

# LIME PLASTER

## Summary:

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Virtually all straw bale 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.

### **Binding Agents and Water:**

There are many different kinds of lime mixtures. Limes with high calcium and low magnesium are considered to be the best types of lime for lime mixtures.

To make a lime binding agent, limestone is mined and fired to drive off water and carbon dioxide resulting in quicklime, a calcium oxide and magnesium oxide mixture. The quicklime is combined with water to make a paste known as hydrated lime. To make lime plaster, the hydrated lime is mixed with more water to make lime putty and combined with a structural filler and, often, and fiber. When exposed to air, the lime plaster reabsorbs carbon dioxide and becomes limestone again.<sup>1</sup>

This process creates a closed loop cycle because you start and end with calcium carbonate, limestone. Although carbon dioxide is released during production, it is believed that a similar amount of CO<sub>2</sub> is reabsorbed as the plaster becomes limestone again. This makes lime plaster a greener alternative to cement plasters.<sup>2</sup>

Unlike cement plasters, lime plasters are less brittle, producing fewer cracks over flexible surfaces like straw bale. Hairline cracks are self healing with the absorption of carbon dioxide. Larger cracks can be filled with limewash, a very thin lime plaster.<sup>3</sup>

Lime plasters are very permeable, allowing water vapor to escape from the inside of a straw bale wall. Also, lime plasters can also hold a lot of moisture meaning they can store water easily rather than letting the water soak into the straw. Care must be taken to ensure the plaster does not wick additional moisture from the ground through proper detailing.

### **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. For lime plasters it is necessary to be sure structural fillers are washed and clean as to not interfere with the curing process.<sup>4</sup>

### **Fiber:**

Fiber materials as an additive reduce cracking and increase ductility. Animal hair is generally used with lime plasters.<sup>5</sup>

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1 Bruce King, *Design of Straw Bale Buildings* (San Rafael, CA: Green Building Press, 2006), 27.

2 King, 28.

3 King, 28.

4 King, 29.

5 King, 38.

***Application:***

Lime plasters are generally applied in two ways: directly applied over the straw bale walls or as a finish coat over a thick earth plaster. To use over an earth plaster, the scratch coat needs a deep texture and a coat of limewash will improve adhesion to the earth mixture.<sup>6</sup>

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6 King, 30-31.