Laying The Groundwork: Tips From an Excavator

by Wes Patnaude

How to get the most out of your excavation budget

Most people building houses these days can't afford to spend a mint on excavation work. Changing the contours of a lot or bringing in topsoil can quickly bust the budget on a new house project. But there are several areas where I believe spending extra money up front for a quality job will result in money saved down the road.

Clearing The Site

Before work begins, I think it's important that a site-work professional come in to clear the site. This may look like it's costing you a little extra, but in the long run it will save you and the owners money. Occasionally the owners want to do the clearing themselves. Discourage this. Chances are they'll cut the trees and have someone come in with a bulldozer and push them in a pile, thinking they'll worry about it later. Then you'll have to work around the piles, and the owners end up paying anyway for someone to come in later and clean them up. It's better to do it right from the start.

If the lot is well cleared before the digging starts the whole job goes much more smoothly for everybody, from the excavator to the concrete subs. I prefer to cut up the trees and remove them, chip the brush, and dig the stumps out and haul them away. We like to have a minimum of 20 to 25 feet clear around the house to work in. It's better not to have trees right next to the house, anyway, because of the leaves and branches falling on the roof and gutters.

Saving soil. With an open building site, I always try to save the topsoil before excavation begins. It's worth the money to have someone come in and till the entire site ahead of time. I can then strip the soil with the dozer and save it for the end of the job. Tilling first means the soil will spread smoothly and easily.

With wooded lots, salvaging topsoil is often more trouble than it's worth because of the roots and stumps. Considering the time it takes to shake out the soil and grade it, it's as expensive to save it as it is to buy clean soil.

Roads And Drives

After the site has been cleaned up the first thing I do — unless it's a gravel site where we can drive easily — is put the road in (see Figure 1, next page). It's important to grade the road surface so it has a good pitch and drainage. We then lay down a good road fabric. I use Mirafi 500X (Mirafi Inc., P.O. Box 240967, Charlotte, NC 28224; 800/234-0484).

Road fabric is a great product. It's a woven plastic mesh, like a woven grain bag, that does two things. First, it actually provides support, allowing the road to carry greater loads. Second, it keeps the gravel up and the mud down. Without a road fabric, the wheel action eventually pushes the gravel roadbed down into the dirt and mud, and the mud pushes up. In time, even with dry, sandy soils, the gravel will disappear. Road fabric prevents that from happening, even when the road is wet and soggy.

Without road fabric, a drive will have to have a new stone base after several years. In that respect, the upfront expense of the fabric easily pays off over the long haul. Road fabric is a good idea under paved drives as well.

On top of the road fabric we use 6 to 8 inches of 1½-inch "plant mix," which is stone that has been screened for size but not washed. Whether it's from a quarry or a gravel pit, plant mix is a good base material because the fines cause it to bind together.

Finally, after the house is finished and we've hauled in the last load of topsoil, we top the road with 4 inches of ½-inch stone with fines to create a smooth surface. When we're building on a really wet site we also use a layer of 5-inch stone on top of the road fabric, to help spread the load over the soggy ground. We then put the plant mix over that.

Ledge

When I'm scoping out a building site with a contractor, ledge is a topic that usually comes up. In the part of the country where I work, most people want a full basement foundation, and the ground around here can be pretty bony.

Predicting where you'll find ledge is difficult. An excavator's best tool is his knowledge of the area where he works. We usually don't have a problem because we know the area we're dealing with. When there's any question, it's always worth the cost to dig some test holes or make test borings ahead of time. (Even so, you can still be surprised. You can be digging one end of the foundation and have nice soil, and at the other end hit solid ledge.)

The costs associated with ledge removal are tough to precisely predict, so I never give a fixed price. There are several cost considerations with ledge. First, you have to hire someone to blast it. The blasting cost is high. Locally it can range from $3,000 to $5,000 for an average 4-foot-deep, 24x36-foot foundation, and as much as $5,000 to $10,000 for a full basement.

