

EXPOSED Aggregate Concrete

An aggregate finish and inset masonry can dress up a humble concrete slab



Concrete is a durable and cost-effective material for walkways, patios, and drives. While plain concrete is not particu-

by Ron Sansone

larly attractive, there are many ways to improve its looks: You can color it with pigment, texture it to look like something else, or cover it with brick or stone. One of the oldest — and best — methods for creating visually appealing concrete surfaces is to expose the aggregate.

Aggregate is present in every concrete slab, but because it's encased in a matrix of sand and cement it's not usually visible. Removing the top layer of sand and cement to expose some of the aggregate makes the surface of the concrete look a lot better, and the process is not much more expensive than plain gray flatwork (see Figure 1, next page).

An aggregate finish is good for walks, driveways, and stairs because it is skid-resistant and wears well. And as long as the original aggregate is still available, the surface is easier to repair or add on to than stamped or integrally colored concrete.

My company specializes in patios that are a combination of exposed aggregate concrete, brick, and stone. The masonry is set flush to the surface of the slab and forms decorative borders and bands. This is less expensive



Figure 1. The same aggregate that is visible on top is dispersed throughout this slab. Some of it even shows through on the sides.

than building the entire patio from brick or stone and it creates more visual interest.

It's difficult to produce this kind of work if you have to bring in separate subs to do it. Most of the people on my crew started out as landscapers but have been trained to do masonry and concrete, which makes it easier to coordinate the work because we can do it with a single crew. Most of our jobs are in existing neighborhoods, so it helps that we can do enough landscaping to repair the yard at the end of a job.

Aggregate

The size and type of aggregate determines the look and color of the finished slab (Figure 2). It's expensive to transport heavy material, so aggregate is usually made from locally available stone. We're located in the St. Louis area; our concrete supplier carries a few types of local stone that look good and are hard enough to be exposed. We can get a white or a slightly darker glacial rock from Illinois or we can get a brown shiny gravel that comes from the

Meramec River. Different types of aggregate are available in other parts of the country.

Our local stone is cheap enough to use throughout the mix, so it's spread through the entire slab. If you expose the aggregate, this is the stone you will see. But it's also possible to throw a thin layer of aggregate onto the freshly placed concrete and float it into the surface. This is called seeding and it's the method we used when I was first starting out. Seeding allows you to use inexpensive aggregate in the mix and put the exotic aggregate on top where it will show.

These days, no one seeds unless they're using an expensive decorative aggregate. We avoid seeding because it's hard to put the stone on evenly, it adds another step to the process, and it requires extra labor. If you can buy a reasonably priced aggregate, it's simpler and less expensive to put it in the mix.

Size. Some contractors like to use normal size ($3/4$ -inch to $1\frac{1}{2}$ -inch) stone when doing an exposed aggregate finish. I don't like doing this because if the concrete is a little too wet, you can end up with areas where



Figure 2. The author makes samples containing different types of aggregate for potential customers.



Figure 3. This walk was formed with $1/4$ -inch Masonite. The cedar crossmembers function as expansion joints but will also be left in place as a decorative element.

there is visibly more cement than aggregate. This can happen anytime you place concrete, but it's noticeable with an aggregate finish.

We prefer to use a smaller size stone. Our local brown river stone is available as regular size aggregate or as a smaller size called Meramec torpedo. They're the same type of stone but the torpedo has been passed through a finer screen. It's small and very consistent in size, so it produces a smooth, uniform surface.

The mix. Concrete contains water, portland cement, graded aggregate, and sand. Technically, the sand is just a finer type of aggregate. The cement, water, and sand form a paste that fills voids and binds the aggregate together. Around here, most contractors use a four- to five-sack mix (four to five 90-pound bags of cement per yard of concrete) for residential flatwork. When we do an aggregate finish, we use a six- to six-and-a-half-sack mix and a little less sand. Reducing the sand makes the pebbles stand out more on the surface, while the extra cement makes for a stronger slab.

Placing the Slab

Prepping for an exposed aggregate slab is the same as prepping for any kind of concrete. Depending on the grade, drainage, and soil conditions, we may or may not put a layer of stone under the slab. In some cases, the stone will be an added expense that does nothing to increase the quality of the job. But most of the time it's necessary to use crushed limestone to level the grade.

