cripple and 2 nails through the top plate into the cripple.
 7. If there are enough volunteers, it is best to assemble all panels for one exterior wall together before lifting. Otherwise, the panels will need to be nailed together after they are in place.

Install Exterior Vent Header

1. If the exterior vent will be installed at a location in the wall which requires a stud to be cut, a header will be needed. The exterior vent will be centered above the range. A vent to the outside is required for the microwave. If the exterior vent does not fall between two studs, install a header. (See Figure 6.14).
2. Construct a 2x4 header, 30 1/2" long. (see "Solid Wooden Header" above).
3. Cut two (2) jack studs. Cut 2x4 jack studs to a length of 70 1/2".

Figure 6.14 – Exterior Vent Headers



4. Cut a bottom sill for the opening. Cut a 2x4 to a length of 27 ½" or 3" shorter than the header.
5. Install the header with the bottom 72" from the bottom of the wall panel using 16d sinkers; 4 nails through each stud into the header.
6. Position the jack studs under the header tight to the studs on either side of the opening. Nail the jack studs in place with 10d sinkers; 1 nail every 12".
7. Install the bottom sill 8" below the header using 16d sinkers. Toe-nail the sill into the jack studs with 16d sinkers. There must be a minimum of 8" of clear space between the header and sill.
8. Cut 2x4 cripple studs; 1 above the header and 1 below the sill. The top cripple cut at 18 5/8". The bottom cripple cut at 52 ½". Install the cripples at 16" oc from the other wall studs. Install the cripples using 16d sinkers; 2 nails through the plates into the cripples and 2 nails toe-nailed into the header or sill.

Add Microwave Blocking

Install 2x4 blocking for supporting the bottom microwave bracket. (see figure 6.14).

- Cut two (2) 2x4 blocks to a length of 14 ½".
- Make a mark on the wall studs below the microwave at 54".
- Install the blocks above the 54" mark, with the wide side facing into the room. Toe-nail the blocks with 16d sinkers; 2 nails on each end.

Square Up Framed Walls

Critical Issues

- ♦ Be sure all plates are securely attached to the wall components. Small gaps must be closed.

1. Tack the bottom plate to a straight line, such as the chalk line.
2. OSB should be used to square up the framed wall as it is installed. (See below)
3. Using diagonal measurements will help get the corners square, but the frame will likely need to be adjusted as the OSB is installed.

Apply OSB

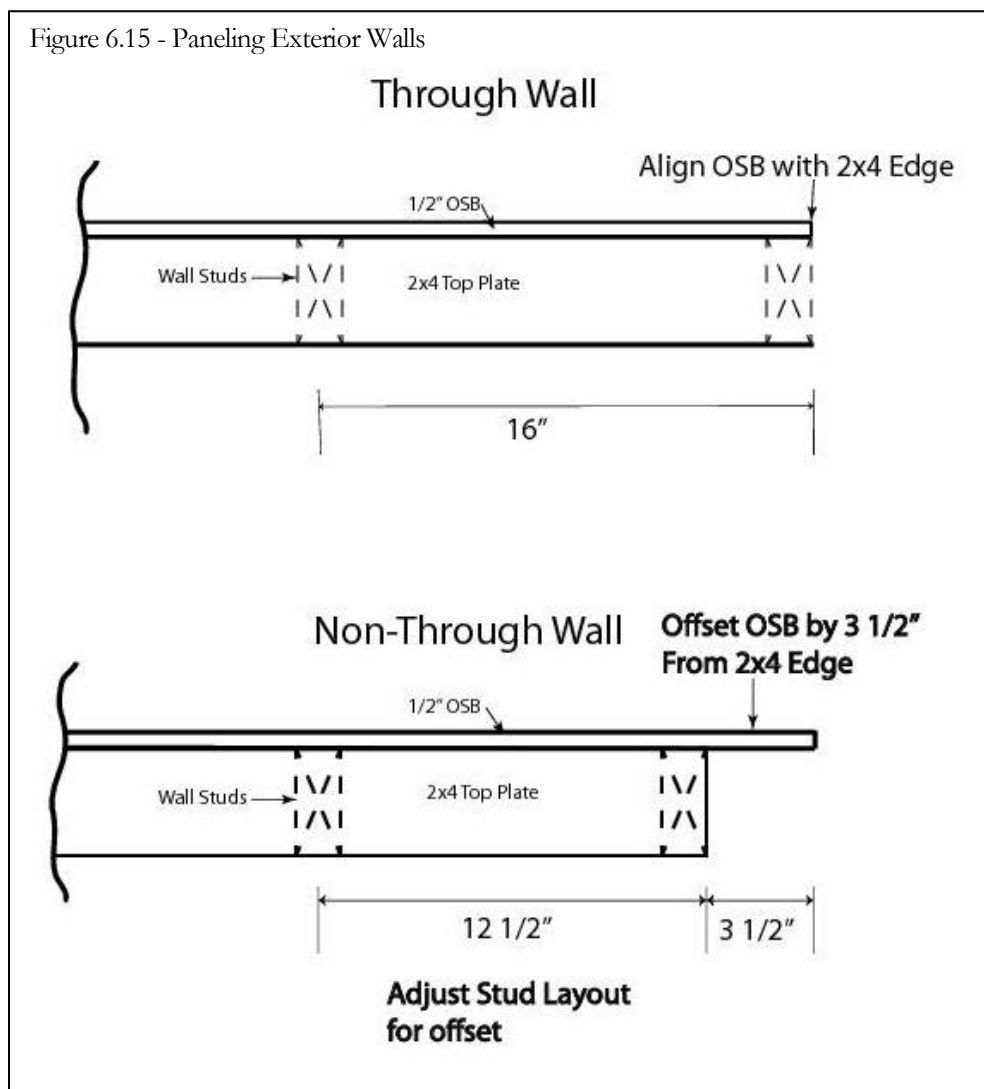
Critical Issues

- ♦ The OSB will be used to square up the walls.
- ♦ Square the wall off the bottom plate.

1. Position the first sheet of ½" OSB.
 - Start installation of the OSB at the end of a wall.

- If the wall is a through wall, the OSB will align with the edge of the framing. (See Figure 6.15)
 - If the wall is not a through wall, the OSB will extend past the framing 3 ½". (See Figure 6.15)
 - Align bottom edge of the OSB with bottom of the wall. The top edge of the OSB will hang over the top plate slightly.
 - Verify the following edge of the OSB is centered on a stud. If the OSB is not centered on a stud, the layout may need to be adjusted.
 - The OSB sheathing must be laid out to ensure no two sheets will join where two wall partitions come together. If necessary, cut the first sheet of OSB to allow for joints on non-intersecting studs.
2. Attach the first sheet of ½" OSB using 8d sinkers. Place the nails 6" apart on the edges and 12" apart along the studs within the sheet.
 3. Position the second sheet. Loosely butt the sheets together. (No separation is required)
 4. Attach the second and remaining sheets as above.

Figure 6.15 - Paneling Exterior Walls



Cut Out OSB at Door / Window Openings

Critical Issues

- ◆ OSB must not extend into the window and door openings.

1. If the wall unit contains windows and doors, cut an opening in the OSB flush with the frame. The OSB should fit snug around the window and door openings but not extend into the openings.
 - For each door and window, locate the top of the opening by measuring down from the top of the frame 13".
 - For each 60" tall window, locate the bottom of the opening by measuring up from the bottom of the frame 22 5/8"; for 62" tall windows measure up 20 5/8"; for 36" tall windows measure up 46 5/8".
 - For each door, locate the bottom of the opening by measuring up from the bottom of the frame 1 1/2".

- Locate the sides of the openings from the marks on the plates indicating the location of the jack studs.
2. Do not cut out the bottom plates of the door yet.

Build Out Windows and Doors

With the switch to 1" Styrofoam, build outs are no longer required around the windows and doors.

With the switch to standard width door jambs (4 ½"), jamb extensions will be added later.

