Building Your Own Retaining Wall

Professional techniques ensure strength and longevity

by Dale Johnson

Timber retaining walls are handsome and useful garden structures. They break slopes into terraces, where plants can grow on display. They let you add level ground to your property. They lend character to patios, entryways and foundation plantings.

But building a timber wall is more than stacking wood. Good construction requires the right timbers and fasteners, a solid foundation, regularly spaced anchors, and drainage. I've been building timber walls professionally for 18 years, long enough to know that they can be designed for almost any site and taste, and long enough to learn what makes a wall look good and last.

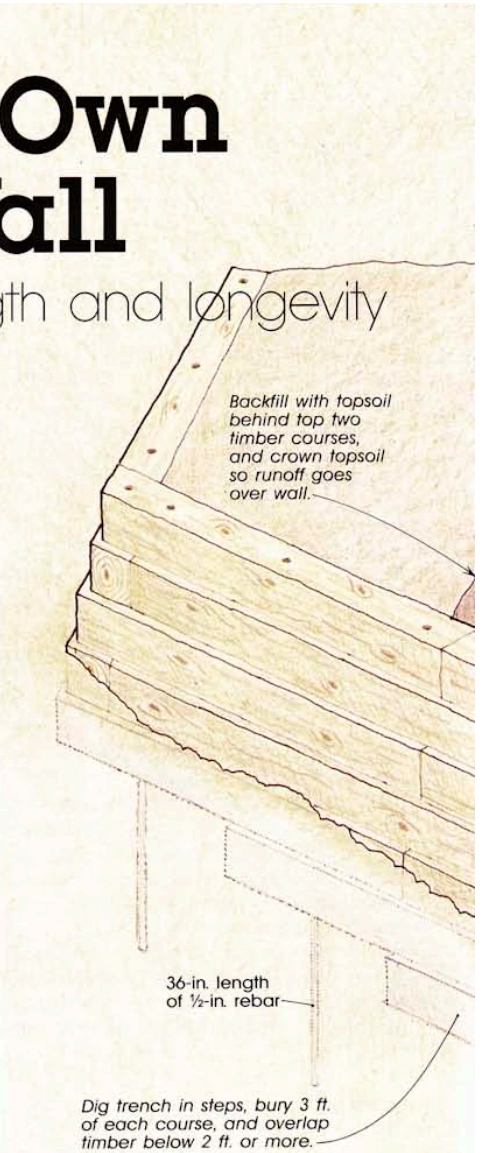
Can you build your own timber retaining walls? You can, if you're comfortable with tape measure, drill, chainsaw and carpenter's level, and if you don't mind hard work with a shovel. I'm not saying that you can build a wall anywhere. Tall slopes take experience. I retain them with several walls, built like a flight of stairs. Every "step" depends for solidity on the step below it, and construction is tricky. I recommend that you stick to slopes you can retain with one wall, and that's what I'll talk about here. The drawing at right shows the basics of construction. So long as you keep these in mind, the design of your own wall is up to you.

Timbers—Use pressure-treated timbers. In contact with soil, they resist rot and insects and remain sound far longer than timbers of any wood reputed to be decay-resistant, and far longer than timbers treated with wood preservatives by painting, soaking or hot-dipping. In pressure treatment, wood preservative is forced deep into the timber, protecting most if not all of the wood. I prefer pressure-treated pine timbers because I've found that pine absorbs wood preservative right to the core, while other woods often do not. Pressure-treated pine timbers should last 30 years or more. I've checked retaining walls that I installed 13 years ago and found the timbers as good as new. Timbers treated by painting, soaking or hot-dipping absorb preservative on the surface. When the wood cracks and checks, insects and fungi move into the unprotected core, and the timbers are shot in ten years.

