

MAKING Curved Railings



Victorian homes, with all their steeply pitched roofs, angles, and gingerbread (corbels, brackets, scallops, and so forth), are a challenge for the carpenter to trim and a bigger challenge for the homeowner to maintain. Queen Anne homes, a specific Victorian style, are also all about radiuses — radius porches and verandas, radius windows, radius gable-end decorations, and radius turrets. In this article, I'll describe how we tackled the radius balustrade work for a contemporary Queen Anne we've been working on recently.

by Gary Katz

New-Tech Materials

When we met the architects on this project, Brian Lehrman and Marlene Ayer from Artistic Residential Creations, they told us that the owners loved the Victorian style but hated maintenance — a tough contradiction for a finish contractor to sand flush. To satisfy on both fronts, we

The new generation of composite and plastic materials works well for period trim and promises to reduce maintenance

used the latest generation of materials available for exterior trim work, products that won't warp, twist, cup, crack, or peel within two years, something impossible with even the best second-growth redwood.

For the molded radius pieces — all the balustrade railings — and any decorative turned elements, we used high-density rigid polyurethane moldings from Fypon (800/537-5349, www.Fypon.com). For all the flat trim, including the radius spindle

railings, we used treated exterior composite trim from Miratec (800/255-0785, www.miratectrim.com). While I was comfortable with my knowledge of polyurethane moldings and confident that Fypon would outlast wooden railings and balusters, I had reservations about exterior composite trim. To quell my fears, I cut a 4-inch-square piece of the 1-inch trim, left the ends raw, and submerged it in a bucket of water under a piece of lead for two weeks. When I removed the

material, it was still exactly the same size and the water hadn't penetrated the raw ends: Shaving less than $\frac{1}{16}$ inch off the raw ends revealed clean, dry trim. After that test, and after reading all the literature I could find on installing composite trim and polyurethane molding, I was ready to start work on the job.

Spindle Railing

Our installation began with the spindle railing — the short decorative balustrade that hangs from a Victorian porch beam — because we couldn't install the balustrade below until the decking was finished. The top and bottom rails on the straight spindle runs were easy: We used 3-inch-wide material, ripping the top rail to 2 inches and the bottom rail to $2\frac{1}{2}$ inches, then beaded the bottom rail with a roundover bit so water would roll off. To make sure the spindles were spaced evenly, I used a Construction Master Pro calculator (see "Speedy Layout," at left).

For the radius sections of railing that ran around the turrets, we ordered 4/4x12- and 5/4x12-inch Miratec boards. I first used the calculator to determine whether I'd be able to get every rail out of a single $11\frac{1}{2}$ -inch-wide board — I didn't want to laminate any of the bottom rails because they'd be spanning almost 9 feet. I'm no math whiz, but it didn't take me long to figure it out: I punched in the 9-foot span and hit RUN, then entered the 12-foot radius (you have to push the CONV key first, then the DIAG key). Finally, I hit RISE, and the result — $10\frac{1}{2}$ inches — landed well within the width of my $11\frac{1}{2}$ -inch boards.

Cutting the Radius Rails

I used an inexpensive site-built trammel arm and plunge router to cut the radius rails. I screwed the railing material down to a sacrificial piece of scrap on top of my workbench. Porter-Cable manufactures a great adjustable fence for its plunge router, which can