Interior Wall Assembly

Critical Issues

- ♦ The walls must be built on a flat surface large enough to contain the wall and with room for work around the outside of the frame.
- ♦ Walls **MUST** be nailed down through the deck into the floor joists below. Never nail into the OSB decking only.

Safety Issues

- ♦ Holes and drop offs must be secured to prevent injury.

1. Position the components.
 - Remove the nails holding your plates together.
 - Separate the plates by the length of a stud. *Be sure to keep the plates in the same orientation.*
 - Lay in any door frames with the header to the top plate. Align the marks for the king studs with the frame.
 - Most interior doors in new builds are non-bearing door frames. Utilize non-load bearing headers in the door frames as required.
 - Lay studs into the approximate positions as defined by the marks on the plates.
2. Attach the studs and components to the top and bottom plates. As each stud is nailed to the plates, ensure the edges of the stud are flush with the plates. If necessary, place shims under the work to align the pieces.
 - First, attach the door frames to the top and bottom plates using 16d sinkers; 2 nails through each plate into the tops and bottoms of each stud. Ensure the location of the king studs before nailing. Additional 16d sinkers will be placed through the top plate into the 2x3 spacer of the box headers; 1 nail every 16".

- Attach the remaining studs to the top and bottom plates using 16d sinkers; 2 nails through each plate into the tops and bottoms of each stud.
3. Attach additional cripples below windows as needed using 16d sinkers; 2 nails through the sill and 2 nails through the bottom plate into the tops and bottoms of each cripple.

Install Tee Intersection Wall Blocking

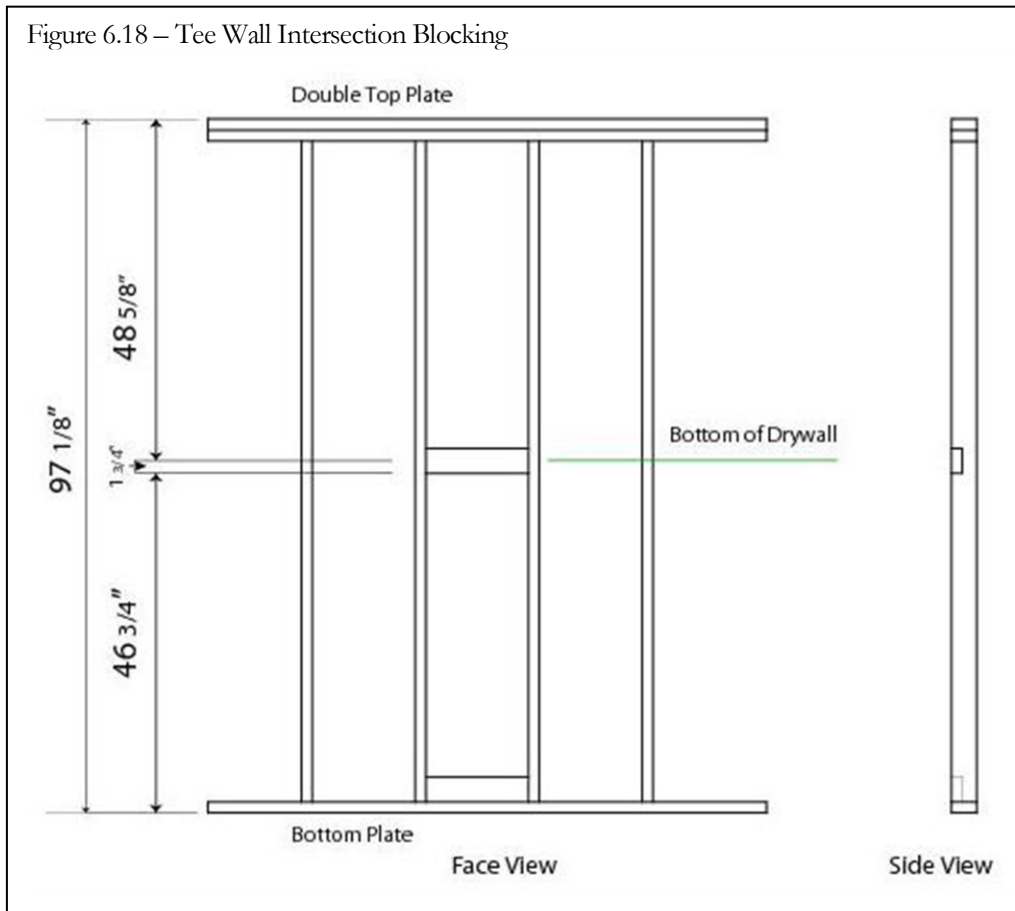
Critical Issues

- ♦ **Be sure that the center of the middle block is positioned at 48 $\frac{3}{4}$ " from the bottom of the wall panel.**

1. Refer to prints for the location of tee wall intersections. Blocking will be installed to provide connection points for intersecting walls at a point other than the end of a wall panel.
2. Cut 2x4 blocks; 2 blocks for each intersection to be built; cut to the size needed for the bay where the wall will intersect. (i.e. standard 16" OC cavity would require blocks which were 14 $\frac{1}{2}$ " long.) Doors and windows framing may change the cavity width and the size of the blocks needed.
3. Install the blocking in the cavity with the 3 $\frac{1}{2}$ " surface flush with the front edge of the studs. Install 1 block with its bottom edge 46 $\frac{3}{4}$ " from the bottom of the wall panel and 1 block with its bottom edge at the bottom of the cavity. (See Figure 6.18).

Placing the bottom of the mid wall blocking with its bottom edge 46 $\frac{3}{4}$ " from the floor will position the center of the blocking 48 $\frac{5}{8}$ " from the top edge of the second top plate. Assuming 5/8" drywall on the ceiling, the top sheet of wall drywall will fall in the middle of the block.

Figure 6.18 – Tee Wall Intersection Blocking



Erect Exterior Walls

Critical Issues

- ♦ Wall units are heavy. Be sure there are enough hands on the wall to prevent injury.

Safety Issues

- ♦ Ensure everyone lifts with their legs, not their back.
- ♦ Ensure the stop blocks have been installed and are secure to prevent the walls from slipping over the edge.
- ♦ Caution must be taken when installing walls on windy days. Extra hands and extra bracing will be required to secure the wall.
- ♦ Once the walls have been erected, ensure they have been braced securely.
- ♦ Once the walls have been erected, install guardrails across all windows.
- ♦ Never stand or lean a wall without bracing it.

Assign Teams

1. Split the volunteers into teams for erecting the wall. Assign the teams as follows:
 - a. **Crew Leader** – 1 person to direct the lifting, bracing and nailing activities.
 - b. **Caulk Team** - 1 or 2 people for applying the silicone caulk. (Reassigned to wall lifting when done).
 - c. **Aligning Team** - 2 people with sledge hammers to align the wall and tack it in place.
 - d. **Bracing Team** - 2 people with 8' level to plumb the wall install the bracing.
 - e. **Lifting Team** - The remaining people will lift and hold the wall until the Crew Leader confirms the wall is braced.
 - f. **Nailing Team** - After the wall is braced, the lifting team can be reassigned to nailing.

