



Site-Built Kitchen

Construct base cabinets with a carpenter's pragmatism and a cabinetmaker's precision

by Tony Simmonds

I built my first kitchen 11 years ago. It included 20 ft. of base cabinets, 14 ft. of uppers, 6 ft. of full-height pantry units, a 4-ft. by 6-ft. cooking island and a built-in computer desk. The job cost almost \$7,000, and it was the biggest commission I had undertaken in my fledgling shop. When I finally pulled up to the job in a 24-ft. delivery truck to install all the parts, I was sweating more from apprehension than exertion.

I took a look around while the driver and his mate started bringing in the cabinets. Fanny how narrow an alcove looks when your pantry units are standing beside it. And who put that window-sill there? Was this the same house I measured?

As I walked around I got more and more panicky. I felt like Alice, alternately crowding the ceilings and then shrinking to the floor. It didn't seem remotely possible that what I had put together on the level, unencumbered surface of my shop

Clean and simple. Waist-high drawers flank the stove in this site-built kitchen (photo above). The author made the edgeworked drawer fronts and doors out of a highly figured sheet of maple plywood. The cabinet carcasses, also made of maple plywood, are edged with thin strips of solid wood.

floor could be reassembled here between these unaccommodatingly real, solid walls. The driver tapped my shoulder and pointed to one of the full-height units. It was lying on the floor next to its opening.

"Anything wrong?" I asked, with the sinking certainty that there was.

Don Watanabe, the site carpenter, was holding a level against the low ceiling over the cabinet's niche. The bubble was nowhere to be seen. Don smiled inscrutably. The converging lines of the

finished floor and the ceiling weren't even close to parallel.

"Cheat it," he said.

Take the shop along—Anyone who has built something in the shop for installation on a job site will recognize the scene. There are so many things to remember that it's nearly impossible to record all the data without dropping a detail here and there. And details can be expensive.

Three years ago, with my enthusiasm for plywood boxes flagging, I decided to get out of the full-time cabinet business and into remodeling. This has meant developing some different procedures for building cabinets and getting by with a no-frills complement of tools.

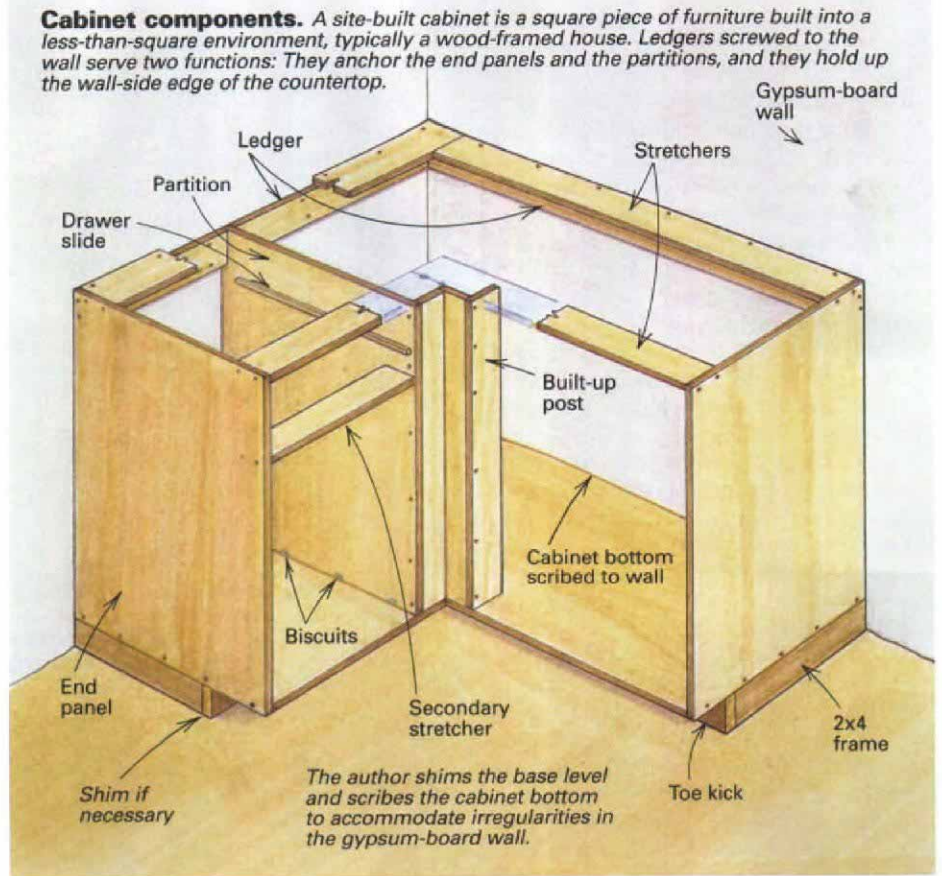
The heart of any cabinet shop is the table saw, and although I have learned to do a great deal with my old #1555 Rockwell radial-arm saw,