Then you have to remove the bulk rock from the foundation hole. Once you get the loose rock out, you may have 2- and 3-foot differences in grade. So you have to haul in more materials and compact them to get the bottom of the hole back up to snuff for the foundation.

Finally, you're usually faced with the problem of hauling the loose rock from the site. It doesn't work well as backfill — it's difficult to pick up with the bucket, it won't compact, and it could even damage

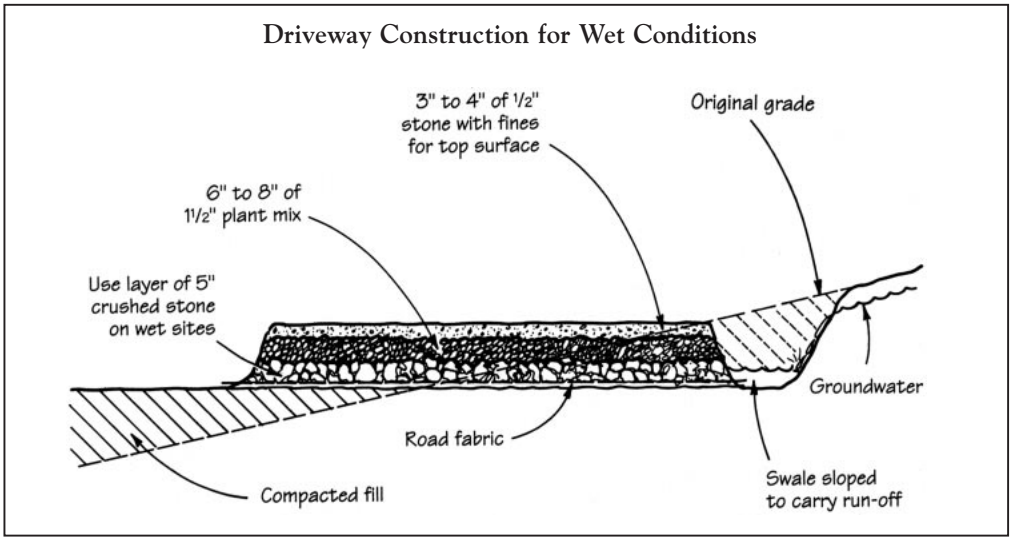

Figure 1. *To get the longest life from a stone drive, the author starts by providing proper pitch and drainage. Then, before placing any stone, he lays down Mirafi 500X road fabric, which strengthens the road and prevents the stone from being pushed into the ground.*

the foundation. And it doesn't make good fill unless you can dump it over a bank or into a hole and cover it with clean material. Most of the time you'll have to haul it away, which will cost $35 to $45 per hour in trucking time, plus dumping fees.

Ledge adds extra cost to every aspect of site work. Since water and power lines have to go deep enough below the surface, hitting ledge 2 feet down means you still have blasting to do.

An alternative. If the owners really like the site but are concerned about the ledge, I often recommend not putting in a full basement. Instead you can go down 4 feet for frost protection and create a crawlspace. This leaves room for wiring, plumbing, and a low-profile furnace. Then, with the money saved by not blasting and moving all the rock, you can build a nice outbuilding or garage — space the owners will use more often.

Sometimes the owners will insist on a full basement in spite of the ledge. In cases where you can't avoid blasting, make sure you have a clear understanding of your contract with the blasting sub. Prices vary widely, and most blasting subs assume that the builder will be removing the rock from the hole and paying to haul it away. Also, be sure to get a certificate of insurance from the blasting sub. If he doesn't have insurance, your rates will skyrocket to cover his liability.

Digging the Foundation Hole

I don't require batter boards on the job site during my work. Instead, I like the contractor to stake out the footprint of the house. Before I start digging, I stake out several reference points, offset about 50 feet, to use later in setting the house square in the hole. Then I set up my machine — an excavator with a 3-foot bucket — so I have the bucket just to the outside of the corner stakes. That way I've got a 3-foot overdig to give the form workers the room they need (see Figure 2). I make a clean pass down each side, digging carefully, outlining the house. This creates a perimeter that's 3 feet larger on each side than the foundation footprint.