Install Exterior Walls

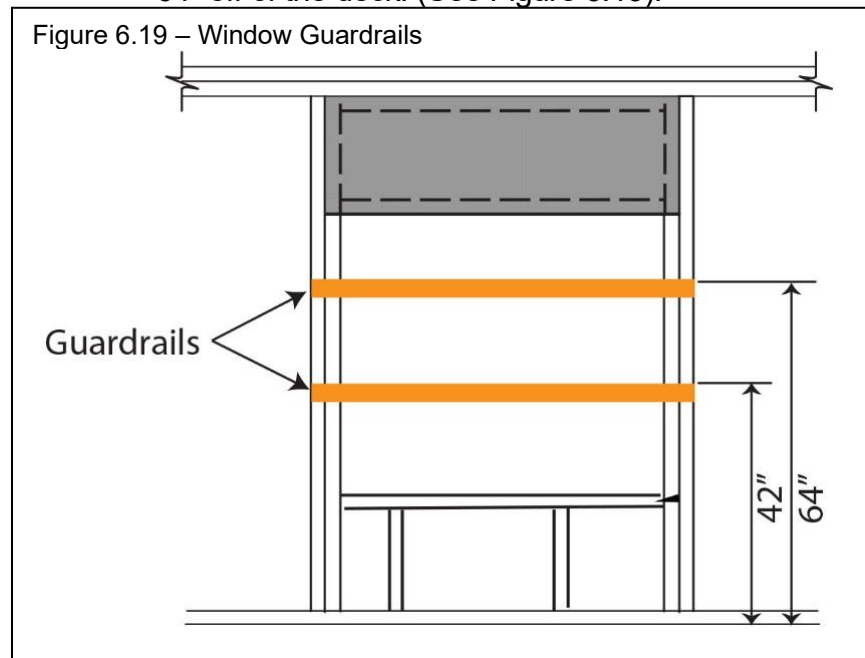
1. Move the wall unit as close as possible to where it will be installed. Place the bottom of the wall towards the edge of the deck. (Lifting Team)
2. Install 2x4 stop blocks on the outside of the rim joists. (Aligning Team)
 - Cut short blocks of 2x4s (12" – 24") to be used as temporary bracing.
 - Cut ½" OSB spacers (3" x 6").
 - Attach the stop blocks to the outside of the floor Joists or 5/4 rim joist with the OSB spacer holding the bracing away from the house by ½". Do not let the spacer extend above the deck.

3. Prepare diagonal bracing. (Bracing Team)
 - Stage 10' long 2x4s which will be used as temporary diagonal bracing for the exterior walls. There needs to be a brace every 8' of each exterior wall. Place these 2x4s conveniently near the wall to be raised.
 - Each diagonal brace will also need one (1) 12" 2x4 cleat. These cleats will be nailed or screwed to the deck to support the diagonal brace.
4. Apply a bead of caulk between the chalk line made above in "Deck Layouts" and the edge of the deck in the area the wall is to be positioned. (Caulk Team)
5. Put the wall in position. (Lifting Team / Aligning Team)
 - Lift the wall to a standing position. *Many hands make light work.*
 - Position the end of the wall flush with the end of the deck or flush to an adjoining wall.
 - Align the wall with the chalk line on the deck.
 - Place a few nails along the wall to hold it in place.
6. Install temporary diagonal bracing on the inside of erected walls. (Bracing Team). Place at least one brace every 8' of wall.
 - Attach the top of each diagonal brace to the side of a stud using 16d sinkers; 1 nail per brace.
 - Attach the cleat to the deck where the bottom of the diagonal brace touches the deck and over a floor joist. Attach with 16d sinkers; 2 nails through the cleat through the deck into the floor joist below.
 - Using a level, make the walls nearly plumb. The final alignment of the walls will be made below in "String Exterior Walls".
 - Attach the bottom to the diagonal brace to the cleat using 16d sinkers; 2 nails through the brace into the cleat.
7. Secure the wall. Nail the wall to the deck using 16d sinkers. In each cavity of the wall, install 2 nails through the deck into the floor Joists below. (Nailing Team)
8. Nail any adjacent walls together. (Nailing Team)
 - Set up a 7' platform ladder inside the corner of the walls to be joined.
 - Ensure the tops of the wall are even. If one of the walls is slightly high, a sledge hammer can be used to drive it down.
 - Align the exterior edges of the top plates and tack them together with a 16d sinker.

- Set up a straight or extension ladder on the outside wall and attach the overlapping OSB to the corner stud with 8d sinkers; 1 nail every 8" up the seam.
- Attach the two corner studs using 16d sinkers; 6 nails evenly spaced across the joint.

Install Window Guardrails

- Once the exterior walls are erected, install guardrails across the windows.
 - Cut two (2) 2x4s which are at least 12" longer than the window is wide.
 - Install the first board with its top 24" off the deck and the second board with its top 64" off of the deck. (See Figure 6.19).



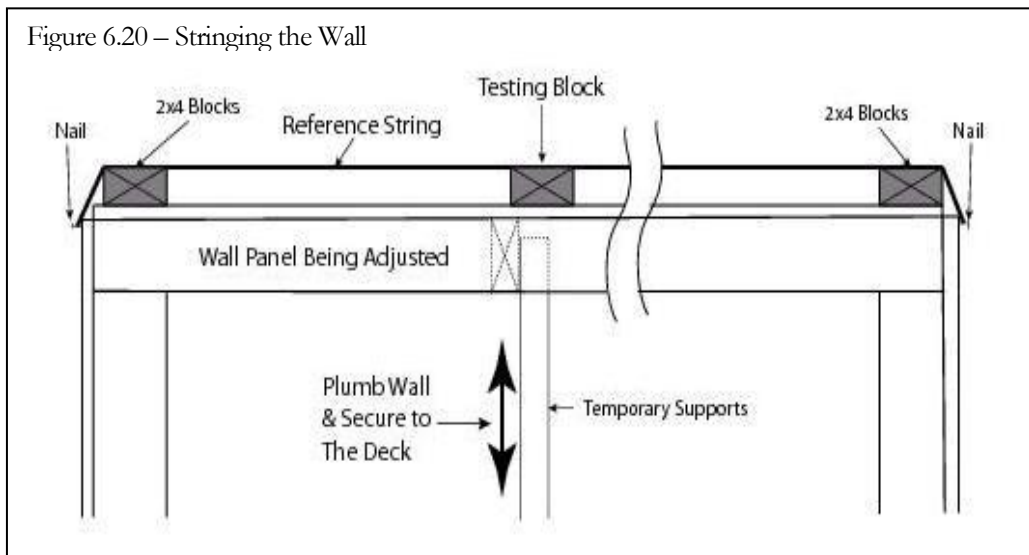
String Exterior Walls

Critical Issues

- ◆ Ensure all the exterior walls are plumb before installing the interior walls.

1. After all exterior walls are erected, verify they are straight and plumb by placing a small block of 2x4 at each upper corner of the wall to be checked.
2. Set nails on the opposing walls.
3. Run a string between the nails. Pull the string tight. Keep pulling the slack and wrapping the string on the nail.
4. Once the string is tight, measure the distance between the string and the OSB on the outside of the walls with another piece of 2x4. If the string touches the 2x4 block, loosen the temporary brace; pull the wall in and re-attach the temporary brace. If there is a gap between the string and the 2x4 block, loosen the temporary brace; push the wall out and re-attach the temporary brace. (See Figure 6.20)

Figure 6.20 – Stringing the Wall



Erect Interior Walls

Critical Issues

- ♦ Do not leave walls standing unless secured to another wall.
- ♦ Nails through the bottom plate must be driven into floor Joists below. Never nail just into only the OSB decking.

Safety Issues

- ♦ Ensure everyone lifts with their legs, not their back.
- ♦ Once the walls have been erected, ensure they have been braced securely.
- ♦ As soon as possible, reinstall any guardrails which were temporarily removed during installation of the walls.
- ♦ Never stand or lean a wall without bracing it.

Install the wall panels

1. Raise the walls into place.
 2. Verify plumb and wall location.
 3. Nail the bottom plate to the deck with 16d sinkers. In each cavity, nail 2 nails near one end of the cavity. The nails should be positioned so they go through the OSB into a Joist below.
 4. Nail into adjoining walls with 16d sinkers at 6 evenly-spaced connecting points.
 5. It may be necessary to move some bracing which is holding the exterior walls to allow for wall assembly. Re-plumb these walls before attaching any interior walls to them.
- Note: Do not install the inside panel or ½" OSB on any double exterior walls until after it has been insulated and inspected. (See "Finish Installing Double Walls and Chases" in the Air Sealing chapter).

Reinstall Guardrails and bracing

- If guardrails were removed to install a wall panel:
 - Reinstall the guardrails as soon as possible.
- If exterior wall bracing was removed:
 - Reinstall the bracing as soon as possible.

Verify All Walls

Critical Issues

- ♦ All walls should be straight, plumb, and correctly located before proceeding. All walls should be square to the other walls.

