A Deck Built to Last

Thoughtful details designed to beat the weather

by R.W. Missell

We get a lot of pleasure from the birds and other wildlife that live near our house here in Virginia. So when we decided to build a deck, it was important that it provide a transition from our living space to theirs. The house backs into the woods, and we wanted a graceful deck that wouldn't obstruct the view. On many other decks I have seen, the assembly of railings and supporting posts masks the view with a clumsy grid of horizontal and vertical lines. But I also wanted to make sure that the deck would stay strong and solid for decades, so it features a number of details that are designed to ward off the destructive effects of the weather.

The design stage—I usually know how the parts of a finished project should fit together. But as a novice carpenter, I had to learn some hard lessons about the nitty-gritty of putting the parts in place. I found that it's less frustrating (and less expensive) to work problems out with a pencil rather than with a saw.

To prepare for this project, I worked up a scale drawing that included a plan view, elevation views and details. I also drew—and drew again—lots of pencil sketches to help me understand how each piece would be made and how each joint would fit together.

I had to balance code requirements and aesthetics. For example, our county's policy requires 4x4 posts to support a deck railing. I knew these would look bulky, so my permit application included calculations showing my railing design (2x5 posts on 42-in. centers) to be stronger than required (4x4 posts on 60-in. centers). This data is found in tables entitled "Properties of Sections" in *The Wood Book* (Hatton—Brown Publishers, Inc., 610 S. McDonough St., Montgomery, Ala. 36197.

I wanted a deck pattern that would be decorative and that would visually break up the 30-ft. length of the deck. After looking at a variety of options, 1 decided to use a herringbone pattern made from 2x4 deck boards, run at a 45° angle. Making each "panel" 5 ft. wide meant that the longest deck board would be just over 7 ft. long, so I could start with standard 8-ft. boards. This minimized expensive waste.

Once I had the design squared away, it was easy to make up an accurate bill of materials. As a retail customer, I was able to negotiate only a relatively small discount on the initial bulk order. I knew I'd pay dearly for what I forgot—both in dollars and in lost time. On the other hand, liberal estimating could leave me with a lot of leftover materials that would be hard to store or to resell. In the end, my detailed material take-off was well worth the effort. On clean-up day, the only wood left over was a few treated 2x4s, which were quickly used in a landscaping project, and some 2x2s, which now serve as tomato stakes.

Figuring a foundation—With the planning complete and the lumber stacked in the garage, safely out of the sunlight to keep it from warping, construction could begin. One side of the deck would be supported by three separate posts. Two of the posts were supported on a concrete-block retaining wall, which had been built two years earlier with the future deck in mind. The rebar-reinforced blocks had been filled solid with concrete, and the footing was oversized in order to support the deck weight. When it came time for the deck, all I had to do was install anchor bolts for the posts (photo at right).

The third post had to be located in an existing sidewalk. I used a hammer drill fitted with a masonry bit to "perforate" a 12-in. square area of pavement, and then chipped the rest away with a hammer and chisel. Then I was able to excavate a pyramid-shaped cavity 24 in. deep, so that the finished footing would spread the load on undisturbed soil below the frost line. The hole was filled with concrete around wire-mesh reinforcement, and a J-bolt was inserted to anchor the post.

The deck rests partially on a concrete-block wall that had been built some years before, but with the later construction of the deck in mind. The cores of the block had been reinforced and poured solid, so holes had to be hammer-drilled into the concrete for the anchor bolts (as shown in this photo), which were later grouted in place.

Sizing structural elements—A primary goal was to build a solid deck that would last at least 20 years and require an absolute minimum of maintenance. For this reason, I was conservative in sizing support members for strength and very careful at those points where wood rot could be expected. Although not required by our code, the galvanized steel bases I put under each post completely separate them from the concrete. A wood-to-concrete connection is one of the first places to rot, but the steel support provides a ½-in. air gap, thus ensuring good ventilation at the end grain of the post.

I decided that the posts would be 6x6s and the lengthwise support beam would be a pair of 2x12s. Local building code permitted 4x4 posts and a 2x8 beam, and upgrading these key components added only $55 to the cost of the project— a good long-term investment.

Where the support beam meets a post, the post was double-notched at the top in order to support a 2x12 on either side of a 1½-in. thick tongue. I sandwiched 2x12 scraps between the 2x12s of the support beam wherever a splice was required, and also at the ends of the beam. All of these components were through-bolted with ½-in. galvanized carriage bolts. The completed substructure formed a rigid, integral unit that helped to make the finished deck rock solid (photo adjacent page).

Ledger details—The support beam, located just beyond the lengthwise centerline of the deck, carries about two-thirds of the deck's weight. The ledger, however, is equally important from a structural standpoint because it ties the whole deck structure to the house as well as supports the remainder of the deck. Attaching the ledger board was a simple matter. I just removed the siding and used lag screws to attach the ledger board to the rim joist of the house.

The decking boards would have to be nailed to the ledger, and it was clear at the design stage that this wouldn't be easy. The 2x6 ledger provided only 1½ in. of nailing surface, and even this was partially obstructed by the siding. As a result, the deck boards would have only an inch of bearing surface on the ledger. This connection would certainly be a weak link in the structure. And beside that, I didn't like the idea of driving all those nails so close to the aluminum siding, a material easily scarred by errant hammer blows. Instead, I nailed in a 2x4 flat to the top of the ledger (bottom photo, next page). The flat side of the 2x4 solidly supports the ends of the deck boards, and each of the 2x8 joists hanging from the ledger would have to be notched to clear the nailer. But the nailer was worth the trouble, because it reduced the likelihood of split end grain in the decking and also kept hammer dings in the siding to a minimum.

