

Homes for Haiti Update October 20, 2015

Background

Jubilee is a slum on the southern edge of downtown Gonaives, Haiti, and is considered one of the worst slums in Haiti. It was formed as the city's trash dump. The trash included human trash. That human trash sorted through the other trash and built homes. They eked out livings in whatever way they could. Malnutrition was common. Population has been estimated from 11,000 to 27,000.

This is the epicenter for the **Homes for Haiti** project where we are teaching the residents to build ultra-low-cost, disaster-resistant homes. We anticipate the technology developed will spread throughout Haiti and beyond. Since its inception, Jubilee has been ruled by Voodoo. At



the entrance of Jubilee is a crucifix. The body of Christ is painted white, which in Voodoo is the color of death. In 2012, police would not go into Jubilee, and Jubilee contained no Christian churches.



The **Homes for Haiti** project started in 2012 when Shepherd of the Lutheran Church (SHLC), San Antonio, TX, sent a short-term mission team to Gonaives, Haiti. Ron Richardson, an optometrist, conducted an eye clinic in Jubilee, one of the worst slums in Haiti (this is where Gonaives' trash is

dumped, including unwanted human trash). As far as we can determine, this was the first medical-related clinic to go into Jubilee. Needless to say, the medical team's security was not happy with the team going into Jubilee. People who were helped asked, "Why are you doing this?" The answer, "Our God wants us to do this."

Jubilee Builds a Church

They wanted to know our God, and they wanted a church. So they built a church from trash. The roof was blue tarps which they salvaged from the dump. The walls were discarded woven palm leaf panels. Three times in two years the church blew down, once during a service.



The Lutheran Church of Haiti provided a pastor. The church grew and soon became

crowded. VBS was held in the church. When the doors were closed, people, especially children, came in through the walls.



A donor has provided funds to build a new church, which was dedicated in 2014. Confined masonry and a metal roof were used. That building has become the community center for Jubilee and is used every day. One of the activities is sewing classes using pedal-operated sewing machines.

The Impossible Challenge

Herb Nordmeyer never planned on going to Haiti. He was very comfortable with retirement while doing some writing, consulting, and kayaking. Numerous people kept prodding him to go to Haiti for just one short-term mission. Meanwhile, Pastor Benoit, President of the Lutheran Church of Haiti, read one of his books and decided that he should move to Haiti for ten years since it would take that long to get all of the projects done which Pastor Benoit thought Herb should adopt as his own.



Herb made a consulting trip to Eugene, Oregon, and while there visited a granddaughter (and fellow author). That Sunday, they went to St. Mark Catholic Church

and heard a sermon from a newly ordained priest. Father John's sermon was titled, "*When the time is right, God will call. Answer!*" Herb finally agreed to go to Haiti for one trip.

In September, 2013, Herb Nordmeyer was part of SHLC's second short-term mission trip to Gonaives, Haiti. Pastor Benoit, President of the Lutheran Church of Haiti, took him to Jubilee and introduced him to people, and they invited him into their homes, often 80 square feet for a family of eight or nine.



Pastor Benoit challenged Herb to find or develop technology to provide the residents of Jubilee with hurricane-resistant and earthquake-resistant homes (disaster-resistant homes) for a materials cost of \$1,000 US or less. Herb accepted the challenge and worked with contacts he had developed during his years in the construction industry where he was involved in research and development as well as forensic analysis of product failures. He worked with David South, President of the Monolithic Dome Institute, with Dr. Richard Klingner, recently retired engineering professor from UT-Austin, and numerous other people.

Additional Problems

Herb identified problems endemic to building in Haiti and worked to develop solutions. He learned Haitian customs so solutions he presented would be acceptable to the Haitian people.

One of the big problems was related to poverty. If 5 bags of Portland cement were needed, often only 2 or 3 bags were used.

Since most small contractors mixed concrete and stucco on the ground with a shovel, the components were not well-mixed.



Most of the aggregate in Haiti is not produced to meet any recognized specification, so extra cement is needed to gain the strength needed.

Much of the aggregate contained clay. While this made stucco sticky, it led to premature failure of the products made with it. These problems were seen in all parts of Haiti, and include concrete for roofs, foundations, walls, concrete block, stucco, and mortar.



