4. Components and Stairs

4.1 CUTTING COMPONENT PIECES
4.2 ASSEMBLING EXTERIOR WALL COMPONENTS
4.3 ASSEMBLING MAIN FLOOR INTERIOR WALL COMPONENTS
4.4 ASSEMBLING BASEMENT WALL COMPONENTS
4.5 BUILDING STAIRS

Tools needed by volunteer:

Hammer
Nail apron
Tape measure
Square
Utility knife
Pencil

Materials needed:

2x6 plate lumber
2x4 plate lumber
16d nails
8d nails
3¼" Collated nails
3" Collated nails (Component Bin)
$^{5}/_{16}$"x1½" Lag screws
6" Timber screws
5" Wafer head screws (Component Bin)
$^{5}/_{16}$" Washers
Air sealing tape
Shrinkwrap

Tools and equipment needed:

Generator
Extension cord
Circular saw w/worm drive
Chop saw
Impact Driver
Framing nailer
Framing square
Framing square w/ stair gauge
Sawhorse
6' level
String line
Felt tip marker
Red crayon
Component Bin

Personal Protection Equipment:

Safety glasses (required)

Reference Materials:

House Plan Support Documents

NOTE: All exterior and interior walls are framed 24" o.c.

Safety First! Review the Safety Checklist before performing tasks in this chapter.

4.1. CUTTING COMPONENT PIECES

1. Before marking and cutting any components, sort and crown 2x4 and 2x6 stud lumber into 3 piles (straight, slightly crowned and RETURN/TO CUT). If the stud has a "slight" crown, mark the wide surface with an arrow toward the "crown up" edge. If the stud is "straight" (no crown) mark the wider surface with an arrow toward the end of the stud. If the stud has a "severe" crown, bow or other unacceptable defect put it in the RETURN/TO CUT pile (if possible place this pile near the street or driveway to separate it from the two "good" piles of studs and for easier pickup by the supplier). Check for studs that are twisted. Do not use these for door components or window components.

   NOTE: Be very selective ("Would you use this for your house?") during the initial sorting of the studs as we can always go back to the RETURN/TO CUT pile if needed.

2. Use only straight studs for kitchen walls, tub walls, and the ends of sliding closet doors first, then for all other walls as available. Use straight or only slightly crowned studs for component King and Jack pairs.

3. Locate the separate bundle of lumber expressly intended for component construction. It should consist of 2x10's, 2x6's, 2x4's, and one 8' 1x6. Label the bundle with "Components" to avoid use for general construction.

4. Determine window and door sizes and dimensions from the House Plan Support Documents.

5. Referring to the Component Cut List in the House Plan Support Documents, cut pre-defined pieces of 2x10 headers, 2x6 headers, 2x4 headers, 2x6 window sill pieces, and 2x4 and 2x6 Jack studs. The Component Cut List specifies the lengths of material to use, how many to cut and to what length. As each piece is cut, label it with the length and check it off the cutting diagram (the diagrams are in in the House Plan Support Documents three-ring binder in the site support box).

   NOTE: The Component Cut List is designed to minimize material waste and cost, so it should be followed exactly. See Appendix A for instructions on how to develop the Component Cut List.

4.2. ASSEMBLING EXTERIOR WALL COMPONENTS

1. Referring to the Component Assembly Drawings for exterior components in the House Plan Support Documents, assemble the window and exterior door components (see Figure 4-1 for examples of exterior component assembly drawings).

   TIP: It is best to work on a flat surface such as the deck or the porch. When doing so on the porch, place one or more pieces of OSB or decking under the work to protect the concrete from protruding nails.

