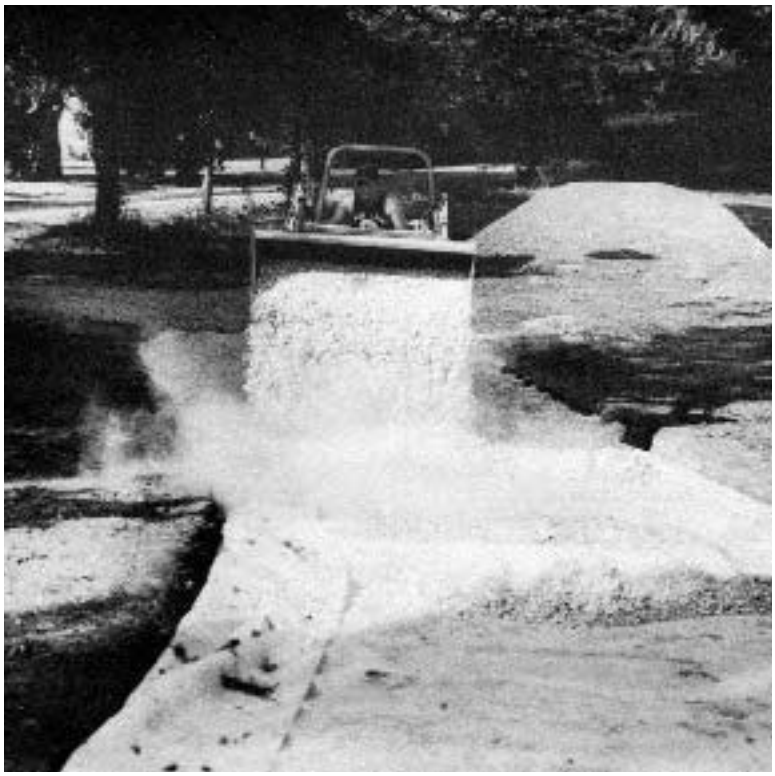
Rural Driveways

Both paved and unpaved driveways can last a long time if you start with a well-drained roadbed



A road contractor places 6 to 8 inches of crushed stone over a geotextile to make a road base. The geotextile, which strengthens the base, wraps around drains set in trenches on either side of the road.

Part of the charm of a rural building site is the driveway leading to it. With houses set back from the road to diminish the sound of traffic, rural driveways can be anywhere from 100 to 1,000 feet long. Whether the driveway snakes through trees, takes off in a straight shot from a country road, or hugs the edge of a hillside, putting in a rural driveway requires all the skill of building a small road.

Laying out rural driveways involves four key steps. You survey the site and lay out the path to the house. Then, you grade the road and stabilize the soil. Next, you put in a compacted granular base, and in an optional fourth step, you may pave the drive.

Layout

While general contractors can do much of the driveway grading and paving, you'll probably want some help with the layout. A surveyor or landscape architect can shoot grades and give you a plan for the driveway. The driveway should slope away from the building site, if at all possible, so rainwater or snow melt drains away from the house.

If the building site is at the bottom of a slope, you may have to put in a swale to collect water, or you can use a slot drain in front of the garage door and wherever else the water might tend to flow toward the building. (A slot drain is a corrugated-steel, plastic, or concrete pipe with a slotted opening at the top to collect water. The slot drain is hooked up to a collection drain large enough to carry the water away from the building.)

Your driveway layout should include a plan to dispose of the water. Water that accumulates in depressed areas can freeze, and if these areas are near the house's entrance, the owner may have to cross slippery wet patches to get into the house. If you suspect that your drainage

by Barry Dempsey

Figure 1. *Build a step up into the garage if the house is at the bottom of a hill.*

design might not completely handle all the heavy rain, you can put a step up into the garage (see Figure 1).

On longer driveways, you might want to save large trees on the site by using some curves. If the distance to the house is relatively short, you can plan a straight route, but pay attention to slope and drainage.

