A Quick Way to Build a Squeak-Free Stair

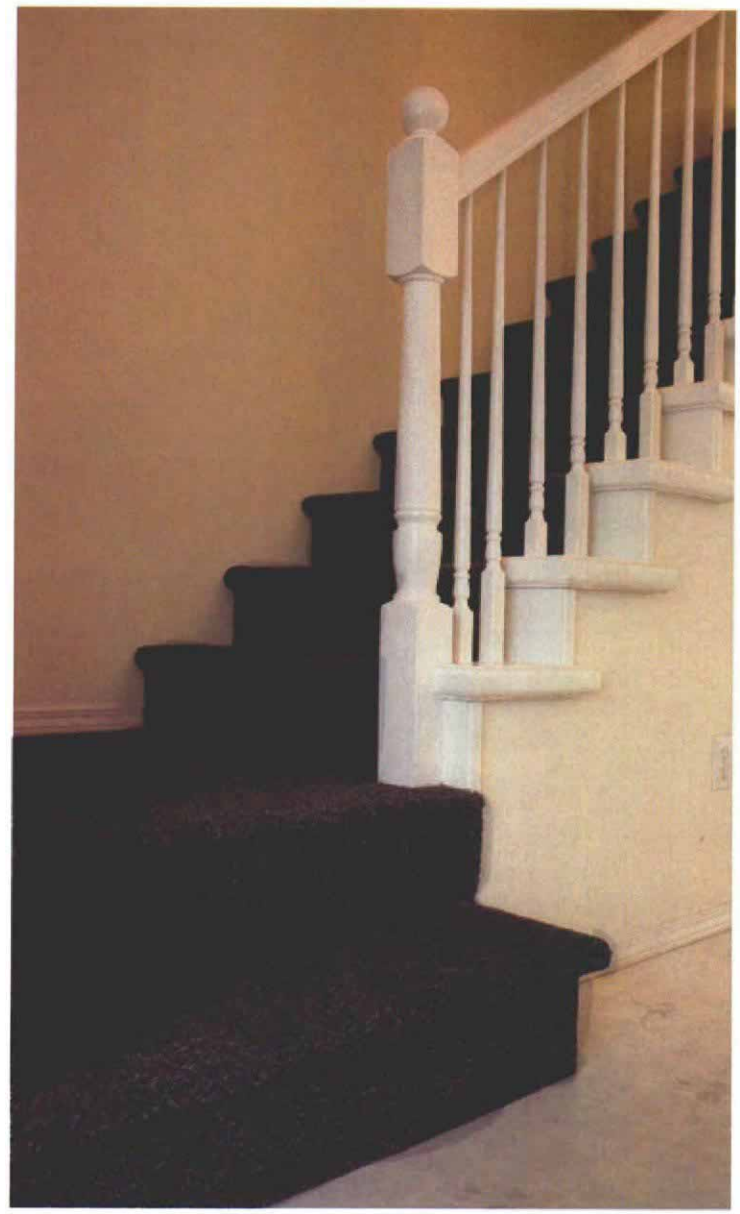
Using plywood instead of framing lumber can guarantee a stable and accurate staircase that won't break the bank

by Alan Ferguson

On a recent job, I overheard one of the young guys hanging cabinets in the kitchen say to his buddy, "Hey, who's the old geezer sitting on the stairs?" To my utter dismay, I quickly realized that there was only one set of stairs in the house, and the old geezer they were talking about was me. But thinking back on it, I have to admit that they were right. I've been building custom stairs for twenty-odd years, doing my own millwork and specialized handrails. As the years slipped by, I guess I have become that old man on the stairs.

But in the process of becoming this old stair geezer, I've learned a thing or two about building stairs, and I've reached a couple of conclusions. My first conclusion was that in order for a stairway to remain level, plumb and squeak-free fora lifetime, it should be built under controlled conditions, such as in a shop.

With large stationary shop machinery, I can produce more accurate components that fit together to a T. Building the stair in a shop also means that I do all of my measurements and layouts in the friendly light and at the comfortable height of my workbench. Here, I can see my work properly to ensure accuracy. Too often on job sites, I end up working on my hands and knees on the floor. In the shop I always know there's an extra clamp nearby if needed, and there's no skimping or making do with less as I might be tempted to do on a job site.



An inexpensive stairway doesn't have to look cheap. Tread and riser end caps create a border for carpeting and a place of attachment for the newels and balusters. With shop techniques, even this economical stair can be built so that it stays level and squeak-free.