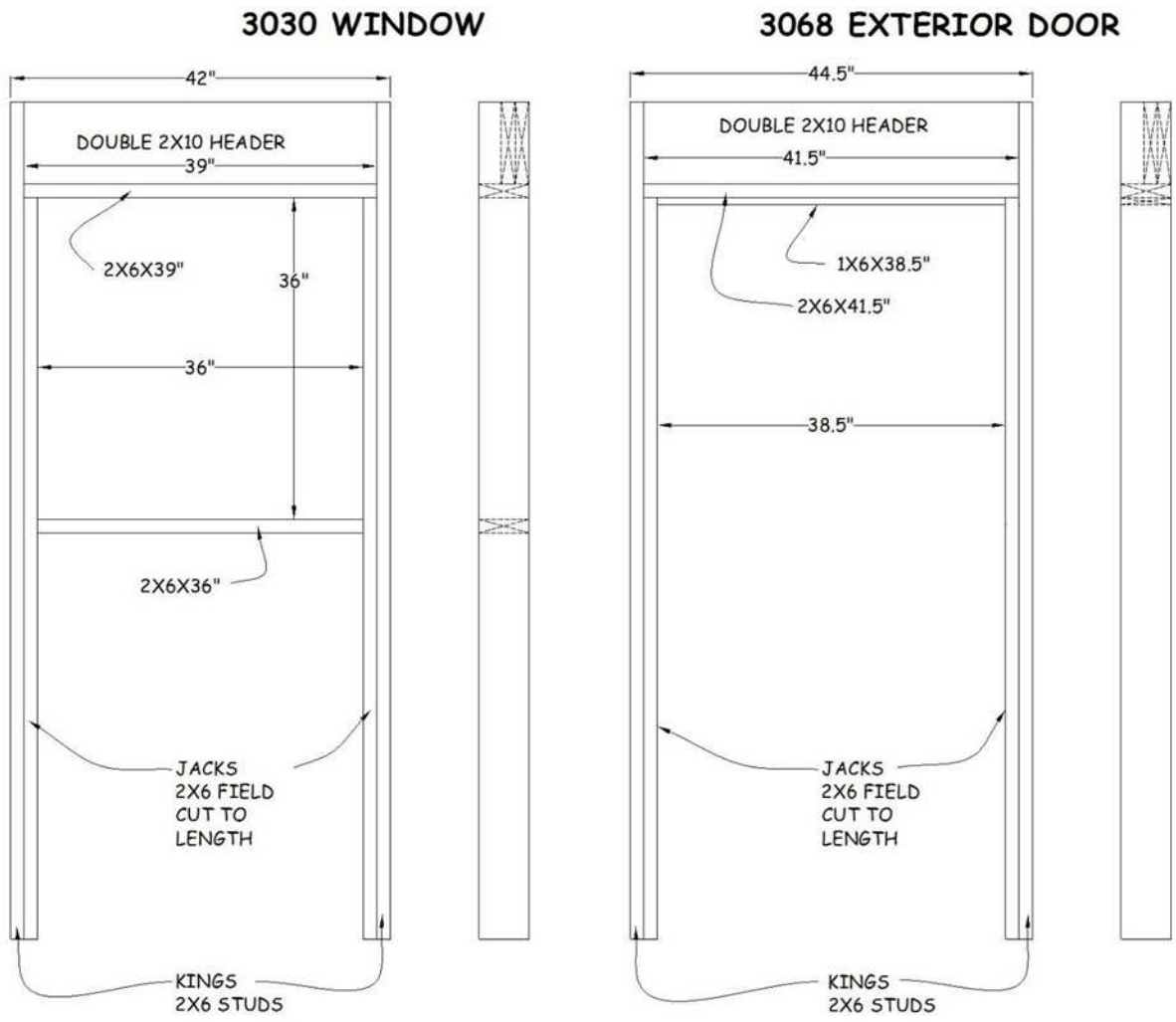

Figure 4-1. Examples of Exterior Wall Component Assembly Drawings.

2. Use 3" collated nails (Component Bin) to assemble headers and King/Jack studs. Return any unused 3" collated nails to the Component Bin.

3. Align two matching-length 2x10 pieces to create an exterior header (windows greater than 6' may require three header pieces). Before assembly, make sure any cup in the 2x10 pieces are oriented in opposite directions, with the concave surfaces of each cup facing each other, **e.g. () NOT)(.**

    a. Ensure that the two header pieces are flush on one end and along one long edge. Nail with three rows of 3" collated nails - two about 2" from each edge and one in the middle - no more than 12" apart. Stagger the nails on opposite sides

    b. If there is a non-flush end, trim it to ensure the two pieces are flush on both ends. If the two pieces differ in width by more than ⅛", rip the non-flush long edge to ensure the two pieces are flush on both long edges.

