How to Build an Earth Block Home (by Jim Hallock)

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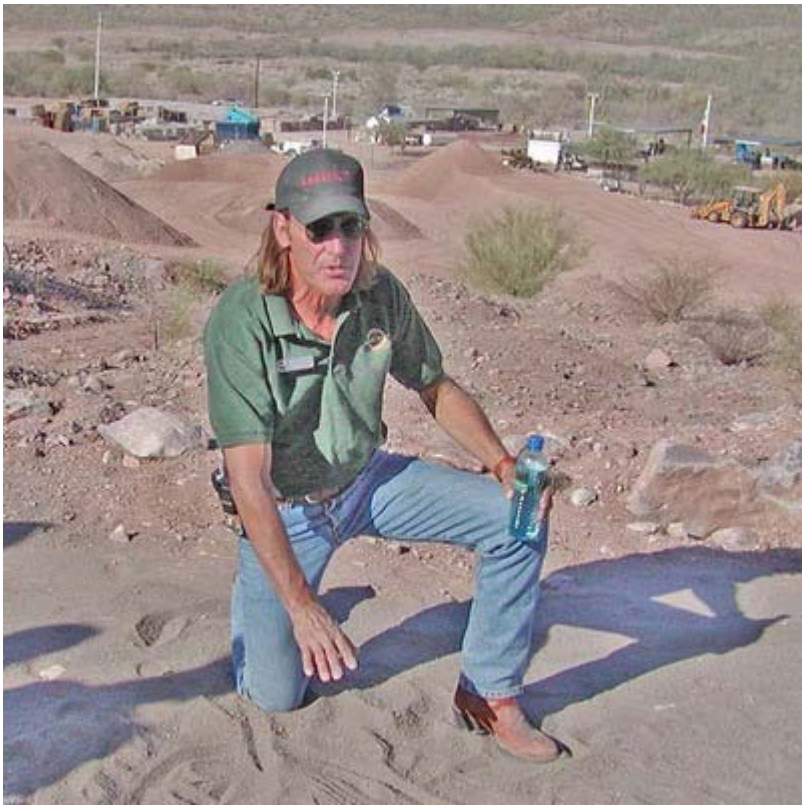
1.- The Magic Building Material



Jim Hallock is director of Earth Block Operations at The Villages of Loreto Bay

Photo © Jackie Craven

When his wife developed chemical sensitivities, builder Jim Hallock searched for ways to construct with non-toxic materials. The answer was under his feet: dirt.

"Earthen walls have always been the best," Hallock said during a press tour of the Baja, Mexico facility where he oversees the production of compressed earth blocks (CEBs) for construction at The Villages of Loreto Bay. Compressed earth blocks were chosen for the new resort community because they can be made economically from local materials. CEBs are also energy-efficient and durable. "Bugs don't eat them and they don't burn," Hallock said.

An added benefit: compressed earth blocks are entirely natural. Unlike modern adobe blocks, the CEBs don't use asphalt or other potentially toxic additives.

Hallock's Colorado-based company, Earth Block Inc, has developed an especially efficient and affordable process for earth block production. Hallock estimates that his plant in Loreto Bay has the capacity to produce 9,000 CEBs a day. 5,000 blocks are enough to build the exterior walls for a 1,500 square-foot home.

2.- Sift the Clay

Before making the compressed earth blocks, the clay must be sifted.

Photo © Jackie Craven

The soil itself is the most important ingredient in earth block construction.

Earth Block Operations Director Jim Hallock knew that the soil at this Baja, Mexico site would lend itself to CEB construction because of its rich clay deposits. If you scoop up a soil sample here, you'll notice that you can easily form it into a firm ball that will dry hard.

Before manufacturing the compressed earth blocks, the clay content must be drawn from the soil. A backhoe mines the earth from surrounding hills at the Loreto Bay, Mexico plant. Then the soil is sifted through a 3/8 wire mesh. Larger rocks are saved to use in landscape design in the new Loreto Bay neighborhoods.

3.- Stabilize the Clay

The mortar is mixed at the building site.

Photo © Jackie Craven

Although clay is essential in earth block construction, blocks that contain too much clay may crack. In many parts of the world, builders use Portland cement to stabilize the clay. At Loreto Bay, Earth Block Operations Director Jim Hallock uses freshly-mined lime.

"Lime is forgiving and lime is self-healing." Hallock credits lime for the endurance of the centuries-old Tower of Pisa and the ancient aqueducts of Rome.

The lime used to stabilize the clay must be fresh, Hallock said. Lime that has turned gray is old. It has absorbed humidity and won't be as effective.