I'm careful on this first pass to make a clean, plumb cut. This is especially important where a full basement steps up 4 feet to a garage footing (see Figure 3). Keeping the cut plumb at the step-up makes it easy for the concrete workers to patch in with forms where the wall levels meet. If they have to start customizing forms to an irregular edge, or filling in and compacting soil, it gets expensive.

Drainage

Many excavators will not install foundation drainage systems. However, I'm pretty particular about them and I prefer to do them myself.

People often argue about how much pitch to place on the drain pipe. But what's really more important, especially in heavy soils, is to pitch the bottom of the foundation hole itself. I first try to dig it as close to level as possible, then gently slope it — about 1/4 inch in 10 feet — toward the drainage exit.

My preference is then to spread at least 4 inches of washed 1-inch stone over the entire bottom of the hole. That way, any water that rises into the foundation will automatically begin to drain out through the stone before it ever reaches the drain tile. With wet conditions in the spring, the drain pipe handles the excess.

Putting a layer of stone in the bottom of the hole adds about $800 to $1,000 for a typical foundation. Not every budget can afford this, but I like to do it when I can — it's cheap insurance against a wet basement. It's critical to use washed stone for all drainage applications because the fines in unwashed stone will clog the stone, drain tile, and filter fabric.

Envelope technique. I use a 4-inch-diameter, 2,000-psi crush, perforated polyethylene drain tile. This is more expensive than the pipe you usually find at the lumberyard, but I use it because it's easier to work with. The joints go together well and it stands up under job-site conditions.

I prefer to create a complete envelope around the drain tile with filter fabric (I use Mirafi 140NS). I first lay the fabric on the ground (or on the stone bed, if there is one), then 2 inches of 1- to 1 1/2-inch washed stone, and then the drain pipe (see Figure 4).

I usually start laying the drain tile from the corner of the foundation opposite the daylight drain, keeping the top of the first sections of pipe below the top of the footer. I keep a slight pitch on the pipe so that it's 2 to 3 inches lower when it reaches the daylight-drain end of the foundation.

Some builders like to use a transit, but I prefer to set each section of pipe with a 6-foot level. I'm always careful to hand-place the stone

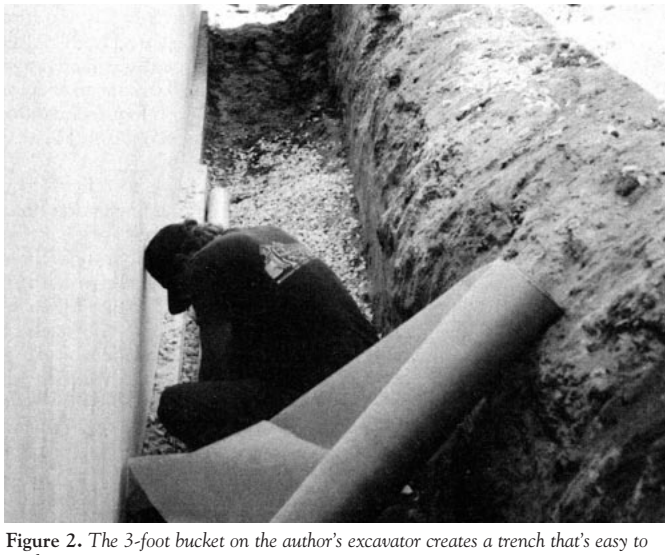

Figure 2. *The 3-foot bucket on the author's excavator creates a trench that's easy to work in.*