4. Select two 2x6 studs for use as King studs and check for crown. Nail each stud to the header assembly with the crown DOWN (this will place the King stud with the desired crown UP during wall assembly). Be sure that a flush, long edge of the header is positioned "down" towards where the Jack studs will be located. Nail three 3" collated nails into each header piece (for a total of six nails per King stud) taking special care that the King stud is flush with both the top and sides of the header.

5. Place the matching length 2x6 header piece between the King studs and tack to the long, flush edge of the 2x10 header pair. Carefully square each end of the 2x6 to the adjoining King stud and nail through the King stud into the end of the 2x6 with three 3" collated nails. Finish nailing the 2x6 to the underside of the 2x10 header with 3" collated nails. (This sequence is crucial to ensuring that the Jack studs supporting the header provide an adequate bearing surface.)

6. Select two precut 82" 2x6 pieces from Section 4.1.5 above for use as Jack studs and check for crown. (The cut list specifies a Jack stud length slightly longer than needed to accommodate varying 2x10 header widths.) Place each piece next to a King stud (crowns and bows opposite king stud if applicable), tight to the header, mark, and field cut to length.

   NOTE: Before assembly, make sure the crown (and bow) of the Jack stud are opposite that of the King stud (this helps to create a straight component). Flush the narrow edges of the two studs along the length, clamp, and nail.

   a. For doors components, place the field cut Jack stud tight to the header and nail through the Jack stud into the King stud using pairs of 3" collated nails, no more than 12" apart.

   b. For windows components, place the field cut Jack stud tight to the header and nail through the Jack stud into the King stud using pairs of 3" collated nails, no more than 12" apart. Secure the matching 2x6 sill piece to each King/Jack pair with two 5" wafer head screws, obtained from the Construction Supervisor.

7. On exterior door components, cut a 38½" piece of 1"x6" pine board (located in the component package) and nail it to the underside of the header using 3" collated nails, ensuring the nails penetrate the 2"x10" header. This will provide an additional nailing surface and also make the top part of the door frame easier to air seal.

8. When the component is complete, verify there are no protruding nails. Then, clearly mark the size of the component on the face of the header that is flush with the edge of the King studs.

9. Stack components separately by size. Be sure the labeled surface of the header is face up to facilitate later identification of the component's size.

4.3. ASSEMBLING MAIN FLOOR INTERIOR WALL COMPONENTS

4.3.1. Preparation

1. Referring to the Component Assembly Drawings for interior components in the House Plan Support Documents, assemble the interior door components (see Figure 4-2 for an example of an interior component assembly drawing).

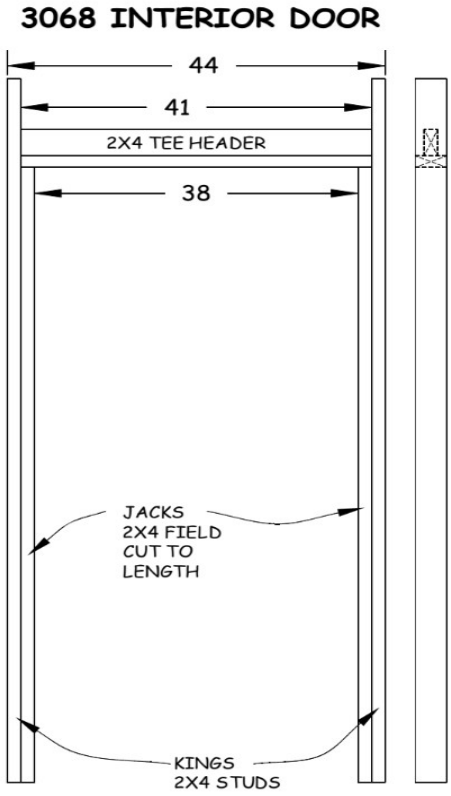

Figure 4-2. Example of Interior Wall Component Assembly Drawing.

