rammed earth building

LILI

what is it?

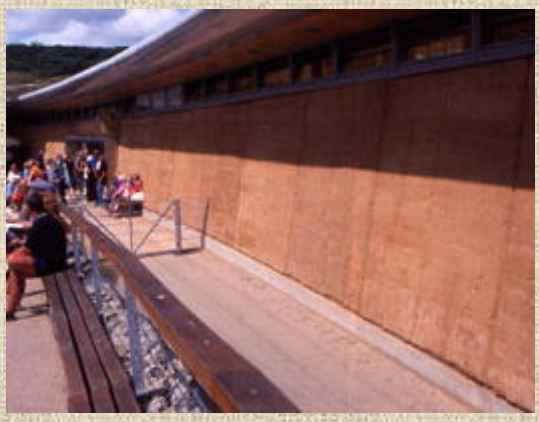
It is building with earth (subsoil rather than topsoil). Two billion people worldwide live in earth constructions and rammed earth building is on the increase in Europe as well as in other areas.

The oldest surviving rammed earth buildings are around 8000 years old, and were built in areas with few trees, like the ancient city-states of Mesopotamia; the Romans introduced it into Europe. The technique was also used on the Great Wall of China. Cob and adobe buildings are not rammed – a mixture of earth and water is built up slowly to form walls, or made into blocks.

True rammed earth building involves compacting soil into formwork. Particle sizes can range from gravel to clays, although the main constituent will be sand (50-60%); clays will be between 10-20% - higher than this will cause shrinkage. Rammed earth is a versatile material and can be used equally effectively for curves and arches as well as straight walls.

Rammed earth buildings have low material costs but high labour costs, so are comparable in price with conventional buildings; they come into their own when you consider the health, environmental, thermal and aesthetic benefits.

compacting earth *into formwork with a pneumatic ram to construct walls.*



Eden Project: *this wall at the Eden Project, Cornwall was constructed of rammed earth by In Situ (see 'resources').*

what are the benefits?

low CO_2 emissions: as earth walls don't require bricks to be fired in a kiln, or cement manufacture, there is a massive reduction in emissions of CO_2 (the most important greenhouse gas). Around 10% of global CO_2 emissions are from the cement industry. Some websites say that 5-10% cement should be added to the earth, but it's not necessary; In Situ (see 'resources') have been building rammed earth structures for years without it.

recyclable: it's just plain old earth, which can be used again on a new building, or be re-absorbed into the environment easily.

high thermal mass: walls can absorb the sun's warmth during the day, and leach it slowly into the building at night; this reduces the energy required for heating, and so further reduces CO_2 emissions and pollution.

non-toxic: no toxic, or factory-produced materials in the walls at all – just earth.

local: cement and bricks are heavy, and their manufacture is centralized; earth can be dug locally, reducing transport requirements, CO_2 emissions and pollution

other benefits: if you're looking for a natural house, then earth can play a part, along with stone, timber, straw, slate and lime. The move to plastics and processed building materials after the war is slowly being reversed now. Non-toxic, breathable, natural materials are good for the environment, for your health, and for buildings and their air quality, which is good news for asthma sufferers.

what can I do?

You can follow the adventures of an Australian rammed earth builder with no building experience at all (below), but maybe it would be sensible to involve professionals in your project. In Situ (below) have experience on several continents, and although rammed earth works well in the UK, they suggest that maybe internal rammed earth, structural walls with timber or straw-bale external walls would be better. This way you benefit from the thermal mass of the internal walls, and the insulation of the outer walls.

Foundations can be concrete, but a more eco-friendly alternative could be lime and flint (or rubble). For extra strength, you can have steel rods from the foundations, up through the walls, and secured to the roof timbers. Ply formwork (sections around 600mm high) is fixed onto the foundations about 350mm wide, with wooden spacers keeping the sides apart, and through-bolts holding them together. A pneumatic (or traditionally, manual) ram is used to compress the earth to around 50% of its original height. Spacers come out as you go, (but it's not the end of the world if some are left in). Plastic pipes can be located in the walls as you are ramming, through which electrical wires can be threaded later. The second layer of formwork fits on top of the first, and later the first layer can 'leap frog' on top of the second. Formwork can come off immediately – there's no setting time – and the holes left by the through bolts are filled. Gaps for doors and windows can be cut into the earth, or formwork can be built around them to save ramming work; no lintels are required. Wire brush the walls when the formwork comes off and you have beautiful, natural walls which connect you and your home to the surrounding environment. Add a conventional roof, with a good overhang for added protection from rain. Walls can be sealed, rendered or limewashed like conventional masonry.

Rammed earth buildings are energy efficient, and conform to fire / health & safety regulations.

formwork is assembled first, *into which earth is compressed.*

resources

- LILI (see below) host a residential weekend course on rammed earth building
- In Situ – UK rammed earth construction company - www.rammed-earth.info
- www.greenhomebuilding.com/rammedearth.htm - wealth of information on natural building, including rammed earth
- www.bath.ac.uk/csae/rammedearth - project to produce UK national guidelines, with a massive rammed earth bibliography
- www.hahaha.com.au/rammed.earth - follow the construction of a rammed earth house in Australia
- www.ihbc.org.uk/Cob_Paper/Introduction.html - repair of earth walled buildings
- H Houben & H Guillaud, 1994, *Earth* Construction, IT Publications - excellent book covering all kinds of earth building
- J Keable, 1996, *Rammed Earth* Structures*: A Code of Practice*, IT Publications – very practical book written for African countries, involving hand tools
- Clough Williams-Ellis, 1919, *Building in Cob, Pisé and stabilized earth*, re-published by Donhead, 1999 – still relevant today
- Paul Graham McHenry, 1997, *Adobe and Rammed Earth Buildings: Design and Construction*, University of Arizona Press

Contact us or visit our website to find out more about our factsheets, manuals & books, residential weekend courses, presentations and shop. You can also become a 'Friend of LILI', and receive our biannual newsletter, discounts on our courses, and help us to make a difference.

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