- ◆ All partition walls and corners should be nailed together using 16d sinkers at 6 evenly-spaced connecting points.

1. Before installing the double top plate, revisit the construction and installation of the walls.
 - Check the walls for plumb using an 8' level measuring from top to bottom plates.
 - Check the top plates for level.
 - Check the window and door dimensions.
 - Check the wall placements.

Install Double Top Plates***Critical Issues***

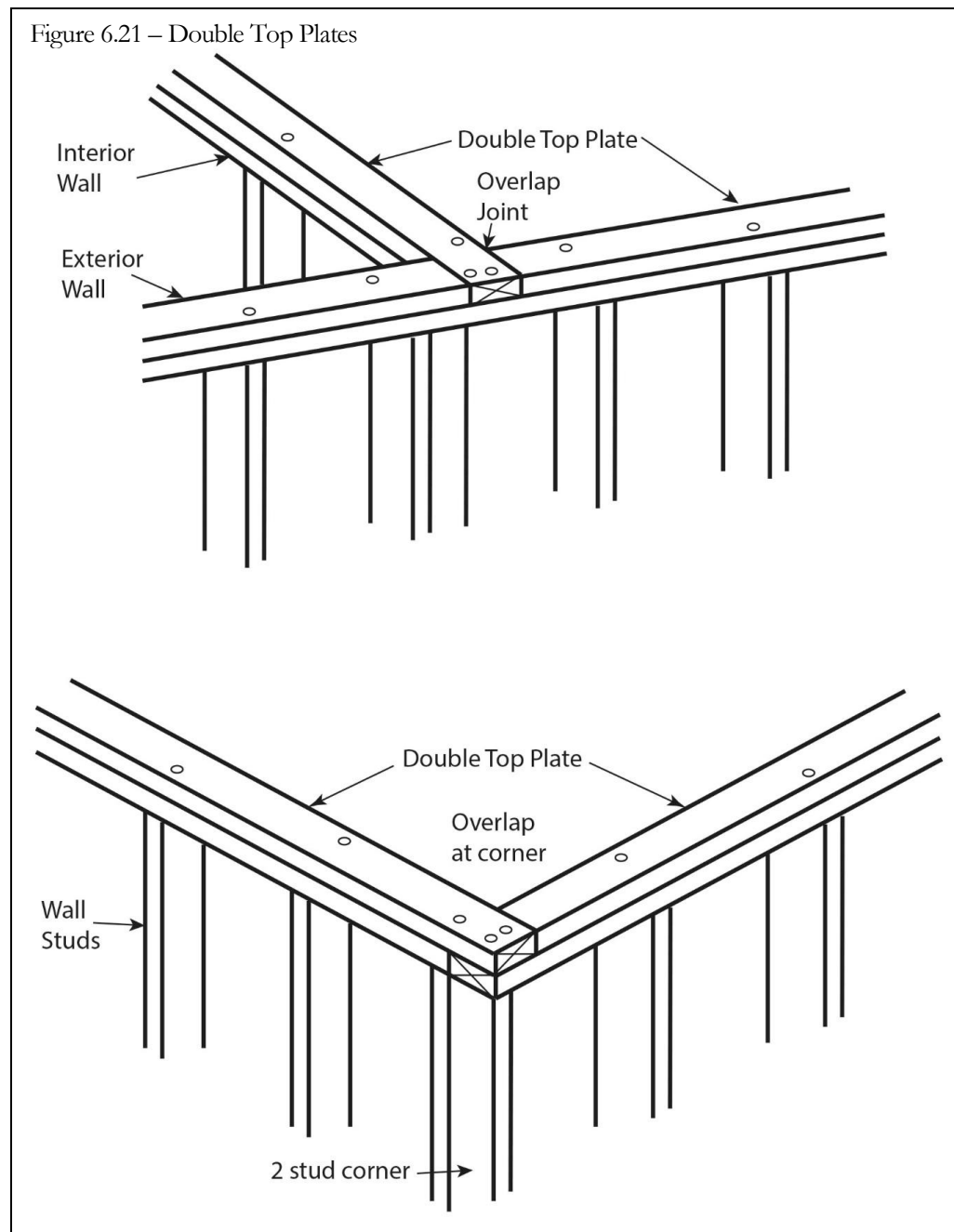
- ♦ Joints between the second top plates must fall over a wall stud below.
- ♦ Joints between second top plates must be at least 24” from joints between first top plates.
- ♦ Caulk between top plates.

Safety Issues

- ♦ Work from 7’ platform ladders or 16’ straight ladder. Do not lean step ladders.

1. After installing the exterior and interior walls, attach a second set of 2x4 top plates to the top of each wall. These top plates will tie the walls together. The walls must be plumb and square before the 2nd top plates are installed.
2. Apply a bead of silicone caulk to the top plates. Then, install the 2nd top plates using 10d sinkers; 1 nail every 16” and 2 nails into adjoining walls. The joints between the 2nd top plate boards must fall over a wall stud below and should never align with the joints in the 1st top plate.
3. On sections of wall where the 1st top plate is constructed from multiple boards, any joints in the double top plate should be placed at least 24” from the joint in the 1st top plate.
4. The second top plates for the interior walls should extend over the adjoining exterior walls. (see Figure 6.21)
5. At the corners, the double top plate for non-through walls should overlap the through wall. (see Figure 6.21)

Figure 6.21 – Double Top Plates



Stairway Landings

Install Stairway Landings

The size and shape to the landings will change based on the house design. Build the landing to the design in the prints.

Landings will be built with either 2x8 or 2x10 floor joists and rim joists. The sub-floor will be $\frac{3}{4}$ " OSB. The prints will identify the proper building materials. Install the floor joists at 16" oc.

- Ensure the joists and rim joists are supported with joist hangers and jack studs. Attach the framing with 16d sinkers. Attach joist hangers with Simpson hanger nails.
- Ensure the floor joists are supported with joist hangers.
- Glue and nail the OSB sub-floor to the joists. Attach the sub-floor with 8d sinkers.

Stairs

Things to Consider	
➤	Most of the houses now have a two-piece stairway. There will be 2 sections for the 2nd floor and 2 sections for the basement. Ensure the correct sections are installed.
Safety Issues	
➤	Workers above the stairway opening must be wearing fall protection.
➤	The stairs are very heavy. Many hands are required to handle them.
Critical Issues	
◆	Set of stairs should be installed by raising it up from the lower level; not lowering into place from the upper level.

Planning the stair installation

1. Install the sets of stairs from the bottom up.
2. Plan for access to upper and lower levels, including access to any landings.
3. Plan for placement of fall protection.
4. Plan for movement of the stairs to ensure the stairs end up in the stair opening lying flat, with the correct orientation and ready to raise.
5. Assign volunteers to:
 - a. Stair Moving Coordinator - 1
 - b. Lower level stair handlers – 4+
 - c. Upper level stair handlers – 3+
 - d. Stair nailers – (2 of the Lower level stair handlers).

Position the Stair Handlers

1. Position the lower level volunteers, wearing gloves, on lower level. For all basement stairs, including two-piece stairs, position all lower level volunteers in the basement.

For second floor stairs, the lower level volunteers will be positioned on the basement stairs below.

2. Position the upper level volunteers, wearing gloves and harnesses attached to the retractable life line, on the upper level.
3. For two-piece stairs, two of the upper level volunteers must be positioned on the landing when the lower section of the stairs is being installed.

Lowering the Stairs to the Basement

Safety Issues

- ◆ Clear the upper and lower areas before moving the stairs.
- ◆ All movement of the stairs must be at the direction of the Stair Movement Coordinator.
- ◆ Ensure the upper level volunteers hold tight to the stairs until the Stair Movement Coordinator gives the direction to let go.

Basement stairs need to be lowered to the basement before they can be installed.

1. Remove the guard railing.
2. Rotate the section of stairs onto its side; narrow side up.
3. Slide the bottom of the stairs into the opening. Keep sliding the stairs forward until it begins to tip. Ensure the upper level volunteers hold tight to the top of the stairs.
4. The lower level volunteers will guide the bottom of the stairs to the basement floor while the upper level volunteers keep hold of the top of the stairs.
5. The lower level volunteers will grab hold of the stairs as high as they can reach and lower the top onto the basement floor.