2. From the 2x4 pieces precut in Section 4.1.5, select matching-length header pieces for each interior door. Nail together with 3" collated nails to create a "T" header (see Figure 4-3).

   NOTE: Some homes may include a door in a 2x6 wall designed to accommodate piping from the basement to the roof (so-called plumbing wall). The T-header for these walls consists of a vertical 2x4 and a horizontal 2x6 per the component cut list.

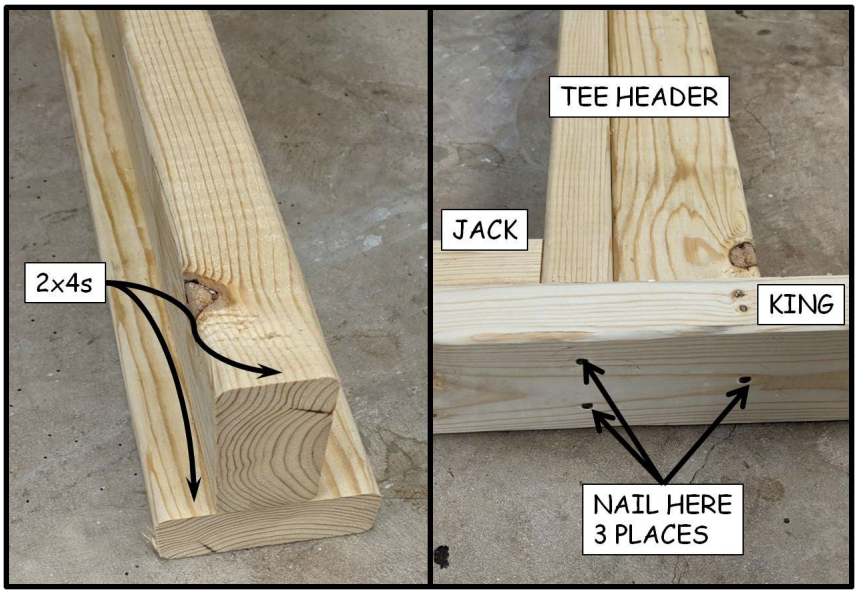

Figure 4-3. T-Header Assembly.

3. Use 3” collated nails to assemble headers and King/Jack studs. Return any unused 3” collated nails to the Component Bin.

4. Be aware that Jack stud lengths are different for various door types and door locations as shown in Table 4-1 below.

Table 4-1. Jack Stud Lengths for Various Door Types and Locations.

Door Type	Main Floor	Basement
Swinging Door	81”	82½”
Sliding Door	82”	83½”
Bifold Door	80”	81½”

4.3.2. Swinging Doors

1. Select two 81” 2x4 pieces from the precut component package for use as Jack studs in each door.

2. Nail each Jack stud to a 92⅝” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails, no more than 12” apart. Write the door size on each King/Jack pair using red crayon.

3. Identify the appropriate header and place it so the horizontal portion of the “T” header is on top of the Jack studs, tight against the King studs. Nail through the King studs into both ends of the header pieces with 3¼” collated nails - two nails in the horizontal piece and one nail in the vertical piece of the header (see Figure 4-2).

4. Write the door size on the header, verify the Jack studs are 81” and set the assembled door components aside.

5. Stack components separately by size. Be sure the labeled surface of the header is face-up to facilitate later identification of the component's size.

4.3.3. Sliding Doors

1. A flush sliding door is positioned flush against a perpendicular side wall, and thus only needs one King/Jack pair. A non-flush sliding door is positioned entirely within a framed wall and thus needs two King/Jack pairs. (See Figure 4-4.)

Figure 4-4. Sliding Door Types; Flush (left) and Non-Flush (right)

2. Select one 82" 2x4 piece for each King/Jack pair needed, from the precut component package for use as a Jack stud in each door.

3. Nail the Jack stud to a 92⅝" 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3" collated nails no more than 12" apart. Write the door size on each King/Jack pair using red crayon.

4. For flush sliding doors, identify the appropriate header. Verify the Jack stud is 82". For each door, bundle "T" header and needed King/Jack pair together using shrinkwrap. **Do not nail header to its King/Jack pair.** Label each header with the door size and set aside with other components ensuring the labeled surface of the header is face up to facilitate later identification of the component's size.

