Housed-Stringer Stairs: The Frame Is the Finish

Treads and risers that are glued and wedged into routed stringers are tighter and more stable than conventionally framed stairs

BY JOE LANZA

Stairs are often built in two stages by two different carpenters. Framers cut stringers from 2x12s (or sometimes LVLs) and nail down temporary treads so that the stair can be used for construction traffic. Later, a finish carpenter removes the rough treads and installs finished treads, skirtboards, and risers.

Trimming a rough set of stairs can be an enjoyable challenge, a sweat-soaked nightmare, or something in between. Where it falls depends on a number of variables that include the skills of the framer, the quality of the materials, and the weather conditions inside the house after framing. At best, trimming a rough stair involves a lot of fussing and a large number of finished cuts that have to be near perfect. It's often an awkward way to build such an important architectural and functional element.

When possible, I prefer to avoid the hassle and build a housed-stringer stair whose treads and risers are glued into routed dadoes in the stringers. Although this process might seem difficult at first glance, careful layout and a site-built router jig make it a lot easier than you might think. The resulting stair is tighter, stronger, and more stable than one nailed together on rough stringers.

First, design the stairs; then order materials

To plan a staircase, I draw a cross section of the assembly to make sure that the rise and run fit evenly in the space (drawing facing page). Designing the basic layout also gives me an idea of the lumber dimensions I need.

Drawings: Christopher Mills

Stringers should be made from clear, straight stock at least 5/4 in. thick and 10 in. wide. I have used white pine and poplar, but those species can be hard to find in lengths suitable for a straight run of stairs. Southern yellow pine, oak, and Douglas fir work well for both stringers and treads, and they're commonly stocked in most lumberyards.

If you can't find stock in dimensions that suit your needs, treads are not too hard to make. The key is using species known for stability. I have used treads of sapele and khaya (African mahoganies) with good results. For softwoods, 5/4 in. is a minimum tread thickness. With harder stock, you can make them thinner. When selecting stock, don't forget to account for at least an extra 1¼-in. width for the nosing.

If I'm milling my own treads, I do it before I rout the stringers so that I know the final thickness of the tread stock. After cutting the stock to rough length, I plane it to thickness and joint if necessary, then rip it to rough width. To keep the stock from cupping, I cut ⅜-in.-deep relief cuts 2 in. apart in the bottom face of the treads, parallel with the length. To rout the nosing on 1-in.-thick treads, I use a ½-in.-radius roundover bit in a router table with a fence.

