

# FRAMING

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# SAFETY TALK

## Basic Construction Safety

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- #1: Drink plenty of water and watch for dehydration!
- When you are tired - Rest!
- Know where the First Aid Kit is - if you are hurt see your House Leader or Site Host immediately. Our Accident Procedure is in the Site Host book, please follow it.
- Fill out an Incident Report any time the First Aid Kit is opened.
- Keep a name tag on at all times.
- Use Common Sense! Keep an eye on your own safety and the safety of others.
- Concentrate -- especially if you are on a ladder or roof.
- Watch for trip hazards wherever you are going.
- Help keep the site safe by picking up and moving things that are in the way.
- If you see something unsafe tell your House Leader or a Staff Member.
- Hardhats are required to be worn at all times through the completion of drywall lids.

## Lifting and Carrying

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- Bend your knees and lift with your legs not your back.
- If something is too heavy, get help - don't hesitate to ask!
- Make sure you can see over what you are carrying.
- When carrying something longer than 8 feet have a person on each end.

## Ladders

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- At the beginning of each day inspect all ladders for any structural defects that would make them unsafe. If any defects are found, mark the ladder(s) and set it aside for the Site Supervisor's disposition.
- Use the right size ladder and place it on a solid footing
- Never lean an A-frame ladder against anything, always use it fully opened.
- Never stand on the top step or back side of a ladder.
- Don't stretch/lean too far – always keep your belt buckle between the ladder uprights - take the time to move the ladder with your work!
- Get someone to steady your ladder if needed.
- Only one person on a ladder at a time.
- The 4 to 1 rule  
For every 4 feet of height, move extension ladders one foot away from the wall.

## Power Tools

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- Make sure you know how to use a power tool and don't disable safety features.
- Wear safety glasses when using power saws and other power tools that create flying debris.
- Take off gloves when working with saws.
- Watch fingers near moving parts and tie back long hair.
- Use a push stick when using the table saw.
- Watch the power cord when cutting and don't carry a power tool by its cord.
- Get help when cutting long pieces of material.
- Secure all loose clothing (shirt cuffs, nail pouches, etc.)

## Framing Safety

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- Once elevated, make sure walls are anchored, nailed and temporarily braced or nailed in place before letting go and walking away.
- When cutting out windows and doors, have a person on the other side of the wall to make sure everyone is clear when the saw blade pokes through.
- Watch out for the back swing on hammers!

## Key things to remember

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- Foam sill seal under exterior wall bottom plates.
- Most interior walls do not have a double top plate. Shear or 3-point bearing walls may, check your plans.
- MASA exterior plate anchors: Every 48" (unless otherwise noted on plans) and within 12" of break in bottom plate. Use ramsets per plans where MASAs are missing.
- Interior plates anchored every 24" (unless otherwise noted on plans) with ramsets.
- OSB, underlayment, and Foam on 8' of wall where electrical panel goes.
- Standard nail pattern for sheathing is 6" on seams and 12" in field (check plans for shear areas and other special nail patterns).
- ***Don't put OSB seams at the sides of windows or doors.***
- Plumb interior walls and doorframe openings.
- Securely fasten interior walls to each other, exterior walls, and floor.

## Efficient material usage

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### LUMBER:

- Cut all vertical pieces from STUD materials or scrap.
- **EFFICIENT USE OF PRESSURE TREATED GREEN PLATE IS CRITICAL!**
- Green plate is to be used for bottom plates only.
- Start by laying out the longest pieces first.
- Then use cut pieces for shorter walls.

### SHEATHING (OSB & PLYWOOD):

- OSB is used vertically on walls. All seams must be supported/blocked.
- Use scrap strips of OSB for soffits and beam construction
- Paint the better side of the plywood

### BLOCKING:

- Cut up warped or older material for blocking before using good material

## Efficient use of volunteers

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- Assign one Team Leader each week to use volunteers to organize the Mini at the end of the day.
  - Empty ALL nail pouches and sort nails and tools into proper places.
-

## FRAMING WALLS

We space our studs at 24" O.C. *On all bearing walls the studs must fall directly under the trusses. On all non-bearing walls (both interior and exterior) there is no restriction on stud location.*

Install studs between the top and bottom plates so that the crowns (the direction of the bow) all face the same direction. Exterior walls should have crowns facing to the outside.

The unevenness in the crowns on the outside of the house will be covered by OSB, foam and stucco. This also allows the drywall to maintain a flat surface on the inside.

Nail Schedule: two 10d nails in each end for 2x4 walls, three 10d nails for 2x6 walls.

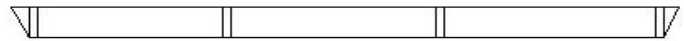
When building walls always make sure the bottom (down facing) side of the verticals is flush with the bottom (down facing) side of the plate before nailing.

### Cripples

- Install cripples above and below window openings following the 24" spacing pattern.

*It is not necessary to install extra cripples at the outside edges of all headers.*

### Angled Wall Layout

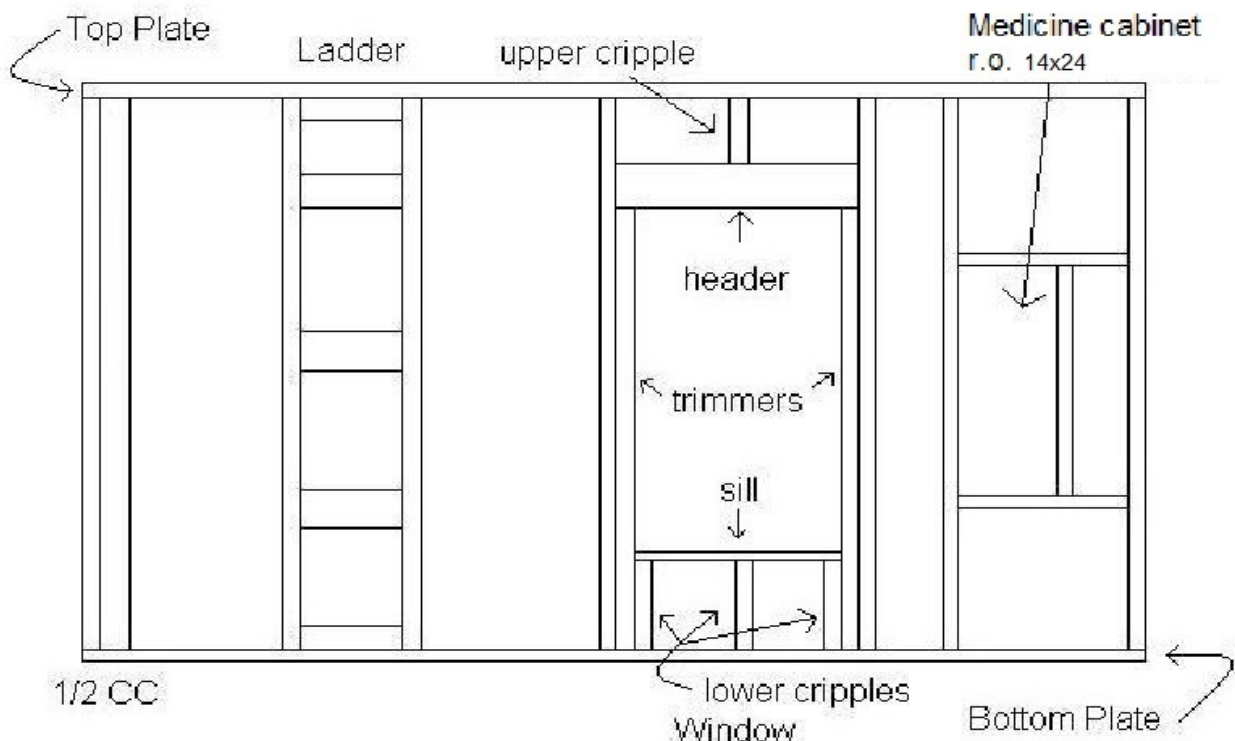


### Angled Walls

At any location where there is a wall that is not designed to be perpendicular/parallel to the rest of the walls in the house figure the measure of the angle and divide it equally on the ends of the connecting walls. For example, if the wall is at a 45 degree angle, cut the ends of each wall at 22.5 degrees. All of the studs in these walls are installed in the normal manner, with the studs at the angled ends installed with their edge touching the short end of the angled cut (see the diagram above).