For a driveway 100 to 200 feet long, you need a 12- to 14-foot-wide roadbed. With a paved roadbed, you could get away with 11 feet, but some drivers might feel a little restricted on such a narrow drive. Where you have two or three houses at the end of the driveway, with two-way traffic likely, you'll need to go with a 22-foot-wide road.

When you're planning a rural driveway, you also need to plan visitor parking and a turnaround so guests don't have to back out (see Figure 2). In subdivisions, visitors park on the street, but on rural sites, you'll want a clearly defined parking area, and possibly a turnaround, near the front door. (You don't want the driveway to terminate at the garage with no turnaround and no extra room.)

Don't skimp on space in a turnaround. The minimum turning radius should be 24 feet. You'll need this much room for larger cars or pickup trucks. If you provide an adequate turning radius, you should be able to put a planted area in the middle. It wouldn't hurt to leave a little extra room for the drivers who are likely to stray onto the sod if the curve is too tight. And plan for a recreational area near the house if your clients are basketball fans who might want to shoot a few hoops.

Grading the Site

To prepare the driveway's subgrade, you either cut out the soil or place fill to create the proper grades (see Figure 3). The road base material, which can be either crushed stone or gravel, is placed on the prepared subgrade. Spreading gravel or crushed stone evenly is much easier if you grade the subgrade correctly.

Figure 2. *Antique farm machinery is the centerpiece of this rural turnaround. The minimum turning radius should be 24 feet.*

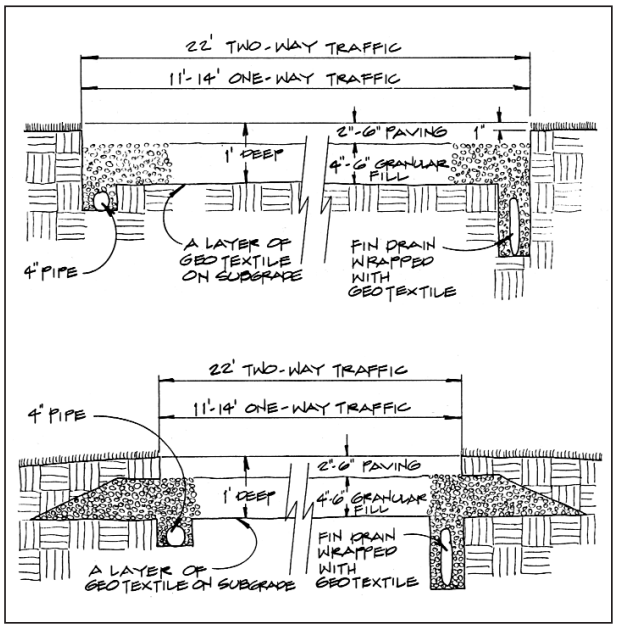


Figure 3. *Both cut and fill sections of the roadbed should have a drainable aggregate base. Use either a 4-inch pipe drain or a fin drain to collect the water.*

On a county road or highway, you would expect to have gravel or crushed stone shoulders on the road, but on most rural driveways the owners will want to landscape right up to the edge of the paving. (Unpaved roads are an obvious exception.) For those who want to plant grass, having gravel shoulders on either side of the drive would be a nuisance. You'll need to grade so the gravel or stone will be contained at the edges with soil, as shown in Figure 3. When you're done, the surface of the finished driveway should come out about an inch higher than the surrounding soil.

To grade long drives (over 100 feet), you'll need a bulldozer, but on shorter ones, you could use a bobcat or small tractor with a landscaping bucket. Remove all the organic material (roots, twigs, bushes, grass, and topsoil) because organic matter will decay, and this could cause your paving to sink or break up.

On areas to be filled, place the fill and compact it with the wheels of a tractor or with construction trucks. You usually can't use large highway rollers on rural drives, but you can rent small rollers from some rental stores. If your customer is willing to wait a while, you may also want to let the driveway sit for several months to allow settlement before you place the final paving.

Subgrade drainage. Driveway subdrainage keeps unpaved drives from turning to mud and extends the life of paved drives. With subgrade drainage you're less likely to get potholes, even on unpaved drives, because water doesn't accumulate (see "What Causes Potholes?" below.)

