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Note to the Reader: Due to differing conditions, tools, and individual skills, the authors of this manual and Charlotte Region Habitat For Humanity assume no responsibility for any damages, losses incurred, deaths, or injuries suffered as a result of following the information published in this manual. Although this manual was created with safety as the foremost concern, every construction site and construction project is different. Accordingly, not all risks and hazards associated with homebuilding could be anticipated by the authors of this manual and Charlotte Region Habitat for Humanity. Always read and observe all safety precautions provided by any tool or equipment manufacturer, and always follow all accepted safety procedures. Because codes and regulations are subject to change, you should always check with authorities to ensure that your project complies with all local codes and regulations.

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This Section Includes

- Proposed schedule and crew assignment
- Task Lists Safety Review
- Tool, Equipment and Material List Material Description

Schedule: Floor Framing - 1 Day

Floor Framing is not part of the regular Habitat volunteer schedule, however, some crews may be asked to help with this stage of building. This work is typically done on weekdays the week prior to framing.

Crew Assignments

Crew assignments will vary depending on task. Typically, 12-15 people build a wood floor.

Floor Framing Safety Guidelines

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

“NO JOB IS SO IMPORTANT THAT IT CAN’T BE DONE SAFELY”

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

Know where water and a first aid kit are located. Tell the site supervisor immediately in the event of an injury.

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

Habitat requires hard hats during floor framing.

Refrain from walking on floor joists. Watch your footing. Don’t accidentally step on joists that have not been secured at each end.

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

Power Saws:

- Only crew members with power saw experience can use them. A busy work day is not the time to teach saw skills nor is it the time to learn saw skills.
- Habitat requires that ear and eye protection be used when using power saws. Don’t bind the
blade of any saw – listen for it. Back off and resupport lumber. Keep electric cords out of the way of the saw and out from underfoot.

- Don’t cross hands over to stabilize material on the miter saw. Find another way or get help.
- **Guards** on saws must be in place & operating.

**Nail Guns:** Though most nail guns are prohibited at Habitat, under certain conditions framing guns are allowed for the sub-floor. Habitat Charlotte’s policy regarding nail guns is as follows:

- crews need the **site supervisor’s approval** before using nail guns.
- Nail guns are dangerous and only **experienced** crew members should use them.
- crews should hand nail framing material in place so nail gun use is limited to one or two qualified users. It should not be passed around for general use.
- All **manufacturer’s safety precautions** must be followed, including eye protection.

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

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

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

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

**Think** & concentrate on your task.

**If you are uncertain about how to do a task, or how to operate a power tool, ask your leader.**

### Task List - Floor Framing

#### Staffing

House Leader Prep Task Leader
10-13 Additional Volunteers

#### Tasks to Be Completed and Crew Sizes

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Crew Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set sill plate</td>
<td>2-3 people</td>
</tr>
<tr>
<td>Set band joists and half of center beam</td>
<td>2-3 people</td>
</tr>
<tr>
<td>Set joists on one side of house</td>
<td>1 crew</td>
</tr>
<tr>
<td>Set ledger strips</td>
<td>2 crews of 3</td>
</tr>
<tr>
<td>Double up center beam &amp; band joists (where required)</td>
<td>2-3 people</td>
</tr>
<tr>
<td>Set remaining joists &amp; ledger strip</td>
<td>1 crew</td>
</tr>
<tr>
<td>Install subfloor</td>
<td>1 crew</td>
</tr>
</tbody>
</table>

#### Quality Checkpoints
Floor Framing Tool, Equipment & Material List

Tools Each Layout Crew Member Will Need

- Hammer (16 oz. Minimum)
- Nail Apron
- Measuring Tape (16' Minimum)
- Square (Speed or Combination)
- Two Pencils
- Safety Glasses
- Hard Hat
- Work Gloves
- Water

Tools Each Layout Crew Will Need

- Measuring Tape (20')
- Drywall Square (4')
- Chalk Line (Red Chalk)
- 12 Gauge Drop Cord (50')

Tools and Equipment Needed On Site

- Ear Protection/Glasses/Hard Hats – extra 100' Drop Cord
- 50' Drop Cord
- 4-Way Electrical Box
- Circular Saw (7¼” with extra blade)
- Electric Miter Saw (10” or 12”)
- Hand Saw
- 100' Measuring Tape (30' Minimum)
- 4' Level Framing Square
- Chalk Boxes (blue)
- Red and Black Felt Markers (wide)
- Two Red Lumber Marking Crayons
- Handy Bar/Crow Bar
- Cats Paw (Nail Puller)
- Wood Chisel
- Sledge Hammer
- Siding Snips Broom
- Saw Horses (Two Pair)
- Saw Table (Optional)
- Joist Framing Plan
Layout Material List

