Building an Elliptical Deck

A layout trick simplifies a complicated project

by Mac MacDonald

When I was first approached by a couple who wanted an elliptical deck built off the back of their house, I was intrigued. I had built my fair share of decks over the years, but never one without any straight lines. We sketched out the basic dimensions and decided to add a smaller oval two steps down off the front for a viewing area (their backyard is a highway for wild turkey and deer). It took me about five weeks to complete the project, working alone. (See also *Day's End,* November 2010.)

Figure 1. The footings were located to provide a maximum two-foot joist overhang.

From Plans to Footing Layout

The homeowners wanted the upper deck to extend 12 feet from the back door. They also didn't want the house to perfectly bisect the deck along the long axis of the ellipse; rather, they wanted the ellipse's curve to reach its apex and start to return before terminating into the house. Guided by these preferences, I drew up the design on paper.

Using my scale drawing and an archi-

Figure 2. Notched posts supporting beams are a familiar detail throughout the country, but the solid 4x10 beams used here aren't often seen in eastern states. The posts and beams differ in color because they were treated with different preservatives.

Figure 3. A combination of peel-and-stick membrane and aluminum flashing keeps water out of vulnerable areas.

tect's scale, I figured out the width of the deck every 2 feet along the ledger (on a computer, most design programs can do the same thing). On the site, I measured the appropriate width out from the house every 2 feet, marked the locations on the ground, and then connected the dots with marking paint to get the rough perimeter of the deck.

Once I knew where the perimeter would be, I laid out the beam locations on the ground, allowing for a maximum joist cantilever of 2 feet. Working from the beam locations, I found the post and footing locations (**Figure 1**).

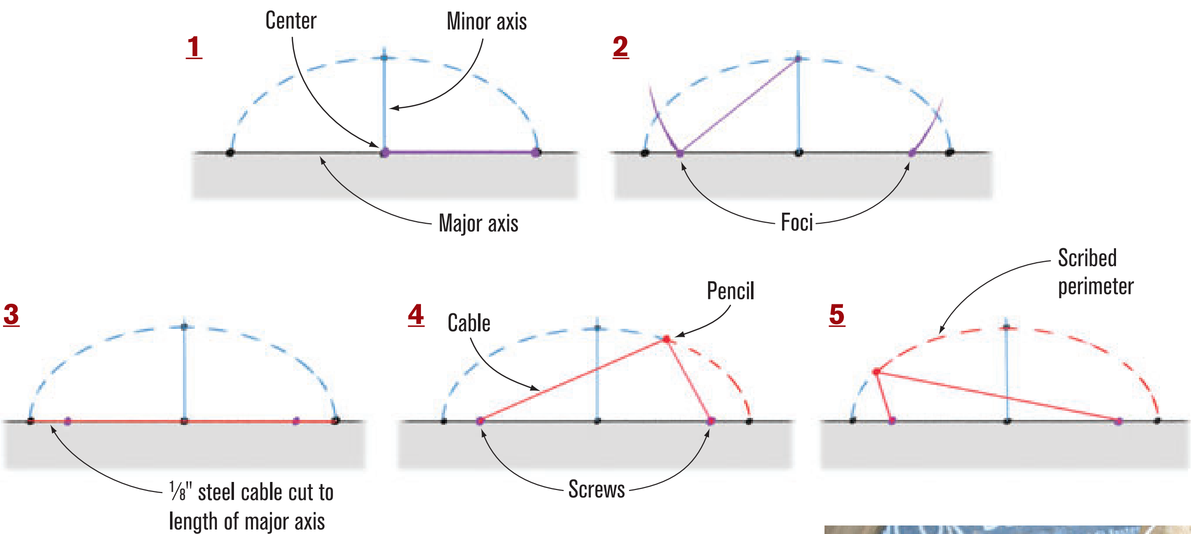
Figure 4. The joists were laid out on 16-inch centers. Their lengths were allowed to run wild; later they would be cut to fit the perimeter of the ellipse.