Formwork. Most of the patios we build have curved outer edges. We form them with 1/4-inch tempered Masonite because it's easy to bend (Figure 3, previous page). For straight edges, we use 1x4s. We hold the forms in position by nailing them to wooden stakes. The top edge of the form functions as a screed strip, so we set its elevation with an optical level.

We used to rip our own Masonite and cut stakes from 1-by lumber, but we found it was less expensive to pay a supplier to do it. The stakes come 3,000 to a



Figure 4. Inset masonry creates visual interest by breaking up what would otherwise be a monotonous expanse of a single material.



Figure 5. The edge of this slab was formed to accept a brick head course. There was too much concrete to pour and finish in a single day, so the crew stopped at a joint.

pallet and the strips of Masonite are 27/8 inches wide. We settled on a single width because it's less complicated than keeping various sizes around. There's no chance of running out of a certain size or having someone bring the wrong size to the job. The stakes and the Masonite are cheap enough to throw away after a single use.

Most of our patios are bordered and inlaid with brick or limestone bands (Figure 4, previous page). Parts of the slab must be lowered to accommodate the inset material, and the 27/8-inch strips are a good height for forming the drops (Figure 5, previous page). Brick is about 25/8 inches thick, so a 27/8-inch drop leaves room for a 1/4-inch bed of mortar. The limestone is around 21/4 inches thick, so it gets a thicker bed. If the edge needs to be thicker, we either

double up the hardboard Masonite strips or allow some of the concrete to ooze beneath the bottom edge. The rough edge won't be visible, because it gets buried when the yard is landscaped.

Reinforcing. Slabs are typically reinforced with 6-by-6-inch wire mesh; in some cases we will add #4 rebar. If the grade falls off badly, we dig holes for piers and cast a hidden grade beam to retain the fill below the slab. Narrow walkways don't need reinforcing.

Control joints. Unless the slab is very small, it should have control or expansion joints to prevent it from cracking. Some contractors will pour areas up to 15 feet square without using control joints. We don't like to go bigger than 10 feet square without a joint. We avoid slabs smaller than 5 feet square because they're more likely to shift.

There are many ways to create expansion joints. Sometimes we'll break up an area by casting 1x4 cedar boards into the slab (Figure 6). The cedar is set flush to the top of the forms, held in position with nails. It gets used as a screed strip when the concrete is placed and becomes a part of the design when the slab is finished.

Control joints can also be made by kerfing the slab when it's partially cured or by pouring the concrete around a plastic or compressed fiber joint. The plastic is not very attractive, but it's a good choice around pools because it can stand up to the constant wetting. Fiberboard, on the other hand, is ugly and rots a lot faster than wood. It's typically used for commercial work and is covered by caulking the joint.

Cedar looks the best and holds up well as long as it remains tightly wedged in place. I've seen strips that look fine after 20 years, but if the concrete shifts, the cedar can rot out in four or five years. At that point, a repair can be made by inserting a new strip, shimming it tight to one side, and filling the remaining space with cement grout.

Figure 6. These cedar control joints divide the slab into sections that can be poured one at a time.



Figure 7. When the concrete can't be poured from the truck, it's transported in wheelbarrows and placed a section at a time.



Placing the Concrete

For maximum strength, the concrete should be as stiff as possible when it's poured. We prefer about a 4-inch slump; any stiffer and it's hard to spread. There's a limit to how much concrete you can place and finish before it starts to set. If the slab requires more than 8 or 10 yards of material, we'll pour on successive days. The cedar expansion joints provide natural stopping points when there's a need to break up the pour. The dropped areas also function as control joints and are another convenient stopping point.

We either pour directly from the truck or transport the concrete in wheelbarrows (Figure 7). Pumping is not usually an option, because most of our work is in existing neighborhoods and there is nowhere to dump the excess material that is left in the hoses.

