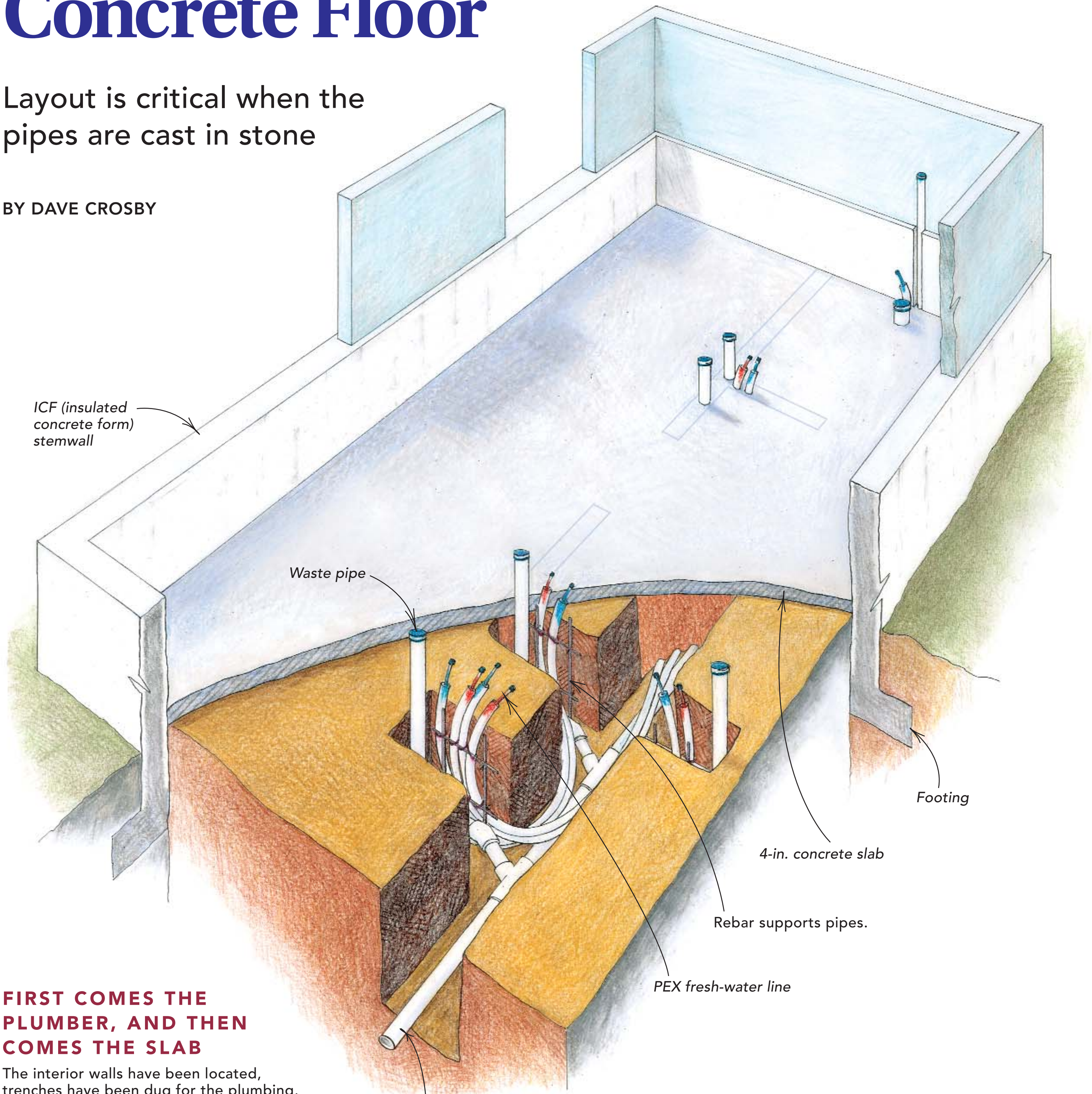
Plumbing Under a Concrete Floor

Layout is critical when the pipes are cast in stone

BY DAVE CROSBY



FIRST COMES THE PLUMBER, AND THEN COMES THE SLAB

The interior walls have been located, trenches have been dug for the plumbing, and the plumbing rough in has been run before the slab can be poured.

Drawings: Christopher Clapp

In slab-on-grade construction, a concrete slab serves as a floor (and at times the foundation) for the structure above. It is common throughout the Southwest because slab-on-grade construction is fast and strong, and because it offers a high thermal mass while being a potentially less expensive route than traditional wood-floor construction. Concrete is easy to tile over, and here in New Mexico, tile floors are king. Also, the advent of radiant heat and color-tinted concrete make a finished concrete floor an attractive, extremely durable alternative to traditional flooring.

