Trouble-Free Stairs

by Rob Dale Gilbert

Correct stringer layout, adequate headroom, and squeakproof assembly are the keys to successful stairs

Back in December of 1976, as a young ex-serviceman, I found myself in a line of 30 job applicants outside the trailer at a New Hampshire ski condo development. Jobs were scarce that year, so I was disappointed but not surprised when the super stepped out and said, "Thanks for coming by, men; we're all set." But my spirits rose again when he paused and said, "Unless any of you are first-rate stair men."

My grandfather and father had taught me to build stairs as a kid, and now it was paying off. Out of the shivering crowd, only I and the guy right behind me stepped up — and we were hired. After a simple quiz, the super sent us up the mountainside to meet the foreman with the words, "Fix the mess those clowns made."

And what a mess it was. Two three-story townhouses were already under roof, with men working at every level. But only one set of stairs had been roughed in, and it was wrong in every detail. Everywhere else, even the plumbers and electricians were using ladders to get from floor to floor. My new partner and I had our work cut out for us. We both realized that day that knowledge was power — or at least a sure paycheck.

During that long winter I refined my stair-building skills, since my partner was an excellent finish carpenter and a master at constructing truly "squeakless" stairs. In the years since, I've found that stair building is always a hurdle for carpenters: Now that I'm hiring guys myself, I see that few who call themselves carpenters have learned how to build a workmanlike staircase.

To cover stair-building thoroughly could fill a book. But basic stair-building isn't that mysterious. In this article, I'll

