Framing Curved Stairs on Site

A stud wall, not a laminated stringer, shapes these stairs

by Scott Paschal

Construction is too specialized today. I once worked for a construction company where we did all the carpentry ourselves, from demolition to trim. I like working in this kind of environment. There is a real motivation to maintain quality. If I am tempted to leave out a difficult piece of blocking while framing, thinking about trying to nail crown molding to air puts me right back on track. Even so, we usually subcontracted the stairs.

Looking over blueprints for the whole-house remodel we were doing, we saw that the main stairs would be difficult. They curved, and their" radius changed halfway up. We solicited bids from several stairbuilders, expecting to be able to choose based on price and delivery date.

Someone has to build them—Only one stairbuilder submitted a bid, and it was high. This setback, combined with our desire to do most of the work in-house, led us to build the stairs ourselves on site.

Four constraints made this staircase challenging. The stairs had to fit in a confined area. Then, the plans called for the stairs' radius to change: The lower half would have a 6-ft. inside radius, and the upper a much tighter 1-ft. 6-in. inside radius. Next, a closet was planned under the upper section, and of course, everything had to meet the current building code.

Our first job was enlarging the stairwell opening in the second floor to accommodate the larger stair. Then we built the platform where the stairs would land on the first floor; it stepped down to the living room, and its edge was a modified French curve (photo left). The platform's right side curved into what would become the inside wall of the stairs, creating an

Straight stringers support this curved stair. A header carries the three stringers used on the lower section of this stair. The kneewall in the middle provides additional support.

Starting with a French curve. The landing platform for these stairs ends in a graceful curve that the author laid out by eye and built like a short stud wall.

area for the handrail volute. We drew the French curve by eye on a piece of ¾-in. plywood, cut it with a jigsaw and used this pattern for the 2x top and bottom plates. We framed the edge of the platform like a kneewall, using 2x4 cripple studs.

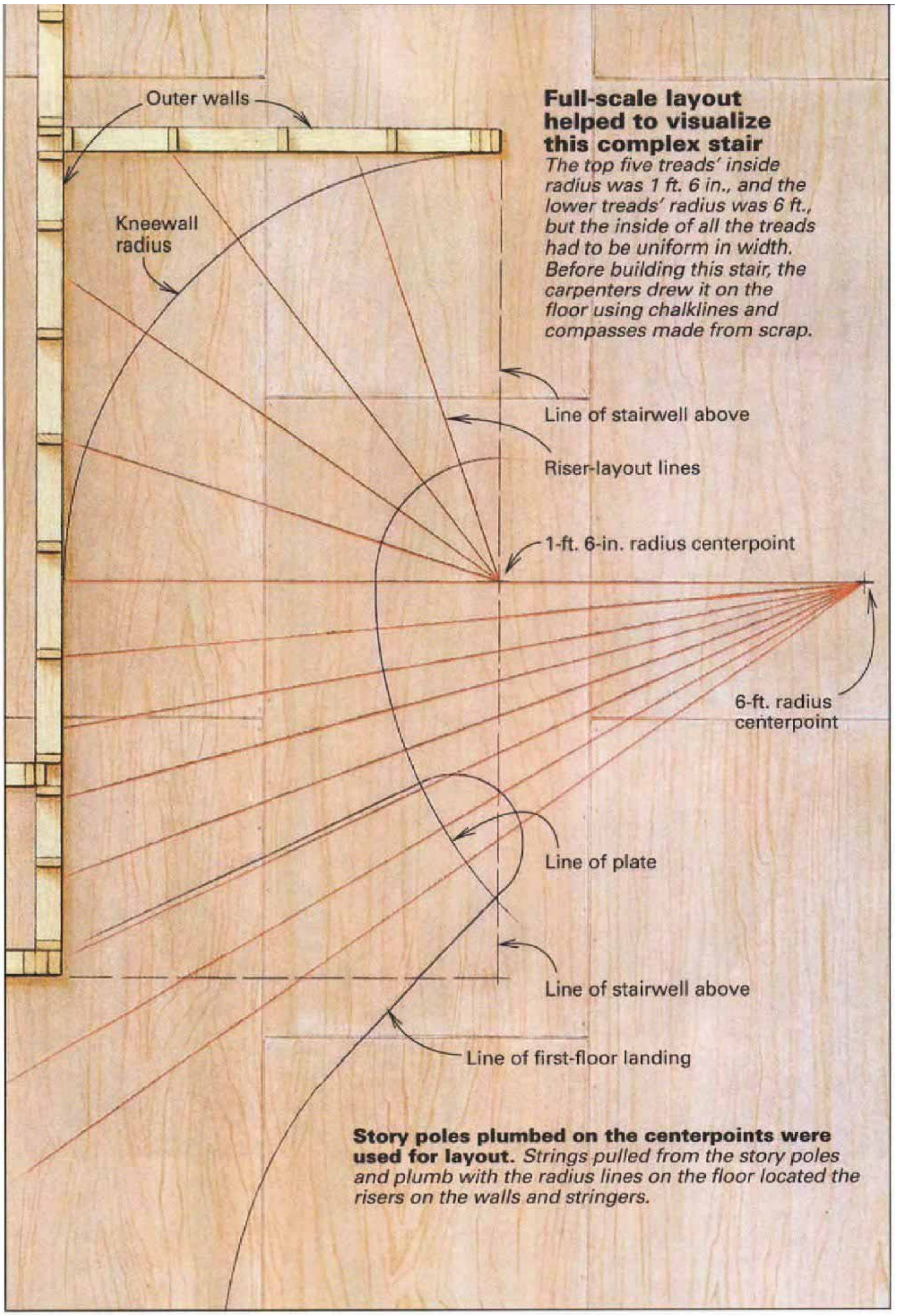
The main body of this platform was framed conventionally—2x8 joists with ¾-in. tongue-and-groove plywood glued and nailed to them. The living room, landing and stair treads all would have ¾-in. oak flooring installed later. We used standard strip flooring on the stairs to avoid wide glued-up treads.

