

FERROCEMENT

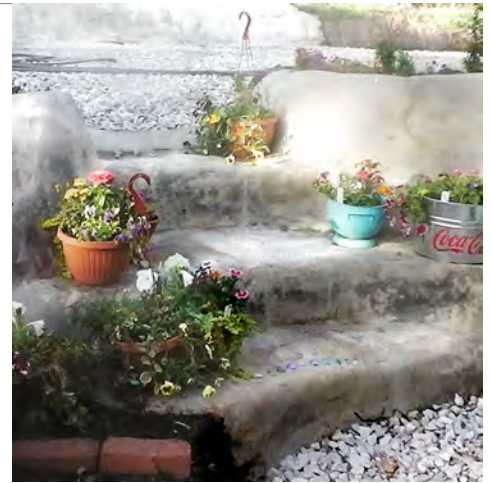


A Step By Step Instructional

Ferrocement is an incredibly beautiful way to sculpt durable, low-cost structures like patios, stairs, fire pits, underground greenhouses, retaining walls, cisterns, swimming pools and even entire buildings. It uses far less concrete than similar traditional structures and is a skill almost anyone can acquire. In this tutorial we will show you how to start with a simple project like stepping stones, and learn the same skills that apply to more complex structures.

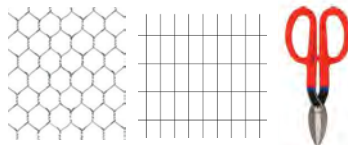
Stepping Stones

For your first experience with ferrocement, it's important to have a starter project to get familiar with the tools, materials and process before you take on something more challenging.



Materials

Chicken Wire
And/ or Hardware Cloth
Portland Cement (not a concrete mix)
Sand
Water
Embellishments- colored glass stones, ceramic pieces, etc.



Tools

Tin Snips or Hardware Snips
And/ or Wire Cutters (as needed)
Shovel
Wheelbarrow + Hoe (for mixing)
Or Cement Mixer
Buckets (5 gal or less)
8-10" Trowel with rounded edges
Rubber Gloves
Mask (optional- to filter cement dust when mixing)



THE ARMATURE- Is a form that the cement adheres to. It is the tensile strength of the structure and you can use anything from burlap, fiberglass mesh, chicken wire, hardware cloth, diamond lath, tensile wire, re-bar (various thicknesses) and other metal & non-metal materials. The stronger and more tightly woven the armature, the more durable your finished project will be. Just one layer of chicken wire is sufficient for stepping stones that will be handled with care, but to increase strength, add an extra layer of wire, burlap, hardware cloth, etc. Hold the layers together with a twist tie or zip tie if needed. Specific Design elements like curves and semi-circles also add strength to larger projects, as well as edges rolled under to create a rim or hidden reinforcement. Well built ferrocement structures have incredible strength and resilience. They have been known to withstand the force of earthquakes and hurricanes because they are not only strong, but also flexible. The concrete is applied only 3/4"-1" thick so that it binds with the armature, but is still able to flex under stress and remain unbroken.



SO LETS GET TO PLASTERING!

1. **Cut your wire armature (form)** and shape it as desired. 10"-12" stepping stones work great, but we've done them up to 2' wide! Set the armature onto a plastic tarp (so it won't stick) and raise it up a bit with some tiny stones underneath so that the cement mix is able to fully surround it. Make more armatures than you think you'll need so you have a way to use any extra cement mix.
2. **Using your shovel add: 1 PART PORTLAND CEMENT TO 3 PARTS SAND** to your wheelbarrow or mixer (it doesn't matter what size scoop you use as long as you take approximately the same amount each time, to keep the proportions the same.)
3. **Lightly mix dry ingredients** being CAREFUL not to inhale any cement dust (cement + water = concrete... you don't want it in your lungs. Please be especially careful with kids and *explain why* they don't want to breathe it!)
4. Add water until the mix resembles a stiff batter. You don't want it crumbly (it's very hard to work with and won't stick together right) and you don't want it soupy (it won't hold a shape- it will slump too much and will be weaker once it's cured).