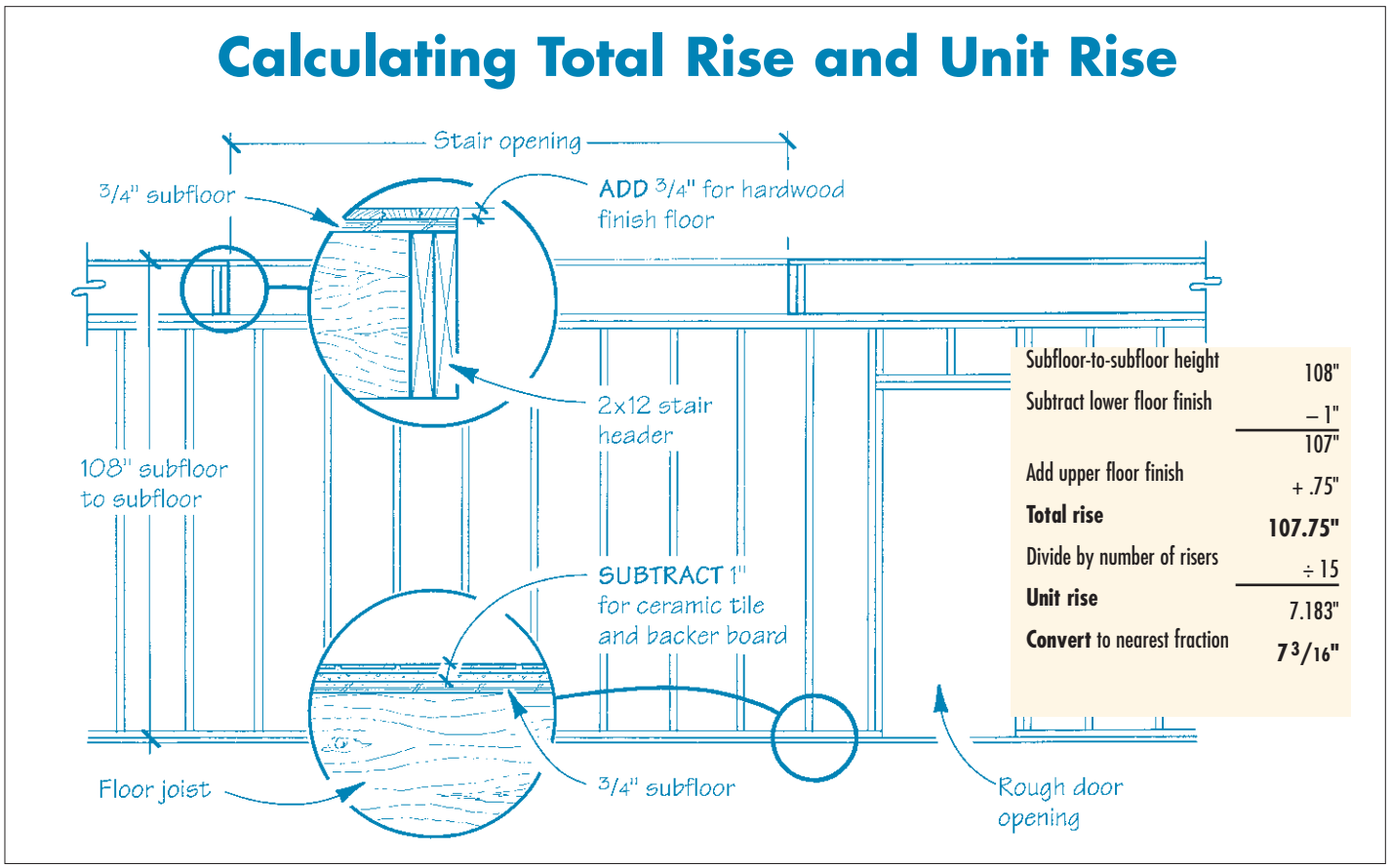


Figure 1. Don't even think about calculating a stair's rise until all floor finishes are decided upon. Add the thickness of the upper floor covering and subtract the lower floor's covering to get total rise. Divide by the number of risers to get unit rise.

