

# CEMENT PLASTER

## Summary:

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Virtually all straw bale and other earth constructions are stuccoed with a cement, lime, or earth based plaster for moisture control, thermal resistance and storage, fire and pest protection, and to increase structural performance. Plasters are made up of a binding agent, the main component of the plaster, a structural filler such as sand, rock or aggregates, and water. Typically, they also contain a fiber such as straw, hemp, plastic, or mesh as an additive.

Cement plasters are considered to be the least environmentally friendly of all plasters because the production of Portland cement requires huge amounts of energy. It also is a highly processed material which will never return to its natural or pre-cured state. It is included because it is a common plaster mixture for straw bale construction.

### **Binding Agents:**

The binding agent for cement plaster mixtures is Portland cement, a very specific type of hydraulic lime. The binder holds the components of the plaster together and is responsible for the plaster's strength and permeability. Because Portland cement is mass produced, the performance of this type of plaster is consistent and quite predictable. The structural properties are much higher than other mixtures with lime or clay as the binder making the mixture a "hard skin" plaster with compressive strengths above 1000 psi.

Cement plasters have very low water vapor permeability. In the case of a cement plaster of over a straw bale wall this is rather unfortunate because plasters must be permeable to remove moisture from inside the wall. Without the removal of water vapor, deterioration will occur. For use over a stud wall with a moisture barrier this is less of an issue although an appropriate mixture must be used to encourage the passage of water vapor.

To increase permeability of a cement plaster, a sufficient amount of lime must be added to the mixture. For straw bale walls, two different mixtures are commonly used: 1:1:6 and 1:2:9 of cement, lime, and sand by volume.

Cement plasters can be brittle over soft and flexible surfaces such as straw bale so a metal lath must be applied around corners, windows, and doors. In seismic areas (and often is non-seismic areas as well), the lath is applied over the entire structure to resist shear forces.<sup>1</sup>

### **Structural Fillers:**

Sand is the most common filler for most plasters. Like reinforced concrete, it is best to use sharp and well-graded sand to encourage strength for compressive structural loads. Generally, it is best to use mixtures with little silt, as it will weaken the plaster.<sup>2</sup>

### **Water:**

Water is needed during mixing to activate the binders. It is also important to keep the plaster moist for a few weeks after application to allow the mixture to properly cure.<sup>3</sup>

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1 Bruce King, Design of Straw Bale Buildings (San Rafael, CA: Green Building Press, 2006), 24-26.

2 King, 23.

3 King, 22.

**Fiber:**

Fiber materials as an additive reduce cracking and increase ductility. For cement plasters, typical fillers include fiberglass, polypropylene, and steel fibers.<sup>4</sup>

**Fire:**

A lime-cement plaster mixture with an average total thickness of 1 inch and applied over a metal mesh was tested per ASTM standard E119. The wall easily passed a two hour test. By the end of two hours, the plaster on the burned side was bulging away from the straw by as much as 10 inches though the mesh was still holding the plaster together. There were no cracks on the non burned side of the wall.

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4 King, 38.