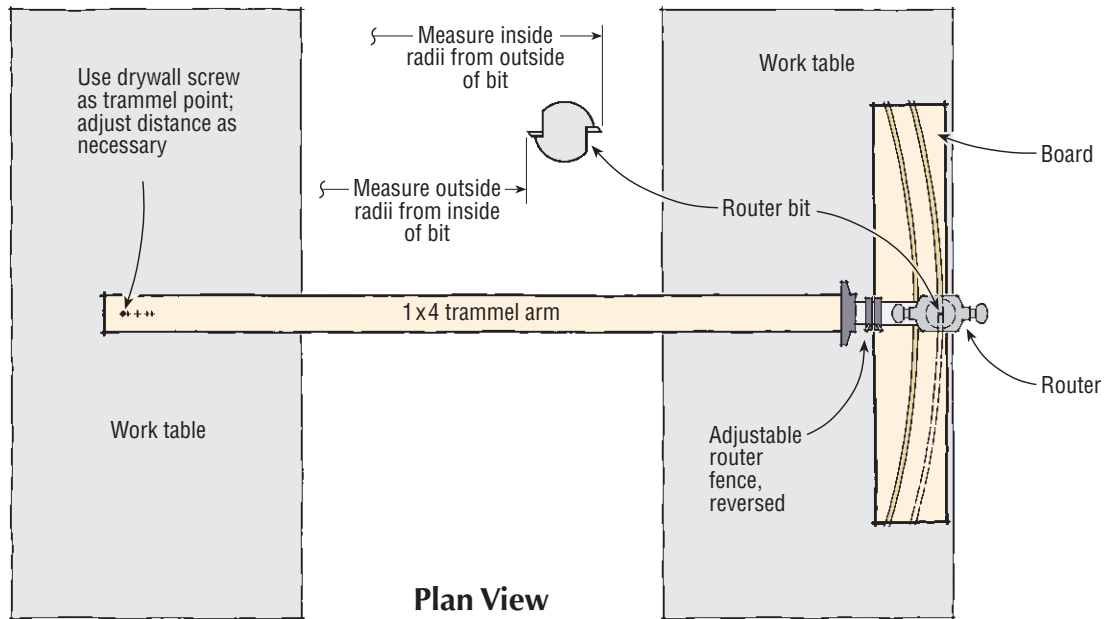
Speedy Layout With a Calculator

Use a Construction Master Pro calculator to lay out *everything*, at least everything I can. It's the only way to ensure quick, precise layouts on the first try. For both the spindle railing and the lower balustrade, I first decided on the end spacing — the distance between the last baluster and the newel post. Jed Dixon, a stair specialist in Rhode Island, once explained to me that those spaces appear best if they're about half the distance of the on-center spacing. So we chose 2 inches for the spindle railing (4 inches on-center) and $2\frac{1}{2}$ inches for the lower balusters (5 inches on-center).

After marking off those measurements, I measured the intervening distance and divided that number by 4 inches for the spindle railing and 5 inches for the balustrade. Of course, the quotient always included a whole number and an odd fraction: For instance, a $102\frac{3}{8}$ -inch run divided by 4 inches equals $25\frac{5}{8}$ inches. I rounded the fraction up if it was well above $\frac{1}{2}$ inch and down if it was close to or below $\frac{1}{2}$ inch, then divided the distance by the resulting sum. With that many spindles, it was safe to round the number down if the fraction was close to or below $\frac{1}{2}$ inch. For instance, $102\frac{3}{8}$ inches divided by 26 equals $3\frac{15}{16}$ inches, whereas the same distance divided by 25 would save one \$25 spindle and the spacing would be only $\frac{1}{8}$ inch more than 4 inches.

But a CMP is even more useful when it comes to marking the layout for each spindle. Stretch a tape measure down the railing. First divide the distance by the number of spindles and press the = button to arrive at the spacing between the center of the first spindle and the center of the second spindle. Then, simply press the + button once, then the = button again. That sum is the exact center of the third spindle. Now press the = sign again and the CMP will calculate the exact center of the fourth spindle. And I mean exact: The calculator remembers all fractional sums less than $\frac{1}{16}$ inch (you can program the calculator to work in almost any fractional increment, but I prefer $\frac{1}{16}$), so it's always adding the fractional increment whenever it exceeds $\frac{1}{16}$.