First the frame. The author assembled the base cabinets atop a frame of 2x4s toenailed to the wall and the subfloor.



Inside corner. A built-up post made of three strips of plywood serves as an anchor for the cabinet-door hinges. The post is secured at the top by screws through the stretchers and at the other end by a couple of finish nails into the cabinet bottom.



when it comes to building a kitchen, the table saw is indispensable. Mine is a 10-in. saw, and I use a thin kerf, 80-tooth carbide-tipped alternating-top-bevel blade on it. This makes smooth cuts in plywood, even across the grain. I still take along the radial-arm saw, though—partly because it's mounted in an 8-ft. table, which I use for everything from workbench to router table to extension supports for the table saw.

I won't pretend there aren't times when I miss the resources of the fully equipped shop, but for me the disadvantages of on-site construction are outweighed by the rewards. Principal among them is that the clients can be involved with the process at every stage—from layout to drawer pulls. If the clients don't like something, they can change it. If they get an idea, they can act on it, and they can do so without feeling that they are causing the construction schedule to run backwards while the meter runs forward.

Maple-plywood cases—The installation I'll describe here was in a suite I helped my neighbors, Don and Shanti McDougall, build in their basement. By the time I got involved, the decisions still to be made centered on cabinet and counter materials and on door and drawer styles.

For the cases we settled on $\frac{3}{4}$ -in. paint-grade maple plywood. The sink counter would be plastic laminate, and the food-prep area would be wood. Economy and expediency dictated that we buy the laminated beechwood counter ready-made. I reckoned I could do the laminate work without involving another subcontractor.

We all liked the idea of a waist-level band of drawers (photo facing page). To these we added two deep bins on drawerslides next to the stove for pots and pans (photo p. 78). The rest of the bases would be simple cupboards with hinged doors. Drawer fronts and doors were to be maple plywood, just like the cases.

With these questions resolved, I set about dimensioning the basic elements of the cabinets—the partitions, the floors and the door and drawer fronts. They were all going to be the same material, so the first thing I did was sort the sheets, selecting one with interesting color and figure for the doors. Then I had to figure out how to cut everything economically.

Paint-by-numbers layout—One thing I like about building cabinets on site is that I can usually pencil a full-size layout on the floor and on the walls too, if necessary. Then the job becomes almost like a paint-by-numbers kit: cut the pieces and put them where they go in the picture.

I begin a layout by marking the length and the height of the last piece—the countertop—and work backwards. Before I settle on countertop dimensions, I make sure I know everything there is to know about the appliances that have to fit in and around the countertop. If I don't have an appliance on hand, I find it at a showroom and take very careful measurements. This is critical—fridges don't trim easily.

For this job the counter is 36 in. high and 24 in. deep. I allow an overhang of at least $\frac{1}{2}$ in. between the countertop and the face of the cabi-

nets (usually the door or the drawer face). With a smaller overhang, drips from the counter will run down the door front instead of onto the floor where they belong. At all costs avoid the sheer, modernist cliff, zero-overhang look. This style directs the drips down the inside of the door.