The size of the pour depends on the weather: We do bigger pours in cooler

weather, smaller ones when it's hot. We also take into account the weather from previous days, because it can affect the temperature of the ground and of the stored material that goes into the concrete. We can offset the impact of the temperature by putting accelerant or retarder in the mix. Neither of these additives will affect the way the aggregate finish looks.

Once the concrete is placed, we spread it with a rake and screed it level to the top of the forms (Figure 8). The surface will be generally flat, but we flatten it even more by bull floating from multiple directions (Figure 9). If we time everything properly, the concrete will begin to set shortly after it's bull floated.

The concrete is ready to finish when the bleed water has evaporated and the surface is hard enough that you can barely push your finger into it. We use a hand-held magnesium float to flatten the slab further and fill any holes in the surface (Figure 10). Some guys will go over the surface yet again with a steel trowel. This makes for a smoother surface on many types of concrete but it will not produce a noticeably better finish when the aggregate is exposed. We usually float the surface and leave it at that.

Exposing the Aggregate

The aggregate is exposed by removing between $\frac{1}{16}$ and $\frac{1}{8}$ inch of cement from the surface. The tops of the uppermost stones will be visible, but will remain firmly encased within the slab.

During my early years in the trade, we washed the surface with water and used brooms to scrub away the top layer of cement. This method requires careful timing. If you start too soon, it dislodges the aggregate; if you wait too long, it takes a wire brush to get the cement off.

Nowadays, finishers use a chemical retarder to slow down the rate of setting at the surface of the slab. The product we use is mixed with water and sprayed onto the freshly floated surface with a



Figure 8. The expansion joints are flush to the forms, so the author's crew can level the concrete by screeding across them with a strike-off board.



Figure 9. A bull float removes any unevenness produced by striking off the concrete.



Figure 10. Here, the author uses magnesium hand floats to do the final surfacing of the concrete. This is the last thing done before the retarder is sprayed onto the slab.



Figure 11. The aggregate is exposed by washing away the top layer of cement. While most of this slab is already hard, the top layer is fresh because it was sprayed with a retarder.

pump-up garden sprayer. Oil-based products are also available. The retarder has some color to it so you can tell if you've missed any spots, but it will not stain the concrete.

Most retarders hold the set for up to 24 hours. Many manufacturers recommend covering the surface with plastic

and waiting several hours or even overnight before washing the slab. However, there is some risk to covering the slab and washing the surface the following day. If the weather is hot, the retarder might not hold the set until you get back. At that point, it may still be possible to expose the


aggregate, but it will take a lot more brushing. If the plastic should blow off, the surface may dry so much that it's hard to expose the aggregate.

We prefer to wash the slab as soon as it's firm enough to stand on. In warm weather, it will be ready an hour or two after floating. All it takes to remove the cement is a good stream of water and some light sweeping with a broom (Figure 11, previous page). Once the excess cement has been removed, the concrete should be allowed to cure in the normal way.

Insetting Masonry Bands

A day or two after the slab is poured, the crew comes back to install the decorative bands (Figure 12). Many contractors set the masonry with Type N mortar; we use Type S mortar because it forms a stronger bond.

Masons who are accustomed to building walls may be tempted to fill joints with the same mortar that's in the setting bed and strike them off with a tool. We prefer to use cement mortar and treat the joints as if they were the grout lines in a tile floor. Standard mortar contains portland cement, sand, water, and hydrated lime. Lime makes mortar easier to work with, but it also reduces its durability. Cement mortar contains no lime, so it's more akin to concrete.

The cement mortar is mixed wet enough that it can almost be poured into the joints. After it starts to set, we scrape and sponge away the excess material (Figure 13). This type of joint will last much longer than a tooled joint because it's flush to the surface and won't collect water. I've seen horizontal surfaces grouted this way that are still in good shape more than 30 years later. 

Ron Sansone is a second-generation concrete contractor with more than 40 years in the trade. He owns Ron Sansone Construction in Pacific, Mo.



Figure 12. At left, the author's crew cuts stone to form an inset medallion in an aggregate finish driveway. Below, a brick head course set into a patio waits to be grouted.



Figure 13. Here, crew members have grouted the masonry joints. They will finish them by screeding flush to the brick and sponge-cleaning the area with water.