### Medicine Cabinet

Remember to mark the plates to include the medicine cabinet framing on the side wall of the vanity in both bathrooms. Make sure that the opening is at least 1 1/2" away from the intersecting wall so that the cabinet will open properly. The rough opening is 14 x 24 with the top at 72". (see below)





## FRAMING DOORS

**Window and door modules may have been pre-built. Check with house leader before building any on site.** If none are available follow steps 1-5.

1. Install one side of the king stud and trimmer assembly as marked on the plates.
2. Set the header pieces into place against the first king/trimmer assembly.
3. Set the second king/trimmer assembly flush on the opposite side.



All door and window headers and sills must be installed tightly. Use a pipe clamp to squeeze the frame together as it is built.

4. Install a pipe clamp from the outside of one king stud to the outside of the opposite king stud (see photo above).

- A. Tighten the clamps to eliminate any gaps on the sides of the header and trimmers.
- B. Nail the headers into place.  
Nail schedule: six 10d nails.
- C. Nail the second king/trimmer.
- D. Toenail both “King//Header” joints.

5. It is easiest to complete the window and door openings before installing the studs on either side. This allows plenty of room to nail the headers from the sides.

### SPIN TRIMMER

When faced with a situation that prevents access to nail a trimmer set to an adjacent wall (where we would normally have to toenail) attach the trimmer to the king stud with only one nail when building the wall. This is called a Spin Trimmer, and by spinning it out of the way it allows easy nailing into the adjacent wall.

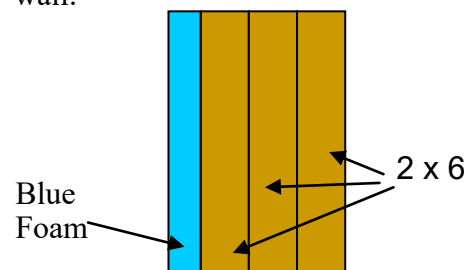
Once the walls are fully nailed off, spin the trimmer back into place and fully nail it off.

### Hinged Doors

- Trimmer length: 81”.
- Header height above finish floor: 82 1/2”.
- Rough framing width: 2” over door size (e.g. frame a 24” door 26” wide).
- Header length: 3” over rough opening size (e.g. a 26” rough opening requires a 29” header).



For an exterior wall the header will have three pieces of 2x, and one piece of blue foam the same length as the 2xs. The three 2xs will be on the inside to provide nailing for the dry-wall.





Interior door headers 38" and under are a single 2x4 laid flat.

## By Pass Doors

- Trimmer length: 81" (81 1/2" for carpeted areas) the floor bracket is installed on a wood block glued to the concrete, hidden by carpet.
- The floor bracket will be installed directly over the vinyl flooring (no block).*
- Header height above finish floor for vinyl is 82 1/2".

- Header height above finish floor for carpet 83".
- Rough framing width: frame to door size (e.g. frame a 72" door 72" wide).
- Header length: 3" over rough opening size (e.g. a 72" rough opening requires a 75" header).
- Header spans less than 38", single 2"x4" laid flat.
- Header spans 38" and greater require a sandwich of 2x4 & plywood.



Interior door headers greater than 38" wide are two 2xs and plywood sandwiched together, installed vertically.

## GARAGE DOOR

To figure the trimmer length for the garage door, subtract the stem height above the floor and 1 1/2" (the plate thickness) from 84. Always use double trimmers and kings for garage door openings unless plans call for more. When rough framing a garage door opening please verify each of the following four items:

1. That the trimmers are flush with the end of the stem, unless the opening is greater than 16'-0". If the opening is greater than 16'-0" allow the trimmers to overhang the stem far enough on each side of the door to make the trimmer to trimmer distance exactly 16'-0".
  2. That the inside edge of the wing walls are on the red chalk line.
  3. That the measurement from the garage floor to the bottom of the garage door beam is 84".
  4. That the measurement from the garage floor to the top of the double top plate is at least 101". If the stem is less than 5" tall, alert your site supervisor.
- Once all of the above conditions are met, install a 2x6 on the inside of the wall around

the rough framed opening. This 2x6 is called a "buck" and is used to attach the garage door to the wall. Set the buck 1/2" into the door opening to serve as the stucco stop. Each of the parts of the buck (one horizontal and two vertical) must each be made from a single 2x6.

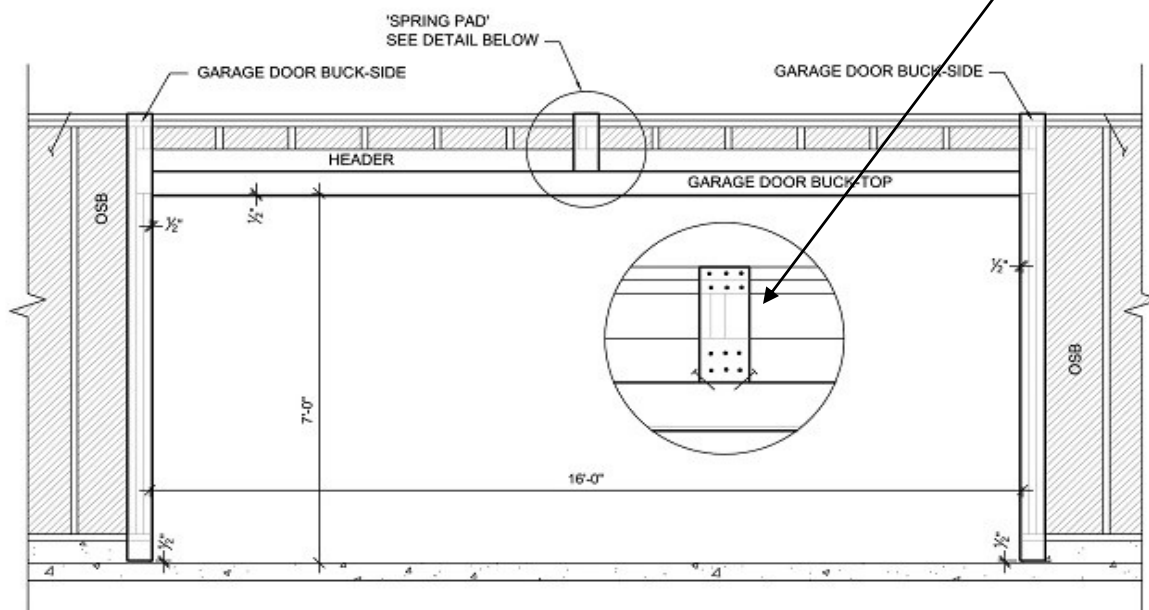
The vertical pieces of the buck run from 3/4" below the top of the double top plate to within 1/2" of the floor. If necessary for it to fit properly, notch the back of the buck where it overlaps the stem. The horizontal piece of the buck runs between the two vertical pieces. The lumber used for the buck must be straight, not twisted and free of splits.

Install the buck using 10d nails in rows of three at 12" o.c. Drive the nails at alternating angles, *not at a 90 degree angle*. At the top of both vertical pieces add extra nails so that they are 6" o.c. for the first 24". Avoid marring the door buck as it is visible as a piece of trim.

Install a vertical 2x6 (called the spring pad) exactly in the middle of (96" for our standard 16' door) and

from the top of the horizontal piece of the buck to the top of the double top plate. **The spring pad board must have no knots or splits.**

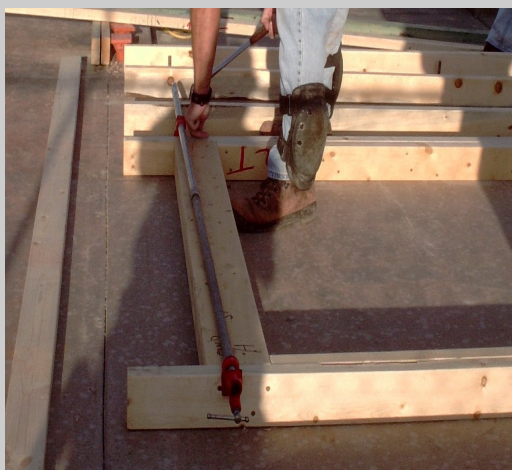
The vertical pieces of the buck must be nailed into both the top and the double top plates, and the intersections of the various buck pieces must be toe-nailed together (see the spring pad detail below for nailing examples).



