A Guide to Building Outdoor Stairs

Building a stairway can be one of the most intimidating tasks any builder–amateur or professional–tackles. But an outdoor stairway is generally not a difficult project, as long as it is planned and executed carefully. This document covers building procedures for a straight-run utility stairway, typically used on porches and decks.

Local building codes regulate the width and slope of a staircase, as well as how the assembly is supported and braced, how the landing is built and whether railings are required. ALWAYS CHECK WITH YOUR LOCAL BUILDING DEPARTMENT BEFORE DESIGNING A STAIRWAY, AND FOLLOW ALL LOCAL CODES.

The following instructions are intended as general guidelines only, and local requirements should be your primary guide.

In this document you will find information about:

- Stair-Building Terms
- Designing Your Stairs
- Building Your Stairs

TOOLS AND MATERIALS

2x10 Stringers	Hex Bolts	Hammer
1x8 Risers	16d Galvanized Nails	Carpenter's Square
5/4" or 2" Tread Material	8d Galvanized Nails	Measuring Tape
2x6 Pressure-Treated Cleat	4x4 Posts	Adjustable Wrench
Angle Iron	2" Railing Material	Joist Hangers
Anchor Bolts	Baluster Material	

STEP 1

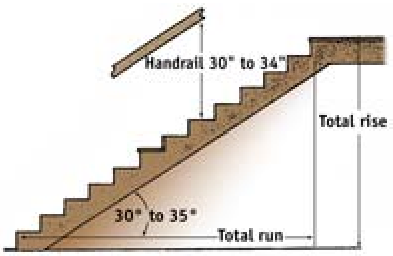

FIG. 1 - How a stairway is built depends primarily on the total rise–the vertical dimension from the upper floor to the lower floor. The total run–the horizontal length of the stair assembly–depends on the slope of the stairway, which is determined by building codes. From the Sunset book, *Basic*

STAIR BUILDING TERMS

- There are five basic design elements you'll need to consider when planning outdoor stairs:
- **The Total Run** (Fig. 1) is the total horizontal distance covered by the staircase, from the edge of the upper floor (porch or deck) to the edge of the staircase where it rests on the landing.
- **The Total Rise** (Fig. 1) is the total vertical distance from the surface of the landing to a point level with the surface of the upper floor (Note: You can't find the rise simply by measuring straight down from the upper floor because the ground directly below may not be level with the landing).
- **Run** (Fig. 2) is the horizontal distance from the leading edge of one tread to the leading edge of the next tread.

Carpentry Illustrated, © Sunset Publishing Corporation.

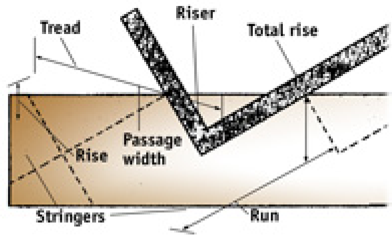

FIG. 2 - The components of a stairway, with basic stair-building terms. From the Sunset book, *Decks*, © Sunset Publishing Corporation

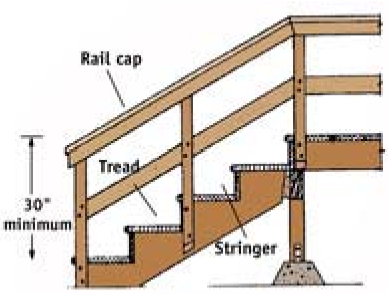

FIG. 3 - The components of a railing. From the Sunset book, *Decks*, © Sunset Publishing Corporation

