

Comparison of Natural Building Techniques

a partial list of wall systems by Michael G. Smith

Technique	Materials needed	Structural properties	Thermal properties	Best applications	Advantages	Disadvantages
Straw bale	Straw bales, sticks or bamboo for pinning; baling twine or wire	Load-bearing or infill; good earthquake resistance	Excellent insulation; low thermal mass	Exterior walls in most climates; quick, temporary structures	Goes up relatively quickly. Fairly easy to permit. Increasing pool of experienced designers/builders.	Very susceptible to moisture damage; bales must be stored carefully; unfinished building must be protected from rain.
Cob	Clay soil, sand, straw	Load-bearing or infill; moderate earthquake resistance	Good thermal mass; low insulation	Exterior walls in moderate or sunny climates; interior walls; ovens and hearths; benches; garden walls; greenhouses; floors	Highly sculptural; enormous design flexibility. Combines well with other materials.	Labor intensive; goes up slowly, especially in cool, moist conditions. Permitting may take persistence.
Adobe	Clay soil, sand, straw or other fiber	Load-bearing or infill; poor earthquake resistance	Good thermal mass; low insulation	Exterior walls in moderate or sunny climates; interior walls; ovens and hearths; domes and vaults in dry, non-earthquake regions.	Adobe blocks can be made in one place and transported. When blocks are made, wall goes up fast. Many pros in SW.	Making and storing adobe blocks takes a lot of space and dry weather. Prone to earthquake damage.
Rammed earth	Clay soil with high content of sand; often stabilized with cement & reinforced with steel	Load-bearing; good earthquake resistance	Very good thermal mass; low insulation	Exterior walls in moderate or sunny climates; benches and garden walls.	Contractors, engineers and permits available in CA and elsewhere.	Very labor or machine intensive. Requires forms. Professionally built RE can be expensive and uses non-natural materials
Earthbags	Woven polypropylene feed sacks filled with clay soil, sandy soil, sand, or gravel	Load-bearing; foundations for other wall systems; good earthquake resistance	Very good thermal mass; low insulation (unless filled with a light fill like pumice or scoria)	Foundations for cob, straw bale, etc.; exterior walls in moderate or sunny climates; benches and garden walls; domes and vaults in dry, non-earthquake regions.	Relatively quick earth building technique. Allows for use of wide range of fill materials.	Poly bags very susceptible to UV damage; must be protected from direct sun; long-term durability unknown.

Technique	Materials needed	Structural properties	Thermal properties	Best applications	Advantages	Disadvantages
Stone	Stones; may be dry-stacked or mortared with a mixture of sand, cement, lime and/or clay	Load-bearing; foundation s; poor earthquake resistance unless reinforced	Very good thermal mass; very low insulation	Foundations, basements, retaining walls; fireplaces and hearths; floors and patios; exterior walls in non-earthquake regions with mild climates.	Very durable, even in wet conditions and in contact with ground.	Very labor intensive.
Straw light-clay or slipstraw	Straw (or wood chips, hemp hurds, or other suitable material); clay slip	Infill	Insulation, thermal mass vary with mix; insulation can be high per thickness	Remodels; exterior and interior walls in many climates.	Walls can be any thickness. Combines well with standard stud framing or timber framing.	Requires forms, so walls generally straight. Prone to water damage. Wood required for frame and forms.
Wattle and daub	Straight, flexible sticks (or bamboo); clay soil; chopped straw and/or manure	Infill	Poor insulation; low thermal mass (thick plaster increases mass)	Interior walls; unheated structures such as outdoor showers, sheds, etc.; exterior walls in hot tropics	Walls can be very thin. Uncovered wattle is very decorative.	Requires lots of straight flexible sticks which can be difficult to find. Labor intensive. Prone to water damage.
Clay wattle	Clay soil; long straw; sticks	Infill	Poor insulation; low thermal mass unless wall is quite thick	Interior walls; unheated structures such as outdoor showers, sheds, etc.; exterior walls in hot tropics	Walls can be very thin, curved and sculptural.	New, little-known technique. Requires long straw. Prone to water damage.
Cordwood masonry	Wood cut into short lengths; mortar may include cement, lime, clay, sand, sawdust; lime/sawdust insulation	Infill or load-bearing (round structures only); poor earthquake resistance	Good insulation; moderate thermal mass	Exterior and interior walls	Decorative. Easy to attach wooden framing and furniture.	Wood must be very dry. Tendency for wood to expand and contract, cracking mortar and creating drafts.
Papercrete / Fibrous cement Fidobe or Hybrid	Recycled paper pulp; sand; cement or clay soil	Infill or load-bearing	Good insulation; thermal mass varies with mix	Exterior and interior walls; floors; plasters	Very versatile techniques. Walls easily modified.	New technique. Requires a specialized mixer. Questionable water resistance.