### KEY ITEMS TO REMEMBER

1. Never set the vertical buck pieces on top of the stem wall.
2. **DO NOT** nail the buck to the wall with nails driven straight (a 90 degree angle) into the wall.
3. The wall must be perfectly plumb. If It's not, correct it before moving on.
4. Overhang the buck 1/2" to serve as stucco stop.
5. Ceiling height at garage door must be at least 101" to clear the standard door track.

## FRAMING WINDOWS



All door and window headers and sills must be installed tightly. Use a pipe clamp to squeeze the frame together as it is built.



**FRAMING: Garage Door**



## STANDARD WINDOW

- Trimmer length: 81".
- Header height above finish floor: 82 1/2".
- Rough framing width: exact size (e.g. frame a 48" window 48" wide).
- Header length: 3" over rough opening size (e.g. a 48" rough opening requires a 51" header).

## BATH WINDOW



-Due to the limited space over the tub, the header is installed directly under the top plate without any cripples.

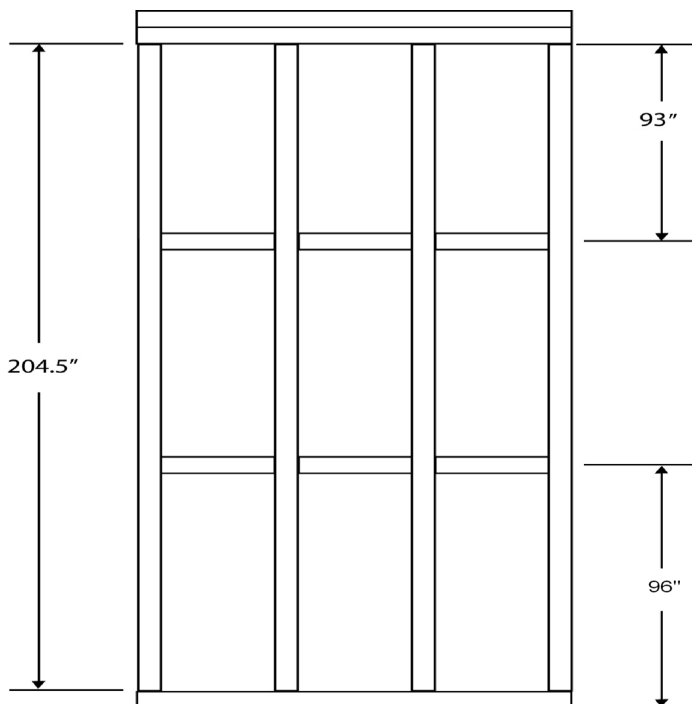
- Trimmer length: 87 1/8" (for 2x6 header).
- Header height above finish floor: 88.5".
- Rough framing width: exact size (e.g. frame a 48" window 48" wide).
- Header length: 3" over rough opening size. The 48" rough opening would require a 51" header.

## BALLOON FRAMING

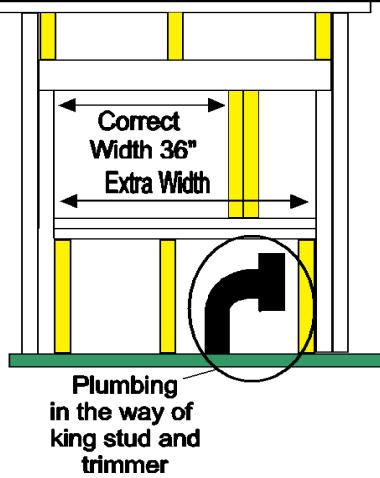
Balloon framing is simply a method of framing walls which involves using studs (longer than standard length) that run in one continuous piece from the lowest floor level to the roof line. As this currently applies to HFHCAZ it is framing a section of a two story wall as a single piece from top to bottom as opposed to stacking two single story sections together. The stud length (for our purpose) will be twice the standard stud length plus the depth of the assembly of the second floor deck, and the depth of top, double top, and bottom plates at the second floor level.

In this example, the stud length should be 204.5" (17'-1/2"). This figure is calculated by taking the two story ceiling height (209") minus the first floor bottom plate and the second top & double top plates (4.5").

We will sheath these areas the same as a regular stacked wall (8' piece, filler strip, 8' piece). This means that the edge blocking for the sheathing will serve as the fire-blocking, and will be placed at centerline 96" above the slab and centerline 93" below the top plate.



## KITCHEN WINDOW



Location of some kitchen windows is critical for cabinet alignment. **DO NOT** move the location until you have checked with your site supervisor. If it can't be moved, use the following procedure.

If there is plumbing blocking the correct location of the king stud and trimmers, relocate the studs to the far side of the plumbing.

When framing the window, lengthen the sill and header. Add a double cripple between the sill and header to create the correct window opening.

## RAISING WALLS



Join together all of the panels for the wall by lining up the bottom and top plates. Then nail the studs together.

Nail pattern: for 2x6 walls 3 –10d @16" o. c.

For 2x4 walls 2-10d @ 16" o. c.

Next attach the double top plate to the walls, and finally, lay out the trusses on the double top plate. See the following sections for truss layout details.

Before standing walls, staple foam sill-seal under exterior wall bottom plates so that there is a 1/2" space between the foam and the chalk line (inside edge of plate).



Work together as a group to stand walls in place.

Tap the wall as needed to line up the bottom plate straight along the chalk line. The chalk line should be clearly visible along the inside. Re-verify proper wall location (end and line), and fasten in place with a powder actuated fastener (ramset) at each MASA.



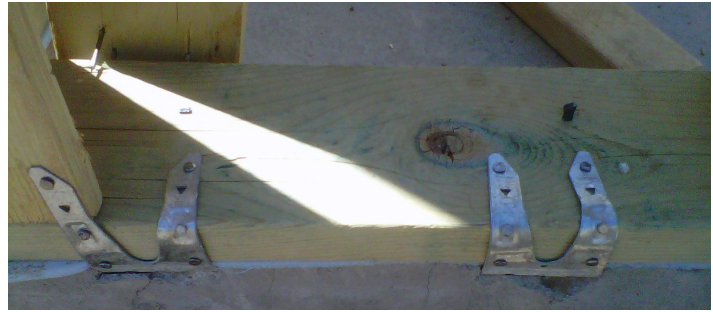
Walls can be braced by nailing the bottom of the brace into a stake driven into the ground (left) or by building an A-frame (right), in areas of exposed concrete where a cleat cannot be anchored to the floor with a ramset. Brace walls thoroughly before letting go.



## ANCHORING WALL PLATE

- Exterior walls must be fastened to the concrete every 48" or less o.c. per the plans, and within 12" on both sides of each break of any kind in the bottom plate (including all exterior wall plumbing cut outs). MASA strap anchors are embedded in our slabs at the required intervals per our plans. Where additional anchors are needed at plate breaks, use ramsets per the plan details sheet.
- Recheck that the plates are properly aligned with the chalk line and then nail off the MASA straps with one Teco nail in each hole.

Interior walls are anchored to the concrete with one ramset every 24" and with one ramset on each side of all plate breaks.



## RACKING EXTERIOR WALLS

Once the walls have been braced and anchored it is time to make sure that the walls are plumb (vertical). Place an 8' level up against the end of the long wall (usually a side wall) being sure that it is tight against both the bottom and top plates. If the level is being held out from one of the plates by a bowed stud, correct the situation before racking the wall (making it plumb). To rack the wall push on it to move the top corner either toward or away from the level as needed for it to read plumb. This can be done either by manually pushing/pulling on the wall, or it can be done using the Racking Stick (see the following section for info on this tool). Once the wall is plumb nail a diagonal 2x4 brace (also known as a racking brace) to the wall at each stud and both plates (using 10d nails) to keep it plumb.

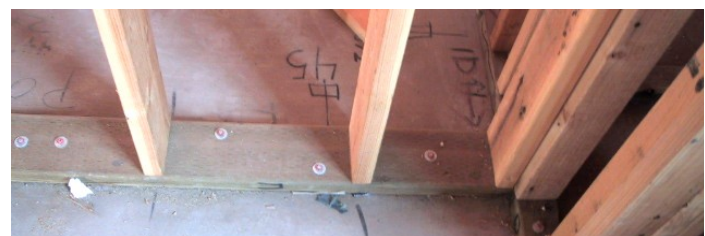
Now move around the corner and perform the same procedure for the intersecting wall. Once this is completed your corner should be plumb in both directions and the bracing should look like that shown in the preceding picture.

