Getting a durable kitchen work surface starts with careful form work and the right concrete

Poured-in-Place

BY REX ALEXANDER

Mary Pitcher's neighbors must have thought she had lost her mind. On a snowy December morning, when everyone else was wondering whether they should try driving to work, a ready-mix concrete truck had parked in front of Mary's house and was maneuvering its chute to within a foot of her kitchen door. As they later learned, the concrete was intended for neither sidewalks nor footings: It was going right into Mary's new kitchen counters.

Months earlier, she had suggested concrete counters for the new kitchen cabinets I was building for her. I loved the idea. As I researched what type of concrete to use, the local ready-mix plant suggested I talk with Mark Story, a concrete contractor in the area. His company, Blue Max Builders, does all kinds of concrete work, and Mark had formed and poured several concrete kitchen counters, including one in his own house. From the minute we started talking, I realized his expertise would be a big help on my job. So we agreed that he and I would work together to form, pour and finish the counter in Mary's kitchen.

A concrete counter is more labor intensive than it is expensive. Counters in Mary's U-shaped kitchen add up to about 47 sq. ft., yet materials were less than $500. That's a fraction of what solid-surface or stone counters would have cost. But labor is another story: Concrete counters involve a fair amount of work. We decided to form these counters in place, saving us the trouble of moving them into the kitchen later and eliminating any seams in the finished top. Our approach has a number of advantages, but one downside is

Inset photo: Dietrich Floeter

The right mix for a countertop. The author dumps ready-mix concrete into forms built over a set of frameless kitchen cabinets. When cured and finished with an acid-based stain (inset photo), the counter looks like burnished leather.

Concrete Countertops

that the kitchen will be tied up for several weeks (for more on casting concrete counters, see *FHB* #90, pp. 86-89). In the end, it was well worth it (inset photo, facing page).

Build strong boxes, and don't forget to check the floor

Mary Pitcher's kitchen was new, but the house wasn't. It was easy to see deflection in the kitchen floor before we started, and new counters weighing more than a half-ton would make the problem only worse. To take the sag out of the 2x8 floor joists, Mary's friend, John Kahllo, added a 6x8 beam in the middle of the 13-ft. span in the crawlspace.

When it came to the cabinets, concrete counters did not pose as much of a weight problem as you would think. At roughly 1,200 lb., the 2-in. thick top translates to a little more than 25 lb. per sq. ft. on the cabinet tops. I built the cabinets in the frameless style using thermofused melamine with a core of medium-density fiberboard. The cabinets are just boxes with a back, sides, bottom and a solid top (for more on building cabinets this way, see *FHB* #99, pp. 68-73). With the cabinets installed, I had a flat, solid surface that would easily support the weight of the concrete.

Concrete forms are simple and easy to build

With the cabinet top serving as the bottom of the form, Mark and I had only to make form sides and then add bracing to support the forms and the cabinets as the concrete cured. We used No. 2 and better pine. The one additional form material we needed in this kitchen was a sheet of ¼-in. cold-rolled steel to support a 10-in. overhang along one side of the peninsula.

We started our form work with the steel, cantilevering 9 in. of the 20-in. by 80-in. sheet over the top of the peninsula cabinet. We drilled holes through the steel and the cabinet tops and attached the steel with ¼-in. bolts, putting the nuts and washers on the top of the cabinets (top photo, p. 64) and leaving the less obtrusive bolt heads visible from the inside.

Edge forms start with 1x4 braces attached to the underside of the cabinet tops with 1¼-in. deck screws (photo top right, p. 65). These pieces support the material that makes the bottom of the form and creates the counter's overhang. We screwed the 1x pine to the braces with deck screws; even

though the screw heads are inaccessible once the concrete is poured, the entire form can be removed by unscrewing the braces from the inside of the cabinets. After adding the 2-in. vertical pieces for the peninsula forms, I used diagonal brackets to support the cantilevered steel (bottom photo). Lengths of 1x2 reinforce each horizontal brace (photo bottom right, facing page). To conceal the steel plate on the peninsula, we held the vertical form piece 1 in. away from the edge of the plate and then braced the form from below (photo top left, facing page). We also added 1x posts inside the cabinets so that the cabinet tops would not sag as the concrete was curing.

