

INTERIOR FINISH



Custom Concrete Windowsills Shop-fabricated concrete adds a custom touch

BY DAVID KELLY

Some of the most valuable real estate in a high-performance home is the 6-inch- to 18-inch-deep alcove created between a window and the interior space. In a home with fat walls, the depth of the window opening makes the sill more than just a trim piece and offers the chance to treat that wide, flat, well-lit surface as a usable space.

We've used maple and other hardwoods for the deep windowsills in our high-performance homes, and that does look great. But I've come to believe that stone or concrete sills are better suited for the microclimate of the windowsill location. Like a concrete slab, a concrete windowsill acts as a thermal battery, absorbing the heat

of sunshine during the day and releasing it at night. Plants love a masonry sill, and so do cats. And of course, concrete is far more durable than wood. It handles abuse and standing water well, so homeowners can feed and water their windowsill fig trees or kitchen herbs without worry. Properly made concrete windowsills will probably outlive the house.

A concrete windowsill doesn't have to be a work of art; I suppose you could buy a bag of Quikrete, set up plywood forms, add water, and get a pretty good product. But with a few specialty admixtures and some attention to detail, you can create a beautiful finish that looks like slate, quartz, or leather—or, as I prefer, just concrete. We

Photos by Ted Cushman/JLC



The author uses a cardboard template made at the jobsite to guide his placement of 1x4 forms, screwing the wood down to the melamine surface of his worktable (1, 2). Where necessary, he sands the wood with a belt sander to even up any inconsistencies in the thickness of the lumber (3).

get most of our admixtures and surface coatings from Buddy Rhodes Concrete Products (buddyrhodes.com), also a good source of education and training.

The best thing is, custom-crafted concrete gives you durability and visual versatility at a cost that is much more affordable than that of stone. Most of the cost of the job I'm showing here was for my own labor. As for equipment, you can do good work with just the basics. Our company casts only about a dozen sills and a couple of counter-tops a year, and we find we can mix efficiently enough for our purposes with a concrete hoe, a wheelbarrow, lots of 5-gallon buckets, a few basic carpentry tools, and a scale. For higher volumes of work, you could invest in specialized gear, but it's not at all necessary.

Windowsills involve pretty much the same steps as casting anything else in concrete: You build forms, cast your product, smooth it, strip forms, finish, and seal. The same technique works for many

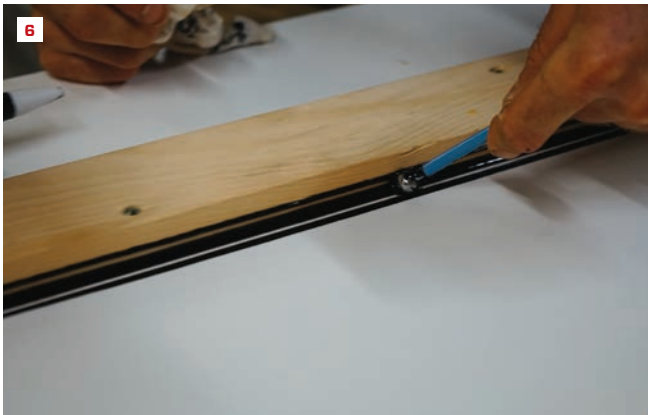
other finish elements in a house, such as vanity tops and counter-tops—or, for that matter, just about any surface in a kitchen or bath where you want durability combined with good looks.

TEMPLATING AND FORMING

Rather than cast sills in place, we “face cast” in the shop. This allows us to precisely regulate our cure and control our mess. It also allows other work to progress on site.

Unlike wood, a cast concrete sill can't easily be sanded or planed, so it has to be built with precision. A good template taken from each rough opening is critical. I use thick cardboard, such as an appliance box, and I use a very sharp box cutter to fit the cardboard to the rough sill. I keep working the piece until it fits just right.

You can cast sills with typical rabbit ears as shown here, although this can make for tight or weak corners in your form, and



The author coats the edges of his wood form strips with paste wax (4), then applies a generous bead of black silicone caulk where the edge forms meet the worktable (5). Tooling the caulk with a stainless steel ball used by cake decorators (6) creates a consistent, smooth eased edge on what will be the upper face of the windowsill. Excess caulk peels away nicely (7).

more fussy corners to fiddle with. A simpler option, if it fits the aesthetic, is forming a simple rectangle. If you have many openings of the same size, that makes formwork a breeze.

You can size the template to fit your rough opening, leave a spacer on site to guide your drywall crew or finish carpenters, and just slide the sill right under the finish when it's made. Installing the sills is easier, however, if you cast and install them before you install drywall and casing. But for this job, unfortunately, I wasn't able to template the sills until after drywall, and I didn't leave a spacer either. This made things tricky for accurate templating, and also for fitting the sills to the openings when it came time to install them.

FORMWORK

If all goes well, most of your time is spent at this stage. Begin with a perfectly level surface (preferably large enough to easily

support a 4x8 sheet). A stainless steel assembly table with adjustable legs is ideal, but a set of sawhorses with a 2x4 strongback frame faced with plywood works fine. Shim up the table and check level with a 6-foot level (or better yet, a rotary laser). Check across too, so you don't get a twist. The stiffer your mix, the less critical leveling is—but with a fluid, self-leveling concrete, "pretty level" won't work.