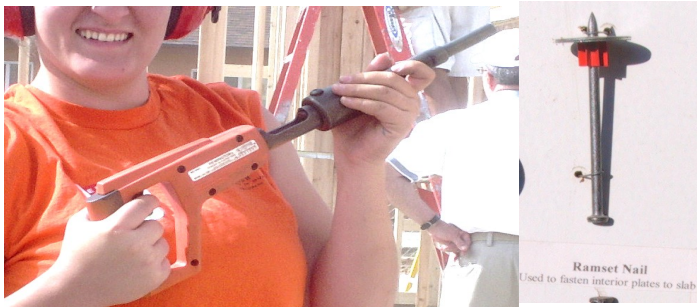
## RACKING STICK

- Take a stud, cut a "V" cut near the middle and reassemble with an 8d nail on each side.
- Using it as shown in the photo allows you to rack any wall with less effort. Simply brace the bottom with your foot, wedge the top into the framing, and push in the middle to move the wall.



## RAMSETS





- Fasten interior walls through bottom plate into concrete floor with one powder-activated fastener (Ramset) every 24" and within 12" of each plate break including door openings. Check your plans for spacing at special situations (shear panels, etc.).

## FHA PLATES

- Install FHA plates over all plumbing breaks in the sill plate on the outside of the wall before nailing OSB. Install a plate on interior side if the pipe is less than 1" from the edge.



## TRUSS LAYOUT

- The layout and installation of trusses is the same for both standard and flat roof elevations, except for the first and last trusses.
- See the truss calcs provided by the truss manufacturer for the particular truss layout for your house. Note the location of any "bastard trusses". **Bastard trusses** are any trusses that are spaced other than 24" apart.
- For a gable roof, start your layout at the opposite end from any bastard spacing, which is normally at the rear. Remember that the gable truss sits flush with the OSB, so your first mark is 1" in from the edge of the 2x. Every 24" along the wall from the first mark, make a mark, and then cut back (subtract) 1 1/2" for your second mark. Continue this pattern until you get to the bastard location. If your bastard location is other than at the

end of the house, repeat this procedure from the other end of the wall.

- For a **flat roof**, the space between the first truss and the second truss should always be 21 3/4". All other non-bastard spaces should be the standard 22 1/2" (24" O.C.).
- Starting from the beginning end, transfer all markings to the other side of the house and to any interior bearing walls.
- **Prior to installing the trusses re-check the corners of the building to ensure that the walls are plumb and straight.** DO NOT REMOVE interior wall braces until after roof decking is completed.

## PONY WALL

- A "Pony" wall is a short height wall, usually dividing the kitchen and dining room and behind the base cabinets.
- Depending on the model, the length can be critical to ensuring wheel chair access. The MINI-

## DOUBLE TOP PLATE

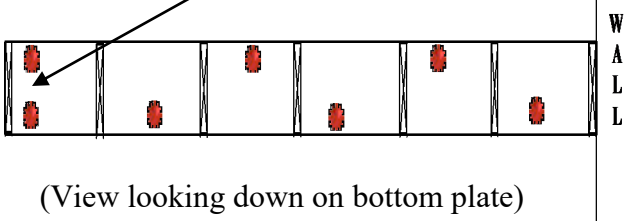


- Double top plates are on exterior walls ONLY.
- Interior walls do NOT have a double top plate unless they are bearing or shear walls. Check your plans to locate these special circumstances.
- Joints in the double top plate cannot be within 4' of any break in the top plate.
- At corners, run the overlap of the double top plate the opposite of how the walls intersect at the top plate.
- Nail Schedule: Two 10d nails every 16". Be sure not to nail right on top of nails in top plate.



MUM finished width opening is 36" including drywall (also, remember the countertop overhang).

- 2x6 Single Bottom plate and Single Top plate.
- Stud length: 42". This length is the same for houses having pass throughs.
- The height measurement is **CRITICAL** for the finished bar top to clear the top of the range.
- Secure the bottom plate with ramset nails on alternating sides between each stud (see below).



This provides greater stability than if they were placed down the center.

- Install two ramset nails in an end not attached to a wall.
- Be sure to install the angle brace for support as shown, and leave it in place until the cabinets are installed.



## BACKING ELECTRICAL PANEL



**This project should be completed by the end of the first day of framing.**

- Locate the Ufer (ground line). This is normally located near the front of one of the two side walls.
- Plumb the wall containing the Ufer.
- The Ufer line should be on the **INSIDE** of the house, coming up through a hole/slot in the plate.
- Starting at the corner of the wall install a *vertical* panel of OSB at the ufer location.
- Install Feltex horizontally. Start at the bottom and overlap the next strip above by at least two inches over the previous sheet.
- If available, install the "J" flashing channel flush with the bottom of the OSB. If not available, install the foam flush with the bottom of the OSB.
- Install the Blue 4'x8'x1" foam insulation board vertically.
- Nail schedule: enough 8d nails to secure it in place.

## BEAMS, POCKETS, POSTS

**ALWAYS** check the plans whether a solid beam or built-up beam is required per location



- Built-up beam construction: (Must be built before constructing Beam Pocket).
- Size and number of components vary by design location.

**Example:** Three 3-2x8s sandwiched together. Nail each layer with three 10d nails every 12".





## POCKET CONSTRUCTION

- Measure the actual width and depth of the beam on your site.
- Construct the pocket post out of 2x4 or 2x6 (depending on wall thickness) trimmer cut to the correct height.
- Determine height by subtracting the exact beam depth from 97 1/8". 97 1/8" is the combined height of the studs, bottom plate and both top plates for an 8' wall. Use 109 1/8" for a 9' wall.
- Determine quantity of trimmers needed to match, or slightly exceed, the actual width of the beam.
- Nail cut trimmers together using 10d nails every 16".



- If the pocket is in the middle of a wall, add a king stud on both sides of the composite post. Insert shims next to beam as needed.

## POST CONSTRUCTION

- Complete beam pocket as instructed above.
- Locate the position of post base (if there is no concrete pier) by pulling a chalk line along the snapped red line and extending it out to the location of the post.
- Install Post Bases with concrete a Titan Anchor, and plate washer.



- Wrapped posts do not need a base as long as they are on a raised pier. If the post sits directly on the slab, the post base must be used to prevent rot.

To determine height of post:

- Set a 2x4 (at least 10') long vertically in the post base as a substitute for the post.
- Set the straightest 2x4 lineal you can find (a minimum of 12') horizontally in the beam pocket. Use an 8' level on top of the horizontal 2x4 to determine the correct height of the post. Where the bottom edge of the horizontal 2x4 crosses the vertical 2x4 draw a line to indicate the correct height of the post.
- Transfer this measurement to the actual post and cut it to size.
- Attach post to base with 16d nails (use galvanized nails where they are exposed to weather). Brace the post in two directions with lineal 2x4 as soon as it is erected.
- Attach post to beam with metal post capitals and 10d nails.

## BEAM INSTALLATION

- Be certain that glu-lam beams are installed top up (look for the label).
- Seat the entire width of the beam on the post.
- Seat the beam into the entire depth of the wall pocket.



- Install a vertical strap on the inside of the house on the end of the beam down to the beam pocket studs.



- Strap beam according to structural detail on plans.

## FLAT ROOFS



A **Parapet Wall** is a partial height wall consisting of a double top plate and a single bottom plate that is installed above the double top plate of the main wall to extend the height of the wall to form the vertical sides of the flat roof.

Parapet walls vary in height by design and location, please check your plans carefully.

Unless they are integral with the truss, build the parallel *Parapet Walls* before installing the trusses. Start your layout at the opposite end from any bastard spacing. Before the first truss is rolled, install that parapet wall, and then attach the first truss to it. Continue rolling trusses in the normal manner (see the Roof Framing Section for all details).

When building your parapet walls the double top plates should be 5 1/2" shorter on both ends than the top plate to allow the double top plate from the side walls to overlap onto the front walls.

The parapets above the bearing walls are created by the extended vertical truss tails, and have top and double top plates installed on top of the tails.

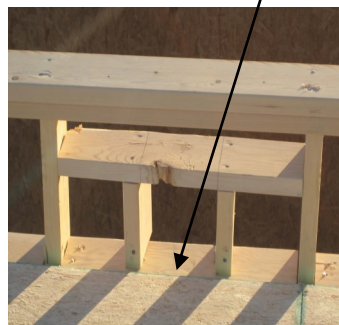
Fire blocking is required at the roof line on all parapet walls. For the parallel walls this is done with a 2x6 block placed in each bay at the height of the top chord of the truss.



