

## Chapter 17

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**Tools needed by volunteer:**

[Nail apron](#)  
[Pencil](#)  
[Square](#)  
[Tape measure](#)

**Materials needed:**

[Depends on Task](#)

**Tools and equipment needed:**

[Depends on Task](#)

[Personal Protection Equipment](#)

[Safety glasses \(required\)](#)

## **17.1 ZERO-GRADE CONSTRUCTION**

1. [TBD at a later date.](#)

## **17.2 GARAGE CONSTRUCTION**

### **17.2.1 Establishing Chalk Lines**

1. [Measure in 3½” from the outer edge of the garage’s foundation back wall and make a mark. Repeat the process at the opposite end of the foundation’s back wall.](#)
2. [From those marks on each end snap a blue chalk line.](#)
3. [On each end of the back wall measure from the chalk line to the outer edge of the front wall. If one side of the foundation is longer than the opposite side, split the difference to maintain a rectangular structure. It is best practice for the wall plate to slightly \(¼” maximum\) overhang the foundation wall rather than it being inset. This may mean the garage dimension is slightly larger than the dimension on the House Plan.](#)
4. [Once again, measure from the back wall chalk line to the front. Using the dimension established in Step 3, subtract 3½” from that dimension and make a mark. Repeat on the opposite end.](#)
5. [From those marks on each end snap a blue chalk line. Measure from chalk line to chalk line on each edge of the wall; they should be the same. If they are not, adjust one of the marks and re-snap with a red chalk line.](#)
6. [Measure from the point where the garage back wall intersects the house wall to the outer edge of the garage side foundation wall. Repeat the same process at the garage front wall. If one side of the foundation is longer than the opposite side, split the difference to maintain a rectangular structure. It is best practice for the wall plate to slightly \(¼” maximum\) overhang the foundation wall rather than it being inset. This may mean the garage dimension is slightly larger than the dimension on the House Plan.](#)

[NOTE: When measuring from the house wall, make sure the measurements are taken from similar surfaces. The house wall by the garage back wall may have 1” foamboard on it; if not, add a scrap piece before taking the measurement](#)

7. Subtract 3½” from the dimension established in Step 6 and make a mark on each edge of the side wall.

### **17.2.2 Measuring and Cutting Wall Plates**

1. Before cutting the wall plates, consult the Plate Layout Drawing for pre-defined plate lengths (hand-drawn on the printed plan).
2. Most top plates will be sized to place the free ends of the plates over a window or door header.
3. Some plate lengths will be shown with a (+/-) designation. This means that a standard-length 2x4 can be used without cutting. Other pieces will be shown with an exact length. They should be cut precisely to that length.
4. The length of the last piece necessary to extend to the other end of the garage wall is typically not specified because of possible differences between the House Plan and actual garage size. Measure and cut these pieces to fit.
5. The top and bottom plates for the front wall of the garage are different because of the overhead door. The bottom plate does not extend the full length of the wall; instead, there are two separate bottom plates. The plates will extend from the outer edges of the wall and hang over the overhead door opening by 3” on each side.

**NOTE:** In selecting pieces to be cut, use standard lengths of 8’ to 16’ wherever possible.

6. Mark and drill bolt clearance holes on the treated bottom plate. Use a ¾” or ⅞” bit to drill holes larger than the bolt diameter in order to allow correct positioning of the plates on the foundation.
7. After cutting the top and bottom plates according to the House Plan, tack the plates together with duplex nails and set them in location on the deck.

### **17.2.3 Marking Window and Door Locations on Exterior Wall Plates**

1. Starting at the garage zero corner (where the front wall meets the side wall), lay out the longest walls first. Using a tape measure attached to the plate at the zero end, mark the center-line location of all windows and doors in each wall section. Mark both top and bottom plates with the window and door size shown on the layout (e.g., 3030 Window or 16070 Garage Door).
2. When laying out the exterior walls that intersect the longest walls, again start at the zero end but this time extend the tape measure 3½” beyond the end of the plate. This

offset takes into account the 3½” width of the intersecting long wall plate wall during layout.

3. Referring to the window or door size, measure and mark the location of the king and jack studs that support the header (see Figure 3-2.)
4. The separation between the jack studs (the “rough opening”) for all windows equals the width of the window being located. The first two digits in the window code is the width in feet and inches.

**Example:** A 3030 window is 3’-0” wide (**not 30”**) wide; in this example, the separation between the jack studs is 3’-0” or 36”.

