INSTALLING Over-the-Post Handrailing

A site-built pitch block permits accurate fitting of curved transitions, and a matching jig ensures that the cuts are dead on

by Ken Reis

Building stairs is one of the most difficult parts of building a house, and building handrails is the most difficult part of stair building. There are two types of open handrail systems. The first is the post-to-post system, in which the rail is cut to fit between the individual newel posts and the posts extend above the rail line. Height change is achieved by using different post lengths and types.

In the second method, known as the over-the-post system, the handrail runs in an unbroken flow from bottom to top of the stair flight. This provides a nice clean look, but it makes for a more challenging installation. Unlike the post-to-post system, where the rail can be cut into the post at one height and exit the post at another, changing height or direction in an over-the-post system involves several types of stock transition fittings that must be precisely cut and fitted at the job site.

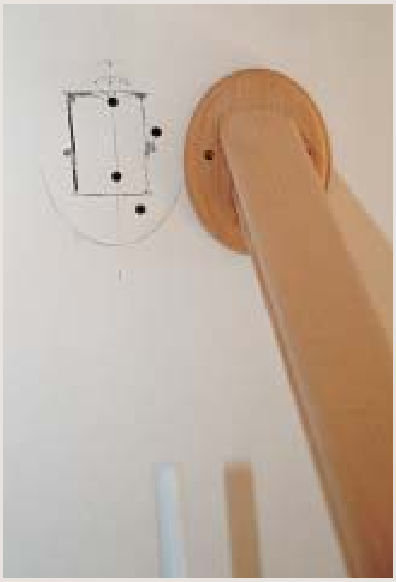
Every cut has to be dead on, and because fittings range in price from $30 to $300, errors quickly become costly. I use stair parts from two companies, L.J. Smith Stair Systems (740/269-2221, www.ljsmith.net) and Coffman (276/783-7251, www.coffmanstairs.com).

Establishing the Handrail Centerline

In most installations, the 3/4-inch turned tenons at the base of the balusters are simply glued into matching holes in the treads. Standard baluster alignment is usually flush with the face of the skirtboard.

Retrofit Blocking

All too often, I encounter a hollow stud bay right where I need a solid mounting for a handrail or end-newel. Because I'm a finish guy, I'm reluctant to tear open the wall and install blocking.



To avoid that, I've learned to reinforce the wallboard where needed without creating an extra drywall repair job. After marking the handrail or bracket location and tracing the outline of the handrail rosette on the wall, I cut a rectangular hole in the drywall within the traced outline and set the cutout aside. The hole is wide enough to allow me to slip a strip of $^{3}/_{4}$-inch plywood, well coated with construction adhesive, inside the wall cavity and secure it to the back of the wallboard with a couple of drywall screws (left). Then I screw the cutout back in place, and the rosette conceals everything. Once the construction adhesive cures, the connection is quite strong.

—K.R.

But long balustrade runs, and especially long over-the-post runs, must be made as stiff and strong as possible. I sometimes reinforce the connection with dowel bolts — double-ended wood screws that anchor the bottom of the baluster directly to the stair carriage. For the bolts to have something to bite into, the centerline of the railing has to sit squarely over the carriage; so I plan my layout with that in mind.

Another exception to standard centerline layout is a partly enclosed staircase, which often has only three or four treads open at the bottom of the run. In that situation, the upper end of the handrail has to land squarely on the center of the buttress wall, thus determining the centerline.

Band-aid blocking. Where the end of the handrail terminates at a buttress wall, as described above, the face of the last wall stud provides solid backing for the railing. In other cases, though, the handrail terminates in the middle of an unbacked drywall-covered stud bay. This is outside my control, since I'm not around when the blocking is installed. Hollow wall anchors are far too weak to support a railing, so I've worked out a method of quickly adding

Figure 1. A pitch block is a simple gauge that's useful for determining post and rail height adjustments on offset newels. It's easily made by marking the diagonal between tread and riser on a square-cut lumber scrap (left), then cutting it to the line with a radial arm saw (right).

a backer block or two where needed (see "Retrofit Blocking," opposite page).

Newel Posts

Once the centerline of the handrail is determined, it's easy to locate the newel posts. On a stair with a change of direction, posts are best located where handrail centerlines intersect. In some cases, though, I can't place a post exactly where I'd prefer. For example, the ideal newel location may coincide with a metal joist hanger, preventing doweling or bolting in that location. I-joists and LVL beams can also create connection problems, as notching or drilling may compromise their engineered performance rating.

The need to keep baluster spacing uniform may also force me to adjust or relocate a newel forward or back of center. But any change in newel location, forward or back along the rail line, affects the height of the rail relative to the post, so individual post height is a critical concern.

Using a pitch block. To calculate a gain or drop in post height, I make a simple gauge called a pitch block for every stair I build. A pitch block is just a scrap of finish lumber or plywood, cut square to the height and depth of a single riser and tread, then cut diagonally from corner to corner (see Figure 1, previous page). Measuring a plumb line anywhere along the base, or tread line, of the block shows the exact rise relative to the horizontal distance traveled, and thus how much to add to, or deduct from, standard post height.