Rotate and Orient the Stairs

Safety Issues

- ◆ Avoid walking backwards

Before moving the stairs into the stairway openings, the stairs must be laid over on its back. In most house models, the stairs cannot be rotated in place due to the framing on each side.

For basement stairs, carry the stairs to a place in the basement where it can be rotated and returned with the correct orientation.

Installing the Stairs

Critical Issues

- ◆ The top of the stairs should be installed $\frac{1}{4}$ " above the sub-flooring for vinyl plank flooring and flush to the sub-flooring for carpeting.

Safety Issues

- ◆ Lift the stairs with your legs, do not lift the stairs with your back.
- ◆ Extreme care must be taken when lifting the upper stairs from the lower stairs. Slow movements are best.

1. The lower level volunteers will raise the top of the stairs up. Then the upper level volunteers will guide the stairs into place. The lower level volunteers must not let go until the stairs are nailed in place.
2. If the set of stairs will set on a landing, the upper level volunteers will raise the top of the stairs up above the floor while the lower level volunteers raise the bottom of the stairs onto the landing.
3. The upper level volunteers will center the stairs in the opening with the top of the stairs flush to the sub-floor for carpeting, or ¼" above the sub-floor for vinyl flooring. The lower level volunteers will slide the bottom of the stairs left, right, in or out at the command of the upper level volunteers to get the stairs level and at the correct height. Ensure at least two volunteers continue to support the top of the stairs.
4. The lower level volunteers will install shims between the stringers and the studs alongside of the stairs, then nail through the portion of the stringer below the stairs and shims into the studs with 16d sinkers; 1 nail in each stud on both sides.
5. Once the stairs are secured, add three (3) 3" wood screws through the top riser into the header.

Install the Temporary Handrail

Critical Issues

- ◆ The top of the temporary handrail must be installed at 36".
- ◆ The temporary handrail must be attached with two (2) 2x4 blocks at each connection point.

Safety Issues

- ◆ A temporary handrail must be installed as soon as possible after the stairs have been installed.
- ◆ The temporary handrail must be installed securely to the wall framing.

Once the stairs have been installed, install a 2x4 as a temporary handrail.

1. On the side wall above the first and the last tread of the stair attach two (2) 2x4 blocks.
 - Cut four (4) 2x4 blocks to fit across two wall studs; typically 21".
 - Attach one block on the side wall above the bottom tread with 16d sinkers through the block into the wall studs; 2 nails into each wall stud. The top of the block should be 36" above the nose of the tread.

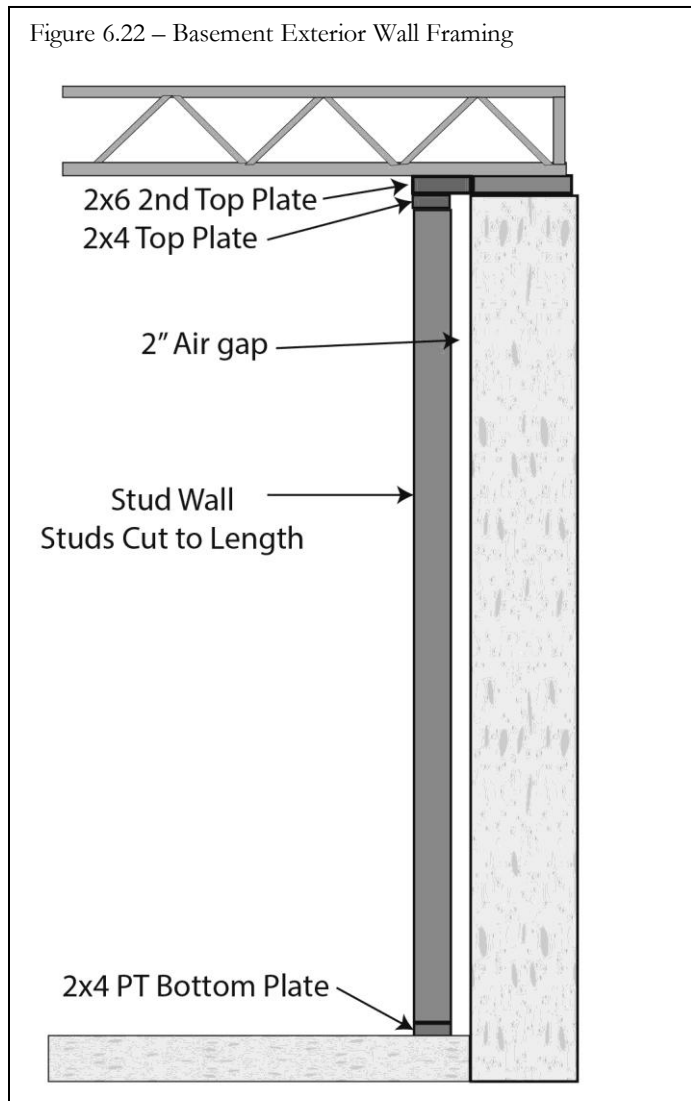
- Attach one block on the side wall above the top tread with 16d sinkers through the block into the wall studs; 2 nails into each wall stud. The top of the block should be 36" above the nose of the tread.
 - Attach a second block over the two blocks install above with 16d sinkers through the second block into the first block.
2. If wall studs are not available, additional bracing will be added to provide an anchor point for the temporary.
 3. Attach the 2x4 temporary handrail to the 2x4 blocks.
 - Position the 2x4 over the 2x4 blocks with the top of the 2x4 at 36" above the nose of the treads.
 - Attach the 2x4 with 16d sinkers; 2 nails into each set of blocks.

Finish Basement Framing

Walls for finished basements will be built similar to the 1st and 2nd floor walls with a few differences:

- All walls will be framed with 2x4s but will need a 2x4 pressure treated bottom plate.
- The 2nd top plate for walls built along exterior foundation walls must be a 2x6. This will create a 2" air gap between the framing and the foundation wall. (See figure 6.22).
- The 2nd top plates are not required to interlock.
- The length of the 2x4 studs will vary due to the variances in the basement floor.

Figure 6.22 – Basement Exterior Wall Framing



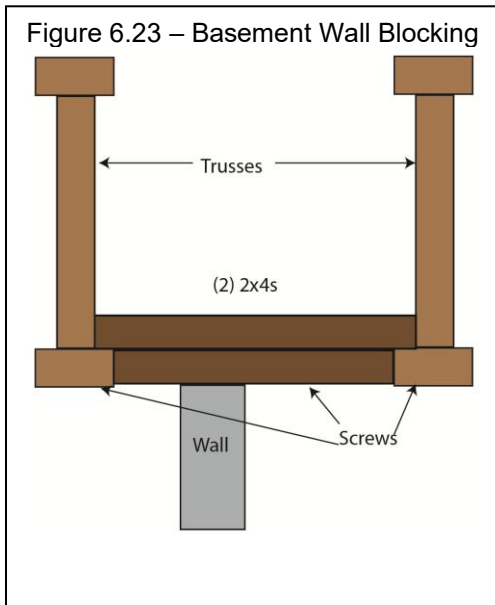
Basement Wall Layout

Mark out the location of the walls on the basement floor; then Snap chalk lines where the walls are to be installed. Care must be taken in locating the walls. Foundation walls may

not be plumb or straight. Measurements need to be taken at multiple points. It may be necessary to measure across the bottom of the floor trusses and drop a plumb bob down to verify the measurements.