A subgrade drainage system works just like the gutters on a house. Trenches on either side of the driveway contain drainage pipes which collect water that accumulates under the roadway. The drainage pipes dispose of the water where it will not cause erosion or undermine the driveway.

A subgrade drainage system consists of trenches, stone or gravel aggregate, and geotextiles. To lay the groundwork, you need to excavate a drainage trench on both sides of the road. The easiest way to put in a trench is to use a small 6-inch-wide chain trencher that will go as deep as 42 inches. These rent for $140 to $160 per day. If you do the work yourself, you should be able to trench 300 to 500 feet in a day, depending on depth and soil conditions.

Soil stabilization. After grading and trenching, you should stabilize the soil, especially if it has a high clay content. Expansive soils (those that contain a high proportion of clay) shrink and swell with seasonal rainfall, and you want the driveway to go on top of the most stable surface possible. Soil stabilization also makes the driveway less muddy while the house is under construction.

Soil stabilization isn't difficult. Load bags of hydrated lime on your pickup, slit them open, and toss the lime off the tailgate. You'll need to figure on adding 3% to 5% by weight of the soil. Mix in the lime to a depth of 4 to 6 inches with a garden tiller or a disk; then recompact it.

Geotextile. Geotextiles are strong, fabric materials used in highway construction to make roads last longer. A geotextile placed between the soil subgrade and aggregate base course separates the two materials and prevents the subgrade from intruding into the granular base and weakening it. The geotextile also imparts tensile strength to the bottom of the base course and improves its ability to carry a load. On unpaved roads, geotextiles keep the aggregate from burrowing down into the soil. This reduces the likelihood of potholes.

Either a woven or a nonwoven geotextile can be used to separate the subgrade and base course. I have found that a 6- to 8-ounce nonwoven geotextile works well for separation, and it costs less (about 40¢ to 60¢ per square yard) than a woven geotextile. Make sure you use a UV-stable fabric—one that won't deteriorate in sunlight. Most have carbon black in them for resistance to ultraviolet light.

You won't find geotextiles at your local lumberyard, but you can order them from landscaping suppliers or paving suppliers (see "Geotextiles and Geocomposites," *JLC* 3/89). The rolls are generally 200 to 300 feet long, depending on the geotextile's weight, and most rolls are 15 feet wide.

After you unroll the geotextile across the subgrade, lay drainage pipe in the trenches that you dug when you prepared the subgrade. Use either a

What Causes Potholes?

The thud of a car's tires slamming into a pothole makes even cheerful clients surly. If there are potholes in a client's driveway—and they don't have the city street crew to blame—they'll blame you for an unprofessional job.

Potholes in paved driveways are caused by poor base and subgrade support. If the soil washes out from under the driveway, of course it's going to cave in. Poor drainage and freeze/thaw action contribute to the problem: Frost heave moves the pavement around; freeze/thaw action pries open the cracks.

If you're using an asphalt concrete paving, make sure the asphalt concrete temperature is above 175°F when the sub puts it down. With higher temperatures you get better compaction. Poor compaction or low asphalt content can contribute to potholes.

You can also get potholes in gravel or crushed stone driveways, but these are caused by tire abrasion and poor drainage. A well-prepared and compacted subgrade, the use of geotextiles, and good drainage will significantly reduce pothole problems.

— B.D.