Lumber
Treated 2x6 Sill Plate
2x10 Band Joists (block walls)
2x12 Band Joists (pier & curtain walls)
2x12 Center Beam
2x10 Joists
2x2 Ledger Strip
3/4" Tongue & Groove OSB

Nails/Screws/Bolts
16d Nails
8d ring shank Nails
Cut Nails

Other
Construction Adhesive (1 qt. per 2½ sheets plywood)
Caulk Gun Chalk (blue)

Floor Framing Material Description

Treated Lumber
Pressure treated lumber used directly next to any concrete block

Assorted Lengths of 2x4s/2x6s
Used for sill and top plates of walls

Construction Adhesive
Heavy-duty adhesive in paper tubes, used with caulk guns for applying OSB sheathing

Nails and Fasteners
16d nails
8d ring shank nails
Concrete nails (cut nails)
General Instructions For Floor Framing

Building the Wood Floor

Charlotte Region Habitat for Humanity typically builds homes over a concrete slab. In some cases, as governed by the terrain a house may be built on block walls. When homes are build on block walls foundation. After the masons have finished laying the foundation, the wood floor can be built.

When a home is built over a wood floor it is advisable that all the crawl space have all the ground cover mix spread out and is properly set up.

When building a 2 story home, the 2nd floor framing is exclusively floor truss construction. The floor trusses come in a package with the roof trusses and are installed according to the truss design. Floor trusses vary from full-span, to partial span (having an interior load wall in addition to both exterior walls), to girder bearing, wherein a series of floor trusses will span from one exterior wall to "hang" from another interior floor truss designed to take the load. Given the complexity of floor truss construction, it is best to leave installation decisions to a site supervisor. Supervisors all know floor truss installation is one task that requires their full oversight and cannot be delegated. It is typically more complicated than roof truss installation.

Block Walls

Setting the Sill Plates - Block Walls

Place treated 2x6 sill plates so that they are flush to outside block. Place sills such that end grain is “cup side down” (a “frown”). Use as many full length 2x6s as possible. Sills must be drilled to fit over the anchor bolts that were installed by the mason. Each sill plate needs a minimum of two bolts, with one being within in 12” of each end. Place joints accordingly.

Use one galvanized cut masonry nail in every concrete block. To keep the sill from cupping, stagger the nails within 1” of each edge of the block. Do not nail or place joints above vents, where the masonry is fragile.

NOTE: It may be necessary to make slight adjustments due to errors in block work. See the site supervisor if this is the case. If the house is out of square, compensate by adjusting the sill plates. (Check for square by pulling diagonals.) Do not move the sill plates more than ½” on any side.
Treated Lumber and Nails

Hot dipped galvanized nails must be used whenever nails come in contact with treated lumber. This is true for all phases of construction.
Detail of Floor Framing - Block Wall

ONE HALF OF THE NOTCHED (2) 2x12 CENTER BEAM

(2) 2x10 BAND JOISTS

(8) 16 BLOCK PIER (TYF)

2x10 BAND JOIST

CONCRETE BLOCK FOUNDATION

TYPICAL BLOCK FOUNDATION

NAIL THROUGH BAND JOIST WITH 4 16d NAILS IN EACH 2x12

(2) 2x12 CENTER BEAM NOTCHED TO SIP ON SILL PLATE

2x10 BAND JOIST

2x10 SILL PLATE

2x10 JOIST

2x10 JOIST

2x10 JOIST

2x10 JOIST

2x10 JOIST
Set the Band Joists - Block Wall

Chalk a line around the house $\frac{1}{2}''$ in from the outside of the sill plate. (This $\frac{1}{2}''$ allows the exterior sheathing to install flush with the block.) Nail 2x10s, around the perimeter of the house with the outside edges falling on the chalked line. Toe nail using galvanized 16d nails 12'' o.c. from the outside as there is more wood for the nail to grab. Treated lumber and galvanized nails are used where concrete porches will come in contact with a band joist.

