

Working with Stone Foundations

by Al Ulmer

Every day, stone foundations like those scattered throughout much of New England—foundations built with outdated materials and designed to meet the requirements of another era—are threatened by the demands of modern times. Consider the following scenarios:

- Taking care not to nick the old stone foundation, the backhoe operator sets his outrigger pads next to the building, hikes its seven tons up into the air, and begins to cut a ditch for a new sewer line.

- A 15-ton garbage truck squeezes into a tiny parking lot created when an old house was converted into apartments. The road ripples as the truck creeps past the window wells in the stone foundation.

- Half a mile away from an old farmhouse, the blaster sets his charge, the mats are dropped, and blasting is under way for a new road. Back at the farmhouse—situated on the very same outcrop of rock as the new road—the rock shudders, fracturing every old lime mortar joint in the stone foundation.

These stories—and the lawsuits that often accompany them—are more common than you might imagine. The damage is considerable, and in many cases, avoidable.

Man-made forces are not the only pressures that threaten old stone foundations, of course. The inevitable effects of age and gravity are the most obvious, but there are others.

Perhaps a gutter breaks after a heavy, wet, early-winter snow, allowing water to drain directly onto the stone wall below—for three months of freeze/thaw cycles. Or perhaps a rotted plate beam gives way and much of the house's weight settles on one flat stone in the dry-laid stone foundation beneath, causing a bulge to fatten.

The fact is that old stone foundations today are under attack from a variety of offerees: heavy equipment, poor maintenance, acid rain, partial repointing, structural modifications, blasting, road vibrations and even the work of plumbers, electricians, builders and remodelers. The fact that most of them have been built by amateur masons with low-quality stone and a weak lime-and-sand mortar doesn't help matters.

What's a stone foundation to do? If we begin with an understanding of how they are built, we can then examine how they can be maintained, repaired and modified.

The foundations with which I am most familiar are located in Chittenden County in northwest Vermont, but are fairly typical of stone foundations found throughout the Northeast. They are fairly evenly divided between those built with field stone and those built with quarried stone. Field-stone foundations can be divided again into those built with mortar and those laid dry.

Although the quality of foundation stonework varies considerably from house to house, it generally is inferior to any other masonry work in a house.

The reasons for this are obvious. The work wasn't done for show—after all, basements were used for food storage and not much else—and most of the good materials were saved for above-ground work, where it would be seen. In addition, the work was done by laborers rather than craftsmen. Over the years, these rough standards of work had proved quite successful—witness the number of such houses still standing.

How They Were Built

In building dry field-stone foundations, techniques used for hundreds of years in building stone farm fences were applied to house foundations.

The stones needed to be laid in their natural bed, so flat stones were greatly pre-