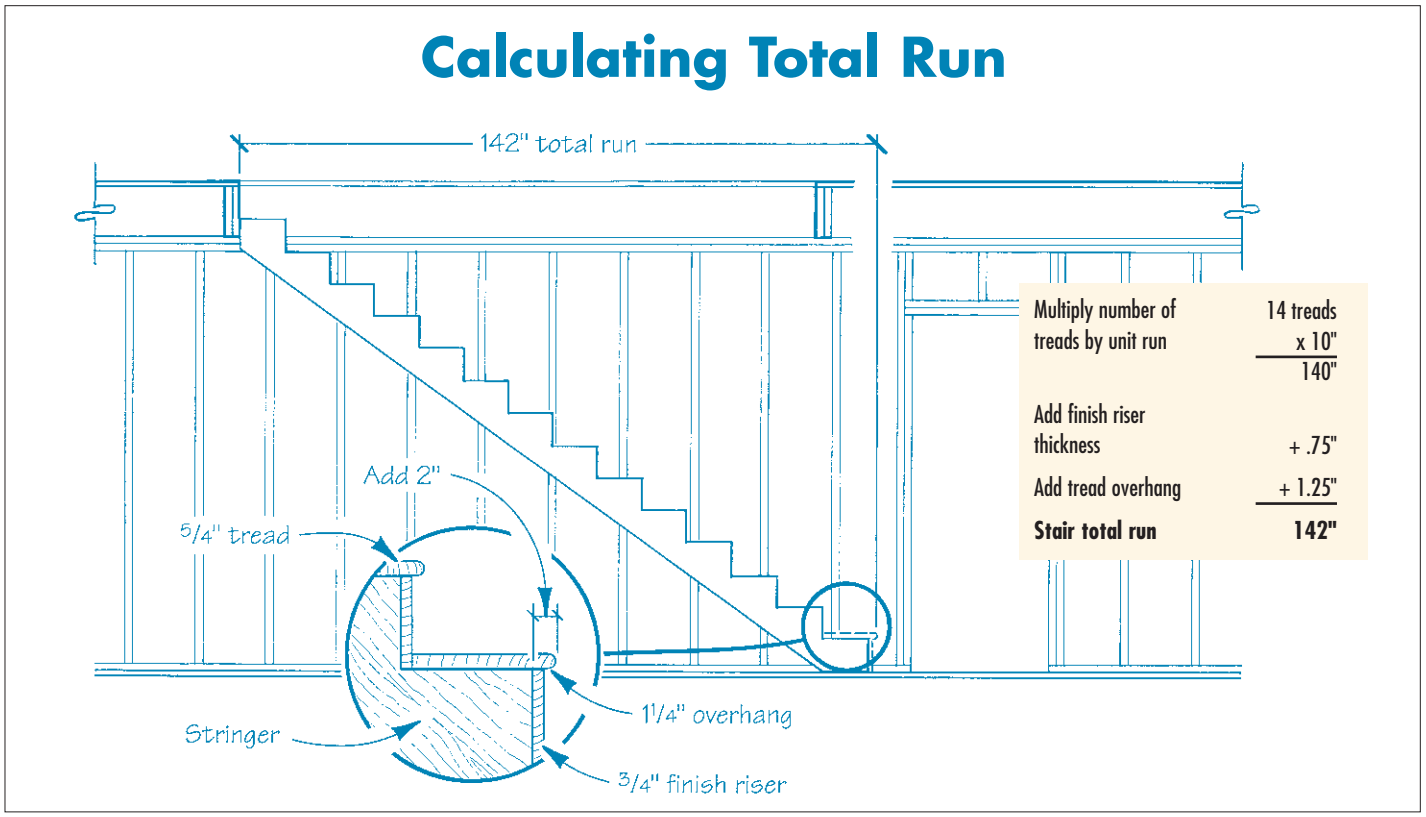


Figure 2. Total run is calculated by multiplying the desired unit run by the number of treads. The author prefers at least a 10-inch unit run because it allows him to use full-width 5/4x12-inch tread stock. Where space is tight, remember to allow for the overhang when determining the unit run.