Chalk lines $\frac{1}{2}''$ from edges of sill plates for band joists.
On all interior piers, put a scrap piece of treated 2x6 to shim the top of the pier to the same level as the top of the sill plate. A string line can be used to verify that the piers are at the correct level. Do not nail until the center beam and half the joists have been set. (This block will later be adjusted to be exactly centered under the beam.)

Band joists that come in contact with masonry are made of treated lumber and nailed with galvanized nails. Use treated lumber at the side door as well as the front porch.

Place a treated 2x6 block on top of piers. Use a string line to verify that this brings each pier to the correct level. (Have you set trusses on a house where cap plates had to be notched because the floor bowed?) Do not nail yet.

Block is “frown down” to prevent cupping. Block is centered under center beam after beam and joists are installed.
Double the Band Joists at Crawl Space Door - Block Wall

Double up the band joist over the crawl space opening (approx. 5') if it is on a wall perpendicular to the joists. (Walls parallel to joists will be doubled in their entirety at a later time.) Scrap pieces of 2x10 can be used. Nail with a staggered pair of 16d commons, 8" on center. Joist hangers will be needed for joists at this location.

“NO JOB IS SO IMPORTANT THAT IT CAN’T BE DONE SAFELY”

Power Saws:

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

Double the band joist over the crawl space door if it is on a wall perpendicular to joists. (Shown here with joists in place.)

Treated band joist at front porch.
Flash Front Porch

With galvanized siding nails, install galvanized flashing between the treated band joist and the front porch. Nail every 12” along the top of the band joist. Turn the flashing under about 4” to place it under the concrete.

Place galvanized flashing between the porch, which will be poured with concrete, and the treated band joist.

“NO JOB IS SO IMPORTANT THAT IT CAN’T BE DONE SAFELY”

Refrain from walking on floor joists. Watch your footing. Don’t accidentally step on joists that have not been secured at each end.
Notching Beams and Joists

When it is necessary to notch a beam or joist, make the notch as small as possible. To maintain the material’s structural integrity, and to pass code, notches may be no more than $\frac{1}{6}$ the depth of the material. Care should be taken not to overcut the notch. Use a handsaw for finishing the notch.

Set Half of Center Beam

Check the exact location of pier centerlines and center the beam accordingly. The beam must center on the piers for even load distribution. Do not nail the block into place yet, because it needs to be re-centered after the center beam is in place.

Cut one 2x12 center beam to sit on top of the piers. If necessary, notch the ends so that it sits on top of the sill plate, centered over the piers. Set this center beam parallel to the long side of the house. This is important since it will make cutting joists easier. End nail through the band joist with a vertical row of four 16d nails.

“NO JOB IS SO IMPORTANT THAT IT CAN’T BE DONE SAFELY”

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

A kerf is a saw cut that relieves a bowed board. Once a kerf is cut in a board, treat it like a splice for code purposes (i.e. bear 4”).

**Crown Joists**

Put crown marks (see photo) on the convex sides of all joists and beams prior to installation. They will be installed crown side up. Cull out any joists with more than a 3/8” crown.
Mark for Joist Layout

On the band joist and center beam, mark for joist layout according to the joist layout plan. Double check plan for extra joists and special blocking.

Set Joists on One Side of House

Starting on the side of the house with the longer joists, measure back to front and mark 16” o.c. for placement of the joists. (End nailing long joists is preferable to toe nailing.) Measure the joist length and cut enough 2x10 joists for one side of the house. (If the center beam is set parallel, they should be the same length.) These should be nailed through the band joist and center beam with four 16d nails (total 8 nails per joist.)

Block Walls: Nail joists flush with the top of the center beam but set directly on the sill plates.
Extra Joists and Blocking

If joists are laid out according to the joist layout plan, it will be easy to avoid placing a joist where the toilet(s) or tub drains or HVAC return will be located.

When blocking for the HVAC return, the joists supporting the header must be doubled. End nail the header before the joist are doubled. Joist hangers must be used. All doubled joists must be nailed together with 16d nails, alternating top and bottom so there is a nail every 8".
Blocking for HVAC Return.

Doubling Joists - Nailing Pattern

* HANGERS CAN BE USED OR END NAIL WITH 4 16D NAILS

Detail of HVAC blocking.

Blocking per joist plan.

Joists that fall over bolts will have to be notched but do not remove more than 1/8 the depth of the material (1 1/8” max for 2x10). Use a handsaw so as not to overcut the notch. Excessively long bolts should be cut off.