On most sites, the handrail installer isn't part of the framing crew, so he's usually not around when the stairs are being built. But when I'm the guy who builds the stair and installs the handrail, I know where not to put fasteners and where to beef up the stair for extra strength, such as adding support for future newel posts. Another reason for not building a stair on site is that I always feel I'm in the way of the other trades coming and going through the house, trying to get their work done.

One final plus to building a staircase in the shop is that I get to truck it to the site when it's finished. There's nothing more impressive than arriving at a site with a stair built as perfectly as a piano, carrying it into the house and nonchalantly slipping it into place. That's a sight that makes a hero out of any humble contractor in the eyes of a customer.

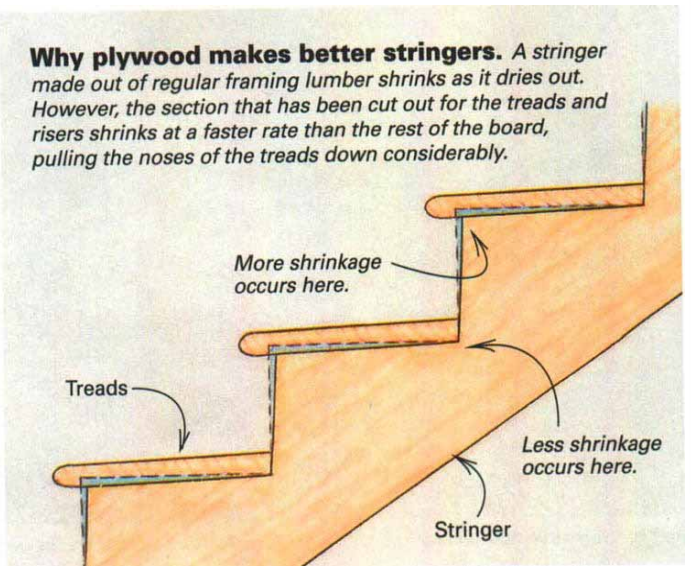
However, in spite of these advantages, most contractors in my neck of the woods like to build their own straight-run stairs on site. A guy like me could get mighty hungry waiting for a client or contractor to knock on the shop door to order a set of stairs. But I haven't been in this business all this time without learning to compromise.

So what about using shop techniques on site? That way, I have the advantage and convenience of building a plumb and level stair myself even if I can't have perfectly controlled conditions. My straight stair design will give you an afford-

Laminated stringers won't shrink or warp. Two layers of ¾in. plywood are glued together for stringer stock that will remain stable and true for the life of the stair.

Each tread/riser layout is duplicated exactly. Stair gauges clamped to the edge of a framing square allow the layout to be repeated precisely for each step.

MDF jig for perfect sawcuts. The table of the circular saw registers against the edge of a simple jig made from MDF to eliminate freehand sawing. The cuts are finished with a jigsaw and fine-tuned with a chisel.



Why plywood makes better stringers. *A stringer made out of regular framing lumber shrinks as it dries out. However, the section that has been cut out for the treads and risers shrinks at a faster rate than the rest of the board, pulling the noses of the treads down considerably.*

Drawing: Kathleen Rushton

Assembly jig holds the stringers parallel and square. A simple jig made from strips of plywood holds the stringers at the proper width while the author is attaching treads and risers.

Witness marks help align the stringers in the jig. Lines called witness marks are made with the stringers laid side by side. Then a square and a straightedge align one stringer perfectly with the other.

Risers go on before the treads. For each step the riser is glued and stapled to the stringers ahead of the tread. Staples driven through the backs of the risers into the treads hold them together until the glue dries.

able stair that can be built either in the shop or on the job site for permanently level, squeak-free perfection just by following a few simple shop techniques.

Plywood stringers eliminate sloping treads—Something else I've realized from my years of building stairs is that stair stringers, or carriages, should be made of a dimensionally stable material, such as plywood instead of 2x lumber or, heaven forbid, green framing lumber. Building stairs on a site where moisture levels change radically intensifies wood movement and shrinkage. Stairs made with plywood stringers are more likely to remain level and plumb as the house heats up and experiences drastic moisture swings from the curing of concrete and drywall compound.

Stringers cut from standard 2x stock will shrink unevenly as moisture levels in the interior of the house stabilize (drawing p. 81). These stringers shrink less at the inside comers of the treads and risers (the narrowest points of the stringer), and more at the outside comers where the stringer is the widest. This differential shrinking pulls the nose of the tread noticeably downward.