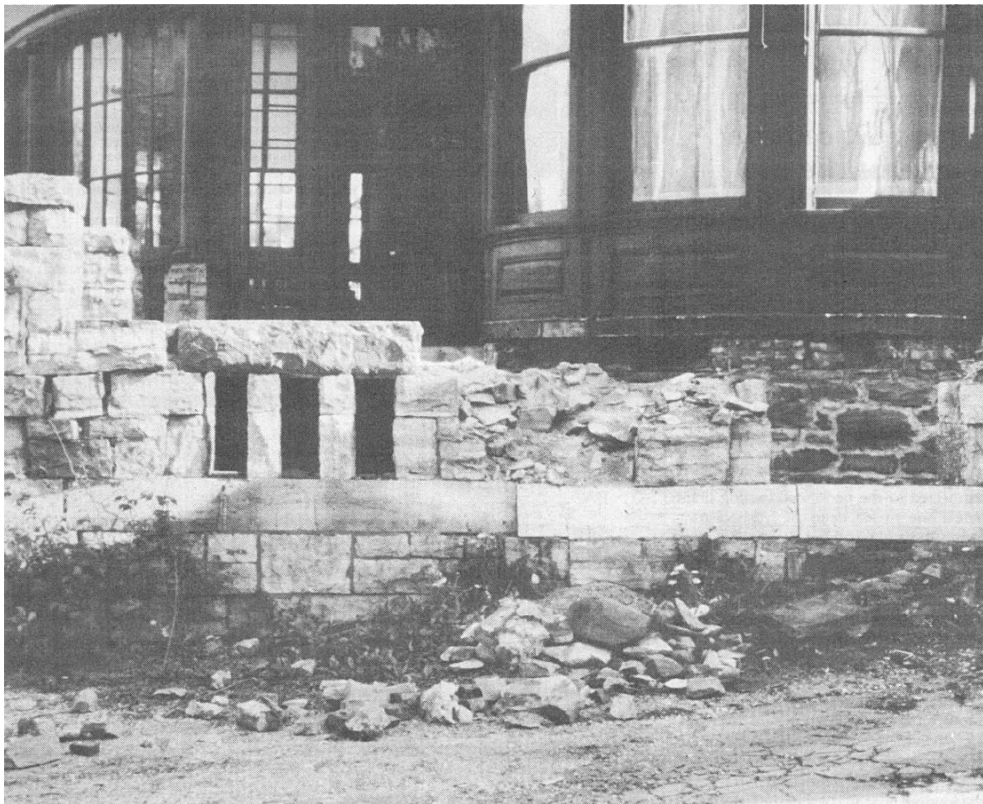


Photo by Al Ulmer

ferred. Each stone had to break bond with the stone below it, and sufficient quoins (stones that are laid through the wall) were required for strength.

Gaps or holes in the wall were filled with spalls, or small stones, which were driven firmly into any holes. Finally, the entire founda-

tion wall was built about twice as thick as the wall resting upon it.

These dry walls worked well under many conditions. They let water through, of course, but as a result they were not threatened by hydraulic pressure. They tended to be weak at the corners, but because they generally ran for some distance, they were they are sufficiently strong.

If you re-point the inside of an old wall that has water pressure against it, you simply increase the hydraulic pressure.

Because they lacked mortar, however, the weight was not distributed evenly, so points of stress were common. And anything that

either should be left totally alone, or they should be entirely rebuilt.

Mortared field-stone foundations have their own problems, especially when it comes to the mortar. If a house is more than 80 years old, chances are that the mortar is a lime-and-sand mixture with perhaps clay and horsehair added. This mortar cannot stand up to repeated wetting; the lime leaches out and then the sand starts trickling down.

After a lifetime of masonry work, my father liked to say that he still didn't know

whether the purpose of the mortar was to keep the stones together or to keep them apart. The answer is that mortar should do both.

The use of mortar in a stone foundation helped distribute the weight of the house more evenly, and it enables us to cut into the wall without causing major problems.

But it also allowed masons to cheat a bit: They could use stones that were not quite suitable for dry walls. What usually happened as a result—and what we often see in stone foundations today—were huge mortar joints, stones perched precariously in the wall, and inconsistent bond breaks between the stones.

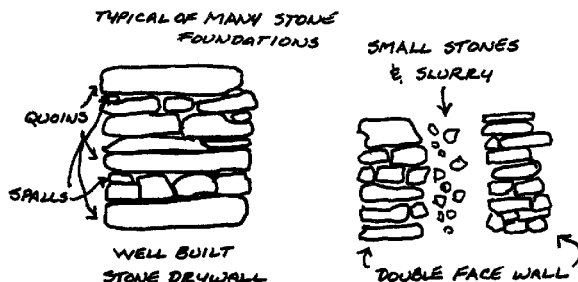
This, in turn, causes these old walls to really suffer when the mortar is attacked by water and begins to break down. It's not unusual to take apart a wall like this and find nothing between the stones—but sand flecked with particles of lime. You can scoop it out with your hands as the stones fall.

Field-stone walls usually were built with two faces and a middle; quarried-stone walls almost always were. In general, the inside face would be laid with some care, but with stones considered unsuitable for the structure above ground. After the inner wall was erected, the outside face would be brought up as well.

The void between the two faces would then be filled with small and broken pieces of stone—those that were too irregularly shaped to be laid—and a slurry of mortar. Often the mortar was simply poured in. In some cases, the outside work set first and cut off air to the middle of the wall, so the slurry in the middle never set properly. As a result, these walls often are much weaker than their bulky appearance suggests.

How to Repair Them

The key to working on an old foundation is to first determine exactly what is to be expected from it. If a watertight basement is



the goal, there are two options: You can jack up the house, remove the stone and pour a new concrete foundation, or you can excavate the entire perimeter and parge both sides, install drain tiles, regrade the lawn and so forth.

If you simply want less water in the basement, maybe fixing the gutters and putting

a little stronger is one part lime to two parts sand and one-tenth part portland cement.