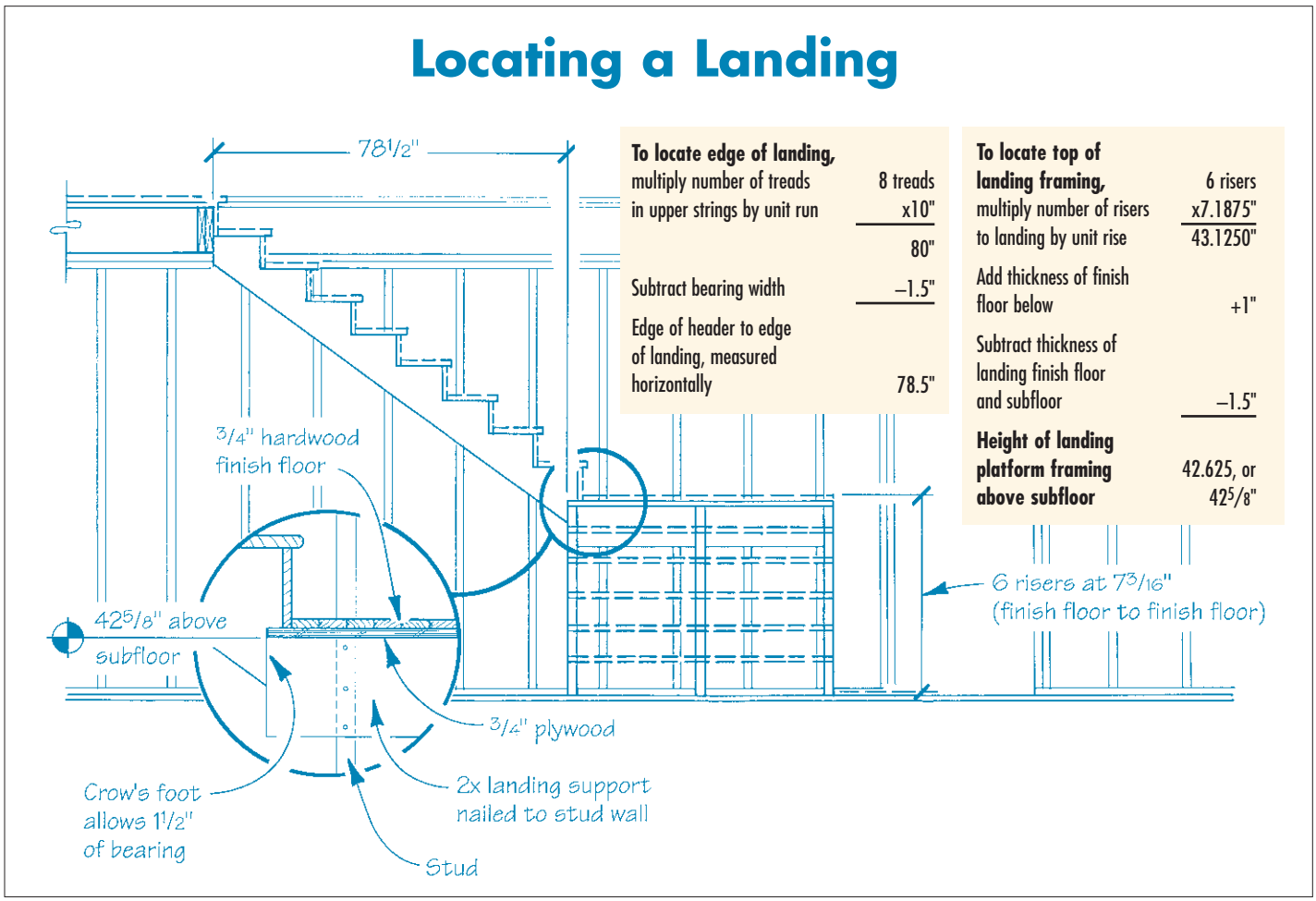


Figure 3. **The landing's finish surface must fall at a stair rise increment. Frame the landing to allow for variations in flooring and tread thicknesses.**

give a few tips on how to build a perfect staircase every time.

Calculating Rise and Run

When you frame stairs, you have to think ahead. Each mistake you make compounds your future problems, right through to the last finish details. The best way to prevent this is to stick to a step-by-step routine: Take things in the proper order and don't skip anything.

The first key to success is to account for the finish floors (see Figure 1). To get the final rise, take the subfloor-to-subfloor rise, add the finish floor thickness upstairs, and subtract the finish floor thickness downstairs.

Now divide the total height in inches by an estimated riser height — I like to use 7 inches. You'll get a number with a decimal remainder. In Figure 1, dividing the total height, 107.75 inches, by 7 yields 15.39. Forget the remainder to the right of the decimal; this tells us we need 15 risers. Now divide 107.75 by 15 to get the exact riser height: 7.183 inches. To convert the decimal to sixteenths, multiply .183 by 16 and you get 2.92, which rounds up to 3/16. So the exact riser height is 7 3/16 inches.

I always do an important cross-check at this point: I multiply the rounded-up riser height by the number of risers, to make sure I'm not building in a cumulative error. In this case, we get 107 13/16 inches. That's only 1/16 inch taller than the true opening, so it won't be a problem.

Tread run. Fifteen risers means 14 treads. I prefer to use 5/4x12 stock treads if possible. I like a nice, wide stair, and I don't want the labor of having to trim each tread. But here's where problems sometimes arise — if you arbitrarily choose a 10-inch or 11-inch tread, you may run out of room. If space is tight, you have to determine the tread run by dividing the total length you have to work with by the number of treads. Codes allow for a maximum total overhang of 1 1/4 inches, measured from the end of the nosing to the face of the finish riser beneath it, so a 10-inch rough tread run will let you use an 11 1/4-inch-wide finish tread. Anything narrower, and you'll have to trim — or even drop down to the next stock size.

With 14 treads at 10 inches each, the total run of the rough carriage is 140 inches (Figure 2). But don't forget to add in the 3/4-inch finish riser thickness and the 1 1/4-inch overhang — another 2 inches. That 2 inches can make a big difference if space is tight.

When you check your horizontal dimensions, don't just measure at the rough opening — think about door casings and other trim details. A tread nosing that crashes into a door casing is a headache you don't need.

Top tread. If you frame the stairs so the top tread is flush with the second

Typical Stair Flaws

Most stair problems start with the framing. Usually, defects happen because the framer blew a measurement or a calculation. Here's a handful of typical mistakes:

Wrong total rise. Though you often frame stairs when only the subfloors are in place, you have to calculate the stairs from finish surface to finish surface. If the finish floors will vary in thickness from floor to floor, you must frame accordingly. Otherwise, the problem will show up at the top or the bottom as a "trip step" that's shorter or taller than all the rest (any more than a 3/16-inch variation is a code violation). Sometimes, a trip step can be fixed by cutting or shimming at just one point, but usually the problem requires recutting the entire stringer.