Once the siding had been removed to install the ledger, the house's main structural system was exposed to the elements. Rain and snow would reach into the voids and joints at the end of each deck board, and it

Photos by R. W. Missel

In order to shield fasteners from the weather, pressure-treated plywood was first screwed to the tops of the 2x railing supports. Screws were then run in through the plywood to the 2x railing cap to fasten the cap in place. The plywood also acts as a splice plate where a joint is required between supports.

The key element of any deck is the support system of posts, beams and joists. In this project, posts were notched to support a beam built from doubled 2x12s. The post extends between the 2xs as a tongue and spaces them apart. Bench supports were solidly bolted to the substructure (above). Below, deck joists hang from a ledger lag-bolted to the house. The black joist hanger on the left is wide enough for doubled joists spaced apart with 2x blocking. Flashing slipped under the siding directs water away from the house. Just visible beneath the flashing is a 2x4, nailed flat to the top of the ledger that provides additional support to the deck boards.

was vital to protect the untreated rim joist from this moisture. The solution was a simple flashing strip, which I slipped under the siding and extended over the top of the nailer strip to form a drip edge well away from the rim joist (photo bottom left). Admittedly, this flashing was perforated with nail holes when I nailed in the deck boards, but the joint between the nailer and the rim joist will still be protected. Next time around, though, I think I'd caulk beneath the flashing, too.

Joist details—For a given load, the correct joist size depends on how far they span and on how closely they're spaced. But figuring the proper spacing wasn't so easy for this deck. First, the diagonal pattern of the decking boards meant that each board would span a greater distance than the distance between joists. Second, a joist would be needed wherever the decking boards changed direction (every 5 ft.). I settled on a spacing of roughly 14 in. o. c. for the joists, resulting in a clear span of roughly 19 in. for the longest deck board. With this reduction in spacing, 2x8 joists were a conservative choice.

Along each line where decking boards changed direction, I doubled the joists, and spaced them apart with scraps of 2x. This provides a full 1½-in. support area at the end of each deck board, and nails can be sunk well away from the ends of the boards, which virtually eliminates end splits. It also provides an open space between joists so that a single pass with a circular saw trims all deck boards evenly. Most important, however, it ensures that the butt ends of the deck boards will be well-drained and ventilated. Tightly made joints directly over a joist will eventually rot as water collects around them. The doubled joists are supported by heavy-duty joist hangers (United Steel Products Co., 703 Rogers Drive, Montgomery, Minn. 56069).

Blending the design elements—All construction details to this point were designed to increase the strength and durability of the deck. But after the joists were in place, appearance became a major consideration. The deck's dominant visual element is the sanded and rounded 2x surfaces. All the 2x4 deck planks and exposed boards in the railing and

The completed deck includes herringbone decking and a privacy screen at one end. Note the rounded front portion of the benches, a detail designed to increase comfort. Edges on the benches and on the railing were sanded smooth.

benches were belt-sanded smooth, and the edges were rounded over with a router and a ½-in. radius corner rounding bit. For assembly-line efficiency, I set up a separate work area for these operations, including a bench vise, sawhorse supports and power cords.

Installing benches single-handed can be tough, but the liberal use of clamps can speed the job. The bench backs and seats were angled slightly to make them more comfortable.

The railing system–Several conflicting design goals affected the construction details for the railing. First, I wanted the view from a seated position on the deck to be as unobstructed as possible. My intent was for people on the deck to feel themselves a part of the adjacent woodland, and not feel fenced out by the deck rail. The final design uses evenly spaced, slender horizontal and vertical lines to create a see-through effect, much like a Venetian blind (photo above). A key factor here is the use of 2x5 posts turned edgewise to the deck to minimize their mass, and edgewise 2x stock for railing and barrier slats. The county safety code requires a 36-in. rail height with openings between railing and deck held to a maximum of 6 in., but the thin profile of the edgewise stock allowed me to meet this requirement with a minimum of visual impact.

Besides keeping a slim silhouette when viewed from a chair on the deck, the railing was designed to offer a broad, flat area for flower pots, serving plates and cold drinks. To achieve this, I used a 2x8 with rounded edges for the railing cap and a 1x apron for trim. Each joint in the rail cap was mitered across the thickness of the cap and carefully fitted to provide a smooth, unbroken surface.

The heart of the railing system is the 4½-in. wide strip of treated ½-in. plywood that ties all the pieces of the cap together (photo top right, facing page). Installation wasn't too difficult. After ripping the plywood to width, I screwed lengths of it to the tops of the posts. Then I cut the 2x8 rail caps to length and attached them to the plywood with 2-in. galvanized woodscrews run in from beneath through the plywood. I ripped the trim pieces from 1x stock and rounded the edges before nailing them to the underside of the railing. As a result, no nails are visible from above, and no plugs are required in the rail. Equally important, the plywood acts as a splice plate to keep butt joints tight and to reduce warping and cupping of the rail cap boards.

Bench building–I cut the bench supports from 2x8 stock, wanting to make sure they would be strongest where each support is bolted to the deck frame. I didn't want them to look clumsy, so each support is tapered to a dimension of 1½ in. by 4½ in. where it joins the railing (photo above). The bench supports were installed at an angle of 15° so that the seat back would be comfortable. The seat rails were cut from 2x6s and mounted with 5° of tilt. Combined with the rolled edge at the front of each bench, these angles result in very comfortable seating. I used galvanized ½-in. carriage bolts to tie everything together.

Privacy screen–In order to block the view from a neighbor's yard, I added a privacy screen at one end of the deck (photo top). The screen was built in the same way as the rail system, but with more horizontal slats–these were spaced ½ in. apart. I added an extra support near the diagonal section of railing in order to support the ends of the slats. □

R. W. Missell is an electrical engineer with 20 years of experience in the operation and maintenance of Air Force facilities.