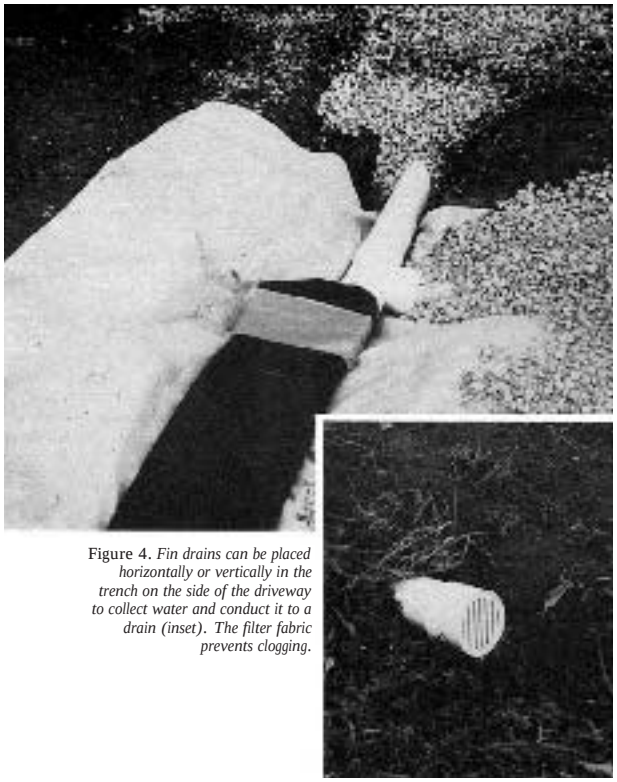


Figure 4. *Fin drains can be placed horizontally or vertically in the trench on the side of the driveway to collect water and conduct it to a drain (inset). The filter fabric prevents clogging.*

standard 4-inch corrugated slotted tubing (such as ADS, 3300 Riverside Dr., Columbus, OH 43221; 614/457-3051) that you buy at the local lumberyard, or use "fin drains." Fin drains, which have a polymeric core, can carry more water, and won't clog because they are wrapped with geotextile (see Figure 4). Fin drain products include Hydraway 2000 (Monsanto, 2381 Centerline Industrial Dr., St. Louis, MO 63146; 800/325-4330) and Stripdrain 100 (Contech Construction Products, Inc., Box 800, Middletown, OH 45042; 513/425-2165).

On hillsides, you should route the water to the storm sewer or ditch at the edge of the main road. On rural sites, the driveway usually passes over an entrance culvert where it intersects the main highway. If you can bring the drain pipe from your drain system to this collection point, the ditch will carry the run-off away. Put a rodent screen over the drain pipe because field mice will damage polymeric materials.

Building the Base

Preparing an aggregate base (gravel or crushed stone) is the next step. Gravel and stone have slightly different characteristics. Natural gravels are rounded because quarries mine them from river deposits. Crushed stone, on the other hand, is angular. This makes crushed stone compact better, making a much firmer and more stable base.

Price, not performance, may ultimately determine your choice of aggregate. Prices vary depending on the supplier's distance from the quarry, and gravel will make an acceptable base if stone is not cost-effective.

Base for an Unpaved Road

The base material used is slightly different for driveways that will remain unpaved than it is for paved roads, but good drainage in the subgrade and base material is important for both.

Road pack. The least expensive unpaved driveways use "road pack." Road pack is a mix of gravel or crushed stone which contains a high percentage of fine material (called "fines"). While it compacts well, road pack has very poor internal drainage. It gets soft and spongy when wet, although it is reasonably stable when dry. Road pack should be regraded several times a year to keep it from getting rough and to keep the drive free of potholes. First costs are cheap, but there are added maintenance costs for your client to consider.

Drainable unpaved drives. If you want a driveway with better drainage, you could use an open-graded aggregate. An open-graded aggregate has particles ranging from about 1/4 to 1 inch in diameter. (The range of sizes in the mix varies according to your local supplier.) The particles of different sizes are mixed together before delivery. Although an aggregate with this size range in the mix drains well, it may tend to be somewhat unstable if used as the surface course of a driveway. Tell your clients they'll have to regrade several times a year to erase the ruts, but with good subgrade drainage and a geotextile, they shouldn't have major wash-outs or potholes.

You can build a more stable road by specifying crushed stone. The more angular the material, the less regrading is required. For instance, in central Illinois, we use "B-stone," which is 4 1/2 to 1 inch crushed stone. The mix available to you will be slightly different, and every region has its own numbering system for specifying aggregate. You'll have to call around to find out what kind of aggregate and mix are available locally. Don't order pea gravel though, because pea gravel is too rounded to make a good roadbed.