For the bearing wall check structural details on your plans.

Once all blocking is complete sheath the roof deck with OSB.

Check your plans for scupper locations, and verify that they don't occur over a window or the electrical panel. If they do, move them one way or the other to eliminate the problem while keeping the spacing as even as possible. Install blocking in the parapet walls at the low end of the slope for the scuppers. The rough opening for the scuppers is 1" larger in both dimensions than the actual scupper, and the bottom of the opening is flush with the roof deck.



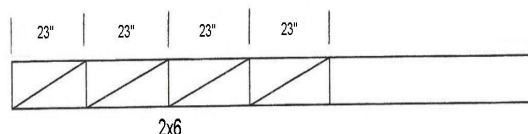
The next step is to sheath both the inside and outside of the parapet walls with regular OSB.

Verify the proper nailing pattern for the parapets on your plans, it usually is different from the main walls.



The final step in framing the roof is installing crickets. A cricket is basically a second roof of a steeper pitch built over sections of the main roof to funnel water to the scuppers.

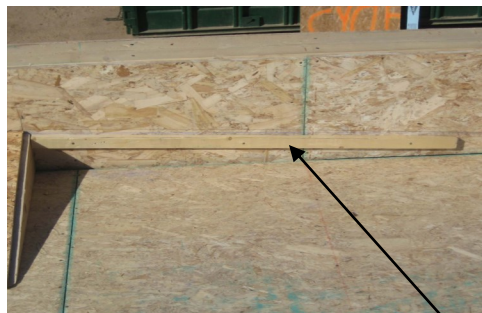
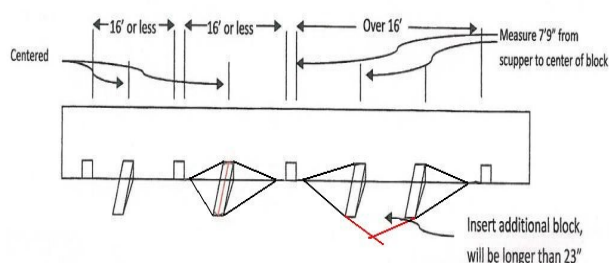
Start by laying out a 2x6 as shown below. First cut the diagonal and then the straight cut for each piece so that the board will be easier to handle while cutting. You will need 8-12 of these wedge shaped pieces depending on the scupper layout of your house.



Measure the distance between two scuppers, *leave the roof flat for 6" on either side of the scupper*. If the distance minus that 12" is less than 16', center the wedge block exactly in the middle. Use a square to make sure the block is perpendicular to the parapet wall.

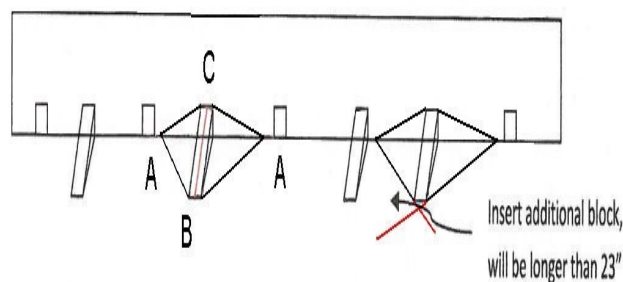


If the distance between scuppers minus the 12" is more than 16', measure 7'-9" in from each scupper and put the wedge blocks there. Find the location for the center wedge block by running a chalk line from each scupper past the wedge block. Where the chalk lines cross is the location of the middle block. This block will be longer than the standard 23" blocks and will need to be cut to fit.

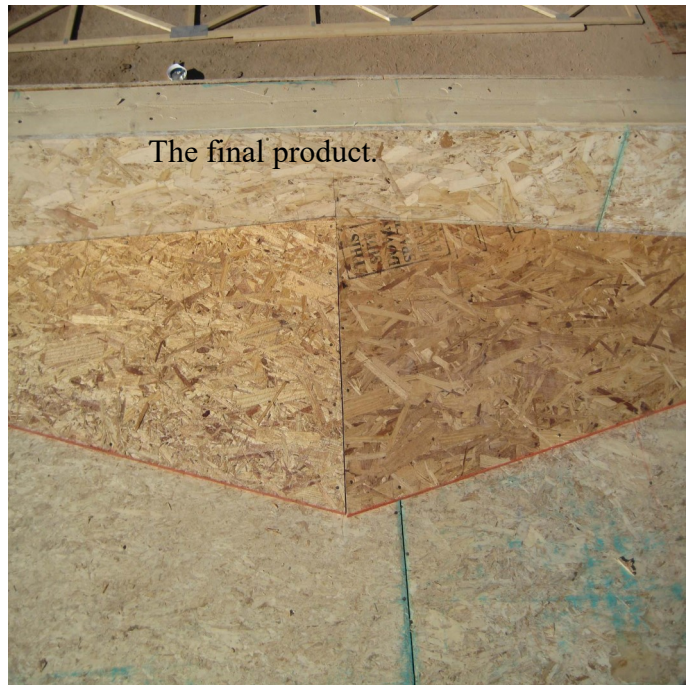
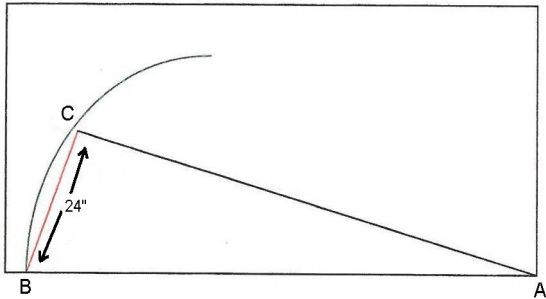


The last framing step is to rip 2x2 and attach it to the parapet wall running from the wedge block to 6" from the scupper, to support the upper edge of the sheathing.

Get measurements for the cricket sheathing by measuring from point A (the bottom corner of the scupper) to point B (the center of the front edge of the wedge block) and from point A to point C (the center of the upper end of the wedge block).



Lay out the cricket sheathing by marking the distance AB from the corner along the long edge. Again measuring from the corner draw the arc AC. Measure 24" from point B to where it crosses arc AC. Snap chalk lines between B-C and A-C. Cut out the triangular piece created by these lines, and it should be a perfect fit for your cricket.



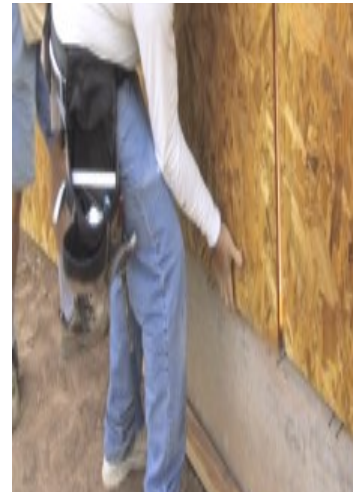
## SHEATHING

**Remember to install insulation in limited access areas and to install all needed straps BEFORE you install the sheathing.**

- First Step: Run a tape measure to determine at which end of the wall to start.
- One direction should line up with a stud at every 48".
- Line up the corner sheet of OSB so that the inside edge is centered on the stud. (The outside (corner) edge may or may not line up flush with the intersecting wall.)



- You will need to use either an OSB hanging jig (if available) or a pair of flat bars wedged between the concrete and the bottom plate under each sheet of OSB to support it while it is being nailed in place.



- Nail Schedule: 8d nails every 6" on the perimeter and every 12" in the field (except in **Shear Wall** areas which require closer spacings per your plans).
- Install OSB around the **entire** exterior of the house (leaving an 8d nail width gap at every joint), and completely check nail patterns.
- Nail the perimeter of window and door openings before cutting them out. Use 8d nails as specified.



## WINDOW & DOOR HOLES

Always use extreme caution to be sure the cutting tools do not hit anyone on the opposite side. Use a spotter to keep the opposite side clear of passer-bys.



- Use a spade bit to mark the inside center of all the corners.



- Use a reciprocating saw from the inside or a router from the outside to cut along the edges of the frame.
- It is helpful to have the spotter hold the OSB firm when making the last cuts to prevent excess vibration.