I use penta-treated and CCA-treated timbers. "Penta" stands for pentachlorophenol, a clear preservative that darkens wood but otherwise preserves its tan or gray color. CCA (composed of compounds of chromium, copper and arsenic) leaves wood with a greenish tinge, which fades with weathering. In my area, CCA-treated timbers are cheaper than penta-treated timbers, but I prefer penta because of the natural look. Freshly treated penta timbers are often soaking wet with preservative. You must handle them with caution—wear gloves, avoid prolonged skin contact, wash well when you stop working, wear safety goggles to keep chips and sawdust out of your eyes, and avoiding inhaling the sawdust. You must also give the timbers time to dry before you plant. Penta vapors stunt and kill plants. I recommend waiting a month before planting near a new retaining wall of penta-treated timbers. The compounds in CCA timbers bind chemically to the wood and pose fewer hazards. Wear gloves and goggles and avoid breathing the sawdust. You can plant as soon as construction ends.

Though timbers come in several dimensions that are suitable for walls, I recommend 8-ft.-long 5x6s. They're less expensive than 6x6s, and faster to build with than 5x5s. I lay the timbers with the 5-in. sides horizontal, so my walls go up 6 in. at a time. I choose the best-looking side for the face of a wall, but with only two sides to pick from, I sometimes have to use one that's knotty and split. I save the best-looking timbers for the top of the wall, where two faces show. For patios and walks, where I need one extra-good-looking face, I use 5x5s or 6x6s because they give me four sides to choose from.

Foundation—Timber retaining walls need solid foundations. If the soil settles or shifts, so will the wall. On sandy or clay soils, I compact the footing before building. On loose fill, or soil with a lot of organic matter, I compact the footing, then spread and compact a 6-in. layer of gravel. I use ¾-minus gravel—which is everything from ¾-in. pieces to dust—because it packs well. For compacting, I use a plate tamper and muscle power, or rent a gas-powered tamper.



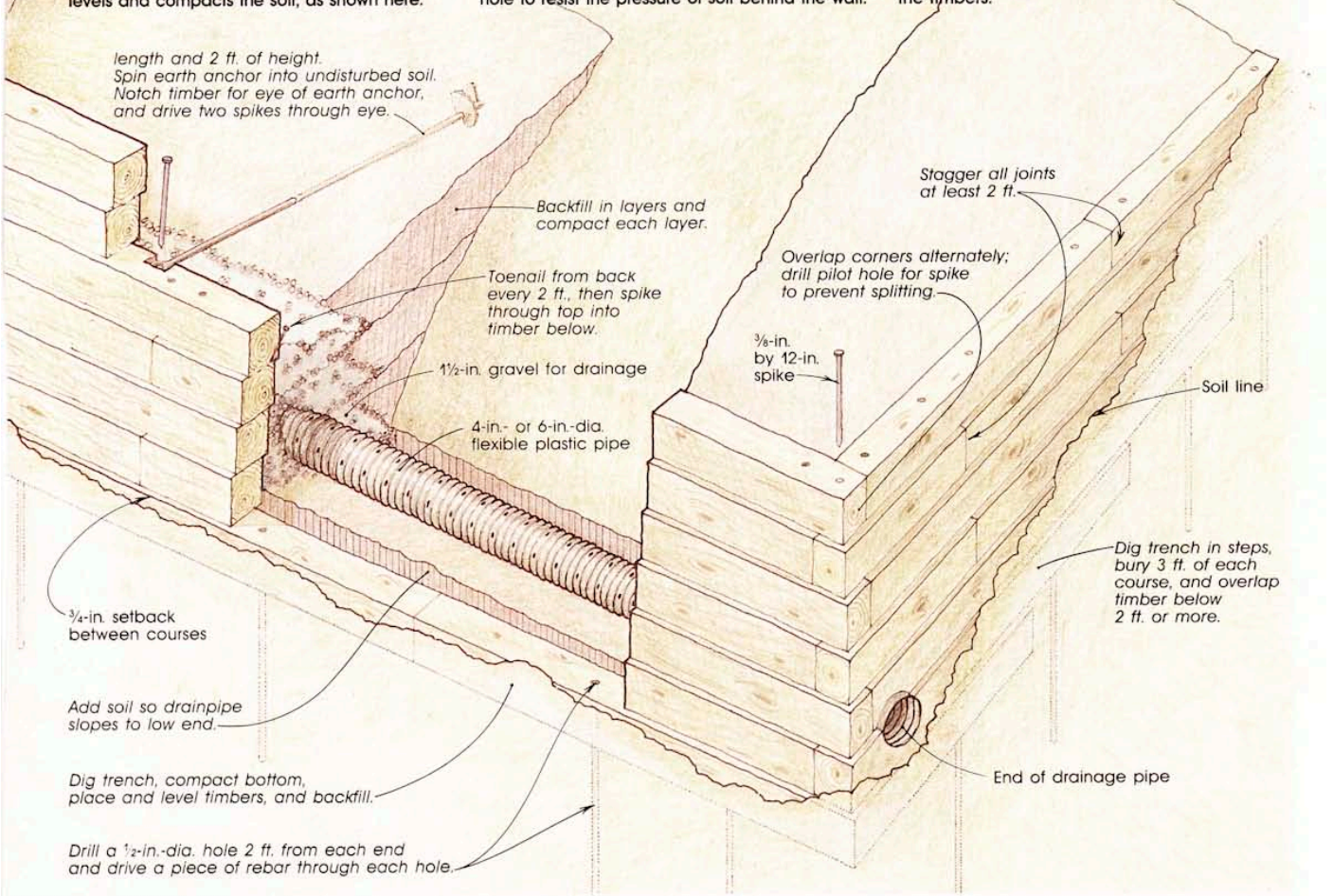
Construction basics of a timber retaining wall

