



earthen floors



Adobe floor in a straw-bale cottage in the US.

what are they?

An earthen floor (or adobe floor in the US) is a floor made of earth that has been compressed, polished and oiled. It relies on the sticky binding properties of clay, which expands when wet, creating sticky platelet particles. When coarse sand is added, compressive strength is increased and shrinkage reduced as the clay dries. Fibre is added to increase tensile strength and knit everything together. The finish mix is essentially the same as cob, and the installation is similar to a concrete slab, only without the environmental impacts or cold nature of cement.

Throughout history, most homes have had earthen floors – usually just rammed earth, often with a layer of straw for warmth, and that could collect dirt and be swept out and replaced. Mint was sometimes strewn on the floor, and treading on it helped spread a minty smell.

A typical modern earthen floor involves a build-up of layers, each with a purpose. The example here demonstrates a floor installed "on grade", similar to a concrete slab. This is a basic method that performs well and is forgiving to install. You can also install on a framed floor, but stiffen the framing to minimize flex, otherwise your floor will crack.

what are the benefits?

- They have a warm, natural feel, but are also cool in summer.
- Earth is a natural, biodegradable, non-toxic material, with no energy required for processing.
- The earth can be sourced on-site, reducing transport distances and therefore fuel.
- The (main) material is free.
- Lower embodied energy than any other flooring, and hugely less than concrete slab.
- They invite creativity – natural materials such as stones can be embedded in the floor.
- Thermal mass can reduce heating bills.

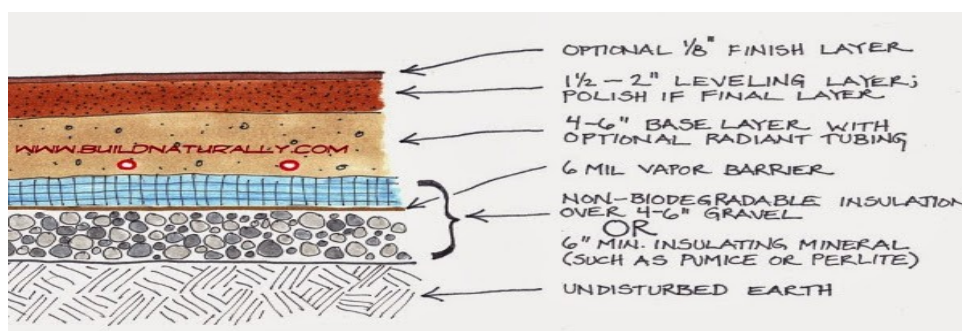
what can I do?

Below is just one method, but there are many more. This is a basic overview. See Lowimpact.org/earthen-floors for more detail. So, starting from the bottom up...

Substrate: the floor has to rest on solid ground (or a stiff framed floor with little flex). You want strong, compacted earth to build on, free of topsoil or organic matter, since it will continue to decompose and shrink in volume over time, leaving you with voids below your floor. Dig down until the soil feels solid and compact. You can even go over the ground with a hand tamper to ensure compaction.

Capillary break: install several inches of gravel to provide a capillary break that prevents water that may be in the ground from rising up into the floor. 10-15cm of pea gravel or angular 2cm stone.

Vapour barrier: lay a vapour barrier that covers the entire floor area. This provides your final moisture control for the earth, blocking any airborne vapour (from evaporated ground moisture). 6mm polyethylene sheeting works – exactly what's used to prepare a concrete slab. The plastic is obviously not natural, but it's excellent insurance.



Layers involved in installing an earthen floor.



Earth floor meets stone floor.

Insulation: this layer is often left out, but it can dictate energy performance and comfort. In a hot climate, skip the insulation, but if you heat your building, you want to keep the heat inside. If you don't have insulation below your floor, you are, in effect, heating the endless thermal mass of the ground. I use R-10 insulation for a typical floor and bump up to R-15 if the floor will have radiant heating in it. You want the heat to follow the path of least resistance into your space, not down into the ground. And you need that insulation to be non-biodegradable, otherwise it will compost and disappear over time, leaving you with a cracked & heaving floor. This is one place to use rigid foam, since the reduction in energy over time quickly offsets the impact of the foam manufacture. For a natural alternative, you can use a rigid insulating mineral, such as pumice or perlite.

Base layer: 2 layers mean you can pour the thick base layer before the exterior walls are closed in. That extra air-flow speeds up drying. Use 15-25% clay plus 75-85% sharp sand – but add more water than with cob, where a wet mix means you can't build higher until the material dries. But with a floor, you want it about the consistency of chocolate pudding. Sifting clay from on-site through a 1cm screen is fine. Add lots of long fibre (straw, or what's abundant in your region). This knits the floor together and prevents cracking. Underfloor heating pipework can be laid in the base layer.

Leveling layer: there are a few approaches you can take for this layer. Some people float it reasonably smoothly, then apply a super-thin layer for the desired texture. By polishing this layer as your finish floor, you avoid the extra step of additional layers. The benefit of applying a thin final layer is that it's easier to control the texture of

a thin coat than a thicker poured floor. Either way, the goal of this layer is to end up with a floor that is level (and if it's your finish, then level & smooth). In the first layer, small imperfections are not a concern, but this layer is what you will see for years to come. This second layer uses the same mixture as the base layer, but sift the clay a bit finer and chop the straw shorter. Smaller particles allow you to float the floor to a finer finish. You don't always need straw in this layer, since it shows in the finished surface and not everyone likes the look. If you don't use straw, it's crucial to get the ratio of clay to sand perfect. To do this, make some test patches on your floor and see how they dry. If they're crumbly and weak, there's not enough clay. If they crack, not enough sand.

Finish: there are several options for finishing your floor. If you chose to apply a thin final layer of clay, you have 2 options: apply 3mm finish layer, much like a clay plaster, but applied to the floor; when this layer is dry, seal as described below; or - apply 1-4 coats of clay paint; when this layer is dry, seal as described below.

If you choose to burnish your floor, then as soon as the clay is completely dry, you can apply a sealer. The sealer makes the top layer more durable, stain-proof and prevents dusting. The most common sealers are hardening oils (like linseed, hemp etc.), which react with oxygen in the air to chemically change into a hard, transparent, water-resistant, but breathable resin. You can also add pigment to your sealer if you want to enhance the color of your floor.

And some no-nos: stilletos (maybe a 'shoes off' regime is best); not in rooms where the floor is likely to get wet – like bathrooms; and no dragging heavy furniture around.

resources

- lowimpact.org/earthen-floors for more info, courses, links & books, including:
- Crimmel & Thomson, *Earthen Floors: a Modern Approach to an Ancient Practice*
- bit.ly/2ISSjR2 – Mother Earth News: Natural Building with Earthen Floors
- nytimes.com/2007/02/08/garden/08dirt.html, Down & Dirty – article on earth floors
- bit.ly/2mhKF2R – Resilience: Earthen Floors, Why, How & Where

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