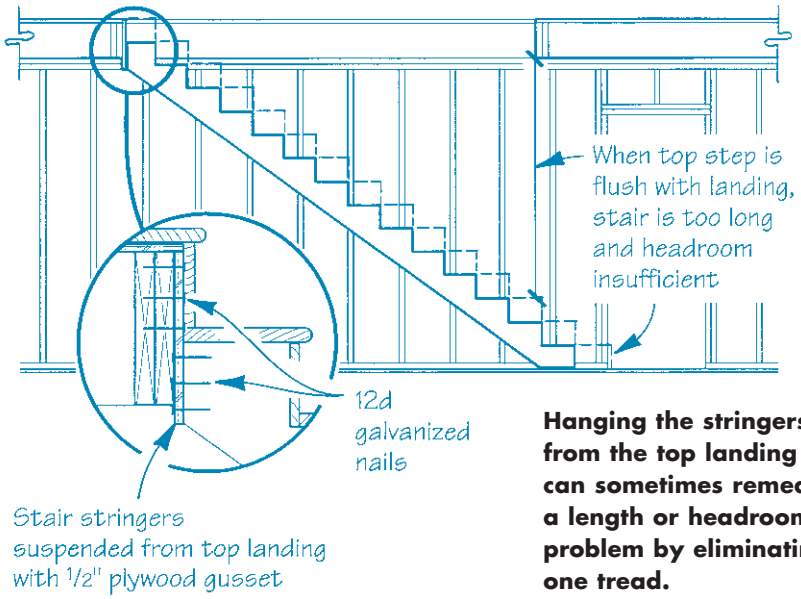
Total run too long. Stairs may encroach on a doorway or hall. Here again, while the problem affects only the end of the run, you have to recut the whole stringer to fix it. If you've laid out the stairs with the top tread flush with the second floor, you can save a whole tread width by dropping the top tread and losing one step (see illustration).

Insufficient headroom. Stairs must be steep enough, or short enough, to clear the opening with 6 feet 8 inches of headroom. Otherwise — need I say it — recut the stringer.

Improperly located landing. If the rough landing is placed too high or too low, the stairs above the landing will not match the steepness of the lower flight, or there may be trip steps at the landing or at the top or bottom floors. To fix this, you have to tear out the whole landing.

Even without these gross errors, framing mistakes can still come back to haunt you. Stairs should be framed to allow for easy installation of drywall and trim. Finally, even if the framing is done right, your customers will still complain if the stairs squeak. Whatever the cause, that squeaking sound creates the impression of faulty workmanship. It's well worth the effort to prevent it. — *R.D.G.*

Drop the Top Step



Hanging the stringers from the top landing can sometimes remedy a length or headroom problem by eliminating one tread.

floor, that extra step adds the width of a whole tread and the height of a whole riser. To avoid this problem (and save the labor and material cost of the extra tread), I always hang the carriage from the top floor with a plywood gusset (see "Typical Stair Flaws"). If space is still tight, I'll try using one less step. With our 107.75-inch rise, for example, 14 risers would have to be about 7 11/16 high apiece — pushing things, but still within reason.

Locating a Landing

With the riser and tread dimensions established, you can now position any landings. To get a landing in the right place, it helps to think of it as a big, wide step: The finish surface of the landing — after the flooring is on — has to fall at an even increment of riser height, just as if it were a step (Figure 3, previous page).

Let's start with the height of the landing. You can either measure up from the first floor or down from the second floor, but don't forget to include finish floor thickness. Say the landing falls six risers up, as in Figure 3, previous page. Multiply the riser height, 7 3/16, by 6; this gives 43.125, or 43 1/8 inches. Now add the 1-inch thickness of the tile floor below; this is the height above the subfloor of the landing's finish floor. To locate the height of the landing's framing, subtract the thickness of the hardwood flooring and the plywood subfloor. The top of the landing's framing will be 42 5/8 inches above the first-floor subfloor.

To find the landing's horizontal location, I always work from the top. If, as in Figure 3, the landing is eight steps down, its edge should be no more than eight tread-widths from the framing at the upper floor, minus at least 1 1/2 inches for bearing for the stringer.