Termites were endemic to Haiti. Native trees which were resistant to termite damage were harvested and shipped to France to pay the debt France claimed she was owed for the plantations lost and the slaves lost during the slave revolt of 1804. Most lumber used for building shows signs of termite damage the first year if the soil is not

treated with an insecticide, but few can afford the cost of an insecticide.



The water table around Jubilee is high, and the water is high in chlorides. Often salt crystals can be seen on the surface of the ground as the soil dries out. Chlorides cause steel rebar to corrode and expand. This causes concrete to crack, which allows more water to enter and corrode more rebar. This photo shows the underside of a water tank which Herb was asked to patch. There was a minor crack

in the concrete and a chunk came off when he tapped on it with his hand. He reached up and grabbed the rebar and it came apart in his hand.

To be able to pour concrete which would have a life span of 50 or more years, the chlorides would need to be removed from the water and the soil, a method would need to be used which would keep the chlorides from attacking the steel rebar, or the concrete would need to be reinforced with something besides steel rebar.



The Solution

Herb identified technology and made modifications to that technology, which resulted in disaster-resistant homes.

While he worked to modify the endemic Haitian construction technology to be disaster-resistant, for Jubilee he selected a dome structure. A dome uses fewer materials to provide a given square footage of space than any other shape. Additionally, a curved surface is stronger than a flat surface. A double curved surface (the surface of a sphere) is even stronger. By dealing with the right design, the thickness of the shell can be reduced without reducing the disaster-resistance of the structure. This reduces the cost of materials.

We held seminars to teach the proper way to mix concrete and stucco. These seminars included lessons on the strength of concrete which:

- Included clay in the mix,
- Was shorted on cement,
- Used inappropriately sized aggregate, and
- Was not consolidated when poured.

We have replaced the steel rebar with products which are made from basalt (lava rock), the same thing that rock wool insulation is made from. Unlike steel rebar which must be embedded at least 1.5 inches into concrete to protect it, the basalt products only need to be covered sufficiently so they bond to the concrete.

For the slab and the footings, we purchase



and import basalt rebar. Per equal cross section, it is twice as strong as steel.

For the domes, rather than having to bend steel rebar to an appropriate curve, we purchase and import basalt rope. While these products are more expensive than steel, they allow us to produce structures whose lives can be measured in centuries, rather than in years. The reduced amount of cement used comes close to paying the extra cost of the basalt products. As production of the basalt products increases, and as we can import larger quantities, the cost will be reduced.

We selected the 20-foot EcoShell I to base our designs on. This structure provides 314 square feet of floor space. According to UN guidelines, this is a large enough home for a family of 9. We are building a disaster-resistant structure with window and door bucks installed. We install stub-outs for sewer, water, and electricity so if they ever become available in Jubilee, the slab will not need to be damaged to install them.



Rather than dig to install the footings, we are placing the footings on the surface of the ground and filling under the slab. This elevates the slab about a foot above the surrounding ground level.

The people who will be living in each dome home are responsible for adding the windows and doors, and for finishing out the home. We are importing hydrated lime into Haiti and will be teaching the residents to white-wash the exterior of their homes. The white-wash, if done correctly, will provide a seal and a highly reflective surface to the stucco surface. Demonstration tests showed that in Texas a dome coated with white-wash remained 5 degrees F cooler during summer daytime conditions than an identical dome coated with a high-reflective paint.

The process of starting to build has been slow, since we are not looking at going in and building these homes for the people, but we are teaching them to build homes and furnishing them with the materials with which to build. While the initial homes will be built in Jubilee for residents of Jubilee and paid for with donated money, the crew that is currently in training envisions going outside of Jubilee eventually to build homes for paying customers.


We met with the Mayor of Gonaives. He has stated that if our first 5 homes perform as we have described them, he will make land available for us to build more homes for the residents of Jubilee.

Herb Nordmeyer is writing a book on the project which contains detailed instructions on building these structures, and we are having it translated into Haitian Creole so the builders and building inspectors will have a full understanding of the dome technology.

