

WORKING WITH FLAGSTONE

by Carl Hagstrom

Few materials offer the beauty, durability, and tire resistance of a stone floor. A good run of stone can be almost as smooth as tile.

In northeast Pennsylvania we are blessed with an abundance of a flagstone we call bluestone because of its bluish-grey color. The quarrymen blast down to a flat table of stone, where individual stones are cut and removed, using a mobile wet diamond saw and wedges.

The standard sizes range from 1x1 to 2x3 feet, in 6-inch increments. The stones are cut a half inch short of their nominal dimensions, to allow for mortar joints. Thickness ranges from 3/4 inch for smaller stones to 3 inches for the largest. Stones can be custom ordered in virtually any size: I've set hearthstones that measured 3x5 feet by 4 inches thick, and have often had stair treads and mantle stones specially sawn.

Laying Out the Floor

A flagstone floor should start with a scale drawing on graph paper. This eliminates confusion as to which stone goes where, and provides a list of the sizes and quantity of stones. The most appealing patterns usually have equal numbers of large and small stones, and no long continuous joints in either direction.

Squareness of layout is a must. Getting halfway done and having to trim stones because of an out-of-square layout would be a nightmare. I screw 1x2-inch wooden strips to the walls around the perimeter of the area to receive stone, and tack finish nails every 6 inches to represent the centerline of the joints. By pulling string-lines from these nails, I can check the positioning of any stone. This also enables me to measure and make all cuts in advance.

Cutting is most easily done with a circular saw and masonry blade. I do it outside, and stand upwind from the

saw, while wearing eye, ear, and lung protection. When making full-length cuts, the surface should be scored 1/4 inch on both sides, then snapped. Narrow strips and pockets have to be cut completely through. Think of it as if you were cutting through large tiles.

Preparing the Stone and the Substrate

Setting flagstone is also similar to setting floor tile. If the substrate is concrete, it should be clean, dry, and well cured. If the substrate is plywood or dimensioned flooring over wood joists, deflection must be limited to 1/360 of the span. When applying stone over wood substrates, a cleavage membrane such as 15# tar paper or 4-mil plastic is installed, followed by galvanized expanded metal lath loosely nailed, with edges overlapping by 2 inches.

Stones should be cleaned thoroughly on both sides with plain water to remove all the residue of dried cutting slurry the stone picked up from quarry Sawing. As you wash, look for and reject stones with cracks or signs of delamination, and scrape off any scale. Set the stones aside to dry. I usually start the day by washing the stones, so they will be dry when I get to them.

Mixing Mud: Keep it Dry

To determine the depth of the mortar bed, plan to make it 3/4-inch thick under the thickest stone you will set.

The mortar bed is composed of one part portland cement and four-to-five parts clean sand, by volume. When mixing by hand, combine the dry ingredients in a mud pan and mix thoroughly, then add water and stir. When the proper consistency is reached, you should be able to pack a good "snowball" with it. It should be much drier than brick or block mud.

Resist the temptation to make a wetter mix. Although a wet mix is easier to handle, any advantage is offset by ex-



Mortar must first be worked into the lath (top). If a large stone is to be set, a straightedge can be used as a screed to prepare the mortar base (center). Once the stone is set, it must be beaten in (bottom).

How to work heavy and uneven stones into a practical and beautiful floor

cessive bleedwater and drifting stones.

Keep in mind that the mud is caustic. Use plenty of lotion to keep your hands from drying out, and use rubber gloves when you clean the tools. "Here's mud in your eye" is only good for toasts. If mortar gets into your eye, flush it out with a lot of water.

Setting the Stone

As you prepare to set a stone, examine it carefully. Think of it as a piece of wood, choosing its best face, noting any cups or warps. Also look for any variance in thickness, as one corner may be 2 inches thick while its diagonally opposite corner may be 1½ inches. This must be compensated for in the mortar bed. Picture the stone in place so you will know which area of the mortar bed should be thicker.

You may wish to use masking tape on the top edges of the stone to prevent staining from mortar oozing up between joints. As you gain more experience, masking will no longer be necessary, but I recommend it until you are comfortable without it.



For an appealing pattern, mix large and small stones and avoid long, continuous joints.

Choose the individual stone you are about to set and prepare a mortar bed for it. Since there can be up to 2 inches difference in thickness from stone to stone, preparing an area for more than one stone is impractical. Think of the mortar bed as a miniature concrete pour.

If installing over wood substrate, first work a thin layer of mortar into the wire lath, forcing it under the lath. "Neat cement" should be used to coat the underside of the stone. If you have a concrete substrate, neat cement should be used to coat both the substrate and the underside of the stone.