5. Label the king and jack stud locations with “K” or “J” to specify the location of the pre-built window and door components during wall assembly.

**REQUIREMENT:** Any opening 6’ or wider requires two jack studs under each end of the header. Therefore, the header will be 6” wider than the rough opening rather than the 3” used with windows and pedestrian doors.

6. In some cases the opening in the foundation for the overhead door is 3” wider than the door width. The innermost jack stud at both sides of the opening will overhang the foundation.
7. Label the top plate “Header Up” to specify that the header will lie above the deck while the wall is built. It will place the header on the outside of the wall when erected.

#### **17.2.4 Laying Out Studs on Exterior Wall Plates**

1. Lay out studs on the long parallel walls at the same time by pulling both sets of wall plates together. Flush the ends of the two sets of plates at the zero end.

**NOTE:** This approach reduces the chance for errors because the same person is laying out the parallel walls. This is very important with 24” o.c. framing because stacked framing (trusses directly above wall studs) is needed to transfer load from the roof trusses.

2. Starting at the zero end, mark the location of all wall studs on 24” centers. In marking these studs, mark all four plates of the two wall pairs at the same time to ensure location of the studs directly under the roof trusses. Place an “X” within the two stud marks. (Note that, by design, some stud locations will coincide with a window or door king stud. Mark an “X” only where a stud is not part of a window or door; kings must be marked with a “K”.)
3. Wherever 24” centers fall within a window, mark a “C” on the bottom plate to represent a “cripple” under the window. For a door opening, mark a “C” on the top

- plate to represent a “cripple” between the header and the top plate.
4. If the length of the two walls is not an even multiple of 2’, it may be necessary to add an extra stud centered 48” from the non-zero end of the wall to accommodate a full sheet of OSB wall sheathing.
  5. On the short wall, add an additional stud either at the end of the wall or inside the wall unless a window can be moved slightly to place the king stud 48” from the outside corner of the house.
  6. After marking the long walls, locate and mark the studs on the short walls. Starting at the zero end, extend the tape measure 3½” beyond the end of the plates and mark the stud locations on 24” centers. Place “X’s” and “C’s” as appropriate

### **17.2.5 Erecting Garage Walls**

1. Before the walls are erected, establish the length of the wall studs. Measure from the garage foundation wall to the top of the top plate of the house wall. Do this at the front and back garage foundation walls. If the two measurements are not the same, split the difference. Subtract 4½” (1½” bottom plate, 1½” top plate and 1½” for the super top plate) and that will be the 2x4 stud length. The studs may need to be cut to proper length from 2x4x8’ studs.
2. Remove the temporary nails connecting the top and bottom plates of the wall section and separate on the deck. Be sure the words “Top” and “Bottom” remain in the same orientation.
3. Select studs for framing walls by sighting along the edge of each stud to determine in which direction the stud is crowned; mark with an arrow pointing to the high side. Place studs with “crown up”.
4. Nail wall sections together with 16d (or 3” or 3¼” Paslode) nails. Two nails through the plate into the end of each stud on 2x4 walls. Always make sure that the edges of the studs are flush with the edges of the plates.
5. When assembling the wall with the laminated beam of the overhead door, do not install it into the opening in the wall until after the wall has been erected and braced. If the lam beam is installed while the wall is on the ground, the wall will be hard to control when it is raised because it will be top heavy.
6. Assemble each exterior wall on the garage floor and then erect in one entire section. Assemble the two full-length exterior walls first. Assemble and erect the gable-end wall after the two longer walls are up.
7. Place foam Sill Seal on the foundation wall slightly back from the chalk line. Stand the wall section up, making sure the bolts emerge through each pre-drilled hole.

- Align the wall so it is flush with the chalk line, then add the washer and nut to each bolt and tighten.
8. One end of each of the front and back walls intersects the house wall and can be plumbed and secured to the house. The other end of the wall needs to be supported using a long 2x4 nailed to the wall near the top and to a 2x4 stake (minimum length of 2') pounded into the ground. Make sure the front and back walls lean out slightly when they are braced so they will not interfere with the installation of the gable end wall.
  9. The gable end wall panel is constructed, erected and braced in the same manner as the wall panels above. Fasten wall panels to each other by flushing the corners and nailing the adjoining end studs every 12" from bottom to top plate.
  10. At each inside wall corner, nail a long 2x4 brace into the top plate and run it diagonally down to the bottom plate. Plumb the wall corner. Nail the brace into the bottom plate and into two of the wall studs with one duplex nail at each point.
  11. After all the walls are up and braced, install the overhead door's laminated beam. Measure from the inside edge of the king stud to the inside edge of the opposite side king stud. Cut the two pieces of laminated beam to that length. Lift one piece of the "lam" beam up onto the jack studs, flush with exterior of the framing. Nail into place with four 3" or 3 1/4" Paslode nails through the king studs into the "lam" beam. Lift the second "lam" beam into place, holding it tight against the first "lam" beam and nail.
  12. Nail the two "lam" beams together with 16d (or 3" or 3 1/4" Paslode) nails - three nails on 18" centers on both sides of the beam, staggering the nail lines on opposite sides of the beam