Finish the forms by adding plastic sheeting, sides and a sink form

Before installing the form sides, we draped a tent of polyethylene sheeting over the cabinets, extending it to the floor. It served two purposes: protecting the finished cabinets from the concrete and finishing materials; and forming a waterproof barrier between the concrete and the cabinet tops. It's also a good idea to protect the walls with polyethylene, but before putting it up, snap a line 2 in. above the top of the cabinet. The line represents the finished top of the concrete, and it will give you a reference when you screed the top later.

Form sides are made from 1x pine that is screwed to the outside edge of the overhang. I cut a gauge block exactly 2 in. wide and used it to get the form sides in the right spot before attaching them (photo top left, p. 66). At the ends of the cabinets, we decided to make the overhang just ¾ in. This overhang was easily formed by letting the 1x3 bottom piece along the edges run past the ends of the cabinet by ¾ in. After the sides were screwed on, the remaining space could be filled in with a ¾-in. by ¾-in. piece screwed in from the outside edge.

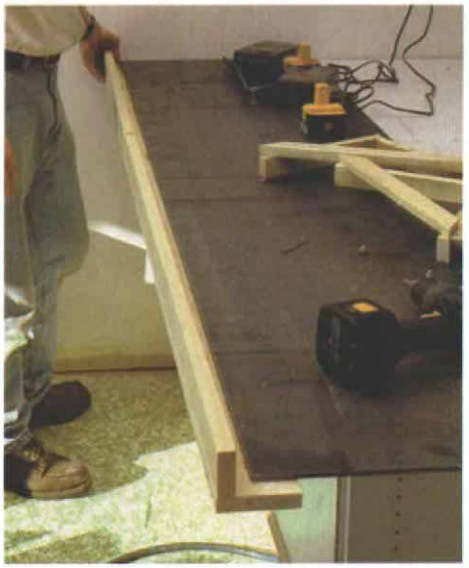
To form the sink opening, I screwed three pieces of ¾-in. flakeboard together and used the paper sink pattern to cut a template. I covered the porous edge with duct tape. Because the sink cabinet had a hole in the top, we screwed a piece of flakeboard from the inside to cover it and then screwed the sink template to that (photo bottom left, p. 66).

As these parts were going together, Mark and a helper started cutting and installing the ½-in. steel rebar on the cabinet top. It helped that Mark had a tool that could cut and bend the rebar; but it can also be cut with a hacksaw or a reciprocating saw. They made a 6-in. grid with the steel, holding it away from the edges and tying it together with form wire (photo right, p. 66). All that remained to be built were the forms for the concrete backsplashes, which we planned to cast separately and install later. Using a 1x6 cut to 4 in. for the bottom and 1½-in. pieces for the sides, we screwed the forms together with deck screws and set them aside on a flat floor out of the way. A single piece of rebar runs down the middle of the form (photo top right, p. 67). Finally, we coated the inside of the forms with vegetable oil as a release agent (photo bottom left, p. 67) and added 1x2 bracing across the top of the forms to prevent the concrete from bowing the edges.

Order the concrete so that it's rich and relatively dry

Even though we needed less than ⅓ cu. yd. of concrete, we ordered it from a ready-mix plant. That saved us a lot of time, and we got exactly the mix that we wanted. In all, it was well worth the 1-yd. minimum we had to pay. In ordering the concrete, Mark specified

