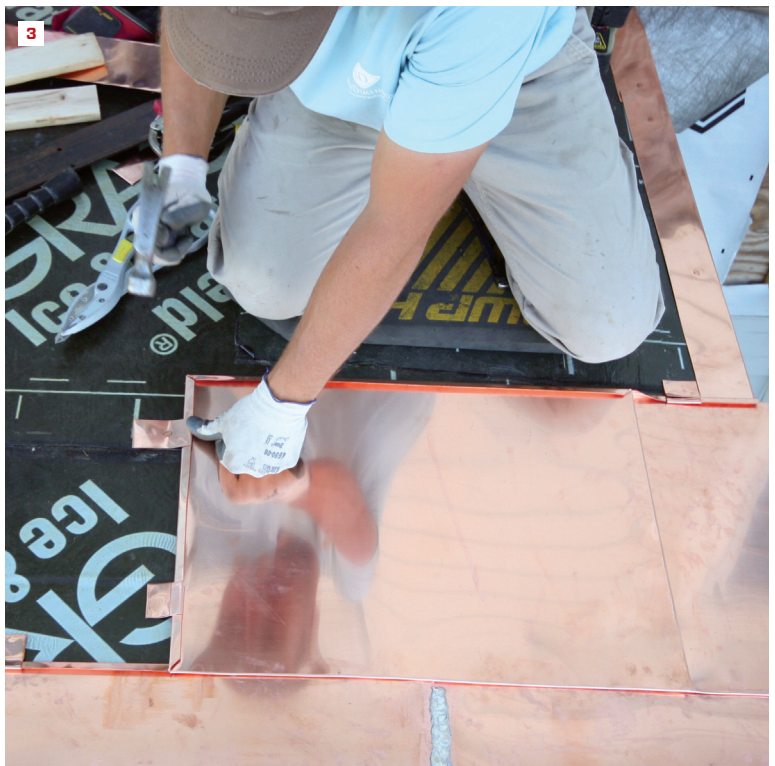


BY KYLE DIAMOND



Copper was chosen for longevity and because the roof would be visible from the second floor (1). At all the corners, a gap is required so the folded seams will fit together (2). Four copper cleats secure each panel. The ends of these cleats must be bent over to cover the nail heads on the off-chance a nail were to work “free” and rub against the pan (3).

Installing a Flat-Seam Copper Roof

A year ago, I was asked to install a flat-seam copper roof on a new entry portico. The homeowners chose to go with copper because the new roof would be visible from windows located in a second-story sitting room. My company, New Dimension Construction, was subcontracted only to do the copper work.

The project's GC built the new entry above an existing flight of stone entry steps, which helped dictate the overall roof size of 12½ feet wide by 9 feet deep (1). The GC's crew built the plywood deck with a slightly

pitched hip roof (for drainage and to keep the crown molding at the same level), and then waterproofed the roof deck with Grace Ice and Water Shield. When we arrived on site to take measurements—before fabricating the roof's components back at our shop—the portico was pretty much done.

IN THE SHOP

For this job, we ended up with 20-inch-by-28-inch pans—six pans across the roof's width and six pans deep. We made them out of 16-gauge copper, cutting the pic-

es from 3-foot-by-8-foot sheets of copper using a metal brake with a cut-off wheel. Our goal was to show up on site with most of the pieces already made.

Before we bent any of the panel's interlocking seams on the “field” panels, we trimmed the corners to allow the sides to be bent properly. We clipped off the panel's corners at a 45-degree angle, and cut them so they would have a ³⁄₁₆-inch gap when the edges were bent (2). From there, we folded two of the field pan's edges up and two down, creating four ¾-inch interlocking



A weighted dead-blow hammer is used to flatten the seams (4). Uphill pans overlap the edges of lower pans (5). Only install as much copper as you can solder in a day (6). The acid from the flux must be neutralized, or it could cause the copper to prematurely (and unevenly) patina (7).

seams. For “starter” pans, we left the bottom edges unbent in order to fold them over the perimeter drip edge. For the “end” pans, we left either the right or left side unbent. We fabricated the drip-edge ourselves in the shop and left the roof-to-wall pieces to be site-bent.

ON SITE

We installed the perimeter drip-edge first and then began fitting the starter pans. We interlocked the side seams, then folded the pan’s bottom edge over the drip’s 3/4-inch overhang, clamping it tightly with a hand seamer.

On succeeding rows, we offset the seams in a staggered pattern, like a running bond. Each panel received four 2-inch by 4-inch-long cleats—two placed along the upturned top seam and two along the upturned side (3). With the panel set in place, we then flattened the seams with a rubber dead-blow mallet (4). A simple block of wood helped drive the panel up and over into position (5). Once we had a few rows locked in and flattened, we began soldering the seams (6). (For soldering tips, see the “Soldering Seams” slideshow at jlconline.com.)

We custom-fit the roof-to-wall pans, bending them on site. In order to make the

90-degree turn with the brake, we had to make V-cuts at the panel’s side seams. We then fastened the vertical leg with a couple of nails at the top of the flashing before we soldered the seams. As a last step, we ran the solder up the vertical leg a few inches.

Before leaving the job, we rubbed the roof surface down with baking soda and water to help neutralize the acid from the soldering flux (7). The roof was now ready for the GC’s crew to integrate the new flashing with the WRB and siding over it.

Kyle Diamond is a partner with his father, Dale, in New Dimension Construction, in Millbrook, N.Y.



Framers muscle a long PSL beam off the delivery truck **(1)**.