A cabinet end that is open to view should also have a $\frac{1}{2}$ -in. countertop overhang. But where a freestanding range (yup, they're still out there) has to be slotted between two runs of cabinets as in this case, I allow $\frac{1}{4}$ -in. overall clearance between the finished ends of the countertops and another $\frac{1}{4}$ in. between the finished ends of the cabinets. This doesn't leave a great deal of space for jimmying a heavy stove into position, but face it: It's going to get dirty in there. The narrower the gap, the better.

The other overhang, between the door face and the toe kick at the bottom of the cabinet, is usually about 3 in. Remember to allow for the thickness of the finish material on the toe kick.

Pay particular attention to inside corners. One typical treatment is installing piano hinges between two doors at right angles to each other. This allows the doors to be opened and closed simultaneously. But what about the drawers above them? They need space to pass each other, and that space has to allow for any handle projection. I've found that a $1\frac{1}{2}$ -in. space between the inside corner and the beginning of the drawer allows for a wide range of handle choices.

Framing cabinets in place—The first step in building the cabinets (top photo, above) is to

establish a level base for them. For this kitchen I had to get 1/8-in. vinyl-tile flooring over 3/8-in. underlayment, so I decided to set kiln-dried spruce 2x4s on edge directly on the subfloor. For a higher toe kick, or to allow for thicker finish flooring, I add furring strips to the tops of the 2x4s.

With pieces cut and assembled, I set the completed frame on the layout lines. Then I check for level. If the high point is at the wall, I screw the back to a level line, then shim up the front as necessary and toe-screw the frame to the subfloor. If the floor slopes down from the middle of the room to the wall, I raise the back accordingly and fasten it to the wall like a ledger, shimming under it if necessary.

With a solid, level base frame in place, the next step is to cut the cabinet bottoms. One side of the kitchen shown here has a run of less than 4 ft., so I cut the bottom from one piece of 3/4-in. plywood. When I need to join two or more pieces to make the bottom, as I did on the other side, I use a plate joiner and glue the pieces together as I lay them.

One advantage of site-built base cabinets is that the walls double as the backs of the cabinets, saving on the cost of a plywood back. On the other hand, the back edge of the cabinet bottom has to be scribed to the uneven plane of the wall [drawing p. 77]. This joint is practical rather than aesthetic, so I leave a gap that can be easily caulked, and I screw the bottom to the base. If screws are counterbored, they can be plugged later, but I don't plug them at this point in case I need to make minor adjustments after the doors are hung.

Next I cut the four cabinet end panels and the three partitions. I planned to flush-fit the doors and the drawer fronts, and because there was no back to allow for, the widths of all the end panels and the partitions were the same. If the bottom of the cabinet has been heavily scribed to accommodate a bulge in the wall, the partition or the end panel may have to be cut down correspondingly. As for height, the end panels overlap both the cabinet bottom and the top stretchers, so they're two thicknesses of plywood longer than the partitions. There's no reason you couldn't run the cabinet ends all the way to the floor, but you'd need to notch them for the toe kick, and you'd need a 35 1/4-in. long panel. I generally cut the longest panels at 31 7/8 in. That way I can get three panels out of an 8-ft. length of plywood.