Site-Built Router Jig



be easily adapted for standard routers. I reversed the fence, then attached a piece of 1x4 to extend the trammel arm. The radius at the outside rim of the deck was 12 feet (see Figure 1). However, the railing was centered on the porch columns, 6 inches from the edge of the deck, which made the center of the railing an 11-foot-6-inch radius. Since the bottom railing was 2¹/₂ inches and the top rail was 2 inches wide, I needed four radius center marks in the trammel arm.

I first marked the radius centers with a pencil, then punched them with my nail set (those holes had to be located perfectly) before attempting to drill pilot holes. I used a drywall screw as a trammel point. After all the setup, swinging the plunge router on the trammel arm was a breeze. I made several passes for each cut, burying the bit about ³/₁₆ inch with each pass. Miratec cuts easily, but taking too deep a bite with the router bit will stress the trammel arm and throw off the smoothness of the cut.

Extendible Measuring Jig

I knew that measuring the exact length of each railing was going to be



Figure 1. A site-built router trammel jig (above) cut the four radii needed — two inside, two outside — for the decorative spindle rail and the main porch railing. A drywall screw (left) served as the pivot point, while a Porter-Cable edge guide secured the router (below).





Figure 2. Two extra pieces of railing served as an extendible template for laying out the radius rails (above). After scribing the ends to fit the posts, the carpenters stretched the two pieces apart until they were tight against the new posts, then fastened the pieces together with drywall screws. Tracing the template directly onto the railings guaranteed a tight fit (right).



Figure 3. Instead of trying to lay out the spindle centers on the curve, the author used a thin strip of flexible material, marking it in a straight position then bending it to the radius to transfer the marks.

a problem and that getting a perfect cut on the end of the rail would be even more difficult. So I cut two extra $\frac{3}{4} \times 2$ -inch spindle rails for each section, then sandwiched those two pieces to use as a template (Figure 2).

Working in place between the porch columns, we slid the pieces apart until both ends were tight against the posts. We then scribed both ends and trimmed them until the joints were snug. At that point, we screwed the two pieces together securely, then used that template to mark the top and bottom rails for that section.

Laying Out the Spindles

Laying out the spindles stumped me for a minute while I considered how to use the Construction Master to calculate the spacing around the radius. Then I decided on a much simpler and almost as exacting method. I first laid out the centers of the two end spindles, 2 inches in from each end of the rail. Then I ripped a $\frac{1}{4}$ -inch-thick strip of $\frac{3}{4}$ -inch exterior trim, curved it around the radius, and marked the distance between the two end spindles (Figure 3). After that, I was able to use the calculator to find the centers of each spindle. I marked them, then bent the trim strip around the radius again to transfer the center marks onto the rail.

Assembly & Installation

Assembling the rails was definitely the easiest part of the job (Figure 4, next page). First we drilled pilot holes with a tapered countersink so the painters could fill over the decking screws that secured the spindles. Before placing the spindles, we squeezed a good dab of Fypon adhesive on top of each hole. Once all the spindles were installed and the adhesive had dried, each ladderlike section was rigid and strong, even though the spindles themselves are lightweight unreinforced polyurethane.



Figure 4. Holes for the galvanized screws were predrilled in both the rail and the spindles (left), but the Fypon adhesive provides the real strength for the spindle assemblies (right).

Installation was almost as easy. Because we had used templates, each section fit perfectly the first time. We secured the top rail to the ceiling with galvanized finish nails, toenailed the bottom rails to the post capitals, then installed brackets beneath the railing with nails and more polyurethane adhesive.

The Balustrade Railing

The lower balustrade railing was a different story. It was too beefy to make with a router and a trammel arm. Instead, I ordered the rails pre-bent by the manufacturer to the radius required. The plans specified every radius on the house. Just as with the spindle railing above, all I had to do was subtract the distance from the edge of the deck to the center of the posts. I then used that center measurement to order all the rails.

Fypon manufactures straight balustrade railing embedded with a 3-inch-diameter steel pipe, so the typical 8-foot to 9-foot spans between my posts were stiff and rigid. But Fypon's bent railing is formed around 3-inch PVC pipe, obviously because PVC is easier to



Figure 5. Balusters for the main railing were laid out on 5-inch centers (above). A hole saw in a drill press made for fast, accurate boring in the PVC radius railings (left) as well as the steel-reinforced straight rails.



