Master Carpenter

Create a Curved Stair Riser

Templates and a laminated riser keep the curves fair and remove the guesswork

BY MIKE BELZOWSKI

THE CRAFTSMAN

According to his mother, Mike Belzowski has had a hammer in his hand since he was a toddler. By the time he graduated from high school, he was an experienced builder; within a year, he had become lead carpenter on a crew. He struck out on his own soon after; since then, he has built everything from commercial urban rehabs to furniture to entire houses.

Like most carpenters, Mike also works on his own house. A few years ago, he and his wife bought a small fixer-upper outside Michigan City, Ind., and they've been enlarging and improving it ever since. In between jobs, he's taken classes with such woodworking luminaries as Sam Maloof, Marc Adams, and Michael Fortune. *Fine Homebuilding* found him in his shop making stair parts.

As a carpenter, I am always attracted to a finely crafted staircase. Stairs are a place where a carpenter's work really can shine, and they make a statement about the rest of the house. In my house, I wanted to incorporate some curves in the staircase, both to add visual interest and to make the project more challenging.

I designed these stairs with a broad starting step whose curve gradually straightens out over the next two treads. The traditional way to make curved risers is to cut shallow kerfs into the back of the stock so that it will bend more easily. I've never liked that method, which can cause the kerfs to telegraph through to the surface and interrupt the fairness of the curve. Instead, I chose to laminate thin pieces of stock around a form. When this method is complete, the riser's curves are exactly the way I want them. Here, I'll break down my approach to the curved bottom riser and tread.

First, draw the plan

Templates are an important part of my stair-building process, especially when I do curved work, and they're based on a full-size drawing. After taking measurements of the existing stair framing and checking to see that everything is level and plumb, I draw the first three risers in plan, full scale on a sheet of ¼-in. plywood.

For accuracy's sake, I draw the risers as equal rectangles, laid out from the center-

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lines, and then add the radiused ends and curved front. At this point, the lines I've drawn represent the inside of the risers. I add the thickness of the riser stock to all the layout lines and draw in the nosing projection of the treads. I also draw in the wall location and determine newel-post position and centerline on the handrail and balustrade.

The building code says that tread depths cannot vary by more than ½ in. within a staircase, but after talking to the local inspection department, I was able to have a different depth on each of the first three steps.

Build a form for the riser

To create an accurate form, I made a ¼-in. plywood pattern based on the full-scale

USE PATTERNS, TEMPLATES, AND FORMS

The foundation of a curved starting step is the riser. On this job, the riser was laminated from thin layers of poplar and walnut. Making a perfect laminating form starts with a pattern for half of the turn. The pattern can be flipped to make a symmetrical template. The template is repeated, and the layers are glued up into the form.

Make the pattern first. *To make accurate curves for the pattern, use a router attached to a plywood trammel that's screwed to the center of the curve's radius.*

Template for layers. *Use a half-pattern to rout each side of symmetrical layers of particleboard that then are stacked into a clamping form.*

The sturdy form. *Glued and screwed together, the stack of layers creates a rigid, smooth, and consistent form that won't buckle under clamping pressure.*

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MOLD THIN LAYERS INTO A STAIR RISER

Only as thin as it needs to be. *After resawing the laminations and then testing their ability to bend to the target radius, plane all the strips to the thickness that bends without breaking, which in this case is slightly less than 3⁄32 in.*

Assembly-line glue-up. *Once the laminations have passed a dry-run clamping test, lay flat each pair of mating pieces, cover them with glue, and fold them together. Repeat the process until the entire 7⁄8-in.-thick stack is glued together.*

TOOL OF THE TRADE

GLUE APPLICATOR

When I'm gluing up a project, I want to get the glue spread as quickly and evenly as possible. After using various applicators and rollers, I found a hopper glue spreader ($195; vacupress.com) that works great. Made of aluminum, the hopper holds about a pint of glue that's trigger-released onto the 7-in. roller. It works best with PVA-type glues and cleans up with water.

TRICK OF THE TRADE

MAXIMIZE CLAMP PRESSURE

You can increase the efficiency of a clamp by using a caul to disperse the pressure over a wider area. After discovering that a clamp's pressure radiates from the clamp at about a 45° angle (see "Get Serious About Clamping," pp. 36-41, *Fine Woodworking* #194), I made a caul for projects like this from a 7-in.-wide length of ¼-in. bending plywood to which I glued 1x blocks every 2 in. During glue-up, I attach a clamp at each block. The thickness of the blocks spreads the clamp's pressure over a wider area so that I can use fewer clamps.

