A Stone Veneer Foundation

I'm no stranger to brick and block, but I've worked with stone for over 25 years. I prefer the look and the challenge of stonemasonry, so,

by Charlie Thomas

early on, I began to specialize. I've worked with a wide variety of materials, including quarrystone, which is relatively geometric in shape, and fieldstone, which is rounded and randomly shaped. Each stone type requires a specific layup technique. In this article, I'll explain how I apply a fieldstone veneer to the face of a building.

There's no question that you can support a massive structure on a solid stone foundation, but for reasons of speed and economy, foundation stonework has mostly been relegated to the function of cosmetic veneer. Unlike man-made concrete "stone," which is made with a flat back for veneering, real stone can't be simply glued to the wall and the joints grouted. Solid stone veneer starts at the footing, set in mortar, one rock at a time.

As an approximate rule of thumb, it takes about one ton of stone to lay 40 face feet of veneer, but this varies somewhat depending on the type of stone. Because it's more uniform, quarrystone more closely fits this calculation than fieldstone. When ordering fieldstone, I figure about

Figure 1. Material and time are saved by using concrete masonry units in areas that will be backfilled or otherwise concealed — in this case, by a fieldstone step.

25% over the basic square-foot coverage. Depending on the details in the veneer, including windows and doors, corners, and ledges, and the type of stone, stone veneer in my neck of the woods ranges between $25 and $75 per face foot, including labor. Fieldstone falls into the lower to middle price range.

Preparing for Stone

A supply of fieldstone doesn't arrive on site neatly stacked on a palette. Instead, it's dumped in a pile, as close to the installation site as possible. Stones must be individually selected, both for aesthetic composition and for various corner and transition detailing. To do this, you have to spread out the pile. And, to keep the work supplied, we scatter selected stones all along the work perimeter, on the staging, and at intermediate depots. In short, stonework requires considerable time and real estate and may interfere with other, ongoing work. An average day's work covers only 10 to 20 face feet, sometimes more, depending on the level of detail. I make sure the builder understands this and adjusts the construction schedule accordingly.

Footings. To support a stone facing on a block or poured concrete foundation, the footing has to be wide enough for both the wall and the veneer. For example, if the proposed veneer will be 8 inches thick, the footing must be 8 inches wider than standard, assuming that a standard footing projects at least 4 inches beyond both sides of the foundation. The additional 8 inches must favor the outside of the wall, giving me a 12-inch-wide base (8 inches plus 4 inches) to build on. There's no point in wasting stonework below grade; if I'm veneering a foundation where only the top foot or so is exposed, I'll build up from the footing with concrete block to within a few inches of finished grade, then switch to stone (see Figure 1).

Drain tile. While we're working on a wall, it's essentially a falling rock zone. Because of the potential for damage to a perimeter drain system, it's best to wait until the masonry work is complete before installing the perforated pipe.

Before I get started on a veneer, it's important that the foundation be damp- or waterproofed. Moisture is certain to penetrate the stonework; in fact, the stone "wythe" is separated from the wall behind it by an approximate 1-inch-wide drainage gap. Because mortar droppings behind the wythe could interfere with proper drainage, a free-draining backing material is commonly applied behind the facing. I use Mortar Net, a 90%-open-weave, high-density polyethylene mesh. Technically, you need the mesh only at the base of the stonework, just above a flashing transition, and above any lintel or opening, such as a window or door. Those guidelines are okay for brick or blockwork, but you can lose a serious quantity of mortar down the backside of an irregular fieldstone layup. Although not essential, it's a good idea to run the backing material full height. Weep holes at the base of the veneer, and above any flashing, allow the moisture

to drain back out of the wall. A short "wick" of natural fiber rope, installed in the masonry from back to front, ensures that masonry droppings won't block the drainage (Figure 2). After the rope rots away, an open weep hole remains.

Extreme standards. Standard masonry practice permits excess mortar to contact the backing wythe or wall, across the void, provided that a drainage cavity and weep holes have been established at the base. On the job reviewed in this article, however, the architect called for a pristine, mortar-free void behind the veneer, and a strict insistence on water-resistant detailing — the location of this house is subject to heavy overspray during coastal storms. To make sure the veneer is as impervious to water penetration as possible, we were careful to completely fill all voids with mortar. While Type-N mortar is generally adequate for above-grade work with normal exposure, we worked with Type-S mortar, which approaches the maximum tensile bond value obtainable with Portland cement or lime mortar. Type-S also provides good flexural bond strength, important for resisting lateral wind-loading. There's a lot more to mortar specification than meets the eye, or will fit in this article. I periodically check my practices against those analyzed in *Masonry Design and Detailing* (McGraw-Hill, 800/352-3566; www.mcgraw-hill.com), which is intended for use by architects, engineers, and contractors.