5. For non-flush sliding doors, identify the appropriate header and place it so the horizontal portion of the "T" header is on top of the Jack studs, tight against the King studs. Nail through the King studs into both ends of the header pieces with 3" collated nails - two nails in the horizontal piece and one nail in the vertical piece of the header (see Figure 4-3).

6. For non-flush sliding doors, write the door size on the header, verify the Jack studs are 82" and set the assembled door components aside.

7. Stack components separately by size. Be sure the labeled surface of the header is face up to facilitate later identification of the component's size.

4.3.4. Bifold Doors

1. Select two 80” 2x4 pieces from the precut component package for use as Jack studs in each door.

2. Nail each Jack stud to a 92⅝” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails no more than 12” apart. Write the door size on each King/Jack pair using red crayon.

3. Identify the appropriate header and place it so the horizontal portion of the “T” header is on top of the Jack studs, tight against the King studs. Nail through the King studs into both ends of the header pieces with 3” collated nails - two nails in the horizontal piece and one nail in the vertical piece of the header (see Figure 4-3).

4. Write the door size on the header, verifying the Jack studs are 80” and set the assembled door components aside.

5. Stack components separately by size. Be sure the labeled surface of the header is face up to facilitate later identification of the component’s size.

4.4. ASSEMBLING BASEMENT WALL COMPONENTS

4.4.1. Preparation

1. Do not pre-build basement door components for Bi-Level homes since King studs may need to be greater than 92⅝”.

2. Be aware that Jack stud lengths are different for various door types and door locations as shown in Table 4-1 above.

4.4.2. Swinging Doors

1. Select two 82½” 2x4 pieces for use as Jack studs in each door.

2. Nail each Jack stud to a 92⅝” 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3” collated nails no more than 12” apart. Write “Basement”, along with the door size, on each King/Jack pair using red crayon.

3. Identify the appropriate header. Verify the Jack studs are 82½”. For each door, bundle “T” header and two King/Jack pairs together using shrinkwrap. **Do not nail header to its King/Jack pairs**. Label each header with the door size and the word “Basement”.

4. Move the shrink-wrapped bundle for each Basement Swinging Door into the basement to an out-of-the-way location. Place the bundle on the floor with scrap wood underneath and cover with scrap material to prevent water damage.

4.4.3. Sliding Doors

1. A flush sliding door is positioned flush against a perpendicular side wall, and thus only needs one King/Jack pair. A non-flush sliding door is positioned entirely within a framed wall and thus needs two King/Jack pairs. (See Figure 4-4.)

2. Select one 83½" 2x4 piece for each King/Jack pair needed, from the precut component package for use as Jack studs in each door.

3. Nail the Jack stud to a 92⅝" 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3" collated nails no more than 12" apart. Write "Basement", along with the door size, on each King/Jack pair using red crayon.

4. Identify the appropriate header. Verify the Jack stud is 83½". For each door, bundle "T" header and needed King/Jack pair(s) together using shrinkwrap. **Do not nail header to its King/Jack pairs.** Label each header with the door size and the word "Basement".

5. Move the shrink-wrapped bundle for each Basement Sliding Door into the basement to an out-of-the-way location. Place the bundle on the floor with scrap wood underneath and cover with scrap material to prevent water damage.

4.4.4. Bifold Doors

1. Select two 81½" 2x4 pieces from the precut component package for use as Jack studs in each door.

2. Nail each Jack stud to a 92⅝" 2x4 King stud. Flush one end and the narrow edges of the two pieces along the length, clamp, and nail using 3" collated nails no more than 12" apart. Write "Basement" along with door size on each King/Jack pair using red crayon.

3. Identify the appropriate header. Verify the Jack studs are 81½". For each door, bundle "T" header and two King/Jack pair together using shrinkwrap. **Do not nail header to its King/Jack pairs.** Label each header with the door size and the word "Basement".

4. Move the shrink-wrapped bundle for each Basement Bifold Door into the basement to an out-of-the-way location. Place the bundle on the floor with scrap wood underneath and cover with scrap material to prevent water damage.