- Be sure OSB joints do not fall at edges of doors and windows. If necessary break the joint over the header.

## SPECIAL SHEAR WALLS

- Check the plans for details for the exact locations of shear walls required on the model house you are building.
- Per the detail, locate all extra fasteners required.
- Install nails at the special spacing required per plans.



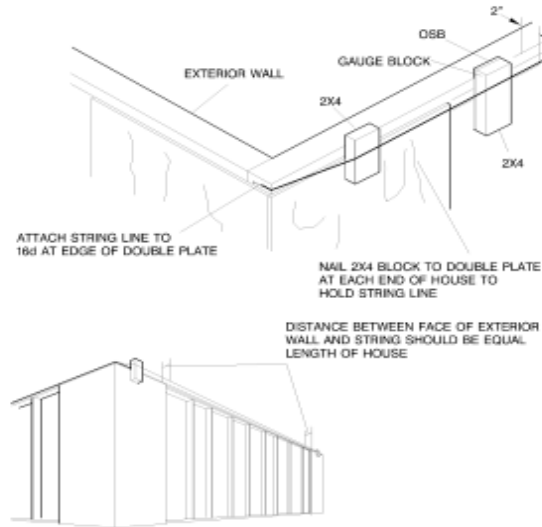
- Once sheathing is completed make sure all walls are vertical.

## STRAIGHTENING WALLS

1. Once all exterior corners have been plumbed, install a very taut mason's line (string) from one of the plumb corners to the opposite end. This line is usually held away from the wall by a small piece of 2x4.
2. The wall will be straightened at each location where an interior wall butts into the exterior wall and at any additional locations as necessary.
3. A piece of 2x4 of equal thickness, as described in step 1, is used to align the wall to the string by pushing the interior wall either in or out until the wall is the same distance from the string as it is on the corners.
4. Nail a lineal 2x4 brace diagonally to a stud on the wall from just touching the top plate of the exterior wall to the bottom plate of the interior wall. Nail the brace to several of the studs along the interior wall also. (Avoid installing braces that will interfere with setting trusses.).
5. Repeat step 3 at all locations.
6. The distance between braces should not exceed 10'. If a brace is needed where there is no interior wall, nail the lineal 2x4 to the side of a stud just touching the top plate and secure it to a 2x4 block nailed to the interior floor with a ramset (powder activated fastener). **NEVER in stall a 2x4 block nailed to the floor with ramset on any exterior or garage concrete.**

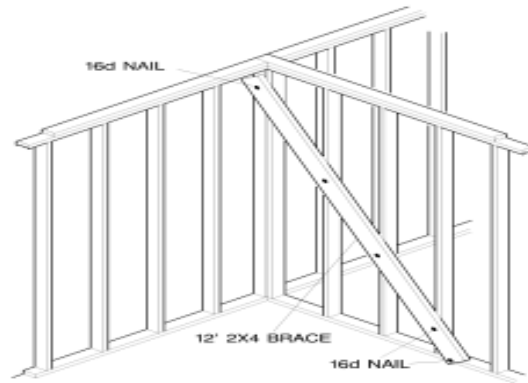
Freestanding walls may require additional bracing to hold them plumb while the trusses are being installed.

7. **To prevent wall movement leave interior braces in place until roof trusses and OSB sheathing have been installed and nailed off.**



An alternate method is to install the line over the top of the top plate with a nail 1" in from the edge at each end. Then adjust the wall as needed to achieve that 1" spacing along the entire wall.

#### BRACING INTERIOR WALLS



## FALL PROTECTION

OSHA (the Occupational Safety and Health Administration) has revised safety requirements for all residential work done by anyone working more than six feet off the ground, but not on ladders or scaffolding. These changes apply to us in the following ways.

### Safety Railings for 2 Story Houses

Before installing floor decking on a two story house a guard rail must be installed around the exterior perimeter and around the stairway opening.

The guard rail is to be made from 2x4 material. The uprights are to be made from studs nailed flat to first floor studs @ 4' o.c., and the horizontals are to be made from lineal nailed to the uprights. The top rail must be between 36" and 42" above the deck, and the lower rail at 18". Make sure that the uprights are nailed into the studs, not just the sheathing, and into the floor truss ribbon after it is installed.

### Roof Guards

All pitched-roof houses that we build will require the installation of roof guards (safety rails). The guards must stay in place until **ALL** roof work (including painting and tarring protrusions) is completed.

**See the Roof Framing chapter for detailed procedure and installation instructions.**

## SCAFFOLDING

**You must erect scaffolding before starting any second floor framing.**

If you are building a one story plan, please skip ahead to the section on rolling trusses.

For two story plans, please continue on in this chapter.

# Safety is our number one priority!

Scaffold safety falls into three categories; **Assembly/disassembly, Maintenance, and Use.**

## ASSEMBLY

**Assembly is the most critical stage in our use of scaffolding.**

**If this is not done correctly the scaffolding will not be safe.**

Our scaffolding consists of the following parts, all of which must be assembled and used correctly for the system to be safe to use:

**Frames** (usually green)– the load bearing vertical tubular assembly.



**Braces** - We have three types of braces:

**Long Straight** for the sides,

**Short Straight** for the ends (both of which also serve as railings),

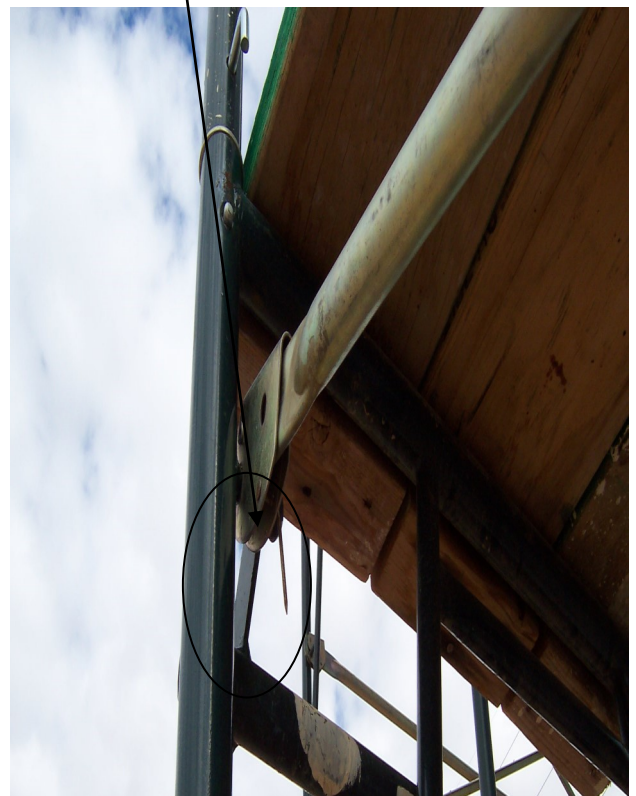
**X-bracing** for the sides.

**On ground level frames the straight brace goes in the lowest possible position inside.**

On the second level and above it always goes in the highest possible position on the inside.

On all frames the x-brace goes on the outside.

***Always lock all clips in place when assembling by using 8d nail through hole!***



**Planks** – the wooden boards we walk on. For safety there should be a pair of cleats installed at one end to help secure the planks to the frames.



**End safety bars** – to keep people from walking off the end of an upper run.



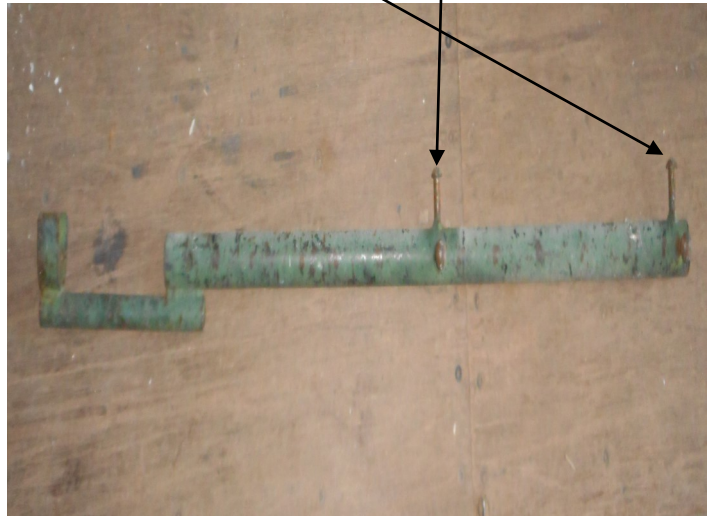
**Adjustable feet** – to allow the frames to adjust closer to the contour of the land and keep scaffolding level.