Cutting and Installing Stringers

When all the rough landings are in place, you can cut the rough stringers. Step off stringers with a framing square (Figure 4). For each riser's height, use the

exact number you've calculated, except for the bottom one — shorten that one to compensate for the difference between finish flooring and finish treads.

Installing the stringers. If you've calculated, laid out, and cut correctly, the stringers should slide right into place with no argument. I usually assemble the whole stair on the workbench. I hold everything together with a single temporary tread at the bottom and a gusset at the top, which I also use to hang the stringer from the framing (Figure 5). Two men can easily lift this assembly into place and nail it.

Spacer for drywall and trim. Rough carpenters commonly nail stringers tight to the wall studs. This creates no end of trouble for drywall and finish installation. You have to piece the drywall in, and cut and fit the side trim laboriously around each step.

To avoid all these hassles, I nail a 2x4 spacer to the side of any stringer that will sit next to a wall (Figure 6, next page). I also hold the temporary treads back from the wall. This leaves space to slide drywall and the 1-by side trim before attaching finish risers and treads. The drywall needs only a straight cut along the bottom edge, which gets buried beneath the finish, and the finish stringer only has to be cut at the ends. This technique also provides full bearing for the treads.

Squeakless Stairs

When installing risers and treads, I still use the techniques I learned from my partner on that first condo job, more than 20 years ago.

I always work my way up the stairs, first installing each riser, then the next tread (Figure 7, next page). Starting at the bottom, I install the first two risers with the top edges standing 1/4 inch higher than the rough tread. The projecting edge of the first riser fits into an oversized dado on the underside of the first tread. I use a liberal bead of construction adhesive at all connection points, including in the rabbet (construction adhesive is flexible, so it holds up to the shock of foot traffic; common wood glue will eventually fail).