With a slab-on-grade floor, there are no joists to house plumbing, so we bury the pipes under the leveled building pad and pour the concrete floor right over them.

Because the plumbing rough in happens prior to the concrete pour, layout accuracy becomes crucial long before the first wall is built. The expression "set in stone" takes on new meaning when you consider that a layout error could place a drainpipe in the middle of a room rather than in the intended wall.

Verifying the plans now saves headaches later

Before starting any excavation work, I make sure that I fully understand the plans. I confirm that everything that's supposed to fit inside the footprint actually will and check that wall thicknesses are appropriate throughout the drawings.

For example, if the bathroom wall that houses the plumbing, also called the wet wall, is drawn as 2x4 framing and a vent stack is supposed to go in there, I'll see if I can substitute a 2x6 wall instead. The vent stack is usually a 3-in. pipe that supplies air to the drain, rises up a wall and exits through the roof. The air keeps water in the traps and allows liquid and waste to drain. Think of putting your thumb over a full straw; it won't drain unless it's vented. Plumbing a vent stack inside a 2x6 wall is just easier, and the plumber will thank me.

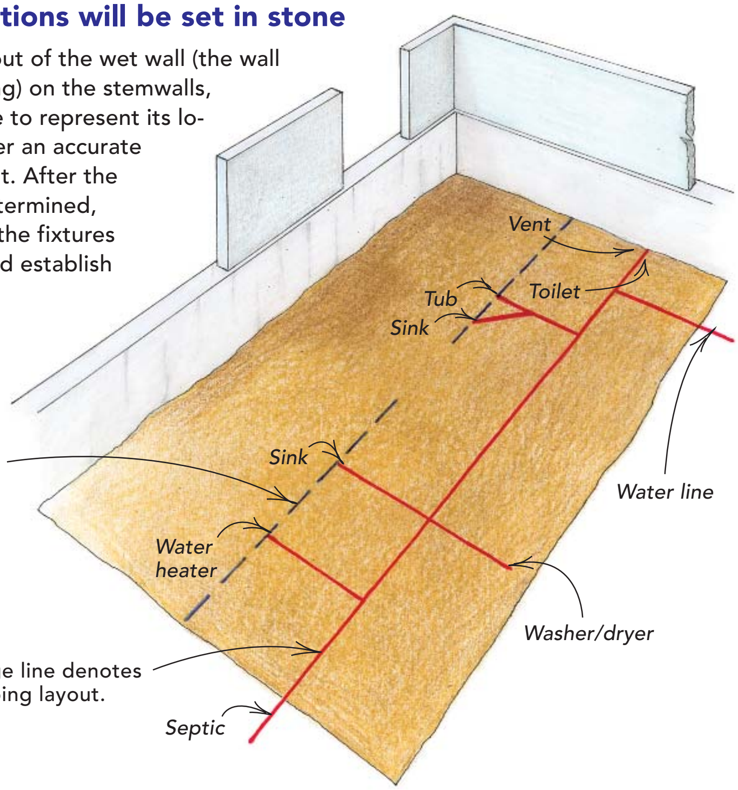
Start all the measurements at the same outside wall

Quite simply, the layout involves transferring dimensions from the plans to the building site, which is why I take the time to verify the plans. Before running a tape or snapping a chalkline, I gather all the interior-wall information from the plans (inset photo). Then I

BUILDER AND PLUMBER ESTABLISH THE LAYOUT

Plumbing under the slab requires precise alignment because pipe locations will be set in stone

Clearly marking the layout of the wet wall (the wall that houses the plumbing) on the stemwalls, then running a stringline to represent its location, gives the plumber an accurate point to begin the layout. After the wet wall's location is determined, the plumber can locate the fixtures (sinks, tub and toilet) and establish the plumbing runs.



