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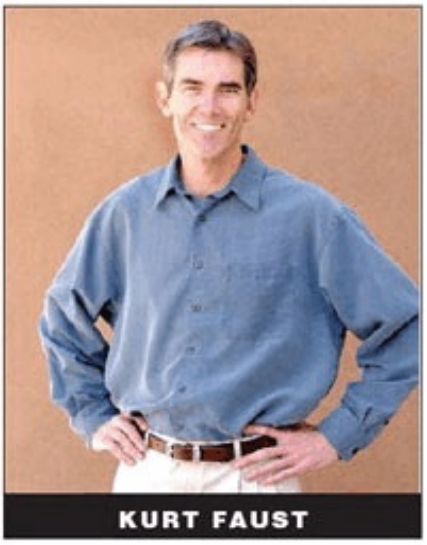
Alternatives: rammed earth, pumice-crete

by Kurt Faust

Rammed earth and pumice-crete are wall construction systems with several things in common. They both have substantial thermal mass, use relatively green sustainable building methods and are both cast in place using standard concrete-forming methods.



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Rammed earth is a very old building system. There are examples still in use in the United States dating from the 1850s and in China from the 16th-century Ming Dynasty. The modern-day technique for rammed earth uses high-tech, reusable concrete forms, form clips, and snap ties, engineered and stabilized soils, and pneumatic tampers to compress the soil mixture.

Concrete forms can be used many times over and are most often made of plywood and 2x4s that can easily be cut into any size. They are not as durable as specially made cast-aluminum panels, which are also used. The forms are set anywhere from 16 to 36 inches apart to form massively thick exterior walls. The form clips are set into the slab to hold the bottom of the panels stationary and snap ties are placed at frequent intervals. The ties are spacers that hold the forms at precise distance from each other at the same time resist the pressure from the earth mixture as it is placed and compacted in the forms.

Local soils from the construction site can be used if they have suitable properties. They must have the proper ratio of gravel, sand, silt, and clay, each being defined by particle size. Approximately 5 percent Portland cement for sandy mixes or 7 percent lime for silty mixes can be added to help stabilize the soil mixture and increase its durability. A precise amount of water is added to obtain maximum compaction and density. The mix is placed in the forms in 8- to 10- inch lifts and each lift is compacted with pneumatic or hand tampers to almost half of its original height. Every time a lift is completed more mix is added to the forms and compacted, raising the height of the wall slowly until it reaches bearing height. A concrete bond beam is poured around the entire top connecting all the exterior walls and effectively tying them together against lateral forces. The roof is then built on top of the bond beam.

Pumice-crete is a lightweight concrete mixture using pea-sized pumice for the aggregate and just enough Portland cement and water to lightly coat each pebble. When it is mixed with the proper proportions and placed in concrete

forms it “honeycombs,” trapping air throughout the wall between each piece of pumice. Too much water and Portland compromises the insulative properties by filling in all the air spaces with cement, while not enough water and Portland weakens the wall.

Pumice is frothy lava that has solidified. It is very low-density, about 90 percent porous, and will initially float when placed in water. Pumice-crete is batched at the local concrete plant and delivered in regular concrete trucks. The walls are generally formed 14 to 24 inches thick with the same type of forms used for rammed earth.

Both materials are known as “poured in place” wall systems and have many advantageous features. Rammed earth is beautiful by itself and does not require additional plaster on the exterior or on the interior, and the textural surface of Pumice-crete can be plastered with little prop work. They each provide good thermal mass, which helps keep the interior temperatures of the home stable: warm in the winter and cool in the summer. They also both dampen sound between rooms as well as noise from outside. The materials are green because they contain a relatively small amount of embodied energy. Embodied energy is the sum total of energy used in the mining, manufacturing, and delivering of a product or material.

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