The exact recipe used to manufacture CEBs will depend on the soil composition of the region. Here in Baja California, Sur, Mexico, the Loreto Bay plant combines:

- 65% clay
- 30% sand
- 5% lime

These ingredients are placed in a large concrete batch mixer that spins at 250 rpm. The more thoroughly the ingredients are mixed, the less need there is for stabilizer.

Later, a smaller mixer (shown here) is used to combine the mortar, which is also stabilized with lime.

4.- Compress the Clay

The earthen mixture is compressed into building blocks

Photo © Jackie Craven

A tractor removes the earth mixture and places it into a high-pressure hydraulic ram. This machine can make 380 compressed earth blocks (CEBs) in an hour.

A standard CEB is 4 inches thick, 14 inches long, and 10 inches wide. Each block weighs about 40 pounds. The fact that compressed earth blocks are uniform in size saves time during the construction process.

Oil is also saved because each hydraulic ram machine consumes only about 10 diesel gallons of fuel a day. The Loreto Bay plant in Baja, Mexico has three of these machines.

The plant employs 16 workers: 13 to run the equipment, and three night watchmen. All are local to Loreto, Mexico.

5.- Let the Earth Cure

The compressed earth blocks are wrapped in plastic.

Photo © Jackie Craven

Earth blocks could be used immediately after they are compressed in the high-pressure hydraulic ram. However, the blocks will shrink slightly as they dry.

At the Loreto Bay plant in Baja, Mexico, workers set the newly made earth blocks on pallets. The blocks are wrapped tightly in plastic to preserve the moisture.

"Clay and lime must dance together for a month, then they can never divorce," said Jim Hallock, Director of Earth Block Operations.

The month-long curing process helps strengthen the blocks.

6.- Stack the Blocks

Mortar should be used sparingly on CEBs.

Photo © Jackie Craven

Compressed earth blocks (CEBs) can be stacked in a variety of ways. For best adhesion, the masons should use thin mortar joints. Earth Operations Director Jim Hallock recommends using a clay and lime mortar, or *slurry*, mixed to a milkshake consistency.

The masons should apply a thin but complete layer to the lower course of the blocks. They must work quickly, Hallock said. The slurry should still be moist when the masons lay the next course of blocks. Because it's made from the same ingredients as the CEBs, the moist slurry will form a tight molecular bond with the blocks.

7.- Reinforce the Blocks

Steel rods and chicken wire reinforce the walls.

Photo © Jackie Craven

Compressed earth blocks (CEBs) are much stronger than concrete mason's blocks. The cured CEBs produced in Loreto Bay, Mexico have a load-bearing capacity of 1,500 PSI (pounds per square inch), according to Earth Block Operations Director Jim Hallock. This ranking far exceeds Uniform Building Code, Mexican Building Code, and HUD requirements.

However, CEBs are also thicker and heavier than concrete mason's blocks. Once the earth blocks have been plastered, these walls are sixteen inches thick. So, to conserve on square footage and to expedite the construction process, builders in Loreto Bay use lighter mason's blocks for the interior walls.

Steel rods extending through the mason's blocks provide added strength. The compressed earth blocks are wrapped with chicken wire and securely anchored to the interior walls.

8.- Parge the Walls

The earth block walls are parged with lime plaster

Photo © Jackie Craven

Next, both interior and exterior walls are *parged*. They are coated with lime-based plaster. Like the slurry used to mortar the joints, the plaster used for parging bonds with the compressed earth blocks.

9.- Insulate Between the Walls

The new earth-walled homes resemble ancient pueblos.

Photo © Jackie Craven

Here you see homes near completion in Founders' Neighborhood at Loreto Bay, Mexico. The compressed earth block walls have been reinforced with wire and parged with plaster.

The houses appear to be attached, but there is actually a two-inch space between facing walls. Recycled Styrofoam fills the gap.

10.- Add Color

Homes in the Villages of Loreto Bay are finished with organic mineral oxide pigments that bond with the lime plaster.

Photo © Jackie Craven

The plaster-coated earth blocks are colored with a lime-based finish. Tinted with mineral oxide pigments, the finish produces no toxic fumes and the colors do not fade.

Many people think that adobe and earth block construction is only suitable for a warm, dry climate. Not true, says Earth Block Operations Director Jim Hallock. The hydraulic press machines make producing compressed earth blocks (CEBs) efficient and affordable. "This technology can be used anywhere there's clay," Hallock said.

Right now, the plant in Loreto Bay produces compressed earth blocks for the new resort community under construction there. In time, Hallock hopes that the market will expand, providing the economical, energy-efficient CEBs to other parts of Mexico.