## **17.2.6 Straightening Exterior Walls**

### **17.2.6.1 Attach String Line**

1. To straighten the exterior walls, a VERY taut string line is stretched from one inside corner to an adjacent inside corner. The wall is adjusted to the string line every 8'-10' and braced to hold
2. For each exterior wall corner, cut a scrap length of 2x4 about 10-16" long.
3. Drive a 16d nail into the approximate center of this 2x4, leaving the nail about 1/2" above the 2x4 (this is left to wrap the string around).
4. At the exterior wall "inside" corner, place the 2x4 on top of the 2x6 top plates at roughly a 45° angle so that the 16d nail rests tight against the "inside" top plates of both walls (nail resting tightly against the inside of the corner).

5. [Nail the 2x4 to the top plate with two 16d or duplex nails on each end of the 2x4. Nail securely as there will be a lot of string tension on these.](#)
6. [In the first corner, attach the string on any nail other than the centered nail \(feel free to add additional “tie off” nails as needed\)](#)
7. [Run the string outside the centered nail.](#)
8. [Continue around the exterior walls, repeating Steps 4 thru 6 at each corner, until back at the starting corner. Make sure the string is not obstructed between corners and is VERY taut.](#)
9. [At each corner, verify that the string is aligned with the “inside” of the top plates and adjust as needed.](#)

#### **17.2.6.2 Straighten the Walls**

1. [Start approximately 8’–10’ from the corner.](#)
2. [Stand on the inside of the wall directly below the string and the inside of the top plate. Look up and align the inside of each garage wall top plate with the string line.](#)
3. [Adjust the 2x4 wall braces, moving the wall in or out, until the wall lines up with the string.](#)
4. [Move approximately to the mid-point of the wall and repeat Steps 2 and 3.](#)
5. [Repeat Steps 1 thru 4 for the remaining exterior walls. After bracing for all exterior walls is completed, recheck the alignment \(using the string line\) and remove string and blocks.](#)

#### **17.2.7 Installing Top Plates and Sheathing the Walls.**

1. [Walls must be tied together by nailing overlapping top plates to the tops of all walls. Top plates at the intersection of interior and exterior walls are done first.](#)
2. [The top plate on all bearing walls must be lapped a minimum of 4’ on each side of the wall plate joint, and at each corner.](#)
3. [Top plates of the garage walls that intersect the house walls must extend into the houses exterior top plates by 2” and must be at least 16" long.](#)
4. [When nailing top plates, use two 16d nails across 2x4 plates. Nail at each intersection of top plates and nail at each stud location.](#)

5. Starting at the zero corner, place a sheet of 4'x8'x1/2" OSB on each end of a wall section, flush with bottom plate and overlapping 3/4" onto the stud 4' from the corner. Secure it to the studs with 8d or 2 3/8" Paslode nails into each stud and the top and bottom plate with a 3" spacing.
6. Continue sheathing across the wall, holding the OSB flush with the bottom plate and tight against the previous sheet. Secure it to the studs with 8d or 2 3/8" Paslode nails into each stud and the top and bottom plate with a 3" spacing.

### **17.3 FRAMING PORCH ROOF VALLEYS**

1. TBD at a later date.

### **17.4 BUILDING BILEVEL DECK**

1. TBD at a later date.

### **17.5 INSTALLING LINEN CLOSET**

1. Shelf heights and depths are as follows:

<u>Height of cleat (top)</u>	<u>Shelf Depth</u>
<u>24" (bottom shelf)</u>	<u>23"</u>
<u>40"</u>	<u>23"</u>
<u>56"</u>	<u>23"</u>
<u>72"</u>	<u>12"</u>

2. Cut strips of 2" wide cleats from 3/4" pine for both sides and back walls.
3. Cut side cleats so they fit the full depth of the closet (ensuring overlap with a stud or blocking on both ends). Cut back cleats to fit snugly between installed side cleats.
4. Find location of side and back wall studs
5. Measure and mark all cleat heights. Use a level to confirm that shelves will be level across the front and back edges.
6. Install side cleats first to ensure they firmly catch the corner studs since these will carry the majority of the weight. Secure with one 2 1/2" screw into each corner.
7. Install the back cleat with one 2 1/2" screw into each corner. Be sure to drive the screw with enough of an angle to catch the stud.