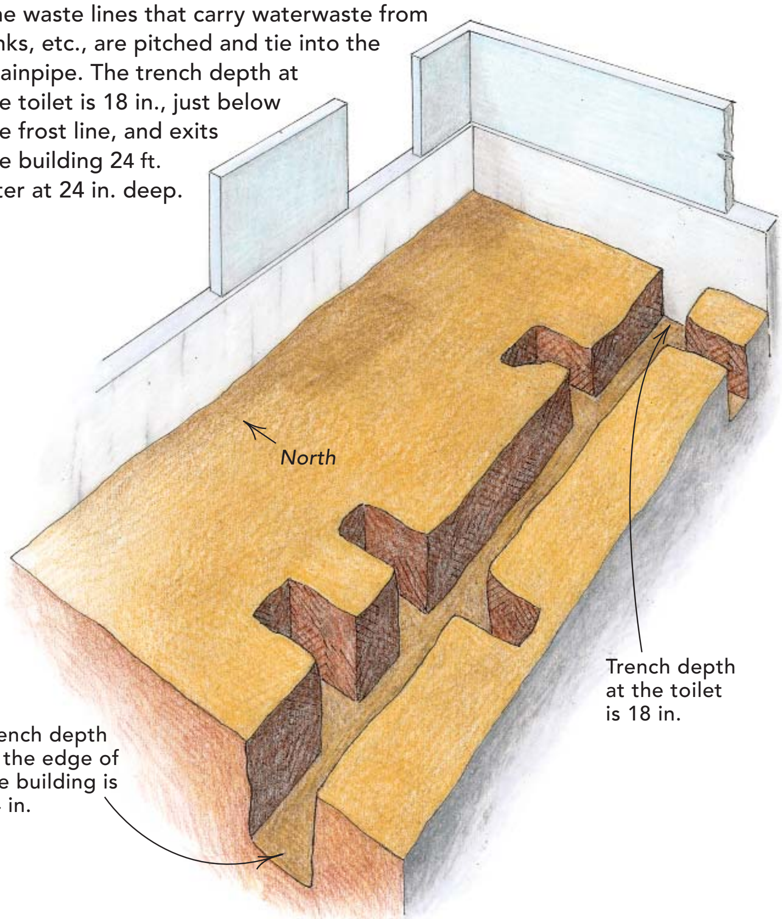
The layout starts with a review of the plans. *The author always verifies the plans in the field before starting layout (inset photo). Then he carefully marks the location of the interior wet wall that will house the plumbing.*

Layout tools: a tape, some paint, two bricks and a string. *After locating the fixtures, the plumber figures the straightest route for the drainpipe. He uses a stringline as a guide to spray-paint the layout on the ground.*

THE PLUMBER'S LAYOUT IS THE EXCAVATOR'S ROAD MAP

Sloping trenches ensure waste lines that drain

The plumber's layout is spray-painted onto the level building pad and needs to be trenched. The drainpipe, which carries both solid and liquid waste, is a straight run descending from the toilet to the building's sewer pipe at ¼ in. per ft. The waste lines that carry waterwaste from sinks, etc., are pitched and tie into the drainpipe. The trench depth at the toilet is 18 in., just below the frost line, and exits the building 24 ft. later at 24 in. deep.



begin the layout. For this layout, I measured from the north stemwall (the concrete wall that forms the perimeter of the slab), having verified that it is square to the other walls and runs parallel to the bathroom's wet wall (drawing p. 61). All my measurements were taken from the north wall, also called the common point. Because all the measurements originate from one point, it's easier to verify them later.

To locate the bathroom's wet wall, I measured from the inside face of the north stemwall along the east and west walls of the addition. I make sure that everyone on the job site knows that this wall is the one to measure from so that there is consistency in the work.

I mark the wet wall's location on the stemwall and let everyone know the wall is set back from this mark (photo bottom left, p. 61). By set back, I mean the measurement is to the edge of the wall plate. A straight mark identifies the plate's edge, and an X behind the mark denotes the plate. I know this sounds elementary, but a surprising number of layout mistakes come up exactly 3½ in. off with a 2x4 wall or 5½ in. off with a 2x6 wall. I always double-check my dimensions at this point. Once I locate this wall, the plumbing is run to fit inside the wall as marked.

A string represents a wall that's not there yet

After marking the east and west walls, I run a stringline between them to represent the wet wall and check it for square. In this case, the string denotes the inside face of the bathroom's framed wet wall and gives the plumber an exact point from which to measure for the placement of fixtures such as toilets and sinks. Because there are variations depending on what the client has chosen, I let the plumber do this part of the layout.

I like having the plumber run his own layout because he will have ideas that make everything go better, including ways to route water-supply and DWV (drain, waste and vent) lines. The DWV system takes away the solid and liquid waste from toilets, sinks, tubs and washing machines to the septic system or sewer; the vent, as discussed earlier, keeps it all flowing. On this project, the plumbing contractor, Marc Scott, used spray paint to lay out the plumbing runs that needed to be excavated (photo right, p. 61).

A compact excavator is the right tool for this job. *Following the plumber's layout lines, the author can maneuver this nimble machine in tight spaces to dig the plumbing trenches quickly. With a tape measure, the author quickly checks the rough depth of the trench. The fine-tuning comes later, with a shovel.*

I always trench for my plumber. It saves money for everyone and lets me do what I do best. I love digging. I love it so much that I bought a compact excavator, and it's the only way to go on a job like this. They're fast, nimble and fit into amazingly tight spaces. Without the machine, I'd hire an excavator.