Each trained crew should be able to produce

Homes for Jubilee

A Manual for Building Disaster-Resistant
Homes for Those Who Have Nothing



Introduction By: Saint Justin Pierrelus
Mayor, City of Gonaives, Haiti

Written By: Herb Nordmeyer

Includes: The 4th edition of **The EcoShell I**
by David B. South,
Monolithic Dome Institute

one home every two weeks. If we have a separate crew to install the slabs, the crew using the Airform should be able to install one dome per week. As more crews are trained and as finances are available, we will add additional 20-foot Airforms.

A 30-foot Airform was shipped to Haiti in error. Domes of the World is making arrangements to have this Airform donated to the project so it is available for use. It can be used to produce classrooms, etc. Production would be about one dome every three weeks with one crew.

Jubilee covers 190 acres and with a density of more than 10 houses per acre, there are over 2,000 homes in Jubilee. All are substandard and need replacing. Over the next 4 to 5 years, we would like to see 10% of those homes replaced and enough of an economic impact so the residents of Jubilee can start paying for a portion of their homes.



Finding an appropriate coating for concrete has always been a problem. The concrete needs to be sealed, but it needs to be breathable. Paint works, but after about 10 years, most paints deteriorate. If it is not recoated before deterioration starts, or removed after deterioration starts, repainting does not result in a protective coating. We have found that white-washing is the appropriate coating for EcoShell I homes. It is applied via a number of very thin coats. At a later date it can be restored by adding additional coats. Testing has shown that a sealed EcoShell that has been white-washed remains about 5 degrees Fahrenheit cooler during a summer day than a similar structure which has been coated with a

high-reflective white paint. Once a structure has been painted, white-washing is not an option.

Cost - 20-Foot Dome

Each 20-foot EcoShell costs about \$7,000 US to build.

- about \$2,800 US in materials,
- about \$400 US in customs fees,
- about \$1,200 US in labor and in costs associated with labor (daily meals for the crew),
- about \$300 US in gasoline for the generator,
- about \$800 US in transportation,
- about \$700 US in security, and
- about \$800 US for oversight of the building crew.

More experience should reduce the number of days to build a dome and that will reduce the cost of labor, gasoline for the generator, and security. Cost of Herb Nordmeyer and others coming from the US to teach and oversee the project is not

included, since these costs are currently being covered by those individuals and their supporters. Further, as the Haitian crew gains experience, there will not be a need for personnel coming from the US to teach and oversee the project. The Lutheran Church of Haiti will oversee the project.

The slab for the first 20-foot dome took about 4 days to install, but the fifth slab took only 1.25 days.

The first dome to be erected on a completed slab took 8 days, but we anticipate that with experience, we can reduce that time to 5 days. Part of the extra time was related to the inadequate scaffold system which was used. Herb Nordmeyer, with assistance from Van Smith who builds domes in Belize, is designing and building a robust polar scaffold which will be shipped to Haiti in December.

Whenever the Airform is in use, it needs to remain inflated at the appropriate pressure. Varying the pressure can cause cracks in the structure. This requires people at the site 24 hours per day and requires that the generator, which provides electricity for the blower, run for 24 hours per day.

Cost - 30-Foot Dome

A 30-foot dome will provide about 2.25 times the living space as a 20-foot dome and will require about twice the amount of materials. Further, the 30-foot dome is about 2.5 feet taller than the 20-foot dome and thus is more conducive to adding a sleeping/storage loft. We estimate that the cost of a 30-foot dome will be \$14,000 US.

Cost - Polar Scaffold

The enhanced polar scaffold with three ladder legs and a center support is estimated to cost about \$1,200 US in materials. Herb Nordmeyer is furnishing the labor. Shipping to Haiti is estimated to cost \$700 US and custom fees are estimated at \$500 US. (Other things will be included in the crate, so the total shipping and customs costs will be more. This is prorated for the scaffold.) It is being designed so that no part of it is over seven feet long, and so it can be used for either a 20-foot dome or a 30-foot dome.

Summary

The project is moving along, and the crew is getting the training they need. We made a few mistakes in the process, but each became a learning experience for us.

Initially Herb Nordmeyer agreed to go to Haiti 4 times per year to work on the project. In 2015, he has gone 6 times. Currently he plans on returning in January, 2016, for a three-week period.

Trips beyond the January trip have not been scheduled.

Due to the heat and humidity, he does not plan on spending time in Haiti during July, August, and September.