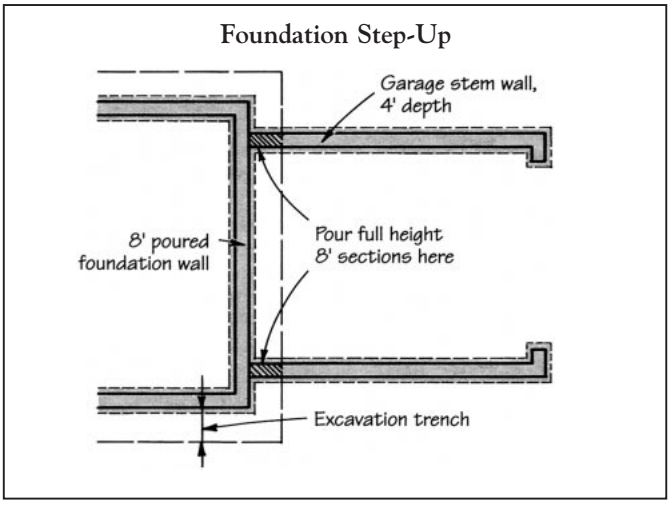

Figure 3. *Where a full-basement foundation steps up to a garage stem wall, the author cuts the sidewall of the basement excavation as close to plumb as possible. This makes it easier for the concrete sub to form the step-up between the two levels.*

Digging With the Right Tools

It used to be that most small excavation contractors used backhoes and dozers to get the work done. But in recent years, that's been changing as new equipment has come on the market. When you're choosing an excavation contractor, you should inquire about the type of equipment he uses — it makes a lot of difference as to how fast he'll get the job done.

The excavator is the best all-round machine for residential site work.

The excavator is the best all-round piece of equipment for most residential jobs. It's basically a big backhoe on tracks, but the bucket and cab have a 360-degree swing. With 12-foot tracks on both sides, it has very good flotation; it also has a lot of power. Larger excavators have been used for years in commercial work, but they were always too big and bulky for residential work. Now they're made smaller so you can move them almost as well, if not better at times, as a rubber-tire backhoe.

The excavator allows me to get the job done efficiently. When I'm digging a cellar hole and I run into a 5-foot-long rock, I've got the power to move it. With a single machine I've got the range to pick up the dirt and swing it clear out of the way. If I'm digging a 24x40-foot foundation, I can make a pass down each side, clear the dirt out of the way, and I'm done. But if you're digging with a backhoe, you have to have a bulldozer on the job to push the dirt out of the way. So there you're running two machines at $50 an hour and it's going to take longer than with the excavator at $75 an hour. In terms of cost, you're way ahead of the game with an excavator.

A skid-steer loader is versatile and fast for lighter tasks.

Excavator buckets are expensive — $3,000 to $5,000 dollars each. Most small excavation contractors can't afford to have three or four different ones. You have to have what you're going to use. The buckets have replaceable teeth, but it costs about $200 for a new set. So sometimes, when a contractor asks me to reef on a rock a little bit more, I ask him if he wants to buy the teeth for it.

The other machine I use a lot is a skid-steer loader ("Bobcat" is a well-known brand). It's small, has four-wheel drive, and is very versatile and quick. It's great for moving stone around and finishing up around the site. And it's small enough that I can pick it up with the excavator and put it down in the bottom of the foundation hole to speed spreading the stone.

Laser saves one man. Another tool that saves a lot of time is the laser level. Contractors will see it on the job and wonder why I've got so much money tied up in a transit. But it basically saves one man and a lot of time. Instead of having to jump in and out of the machine to look through the transit, or having to pay someone to stand there, I can keep digging the whole time while one man is down in the hole with the stick.