**Pads** (also called sills)– wooden bases (usually cut up planks) to fine-tune the frames to the contour of the land to assure the verticality and stability of the entire assembly.



**Railing supports** – used on the top level only. Must always have both upper and middle railings attached in all positions.



**Connectors** – used to connect stacked frames. At the time of disassembly these are clipped in the top of each frame.



**S-clips** – used to hold the adjustable feet into the bottom level of frames.





**Gravity clips** – used to attach the bottom of upper level frames to the connectors in the frame below.



**Ladders & brackets** – to be attached at the open end of scaffold run to allow access the upper levels.



**Assembly must be led by a qualified person,** and if possible under the direction of a trained Site Supervisor. Only people extremely comfortable with heights and in good physical condition should be involved in the off the ground assembly process.

Begin assembly by putting two feet into a frame and standing the frame in place with the leg closest to the house 12” away from it. Put one pad under each foot. There must always be a pad under every foot unless it is setting on concrete.



Please note the proper placement of the horizontal bracing in the photo above. On the first level it is low and on the second level it is high.

If the frame leans into or away from the house, raise the short side by one of the following methods: extend the foot to the next level, insert another pad, or use a sheet goods shim between the pad and foot. Once the frame is vertical, position a second frame assembly and install a straight brace for spacing purposes. Once the second frame is vertical, install the x-bracing. Continue this procedure for the entire length of the run. Once the run is completed install planks on top of the frames. Always install all three planks in every section. Install a ladder at one end of the run.





Attach the second level of frames and braces to the top of the first. Install clips in all locations. Before installing planks, attach frames to house per the following guidelines:

Using eyebolts and multiple strands of wire (tie wire or heavier) attach the two end frames to the house. The bolts should be placed at the level of the frame header. If the distance between the anchors is greater than 25', install a third anchor to the frame closest to the middle of the run. Install second level planks, ladder and end safety bars. Other than in exceptional circumstances, there will not be a third level, but if there is, the procedure is the same as for the second level (including anchors).



Please note in the above picture the proper tying together of two scaffold runs at a house corner.

Install railing supports and railings. Double-check everything! Move on to installation of next run. Whenever possible install runs so that it is possible to walk directly from one to another without have to climb down and back up.

When all runs are installed double-check everything.

It is recommended that where possible access to the upper level is obtained from a second floor window rather than climbing the scaffold ladders as it is usually safer for our inexperienced volunteers.



When in use, allow no more than two people per section per level.

Never leave anything setting on the scaffold.

Never carry anything when climbing the scaffold ladders.

## MAINTENANCE

At the start of each workday the scaffolding must be inspected. This inspection should be done by the Site Supervisor (when available) and the House Leader. This must be done before any volunteers use the scaffolding. If any problems are found they must be fixed before anyone is allowed on the scaffolding.

## SCAFFOLDING USE

**Only persons comfortable doing so may be allowed on the scaffolding.**

***Nothing* (tools, materials, etc.) is to be left setting on the scaffolding.**

***No parts may be removed “for convenience” of the users.***

**Both hands must be free to use when climbing the ladder**

**Use care and common sense at all times!**



## SECOND STORY FRAMING

### LAYOUT

- Layout for floor trusses is done in the same manner as for roof trusses.
- Trusses are installed 24" o.c. (unless otherwise specified). Using a 100' tape, lay out both load bearing surfaces identically. The bearing surfaces may be exterior walls, interior walls or

beams depending on the model house you are building. See your floor truss layout for exact layout, including any abnormal (bastard) spacings.

- **Prior to installing the trusses check to ensure that the corners of the building are plumb and the walls are straight.**

## FLOOR TRUSSES & DECK

Trusses are placed per the layout and nailed to the double top plate using two 10d nails placed inside of the two end verticals.



For installation safety use temporary braces across the truss tops as we do on the roof trusses and then install the 2x4 ribbon to each truss with two 10d nails.

Our decking is  $\frac{3}{4}$ " tongue and groove plywood. Start installation with a tongue edge along the outside wall. Decking is laid perpendicular to the framing members when possible. In a plan where the framing members run both ways in different areas, run perpendicular to the larger area if possible. The decking is attached to the floor trusses using deck adhesive and deck screws or 8d ring shank nails.

Run a bead of deck adhesive on top of all contact surfaces before permanently setting the sheet of decking in place. A screw or nail is required every 6" along each joist.

Make sure all anchors are driven tightly or it will result in a squeaky floor.

As you are installing a piece of decking **Do Not Install** the last row of anchors until after the next piece has been seated. This is because you may have to lift the edge of the attached

piece to get the tongue and groove aligned. The sheets of decking almost never seat easily. Use a piece of scrap 2x as protection for the tongue or groove on the far end before pounding the sheet into place with a hammer.

If the floor trusses aren't quite centered on the edge of the decking, you can adjust them in the same manner as we do for roof trusses by using a stud as a lever. As with roof decking, avoid pieces less than 48".

## SECOND STORY WALLS

After work on the decking is completed, lay out the second floor wall locations on the deck in the same manner that the first floor walls were laid out on the slab. The safety rails will prevent a wall from accidentally slipping over the edge as it is being raised and positioned. Remove the safety rails only after all exterior walls have been installed and nailed off.

Build and sheath each exterior wall section before carefully standing it in place. Walls with OSB attached are extremely heavy. After standing the wall up, but before moving it into place, install a couple of horizontal pieces of scrap 2x4 to use as handles. Install these handles about 1/3 of the way up the wall and use them to help control the wall as it is moved into position. Even more than with ground floor walls, you will need extra people to help move the second floor walls into place. Attach the wall to the deck using a 10d nail driven into the structural ribbon 1" in from the edge at 16" O.C. If the nails drive too easily you have probably missed the ribbon. Try installing another nail closer to the outside edge of the bottom plate. Get the first section plumb and then brace it to the deck using 2x4 lineal (in the same manner the lower walls were braced to

the slab). Stand the second section, attach it to the first section using 3-10d nails every 16" and to the deck, plumb the loose end and then brace it to the deck. Continue with each successive exterior section around the house. Only after all the exterior panels are up should the interior walls be constructed and erected.

After the exterior walls are in place, fill in the gap between the first and second floor sheathing with 8' long strips of OSB. The nail pattern here is 8d nails at 6" O.C. around the perimeter.

Any windows with sills less than 36" above the deck will need to have a 2x4 safety rail nailed across them at 36" above the deck. These rails may be removed as soon as the scaffolding is installed.

You will need to create second floor access for the delivery of your sheetrock. Depending on your plan and where at your site the boom truck will be able to get to the house you will need to remove the OSB from one bay at that location. *If you have a window opening that is more than 4' high and in the right location, you may load through it and skip this step.* Remove the 8d nails from both studs (and those in the plates between them) and then cut vertically down the center of each stud. After removing the access panel re-nail the sheathing edges with 8d nails at 6" O.C. **Save the piece of OSB to reinstall after the sheetrock is delivered.**

## STAIRWAY DESIGN

The following five rules are commonly used when designing stairs. *Tread* depth does not include the *nosing*.

1. The sum of one *riser* and one tread should be between 17" & 18".
2. The sum of two risers and one tread should be between 24" & 25".

The height of the riser times the depth of the tread should be between 70" & 75".

4. The angle of the stairway is between 30 and 38 degrees.

5. 7 3/4" maximum rise and 10" minimum run.

If your stairway meets all five of these guidelines you will have a comfortable and functional stairway. People subconsciously measure the first couple of steps and assume all of the rest are the same. All of the risers and treads in a stairway must be the same for both comfort and safety.



In any stairway the number of treads will be one less than the number of risers. The width of the tread should be a minimum of 36". Wider is better, especially in L or U shaped stairways that have a turn to negotiate at the *platform* (the flat area between floors). Only the floor at the top and the bottom of each story, where each flight of stairs begins or ends, is correctly called a *landing*.

The handrail height should be 36" at rake and 42" on the flat. Support brackets cannot be more than 48" apart. There must be a return (the rail turned perpendicularly into the wall) at each end of all rail runs.