Ready, set, clamp. *When the laminations are glued, lay the clamping caul on top of the stack, wrap each end with plastic, and carry it to the form. Start by applying clamps at the center, then clamp the ends loosely. Work from the center to the ends, applying a clamp at each caul block.*

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drawing of the inside dimensions of the riser. I made it just over half the size of the plan view so that when I trace it onto the form stock, both sides are identical and the curve is fair across the middle.

Next, I set up a router with a ¼-in. upspiral bit on a trammel, screwed the trammel to the center of the radius, and routed the radiused end. After cutting out the rest of the shape close to the line with a jigsaw, I faired the curves to the line with a block plane and a spokeshave.

I traced the riser pattern onto a sheet of ¾-in. particleboard, flipping the pattern to get both sides. Again, I used a jigsaw to rough-cut the shape, leaving about 1/16 in. from the line. I screwed the pattern to the particleboard and trimmed half with a router and the pattern bit. Then I flipped the pattern and repeated the procedure on the other half.

This full-size shape became the pattern for the next seven layers of particleboard, using the same process. When they were all cut, I glued and screwed them together, making sure to keep them lined up. A few quick passes with a belt sander took out any minor rough spots on the outside edge.

The layers must be thin enough to bend

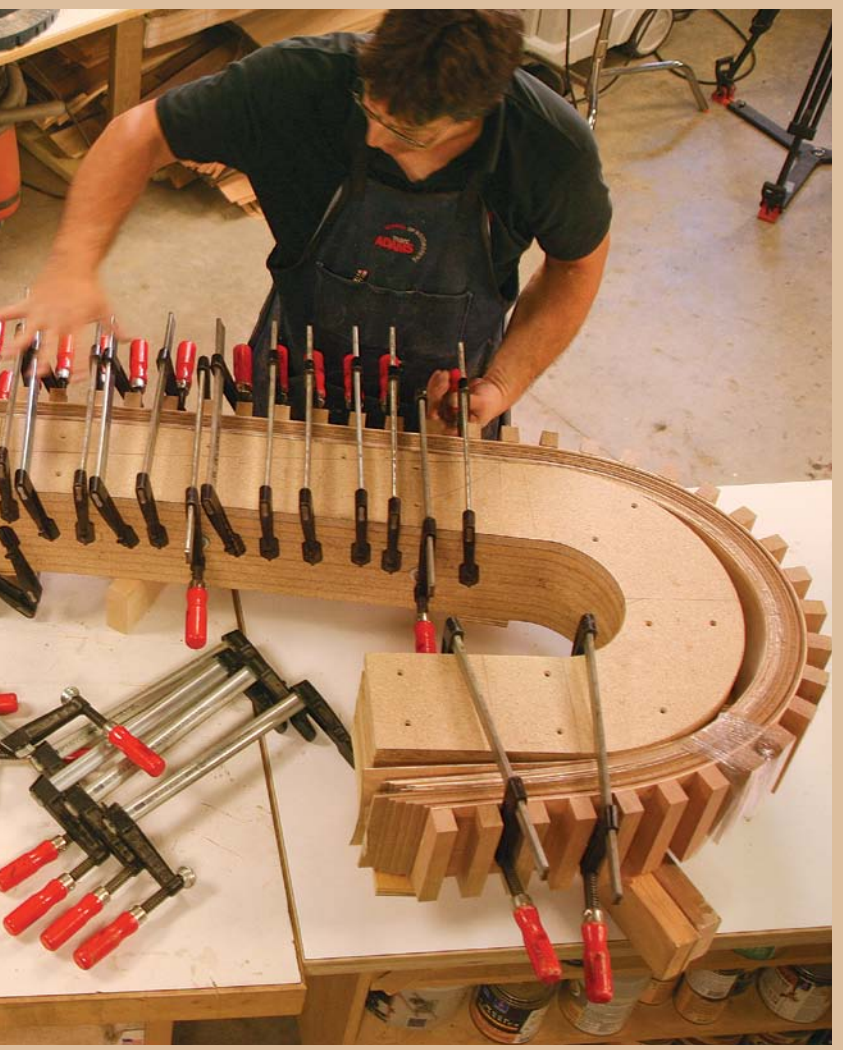
Once the form was finished, I milled the solid-wood laminations. I could have used bending plywood, but it's only available in 8-ft. lengths. I wanted the laminations to be continuous, and the riser is more than 13 ft. long. With solid wood, I also could customize the thickness to its ability to bend around a certain radius.

I tried a couple of test cuts to see whether the piece would bend easily around the form. Once I dialed in the thickness, I resawed the layers from a piece of 4/4 stock, always planing one side before cutting the next piece, and sent them through the planer to clean up the bandsaw marks.

