

Construction of "Kay Espwa" (House of Hope)

A Prototype Earthbag House in Mizak Haiti, 2010

by Michael Windover

In January 2010, I was asked to design and build a prototype Earthbag house in Mizak. I am a retired pharmacist who with my wife 30 years ago built a house that had been roughed up on a basement for us. I have done minor remodeling, but, am by no means a qualified contractor. The request specified a one room house with porch. We were also asked to do a program called Operation Safe to aid children traumatized by the earthquake. This entry will present the house project part of our trip.

With the help of more knowledgeable people such as Pastor Gary McDonough, Owen Geiger, Kelly Hart, Father Marc and others, I designed, as requested, a one room sandbag house with porch. I also added a grid system to prevent the roof tin from blowing off in a hurricane.

The Haitian Artisans for Peace International (HAPI) coordinator who had asked me to do this together with Pastor Paul Prevost of Mizak chose a local contractor for us to work with. He and another man went to LeCaye to learn about "The Sun House" before we arrived.

No advanced preparation or gathering of materials was done mostly due to difficulties in communication and my lack of knowledge of how much sand, rebar, cement, etc it would take. It was left until we could talk together in Mizak to determine these things.

Before beginning, have a meeting with all leadership in the project. Get a clear understanding of who is boss, what the workday will be, how much the pay will be, who will hire and fire, who will pay, who will order materials. Copies of all receipts should be obtained as well as a translation of them into English. Our receipts from the hardware in Jacmel were in French and Haitian dollars. These are all things that came up as problems. Know exactly what is ordered as it is being ordered and how much it costs. Have everything delivered and then double check the inventory. If the site is difficult for delivery of materials, plan on extra workers, wheelbarrows, buckets, shovels, etc to move materials.

When buying materials and equipment in Haiti use caution. Some wheelbarrows fall apart in a couple days. Some shovels are so thin as to bend easily. This year a

hammer and sledge hammer both broke the first day. I'm talking about the steel head, not the handle. I suspect they were Chinese steel. The French wheelbarrows held up well. The Brazilian shovels were good. Boards were not the nominal measurement like ours but actual 2x4's and 1x4's both 16ft long. Planks were 16 ft long. Rerod comes in "ba" s bent over in the middle and about 20 ft long. The wire used to tie bags and rerod structures comes by the pound. I am not sure but think we used about 30 lb. Also barbed wire is sold by the pound too. We used a full three rolls of unknown wt. Plain wire is called "fil fe" Barbed wire is also referred to as "fil fe" but can be clarified to be "fil fe -----?" Sorry lost it. The 1" square steel tubing called "tib" is about 25ft long. Sand comes by the truck-full. This cannot, it seems, be converted into tons or yards of sand.

The site for the house was chosen by HAPI coordinator based on the premise that it would be for one of the HAPI workers first, and accessibility of the site second. As it turned out, although the best choice under the circumstances, the difficulties due to location were profound. The site was a 30-40 minute difficult walk. Trucks could get no closer than a quarter mile from the site when the road was dry. When it rained, the trucks at one time dropped boulders and sand a mile away. Even when drops were made nearer, material had to be hand moved down a very steep hill. This created many delays, greater expense, and much frustration on everyone's part.

The layout of the house at the site was made based in part on the requirement to leave the old house standing until the new one was done. Also the lack of another level place left little choice. As a result of the slope of the land, the foundation was made higher on one end than the planned 8 inch above grade planned.



The foundation went in without problems using typical Haitian techniques. The cement slab was done without difficulties. Rerod spikes were placed along the foundation which would stick up into the first layer of bags. I had to insist on putting a grid of rerod in the central areas. The "boss man" wanted only the peripheral rerod.



Filling the bags: First the bags were used. They had been ripped open to different degrees. It made some difficulty sealing them. The length varied also due to the fact that our bags had been ripped open giving us various amounts of bag to fold over and sew. A few of the bags were also a smaller size. We didn't use these until we ran out of the larger ones. I will use new bags next time for more uniform

and longer bags. The bottomless bucket as a funnel worked well but they stopped using it for some reason. When sewing the bags don't roll the end down any further than necessary. Leave the bag as long as possible. Also, the two men recommended

that we use twelve shovels full for each bag. This led to our making a big mistake. We should have listened to advice to use a measuring bucket! Our bags ranged from good to roly-poly. **USE A MEASURING BUCKET TO GET UNIFORM AMOUNT OF FILL IN ALL BAGS!!** The fill for the bags was a combination of purchased black sand and local dirt. The recommendation from Serg and Jefries who visited LeCaye to see the "Sun House" was one fourth earth and three fourths sand. I am convinced that it is too expensive to buy the sand. We should have used only the local dirt. Although various recommendations for different ratios of clay and dirt are out there, so too, are reports of using just about anything including rice hulls. How about Michigan cherry pits anyone?