Neat cement is a mixture of portland cement and water, mixed to a consistency of heavy cream and allowed to slake for five to ten minutes. Mix only what can be applied in an hour, and apply with a brush or trowel to a stone or concrete substrate that is completely dry. Unlike bricks or blocks, the stone draws little moisture and offers little mechanical bond. The neat cement coat insures a chemical bond between the stone and the mortar.

Beating In the Stone

I use a small wooden straight edge to prepare the mortar base for larger stones, and a trowel to prepare the base for smaller stones. The base should raise the stone 1/8 to 1/4 inch higher than the level of the finished floor, so that the

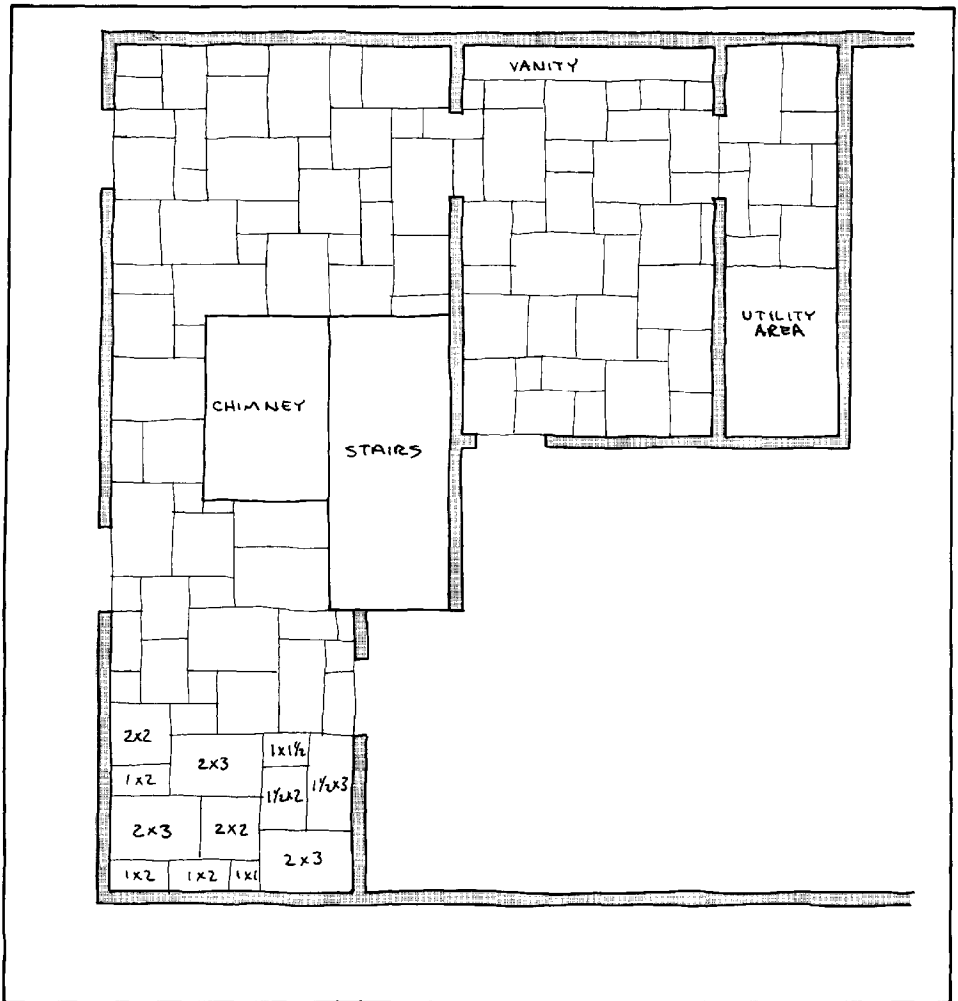


Figure 1. A scale drawing should be the first step in planning a flagstone floor. It reflects the stone sizes that are available and eliminates any doubt as to which stone goes where.