A carpenter fastens a block to the garage slab to secure a wall brace **(2)**.

The crew starts to lift a steel I-beam garage header into place with the help of a crane **(3)**.



Cantilevered Balcony Beams

BY TED CUSHMAN

As the homebuilding industry slowly comes back from the “Great Recession” of 2007-2009, the urban infill market stands out as a bright spot. City living is attractive to singles, young families, and downsizing baby boomers. And in markets where undeveloped land is scarce, scattered infill lots offer some of the last available building sites around.

Portland, Maine, offers a good example. In the city’s trendy East End, teardown and infill projects are sprouting up on almost every block. The project shown here, in the

city’s Munjoy Hill neighborhood, is a four-unit building squeezed into a tight lot between an older, existing wood-frame house and a brand-new four-story mixed-use condominium building.

THE DESIGN PROBLEM

Architect David Lloyd of Archetype Architects in Portland (archetype-architects.com) told *JLC* that a change in city zoning rules last year allowed his clients, who also own the old wood-frame house next door, to build a separate structure on the property.

(The earlier rule would only have permitted a structure adjoining the existing house.) But the required setbacks still limited Lloyd’s design options. The front setback from the street had to fall at the average of the setbacks of the existing buildings on either side. And required clearance on the sides and back of the long, narrow lot also applied a squeeze to Lloyd’s vision.

Lloyd chose to place his new four-unit building as close as possible to the boundary with the new condo to its north and to leave space on the south side, to gain the benefit

Photos by Jeff Barker and Ted Cushman

of sunshine on the new building's windows and balconies, facing due south. Lloyd located the balconies toward the front of the building, near the street, allowing a view over the open street toward the waterfront. A garage under the building, with doors facing south, provides four parking spaces—although the location's tight confines, Lloyd said, barely left room for a driveway.

A STRUCTURAL SOLUTION

With the form of the building tailored to the lot, the structural design was a secondary problem—which landed in the lap of Portland engineer Aaron Jones, of Structural Integrity Consulting Engineers (structuralinteg.com). Jones chose steel I-beams for garage headers, and parallel-strand lumber (PSL) beams running across the width of the building and cantilevering out to support the balconies.

The pair of two-car garage doors falls under a stepped overhang, in a profile similar to a garrison colonial house—a familiar concept to most builders. But with the overhanging upper-story walls carrying three levels of roof and floor loads down onto the cantilevered trusses of the first occupied floor above the garage, the loads involved are heavy. That's what drove the choice of steel I-beams for the garage headers, Jones explained. Engineered wood might have been able to make the spans, but steel offered better control of deflection across the wide garage door span.

The steel beams for the two garage-door openings were the same, even though one of the headers also has to carry one of the PSL balcony supports crossing the steel beam near mid-span. (Compared with the main floor loads, Jones explained, the balcony loads are relatively minor.)

PSL members can easily handle the weight of the balconies, Jones said. But he beefed up the PSLs in order to enhance the feeling of stiffness underfoot for building occupants. "Cantilevers are a big concern to all of us who are designers," Jones said, "because we're trying to make them not bounce. To make everybody happy with them at the end of the day is always a battle, because we can put so much structure in there trying to make that diving board



Controlling the heavy steel beam with a tag line, the crew gently lowers it into place across the garage door opening (4). A carpenter marks the 2x6 plate for a bolt hole (5); the plate is then drilled (6) and bolted down to the steel beam (7). A crew member attaches a lifting strap to a PSL beam in preparation for lifting the beam onto the walls (8).



Working carefully on the tight site, the crew begins to lift a heavy PSL (9). The crane lowers a PSL into place at mid-span on the steel I-beam (10). At the north side of the building, a carpenter guides the end of a PSL down onto the framed wall (11). The crew lowers a PSL onto the wall on the street end of the new building. PSLs in the foreground will support the balcony (12). The steel I-beam shown here (13) is sized to carry floor loads from two occupied stories, plus the roof, transmitted through the walls onto these cantilevered floor trusses. The projecting PSL beams (and two more to come above) will support balconies.

feel less springy.” In this case, the PSLs that were lined up with partition walls inside the buildings were only 3½ inches thick. But the beams that ran through the floor, away from any floor or wall loads that would stiffen the beams, were sized at 5 inches thick to maintain a stiffer feeling underfoot for people using the balconies.

PRACTICAL EXECUTION

Detailing the two stories of balconies will be interesting for contractor Shawn Geyer, of Geyer Construction, who is responsible for all the building’s exterior details as well as the framing. The projecting PSL beams will have to be cut down with a taper to

shed rain and equipped with outer beams and an infilled floor frame (also tapered for drainage). Then the deck structure will have to be waterproofed, tapered sleepers will be applied to restore a level plane, and finally, the decking and a railing system will be installed. The underside of the balconies will receive a tongue-and-groove board ceiling.

But Geyer’s immediate task was just to get his materials off the delivery truck and onto the site—a task made easier by having a large crew of framers on the job. Setting the steel I-beams, however, required more than muscle power: After bracing off the wall, Geyer called for a crane to lift his

beams into place. The crew bolted 2x6 plates onto the underside of the beams before setting them, then marked and fastened an upper plate to the beams in place, allowing wood-to-wood connections between the steel beams and the walls below and floor framing above.

With the steel headers in place, the next task was to set the first level of Parallams—again, a job for the crane, along with plenty of skilled hands. On the upper levels, the crane was even more useful, as it came in handy for booming bundles of floor trusses and clips of sheathing up onto the higher stories.

Ted Cushman is a senior editor at JLC.