Rail height. In most cases, rail height is regulated by code. Generally, standard handrailing must be between 30 and 34 inches, measured plumb from the tread nosing to the top of the hand rail. But the building inspector may determine that the handrail must also qualify as a guardrail. Minimum guardrail height starts at 34 inches, so I typically default to a 34-inch-high hand railing as a play-it-safe standard.

Starting newels. At the bottom of the rail, a starting newel supports a handrail volute — a starting rail fitting that scrolls left or right — or a curved starting-rail fitting called a turnout. Starting newels are available in both adjustable and nonadjustable versions. A nonadjustable newel typically has a 9-inch-long by $1^1/_2$-inch-diameter dowel bottom and a 1-inch-diameter pin top for securing the rail fitting. Because its length is fixed, this type of newel dictates the height of the finished railing.

Adjustable newels are similar, but instead of having a fixed dowel bottom, they're end-bored for a separate anchor dowel and can be trimmed to the exact length needed (Figure 2). I prefer the adjustable option so that I can fine-tune the railing height as needed.

The starting step is drilled full-depth, through to the subfloor, to accept the newel dowel. A starting volute comes with a paper template, used to deter-

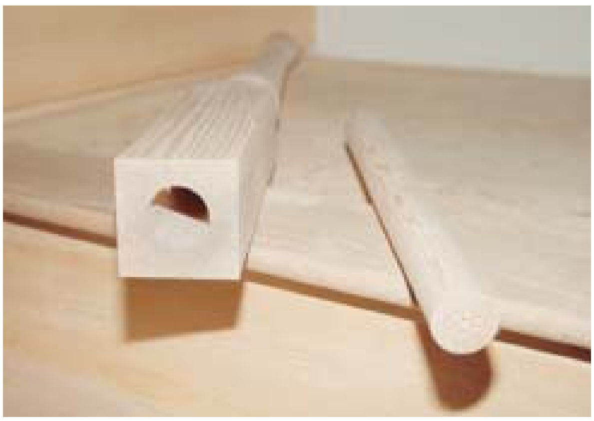


Figure 2. Adjustable starting newels are end-bored for an anchor dowel, which permits trimming them to length as needed (above left). Once the position of the starting newel has been determined with a paper template (left), the starting step is drilled through to the subfloor and the newel is dropped into place (above).

Figure 3. Newels at a landing are notched and fastened with hardened lag bolts (left). The recessed holes will later be plugged and sanded smooth. Where the newel is let into the stair nosing, the author provides a neat joint between post and tread by cutting an undersized notch and routing a matching profile in the face of the newel (right).

Figure 4. The correct cut location on a curved easing is established by positioning the pitch block beneath the curve and marking the tangent point (above). Rotating the block 90 degrees from its original position defines the cut line across the face of the easing (right).

mine the newel location on the starting tread. Although baluster locations are also indicated on the template, I ignore them — they almost never match the on-site spacing.

Transition newels. Newels at a landing where the stair and handrail make a turn are typically notched onto the riser and tread and anchored using hardened-steel lag bolts. I like RSS screws (GRK Canada, 800/263-0463, www.grkfasteners.com). The post should be notched only enough to center it on the railing layout line and baluster spacing in both directions. Two lags are normally sufficient to secure the newel post (Figure 3). In addition, I always use a good construction adhesive, such as PL-400 (OSI Sealants, 800/321-3578, www.osisealants.com), when fastening newels. The lag heads are recessed in 1-inch-diameter holes, which are later plugged and sanded flush. The overall height of a simple transition newel must be at least equal to the starting newel height plus the first riser of the continuing flight.

Nosing support. The overhanging tread nosing must also be notched to let the newel in against the riser. Rather than notching to the full width of the newel, I cut out the nosing 1/2 inch narrower than the newel, flush to the face of the riser. Then, at the tread line, I trace the projection of the nosing profile onto both sides of the post face and use a router to plow a 1/4-inch-deep, contoured recess. This method makes a strong, neat joint between tread and newel and supports the nosing at the cut.

Fitting the Handrail

Once the posts are installed, the real fun begins. Over-the-post handrailing requires the use of special railing sections, or fittings, to flow gracefully through its turns and rises. There are three basic types of fittings to work with: starting fittings, goosenecks, and transition fittings.

Fitting tangents. Starting fittings connect to the main railing with an upturn, or easing. For a smooth transition to the straight rail segment, the starting fitting must be trimmed square to the rake angle of the stair. Although you can buy a handrail miter jig for this, I establish the correct angle with my pitch block.

I begin by laying the starting volute or turnout flat, with its curved section sweeping upward (Figure 4, previous page). I then slide the pitch block under the curve, tread edge down and parallel to the section. At the exact point where the hypotenuse of the pitch block contacts the curve — the tangent point — I make a small pencil mark on the side of the fitting.

Standing the pitch block on its riser end alongside the fitting lets me align the hypotenuse with the pencil mark. At that point, I trace the hypotenuse across the face of the fitting.

To make the resulting cut accurately, I first make a jig from the diagonal cutoff from the pitch block, screwed to a matching piece to double its thickness and mounted on a 1x2 base (Figure 5).