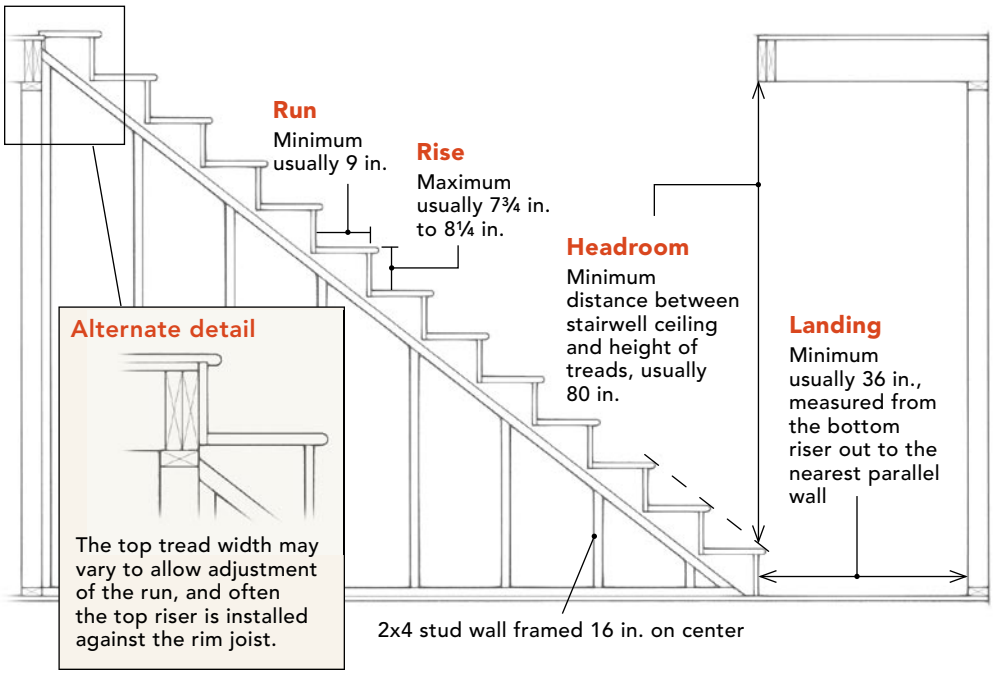
Draw the layout, then rout

Once you have the stringer stock, you can use a framing square to lay out the stair on the first stringer. If you're accustomed to laying out and notching rough stringers, you'll need to reorient yourself. Because the treads and risers fit into stopped dadoes, the stringers are laid out from the lower edge rather than the upper edge.

Using a combination square, draw a line at least 1½ in. from the stringer's lower edge along the entire length of the board. This line represents the intersection of treads and risers on the stringer. Orient the framing square so that the numbers representing the rise and run are registered on the line, then attach stair gauges to the square at the lower edge of the stringer. Starting at the bottom landing, lay out all the treads and risers. Keep in mind that you are marking the front of the riser and the top of the tread. Most of the meat of the stringer will be above the lines. Double-check the layout, and make sure you have

DRAW THE STAIRS FIRST

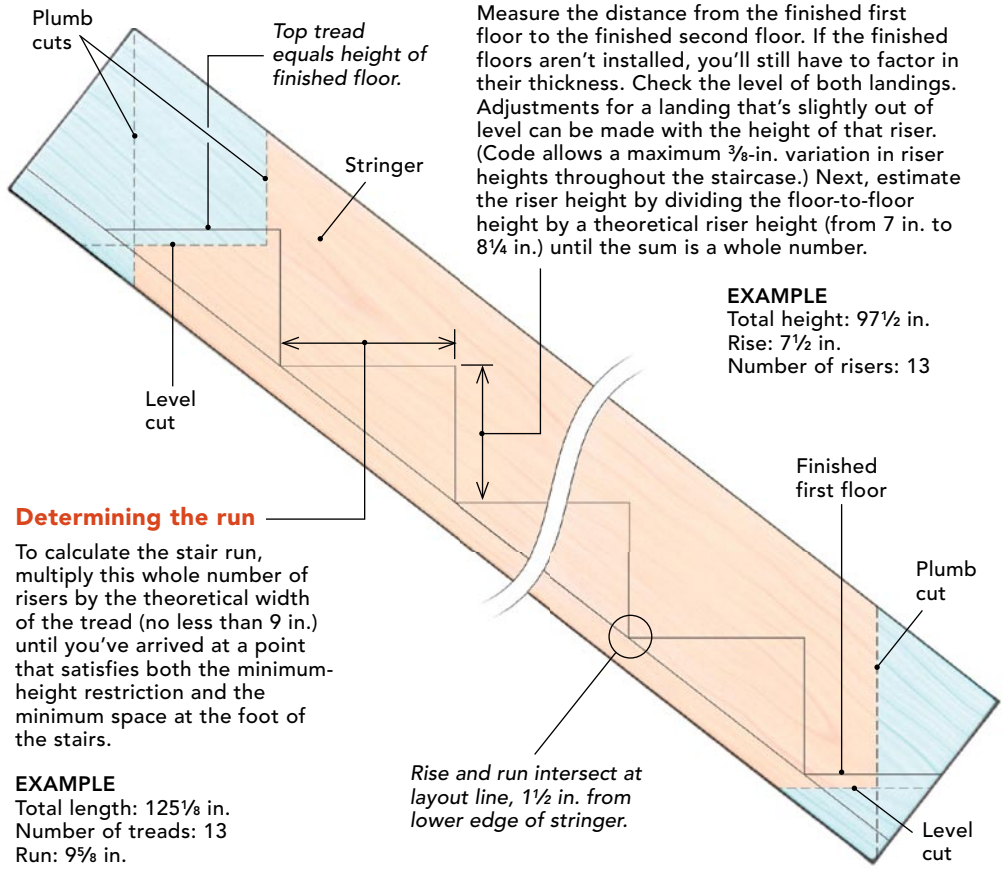
The best way to design stairs is first to measure the space, then to draw the space in cross section. There are four critical code-related elements to keep in mind, so it's imperative to know the local stair code, which varies by jurisdiction.



