



earthbag building



Earthbag building in Nepal with cement bond-beam in place. (timber would be more usual in eco-builds).

what is it?

According to some estimates, one-third of the world's population is housed in earth buildings. Building in earth has a very long history, and has been practised in regions as diverse as Asia, Europe, Africa, the Americas, and in modern times Australia. Earthbag building then, is a modern twist on perhaps humanity's most important building tradition.

Bags or tubes are filled with earth (a suitable aggregate, sometimes with additions, and if you're really lucky it'll just be the stuff you moved to make the site for your building), and then placed in walls; barbed wire is used as a tie or 'mortar', and the bags are 'rammed'. Most often then, the earth cures, and makes solid walls which no longer rely on the bags or tubes for their integrity. From its origins in the building of military bunkers, and in flood defence, earthbag has been developed and applied around the world. It has been widely tested both structurally and thermally. The history of earthbag building is covered in detail in this article by Kelly Hart – earthbagbuilding.com/history.htm.

what are the benefits?

One of the reasons earthbags were widely used for military purposes and for flood defence is that the materials are easily transportable and easy to assemble. The advantages of the technique however are much more extensive than this. Kelly Hart's colleague, Dr Owen Geiger put it this way: 'Earthbag is extremely versatile and strong, and also very low-cost and simple. It's ideal for harsh climates and regions with hurricanes and earthquakes. A large portion of humanity lives in hazardous areas like this and so earthbag building has enormous potential. Just look at Nepal for instance. All of the 50-some earthbag

buildings survived the recent earthquakes with little or no damage even though they were not built to the highest standards.'

Cost-effective and community-empowering, earthbag buildings share their 'feel' with earth structures of other, older styles. Dr Geiger again:

'The final homes feel wonderful – very safe and secure. You could literally drive a speeding truck into the side of these structures and cause only minor damage such as chipped plaster. Right now in Nepal, people want to stay in the earthbag buildings because they're fearful of their concrete and brick houses. In hot climates like where I live, they stay cool and comfortable 24 hours a day every day of the year with appropriate design.'

I asked Dr Geiger about the durability of earthbag structures, and about any limitations he could see in the technique:

'Earthbags evolved from use in the military and flood control. They are bomb, bullet and flood resistant if built correctly and therefore should have a very long lifespan. Just keep in mind that buildings made of earth and other high mass materials such as stone are not the best choice in cold climates. You could add exterior insulation, of course, but straw-bale seems like the best solution for Canada, northern US, etc.'

The relative simplicity of earthbag building makes builders of people who have never thought of themselves as such. Dr Geiger puts it this way:

'Each step can be demonstrated in a few seconds (see videos on earthbagbuilding.com). I've taught housewives, 75-year-olds, teenagers - It boils down to filling buckets with moist soil, dumping it in bags and tamping them solid. It's super simple. The only difficult part is standard carpentry. Every home needs doors, windows, etc. and that's where it's helpful to check out a carpentry book from the library with lots of good drawings.'



A completed, rendered earthbag home – the first permitted earthbag house in Utah.



what can I do?

Wherever you have a suitable material to fill bags, you can build. Originally, for military bunkers and flood defence, burlap sacks were used, but modern earthbag builders mostly use woven polypropylene bags. Tubes are also commonly employed, in a practice known as superadobe; and a material called Raschel mesh is sometimes used for the tubing – this is called hyperadobe!

Dr Geiger had to say to me on the matter: 'Poly bags are very strong and will last at least 500 years if kept out of sunlight – poly and Raschel mesh bags break down in UV, so protect the bags until the walls are plastered.'

As for the material to fill the sacks, if the earth is going to provide the strength in the wall system as it cures, then earthbag builders need a soil that is approx. 30% clay and 70% sand. This is the standard soil for rammed earth building, what Hunter and Kiffmeyer call 'the Ultimate Clay/Sand Ratio'. Earthbag can be used where clay is not present in these quantities by importing materials to the site, or by relying more on the integrity of the bags or tubes. Earthbag infill systems can also be considered, and, much like straw bales, earthbag can be combined with a timber frame.

Earthbag is not necessarily the best material in cold climates, and straw-bale has advantages where super insulation is required. Earthbags can be made more insulating through the addition of materials like rice hulls or hemp, and earth-sheltering can make earthbag building feasible even in regions with very cold winters.

Earthbag structures are finished in various ways: cement is often used externally, & earth plasters on the interior. Lime is preferable if available, as it's virtually carbon-neutral, unlike cement.



Rendering begins on an earthbag roundhouse.

Polypropylene is susceptible to UV damage, so walls should be protected with builders' sheets before rendering. Raschel mesh can be UV-protected. Burlap sacks are not UV sensitive, but wick moisture, so would need the same 'good hat and stout boots' as cob or straw-bale structures.

Earthbag buildings are often a distinctive dome style, with arched windows and doors. This aesthetic has arisen because earthbag building, particularly superadobe, is well suited to such expression, but they can be any shape.

In any region with a vernacular earth building tradition, earthbag building is worth considering for self-build projects. Even in areas where the earth is not suitable, other materials might be usable. As with all self-builds, you will need to be aware of the planning implications, and if you're building something large enough, you may encounter an as yet undefined area of building regulations.

Earthbag is cost-effective and technically accessible, and is being used in at least one of the dwellings at Lammas Eco-village in Pembrokeshire, so it is already being pioneered in this country. The required toolkit is very simple. You can make tampers (a stick with a lump of concrete set on the end, or a log with a handle put into a hole drilled in it!); you'll need a shovel, and something to cut the barbed wire with. Search online for suppliers of woven polypropylene bags and Raschel mesh, but it's worth shopping around because even a small difference per sack could change the economics of your whole project.

For self-build homes, community and ancillary buildings, earthbag offers an interesting and adaptable alternative. Whether it's right for your site, or for your needs may well depend upon the present cost of small bales, because bale building would seem to be the most obvious alternative.

Earthbag building in the UK is in its infancy, which means that if you're interested enough to give it a go, you'll be right at the cutting edge.

resources

- see lowimpact.org/earth-bag-building for info, courses, links & books, inc..
- Kelly Hart, *Earthbag Architecture*
- Hunter & Kiffmeyer, *Earthbag Building*
- earthbagbuilding.com – biggest earthbag building resource on the web
- earthbagstructures.com – earthbag solutions for disaster-prone regions

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