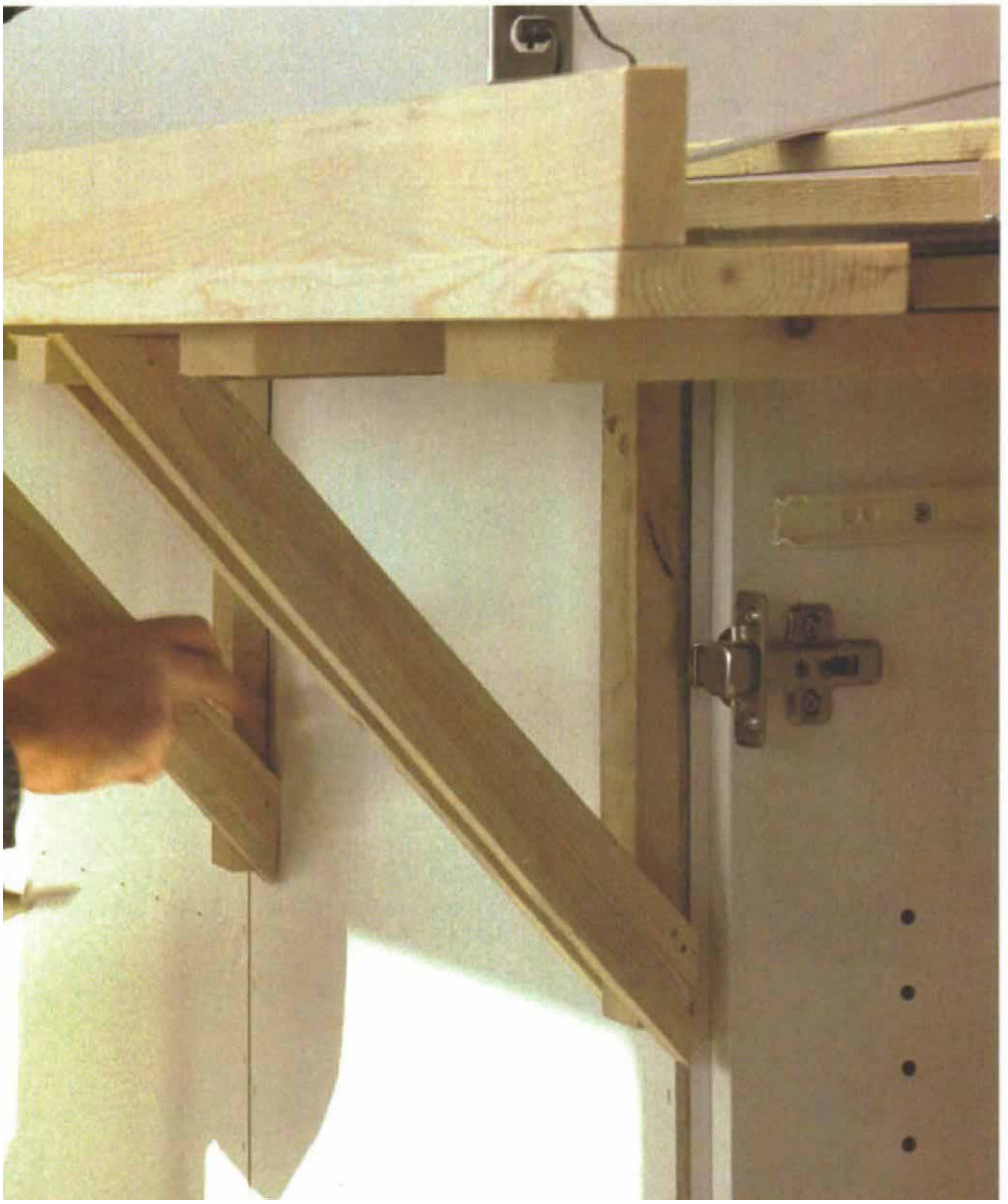
Steel sheet reinforces a wide overhang. Rex Alexander (right] and Mark Story bolt a piece of ¼-in. steel to a cabinet top to support a 10-in. concrete overhang. Bolt heads are inside the cabinets.



Concrete covers the edge of the steel. By pulling the edge of the form 1 in. away from the steel, Story ensures that concrete will hide the rough edge.

Braces are screwed to cabinet tops. To support the forms for the 2¾-in. overhang, Story uses deck screws to attach 1x bracing to the inside of the cabinets.

"Although well-made cabinets should not have any trouble supporting the weight of concrete counters, adequate bracing is crucial until the concrete sets up."