Determining the rise

Measure the distance from the finished first floor to the finished second floor. If the finished floors aren't installed, you'll still have to factor in their thickness. Check the level of both landings. Adjustments for a landing that's slightly out of level can be made with the height of that riser. (Code allows a maximum ⅜-in. variation in riser heights throughout the staircase.) Next, estimate the riser height by dividing the floor-to-floor height by a theoretical riser height (from 7 in. to 8¼ in.) until the sum is a whole number.

EXAMPLE
Total height: 97½ in.
Rise: 7½ in.
Number of risers: 13



Determining the run

To calculate the stair run, multiply this whole number of risers by the theoretical width of the tread (no less than 9 in.) until you've arrived at a point that satisfies both the minimum-height restriction and the minimum space at the foot of the stairs.

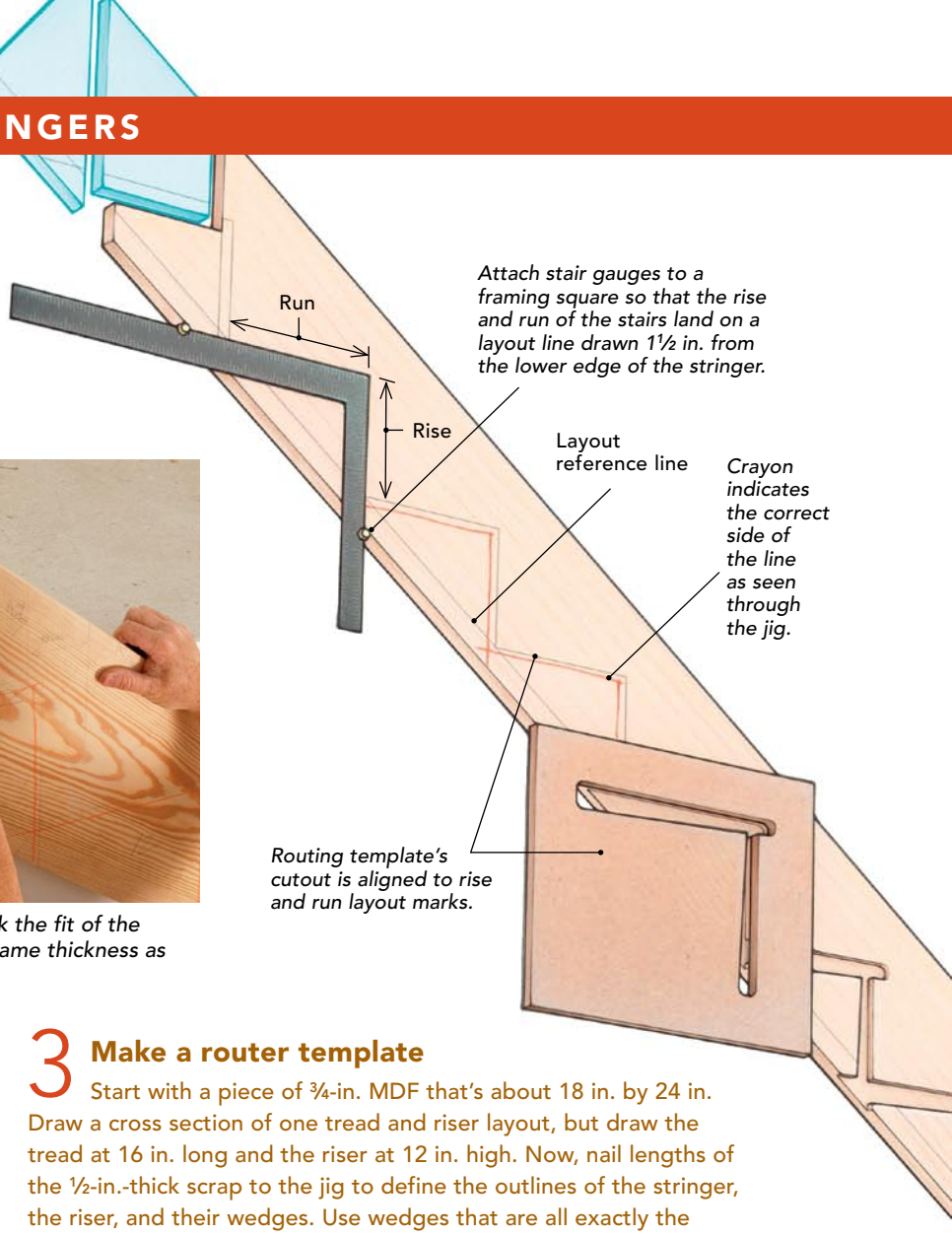
EXAMPLE
Total length: 125⅛ in.
Number of treads: 13
Run: 9⅝ in.