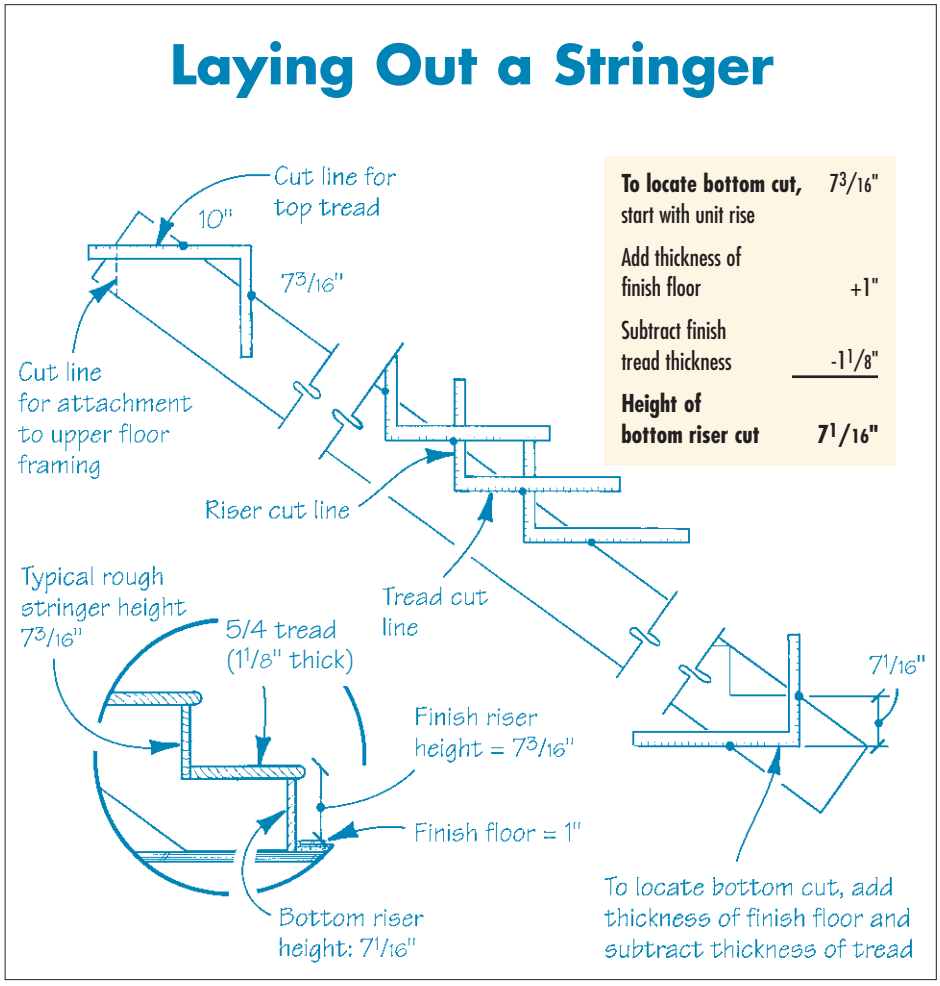


Figure 4. When laying out stringers, be sure to adjust the height of the bottom riser for tread and finish floor thickness: Subtract the tread thickness, then add back in the finish floor thickness.

I used to use 12d galvanized finish nails to secure risers and treads, but over the years I switched to using square-drive finish screws throughout. Finish screws have better holding power and don't leave hammer marks. The small heads are easily filled or can be hidden by lifting a grain chip with a chisel and gluing the chip back in place over the head of the screw.

I also apply adhesive to the joint between each tread and the riser behind it. Reaching inside the stair, I also screw through the back of the riser into the tread with four 2-inch screws. With this combination of careful joinery and adhesive, the stair is rigid and squeakfree. Since the dado in each tread covers the riser beneath it and the tread butts tightly against the riser above it, no gaps are visible to anyone climbing the stairs.

The only callback I've had on a set of

Figure 5. The author attaches a gusset and one temporary tread to hold his stringer assembly together. He nails the gusset to the second-floor framing to hold the assembly securely in place.

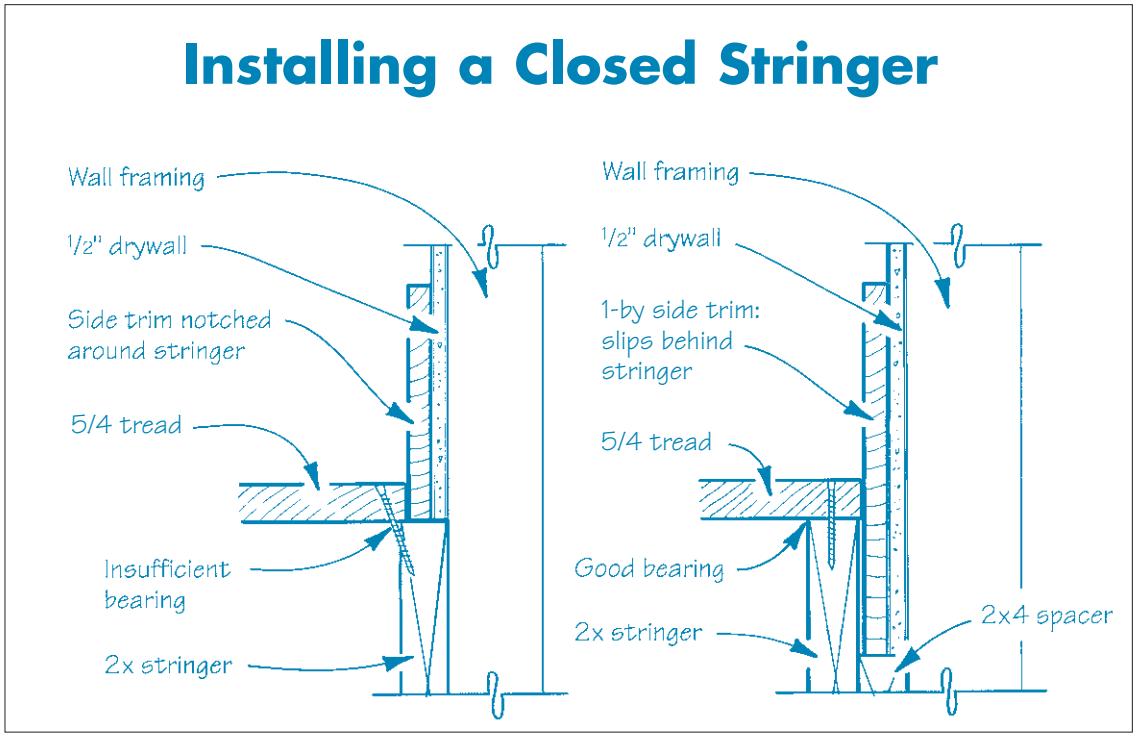


Figure 6. When stringers are nailed tight to walls, drywall and trim require laborious scribing and leave insufficient bearing for treads (far left). The author spaces stringers off the wall with a 2x4, leaving plenty of room to slide drywall and finish trim into place (left).