Add vertical supports. Beneath each brace, Mark Story wedges a 1x post. The bracing will prevent the forms at the overhang from flexing as the concrete is poured and troweled.

For a wide overhang, brackets help. Simple brackets made from 1x material provide additional support to a wide cantilevered edge. This cabinet side will be covered later with paneling, so screw holes don't matter.

A gauge block sets counter thickness. The author uses a 2-in. wide block to locate the form edge. Because the screed will ride on the top of the forms, accuracy is important.

The sink goes here. Built-up layers of flakeboard cut to the sink manufacturer's paper pattern will keep concrete out of the sink opening. Duct tape makes a good moisture barrier.

a seven-bag, pea-stone mix with Stealth fiber and a 3-in. slump. Here's what that information all means:

A seven-bag mix used to mean that seven 94-lb. bags of portland cement were used for each cubic yard of concrete. Even though people are accustomed to ordering concrete that way, what the ready-mix plant actually did was deliver a mix that would yield a compressive strength of 5,000 lb. per sq. in. when it cured. Concrete with a consistency this rich is much stronger than a standard mix, and it's creamier and easier to trowel to a smooth surface. Pea stone has a maximum diameter of 7/16 in., which is a good choice for thin work such as a countertop.

Slump is a measure of how wet or dry the concrete is. A 3-in. slump mix is slightly drier than typical ready mix, not as messy to work with and stronger when cured. Finally, there are fibers, which reinforce concrete and help to prevent shrinkage cracks. We used a product called Stealth, polypropylene fibers ½ in. long (Fibermesh; 800-368-2888). They are not as coarse as fiber additives used in commercial work and virtually impossible to see in the finished top. Typically, a 1-lb. bag of Stealth is added to 1 cu. yd. of concrete.

Getting the forms and steel ready took us about a day and a half, and then, suddenly, it was showtime: The concrete truck had arrived. The driver was able to get the chute right up to the kitchen door. We ferried wet concrete in 5-gal. buckets to the counter and dumped it into the form. As Mark used a 4-ft. level to screed the top of the counter, his helper used a palm sander along the edges of the form to settle the concrete (photo bottom right, facing page). From this point forward, Mark's expertise in working fresh concrete was immediately apparent. Using a magnesium float and then a steel

trowel, he produced a flat, blemish-free surface (for more, see sidebar, pp. 68-69).

Finishing up with stain and sealer

Several days after the pour, Mark removed the forms and cleaned up the edges with a concrete rubbing stone. He painted the edges with Acryl-60, a bonding agent, and then filled the edges with Thoropatch (ChemRex; 800-327-1570). Both products should be available at your local lumber supplier. While the concrete was still fairly green, we also popped the backsplashes out of their forms and cut them to size, mitering

"For added strength and crack resistance, fiber-reinforced concrete for the counter will be poured over ½-in. steel rebar that has been wired into a 6-in. grid."

Wire it up. Intersecting pieces of rebar should be wired together so that the grid doesn't shift as concrete is poured around it. A bag tier makes short work of this otherwise tedious process.

Steel runs the full length. A single piece of ½-in. rebar strengthens the concrete backsplashes. Wood blocks keep the steel from sinking to the bottom of the form when the concrete is poured, and braces prevent the form from bowing.

TWO TIPS FOR SMOOTH EDGES

Vegetable oil too far gone for cooking is perfect as a form-release agent. Story spreads the oil with a cheap brush to keep the concrete from sticking to the wood. Two coats may be needed.

Vibrate out the bubbles. A palm sander (without the sandpaper) settles the concrete and reduces the honey-combing that could appear in the finished edge.