LAY OUT AND ROUT THE STRINGERS

1 Draw the stairs on the stringer

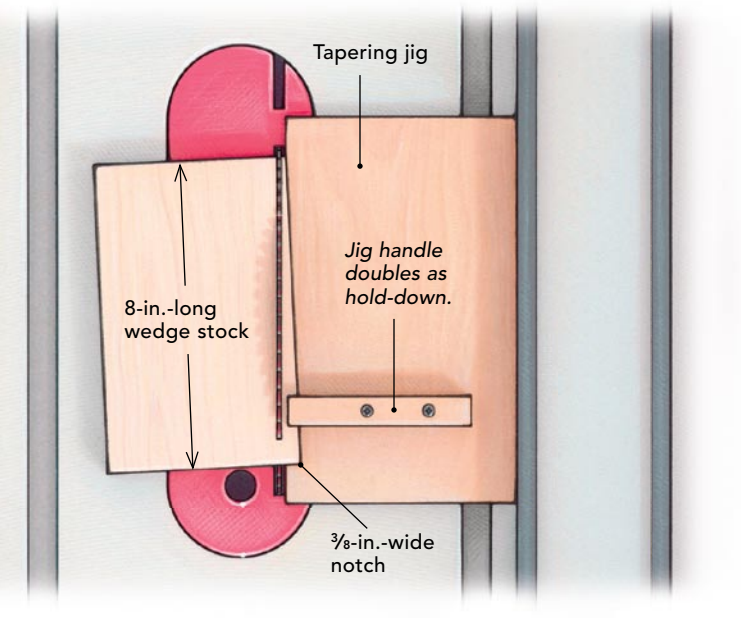
Draw a line 1½ in. from the lower edge along the length of the stringer to establish the intersection point of tread and riser. Starting with a level line for the bottom landing, lay out all the treads and risers. Use a crayon to mark which side of the line to rout. When marking the plumb and level cuts, don't forget to include the finished-floor heights.

Test-drive before the cut. *Before routing the stringers, check the fit of the stringer at the upper and lower landings. A wood scrap the same thickness as the flooring helps to determine the fit.*



2 Make a bunch of wedges

The easiest way to cut a bucketful of identical wedges is on the tablesaw with a tapering jig. Made of plywood, the jig rides against the fence and is notched to carry the wedge stock at a predetermined angle through the blade. After the cut is complete, the stock is flipped end to end, and the process is repeated.