Framing an Ellipse

The posts are 6x6s and the beams are 4x10s — all pressure-treated Douglas fir (**Figure 2**). The color difference visible in the photo is due to the treatment chemicals — 6-by and larger material is still treated with CCA (green) in Oregon, whereas 4-by and smaller wood gets the newer ACQ (brown) treatment. To keep water off, I flash

Laying Out an Ellipse

If you know the lengths of its major axis and minor axis, an ellipse can be laid out using a string and a pencil. This method involves no math, though it revolves around a geometric construction. The instructions I found online at mathopenref.com/constellipse1.html suggested using string for the layout, but my string was too stretchy and allowed the pencil to wander off the ellipse's path. Instead, I substituted 1/8-inch steel cable. — *M.M.*



1. Lay out the minor axis so it bisects and is square to the major axis. Measure to find half the length of the major axis.
2. From the apex of the minor axis, mark the two foci on the major axis with arcs whose radii equal the length from (1).
3. Put loops in the ends of a cable so its length equals that of the major axis.
4. Anchor the cable ends with nails or screws at the two foci.
5. Starting at one end of the major axis, use a pencil or marker with the cable to lay out the ellipse.

Screws anchor the ends of the cable at the ellipse's foci.

the tops of beams and posts with a combination of flashing tape and aluminum L-flashing (**Figure 3, page 2**). Because treated lumber is corrosive, particularly in our damp northwest climate, all hardware gets sprayed with a layer of Plasti-Dip where it directly contacts the lumber.

When I installed the 2x8 joists, I let the ends run wild (**Figure 4, page 2**). I laid out the ellipse with the pins-and-string, or gardener's ellipse, method (see illustrations above), drawing its perimeter on the tops of the joists. Using a level, I drew plumb lines down from the perimeter marks, on both sides of each joist. Because of the curve, every joist had to be cut at a different bevel, so I set my circular saw accordingly. (The offcuts became blocking for the joist bays, reducing waste.)

To minimize the chance of rot taking hold, I paint all cut ends with a copper-napthenate preservative. This is particularly important with treated lumber in the West, as the Douglas fir most of our framing lumber is milled from

Figure 5. An assembly of blocking and 2x10s on the flat creates the substructure to support the decking at the ends of the ellipse's major axis.

Figure 6. With the stairs framed and the ends of the joists blocked, the framing is ready for the fascia and decking.

Figure 7. Construction adhesive will hold the first of the four thin layers of fascia to the ends of the joists.

doesn't accept pressure treatment as well as the southern pine used in the East.

The curve of the ellipse at the ends of the major axis extends past the end joists. Framing to support the decking and railing at these points was assembled from a couple of 2x10s that I blocked, screwed, and glued to the side of the outermost joist (**Figure 5**). I laid out the assemblies when I laid out the rest of the ellipse — by temporarily screwing the 2x10s to the outer joists, I was able to mark the upper pieces, which then served as templates for the lower pieces. Blocking between the ends of the joists completed the framing (**Figure 6**).

Bending the Fascia

Figure 8. Clamps were used to bend the fascia, which was fastened to the joist ends with adhesive and finish nails.

One of the trickier parts of this project was installing the curved fascia over the framework. The fascia consists of four layers of 3/16-inch-thick strips that I had the local lumberyard rip from 20-foot-long 2x8s of clear redwood. I applied construction adhesive (PL Premium) to the joist ends (**Figure 7**) and attached the first fascia ply to the joist ends with finish nails, holding it in place with clamps (**Figure 8**).

Subsequent plies were added using finish nails and a copious amount of


Figure 9. Each layer of fascia depends on lots of glue to hold it to the underlying layer.


Figure 10. Full-height clamping cauls prevent the thin layers of redwood from splitting as they are bent.


Figure 11. Flashing keeps water out of the fascia layers, and solid blocking prepares the frame to receive top-mounted railing posts.

adhesive (**Figure 9**). Starting at one end, I finish-nailed the newly added ply, clamping it into place and slowly bending it around the curve. Only one ply split on me, and that was from uneven clamp pressure. I solved the problem by adding full-height stickers between the clamps and the fascia, which equalized the pressure across the thin ply (**Figure 10**).