If you're casting with the finished surface facing up, and either grinding the top or hand-troweling, a smooth plywood base is sufficient for your forms. But in this example, we're using the "face cast" method, where the top, finished surface of the sill is the face that's touching the form. That means we need smooth forms. I've played around with barn wood, OSB, and plexiglass, but I find that a sheet of melamine yields a nice surface.

Fasten the melamine down to your assembly table and lay out

Traditional Mix Design Example

Material	Parts	Weight (lb.)
Aggregate - 3/8" crushed stone	3	50.00
Playground Sand	3	50.00
Cement Total	2	33.33
Pozzolan - VCAS	0.2	3.33
Portland Cement	1.8	30.00
Water	1	16.67
TOTAL	9	150

*Water Reducer - 205 - 3 grams/lb water 50.00

GFRC Mix Design Example

Material	Parts	Weight (lb.)
Playground Sand	8	49.52
Cement Total	10	61.90
Pozzolan - VCAS	1	6.19
Portland Cement	9	55.71
Liquid Total	3	18.57
Water	2.55	15.79
Acrylic Fortifier	0.45	2.79
TOTAL	21	130.00

*Water Reducer - 205 -3 grams/lb water 185.71

**Fiber Reinforcement @ about 50% volume of sand

Traditional Mix Weight Totals

Lb./Cubic Ft	Cu Ft	Total Weight	Lb./Part
150	1	150	16.67

GFRC Mix Weight Totals

Lb./Cubic Ft	Cu Ft	Total Weight	Lb./Part
130	1	130	6.19

Shown above are the ingredient proportions for the author's traditional mix for heavy components such as countertops (left), which requires steel reinforcing ladder wire, and for his glass-fiber reinforced mix (right), which uses fiberglass filaments instead of steel and is suitable for very thin castings. Working from the ratios in his formulas, the author breaks the total quantities into small batch sizes for easy mixing. The table shows a sample calculation of the ingredient ratios for 1 cubic foot of each type of mix. If your project requires more than one cubic foot of concrete, the same ratios can be applied to much larger batches by simply changing the overall volume, which carries through in the calculations to result in a revised total weight and weight per part. The author has put all of this into an Excel spreadsheet for quick recalculation from one job to the next.

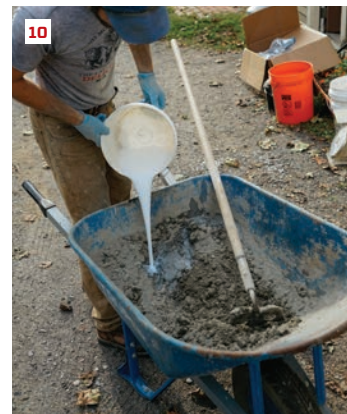
your templates. Carefully transfer the templates with a pencil, or just build around them. (By the way, don't forget that since we're casting face-down, the top side of the template has to face down and touch the melamine.) For anything thicker than 3/4 inch (such as a typical countertop), I rip strips of melamine and use a Kreg jig and pocket screws to set the strips on edge alongside my templates. I add mini strongbacks along the perimeter to prevent bowing. For these 3/4-inch-thick windowsills, however, I just screwed down 1x4 pine, remembering to fill my screw holes with plumber's putty for easy removal.

At this point, I caulk the corners of the form to give a nice relief to the visible, touchable edge of the finished product. I like to use black 100% silicone because I can see its shape better than white or clear caulking. For a crisp bevel, I tool the caulk bead with a tooling ball (I bought mine from Buddy Rhodes, but it's actually a baker's

tool). I wipe paste wax around the perimeter, so the excess caulk will release. After the caulk cures, the waste peels up, leaving a perfect radius that will form your sill's eased edge.

CHOOSING A MIX

There are two basic mix designs: "traditional" and glass-fiber reinforced concrete (see tables, above). My traditional formula is pretty much like any ordinary concrete mix: It's mostly coarse playground sand, small coarse aggregate, Portland cement, and water. But it also has some important admixtures. I add a pozzolan called VCAS (vitrominerals.com), as well as a superplasticizing water reducer that increases the fluidity of the wet mix while limiting the amount of water, thus improving cure strength while maintaining workability. For colored concrete, I add a small amount of dye.



The author weighs out his ingredients using 5-gallon buckets (8). He pre-mixes the cement and dry admixtures (9), places them in the wheelbarrow in small batch amounts, and adds pre-mixed water and acrylic fortifier until the material is well wetted (10). He adds a water-reducing admixture to make the mix more workable, then mixes in fiberglass reinforcing filaments (11).

Without reinforcement, this traditional mix would be prone to cracking, so I add a layer of ladder wire for reinforcement (or, if the piece is thick enough, two layers of wire). I use this traditional mix for anything thicker than 1 $\frac{1}{4}$ inches. Anything much thinner than that just isn't thick enough for me to be sure it won't crack.