Using chalklines and story poles to lay out the stair—Two existing straight walls at 90° to each other defined the outside of the stairs (drawing right). The double curve that defined the inside of the stairs was more difficult. The blueprints showed the locations of two centerpoints for radii to establish the inner curves and specified where on the staircase the radius changed. Once we found the centerpoints, we used compasses made from 1x4s to draw two connecting arcs on the floor. We snapped lines on the floor representing the stairwell opening, which, with the two back walls and two intersecting arcs, provided us the outline of the stair in its opening.

We then calculated the riser height and tread widths. The total rise of 105⅞ in. divided by 14 risers gave us a 7\u00b9\u2044\u2081\u2086-in. rise per step. Next, we measured the length of the two arcs with a digital estimating tool, essentially a wheel on a handle that is rolled along, giving a digital readout of the distance and usually used for plan takeoffs (Scale Master, Calculated Industries Inc., 4840 Hytech Drive, Carson City, NV 89706; 702-885-4900). The measurement was 85⁵⁄₁₆ in., divided by the number of treads—13—which calculated to 6⁹⁄₁₆ in, per tread. The building code states that a pie-shaped tread can't be any less than 6 in. at its narrowest, so this was perfect. Using the digital estimating tool again, we put a mark every 6⁹⁄₁₆ in. on our curves.

Next, we snapped lines from the two centerpoints through these marks on the curves to the outside walls. These chalklines represented the fronts of the risers and radiated from the two centerpoints like the spokes of a wheel. We plumbed and braced a 2x4 story pole at each of the two centerpoints. The story poles were marked every 7⁹⁄₁₆ in. to represent the rise of each step.

Framing the lower stairs—The outside wall at the 6-ft. radius section was straight—only the inside wall curved here. Three straight stringers were used to carry the outside and the center of the stairs. The treads and risers at the inner curved area were supported by a stud wall.