Basement wall blocking

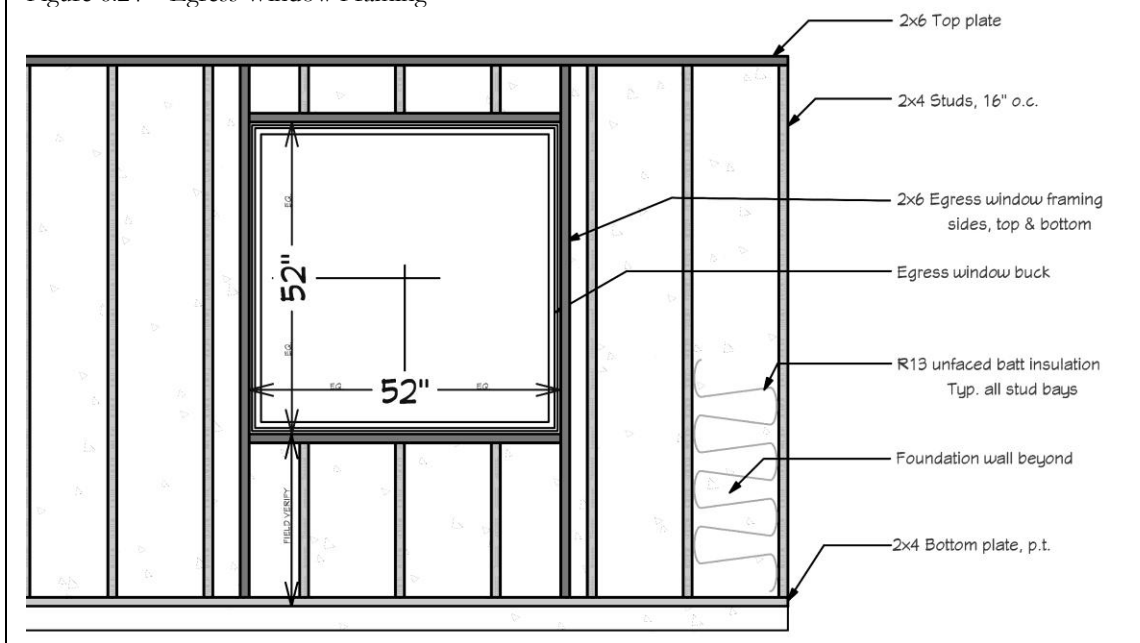
For walls which run parallel to the floor trusses and fall between the trusses, blocking will be required between the floor trusses above the wall. Cut two (2) 2x4 blocks; 1 to fit between the bottom chords of the floor trusses; and 1 to fit between the vertical chords. Sandwich the blocks together and place them between the two floor trusses with the top block resting on the bottom chords. Secure the blocks by inserting 2 ½" screws up through the bottom chords into the blocks. (See figure 6.23).



Egress Window Framing

Build the 2x6 frame around the egress window such that when the drywall is wrapped around the frame, the drywall is flush with the concrete edges of the window opening.

Figure 6.24 – Egress Window Framing



Additional installation tools

- Ramset – will be required to anchor bottom plates to the floor.
- Pneumatic Nail Gun (optional) – anchoring the walls to the floor trusses or blocking above will require nailing or screwing upwards.

Basement Wall Build Techniques

The installation of the basement walls will vary from the 1st and 2nd floor due to reasons which are documented above. The techniques will change due to:

- The uneven basement floor.
- The 2nd top plate cannot be installed as above.
- Walls which are built to full height will not clear the floor trusses when they are raised.

Three techniques to build and install the walls are documented here. It is likely the walls will need to be built in sections due to space available and lengths of the walls.

1. Install 2nd top plate last.

- Build a 2x4 frame with top and bottom 2x4 plates.
 - Cut the bottom plate (2x4 p.t.) and top plate (2x4) to fit.
 - Mark the stud locations on the plates. As much as possible align the studs to the trusses above.
 - Cut studs to length. Measure the distance from the floor to the trusses above at each location; then cut the stud for each location to that length minus 4 1/2".
 - Assemble the 2x4 frame.
- Erect the wall into place.
 - Stand the wall and move it into place using the lines made above.

- Measure the gap between the top plate and the floor trusses. If the space is less than 1 ½", lower the wall and correct the stud lengths.
 - Plumb and temporarily brace the wall in place using diagonal braces.
 - c. Add the 2nd top plate.
 - Cut the 2nd top plate (2x4 interior or 2x6 exterior walls)
 - Place the plate above the 2x4 frame. It will likely require a few taps of the hammer.
 - If the gap between the 1st and 2nd top plates is more than a ¼", shims may be added between the plates to keep the frame secure.
 - d. Plumb and install the wall.
 - Nail up through the top plate into the 2nd top plate with 16d nails; 2 nails between studs.
 - Toe-nail the 2nd top plate to the floor trusses using 16d nails; 1 nail into each truss.
 - Re-check the wall to be sure it is still plumb. Adjust as needed.
 - Nail down through the bottom plate into the floor using a ramset and 2 ½" nails.
 - e. Remove the temporary braces.
- Pros:
- More traditional building technique.
 - Easier nailing
- Cons:
- Requires more accurate measuring and calculations when building the walls.
 - Requires more time to adjust stud lengths, if needed.

2. Install 2nd top plate; then the 2x4 frame below.

- a. Install the 2nd top plate to the bottom of the floor trusses.
 - Cut the 2nd top plate (2x4 interior or 2x6 exterior walls)
 - Mark a line on the bottom of the floor trusses, directly above the wall layout lines on the floor using an 8' level.
 - Install the 2nd top plate to that line using either 16d nails or 2 ½" screws; 1 into each truss.
- b. Build 2x4 frame to fit below.
 - Cut the bottom plate (2x4 p.t.) and top plate (2x4) to fit.
 - Mark the stud locations on the plates. As much as possible align the studs to the trusses above.
 - Cut studs to length. Measure the distance from the floor to the 2nd top plate at each location; then cut the stud for each location to that length minus 3".
 - Assemble the 2x4 frame.
- c. Raise and tap the 2x4 frame into place.
 - Raise the 2x4 frame and tap into place. It will likely require a few taps of the hammer.
 - If the fit is too tight, lower the frame and correct the studs.
- d. Plumb and install the wall.
 - Nail up through the top plate into the 2nd top plate with 16d nails; 2 nails between studs.

- Nail down through the bottom plate into the floor using a ramset and 2 ½" nails.

Pros:

- More traditional building technique.

Cons:

- Requires more measuring and calculations when building the walls.
- Requires more time to adjust stud lengths, if needed.

3. Install the 2nd top plate; bottom plate; then the 2x4 studs between.

a. Cut the plates.

- Cut the bottom plate (2x4 p.t.); 2nd top plate (2x4 interior or 2x6 exterior walls); and top plate (2x4) to fit. If two top plates are not needed, only cut the 2nd top plate.
- Mark the stud locations on the plates. As much as possible align the studs to the trusses above.

b. Install the 2nd top plate to the bottom of the floor trusses.

- Mark a line on the bottom of the floor trusses, directly above the wall layout lines on the floor using an 8' level.
- Install the 2nd top plate to that line using either 16d nails or 2 ½" screws; 1 into each truss.

c. Install the top plate to the 2nd top plate. (if two top plates will be used)

- Align the top plate to the bottom of the 2nd top plate and secure them together with 16d nails or 2 ½" screws; 1 every 16".

d. Install the bottom plate to the floor.

- Place the bottom plate in place using the marks on the floor.
- Nail down through the bottom plate into the floor using a ramset and 2 ½" nails.

e. Cut the studs to length and toe-nail into place.