— *W.P.*

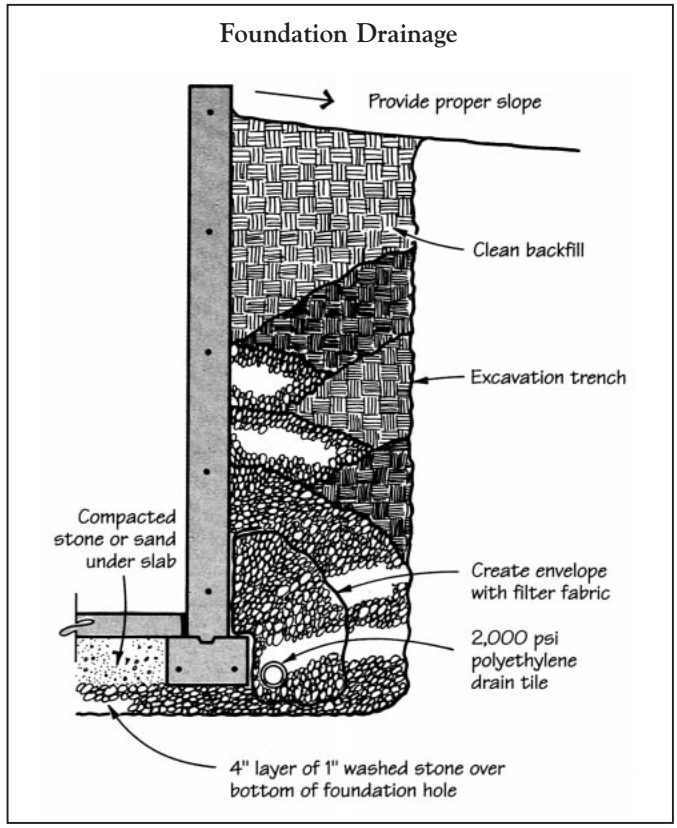

Figure 4. *Washed stone, heavy-gauge polyethylene drain tile, and high-quality filter fabric are the main ingredients in a long-lasting foundation drain.*

around the pipe — you don't want to just dump a yard of stone on top of the pipe, as it will knock it out of line or pull the joints apart.

After the pipe is pitched correctly, I add enough stone to completely surround the pipe. I then wrap the fabric around and place more stone on top. I bring the stone up the wall about 18 inches, sloping it away to the outside.

Cleanouts. I always include cleanouts, or flush tubes, in my drainage systems (see Figure 5), usually two at the high corner and one at every other corner. I bring these up above grade and, after the landscaping's done, cut them off just below the surface and cap them. That way they're hidden in the mulch beds around the house. With the filter fabric and the cleanouts, the drainage system should last the life of the house.

Some owners want to connect downspouts from the gutters to the cleanouts. This is a bad idea — it just pours more water around your foundation.

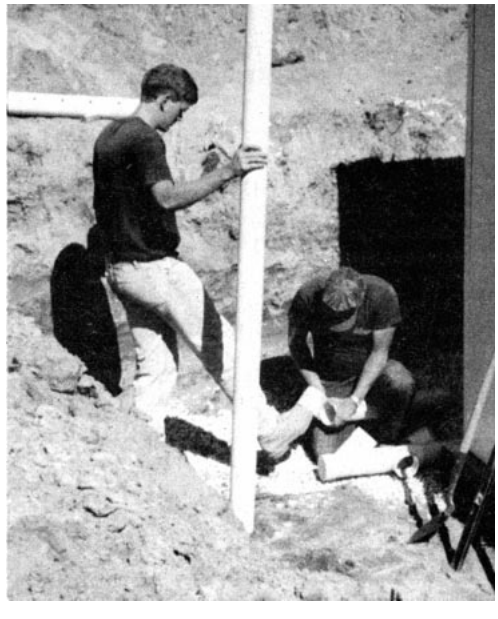

Figure 5. *The author always includes cleanouts at every corner of the drainage system for periodically flushing the pipe. At left, he fits a wye for running the flush tube up to grade.*

