

# Earthbuilding

## *Factsheet from Coconino County Sustainable Building Program*

The following building methods focus on the use of materials already available on the home site. This is the way homes have been built for thousands of years, as the transportation of materials across long distances was not feasible prior to modern times. Earthbuilding is becoming more popular, and homes built with earth materials run the gamut of modest to luxurious. The use of locally available and indigenous earth materials enjoys several advantages such as reduced transportation costs, reduced material costs, and support of local businesses. Almost all earthbuilding techniques are cheaper than a conventional wood-frame house, depending on how much of the work you are willing to do yourself. As a group, these homes use the most sustainable techniques, are comprised of non-toxic materials, and generally enjoy high fire-resistance. The following list defines various techniques and briefly touches on advantages and disadvantage.

**Adobe** - Mud bricks are made by mixing dirt with straw and water and letting them dry in the sun. Soils best suited for adobe have between 15 and 30% clay. Adobe buildings have thick walls and have good thermal mass. However, adobe has poor insulation. This means that uninsulated adobe buildings tend to hover around the average daily temperature. Also, adobe houses degrade more quickly when exposed to severe wet weather.

**Cast Earth** - The invention of Harris Lowenhaupt of Phoenix, Arizona, cast earth techniques are comparable to cast concrete homes. Similar to rammed earth and adobe, cast earth has the advantage of utilizing a wider range of soils. It is also less expensive. However it is a patented process and requires a licensed contractor (there are two in Flagstaff).

**Cob** - Another old method of construction, cob is similar to adobe but with a higher percentage of straw and no production of uniform blocks. The mud and straw mixture is built up as more materials are added. One advantage over adobe is the ability to better incorporate curves, allowing more sculptural forms. The addition of more straw makes the building a bit more insulated than adobe, but not sufficiently so to make it comfortable in extreme climates. Cob homes are inexpensive to build provided builders are willing to expend the sweat equity to build the home.

**Cordwood** - Short, round pieces of wood are stacked and joined together with masonry mortar. Cordwood homes have both thermal mass (mortar) and insulation (wood) properties. Like strawbale a post and beam support structure is sometimes required with the cordwood used as infill.

**Earthships** - Part philosophy, part construction, Earthships are completely independent dwellings that harvest their own electricity, gather water, and process waste. The primary structural component is recycled automobile tires filled with rammed earth. Earthships are built from the surrounding earth and are partially underground. The advantages of earthships include excellent insulation values, minimum to zero energy costs, minimal building costs (provided you are willing to do the work). Permitting for earthships in urban areas is difficult at best, and earthships require constant attention to maintain.

**Rammed Earth** - An ancient technique used in the construction of parts of the Great Wall of China, rammed earth is similar to adobe and cob. Soil that is mostly clay and sand is compressed into walls. Modern rammed earth techniques use heavy machinery to compress the soil. Walls tend to be at least a foot thick for stability and also thermal mass. Insulation is often applied on the outside.

**Sandbag (Earthbag)** - Often associated with flood protection, these same qualities of stability and safety can create stable home structures. Massive walls are stable in severe weather and sandbag homes are quick and easy to construct. Traditional bagging material eventually rots, so burlap sacks have been replaced with polypropylene (which degrades in sunlight). Outside surfaces can be plastered for further protection. The Cal-Earth institute has been experimenting with creating vaults and domes with sandbag architecture.

**Stone** - Stone construction practices are standard. Stone construction materials include raw rock (fieldstone), brick, and shaped stone (granite, flagstone, sandstone, marble, limestone, etc.) Stone structures must have carefully planned foundations to accommodate the weight of the building. Stone buildings enjoy great thermal mass, but poor insulation. Outside walls must be insulated to retain heat or cooling.

**Resources:**

[www.greenbuilder.com/sourcebook/EarthGuidelines.html](http://www.greenbuilder.com/sourcebook/EarthGuidelines.html) - descriptions of various techniques

[www.greenhomebuilding.com/natural\\_building.htm](http://www.greenhomebuilding.com/natural_building.htm) - descriptions of various techniques

[www.castearth.com](http://www.castearth.com) - Cast earth homepage

[www.deatech.com/cobcottage](http://www.deatech.com/cobcottage) - Info on cob construction and other techniques

[www.cobworks.com](http://www.cobworks.com) - Info on cob construction

[www.daycreek.com](http://www.daycreek.com) - Info on cordwood construction

[www.earthship.org](http://www.earthship.org) - Info on earthship construction

[www.calearth.org](http://www.calearth.org) -California Institute for Earth Art and Architecture

[www.adobebuilder.com](http://www.adobebuilder.com) -Adobe building resources

Adobe and Rammed Earth Buildings: Design and Construction, Paul G McHenry, 1997

The Rammed Earth House, David Easton, 1996

Adobe: Build it Yourself, Paul G McHenry, 1985

The Adobe Book, John F O'Conner, 1999

Earthship: How to Build Your Own, Michael Reynolds 1990

Earthship: Systems and Components , Michael Reynolds 1991

Earthship: Evolution Beyond Economics, Michael Reynolds 1993

The Hand Sculpted House: A Practical and Philosophical Guide to Building a Cob Cottage,  
Evans,Smith and Smiley, 2002

The Cob Builders Handbook: You Can Hand-Sculpt Your Own Home, Becky Bee, 1998

Buildings of Earth and Straw: Structural Design for Rammed Earth and Straw Bale Architecture,  
Bruce King, 1997

Building with Earth A Guide to Flexible-Form Earthbag Construction, Paulina Wojciechowska,  
2001

Ceramic Houses and Earth Architecture: How to Build Your Own, Nader Khalili, 1996.

Complete Book of Cordwood Masonry Housebuilding: The Earthwood Method, Rob Roy, 1992.

Complete Book of Underground Houses: How to Build a Low-Cost Home, Rob Roy, 1994.

The Stonebuilder's Primer: A Step-By-Step Guide for Owner-Builders, Charles K. Long, 1998