Full-scale layout helped to visualize this complex stair *The top five treads' inside radius was 1 ft. 6 in., and the lower treads' radius was 6 ft., but the inside of all the treads had to be uniform in width. Before building this stair, the carpenters drew it on the floor using chalklines and compasses made from scrap.*

Story poles plumbed on the centerpoints were used for layout. *Strings pulled from the story poles and plumb with the radius lines on the floor located the risers on the walls and stringers.*

Because the treads widen from inside to out, the notch in the outside stringer would be deep. We needed beefy stock, so we used 1¾-in. by 11⅞-in. laminated beams. The stairs get wider at the bottom, so the stringers aren't parallel to each other. This variance, combined with the widening tread, made it impossible to step off the stringers with a framing square. We needed a way to mark each riser and its angle of cut on the stringers.

We determined where the upper and lower sections would meet by plumbing up from the chalklines on the floor and leveling over from the story pole. We framed a kneewall and a header there to carry the lower stringers (photo right, facing page). We figured the overall length of the stringers by measuring from our layout lines on the floor to the header. We then made the top and bottom cuts on the stringers and set them in place.

To lay out the treads and risers on the stringers, we plumbed up from the chalklines and leveled over from the story pole again. By pulling a string over the stringers from the story pole to the points where the bottoms of the treads and the backs of the risers meet, we could mark the cut angle for the risers and notch the stringers. Next we built the bottom plate for the inside

Drawing: Dan Thornton

Winding stairs without a stringer. Two-by-tens, resting on the inner wall and fastened to ledgers on the outer wall with framing hardware, support the treads and risers.

A curved kneewall forms plant shelves. Stepping up with the stairs, this kneewall supports two platforms that will later be used to display plants.

Studs take the place of a laminated stringer. These curved stairs have no laminated stringer. Studs rise from a curved plate to support the treads and risers.

wall by stacking three pieces of ¾-in. plywood cut to the radius marked on the floor. This plate was thicker than the usual 1½ in. to give us better nailing for the curved baseboard that would come later. The studs for the curved wall were placed to support the ends of each tread and riser (photo above left). To complete the framing of the lower part of the stairs, ¾-in. plywood subtreads and risers were glued and then stapled in place.

Stairs without stringers—We had to build the upper section with no stringers to provide headroom in the closet below. Stringers would have taken too much space. The radius was too tight for straight stringers, anyway.

We started by framing the inner wall, using the story pole and chalklines for reference just as we did on the lower stair. The inner-wall studs carry single 2x10s on edge under the back of each tread, and we nailed these 2x10s to the ledgers on the outside wall. Blocking then was screwed between these 2x10s and the risers, and ¾-in. plywood subtreads were glued and stapled to all. As each step was completed, the next riser was placed over the 2x10 at the back of the lower tread (photo top right), and the process was repeated.

After all the treads, blocking and supports were in place, the last bit of framing was building a section of curved wall in the corner of the upper stair (photo bottom right). We drew an arc with the upper story pole as its center on the treads, maintaining the stair width. We followed this arc with a short wall that we capped at two levels for plant shelves.

Finishing the stairs—The finish skirtboards were bent from kerfed medium-density fiberboard and scribed to fit the subtreads and subrisers. We made the tread nosings from 5/4 stock, following the inside radii of the treads and the French curve of the landing. We rabbeted the backs of the nosings to a ¾-in. thickness that matched the oak flooring we used for the treads themselves.

We bent the curved risers from ¼-in. plywood. This worked well on most of the curves, but in some places the radius was tight enough that we had to kerf the back of the plywood to keep it from breaking. Working from the bottom up, we placed the risers, nosings and finish flooring. Finally, we nailed the scotias—the molding under the nosing—and called in the railing contractor (photo facing page). We just didn't have enough clamps to laminate a curved railing. □

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The curves of this finished stair hide its straight skeleton. Built without the rushed panic of gluing a laminated stringer and using methods a journeyman carpenter can master, these stairs look like the product of a master stairbuilder.

Photo this page: Ron Ruscio