



TECHNICAL BRIEF

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CONSTRUCTING SEPTIC TANKS ON-SITE USING FERROCEMENT

Ferrocement is a system of reinforced mortar applied over a layer of metal mesh that produces a light thin wall but a very strong structure.



Fabricating the metal cage, that is, the structural support for the tank. Metal cages can be fabricated off-site for mass production and cost-saving purposes.



Wire mesh and mortar make an exceptionally strong and waterproof structure. Thinner and lighter than typical concrete construction.



Ferrocement septic tank under construction in Yopougon, a suburb of Abidjan (Cote d'Ivoire).

THE PROBLEM

In the urban slums of Abidjan (Cote d'Ivoire), delivering precast concrete septic tanks is often not feasible due to narrow roads that could accommodate a crane truck. Costs of plastic or fiberglass tanks are generally too expensive for the local population to afford. Ferrocement provides an option that is less costly and stronger than concrete block or brick construction. Such tanks can be custom fabricated on site.

ISSUES AND OPPORTUNITIES

The simple manufacturing technique used in making ferrocement panels and the buddy system required in constructing the septic tank system are beneficial on multiple levels, as it engages more workers in the field of sanitation, which raises awareness while providing employment. This labor-intensive process makes it highly appealing in low resource countries. The ability to vary the shape and volume is a desirable feature for site-built tanks.

TECHNICAL DETAILS

For septic tank construction, these steps are followed:

1. The tank hole is prepared at the prescribed depth with a level bottom. A screed board with a carpenter's level is used for this purpose;
2. The metal cage is prepared using #3 rebar bent into the desired shape and held together with wire. Galvanized wire mesh is affixed to both sides of the mesh using metal spacers to create the desired wall thickness. The baffle and manhole access ports are also formed with the rebar and mesh;
3. A concrete base is poured to support the tank. Once set, the metal cage is lowered into the tank hole, and the level is checked again. Holes for the inlet and outlet pipes are installed, as is for the transfer pipe in the baffle;
4. A mortar mixture is prepared using 1 part Portland cement, and 2 parts of washed sand. It may be mixed by hand or machine;
5. The mortar is applied to the base first by pouring one bucket at a time, and pressing it into place using a trowel;
6. Using the buddy system, one worker holds a plywood board against the outside mesh while the second worker presses the mortar from the inside of the cage against the board, again using a trowel, and ensuring that all the spaces within the mesh cage are filled;
7. A thinner mortar mix is used for the final scratch coat, which is applied to both the inside and outside of the tank. Final wall thickness is 5 cm.

The total process takes about one week. Two days to dig the tank hole, erect the metal cage, pour the base, and apply the mortar to the metal cage. Then 5 days for curing, leak testing and backfilling.¹

¹Robbins, David M., and Grant C. Ligon. *How to Design Wastewater Systems for Local Conditions in Developing Countries*. IWA Publishing, 2014; *Ferrocement: Applications in Developing Countries*, by National Academy of Sciences (U.S.). *Ad Hoc Panel on the Utilization of Ferrocement in Developing Countries*.