Laying the bags: We didn't use a slide sheet. Moving bags was somewhat problematic due to the barbed wire. Two rows of barbed wire was laid down on each row of bags. Next time I plan to omit the barbed wire. It is hard to deal with even though it seems very effective. Instead I will use rerod to stabilize the bags. At half wall, drive rerod down through the bags to the foundation. Space



them so at least one rod goes through each bag. Mark the top layer of bags at this height with a marker. At full height, drive another set of rods down into the wall pasted the marked row of bags This would be much easier and accomplish just as effective a system to prevent bag shifting. I don't know the relative cost of this procedure, but, the ease and time saved would, I think, make it a good idea. Bags of course should be overlapped to avoid ends over each other. Several instances of doing this wrong missed my attention. When it couldn't be redone, extra rerod was used to stabilize that area. As a result our house has almost a double system of barbed wire and rerod. The first layer or two of bags were laid against a form made of planks. There were not enough planks to do this at every level. As a result visual inspection as the bags were laid down led to less than perfect plumb and straightness of the walls. Next time we will have enough planks to complete the form to lay the bags down better. At the doors and windows bags were stacked alternating full and half bag against the frame. Rerod was used beside the frame to stabilize this weaker

area. Using full bags only against the frame would have resulted in joints in line at the end of the first bags. Not sure at this point if one way is better than the other.

The boss didn't understand or want to use a spool holder to dispense the wire. Barbed wire is very effective at preventing bag shifting, however, it is very difficult to use. In our case, we used so much rerod to stabilize weak areas or mistakes that we might as well have just used rerod.



The doors and windows were framed using 12" wide planks. A double layer of framing was used on top of each door and window to support the bags above. The windows were 30" square. Placement of windows seemed high to me, but, it was the norm for Haitian practice. We left a space for the door in the first layer of bags. Our house had a raised floor and sheltered doorway. Some plans might require

making a curb or step by using the bottom layer as a threshold to prevent rain from entering the house. Doorways were made about 4 inches too narrow due to the builders error. This will have to be accounted for by reducing the width of the doors. Doors and window shutters will have to be installed after we left. The plan called for "Dutch" doors. Although seen in other areas of Haiti, this concept was not easily understood.

The form for the "bond beam" was made of planks (1x12's). A layer of rerod



using two heavy and one medium rerods was linked with cross bars of small rerod all tied with wire. The rebar will extend from deep in the wall up through the bond beam and wrap over the 2x4's of the rafters.

We used a tall step ladder which was very handy. The workers rejected ideas of scaffolding. As you can see, they are quite imaginative at use of 2x4's without cutting them. I had suggested that gaps could be left in the walls at strategic points to allow 2x4's to be slid into the holes to support scaffolding like the typical technique used in block wall construction. The holes could easily be filled when the wood was removed.



Venting: The plan called for vents within the bag walls on the high and low side. Using the planks on the bottom of the bond beam forms prevented rerod from being driven down into the bags and left sticking up above the cement. Attempts at a work-around were less than desirable. The eventual solution was to insert rerod into the wall, bring it up and over the rafter, back down and into the wall on the

other side. I'm not happy with this. This is where we had a problem with chain of command and communication too. All led to a failure to follow the planned rerod system to tie the wall, beam, and roof system together. Notice the gap under the back beam. This area was to hold vent block for ventilation. The blocks were not on site, so, we proceeded by using a plank at the bottom of the form to hold the cement. This latter led to a disastrous result. We proceeded to erect the walls leaving a place for the block expected later. On the high wall this created a gap about a foot high and almost the full length of the back wall. On the last day, the boss man knocked out the plank under the back bond beam. The bond beam immediately fell in the middle creating an evil grin. This was levered up most of the way and the block area filled with bags and rocks. The vent block never did come. The fall of the back bond beam caused a bow in the back corners. I believe that because of all the extra rerod used that the building will still meet the required stability in an earthquake. The day was saved for venting however.

The boss man constructed the roof system by starting with a "square" of 2x4's on edge around the bond beam. Next he placed 2x4's on edge along the long axis across the top. Finally he laid the purlins of 1x4's on top of the second layer of 2x4's. When the sheet metal was put on, this created a perfect vent area all across the high and low walls. We filled in the areas previously left for vent block. With the application of a 1x4 facing board on the back even horizontal rain would not get in but plenty of air will.