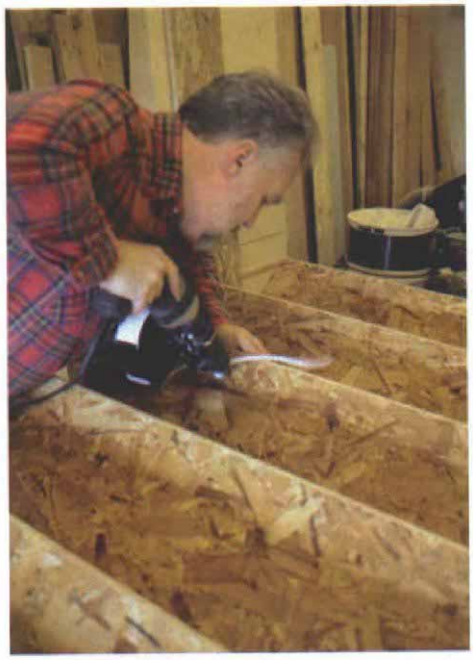
Stairs with sloping treads are dangerous, and as a handrail installer, I shudder at the thought of sloping treads. Making good baluster cuts to fit sloping treads is difficult enough, but cutting mitered returns for these treads and risers with any precision is practically impossible. Stringers cut from plywood don't suffer the same shrinkage problems, which eliminates sloping treads.

Materials are chosen to fit the budget—My stair design is versatile and can be adapted to almost any finishing style and budget simply by selecting different materials. The stair in this article was an economical solution for first-time homeowners struggling to stay within budget. Although they would have preferred hardwood treads, they opted for carpeted treads with exposed hardwood tread end caps (photo p. 80). I cut the treads from off-the-shelf 16-ft. lengths of 1-in. OSB tread stock that come 11¾ in. wide with one bullnose edge.

Like the treads, the stringers can receive a variety of treatments, such as paint, veneer or addition of a stylish trim. The stringers I used on this stair were to be covered with drywall, then painted, so I chose ¾-in. poplar exterior-grade plywood; however, any high-quality exterior plywood would have worked.

The risers were also to be carpeted, so I cut them out of ½-in. fir plywood. I always use kiln-dried 2x2 cleats for the riser-to-tread connections. I'm a stickler about using good-quality cleats to guarantee the best connections, so I buy baluster manufacturers' blanks that could not be used because of minor blemishes. Baluster companies are usually happy to sell me bundles of these seconds, called "sweet ones" in the industry, at a reduced price.

Top riser is reinforced for installing the stairs. The top riser is reinforced with a plywood backer that is screwed to the stringers from behind. A cleat will be added to the bottom of the backer board to support the top tread, and the nosing acts as a handle for guiding the stairs into position.



Screws keep out the squeaks. After the glue has set, screws are driven to fortify every joint and ensure a squeak-free stair.

Two layers of plywood form the stringers—My first task was ripping the plywood for the stringers into 11½-in. widths. Using 8-ft. and 4-ft. lengths for each layer, I laminated two layers of plywood together to form stringer stock 1½ in. thick and 12 ft. long (photo left, p. 81), which I had estimated to be just long enough for this stair. Because the house was already weather-tight and because there was no danger of the staircase getting rained on, I was able to use one-part, shop-grade white glue with a 20-min. setup time. I staggered the butt joints of the short and long pieces between the layers and glued the butts with construction adhesive. If rain or moisture had been a consideration, I would have used an exterior waterproof glue.

I brought a big portable workbench to the site to give me a flat working surface for efficient clamping and gluing, but I could have easily set up a temporary workbench on site. Most guys would have skipped this step and done their glue up on the plywood deck, but the glue up is much easier to control on a good workbench.

For fast glue application, I use a fuzzy 3-in. paint roller with the glue in a pail. After spreading glue on both layers of plywood, I mated the top and bottom layers together and clamped them every 12 in. using C-clamps. I always double-check that my clamps are all tight, which means there will be no glue voids. While the glue was setting up on my stringer stock, I cut the tread and riser stock.

To determine the depth of my treads, I first had to calculate the width of the nosing. The end caps I chose for the treads came with 1¾-in. nosing, but the tread stock was to be covered with ½-in. thick carpet that my customer had selected. To make the overhang of the carpeted tread flush with the end cap, I added 1¼ in. (1¾ in. minus ½ in.) to my unit run and ripped the OSB tread stock to that width. Ripping the riser stock to my unit rise was straightforward.