Base for Paved Drives

Some people like to use road pack as a base, but it's not a good idea. In wet, low-lying areas, road pack is likely to result in a wet, sloppy subsurface. For just a little more money, you can use subgrade drainage, geotextiles, and a good open-graded base. The driveway will have added stability, and no matter what kind of paving you choose, the paving should last much longer than if you put it over an undrained base such as road pack.

The aggregate mix is slightly different from that used for a drainable, unpaved road. Because pavement goes over the top of it, you can use larger chunks of aggregate. These will leave plenty of room for water to percolate through and travel over to the drains at the sides of the road.

To build a free-draining base, use a 3/4- to 1-inch-sized aggregate. Small tires sink into this big aggregate, but construction trucks won't have a problem driving on it. Because it is harder to spread and compact than dense-grade bases, such as road pack, you might want to add some smaller aggregate just at the surface, especially if you intend to leave it for a few months while the material settles. I mix in a 1/8- to 3/8-inch angular aggregate, and this keys down into the larger material and makes the larger aggregate more stable. The two will mix together as you spread the small stone on top of the larger stone.

You'll want 6 to 8 inches of aggregate base material in your roadbed. It's cheaper to put in more base material and less concrete or asphalt paving because the base course costs less than the paving. Cover the drain system, as well as the roadbed, with the aggregate. You'll need about 600 cubic feet or about 40 tons of crushed stone for a driveway 6 to 8 inches deep, 12 feet wide, and 100 feet long. Delivery to a rural site should run you about $10 to $12 per ton.

If your base is well-prepared, on a rainy day you won't see any water sitting on the surface. If that's the case, you're ready to go over the top with paving.

Paving Options

You'll find quite a variation in price between the pavements available to finish off a driveway. But if you've prepared a good drainable base, all of them will last far longer than paving over a nondrainable base. Your three surfacing options are asphalt concrete, portland cement concrete, and concrete pavers.

Asphalt concrete. Asphalt is the least expensive paving option, at $4.50 to $5.50 per square yard (see "Cost Comparisons"). The sub should lay down 2 to 3 inches of asphalt concrete. You don't need an edge or reinforcing with this road system, but you will need compacted soil along the edges of the asphalt, or else the outer few inches can chip off. It's best to cover the gravel base at the edge with geotextile and sod; that way you won't have gravel coming up through the sod or soil clogging your aggregate.

An asphalt drive is probably the best system to use when you have a long approach to a home, but asphalt will not last forever. The biggest problem with asphalt is thermal cracks in cold weather. Once you get those, the driveway starts to look unsightly. To prolong the life of the driveway, your client should fill cracks and put on a sealer coat every two years.

When your sub installs the asphalt, make sure he's working on a warm day because asphalt that cools too fast doesn't compact well. An asphalt system should last for 12 to 14 years, but the asphalt will eventually begin to lose its ability to expand and contract with temperature changes, and cracks will form.

Cost Comparisons

Estimating costs for the driveway's aggregate base material is difficult because the price depends on how far the supplier is from the quarry and how far the final delivery site is from the supplier. Below are rough estimates for aggregate and paving obtained from Central Illinois suppliers. We priced a hypothetical driveway 100 feet long and 12 feet wide. Check prices in your area.

Granular material	*Square-Yard Price*	
Gravel or crushed stone road (6 inches deep)		
Road Pack (6 inches deep)	$3.26	total cost: $435
Open Aggregate (stone)	$3.06	total cost: $408
Open Aggregate (gravel)	$3.88	total cost: $518
Drainable base (6-8 inches deep)		
Open Aggregate (stone)	$3.95	total cost: $527
Open Aggregate (gravel)	$5.01	total cost: $668
Paving Materials		
Asphalt (3 inches)	$4.75	total cost: $633
Concrete (6 inches)	$11.34	total cost: $1512
Concrete Pavers	$17.10	total cost: $2280

Figure 5. *With concrete pavers, a 6- to 10-inch granular base will handle most driveway loads, but if you expect large trucks on the driveway, put in a 12- to14-inch base. The shape and thickness of the paver affects its load-carrying characteristics.*

An asphalt drive will eventually need a major overhaul. A second layer can be added, but the extra couple of inches can put the driveway at the wrong elevation for the garage slab. Paving subs handle this by removing asphalt from the 10 feet in front of the garage and tapering the new layer so that it slopes down slightly toward the garage. Clients who plan to live in the house for more than ten years might want to consider a longer lasting paving material.