Layout. On a ground-up installation, we start with a chalk line to establish the running plane of the stonework. We use some of our largest stones at the base of the wall but mix in various sizes for aesthetic balance. After the baseline is laid, we establish the faceline. We stretch plumb and diagonal control lines from bottom to top and corner to corner. Some stones may protrude beyond, and some fall back from, the faceline, but we apply the rule of average, overall plumb. Your eye is as important as the string in keeping the work in line as you go. Although I work with a fairly stiff mix, wet mortar tends to slump under the weight of the stone, so I repeatedly backtrack and thump the stones into place with a rubber mallet until the mortar stiffens.

Figure 2. To ensure that any water that penetrates the masonry veneer will drain out again, a narrow void behind the face wythe is protected from mortar droppings by an open polyethylene mesh. The supporting wall has been waterproofed with a sprayed-on membrane. A natural fiber rope wick, inserted at the base of the veneer, prevents mortar from clogging the weep hole.

Wall ties. Veneer masonry is essentially an interdependent structure, because it relies on an adjacent, structural wythe or wall for its lateral stability. Steel wall ties provide a positive connection across the mortar cavity. Because the ties are flexible, the two parallel surfaces can move and settle independently. A wall tie is a simple, corrugated strip of galvanized steel, nailed or screwed to the supporting wall at regular intervals — about one per square foot. The corrugations enable the cured mortar to securely grab the tie. When I do an oceanfront job, I use stainless-steel ties to resist salt corrosion. At $1.50 each, you won't find any lying around on the ground. To fasten the ties to a concrete foundation wall, I use Ramset (powder-actuated) nails, unless the location is too close to a corner or other fragile section that might break away under impact. I use Tapcon screws in those locations. These thread directly into a $^3/_{16}$- or $^1/_4$-inch-diameter hole, drilled into the concrete. A decent hammer-drill and screwgun make short work of it.

For a fieldstone facing, you can't work ahead, attaching ties along a predictable

Figure 3. Dovetail channel provides a flexible attachment system over cast concrete (left). The proprietary ties wedge into the channel anywhere along its length (right).

Figure 4. The structural integrity and visual continuity of an outside corner depend on a careful, sequential left and right distribution of stones. This requires both sides of the corner to be worked simultaneously.

chalk line. Instead, ties go up one at a time, along with the stones.

Where the veneer makes a transition from foundation to framing, I use 3-inch ringshank nails to attach the wall ties directly to framing members, and never to the sheathing alone. To protect a wood wall from moisture, it should first be covered with a double layer of 15-pound saturated felt, with successive top sheets overlapping the course below. If the felt gets damaged or torn, I replace or repair it, paying close attention to overlaps for proper drainage.

Channel ties. This job also featured a series of cast, reinforced-concrete columns, supporting a second-story deck. To attach the stone veneer, we resorted to an alternative tie system, known as dovetail channel. Cast into the concrete, the channel runs continuously up all four sides of each column. A corresponding wall tie can be rotated and locked into the channel anywhere along its length, so it works well with an irregular stone facing (Figure 3). There's no need for a drainage gap around the columns, so the stone was laid hard against the concrete and thoroughly mortar filled.

The Right Mortar

To get conventional mortar to stick, brick and block must have a balanced moisture content. If the masonry unit is too dry, it will draw water out of the mortar and interfere with proper hydration — in other words, you don't get a proper bond. If the unit's too wet, it won't stay in place while it's being laid up. Fieldstone, on the other hand, should be kept and laid dry. The fieldstone I work with is predominantly granite, an igneous, nonporous stone that neither contains nor absorbs any significant moisture. Fieldstone is also smooth, rounded, and prone to rolling. If its surface is wet, it'll slide around in the mortar and you'll chase your tail trying to get it to stay put. To securely bond fieldstone to the mortar, you've got to eliminate mortar shrinkage — CMUs will play along with mortar shrinkage, but stone won't. Instead, it will loosen or even fall. To make the Type-S mortar as dense and stable as possible, I used fine-screened sand aggregate — coarse sand aggregate in the mortar can leave myriad air pockets, giving the mortar poor resistance to water penetration — and added Umaco Add Mix-21, an acrylic agent that is said to improve mortar bond to smooth, dense-surfaced stone. The admixture is also supposed to help reduce shrinkage and improve the mortar's flexural and tensile strength.

Type-S mortar is a "hotter" mix with a relatively short working life — I've got about 45 minutes to work my way through a one-bag batch before the mix becomes too stiff to use. I typically lay up about 4 face feet per batch on an 8-inch-thick veneer (thinner veneers consume less mortar). My assistant keeps things moving by selecting and stockpiling stones and keeping the mortarboard full.