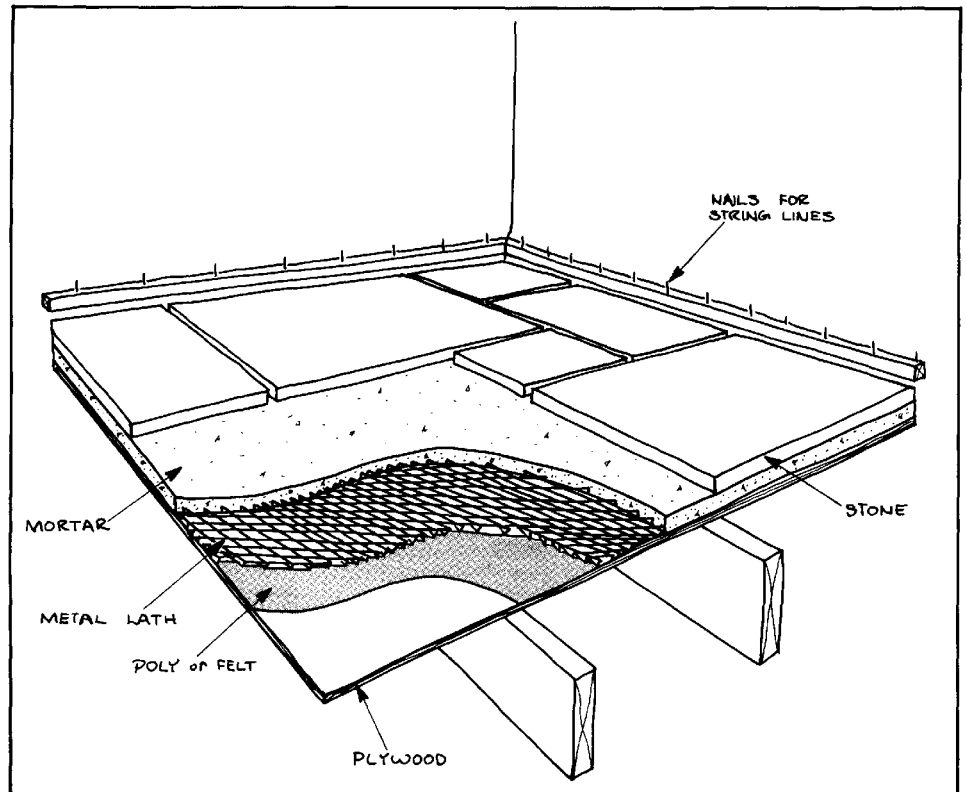


Figure 2. A plywood substrate should first be covered with either plastic or tar paper, then metal lath, then mortar. The nails around the perimeter are at 6-inch intervals, so that stringlines can be pulled to check the positioning of the stones.

stone can be beaten in to the mortar.

Set the stone on the prepared mortar base. If a stone is flush or lower than the adjacent stone, remove it and add mortar. If a stone projects more than 1/8 to 1/4 inch, remove it and reduce the mortar base. It's easy to remove a 1x1-foot stone, but no fun to remove a 2x3-foot stone that's 3 inches thick and weighs 180 pounds. Do your best to prepare the mortar bed properly, especially for the larger stones.

Once the new stone sets 1/8 to 1/4 inch "proud," above the level of the adjacent stones, I beat it in with a rubber mallet until it is flush with the adjacent stones. This levels the stone, and also creates a hydrostatic tension between the mortar and the stone. This tension can be strong enough to make it difficult to remove the stone, even immediately after beating it in.

On large stone (2x2-feet and up) it's often necessary to work a high corner down. Have someone stand on the stone, to apply point pressure as you beat it in.

When setting a large stone, I set two wooden 2x3s on the mortar bed, position the stone, lift the stone up and remove the boards, then set. With a 180-pound stone, this becomes a three-person operation. I use the end of a Stanley Wonder Bar with the 90-degree bend to lift and lower the stone. If you value all 20 of your digits, then gloves and steel toes are recommended.

Raking and Grouting

Remove excess mortar as it works its way out of the joints, and leave the joints 1/2 inch low to accept grout. I also keep a wet sponge handy to wipe up any bleed water that finds its way onto the face of the stone.

The distance between control joints varies from job to job. I use the same guidelines for control joints as with floor tile. The mortar in the control joints should be raked out completely, then the joint should be caulked.

After all the stone is set and the mortar is dry (24 hours), grout the joints. I use standard floor tile grout with a latex additive instead of water. To apply, I use a grout bag (Goldblatt Tool Co., Kansas City, Kan.) which looks and acts like a large cake decorator. Mix grout according to the directions, till the bag about half way, and go to it. Fill the joints completely, as any excess can be cut off with a trowel. As the grout tightens up, tool the joints smooth with a tuck pointers trowel.

The Finishing Touches

During the whole process, use care not to get mortar stains on the stone. Few things are as difficult to remove. Muriatic acid may work, but it's a nasty job, and it may discolor the joints. If you must use acid, wear rubber gloves and eye goggles, and don't breathe the fumes.

When the job is complete, I seal the floor with Terrazzo Sealer (M.A. Bruder and Sons, Inc., Philadelphia, Pa.) as it does not change the appearance of the stone.

Bluestone, the type of flagstone I use, currently costs \$1.20 per square foot at the quarry. The price rises considerably in other locations, depending on how far it is trucked. Installed costs range from \$5 to \$8 per square foot, depending on the difficulty of layout and the amount of cutting. That puts it in the same general price range as tile, and it is an attractive alternative that is preferred by many of my customers. ■

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