Special notations, such as “extra joint” are made very visible when laying out joists.
Ledger Strips
Set Ledger Strips on Center Beam

Nail 2x2 ledger strips to each side of the center beam under the joists as the joists are being installed. Be sure to push the 2x2 tight against the joists and attach with three 16d nails at each joist.

If one person will use a hammer to place the ledger strip tight to the underside of the joist, it will be easier for the second person to nail the ledger into place with 3 16d commons.
Joist hangers are used at the crawl space door if it is on a wall perpendicular to joists.

Ledger strips get three nails under every joists.
Double the Center Beam

Double up the center beam with another 2x12 after one side of joists have been completely nailed. Attach with pairs of 16d nails, alternating top and bottom so there are two nails every 8”.

Set the Remaining Joists and Ledger Strips

Mark 16” o.c. for the remaining joists. Measure the length of each joist as this distance may vary slightly. It is helpful to mark the joists with numbers in the order that they will be placed.
Toe nail to the center beam with 4 16d nails and through the outside band joist as before.
Look at the floor plan of the house. According to building code, all walls that lie parallel to the joists must be within 2" of a joist. If this is not the case, add joists as necessary. Add joist blocking, or a joist parallel with and under all interior walls to prevent squeaking. Blocking consists of 2x10’s placed 2’ o.c. end nailed with four 16d nails.

**Double the Band Joists**

**Double Band Joists - Block Wall**

Double up the band joist on the two exterior walls that are parallel to the joists. This provides support for the walls. Scrap pieces of 2x10 can be used. Use the same nailing pattern as above.

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**Nail Guns**

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

Though most nail guns are prohibited at Habitat, under certain conditions framing guns are allowed for the sub-floor. Habitat Charlotte’s policy regarding nail guns is as follows:

Crews need the site supervisor’s approval before using nail guns.

Nail guns are dangerous and only experienced crew members should use them.

Crews should hand nail material in place so nail gun use is limited to one or two qualified users. It should not be passed around for general use.

All manufacturer’s safety precautions must be followed, including eye protection.
Install the Subfloor

3/4” tongue and groove OSB is used for the subfloor. A ½” liberal bead of petroleum based construction adhesive must be applied to each joist before installing the OSB.

- Use at least one quart of adhesive for every two and a half pieces of plywood.
- Don’t let the glue person get more than two sheets ahead of OSB installation
- Use a double bead on joists that catch the ends of two pieces of sheathing.
- Guard against glue setting up before sheets are fully nailed. Be particularly careful on hot days.
- Crew should complete nailing pattern as soon as board is into position.

Lay each piece of OSB perpendicular to the joists. Begin first piece with tongue side away from the house. If the piece does not end in the center of a joist, it will be necessary to force the joist over before nailing. (“Persuade” all joists to stay 16” o.c..) This can be done easily by someone who sits in between two joists and pushes the trouble joist into position with his/her feet.

Nail each piece of OSB with ring shanked nails, 5 nails along middle joists and 7 nails on each end. Galvanized nails must be used where sheathing is nailed into treated band joists. You may find it helpful to chalk lines (use blue chalk) before nailing.

When beginning the second course of subfloor, keep these guidelines in mind. The tongue side should fit inside the groove, but should not be perfectly tight. Use a sledge hammer and a buffer board (scrap 2x4) to encourage the OSB.

Stagger your seams by 4’ (three joists apart). The subfloor should come to the edge of the outside of the band joist, so when you get to the end, it most likely will be necessary to use small strips of OSB.
Mark the OSB for 16" centers.

Apply a liberal bead of construction adhesive to each joist before OSB is put in place.

Forcing a joist to stay 16" on center until it can be nailed.

Joints in OSB occur in the center of joists.

Protect tongue and groove by using the sledge against a 2x4, and not the OSB’s fragile edge.
OSB subfloor installed perpendicular to the joists.

Stagger seams 4" on center (every three joists)

Joists 16" on center

Use 8d ring Shank nails:
5 nails along middle joists
7 nails on each end
Galvanized nails if into treated lumber

Apply construction adhesive before nailing
(1 qt for 2-1/2 sheets)
Step 1. Place OSB into position after glue has been applied to joist.

Step 2. Drop board into position.

Step 3. Use a scrap of 2x4 and a sledge to persuade tongue and groove together.

Excess OSB can be trimmed flush with band joist after it is installed. In this case, a strip of OSB will be added along the edge to bring it flush to the band joist.