Leaving out the squeaks—When the glue had set, I undamped the stringer stock and began my layout. Being careful to allow for pencil-lead thickness for each tread and riser, I laid out the stringer with my framing square and stair gauges (photo top right, p. 81). Yes, I know it's a pain, but you'll thank yourself for making that extra trip out to your truck to get your stair gauges. Without them, it's impossible to duplicate the exact measurements from one tread/riser combination to the next. Just about or close enough at this point won't yield a precision stair.

For most stairs total run and width measurements come from the framed opening in the

A spacer strip allows room for drywall. A 1-in. strip stapled to the stringer will keep the stringer away from the wall studs so that drywall can be slipped in behind the stringer after the stairs are installed.

floor. Rise measurements are normally taken from finished floor to finished floor. However, these plans called for a landing with one step down at the start of the run. This detail meant that I needed to take my total-rise measurement from the top of the landing deck to the top of the second-floor deck. (For more on calculating rise and run for stairways, see *FHB* #100, pp. 54-56).

The completed layout included the bottom foot cut where the stairs sit on the landing as well as the joist cut at the top of the stringer. The joist cut lets the stringer run up to the ceiling rather than end in an abrupt drop from the deck at the top of the stairs. I believe that attention to visual details such as this one is what distinguishes a craftsman's work.

Having determined the exact size of the bottom foot on the stringer, I gave the framer precise measurements for the height of the landing, which he began immediately so that it would be ready when I finished my stair. When the framer built the landing, I made sure that he glued and screwed every connection, which is the greatest factor in making squeak-free stairs.

Squeaking stair treads start with the shrinking and warping of wood as it dries, which allows the nails to work loose. What you hear when you step on a squeaky tread is the sound of the wood moving against a nail. All framing nails, even galvanized, tend to work loose whereas screws seem to stay put. My theory is that the glue fills any voids and that the screws hold everything together. The result is silent stairs.

I always add plywood backing to the top riser where the stairs attach to the upper deck. This extra layer of plywood helps to stiffen the stairway during installation and provides extra reinforcement under the nosing of the top landing. Because this small house was built with 8-in. rather than 10-in. or 12-in. floor joists, I cut a 2-in. deep mortise in the stringer at the inside comer of my joist cut that allowed me to use a full 10-in. width for my extra-plywood backing.

Simple jigs speed up cutting and assembly—Next I make a jig from MDF scraps to act as a fence for my circular saw to follow when I make riser and tread cuts in the stringer (photo bottom right, p. 81). The jig has a fence that registers against the bottom of the stringer, and I line up the jig with my layout, using a wooden block whose width is the same as the distance from the edge of the saw's foot to the sawblade.

Using a jig to make the tread and riser cuts is another shop technique most carpenters working on site would probably skip, thinking it too much trouble. But using this jig as a guide, I eliminate problems and imperfections that result from freehand cutting with a circular saw. My cuts with the jig are perfect, ensuring cabinet-quality joinery for the finished stair.

Because the circular saw doesn't reach all the way into each corner, I finish each cut with a jigsaw and then clean up the inside corner with a wide chisel. When the first stringer is finished, I clamp it securely to the second one and trace it to ensure an exact match. I cut the second stringer the same way as the first.

Now, with both stringers cut, I make a simple assembly jig that screws to two sawhorses (photo top left, p. 82). This jig holds the stringers firmly and perfectly parallel at waist height. Here again, most of the guys I see on site either assemble the stairs on the floor, working on their hands and knees, or they assemble the stairs in place, struggling to fasten the treads and risers while keeping the stringers aligned properly.

My assembly jig took a few minutes to set up, and it gave me a workstation at a comfortable height where I could keep things square and level. The assembly jig is made of two 8-ft. long platforms mounted between two sawhorses. Each platform consists of a 3-in. wide plywood cleat screwed to a 10-in. wide base piece. These platforms are screwed to the sawhorses so that when the stringers are standing up against the cleats, they are at the desired stair width. Some simple spreaders between the stringers hold the stringers firmly in place against the cleats.

Next I square one stringer to the other in the assembly jig using witness marks and my framing square (photo top right, p. 82). The witness marks are made by placing the stringers flat against each other and making a pencil mark across both of them at some point. Then, with the stringers in the jig, I line up both pencil marks using a framing square and an extended straightedge that leaves my stringers perfectly square to each other in the jig.