Illustrations: Vince Babak

Timber retaining walls demand careful construction. If the bottom timbers shift or settle, so will the wall. Author Johnson digs a trench for them, and levels and compacts the soil, as shown here.

Johnson lays the bottom timbers in the trench, tamps soil beside them to hold them in place, drills a ½-in.-dia. hole 2 ft. from each end, and drives a 36-in. length of ½-in. rebar through each hole to resist the pressure of soil behind the wall.

Timber walls need good drainage. Johnson installs 4-in.- to 6-in.-dia. perforated pipe along the footing and shovels 1½-in. gravel against the timbers.



Construction starts with a trench. Lay out the trench with stakes and string, and dig carefully to avoid disturbing the underlying soil. Be sure the bottom is level. I check as I go with a carpenter's level along the trench and a torpedo level across the trench. Dig the trench deep enough so the first timbers will be entirely below ground level (remember to dig 6 in. deeper if you're going to add gravel). Make the trench at least 10 in. wide so you don't have to contend with dirt spilling where the timbers go. Compact the trench, recheck the level, and adjust by shaving the high spots and compacting additional dirt in the low spots.

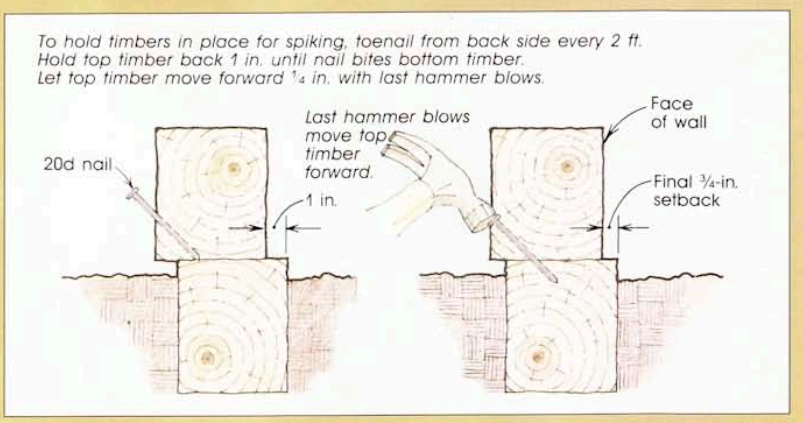
If you're working on a slope, you'll have to break the trench into steps. Look over the site, and start digging at the lowest point. Extend the trench until the working end is well below ground level and you can end with a good length of timber, 2 ft. at least. Lay timbers in the trench and start digging again, one step up—hold the bottom of the new trench level with the top of the timbers. Lap the next timber several feet over the last timber below, and make sure at least 3 ft. of the other end is below ground level.