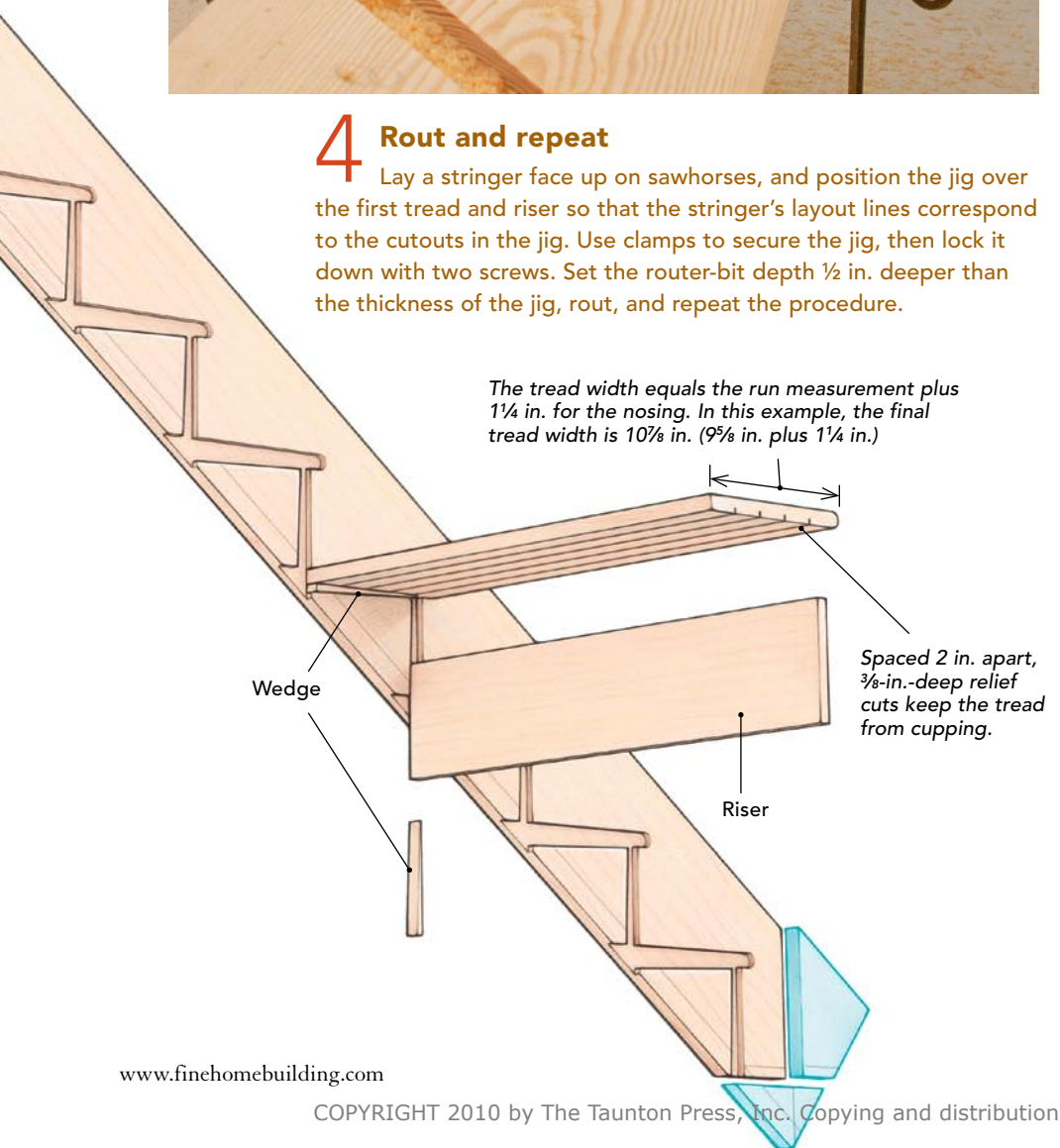
3 Make a router template

Start with a piece of ¾-in. MDF that's about 18 in. by 24 in. Draw a cross section of one tread and riser layout, but draw the tread at 16 in. long and the riser at 12 in. high. Now, nail lengths of the ½-in.-thick scrap to the jig to define the outlines of the stringer, the riser, and their wedges. Use wedges that are all exactly the same size—8 in. long, tapering from ½ in. to ⅛ in.—and draw lines representing the wedges that start at 1/16 in. off the inside corner and slope away. This defines a space for the wedge that will be tight enough to stop it before it bottoms out on the inside corner.

Use pieces of scrap to create a routing template. *After drilling a pilot hole, use a top-bearing straight bit with the same ½-in. radius as the tread's nosing to rout out the template. Pop the ½-in. material and nails off the jig, and you're ready to go.*

4 Rout and repeat

Lay a stringer face up on sawhorses, and position the jig over the first tread and riser so that the stringer's layout lines correspond to the cutouts in the jig. Use clamps to secure the jig, then lock it down with two screws. Set the router-bit depth ½ in. deeper than the thickness of the jig, rout, and repeat the procedure.



accounted for the thickness of the finished floor at the top and bottom of the stair.

