

# Feats of clay - earthen architecture - natural building

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Would you be interested if there was a building material that is:  
abundant in many places;  
easily found and used;  
is non-toxic;  
has low environmental impact;  
has low material cost;  
which requires low maintenance;  
that moderates swings in temperature and humidity inside buildings;  
that is sturdy and durable;  
that can readily be made into many different and sculptural shapes;  
and which is readily placed and decorated by owner-builders?

Indeed – why wouldn't you use it more often? This is a question often asked by visitors to earth buildings. After all, it is material with a long pedigree. If it was good enough for God to use clay to fashion the first man out of, it's good enough for us to make buildings with too. Not only that but it is ideally suited to either mechanised or hand crafted owner-building.

- Earth - i.e. subsoil containing clay – has been used for at least 10,000 years for building with. Using it creates what is arguably one of the most localised forms of architecture that exists. Successful use involves careful response to local climate and seismic risk in a very direct way.
- There are many methods of getting earth out of the ground into the walls. The process of building and the end aesthetics can be quite varied.
- Earth is a massive, relatively low-strength material that is used to make thick walls of limited height, with structures generally limited to one or two storeys.
- Using earth when sensible to do so means a reduction in the use of scarcer materials such as framing timber, or high-energy materials such as fired brick, concrete, steel, or aluminium.
- With careful design, earth buildings possess excellent thermal characteristics, and can greatly reduce energy consumption and pollution to give sturdy, healthy, long-lived buildings.
- The walls require little maintenance and require no energy-intensive or toxic sealants, but non-toxic aesthetic or protective coatings can be applied and enjoyed, if wished.
- The environmental benefits become even more compelling as we engage with re-localisation and energy descent scenarios that accompany peak oil and climate change, and as the toxic chemical regime that prevails on many building sites and the resultant buildings become recognised as the health hazards they are.
- Earthen architecture can now be designed and built to meet the highest standards of structural safety that meet all the requirements of the New Zealand Building Code. To this end, Standards New Zealand has produced a suite of Standards for earth buildings - the first comprehensive set of standards of this nature in the world.

They are:

NZS 4297:1998 Engineering Design of Earth Buildings

NZS 4298:1998 (including amendment #1) Materials and Workmanship for Earth Buildings

NZS 4299:1998 (including amendment #1) Earth Buildings Not Requiring Specific Design.

The DBH has also issued a supplementary compliance document to deal with issues around external moisture and earth walls.

- Earth building uses raw un-fired subsoil that contains a percentage of clay, which is the very smallest particles in soil, (less than .02 microns). Clay provides the cohesion and waterproofing in the soil. It is the material which distinguishes earth building from other forms of construction, and which causes the difficulties as it can shrink when it dries, and can swell and react with water.
- Additives such as sand, fine gravel, light-weight minerals, straw, wood or paper fibre, are sometimes added to the raw earth to improve the natural soils workability, strength, shrinkage, durability, or insulation values. Stabilisers such as cement, lime, or asphalt may be used but they increase the earth's embodied energy while decreasing the recycle-ability of the earth, and nullifying some of earth's better environmental characteristics. For a more detailed discussion on this see: [http://www.ecodesign.co.nz/files/5/MudBrickCob\\_Stabilisers.pdf](http://www.ecodesign.co.nz/files/5/MudBrickCob_Stabilisers.pdf)
- Unfired earthen materials are ideal for helping with sustainable management of the earth's resources. Earthen materials have some of the lowest embodied energy profiles of any building material
- At the end of the long life typical of a well-built earth building, earth walls can be recycled or left to return to the earth with minimal energy consumption or pollution.
- Considerable effort is currently underway to develop lighter weight earthen materials to give improved external insulation, reinforced with carbon-sequestering timber.
- Earthen plasters are now appreciated for their wonderful aesthetic and humidity controlling properties when applied over a wide variety of substrates including strawbale or plasterboards. Humidity regulating plaster may also reduce or even help eliminate some air conditioning loads and these natural and simple methods of moderating internal environments are undergoing further investigation.
- Earth buildings certainly have an ambience hard to define yet people do react positively when surrounded by earth walls, floors, or earth plastered walls for ceilings – buildings of natural earth are not some of the buildings that people feel better once they have gone outside.
- The major difficulty with using earthen materials for building with are not so much the technical questions so much as accessing appropriate expertise and a supply of products.
- Fortunately there is good help available and it is worth taking care to seek it out to make sure that the expertise you are using is able to provide the technical support you require.