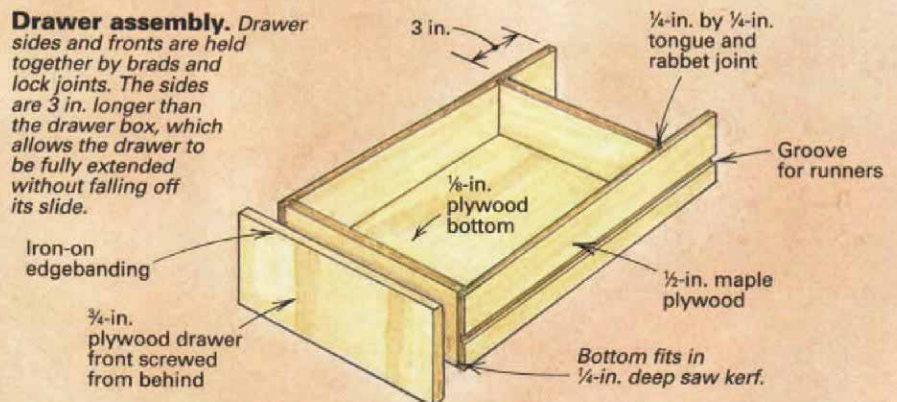
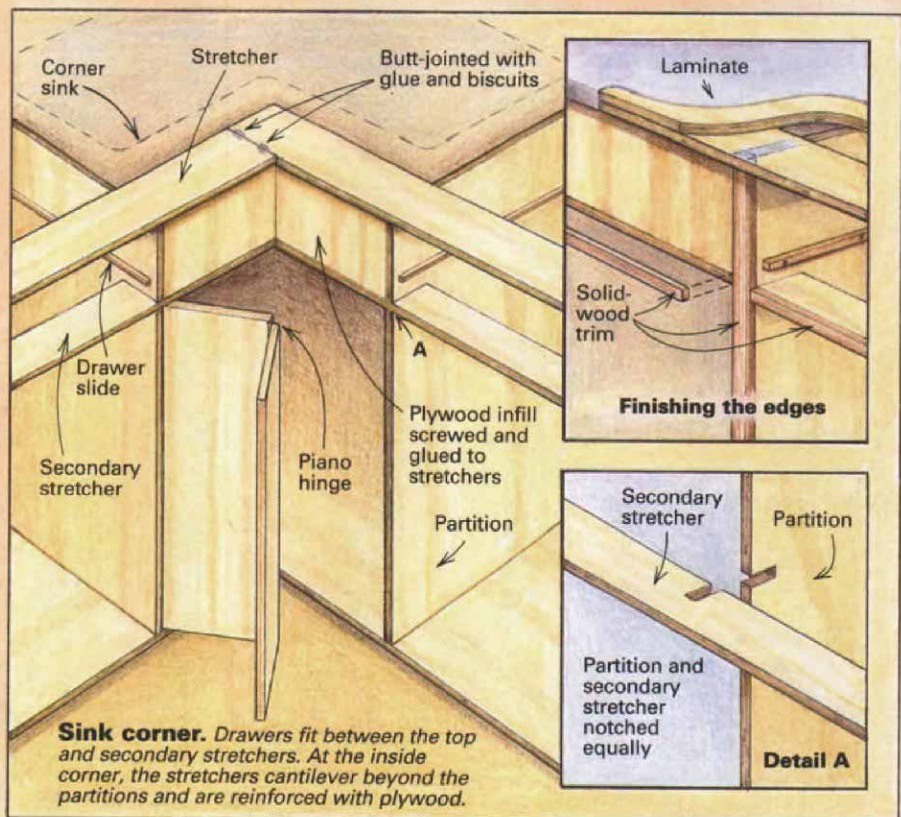
This is a good time to put at least some of the hardware on the cabinet end panels and partitions. Mechanical drawer slides and European-style hinge-mounting plates go on easier with end panels and partitions layed flat on the bench. For this job I used 1/2-in. by 1/2-in. wooden drawer slides screwed to the plywood.

Before I install the end panels and the partitions, I cut some strips of plywood about 3 in. wide for the ledgers and the stretchers. These plywood strips usually come from the offcuts of the cabinet pieces.