Next, cut the level line at the bottom and the plumb and level lines at the top of the stair. Put the stringer in place, and see how it fits. If everything looks good, put the stringer back on the sawhorses, and mark the inside of the layout (the part you will rout) with a crayon. This will keep you from routing the wrong side of the layout lines. Put the other stringer on the horses alongside the first, and repeat the layout process with the framing square. You now should have two stringers that are mirror images of each other.

Rout the stringers

After the stringers are laid out, I make wedges. I cut them with a sliding tablesaw jig that rips a consistently correct angle. Using scrap pieces of tread or stringer stock cut to an 8-in. length, I rip all that I need plus a few extras. Don't use anything softer than southern yellow pine for the wedges.

After making the router jig, position it along the lower edge of the first stringer, and align the jig's tread and riser cutouts with the stringer's first layout lines. The crayon marks should be visible through the template. Clamp the template to the stringer, then screw it down.

Using the same router bit you used to make the template, set the router for a ½-in.-deep cut into the stringer. Insert the router into the template space beyond the stringer, turn it on, and rout out the dado. Turn off the router, remove it from the template, and check the dado to make sure the routing is complete. Now, move the template up to the next set of marks, and repeat the process until all the tread and riser dadoes are done. Make sure you can see the crayon marks through the template every time. (Don't ask me why; I'll spare you the gory details.) Check the dadoed stringer against the second layout to make sure it matches, rout the dadoes in the second stringer, and double-check the dadoed stringers against each other.

Start the assembly on the deck

Measure the routed stringers to determine the exact width of the treads and risers. Remember that the risers should be an inch or so wider to lap behind the tread below. Rip them all to width, then crosscut all treads and risers to the same exact length.

Set the stringers upside down on the floor (resting on their upper edges), roughly paral-

START THE ASSEMBLY ON THE FLOOR

1 Clamp
Lay the stringers on edge and parallel on the floor, and fit the bottom tread into the dadoes. Bar clamps help to keep everything together and the tread ends tight against the dadoes.

4 Lift
Raise the stringers into position, and after rechecking to make sure the stairs will meet the finished-floor height, anchor both ends with screws toenailed into the landings.

2 Wedge
Coat three sides of a wedge with glue, and drive it into the remaining gap. Spread glue across the back edge of the tread, seat the riser, and lock it in place with wedges.

5 More wedges
Install treads and risers as before, locking them into position with glue and wedges.

3 Screw
Pocket-screw the riser to the underside of the tread. Repeat the procedure at the top of the stringer.

6 More screws
Drive three or four 1½-in. self-tapping wood screws through the back of the riser into the treads above and below. When the glue has dried, fasten the inside stringer to the wall with 4-in. construction screws.

lel and square to each other. Starting at the bottom, insert the first two treads, the connecting riser, and their wedges. Next, go to the top of the stair, and put in two or three treads and one fewer riser. (Don't put in any risers before the tread below it, or you'll block yourself out.) Make sure that everything stays aligned and that the ends of the treads and risers are seated fully in the dadoes.

If the stair is not too big and you have help, you can assemble the whole run this way. If not, stop now and let the glue dry. Then, get some help to set the stair in place, and attach it at the top and bottom landings only. To match the finished floor, rabbet the 1-in.-thick top tread underneath so that it extends over the landing subfloor. At the top landing, drive 2½-in.-long construction screws through each stringer side into the joist. At the bottom, angle screws through the side of the stringer into the subfloor. Now you can install the remaining treads, risers, and wedges. If the adjacent wall is straight, anchor the stringer to the framing before filling in the treads and risers. Otherwise, let the glue dry completely before fastening the stair to the wall framing with construction screws. If the wall is not as straight as the stair, shim between the stringer and the wall to prevent the screws from pulling apart the glued joints. It's also a good idea to build a stud wall below the outer stringer. Besides creating an enclosure for storage space, it will give extra support to that side of the stairs. □

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