A pleasing and functional driveway is not something you can throw together when the house is finished. It should be designed and constructed to set tolerances.

Concrete. A concrete driveway costs considerably more than asphalt, but it should last 20 to 25 years without cracking. It's a good paving material to use on rural sites with relatively short driveways. It's also a good option for general contractors who prefer to eliminate the paving sub.

Concrete for rural driveways should be 4 to 6 inches thick. The 6-inch thickness can take heavy loads, such as a garbage truck, much better. The added stability of the thicker material makes it a good investment.

Use air entrainment in freeze/thaw climates to improve performance. If your clients are planning on salting the driveway, or if they're near a road that is salted, you'll need air entrainment because, without it, the driveway will spall.

To control cracking, you need a sawcut (control joint) every 12 feet or less. The rule of thumb is to space the sawcuts 3 feet apart for every 1 inch of depth (for example, a 3-inch slab should have joints every 9 feet). The sawcut depth should be 1/4 the thickness of the slab. You can hand-cut the joints when you're finishing the concrete, or you can go in with a diamond blade once it sets. For good performance, you need reinforcement in the concrete—wire mesh in the slab itself and #4 reinforcing bar to span sawcut sections.

Eventually, small cracks will open up in these control joints and water will filter into the granular base. But if you've installed a drainable base, water will flow into the aggregate and be carried away in the subdrainage system. You'll also need expansion joints where the concrete abuts the house (or sidewalk). You can use fiber, aluminum, or plastic expansion joints, but many landscape contractors have been using treated 1x4 pine expansion joints where they want decorative effects.

Concrete pavers. One final option worth considering is concrete pavers. The big advantage of this paving system is that if some irregularities develop, or the owner needs to lay a new electric or sewer line, it is simple to lift out the pavers and then put them back in place (see Figure 5). You also do not have to worry about cracking. Damaged blocks are easy to replace.

Concrete paving block can carry heavy loads, especially if the heavy loads are infrequent. With pavers, a 6- to 10-inch granular base will handle most driveway loads, but if you expect large trucks on the driveway, put in 12 to 14 inches of the base course. The shape and thickness of the paver affects its load-carrying characteristics, so consult a reputable supplier for specifics.

With pavers, rainwater percolates through the joints into the base, reducing the amount and velocity of runoff. This can reduce erosion, which could be important on sloping sites.

Pavers are slightly more expensive than asphalt or concrete, so you might want to reserve them for the turnaround area near the house if the driveway is a long one. I'm going to use them on my own 300-foot-long driveway when I finish it up next spring because I want something that is a little more distinctive than asphalt or concrete.

If you're using pavers, place a geotextile over the aggregate base course; then spread 1/2- to 1-inch of bedding sand. The geotextile keeps the sand from migrating down into the open-graded base, which would eventually cause irregularities in the paver surface. Place an edging material, such as Pave Edge (Pave Tech, Box 31126, Bloomington, MN 55431; 800/728-3832), and stake it down at the perimeter to keep the block from spreading.

Place the pavers on the bedding sand and vibrate them with a plate vibrator. Brush fine, angular sand into the joints to complete the interlock between the individual blocks. Don't use mason's sand because it can wash out of the cracks.

Even though you've used a geotextile, your client is still likely to have some vegetation springing up between the pavers. They can keep weeds down with herbicide or periodic maintenance.

A pleasing and functional driveway is not something you can throw together when the house is finished. It should be designed and constructed to set tolerances. The material selected for the driveway will be important to its long-term appearance and to the home's value in the years to come. ■

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