4.5. BUILDING STAIRS

4.5.1. Calculations

1. Refer to the House Plan in the House Plan Support Documents for layout dimensions. Remove the Stair Stringer Riser Calculations Worksheet (Figure 4-5)

from this manual. Measure from the top of the deck to the basement floor on the end of the opening where the stairs will sit on the basement floor. Insert this dimension in the first box of the worksheet.

EXAMPLE: Overall dimension from deck to basement floor is 102". If there is hard flooring at the top of the steps, add ¼"; this = 102¼" working dimension.

2. Refer to the House Plan to find the number of treads and risers to be used. (13 rises and 9¾" deep cut runs are normal). Established run/rise relationships must be followed. No rise can exceed 8". No rise can vary more than 3/16". Treads must be at least 9" wide.

EXAMPLE: Using the assumptions in Step 1 above: the calculated rise height = 102¼"/13 = 7.865". To convert the decimal portion to a usable fraction, refer to Table 4-2 below. 0.865 is between 0.845 and 0.906 in the table, indicating the nearest fraction is 7/8". Therefore, use 7-7/8" for the rise height.

Table 4-2. Determining Rise Height Fractions.

Calculated Riser Height		Rounded to Fraction
0	0.031	0
0.032	0.094	1/16
0.095	0.156	1/8
0.157	0.219	3/16
0.220	0.281	1/4
0.282	0.344	5/16
0.345	0.406	3/8
0.407	0.469	7/16
0.470	0.531	1/2
0.532	0.594	9/16
0.595	0.656	5/8
0.657	0.719	11/16
0.720	0.781	3/4
0.782	0.844	13/16
0.845	0.906	7/8
0.907	0.969	15/16
0.970	1.000	1

Worksheet - Stair Stringer Riser Calculations

Calculate Step Rise

		Total Height - measured - basement floor to top of deck
+		Hard flooring at top? If yes **Add** 1/4" (0.25")
=		**Calculated Total Height**
÷		Total number of risers (typically 13, verify with Construction Supervisor)
		Calculated Riser Height (7" minimum, 8" maximum)

Calculate Bottom Step Rise

		Riser Height - as Calculated Above
-	(1-1/8")	Tread thickness - **SUBTRACT** 1-1/8" (1.125)
=		Intermediate result
+		Hard flooring at bottom? If yes **ADD** 1/4" - 0.25 (this is RARE)
		Bottom Step Rise

Adjust Top Step Rise (i.e. Calculate Stringer Top Mount Location)

		Riser Height - as Calculated Above
-	(3/4")	Deck thickness - **SUBTRACT** 3/4" (0.75)
=		Intermediate Result
+	1-1/8"	Tread thickness - **ADD** 1-1/8" (1.125)
=		Intermediate Result
-	(1/4")	Hard flooring at top? If yes **Subtract** 1/4" (0.25")
		Top Step Rise (measure down this distance from underside deck and mark - Mount top edge of stringer at this line)

NOTE: The TOP step of each stringer must have 3/4" (0.75") removed from the run resulting in a 9" run versus the normal 9-3/4" run because there is no riser board for this step

Figure 4-5. Stair Stringer Riser Calculations Worksheet.

THIS PAGE INTENTIONALLY LEFT BLANK

4.5.2. Layout and Cutting Stringers

1. Select one 2x12 stringer and place it on saw horses with the crown up toward you. The stringer is strengthened by this orientation because the run/rise sections can now be cut from the crown edge of the 2x12.

2. Attach stair gauges to the framing square and locate the precise dimensions calculated in Section 4.5.1 for run and rise. If the rise is 7¾", set the gauge to this dimension on the short side of the square; set the gauge to 9¾" on the long side of the square (see Figure 4-6).