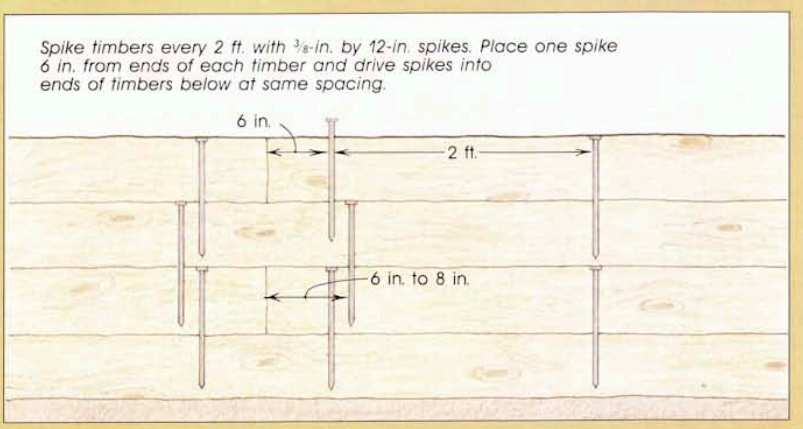
When I lay the bottom timbers, I make

All photos: Dale Johnson

Toenailing and spiking timbers

Tilting the wall toward the slope makes it strong. Johnson sets each course of timbers ¾ in. back from the course below.





sure they're solidly bedded and level, and then I pin them to the ground. Lay the timbers in the trench, line them up straight, and whack them hard several times with a sledgehammer to bed them firmly. Then check them for level. If you can't get a timber level with the sledgehammer, roll it out of the trench and dig or fill as needed. When all the timbers are level, shovel soil on both sides of them and tamp it carefully, making sure none creeps under the timbers. Then bore ½-in.-dia. holes in each timber, 2 ft. from the ends, and pound a 30-in. to 36-in. length of ½-in. rebar (the steel rod used to reinforce concrete) in each hole. When all the rebar is in, check the timbers again for level. If they're off, tap them with a sledgehammer. Be finicky. The first course of timbers is the foundation of all your work from here on up.

Laying up the wall—Lay up the timbers one course at a time, staggering them so each one spans two below it. Set each course back ¾ in. from the one below it. This setback tilts the wall slightly, so it leans into the slope and offers more resistance to the pressure of soil, water and ice than a vertical wall would. You can build timber walls without a setback, but if they're taller than 2 ft. you'll need engineering help.

I cut timbers with a gas-powered chainsaw. The more horsepower the better—an underpowered saw slows down, making the chain hard to guide. Mark timbers for cutting on adjacent sides. I prefer to cut with the back of the timber facing me—chainsaws tear wood on the side of the timber you're facing, and I want the face of the wall to look as good as possible. Here's a tip when you're butting timbers end-to-end and the joint is slightly crooked: Just run the chainsaw down the joint, shaving a bit off each timber, and you'll get a perfect match. Take care with a chainsaw. Wear safety glasses and gloves, stand on firm footing, and keep the blade outside the line of your body so a kickback won't hit you.

As you set each timber in place, nail it to keep it from moving until you can spike it. I toenail every 2 ft. on the back side into the timber below with 20d ringshank nails (they often go by the name "pole-barn nails"). Start each nail a good 2 in. up the timber to allow for the setback, and hold the timber about 1 in. back from the timber below until the nail begins to bite (see the drawing at left). As you drive the nail home, the timber will move forward ¼ in., leaving you with a ¾-in. setback.