Next I select one partition and check that it's square and correctly dimensioned. Standing it upright on the cabinet bottom and flat against the wall, I pencil a line on the wall along the



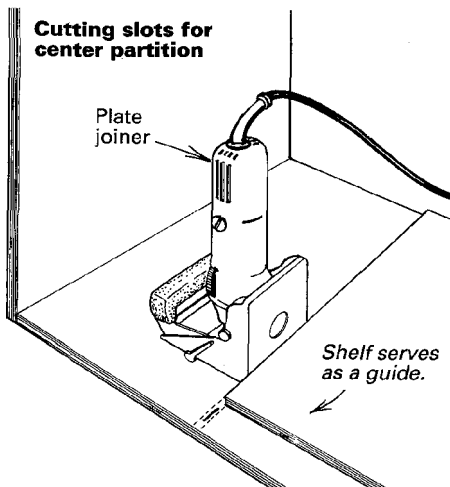
Under the doors and the drawer fronts. Shallow drawer boxes ride on wood runners affixed to the cabinet partitions and end panels. The lower drawers on the sink-side base cabinets are commercial bins that use roller hardware.



partition's top edge. I slide the partition along the bottom of the cabinet, marking the wall as I go. Now I can set the ledger to a level line.

I mark the position of the partitions on the front edge of the cabinet bottom and extend the lines across the cabinet bottom with a framing square. Then I use the partition, resting on the cabinet floor and flat against the wall, as a big square to draw plumb lines on the wall that mark the vertical lines of the partitions and the end panels.

Ledgers go between partitions—I join the partitions to the floor with biscuits, cutting the slots with a plate joiner. If there's a shelf between two partitions, I'll cut it now and use it to guide the plate joiner (drawing below). Otherwise, a spare piece of plywood can be clamped or tacked to the layout line as a guide.



Once I have the slots cut for the partition biscuits, I can assemble the pieces. Beginning in one corner, I cut the ledger long enough to take me from the corner to the edge of the first partition. I screw the ledger to the wall, drop the partition onto its biscuits and run a screw through the partition into the end of the ledger. Then I install the next length of ledger and partition and so on until I get to the end panel.

The stretchers are screwed to the end panels and the partitions. To keep things square and plumb while installing the stretchers, brace the end panel temporarily by pipe-clamping a piece of plywood about the size of your cabinet door in the opening the door will occupy.

The back stretchers intersect at the corner of the walls. Make the butt joint there with glued biscuits or by screwing a piece of plywood across the joint from underneath. If you screw plywood across this joint, make sure it won't interfere with the door or the drawer.

In this kitchen I wanted to emphasize the division between the band of drawers and the doors underneath them, so I installed a secondary stretcher between them. Each secondary stretcher is screwed in place on the ends and half-notched into the front edge of any partition that it intersects (detail A, facing page).

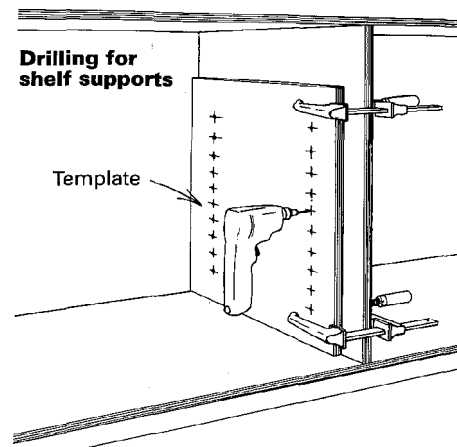
To support the corner sink, I cantilevered the stretchers beyond the partitions and attached them to each other with a glued biscuit. I filled the spaces between the top and secondary

stretchers with plywood, which acts like the webs of two short trusses. The corner is solid.

The other inside corner required a post made out of a couple of filler pieces to create a jamb for the cabinet-door hinges and clearance for the drawer (bottom photo, p. 77). We did without a lazy Susan or a revolving-shelf fitting for this corner. If you're using one, make sure the corner post will accommodate its mounting brackets.

Mounting shelves and slides—I like to do all the work I can on the interior fittings of the cabinets before installing the countertop. There's more light in there without the roof, and countertops are susceptible to damage through misuse as workbenches.

Adjustable shelves used to be considered a luxury in a kitchen cabinet. Now they're practically de rigueur. I use the little spad&shaped nickel-plated steel shelf supports with a $\frac{3}{8}$ -in. long shaft that can be inserted into a 7mm hole. I make a template with holes on 2-in. centers out of a strip of plywood as wide as the shelf, and I clamp it against the partitions and the end panels to guide my drill (drawing below).