Goosenecks. At landings, or at the end of a flight, over-the-post handrailing commonly transitions over the newel post with a gooseneck fitting. The fitting has a cap, drilled to fit over the newel's pin top, that's mitered to a trimmable vertical section equal to two risers. A separate, curved easing piece — which is cut to the rake angle in the same manner as the starting easing — connects the vertical section of the gooseneck with the run railing below.

Making connections. Most rail easings come with one end already squared to a horizontal or vertical railing transition and predrilled for the rail bolt used to connect adjoining segments. The site-cut end of the fitting must also be drilled for a rail bolt. An inexpensive rail-bolt wrench, available from the stair manufacturer, simplifies this job considerably (Figure 6).

Figuring the railing run. Before you can connect the gooseneck easing, the run railing must be cut to length. I've found that the best gauge for determining the segment length is the

Figure 5. A simple tangent jig, clamped to the fence of a miter saw, makes for accurate cuts in curved easings. The 1x2 base of the jig is allowed to run long at first, and the tangent point from the easing is marked on the base of the jig, which is cut off square at that point (left). The tangent point marked on the fitting is then aligned with the end of the 1x2 as the saw blade is dropped slowly through the stock (below left).

Figure 6. A built-in gauge on the proprietary rail-bolt wrench provides necessary drilling centers for bolt and access holes. Drilling the access hole before the bolt hole prevents the access-hole bit from wandering when the lead spur intersects the bolt hole.

Figure 7. The staircase itself provides the best way to measure railing runs. With the starting newel removed and the volute fitting connected and supported on a temporary rest (right), the author marks the run railing for length, measuring back from the landing newel to the easing fitting (below). The offset distance for the easing is already determined by the cap fitting (below right).

Figure 8. The face of the first baluster aligns with the riser face. Other balusters are spaced by equal division of the tread from the face of one riser to the next.

staircase itself. With the volute or turnout dry-connected to the lower end, I lay the railing section directly on the steps, over the layout line. I make a temporary support for the volute to hold its bottom flush with the first tread (Figure 7). The final step is to position the trimmed easing alongside the railing at the correct offset from the landing newel, then mark and cut the railing square.

Vertical transitions are easiest to mark for cutting when dry-mounted and leveled on the landing newel. With the railing resting in position on the steps, measure up from the top of the easing a distance equal to the height of the starting newel and mark the vertical section for cutting.

Don't drill for the rail bolt until you've checked the entire segment assembly for fit. The starting and transition newels must be both parallel and plumb. If the newels lean toward each other, you've cut the run railing or the vertical fitting too short; as always, it's better to measure strong and have to trim a little off.

I assemble fittings with a generous application of adhesive. In the center of the bonding area, I use PL400. Around the edges, however, I use common yellow wood glue, because the squeeze-out cleans up more completely — essential for an unblemished clear finish. And I don't touch any squeeze-out until the glue has dried; this saves a lot of unnecessary sanding.

Setting Balusters

I have one unvarying standard for spacing balusters: Viewed from the side, the face of the first baluster (at the front of the tread) aligns with the face of the riser (Figure 8). The first baluster location determines the positions of the others. Whether I install two or three balusters per tread, I maintain a uniform spacing between them.

Wood balusters come in two types, pin-top and square-end, and in several lengths. The top of a square-end baluster is first cut to the rake angle, which fits into a matching plow in the underside of a proprietary handrail. The plow between balusters is capped with a fillet strip that's included with the handrail.

Pin-top balusters self-dowel into 5/8-inch site-drilled holes in the underside of an unplowed rail. After marking and drilling the baluster locations on the stair treads, I temporarily insert and plumb it and mark its location square across the underside of the rail, which is dry-fitted to the posts (Figure 9).

Once I've marked the positions of the balusters, I remove the handrail from the newel posts and lay it upside down on the stairs. Positioning the railing like this lets me drill the baluster holes plumb (Figure 10). To ensure accuracy, I use a drill with a bubble vial built into the handle, but you can also do this by eyeballing the angle of the drill bit against a try square standing on the tread. I wobble the bit slightly while drilling to ream the edges of the holes. This simplifies fitting the balusters into the holes.

After a complete dry-run test fit, I put a squirt of PL400 in every dowel hole — treads, railing, and fittings — drop the railing into place, and set the balusters singly, beginning at the bottom and working up. The top end of the railing is left loose, allowing me to lift it as needed to insert a stubborn baluster or add a dowel bolt. But when I drill the underside of the railing, I make the holes deep enough for some vertical play, so that I can lift and then drop the balusters into the tread holes.

Unlike yellow glue, PL400 is forgiving stuff, with a sufficient open time to work a rail run without dripping or forcing me to rush. It also fills small gaps around dowel ends, making a rugged, permanent connection.

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Figure 9. With the assembled railing dry-fitted to the newels, balusters are inserted and plumbed to establish the positions of the holes in the underside of the rail.

Figure 10. Drilling accurate holes for pin-top balusters is most easily done by turning the railing upside down on the stair. In that position, plumb holes will lie at the correct angle to the railing.