YOU'RE READY TO APPLY THE MIX!

Scoop the mix onto your armature using your trowel, another tool, or even just your hand and spread it evenly over the surface keeping the thickness at about 3/4"-1". You want to make sure that the mix is pressed into all the crevasses first and then smooth out the top. Going over the surface too many times draws the cement out to float on the top, which weakens the bond. You will see it appear creamier and creamier the more you go over it- this is the cement being pulled to the surface. Poke a spare piece of wire into the project to measure the thickness from time to time to make sure it is more or less 3/4"-1".

*We enjoy free form shapes, but you can also create an edge around your Stepping Stone with a flexible piece of plastic or cardboard (covered with a garbage bag so it doesn't stick) connected together around the sides to give your cement mix a boundary. Be sure to remove the form in an hour or two and gently wipe the edge with a damp sponge to smooth it and knock down rough edges.

Don't be discouraged if you find that troweling is a fairly complex skill, and physically challenging. Many times when I'm sculpting I find it's easier to use my hands to apply the mix instead of a trowel. This creates less stress on my arms and wrists, and then I can use the trowel just to smooth the surface. You'll want to have a good pair of gloves because cement is fairly caustic (alkaline- think bleach). No worries though, you can counter the effects of the alkalinity on your skin by dipping them in some vinegar water after clean-up (it's acidic, so it neutralizes the alkalinity). I've had my hands in the mix for hours with not much of a reaction, and at the end, a little wash in vinegar water restores the Ph.



Embellishments

Before the cement sets, you can add embellishments like colored glass stones, pieces of mosaic tile, etc. For the stones to stay set, they must be embedded slightly over the edges, and be sure that any broken or sharp mosaic pieces are set just below the surface so they won't cut bare feet. You may want to apply a bit more mix over the top, and wipe glass pieces off with a damp sponge.

WATERPROOFING is the only component of Ferrocement not addressed in the Stepping Stones project. Cisterns, pools etc can be waterproofed with a final cement wash ratio of 1:10 (cement: water). The absorption of water in typical concrete is due to the many tiny holes that are left when it cures and the water evaporates. If need be, these can be filled in with a final, cement wash painted onto the surface just after the initial application.

CURE

Cement sets in 24-48 hrs, is partially cured within a week, but does not fully cure for up to 28 days. To achieve maximum strength, it must be kept damp during THE ENTIRE cure period (once it dries out, the cure is basically OVER) and keeping it fully covered with a tarp is extremely helpful (wind can be a real bummer for curing cement). However, not every project needs a FULL cure. We've had some Stepping Stones that we flopped down in place after 3 days. Most of them have remained in tact even after moving them several times. With our patio projects, we try pretty hard to keep them damp for at least 7 days, and they have always been fully functional with very minimal cracking. For a cistern I would definitely give it the full 28 day cure.



CONCLUSION

Beginning with a small project like Stepping Stones will familiarize you with the entire process and help you realistically assess the difficulty, time, labor and cost involved in something more complex. It will also help you see where it will be worthwhile to invest in good tools to make the jobs easier. Five years ago we bought the cheapest Harbor Freight (no we're not affiliated) cement mixer for around \$160. We've used it for many projects and it's still running strong. Worth it's weight in gold by now! There are a myriad of trowels out there. My husband has done quite a bit of plastering, so we've had lots of options to choose from. Our favorites for Ferrocement are 8"-10" and rigid or slightly flexible and *MUST* have rounded corners so you don't dig the edges in every time you go over the surface. We don't recommend traditional concrete tools like 2' long floats, because you're not trying to create a completely flat, manufactured looking surface.

The beauty of Ferrocement is it's organic shape and appearance, and it's important not to get hung up in trying to achieve uniformity, but to enjoy the media for what it is!

If this Tutorial has been helpful, and you'd like a little more in depth, visual guidance, we will be creating a How To Ferrocement Video to add to our upcoming REGENERATION-T shirt Kickstarter. Subscribe to our mailing list to receive notifications when the new content becomes available, and we'll send you an announcement when we Launch!



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