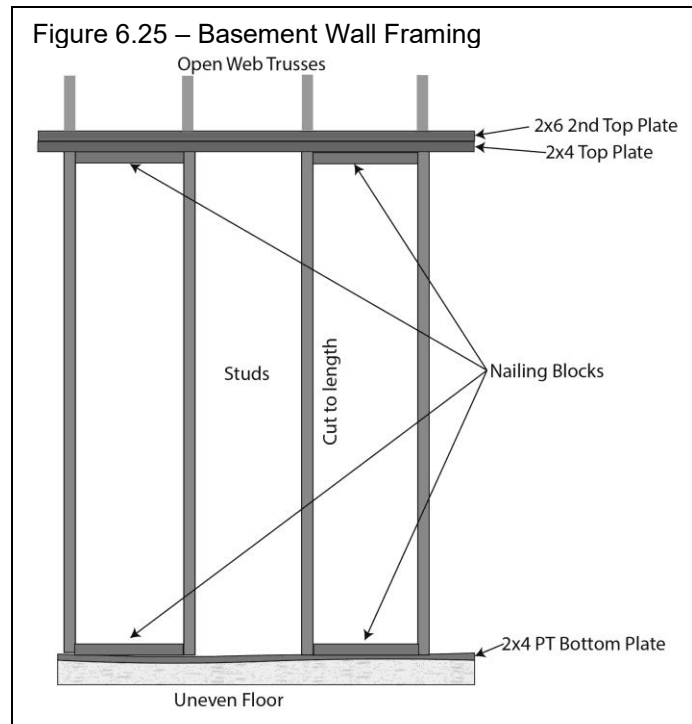
- Measure the distance between the top and bottom plates at each location.
- Cut the studs to fit.
- Toe-nail the studs to the plates.
- OR Install a nailing block between the studs. Nail the blocks to the plates and the studs to the nailing blocks. (see figure 6.25)

Pros:

- Easier to calculate stud length and correct stud lengths, if needed.
- May not require two top plates.

Cons:

-



Mechanical Chases and Soffits

Critical Issues

- ◆ If the chase or soffit will run next to an exterior wall, the area of the exterior wall which will be covered must be insulated and inspected before it is covered.

Many of the house plans require construction of chases and soffits to provide places for the plumbing and HVAC runs. A simple 2x4 box is usually enough to create the channel and provide support for the drywall covering the channel. (See figures 6.26 & 6.27).

For chases and soffits to be installed along external walls, see the Air Sealing chapter for installation procedures.

1. If the chase or soffit will run next to an exterior wall, install $\frac{1}{2}$ " OSB to the wall first.

- Cut pieces of $\frac{1}{2}$ " OSB to fit exactly behind the chase or soffit.
- Attach the OSB to the wall studs with 8d sinkers.

2. If the chase or soffit will run up to the ceiling joists, install a $\frac{3}{4}$ " piece of OSB or two (2) pieces of $\frac{1}{2}$ " OSB to the ceiling joists first.

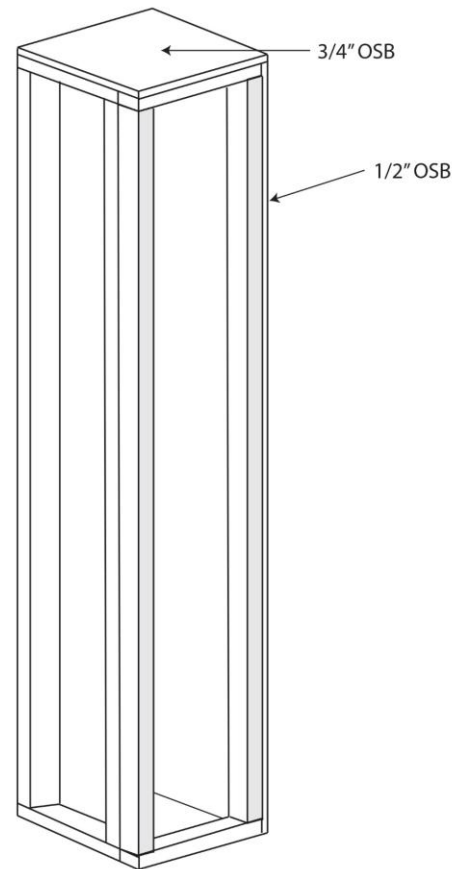
- Cut pieces of $\frac{1}{2}$ " OSB to fit exactly above the chase or soffit.
- Attach the OSB to the bottom of the ceiling joists with 8d sinkers.
- If the OSB cannot be supported by the ceiling joists, 2x4 blocking will be needed above the OSB. Run the 2x4s between the ceiling joists.

3. Chases – Build the walls similarly to the interior walls with 1" longer studs. A double top plate is not required. The $\frac{1}{2}$ " OSB will hold the joint together.

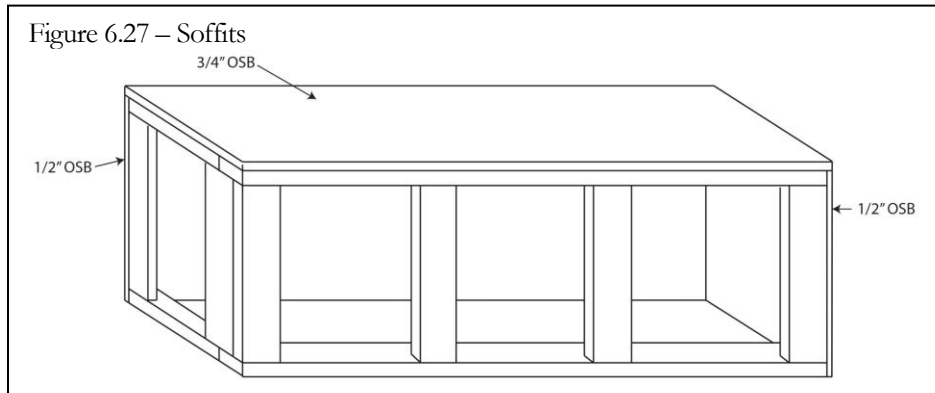
4. Soffits – Build the walls similarly to the interior walls with very short studs. Installing the studs on the flat ($3\frac{1}{2}$ " side facing out) provides more room for the mechanicals. A double top plate is not required.

5. Attach all framing members with 16d sinkers.

Figure 6.26 – Chases



6. Insulate any joist bays or exterior wall bays which will not be accessible after the soffit or chase is installed using R-13 batts.



Finish Exterior Sheathing

Attach OSB at overlapping joints

After the exterior walls have been installed, any OSB sheets which span wall panels must be secured with 8d sinkers into the framing lumber of the overlapping wall panel. Attach with the same nailing pattern as above; 6" apart along the edges and 12" apart along the studs in the center of the sheet.

Install OSB on Floor and Rim Joists

Critical Issues

- ◆ **Caulk the seams between the Rim/Floor Joist and Sill Plates and between the Rim/Floor Joist and Wall Bottom Plates before installing the OSB.**

1. After the exterior walls are installed, strips of 1/2" OSB should be installed in any holes in the exterior sheathing including:
 - Between the top of the foundation and the bottom of the OSB on the first-floor walls.
 - Between the top of the first-floor sheathing and the bottom of the second-floor sheathing.
 - Between the top of the exterior sheathing and the bottom of the roof truss tails.
2. Ensure all of the edges of the 1/2" OSB break on a framing member. 2x4 blocks must be added behind the joint if a framing member is not available.
3. When covering the space along the sill plate, place 8d galvanized spiral nails at the bottom of the OSB into the sill plate every 6", four (4) 8d sinkers into the end of each Joist and 8d sinkers into the rim joist every 6".



Before continuing, stop and complete the **"Wall Installation Checklist"** found in Procore/Inspections.

Build Fire-Rated Wall Assemblies

Critical Issues

- ♦ Any wall or eave within 5' of the property line must be covered with fire-rated building materials.