8. [Paint cleats to match wall color](#)
9. [Cut shelves for length and install. Do \*\*not\*\* nail the shelves to the cleats.](#)

## **17.6 INSTALLING BIFOLD CLOSET DOORS**

1. Install the track 1 $\frac{3}{4}$ " back from the outer edge of the doorjamb. Fasten using 2" flathead screws.
2. Location of the pivot hole determines the direction the door will open.
3. Bottom pivot point locations must be plumb with top pivot points. The bottom pivot bracket may need to be shimmed up  $\frac{1}{2}$ " to allow for carpet. Attached the bracket to the deck and doorjamb.
4. Door pulls should be installed at the same height as interior doorknobs and in the middle of the two inner panel fronts.
5. On 4-panel doors (two bi-fold doors opening in opposite directions), align the doors by moving the top or bottom pivot point.
6. [Measure the width of the door opening, add 3" to that measurement, and cut a piece of baseboard that long. Place the bottom edge of the baseboard flush with the top edge of the door opening and centered so that 1 \$\frac{1}{2}\$ " of the baseboard extends horizontally beyond each door jamb. Using 2 \$\frac{1}{2}\$ " Paslode nails, attach the baseboard to the wall.](#)
7. Set nails and putty.

## **17.7 INSTALLING RURAL MAILBOX**

1. Proper mailbox placement is important for city crews as well as postal carriers. Snowplows, street sweepers and garbage trucks can damage mailboxes that extend over the road.
2. [Ideally, there will be a pre-dug hole 42" deep and centered 24" back from the street or curb \(street side\). If not, use a post hole digger to create one.](#)
3. [Add and tamp \(using a 2x4\) stone into the bottom of the hole until the top of the stone is 30" below grade. Cut a 5' length of 4x4 for the post; this leaves about 30" of post above grade.](#)
4. [Install mailbox per manufacturer's instructions.](#)

## **17.8 INSTALLING EGRESS LADDERS AND COVERS**

### **17.8.1 Egress Ladders**

1. Egress ladders are installed ONLY in wells outside finished basement bedroom areas.
2. Make sure all foundation form tabs are knocked off egress foundation walls.
3. Make sure stone is level with the bottom of the window.
4. Measure the distance between ladder steps (usually about 12"). Mount the ladder so the bottom step of the ladder is approximately this height above the stone.
5. Mount the ladder centered between the inside of the foundation wall and the house, making sure to place the ladder on the side of the egress cover that opens.
6. Orient the ladder so the curved ends are at the bottom. Make sure ladder steps are level and mark on the foundation wall the location of the two holes near the top of the ladder frame. Drill two 3/8" diameter holes about 4" deep. Enlarge the egress ladder's holes using a 3/8" metal bit.
7. Attach the ladder using the 3/8" x 3-4" wedge anchors (red head anchors). DOUBLE nut the anchor and hammer it in place until the nut touches the concrete. Remove the nuts. Install the ladder, washer and nut and tighten until the anchor wedges tightly in place and the ladder is tight to the foundation wall. Cut off the remaining bolt if it projects more than 1/4" past the nut and be sure to file or hammer down any remaining sharp edges.

### **17.8.2 Egress Covers**

1. All egress wells must have a cover installed.
2. Clear mud, stones or other debris from the top of the egress foundation.
3. Position egress cover so it is centered over the egress foundation (side-to-side) and 2" from the siding. Make sure all reveals (front and side foundations) look good. Open the cover to make sure it opens fully and clears the house and any exterior penetrations.
4. Use 1/4" masonry bit and 1/4" x 1 3/4"-2" Tapcon® screws. Drill holes 1/2" deeper than the length of the Tapcon® screw, cleaning debris out of the hole while drilling.
5. Install Tapcon® screw with Tapcon® driver extension and tighten frame to the foundation.

6. Drill the hole for the “gate” side next to the house last. Before drilling, make sure the clearance between the frame and the gate allows the gate to open and shut freely (sometimes this end of the frame gets bent in or out and we don’t want the gate to hit or rub against this part of the frame or be too far away either).