A little beige or tan color added to a point mix can "age" it slightly, as can a small amount of black. But be conservative. Color is tricky stuff, and a little goes a long way. In addition, color tends to fade, so don't panic if the color is too strong right after poin-

It's not unusual to take apart an old mortared stone wall and find nothing between the stones but sand flecked with particles of lime.

in downspouts will do.

Let's take the ultimate fix-up first: the foundation overhaul. This is an all-or-nothing job; it can't be done halfway. If you re-point the inside of an old wall that has water pressure against it, you simply increase the hydraulic pressure, the risk of frost damage, end up raising the water table, and still have a wet basement.

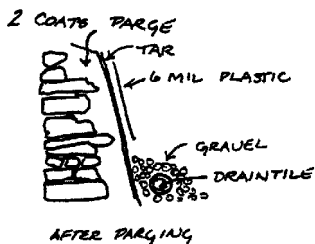
What you have to do is excavate the outside wall, install drain tile, parge and waterproof the outside wall and then repoint the inside wall.

Because these walls often were simply laid into the bank, the outside face can be very irregular. In these cases, spraying gunite might be the way to be begin. Or you might trowel



a rich mix of masonry cement (two and a half parts sand to one part masonry cement) into all the voids, then follow it up with a second coat of cement and a coat of asphalt waterproofing.

In exceptionally wet ground, six-mil plastic



stuck to the asphalt can be added before carefully backfilling.

Points on Pointing

For pointing the interior wall, this same mix works well. If only part of the wall needs repointing, however, try to match the original mortar. A lot of stone work is spoiled because of careless repointing, and foundations end up looking as if they are wearing different-colored socks.

To match mortar, make several trial mixes using different proportions of materials, and keep records of what you are doing. If a color has been used, take a sample of the mortar to a masonry-supply store and match it to a color chart or a sample in the store.

If this doesn't do it, take a sample of the mortar, grind it up and mix it with water. Shake the solution and let it settle, then read the layers of sand, lime and whatever to get an idea of the proper proportions to use.

The mortar should be as hard as the stone you are working with—but not any harder. A very soft shale or sandstone cannot handle a strong, brittle portland cement without cracking against it. The standard recipe for copying a white-lime mortar but making it

ting; it will fade to about one-third its intensity.

After excavating the old mortar, clean the wall thoroughly of all dust, then do your pointing, or parging, while the wall is still damp.

Pointing is tedious, but it is not that difficult if the mortar has been prepared correctly. It should be damp enough to make a pancake of it on a large trowel, yet not so wet that it slides off the trowel if it is turned.

I've also found that a good stainless-steel kitchen knife, bent slightly at the end, works better than most pointing trowels.

With the mortar flattened to the approximate thickness of the void you want to fill, force the "mud" into the crack and compress it. Don't attempt to cut off the excess yet, as the water in the mortar might stain the stone. Wait until the mortar has dried slightly, then trim the point up and restroke the surface.

The more you go over a point, the more cement you pull to the surface—and, if you are using portland cement, the lighter the finished point color will be. So try not to go over some points more than others.

Throughout all this work, be sure to wear adequate respiratory equipment. Lime mortar is extremely caustic and the dust is very fine—and therefore dangerous.

Finally, points in some old houses may be raised (either squared or rounded) or have a "grapevine line" through them. You can match this point in your work with grapevines or extruded jointers, which are available at most masonry-supply stores or through supply catalogs.

Show Some Respect

Keep in mind that old stone structures—and even some of their imperfections—deserve respect. Perhaps a bulge should be accepted if it shows no sign of growing, or a shifted stone should be left alone if the wall would be upset even more by fixing it.

We've changed the rules of the game in recent years, adding a lot of stress to these walls. If we react to this stress with inappropriate or partial solutions, we risk compounding the problems.

If there is a crack in the wall, measure it over several months to see if it is getting larger. If it isn't, repointing should be sufficient.

Fix a problem at its source whenever possible. For example, repair the gutters and downspouts and run them out to daylight; fix flashing, sills and window wells to prevent water from dripping onto the wall; drop the water table with drainage tiles; regrade the yard to drain off surface water.

If you repoint the inside wall but not the outside, leave weep holes every few feet to allow the water to leak through. If you simply must have a dry basement, let this water run into some gutters cast in the floor and pitched to a sump pump.

With some basic preventive measures and a moderate amount of maintenance, most old stone foundations can keep doing what they've done so well for several hundred years: holding up houses. ■

Al Ulmer is a second-generation stone mason in Williston, Vt. He says he's never seen a stone that wasn't beautiful, although a few of them have just made it.