## STAIRWAY CONSTRUCTION

Once the riser and tread sizes have been determined, it is time to lay out the stringers. Verify that the as built total rise equals the design and adjust riser size as required. Remember to take any difference in the finished flooring thickness into account. Also, the bottom rise will be a tread depth less than the others, and the top tread will be the riser thickness less.

**There will be three stringers per flight and accuracy in laying out and cutting is imperative.** Use a sharp pencil and make sure that the lines meet on the edge of the stringer stock. When using the framing square to do the layout, accuracy can be assured by using *framing square clips* clamped to the square's *blade* and *tongue*.

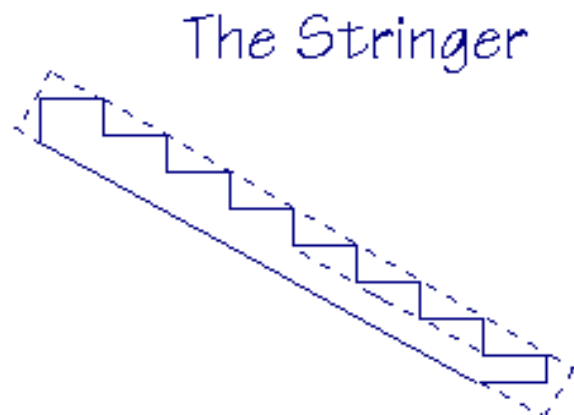
Place the stringer stock flat on top of sawhorses to make the layout. Begin at the end of the stock that will be the top and hold the framing square in the position shown in the following drawing.

Let the blade (that's the longer side), represent the treads and the tongue represent the risers. For example, if the risers are 6.75" align that mark on the outside edge of the tongue with the edge of the stock and if the treads are 11" also align that mark on the outside edge of the blade with the edge of the stock.

Draw a line along the outside edge of the blade and tongue. Now move the square down the stock to the next position and repeat. Continue stepping off with the square until the required numbers of risers and

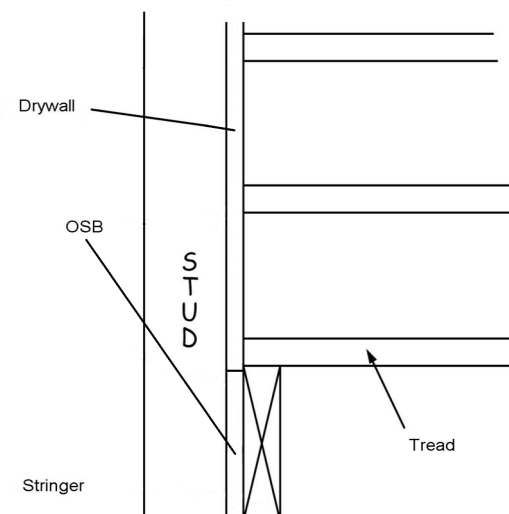
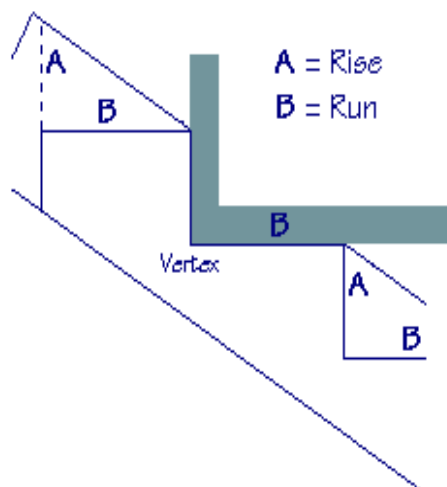
treads have been marked.

The completed layout should look something like the following drawing.



The stairway begins with a riser at the bottom, so extend the last tread line to the back edge of the stock. At the top extend both the last tread and riser lines to the edge of the stock.

One other adjustment must be made before the stringer is cut. Because we need to account for the thickness of the tread, we must shorten the bottom riser by that amount. Also the top tread will be the riser thickness less.



Cut the stringer out of the stock being careful not to over cut any of the lines as this would weaken the stringer.

Check your plans for proper details for top and bottom stringer attachment.

Before installing the stringers, attach a 3/4" OSB strip to the studs along where the lower outside edge of the two outside stringers will be. When the stringers are installed, this will create a space between the stairs and the walls into which the drywall will slide.

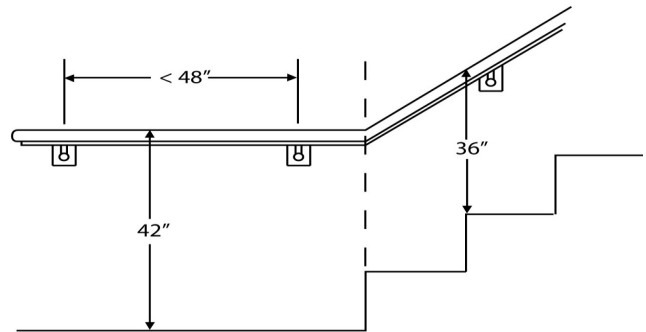
Install the risers next so that they will fit behind the treads. **Remember to cut riser 1/8" shorter than stringer riser height.** Having the riser behind the tread allows the joint to be reinforced by gluing and driving screws through from the back of the riser into the tread. The joint between the top edge of the riser and the tread is also glued and screwed.

If the tread is at least 11" it is not required by code to have a nosing (overhang). However, ***we will have a nosing on all stair treads.*** The nosing must be between 3/4" and 1 1/4".

To prevent warping of a freestanding stairway wall, use a U-shaped riser/gusset combo, as shown above right.

Install 2x6 blocking for the rail brackets @ centerline 42" above the platform and 36" above the nose of each tread.

The handrails will be installed during the Trim Phase of construction, and the instructions are located in that section.



## SHEAR BOXES

If your house model has shear boxes between trusses above a shear wall, now is the time to build them.

The boxes will be 22 3/8" wide, unless there is an odd truss spacing, and the height will be the same as that of the truss (from the bottom of the bottom chord to the top of the top chord) at that point. Make the top and bottom 2x4 the full width, and make the vertical 2x4s 3" shorter than the full height. Remember to cut the tops of the vertical

2x4s to match the slope of the roof (i.e. 18 1/2 degrees for a 4/12 slope).

Sheath the frames with roof decking, and be sure to place the radiant barrier so that it is facing into the house attic not the garage attic, if the frames are located there.

Nail pattern: same as for the shear wall directly below the boxes. Usually 8d nails at 6" o.c., but check your plans.

Set the completed boxes aside, to be installed as the trusses are being rolled.

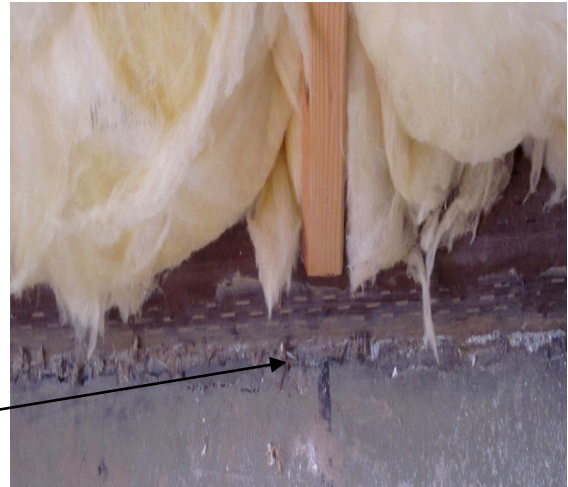
## SEALING THE AIR ENVELOPE

There have been changes made to the EnergyStar and LEED air tightness requirements, however, our current procedures cover all of the changes.

We will run a bead of caulk along the 2x framing/OSB contact point at only the following location: Where the OSB joins a bottom plate.

*The caulk must fill all gaps. It does not need to be smoothed in place.*

We must run a bead of **Liquid Nails** along the joint between the concrete slab and all exterior wall bottom plates. *Be sure not to run this bead across door openings.*



## TUB BLOCKING



- Install blocking between each wall stud at the top edge of tub surround.
- Center the 2x6 blocking @ 73" above finished floor. (This allows you to attach the tub and the drywall to the same block.)
- Install the blocking flush with the inside of the wall.
- Install a full stud at both vertical side flanges, as needed. Center @ 31" from back wall.
- After the plumber has finished *top out/rough plumbing*, verify the flange was properly attached every 8" using washer head screws.