To control the depth of the holes for the supports, I make a depth gauge out of a short length of dowel. I drill the appropriate-diameter hole in the dowel and slip it over the bit. I use this depth gauge to avoid drilling through an exposed surface. Even where two sets of holes in a partition line up opposite each other, I drill from both sides using the depth gauge to avoid the tearout that occurs when a bit exits the back of the work.

When I finished with the template on this job, I ripped it in two and screwed each half to the inside corners where I would need shelf support, but there was no partition to provide it.

If you're using drawer slides, and you didn't mount them before installing the partitions and the end panels, you can make the job easier by using a plywood spacer. Shove it against the underside of the stretcher, butt your slide to it and hold the slide steady while running in the screws.

Doors, drawers and counters—The door blanks I cut earlier now had to be trimmed to size and have their drawer fronts separated from them. The grain pattern of the sheet I had selected made it important to do this carefully to pre-

serve the flow of the intricate figure across the front of the cabinets, as well as vertically from door to drawer. I made sure I had a helper on hand to assist with the delicate table-saw cuts.

All four edges of the doors and the drawer fronts are bound with hot-melt glue veneerstrips. This edgetape is available in several wood species and is easy to apply with a household iron (medium setting—no steam). It never fails to amuse a client if they happen to come in and see me in my apron doing the ironing.

I made the drawers for this job out of $\frac{1}{2}$ -in. maple plywood (bottom drawing, facing page). I let the sides run 3 in. long to allow the drawer to extend all the way without falling off its runners. The width of the drawer should equal the face-to-face distance of the runners plus $\frac{1}{2}$ in. The fronts and backs of the drawers are joined to the sides with a tongue-and-groove joint (called a drawer-lock joint) and glue and brads. For drawers of this size, I use $\frac{1}{8}$ -in. plywood bottoms, which fit in a regular saw kerf. To cut the $\frac{1}{4}$ -in. deep grooves for the runners, I run the assembled box over a $\frac{1}{2}$ -in. dado head with a plastic-laminate spacer added between the blades to make the grooves slightly larger. The runners are $\frac{1}{2}$ in. wide, so the laminate provides the necessary clearance. I take care when assembling the drawers not to put any nails where the groove will be.

So-called European-style concealed cabinet hinges, with their several adjustments, have made hanging cabinet doors a snap. About the only thing you can do wrong is make the doors too big. I cut them to be $\frac{3}{16}$ in. shorter and narrower than their openings. The edgbanding adds $\frac{1}{16}$ in. to that, leaving a $\frac{1}{16}$ -in. gap all around in the finished installation. The doors stop against a continuous strip of wood that is affixed to the underside of the stretcher. A continuous strip looks more like a trim piece than a little stop block, and it's easier to install. The edging I used for these cabinets was cut from a single piece of Douglas fir, which yielded a particularly crisp and pleasing pattern in its edge grain. The vertical edges are finished with $\frac{3}{8}$ -in. thick strips, and the horizontal edges are capped with $\frac{3}{16}$ -in. strips, making for a stepped intersection that is more practical and more pleasing than is a flush one.

I hung all the doors and adjusted them, then I fastened the drawer fronts to their boxes with screws driven from inside the drawer. Where two or more drawer fronts are stacked on top of each other, as on the left-hand side of the range here, I install the bottom one first and then use a spacer (two thicknesses of edgetape is about right) to position the one above it.

I attached the wood counter to the stretchers with #8 wood screws driven into pilot holes for #10 screws. The oversized shank holes allow seasonal expansion and contraction of the countertop without splitting the wood. The countertop on the sink side of the range is plastic laminate installed over a substrate of $\frac{3}{4}$ -in. AC plywood. We added a tiled backsplash with green grout to pick up the color of the deep-green laminate. □

Tony Simmonds is a designer and builder in Vancouver, B. C., Canada. Photos by the author except where noted.