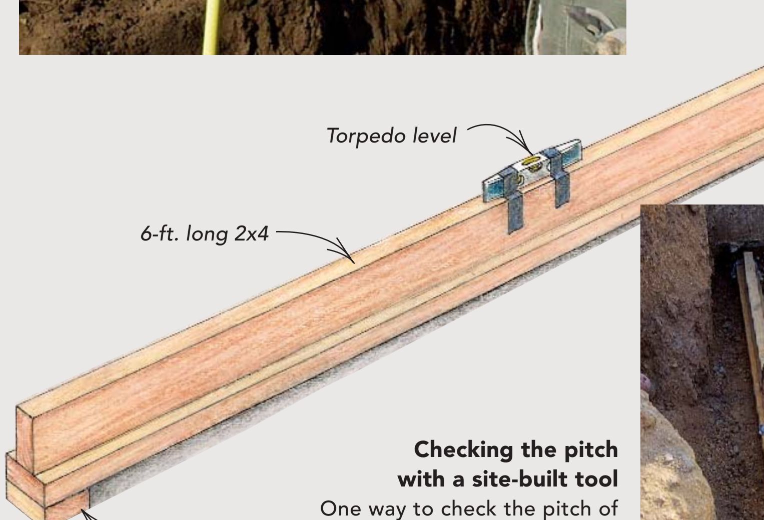
I follow the plumber's layout, paying close attention to depth and pitch (photos above). The plumber planned the drain as a straight run from the toilet to where it exits the foundation, with other waste pipes joining it in short, direct runs. The drain line should descend at ¼ in. per ft. toward the septic or sewer to ensure that both solid and liquid wastes are removed.

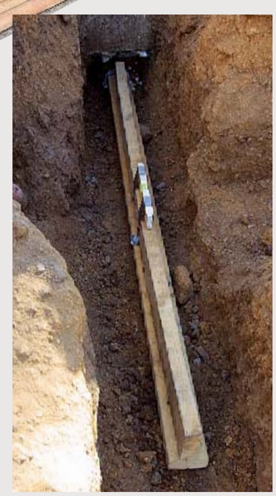
By measuring the elevation where the drainpipe exits and working backward gaining

ACHIEVING PERFECT PITCH

The pitch of a drain line is crucial, and ¼ in. per ft. is the rule. Any flatter, and it drains slowly. Much steeper, and the liquids outrun the solids, leaving them high and dry. That's a mess and exceedingly difficult to correct once the slab is poured.

A helper makes using a transit an accurate operation. *The author quickly knows the depth of the drain trench in relation to the elevation of the finished floor and can make adjustments if needed. The belt clip steadies the tape and makes holding it extended upward a one-handed operation.*





Checking the pitch with a site-built tool

One way to check the pitch of drains is to use a pitch stick. A torpedo level is taped to a 6-ft. long 2x4 with a 1½-in. block at one end. The bubble will read level when placed (block end downhill) on a pipe that slopes ¼ in. per ft. This is a fast, solitary way to check the trench's pitch.

¼ in. per ft., I can trench close to the proper depth and pitch. At this point, I verify that the slab's elevation is high enough to accommodate the plumbing, which of course becomes higher the farther it is from where the drain exits. If I planned right, I won't have to raise the pad with additional fill for the plumbing to work. If all is well, I mark the slab elevation on the stemwall.

When I've dug trenches as close to the right depth and pitch as possible with my excavator (photos pp. 62, 63), I clean them out by hand using a flat shovel. A pitch stick (drawing p. 63) or a transit (photo center, p. 63) quickly and accurately verifies the pitch of the drain line.

The rough in is completed, inspected and backfilled before sunset

The plumbers run their own stringline from my layout marks on the stemwalls to locate the bathroom's framed wall as well as the finished-floor height. They measure from this stringline to run the pipes accurately (top photo, this page). They dry-fit the system, verify its accuracy, stake in rebar to keep it in position when the concrete is poured, then cement the PVC and use plastic zip ties or steel tie wire to affix it to the rebar anchors (bottom photos, this page). If the slab is going to be a finished surface, it's a good idea to make sure that no metal is sticking above the finished-floor elevation, or that any steel that does stick up will be inside the wall layout. That way, it can be cut off with a reciprocating saw to remove it as we frame the wall.