Glass fiber reinforced concrete (GFRC), the variety I used for these windowsills, is a whole different animal. The aggregate is omitted, in favor of higher cement and sand proportions. Acrylic fortifier is added to the water to improve bond strength. But most notably, the ladder wire is replaced by thousands of alkali-resistant fiberglass filaments. These are mixed right in. So rather than crumble, the concrete behaves more like wood, with lots of overlapping fibers. This leads to impressive flexural strength. I've gone as thin as $\frac{1}{2}$ inch with GFRC, and I wouldn't be surprised if it could be pushed further. The sills shown here were fabricated at $\frac{3}{4}$ inch thick.

POURING DAY

Particularly if I'm pouring alone, I make sure to measure out all the proportions I need beforehand. I use 5-gallon buckets and a good scale to weigh out each of the ingredients into smaller, manageable "batch" proportions that I can mix up by hand in a wheelbarrow. For bulky materials like sand and cement, I measure my weight once, and then mark the level on the inside of a bucket with a crayon marker. That way I don't need to weigh every time.

Like a baker, I measure my dry ingredients first. For GFRC, that's VCAS, cement, and sand. Then I start adding water and fortifier. This mix is thirsty; it will suck up a lot of water. Be patient, and don't add too much. Once the batch is well "wetted," the trick is to add some water reducer a little at a time and watch for the alchemy—all of a sudden, your mix will get significantly more fluid. Then



The author packs the stiff concrete into the forms by hand (12), then strikes the material off with a 2x4 screed (13). After allowing the concrete to set under a tarp for a few hours, he trowels the surface (14), then covers the sills again to let them cure. After a few days, he strips the forms and finishes the surface, starting by rubbing off rough spots with a grinding disk (15).

add the rest of your water, until the batch has a thick, stiff pudding consistency. Finally, sprinkle in and incorporate the fiberglass a bit at a time, making sure you don't have any mats or clumps.

Now you're ready to add the concrete to your forms. I scoop the material into the forms with my hands, working in layers rather than sections. Make sure to work it into the corners; otherwise, you'll end up with more air holes on your corners, because air has the hardest time escaping from those areas.

Once the forms are filled, take a screed (I use a straight chunk of 2x4) and ride it along the top of your forms, using sort of a walking and sawing motion. Hold the screed at an angle—I've found that if I hold the screed square to the forms, it tends to pull glass fibers out for some reason. I make sure to reserve some excess concrete to add to low points; you want to see the screed push out concrete the whole way.

Cover your form tables with a tarp and a blanket for a couple of hours, to hold in heat and moisture and help the concrete cure. Timing is key here—the concrete needs to be wet enough so that you can still manipulate it, but set hard enough so the back doesn't slice up or "pull." When you can barely make a mark on the surface with a finger, it's time to trowel the backs, removing any junk along the edges and making sure it's fairly smooth—this will help your windowsills slide easily into place and sit nice and flat. Then cover everything up again and wait for the cure to finish. I usually give sills at least two days in the forms, and more time doesn't hurt.

SURFACE FINISHING

In a few days, you can strip forms and do some finishing. I ease the bottom edge of the sill with an old grinding wheel (by hand, not in a grinder), so it's smooth to the touch. Fill any pinholes



The author fills pinholes using a paste of cement, pozzolan, and acrylic fortifier **(16)** and applies ICT PS1 Reactive Sealer to the surfaces of the windowsills **(17)**. On site, the installers apply a setting bed of silicone caulk to the rough framing **(18)**, then set the concrete windowsills into place **(19)**.

with a paste mix of cement, VCAS, and acrylic fortifier (I work the paste in with my fingers, sometimes with the help of a razor blade used trowel-fashion). Give it a few days to cure, if you can, before you apply the paste; otherwise, I have found that the surrounding concrete will steal moisture from the paste, so that the patches don't adhere as well. (Another option that works is to seal the concrete before you fill the pinholes and voids.)

When you're happy with the surface, it's time to seal the sills to prevent staining and degradation. I allow at least a week of curing time before doing this; otherwise, coating adhesion is poor because the concrete is still releasing moisture.

I've tried the whole spectrum of sealer choices and hadn't found the right one until recently. There are drawbacks to most options: Epoxy sealers can look wet and artificial; acrylic sealers are prone to hazing and streaking; and waxes (such as Feed-N-Wax, for exam-

ple) give a great finish but need maintenance and don't actually seal anything. Recently, however, I started using ICT PS1 Reactive Sealer from Buddy Rhodes Concrete, a hybrid between penetrating and micro-coating systems. This coating provides excellent protection without sacrificing the look or feel of concrete. The Buddy Rhodes website provides good instructions, and the sealer is easy to apply without drips or runs. If time allows, let the sealer really harden up before you manhandle the sills into place.

When it's time to install, begin by dry-fitting all your sills. When the fit looks good, we run a few beads of silicone on the rough opening, set the concrete sill down, and then slide it into place. When all your sills are in, you may need to apply some drywall compound and caulking to the wall for a clean joint.

David Kelly is a project manager for House Revivers, in Bangor, Maine.