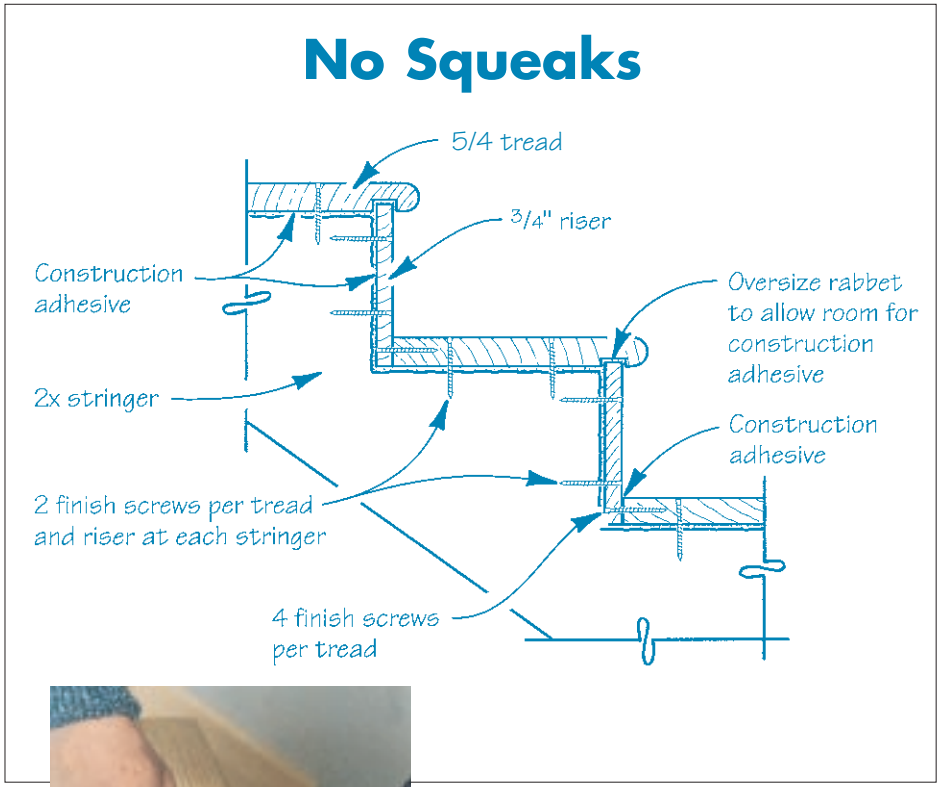


Figure 7. The author relies on careful joinery, finish screws, and construction adhesive to build squeakless stairs. The dado construction (photo inset) also hides any gap between the top of the riser and the tread.

stairs built this way came when someone dropped a heavy piece of furniture on the stairs and broke off the nosing. I figured out that I had made the dado too deep, weakening the piece. I now make the dadoes no deeper than 3/16 inch.

Trim Tips

With the poor quality of framing lumber these days, I sometimes find myself building stairs next to a badly bowed wall. If I can get at the back side of the wall, I drive screws right through the back of the drywall and the side trim, pulling everything tight to the risers and treads.

If you can't get behind the wall, you can still pull the side trim tight to the steps. Just drive a screw halfway into the 1-by board so you can grab onto it, and use that screw as a handle to pull the trim in. Then reach inside the staircase behind the riser and run a hidden "toe-screw" through the riser into the side trim, to suck the finish board in tight. As long as you remember to do this as you go, any gap between the side trim and the drywall can be covered later by a cap molding. ■

Seventh-generation carpenter ***Rob Dale Gilbert*** *is a custom builder and remodeler in Lyme, N.H.*