Safety Issues

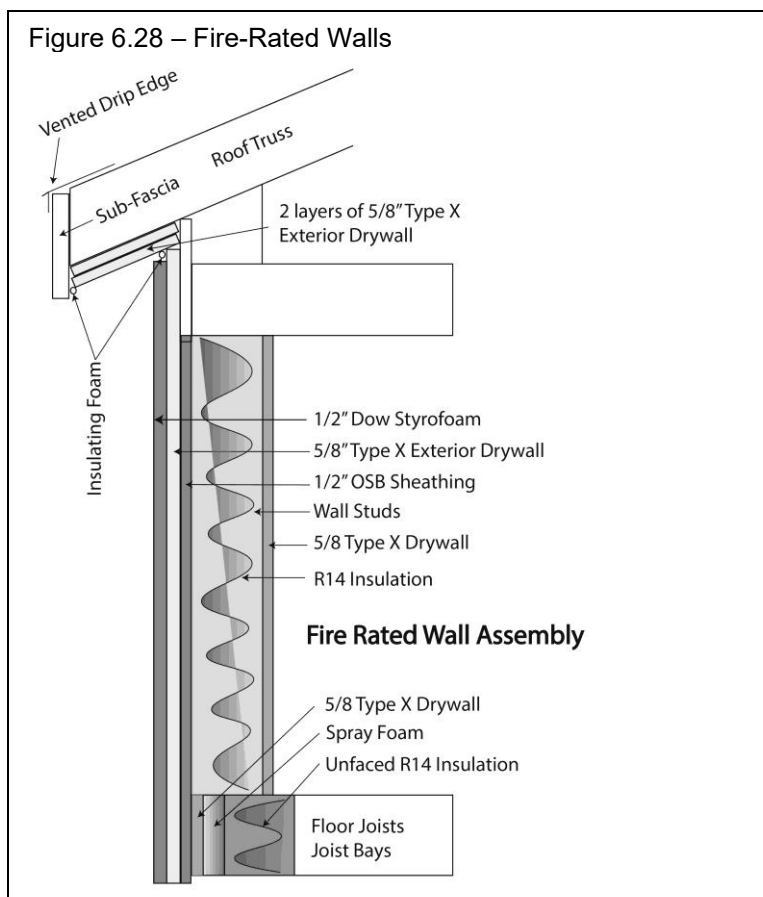
- ♦ Type X Exterior drywall sheets are very heavy. At least 2 volunteers are required to lift the sheets.
- ♦ Gloves and long sleeves are required when working with Type X Exterior.
- ♦ Dust Masks are required when cutting the Type X Exterior. The dust is hazardous to breathe.
- ♦ DO NOT cut the Type X Exterior with a power circular saw. The saw will create lots of dust and blow it into the air.

Fire-Rated Wall Assemblies

The walls which are nearer than 5' from the property line must be protected with fire rated building materials to provide a one hour burn rating. To achieve this rating:

- Apply 5/8" Type X Exterior drywall over the exterior sheathing
- Apply two (2) layers of 5/8" Type X Exterior drywall under the eaves.
- Also, 5/8 Type X, fire rated, drywall must be installed to the inside of the associated walls and in the floor joist bays.

The Type X Exterior on the walls will be covered with ½" Dow Styrofoam to keep the same profile. (See figure 6.28).



Installing Type X Exterior Drywall to Eaves

1. Apply Type X Exterior drywall to the eaves before installing Type X Exterior Drywall on the walls.
2. Cut and install two (2) layers of Type X Exterior drywall to the underside of the roof truss tails. Each piece should reach from the sub-fascia up to the wall sheathing and break on a truss tail. To cut the drywall, score it with a utility knife and break. Alternatively, a hand saw can be used.
3. Install the drywall pieces under the eaves. Two volunteers working from ladders will be required to lift these pieces into place. Attach the drywall to the truss tails with 2 1/2" drywall screws; 1 screw through both pieces along the bottom and 1 screw through both pieces 6" from the bottom.
4. Cut the Type X Exterior Drywall even with the bottom of the sub-fascia. Do not allow the Type X Exterior Drywall to extend below the sub-fascia.

Installing Type X Exterior Drywall to Exterior Walls

1. Install Type X Exterior drywall to the exterior wall sheathing. Install the drywall horizontally. Fit the pieces tightly together. Do not allow the Type X Exterior Drywall to break on top of a seam in the wall sheathing.
2. If sheets need to be cut to fit, cut sheets as described above.
3. Install the sheets horizontally, starting at the bottom of the wall. The seams between the sheets of drywall must not be aligned with the seams of the exterior OSB. Two volunteers will be needed to lift each piece into place.
4. Attach the Type X Exterior drywall to the walls with 8d sinkers, 1 nail installed every 7" up each stud.
5. After the bottom row is complete, the second and following rows of drywall should be installed using a pair of ladders. Slide the drywall up the ladders and slide it into place.
6. Carefully seal the edges of the Type X Exterior installed on the eaves with high expansion insulating foam.
7. Do not tape the joints on the Type X Exterior Drywall.
8. Call for an inspection before continuing with the Dow Styrofoam.

Installing Type X drywall to Joist Bays

1. Cut pieces of 5/8" Type X drywall to fit into the floor joists bays along any wall which must be protected with a Fire-Rated wall assembly. This includes the floor joist between the basement and the first floor, and on two-story houses between the 1st and 2nd floors.
2. Cut the pieces to fit snugly between plate below and the OSB above and snugly between the two Joists.
3. Attach the drywall to the OSB sheathing with 1 1/4" roofing nails; 3 rows of nails 7" o.c.

Providing Attic Ventilation

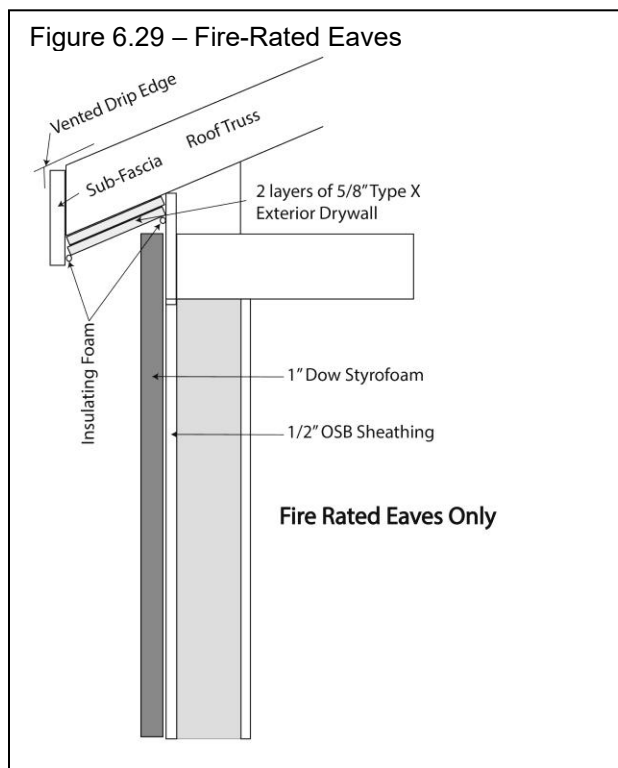
The Type X Exterior drywall on the eaves will restrict the attic ventilation through the soffits; therefore, the roofers will install perforated drip edge along the eaves.

*** Ensure both the interior and exterior drywall is inspected before covering the nails.

Fire-Rated Eaves

If a wall is not within 5' of the property line but the eave is, then the eave must be protected with fire rated building materials. Apply two layers of 5/8" Type X Exterior Drywall on the bottom of the roof truss tails. (See figure 6.29).

The walls will not need protection.



1. Install the drywall as described above in "Installing Type X Exterior on Eaves".
2. Carefully seal the edges of the Type X Exterior installed on the eaves with high expansion insulating foam.



Before continuing, stop and complete the **"Fire-Rated Wall Assembly Checklist"** found in Procore/Inspections.

Summary

Jack Stud Length	81 1/8"
Header Height	11 1/2"
Door Header Width	Door Width + 5"
Window Header Width	(3-0) 39"; (6-0) 78"
Top Window and Door Cripples	10"
Bottom Window Cripples	(5-0) 19 5/8"; (5-2) 17 5/8"; (3-0) 43 5/8"
Exterior Vent Header Height	73" – 76 1/2" above deck
Tee Wall Blocking Height (Mid Wall)	46 3/4" – 50 1/4" above deck
King – Jack Nailing Pattern	2 – 10d sinkers every 12"
Studs to Plate Nailing Pattern	2 – 16d sinkers through each plate into the stud
Second Top Plate Nailing Pattern	1 – 10d sinkers every 16"
OSB Nailing Pattern	8d sinkers 6" apart on the edges and 12" apart along studs in the center of the sheet
Type X Exterior Nailing Pattern	8d sinkers 7" OC up every stud
Window Guardrail Heights	42" and 64"