Each lamination ended up at a little less than 3/32 in. thick, and I made eight layers of poplar for the substrate and two layers of walnut for the finish layer.

Plan carefully for an easy glue-up

I didn't want any surprises with more than 13 ft. of laminates oozing glue and starting to dry, so I first clamped the pieces dry around the form. I checked to see that they conformed evenly to the form and that there were enough clamps. When I was confident that everything would work out, I removed the clamps and cauls, set the laminates aside, and applied a coat of butcher's wax to the form as a glue resist. (Packing tape works, too.) I spread out the laminates in order and began by applying glue to the first two pieces, then put the glued surfaces together and repeated until the entire stack was glued. The glue I used here is Unibond One ($28 per gallon; vacupress.com), a newer one-part PVA glue that doesn't creep, has an open time of 15 minutes (as opposed to the five to 10 minutes of regular yellow glue), and creates a rigid glueline. After laying the cauls on



Clean up the edges. *When the glue is dry, use a scraper to remove dried glue from the riser's top edge. Even it up with a router and flush-trim bit, using the top of the form as a bearing surface.*

Plane it straight. *Remove the riser from the form, and turn it over so that the clean edge rides on the planer bed. Carefully feed the riser through the planer, taking light passes until the riser measures its correct width.*

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INSTALLATION STARTS WITH BLOCKING

To locate the riser blocking, tack into place a template sized to the riser's inside dimensions, and use a square to position the first layer of plywood blocking. Using the same template, mark and trim the riser to length. With a double layer of plywood blocking screwed to the floor and the steel newel supports bolted in place, attach the riser from the inside with pocket screws.

Tackle the blocking one layer at a time. *Start with the blocking attached to the subfloor. Add small pieces of blocking to support the final double layers of plywood that will fill out the riser. Shims below the riser will allow the flooring to slip beneath without scribing.*

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top, my helper and I wrapped the ends with plastic to keep everything together, then carried the stack to the form.

Clamp carefully, but quickly

Now comes the tricky part: We had to clamp the laminated stack onto the form with even pressure before the glue set (see "Trick of the Trade," p. 62). Even with the caul, this form required about 65 clamps, which all took time to get into place. We started by putting a couple of clamps in the middle, and then we loosely clamped the ends in place so that they wouldn't ride up as we progressed toward the ends. When I was satisfied that the laminations were clamped evenly, I let the assembly dry for 24 hours.

While the riser dried, I glued up white-oak boards to make the tread, then drew and cut out a full-scale template of the tread on ¼-in. plywood. I used the template as a guide to lay out the tread. After the riser was installed, I used it to check the fit of the tread.

After tracing the template onto the tread, I used a jigsaw to cut nearly to the line and then cleaned up the profile with a pattern bit. I added the bullnose on the edge with a ½-in. roundover bit referenced from both sides.

Use a template to locate the riser

When the riser and tread were finished, I made another template to the inside dimensions of the riser and cut it so that it would fit over the stair framing and sit on the first rough tread. Using a Speed Square, I plumbed down to the floor and marked out where the inside edge of the riser would sit. I also used the template to make eight radiused ends from ¾-in. A/C plywood for blocking.

I located the first layer of blocking at each end by screwing them to the floor. A curved piece filled out the center. After locating the newel supports, I added another layer of blocking, then scribed and cut the riser to fit. I filled in the blocking until it was flush to the riser's top, attaching the riser with pocket screws as I went.

I checked the tread template's fit on the framing and the amount of overhang for the riser. When it was dialed in, I traced it onto the tread, made the necessary cuts, and dropped the tread into place. To avoid any visible nail holes, I fastened the tread in the areas that would be covered by the newel posts and by the shoe molding. □

Photos by Charles Bickford.

Profile the tread. *After finalizing the tread's shape, add a bullnose profile with a ½-in. roundover bit. To avoid tearout of the grain, climb-cut the ends of the tread by carefully pushing the router in the same direction as the bit's rotation.*

TRICK OF THE TRADE

MAKE A PERFECT ROUNDOVER

Unless you use a router table with a fence, the critical aspect of using a roundover bit is the placement of the bearing. There's never any problem with the first cut because there's plenty of surface for the bearing to ride on. The second cut is trickier. The most common mistake is setting the bearing too deep, which makes the bit dive into the surface. To make the second cut properly, register the top edge of the bearing just past the centerline.

First tread goes down on the first try. *After checking and adjusting the fit of the full-size tread template, transfer the template's measurements to the tread, making the necessary cuts and dropping it into place.*

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