A note of caution here about stair width. When determining stair width, be aware of any compensations you might need to make for drywall or to make the stairs fit in the rough opening. This stair was being installed along a wall, so I allowed for a 1-in. space for drywall installation. I also had to ensure that the finished stair would fit the rough opening, so I subtracted an additional ¼ in. when figuring the correct distance between the stringers. This extra space gave me ample clearance to slip the stair easily into place in the rough opening of the second-floor deck.

Staples hold the stair together initially—After the treads and risers were cut to length, the stair was ready for assembly. As I mentioned before, I always glue and screw all surfaces on all of my connections to ensure a squeak-free stair. Initially, however, I assemble the stair with a few staples, just enough to hold the elements together while the glue dries. At that point, I go back and add screws to every connection.

I start my assembly with the bottom riser. When it is glued and stapled in place, I set in one of my 2x2 "sweet" cleats behind the top edge to give me sufficient material to screw the tread into. Before putting in the first tread, I install the second riser and cleat (bottom photo, p. 82). Then I glue the first tread in place and fasten it with one staple in each stringer and a couple of staples in the riser cleat. I also drive a couple of staples through the plywood riser into the tread, which has to be done from the backside of the riser. Following the same process, I staple and glue the rest of the risers and treads in place except the top tread and riser.

Ready for traffic. With the stair screwed in place and the step to the landing installed, the stair is ready for use by the construction crew. End caps and balusters will be added later during the trim stage. (Note: Insulation scraps made a great sound barrier for the wall behind the stairs.)

At this point I preassemble the top riser and nosing together with the piece of backing plywood that fits into the stringer mortises I made earlier (top photo, p. 83). I hold this assembly in place while I lay in the last tread and staple it. This special beefed-up riser is one of the trademarks of my stairs. It not only stiffens the top riser for handling (and transporting), but it comes in handy when I'm setting the stairs in place.

Before removing the stair from the jig, I screw the treads to both the stringers and the riser cleats using 2-in. coarse-thread floor screws with square-drive heads (bottom photo, p. 83). I use these screws because they're beefier than drywall screws, so normally I don't have to predrill. In fact, the only predrilling I do is when I screw the top nosing to the top riser and backer. I finish the top assembly with a few screws through the backer into the stringer at the joist cut. I also glue and staple a 1-in. spacer strip (photo facing page) to the edge of the wall-side stringer.

Now I'm ready to flip the stair up on its side to screw through the back of each riser into each tread on approximately 6-in. centers. As a final touch, I add a 2x2 cleat under the top tread against the ½-in. plywood backer where it extends down past the top riser. And the stair is ready for installation, barely six hours from when I started.

The top nosing acts as a handle—Ordinarily, a simple straight stair such as this one could be installed the same day. But those two young carpenters in the kitchen got so tuckered out just watching me whip up these stairs that I decided to postpone the installation until the next day when they were fresh.

The following day, I arrived to find my two young friends and the framer waiting to help with the installation. After double-checking the landing dimensions, we lifted the stair into place for a dry-fit. Now here's where that top-riser/nosing assembly comes in handy. I got on the top deck, and with three guys lifting the stair, I reached out, grabbed the top of the stair by the nosing and guided the whole thing into place.

The stair went in beautifully, so we took it back out to prepare for the final fit. I applied construction adhesive liberally to the joist header and under both stringer feet on the landing; then we installed the stair for good. My two crucial checkpoints were making sure that the 1-in. spacer strip was snug against the wall and that the top nosing was flush with the deck.

When everything was lined up properly, I quickly drove a nail through the top riser into the joist header to hold the stair in place temporarily. The guys down below could now let go and breathe easily while I took my time securing the stair through the beefed-up riser with 2-in. screws. Then I moved to the bottom and angle-screwed through the stringer feet into the landing. Finally, I screwed the wall-side stringer to the studs with long screws.

In my spare time the day before, I built the single step leading up to the landing by gluing and screwing a box together using offcuts from the OSB treads, and I secured the step in place with screws and construction adhesive. The wooden end caps would be installed when I came back to install the handrail. And voilà, much to the relief of the other subcontractors and to the joy of my customers, the stair was ready for use with a humble price tag but a picture of close-to-cabinet-quality precision and squeak-free perfection (photo above). □

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