- **Rise** (Fig. 2) is the vertical distance from the surface of one tread to the surface of the next tread.
- **Passage Width** (Fig. 2) is the width of the stairway.
- The ratio of the total rise to total run (or rise to run) determines the slope of the stairway. As a rule, that slope should be between 30 degrees and 35 degrees; an outdoor stairway may be slightly shallower but should not be steeper. The ideal riser height is 7" with an 11" run–which also works out well with standard lumber widths–but you may have to vary the proportions somewhat to make the height of each step work out evenly between the landing and the upper floor.
- The passage width can also vary, depending on how heavily you expect the stairs to be used. As a rule, 36" is the minimum; 48" is better for a single person, and you may want to go to 60" to allow room for two people to pass comfortably.
- A stairway consists of four basic components:
- **Stringers** (Fig. 2) are the sloped members that support the stairway. 2x10s are generally allowed for stairs with four treads or fewer, but 2x12s are sturdier.
- In most cases, you'll need good quality material with no large knots, either pressure treated or cut from heart redwood or cedar, to resist decay. Stringers should be placed no more than 24" apart if the treads will be 5/4 material or 36" apart for 2"-thick lumber.
- **Treads** (Fig. 2) are the horizontal members that you walk on. When building an outdoor stairway, they are typically cut from the same material as the upper floor deck or porch–5/4" pressure-treated pine or 2"-thick lumber.
- **Risers** (Fig. 2) are the vertical members at the back of each tread. 1" surfaced boards (3/4" net thickness) are the most common material used.
- **The Railing Assembly** (Fig. 3) consists of posts, a cap rail and vertical balusters between each post. 4x4 is the most common post material with a 2x4 handrail. Codes regulate the overall height of the railing assembly (usually 30" to 34") and may specify a maximum width for the handrail.

STEP 2 DESIGNING YOUR STAIRS

- To design the stairway, first find the total rise. Divide that number by 7 (the ideal riser height) to find the number of steps. You'll probably have

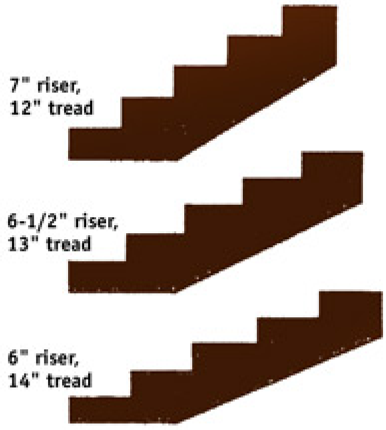

FIG. 4 - Common tread-to-riser ratios. From the Sunset book, *Decks*, © Sunset Publishing Corporation.

a fractional remainder, so round your result up or down to the nearest whole number.

- Then divide the total rise by that number to find the exact height of each riser. For example:

1) Total rise = 40-1/2"

2) 40-1/2" divided by 7" per riser = 5.78 risers

3) Round 5.78 up to 6 risers, then 40-1/2" divided by 6 = 6.75" or 6-3/4" per riser

This document assumes that the total run is not limited, so you can make the assembly as long as you want. Use the following table to determine the width of the treads, depending on your riser height.

Riser Height	Run Width
6"	14"
6-1/4"	13-1/2"
6-1/2"	13"
6-3/4"	12-1/2"
7"	12"
7-1/4"	11-1/2"
7-1/2"	11"

- To find the amount of material needed for risers, simply multiply the number of risers by the passage width. To find the amount of tread material, subtract 1 from the number of risers (you'll need one fewer tread than risers) and multiply by the passage width. Remember to double up if you'll be using two boards for each tread.
- To find the length of the stringers, you'll need a calculator with a square root function. First, find the total run (number of treads multiplied by the width of each tread).
- Then find the square of the total run (total run multiplied by itself) and the square of the total rise and add them together.
- The square root of the result gives you the exact stringer length; round up to the nearest standard lumber length, then multiply by the number of stringers you'll need.

STEP 3 BUILDING YOUR STAIRS

- To build the staircase, first notch the stringers for the treads and risers. Fasten two stair gauges to a carpenter's square at the dimensions of the rise and run (for example, at 6-1/2" on one leg and 13" on the other). Set the square on the stringer so the gauges are flush against the edge and trace the notch along the edge of the square (Fig. 5).

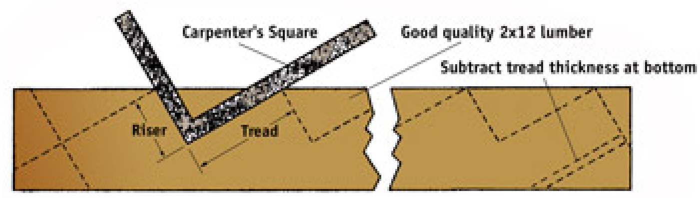

FIG. 5 - Set the carpenter's square on the stringer so the riser and tread dimensions are at the edge, then trace along the square. Move the square to the previous mark and repeat the process. Subtract one tread thickness from the layout at the bottom so the last step is equal in height to the rest. From the Sunset book, *Decks*, © Sunset Publishing Corporation.