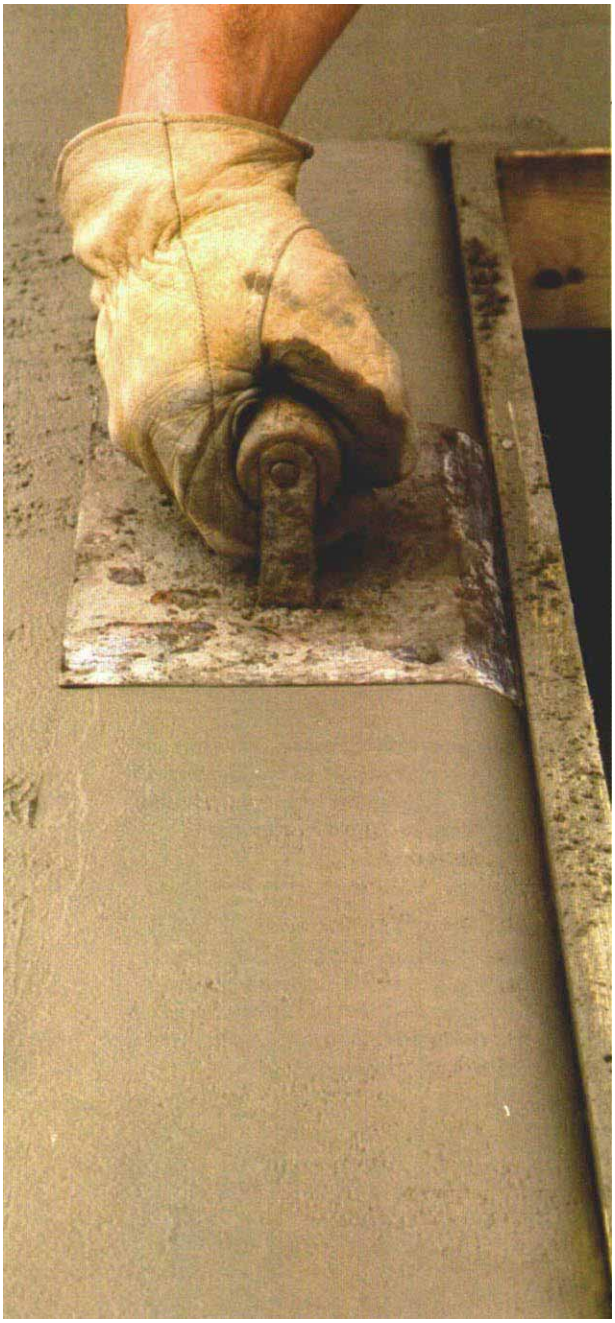
A smooth finish takes time and patience

by Mark Story

1. Pack the concrete into the forms.

2. Remove the braces, and screed the top.

3. The mag float flattens the surface.



4. A steel edging tool makes a clean radius at the outside edge.

5. A steel trowel polishes the surface.

You need only basic tools for finishing a concrete countertop: a level, a magnesium float, a steel trowel and a steel edging tool. With practice, the process is not difficult. But it does take time: Several hours of intermittent work will be needed before you can call a countertop truly finished.

Initially, concrete can be packed into the form with a float (photo 1) or even with gloved hands. Then I screed it with a 4-ft. wood level (photo 2). Next is a magnesium float, which knocks down any screed marks and stones. When using the float, try what we call a basket weave. This technique means once you have gone east to west, you also want to go north and south over the entire area. This approach gives you a flatter surface (photo 3).

KEEP TOOLS FLAT TO AVOID MARRING THE SURFACE

When using any finishing tools, it is best to keep them as flat as you can, at least initially, so that you don't dig into the surface. But as the concrete begins to set up, you will have to tip the float at a steeper angle to bring what I call cream to the surface. Cream, as its name suggests, is a smooth, wet slurry that helps to give the surface a finished look and feel. You do not, however, want to bring up a lot of surface water, or what is called bleed water. If you see water on the surface, you've worked the concrete too much. Don't try to do the finishing all at once.

After the magnesium float comes the edger. You should put in the first edge right after you've mag-floated the entire surface and before the concrete sets up too much (photo 4). Edgers come in different sizes and shapes, but I use a 6-in. blue-steel edger with a ¼-in. radius. As you move the tool back and forth, be careful not to dig the leading edge into the surface. Also, you want most of the pressure to be on the outside edge, next to the form, so that you don't leave an impression on the inside that you will have to fill later.