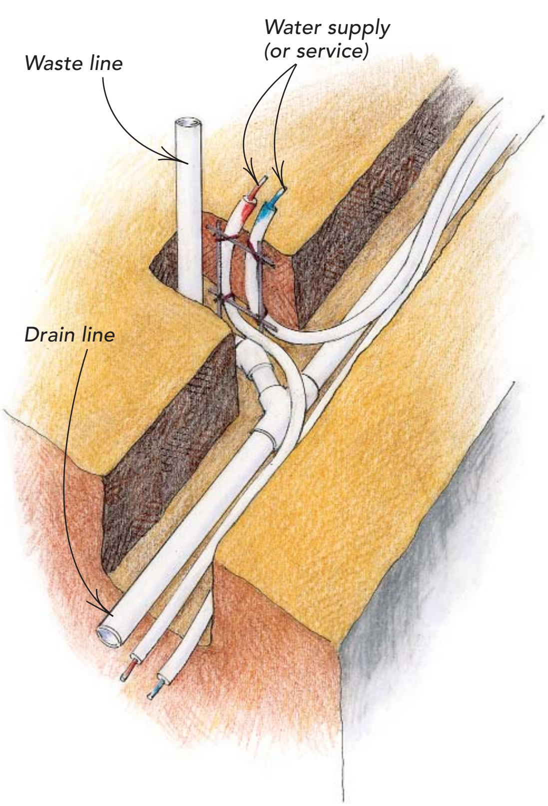
Although the rough in is by far the most critical part of the procedure, it's also the easiest for me. I just get out of the way and let the plumbers do their thing. They ask for a starting elevation where the waste line leaves the house, but otherwise, they are on their

THE PLUMBERS ROUGH IN THE PIPES

Only after the pipes are staked in position can the backfilling begin

The first pipe the plumbing crew places is the drainpipe, and it is checked for pitch. They plumb in the rest of the waste lines and tie them into the drain; recheck it for proper pitch; then start plumbing the fresh-water supply (or service) and distribution lines. Running the water-distribution lines is quick: Pitch isn't a concern because the water is pressurized. The water lines are run with insulated PEX, a tough plastic pipe that comes in long rolls to eliminate buried connections.

Positioning the stack is dependent on the plumbing run. *The plumber levels the elbow joint on this waste pipe so that the waste stack, the vertical pipe, will be plumb and perfectly placed.*



Pinpointing the waste line's position guarantees the fixture's proper placement. *The waste pipe then is anchored to rebar stakes to keep the pipes from shifting during the concrete pour.*

Placing the supply tubing isn't as critical. *The plumbers slip the water-supply pipe through a protective insulator; then both ends are spray-painted (orange for hot, blue for cold). Although copper piping can be used, PEX is installed more quickly.*

own. I'm always on site when the plumbers run their rough in because if questions arise, I'm the one who has to answer them.

It's best to have the plumbers bed their own work; they place suitable soil (no rocks or organic material, not frozen) under and around the plumbing so that it stays in place but is still visible for the inspector. They fill the system with water, cap it and check for leaks.

A happy inspector means it's time to backfill

When the inspector signs off on our permit, I start burying the rough in. Although this process takes longer, I prefer to set the first 6 in. of clean, rock-free fill by hand and tamp it in place. After that, the grading blade on the compact excavator and a jumping jack make short work of the rest of the backfill (photos below). Don't skimp on the compaction and risk uneven settling of the soil below the slab.

Now is the time to finish preparing to pour the slab. If I'm using a vapor barrier, radiant barrier or capillary break, I put it down, followed by the reinforcing steel.

When installing the tubing to be used for radiant-floor heat, the plumber spray-paints the exact location of the future walls on the building pad after the steel has been set. He keeps the heat lines a safe distance from the walls so that after they have been covered in concrete, I don't nail a bottom plate into a heat line. The plumber then ties the radiant tubing to the steel mat, and the entire system is pressurized to check for leaks and left on for the inspector to examine. All that's left is the concrete pour. □

Dave Crosby is a custom builder living in Santa Fe, New Mexico. Photos by James Kidd.

BACKFILLING IS THE FINAL STEP BEFORE CONCRETE PREP

After passing the plumbing inspection, the author prepares for the concrete slab

The plumbing is bedded by hand with clean, rock-free fill, which then is compacted. The tamper begins to sound like a hovering helicopter when the soil is compacted properly.

If you get the subgrade right, you get a better slab. *The author uses a level in the cab of his excavator because if the machine is level, the grade will be, too. He uses a transit to verify that the subgrade is level and flat. If the subgrade is uneven, the concrete can vary in thickness and cure unevenly; it also interferes with the natural expansion and contraction of the slab and can cause it to crack.*