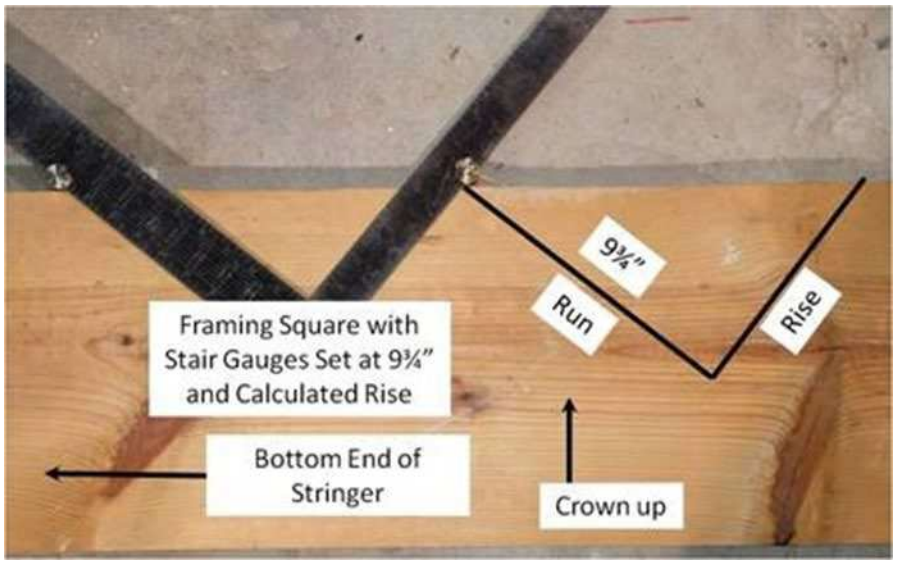

Figure 4-6. Stair Stringer Layout.

3. Mark the rise and run along the stringer until the proper number of rises needed are marked.

4. Reduce the height of the last rise at the bottom of the stringer by 1⅛" (the thickness of the tread). This will accommodate the 1⅛" thickness of the tread (see Figure 4-7).

5. Use a worm drive circular saw to cut out the stringer, cutting so that half of the pencil line remains.

REQUIREMENT: Building inspectors will reject a stair unit if dimensions between risers vary by more than 3/16".

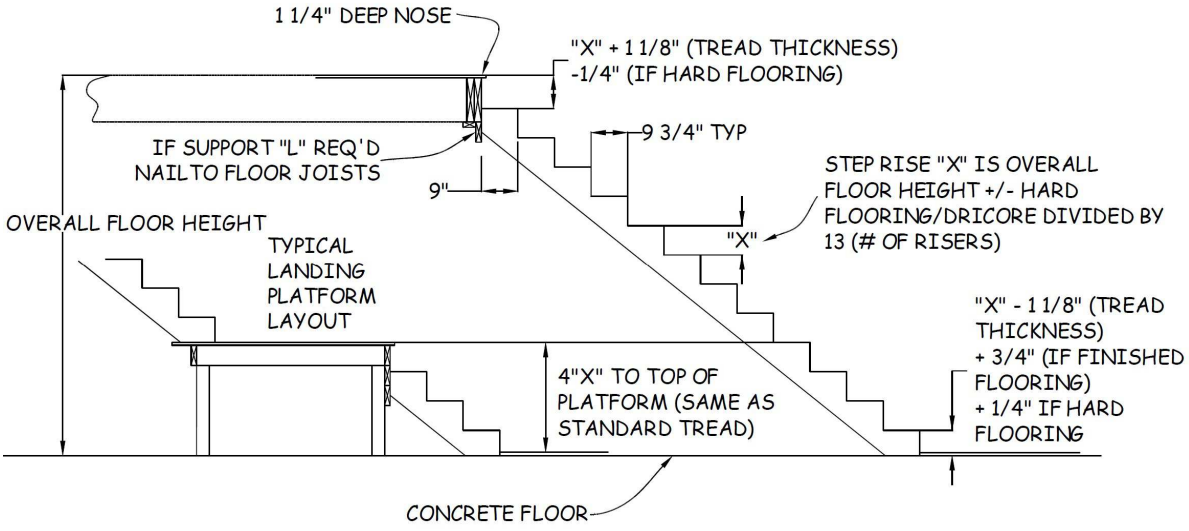

Figure 4-7. Stair Stringer Installation.