When you finish a course, spike it. I use ⅜-in. by 12-in. spikes. You can use 10-in. spikes and save 2 in. of work, but I like the extra holding power of the longer ones. Spikes come in 50-lb. boxes of

roughly a hundred that cost about $30. To drive spikes, you need a maul—a sort of mini-sledgehammer. If you've never swung one, be prepared to discover some new muscles. Use an 8-lb. or 10-lb. maul, and practice before you start. When you're spiking, straddle the wall or stand alongside it. Don't hammer facing the wall—if you swing short of the spike, you're liable to mash the timber where the damage will show. If you find spiking too strenuous, you can ease the work by drilling a pilot hole for each spike to the timber below. Spikes sometimes split timbers at the ends. The damage matters only on the top course of a wall, where it would show. I always drill pilot holes for the top course.

Spike each timber 6 in. to 8 in. from each end, and 6 in. to 8 in. from each end of the two timbers below it. If you happen to hit a spike in the timber below, cut off the stalled spike with a hacksaw, move over an inch or two, and start a new spike. If a spike wanders and pops out the back of the timber, just drive it flush with the top of the timber, move over an inch or two, and drive another spike. If the spike wanders out the front of the timber, get the biggest crowbar you can find and pull it out. (This is a lot of work.) Then re-spike, taking account of how the first spike wandered.

Anchoring—To resist the pressure of soil, water and ice, the wall must be tied into the soil behind it at regular intervals. I reinforce my walls with earth anchors, which are steel contraptions with an auger at one end that you spin into undisturbed soil, and an eye at the other end that you fasten to the wall. They cost about $10 apiece. You need one every 8 ft. along a wall for every 2 ft. of height, placed in the middle of a timber. I install earth anchors with the same big crowbar I use to pull wandering spikes. Slip the crowbar through the eye and spin the auger into the soil. I angle the anchor so the eye comes to rest on the back edge of the timber. Then I push the eye aside an inch or two, notch the timber, push the eye into the notch, and secure it with two or three spikes. You should spin the auger at least 3 ft. into undisturbed soil. If the eye won't reach the wall, you have to cable it to an eyebolt in the wall (see the drawing at right). I use forged eyebolts; the eye is a complete circle and can't pull open. If you're working with disturbed dirt, such as fill from an excavation, you'll need engineering help to anchor the wall properly and a building permit before you start.

I anchor the ends of a wall by turning the courses back into the slope (see the drawing on p. 31). You can choose the angle of the corner to suit your taste and the slope. Prepare trenches for the end walls as you did for the main wall, and set the bottom timbers the same way as before. The end walls should go up at the same time as the face wall. Each course of the end wall should cut into the slope at least 3 ft. Extend the trench in stairsteps to make room.

Drainage—When you've set three or four courses, start providing for drainage. You want water behind the wall to be able to escape freely, both to minimize pressure on the wall and to discourage insects and decay. I use gravel and 6-in.-dia. flexible perforated plastic pipe for drainage. I look over the site, decide which end of the wall the pipe should drain toward, and pack dirt behind the wall to slope in that direction. I carve an exit hole for the pipe in two timbers of the end wall. Then I lay the pipe on the dirt, and cover it with 1½-in. gravel.

For walls less than 2 ft. tall, and taller walls that have little water to contend with, I just drill 1½-in.-dia. weep holes through the timbers just above the foundation course.

Backfill behind the wall after each course or two. First shovel gravel against the wall to maintain drainage to the foundation. Then add soil behind the gravel and compact the soil. When the last two courses are in place, backfill with topsoil and grade it carefully so it rises above the top timbers. You want runoff to go over the wall, not pool behind it.

Before you start—Stretch your imagination before you build. Walls can jog, step up, turn and turn again. You can set stairs in them, straight ahead, on an angle, or turning. Take your time planning. Draw the site and make overlays with tracing paper to compare alternative designs. The happier you are with your plan, the happier you'll be when you finish building. □

Dale Johnson's company, Environmental Landforms, in Minnetonka, Minnesota, specializes in timber retaining walls.

Anchoring timbers