The completed fascia was a little over 3⁄4 inch thick. To prevent water from collecting between the fascia plies and rotting out the thin wood, I sealed the top with flashing tape. The handrail would have top-mount metal posts, so I added solid blocking behind the fascia where the posts would be mounted, then flashed the blocking as well (**Figure 11**).

Decking

I avoid random butt joints in my projects whenever possible. In this case, I knew the larger, upper section of deck was going to be longer than 20 feet (the longest decking I could buy), so I planned for a seam board. To support it, I ran blocking between the two joists at the middle of the larger deck.

I ran the field decking first and didn't worry about where the boards ended as long as they fell within the area the seam board would cover. Before I cut the decking to its finished length to receive the seam board, it looked as if a drunk builder had laid it (**Figure 12, page 6**). Once I cut the decking ends, I finished off the edges with a 1⁄8-inch roundover bit in a router (**Figure 13, page 6**).

Cutting the decking to match the curve of the fascia was a multi-step process. First I rough-cut the decking so it overhung the fascia by a maximum of 3 inches at any point.

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Figure 12. Before the seam board was installed, the decking boards met randomly in the center of the deck.

Figure 13. Once all the decking was laid, it was cut and the edges were eased in preparation for the seam board.

Figure 14. The author built a U-shaped jig to transfer the elliptical shape from the fascia to the decking. As he moved the jig around the perimeter of the deck with its bottom arm bearing on the curved fascia, the marker inserted in the top arm drew a matching curve on the top of the decking.

Then I made a U-shaped scribing tool out of a chunk of 2x6 (**Figure 14**), cutting the throat more than 3 inches deep so it would clear the decking ends when the tool was held sideways with the bottom arm touching the fascia. On the top edge of the tool I measured in 1½ inches and drilled a hole to receive a Sharpie marker. As I moved the tool around the perimeter of the deck, the bottom edge slid along the fascia while the Sharpie on top marked the decking for a 1½-inch overhang (**Figure 15**).

The curve on the larger deck was gentle enough for me to cut it with my wormdrive. Setting the blade depth so it just barely cut all the way through the decking put less of the blade in the cut and made cutting the curve easier.

The tighter curves on the smaller deck required a jigsaw. After cutting the line, I smoothed the saw marks with a belt sander and finished the edges with a ¾-inch roundover bit (**Figure 16**).

Figure 15. The decking was laid out to overhang the fascia by 1½ inches.

Figure 16. After being cut, the ends of the decking were belt-sanded smooth and the edges eased with a router.

Figure 17. The stair stringers follow the curve of the deck. Blocking cut to that same curve is affixed to the stringers at the top and bottom of each riser.

Figure 18. The risers are made from the same material as the fascia. The treads are 2x12s whose fronts are cut to the curve of the ellipse. The offcuts were then fastened to the back of each tread to fit it to the curved riser behind.

Elliptical Stairs

Two staircases, one off each side, provide access to the backyard. Having the stairs follow the curve of the ellipse was actually simple. Since the stringers for a stair are all the same length, the stairs naturally follow the curve of the ellipse.

The stair risers are essentially a smaller version of the fascia. I cut blocking that matched the curve of the deck at the stairs and secured that to the stringers at the top and bottom of each riser (**Figure 17**). This blocking backs up the risers, which were cut from the same material as the fascia and glued and nailed into place.

I cut the curved treads out of 2x12 redwood, using the risers as guide. After cutting the front edge of the tread in a curve, I glued and screwed the offcut to the back edge so treads were uniform in depth. I used a ¾-inch roundover bit to create a rounded nosing (**Figure 18**).

Railing

A local metal company built the curved handrail (**Figure 19**); to get the right curve, they used full-size cardboard templates on which they had traced the perimeter of the deck. ❖

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Figure 19. A local metal shop crafted the railings from full-size templates made on site.