6. Cut ¾" off the back edge of the top riser so the stringer can be fastened to the floor joist (there is no ¾" thick riser at the top step since the floor joist serves as the finished riser).

7. Place the finished stringer in the stairwell hole to check for accuracy of installation. When set in place treads must be level and risers must be plumb. Verify that the bottom riser is equal to the height of the risers minus the thickness of the tread (1⅛" for an unfinished basement floor) if the basement floor will be finished. Verify that the top tread is located below the surface of the deck by the height of the rise plus the thickness of the tread (1⅛") minus ¼" if hard flooring will be installed.

8. Use the one correctly cut stringer as a template to mark the other two 2x12's. Cut out the remaining stringers with care.

9. On each stringer, drill $^{3}/_{16}$" pilot holes and use three $^{5}/_{16}$" x 1½" lag screws and $^{5}/_{16}$" washers to attach an L-bracket flush to the top of the tread and flush with the end of the stringer. Be sure to use correctly oriented brackets (left and right) on the appropriate outside stringers (either bracket can be used on the middle stringer).

10. Create a "sandwich" at the bottom of each of the outside stringers. For each of the stringers.

    a. Cut a 2x4 slightly shorter than the bottom of the stringer.

    b. Rip 3½"-wide pieces of OSB cut to a total length approximately equal to that of the 2x4.

    c. Create the "sandwich" of 2x4/OSB/stringer by nailing the 2x4/OSB pair to the outside, bottom of the stringer with 16d or 3¼" collated nails. (This sandwich provides a 2" gap between the stringer and the wall to allow for installation of sheetrock and a skirtboard later in the construction process.)

NOTE: Before attaching the 2x4/OSB sandwich to the outside stringers, the finished stringer to the wall, or the 2x4 support to the center stringer (see Step 11), check each cut stringer for crown. Cutting the riser/tread notches may have relieved built-in stresses, resulting in distortion. If significant movement has occurred, contact the Construction Supervisor

11. Cut a third 2x4, also slightly shorter than the stringers, and nail it to one side of the center stringer, flush with the bottom. This will provide additional stiffness during use of temporary stair treads.

12. Use the last calculation in Figure 4-5 (Top Step Rise) and measure that distance down from the underside of the deck. Make a line on the stairwell framing at this point. This line marks the location of the tops of the three stringers (Figure 4-7).

13. Before installing the stringers, attach air sealing tape to the bottom of the stringer where it will rest on the concrete.

14. Align the top of the outside stringers to the mark from Step 12 and clamp each stringer in place to a convenient stud. Drill $^{3}/_{16}$" pilot holes using the bracket as a template, and then secure the angle bracket at the top to the rim board/lam beam using three $^{5}/_{16}$" x 1½" lag screws and $^{5}/_{16}$" washers.

15. Secure the two outside stringers to the stairway walls with one 6" timber screw through the stringer into each stud between stairs 4 and 9. This makes it easier to remove a stud when creating the angled stairway wall.

16. Install the center stringer with the top aligned with the mark made in Step 12, centered between the two outside stringers, attaching the top bracket with $^{5}/_{16}$" x 1½" lag screws and $^{5}/_{16}$" washers.
    .
17. Install the temporary stair treads using one 2x4 and one 2x6 on each step. Attach each piece of lumber to the stringers using a SINGLE 8d nail at each end of the lumber. Treads must not extend beyond the width of the two outside stringers as this will conflict with installation of sheet rock and the skirt board. These temporary treads will be removed later when finished treads are installed.

4.5.3. Landing Design and Dimensions

1. A landing, if required, is a "joist" box made of 2x6's covered with ¾" floor decking with floor joists installed on 16" centers (see Figure 4-7).

2. Think of the landing as a step with the top surface acting as a finished stair tread.

3. Refer to the House Plan for landing location. The elevation above the basement floor is determined by the number of steps to the landing times the riser height. Remember, the bottom rise on the platform and the bottom riser on the basement

floor are both reduced by the thickness of a tread (1⅛”). Furthermore, the distance from the main floor to the first tread is increased by the thickness of a tread.

4. Nail the landing box to wall studs. Any vertical supports that contact the concrete floor must be green.