- "Step" your way down the stringer, repeating the process until you have laid out the correct number of notches. Use the carpenter's square to lay out the top cut on the stringer. The height of the last riser should be less than the others by an amount equal to the thickness of the tread. That way, when you nail the last tread in place, the step down to the lower floor will be equal to the others.
- You can set the stringer directly on the lower floor (typically a landing pad) and bolt it in place with a piece of angle iron, or bolt a length of pressure-treated 2x6 to the floor and nail the stringer to it.
- If you plan to set the stringer on a 2x6, you may have to notch the bottom of the stringer to allow for that piece.
- Once the stringer is laid out, cut the notches partway only, using a circular saw. Take care not to cut beyond the layout lines. Finish the cuts with a handsaw.
- Once you have one stringer finished, set it in place to make sure it is cut correctly, then use it as a template to lay out your cuts on the other stringers.
- You can hang the stringers to the rim joist with joist hangers (Fig. 6), or bolt them in place to a joist (Fig. 7). If you need to pour a concrete landing pad at the bottom of the stairway, set the stringers in place

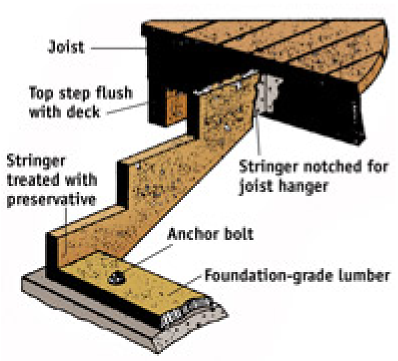

FIG. 6 - Stringers may be hung from the rim joist with a joist hanger so the first step is flush with the deck surface. In this configuration, a piece of pressure-treated lumber is bolted to the landing pad and the stringer is nailed to it with 16d galvanized nails. From the Sunset book, *Decks*, © Sunset Publishing Corporation.

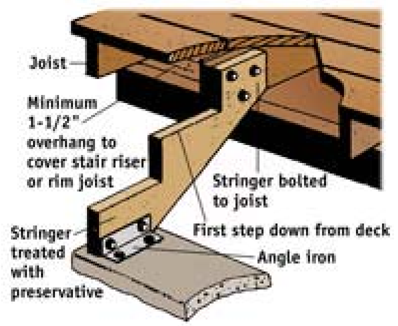

FIG. 7 - The stringer can be bolted to the end of the joist so the first step is one step below the surface of the deck. At the landing pad, the stringer may be fastened to an angle iron (the angle should be galvanized) bolted to the concrete. From the Sunset book, *Decks*, © Sunset Publishing Corporation.

temporarily and lay out the location of the pad. Pour the pad and set anchor bolts for the angle iron or 2x6 base. Instructions for pouring concrete are in another brochure in this series.

- Once the landing pad is cured, secure the stringers at the top and bottom. Rip the risers to the same width as the height of the riser cut in the stringers. Then cut them to length and nail them to the stringers with 8d galvanized nails.

- Measure the distance from the face of the riser to the edge of the notch cut, then rip the treads to width so they extend 1" to 1-1/8" beyond the edge of the notch. If you're using two boards side by side as treads, rip half the dimension from each board so both will be the same width. Cut the treads to length and nail them to the stringer with 16d galvanized nails.

- To build the railing, first secure 4x4 posts at the top and bottom of the stringer. Notch the posts 1-1/2" deep and bolt them to the sides of the stringers with 1/2x4-1/2 hex bolts, using a level to keep them plumb. Use decay-resistant lumber for the posts. They should be at least long enough to extend 36" above the surface of the treads. Leave them a few inches too long at the top so you can cut them after they are in place.

- Measure from the bottom of the stringer up the posts to the location of the top and bottom rails. The top surface of the upper rail should be 30" to 34" above the tread; the rail should be about 6" above the tread. Lay the railing material against the posts and lay out angled cuts for any rails that will be fastened between the posts.

- Cut the railings to length and toenail them with four 8d galvanized nails. If you'll be using balusters, cut them to length and nail them to the rails. Check local codes for spacing requirements on balusters.