Figure 6. When assembling the Fypon railings (left), 2¹/₂-inch galvanized finish nails, four in each baluster, provided temporary security until the polyurethane adhesive dried. Fitting the top rail (above) was tricky and required two sets of hands because of the varying lengths of the ³/₄-inch pipe projecting out the end of the balusters. This required finding and setting the longest dowels first.

bend. I would have preferred steel pipe in the radius sections, but with the ¹/₄-inch steel cable supplied by the manufacturer, we were able to stoutly reinforce the long spans.

Layout and cutting. We were able to reuse the template we'd used for the spindle railing because the radius was exactly the same. After marking the top and bottom rails for each section, I used my miter saw to cut the PVC embedded railing.

We laid out the balusters in the same manner, though the end balusters were centered 2¹/₂ inches in from the ends of the railing because the spacing was 5 inches on-center (Figure 5, previous page).

Drilling. Fypon balusters are formed around ³/₄-inch aluminum pipe, with the pipe extending from

the baluster by 1 to 1¹/₂ inches. For drilling the ³/₄-inch holes in the railing, I experimented with several types of drill bits on both the PVC and the steel-embedded railings. I found that a ³/₄-inch hole saw worked best on both. I thought I'd have to stop the drill every three or four cuts to clear the hole saw, but strangely enough, after two or three holes, the compressed polyurethane inside the hole saw acted like a spring and pushed out the waste, which we then removed from the spinning hole saw with a small stick.

Assembling the Railings

Assembling the railings' lower baluster was a little trickier than assembling the spindle railings. We started at the bottom rail, applying a

liberal amount of Fypon adhesive around each hole, then inserted the baluster (Figure 6). After squeezing each baluster tightly against the railing, we toe-nailed each one with 2¹/₂-inch galvanized nails.

Next we added the top railing, starting at one end and slowly working each of the balusters into its hole. Then we turned the section upside down and used 5-foot Bessy clamps to hold things together. The deep plastic jaws reached well over the railing and didn't mar the polyurethane. Once the entire section was snugly clamped, we toe-nailed the top balusters, too.

I learned the hard way that I had to let the adhesive dry before moving and installing the balustrade, because the mixture of nails and polyurethane wasn't strong enough to secure the joinery.


Once the adhesive dried, the pieces were practically welded together.

Threading the Cable

Before starting the installation, we drilled a 1/2-inch hole through each of the porch posts, exactly at the center of the top railing, then passed a fish tape through each hole with a pull string attached. We did the same with each section of the radius railing, leaving a pull running through the hollow top rail.

Starting at one end of the railing, we pulled the 1/4-inch steel cable through each post and railing section until the cable reached the opposite side of the last post. Then we installed all the railings on L-clips, first applying a generous amount of adhesive on each end.

After all the railings were mounted, we slipped several fender washers over the dead end of the cable, secured the loose end with a compression fitting, then pulled the cable tight with a come-along until it sang like a piano string (Figure 7). In fact, we had to release a little tension on the cable, because it began to flatten the radiuses.

Before starting the installation, I drilled a 3-inch-diameter hole into the last post so we'd have room to tighten the compression fittings. Once we were satisfied with the tension on the cable, we locked it down but didn't cut the cable. Instead, we left the end long and looped it inside the oversized hole. The next section was straight railing, which didn't need to be fastened with adhesive. The end of the straight rail would cover the hole, but if the cable ever loosened, I'd be able to access the cable to retighten it by removing that section of straight rail. 

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Figure 7. The PVC radius railings rely on a tensioned steel cable for strength (top). A come-along provided the necessary pull (bottom). The 3-inch hole where the cable is cinched will be covered by a removable section of straight railing, should the cable ever need retensioning.