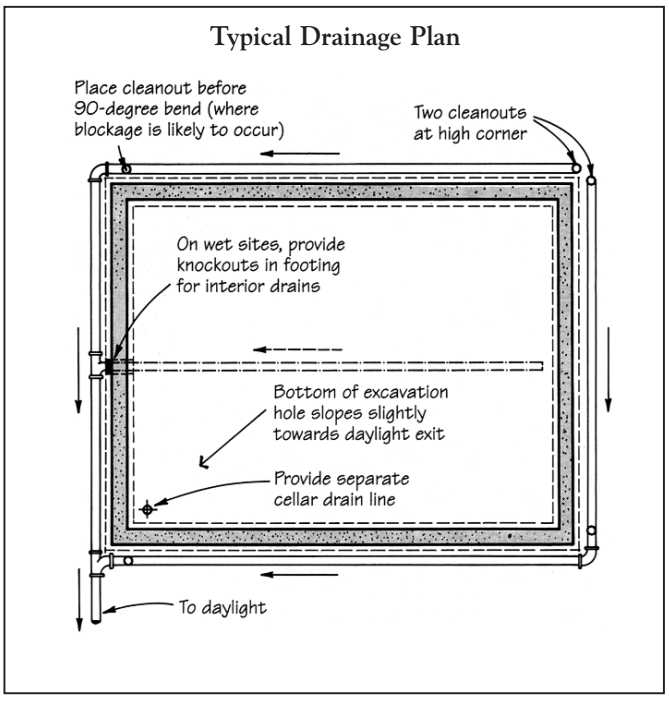

Figure 6. *On wet sites, the author puts one or more knockouts through the footing to connect to a drain under the slab. He also recommends extra washed stone in the bottom of the excavation to let water flow under the footings. Additional stone is used to backfill any sides of the foundation where underground springs flow.*

Wet conditions. Occasionally in digging a cellar we'll hit a spring 3 to 5 feet down, bringing water into the sidewall of the hole. When there's a lot of water, I'll usually place 6 to 8 inches of stone (sometimes more, depending on the amount of water) in the bottom of the foundation hole. Then I'll put a knockout in the footing so I can run a tee off the perimeter drain through the footing to connect to a drain under the slab (see Figure 6). Later, on the side of the foundation where the water's coming in, I'll backfill to within a foot of the surface with washed stone or gravel.

I try to avoid sump pits, but sometimes you don't have a choice; for example, when you have a dead-level lot where you could go 1,000 feet before you get any kind of drop-off. In that case I'll carefully pitch the bottom of the cellar hole toward the sump pit. Then I lay the Mirafi 500X road fabric in the bottom of the hole and as much as 12 inches of stone on top. Again, I'll tee off the perimeter drain and bring a line under the slab.

Backfill

It pays to be careful with backfilling. Many carpenters like the foundation backfilled before they start framing, to make access easier. It's not a good idea, however, to backfill a wall over 26 feet long unless it has some sort of jog in it to provide support; you can easily crack the foundation. I usually make the decision. I'm the one who's responsible, so it's my call.

An excavator is definitely the right tool for backfilling (see "Digging With the Right Tools," previous page). You don't have to get too close and put added pressure on the wall the way you would with a dozer. Instead you can bucket the dirt in gently.

I use clean, granular backfill, usually bringing it up 3 to 4 inches above final grade to allow for settling. I don't compact the backfill — it compacts itself over time. Usually I'm on a job site several times over the course of the construction. The backfill has some time to settle and I'll come in toward the end of the job and top it up and slope it correctly — about an inch per foot. If it's clean I usually put 4 inches of the native soil from the site back on top. We have a lot of clay in this area, and that works well for shedding water.

Backfilling over foam board. If contractors want to insulate the exterior of the foundation, they should use full-height 8-foot sheets. Stand them right on top of the footing and cut them flush with the top of the wall. Or you can come up from the footing with two sheets placed horizontally — this also reduces the number of joints above grade that you have to finish. But if you try to insulate only the top 4 feet, as some builders do, then the settling of the ground will pull the foam down with it. Ground movement has a lot of force, and it will drag the foam down no matter how you attach it. ■

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