A steel trowel is next, but the surface must be ready for it. I test the concrete on a counter by pressing on it with my

fingers. When I can make an impression only about ⅛ in. deep, I know it's time to get onto it with trowels.

COUNT ON TROWELING MORE THAN ONCE

The thing about a concrete countertop is that it will dry slowly, and you want to give the water on the surface time to evaporate. A steel trowel tends to seal the surface, making it harder for the surface to dry. If you trowel bleed water in, you are sealing too much moisture into the surface, which makes the concrete brittle.

Hold the trowel nearly flat when you start, just flat enough to work up the surface in same basket-weave pattern you used with the magnesium float. As the surface tightens up, you can tip the trowel slightly to get a smoother finish (photo 5). Don't expect to get a smooth surface the first time over. You will have to trowel the surface at least three times, with periods of rest between.

What you're trying to do between steps is to give the concrete enough body to be worked without drawing a lot of bleed water to the surface. When you think it is time to hit it again, start by having someone go ahead of you with the edger. You follow to take out all the edge marks. Typically, I wait from 30 minutes to 60 minutes between trowelings. You will really have to lean on the trowel to get a smooth surface. If you see trowel marks, you'll know the surface is still too wet.

Sometimes the concrete can set up before you've had a chance to finish troweling it. If you think the concrete is getting away from you, you can use the mag float again to bring more cream to the surface. Or you can use a product called Aquafilm (Hausman Corp.; 616-241-3631), which allows you to get more moisture to the surface. Use this product sparingly, though. Spray it on with a garden sprayer as evenly as you can.

I troweled this countertop three or four times over a period of a several hours before I was satisfied.

—Mark Story operates Blue Max Builders, a concrete contracting company, in Frankfort, Michigan.

Acid etches the cured top. After curing for 14 days, the counter is washed with a solution of water and muriatic acid, which will help the acid-based stain to bite into the surface. Wear gloves; safety goggles would have been a good idea here as well.

Turning concrete into burnished leather. An acid-based stain makes ordinary concrete look anything but ordinary. After the muriatic-acid wash has dried, two coats of color are applied 24 hours apart.

inside corners with a circular saw and an abrasive blade.

Mary had fallen in love with a rich brown stain called Stain-Crete (Increte Systems Inc.; 813-886-8811). Stain-Crete, normally used for floors and sidewalks, is a muriatic-acid based stain that leaves a beautifully mottled surface on concrete. It actually looks like an expensive leather. But before you can apply it, concrete must cure for 14 days.

After the concrete cured, we prepared the top with a solution of muriatic acid and water, mixed 10 parts water to 1 part acid (top photo). Rubber gloves and eye protection are called for here. After 24 hours, Mark saturated the top with the stain (bottom photo). This stain should foam. If it's not foaming, it's not working, and more acid should be added. Mark added 4 oz. of extra acid to 12 oz. of stain. After the first coat, several light spots appeared. But Mark was able to blend it in and cover the spots. Two coats of stain are recommended, 24 hours apart.

Before the sealer is applied, a final wash is crucial to get a good bond between the stain and the sealer. Mix 1 lb. of baking soda in 5 gal. of water and sprinkle it on the surface. Let it sit for three to five minutes, then wash the surface down with the baking-soda mix. It takes more than a single wash to neutralize the salts and other residues from the chemical stain; keep washing and rinsing until the water is clear. Also, this wash can ruin cabinets. Measures should be taken to protect them with plastic sheeting.

After several days of drying time, a sealer can be applied. We used a solvent-based clear sealer provided by Increte, cutting it in half with xylol, a solvent, to increase penetration. We applied it to the top with a fine-nap roller. Each coat burns into the previous coat. We applied three coats. Concrete sealers, however, are not impervious to grease that is allowed to saturate the surface. To condition the top against grease spills and to give a final patina, we applied one coat of pure olive oil after the sealer had dried. □

Rex Alexander, a frequent contributor to *Fine Homebuilding*, makes furniture and cabinets in his Brethren, Michigan, shop. Photos by Scott Gibson, except where noted.

Photos this page: Dietrich Floeter