Finishing corners. Done properly, outside corners have a wrapped, con-

tiguous look — a running vertical mortar joint would disrupt the aesthetic continuity of the veneer. More important, by turning alternate corner stones in opposing directions, and concurrently working both sides, we ensure the structural integrity of the corner (Figure 4).

Bridging openings. If the veneer continues above a penetration in the wall, such as a window or door, you have to bridge the opening and support the considerable weight of the veneer above. There are many ways to do this, falling into two main categories: use a beam or lintel of stone, steel, or reinforced concrete; or lay up a compressive arch, which may be elliptical, semicircular, parabolic, or even flat. Each construction sequence requires extensive description, worthy of a separate focus that you won't read here.

Keeping the Weather Out

Where stone meets millwork, siding, or trim, the transition must be sealed against water entry. Usually, there'll be an inward shift in the wall plane at the transition from stone to trim. I back, or spline, the interface at vertical transitions, like door and window casings, with a double layer of 15-pound felt, taking care to overlap it properly for positive drainage. Rather than work to the finished trim, I prefer to screw a temporary placekeeper in position to define the outside edge of the casing, and grout the mortar to it (Figure 5). Later, the permanent trim is bedded in a bead of caulk against the cured mortar. The caulk, like the stone veneer itself, provides a primary barrier against water infiltration, but the detailing of the felt underlayment is critical to prevent hidden water damage. Positive drainage and a properly installed mortar screen at the base of the wall provide insurance against moisture problems.

Because the veneer and the window and door heads on this job all terminated at the underside of an upper deck, we had no bridging lintels and no head casings to weather-detail. But a window or door head casing would be flashed much the same under stone as under any other siding material. Metal Z-bar head flashing with its wall flange properly overlapped by the felt underlayment provides standard protection.

Unless the building frame fully overhangs the foundation, or there's a special siding detail like a flared skirt that accommodates the full depth of the veneer, the exposed top of the veneer should be protected in a watertight manner. A custom-sawn limestone cap is a classy, simple, and expensive way to top off the veneer (Figure 6). Sheet copper or lead can also be used to flash the top of the veneer, just like flashing

Figure 5. A temporary stick stands in for the window casing during mortar pointing (left). The permanent trim will be bedded in caulk against the cured masonry edge. Stringlines control alignment, and a custom-sawn limestone sill finishes the bottom of the window surround. The author used a section of wood sill molding as a gauge block to position the limestone (above).

Figure 6. It's important to protect the top of the veneer from water penetration. Here, a sloped limestone cap delineates the transition from stone to wood siding.

Figure 7. The author carved the mortar joints to complement the irregular stone surface.

Figure 8. A mild acid wash removes residual dirt and encrusted cement from the finished veneer. The film of Portland on the exposed mortar also dissolves, exposing the natural color of the sand aggregate.

Sources

Mortar Net USA, Ltd.
Gary, Ind.
800/664-6638
www.mortarnet.com

Umaco
Lowell, Mass.
800/442-5535
www.umaco.com

ProSoCo
Lawrence, Kan.
800/255-4255
www.prosoco.com
Sure Klean 600

an exterior skirt board.

Topping the wall. Because fieldstone is irregular in shape and size, it can get a little tricky leveling off at the top. You've got to have a generous variety of stone on hand to choose from, in order to work square corners and wind up with a relatively flat, uniform wall cap. We stretch a tight, horizontal line to represent the coping, or top of the wall, and work carefully to it, picking flat-faced stones that can be turned to create a regular, running ledge.

Signature joints. There are plenty of ways to finish a mortar joint — in fact, the way joints are handled can be part of a mason's personal style. For this fieldstone veneer, I faceted the mortar to emulate and blend with the general surface (Figure 7). This gives the veneer an overall "soft," unified, and natural look. I waited until the mortar stiffened and carved it with a flat joiner, which has a thin, offset blade. Quarrystone features regular, geometric shapes and looks better with a raked, or recessed, joint, because it accentuates the pattern.

Brushwork. Before the tooled mortar and droppings harden and stick, I clean the wall and joints with a soft nylon-bristle brush (Figure 8). Brushing removes tooling marks, softens the appearance of the joints, and leaves the veneer looking relatively clean. The fieldstone still has a patina of dirt and cementitious drool on it, though, which we remove with a final, diluted acid wash. I use Sure Klean 600, diluted about 6:1 with water and applied with a low-pressure sprayer, followed by a thorough fresh water rinse. The solution does a nice job of cleaning the stone and removes the haze of Portland from the exposed mortar aggregate. The natural color of the sand is revealed and blends beautifully with the surrounding stone.

Charlie Thomas *owns Charles Thomas Stone Work in North Eastham, Mass.*