When the roof support system was put down, the purlins extended out over the sides an appropriate distance for the planned overhang. However I turned around at one point just in time to see the boss man sawing off the last of these along the wall line. As a result the roof has no overhang on the sides. Since we left at this point, it is yet to be seen how he will treat the wall/roof juncture.



Because of the crooked roof, extra metal had to be patched on the one corner and the metal was bent over on the other corner. The original "square" of 2x4's was not. That is he measured the length of the sides but never the diagonal. This resulted in a parallelogram to which the truly rectangular sheet metal could not be applied without going over on one side and

being short on the other. Worker skill levels cannot be relied upon for even such a

basic thing, so better observation will have to be used. The layout of the first rafters is critical. They must be square.

The columns for the porch were set into the corners of the foundation. The square rered structure consists of two large, two medium rered rods tied by squares of small rered rod at 6-10" intervals using the wire to fasten them together. We didn't pour the columns until we could lay a 2x4 along the slope of the bond beam to determine the column height exactly.

As with so many other things, the welder and equipment never appeared on the horizon. So I put a grid of square steel on the roof using lag screws to tie it to the long axis 2x4's. This too was difficult due to the irregular pattern of the 2x4's below. A fortunate thing was that a good, easy to use generator was available so I could use an electric drill to pre-drill tubing and wood. I first placed tubes on the long



axis. Then I put cross pieces at each end and in the middle. I would have used more cross pieces, but, the only drill bit I brought bent about 1/3 of the way through making it almost impossible to drill the holes.

Because of all the delays we were not able to complete the house in the two week period. Two of us, Carla and I, stayed an additional week but when we left, they still had to complete 98% of the parging, and the painting. I really liked the idea that the LeCaye house had a name, so, Eugene, the home owner chose Kay Espwa (house of hope) as a name. An artist has been commissioned to paint a bowl of flowers on the front of the house with the name below.

The work crew will install a gutter made of a PVC pipe cut in half along the porch roof. The square steel was left to overhang the roof by about 8 inches to support the gutter. The two water barrels used are given to the owner to collect water.

Something that we came to realize is that the local builders do not seem to be able to

comprehend the written plans. I drew many extra drawings to help them visualize things. They agreed to them but didn't act as though they really understood. It is possible that reading or using even pictures is something they are not accustomed to doing. Even though we usually get along well without an interpreter in other areas, we believe that a very good interpreter with experience in building language is necessary.



When we left after 3 weeks, the parging or crepitzing (cement coating) was started on the inside. They will finish the parging inside and out. The gutter is yet to be installed along the porch. The last thing I did before leaving was to install a grid of 1" square steel tube on top of the sheet metal. This will prevent the metal from being blown off in high wind. Originally, I was going to weld the grid. The plan was changed due to lack of a welder. It is connected and fastened into the rafters with 5" lag screws. Fortunately, a generator was available to enable me to use an electric drill. The bit bent about 1/3 of the way through the installation however or another cross member would have been added. When walking on the roof, use planks on the roof to avoid denting the very thin sheet metal. Trying to walk over the purlin areas is too difficult. The steel tubes were left extending out about 8 inches to support the gutter. The two water barrels were left for the homeowner to collect water. An artist has been commissioned to paint a bowl of flowers with "Kay Espwa" (house of hope) underneath it on the front wall. This is the name chosen by the home owner. (I liked the idea of naming the house like was done for "The Sun House".

With everything considered, I think we were successful in our mission. The house will be safe in earthquake or hurricane. It will be as cool as any house can be in

Haiti with excellent mountainside breezes and ventilation. Hopefully when the house is finished, it will have a pleasant appearance.

The next trip I intend to go down early to enable all leaders to conference together point by point all the way through the plans in detail. This may take a couple full days, but, it will be worth it. This would also be a time to clarify the chain of command and workday expectations. On this trip, the boss man didn't understand or resisted that I was the authority on the project, not him. Middle man and interpreter didn't have the ability to cope with making this understood either. We assumed an 8am to 5pm work day. After the first such day, we were told that the day should end at 3pm with a following 30 min. cleanup time. Also, we were unfortunate enough to have Good Friday and Holy Saturday fall during our project. I asked whether we would be working or not trying to be sensitive to their wishes. I was told they would work. As it turns out they worked half days for each of these days. After the fact, the boss man got angry because he was only paid for half a day each. He thought he should have been paid whole days on each. Therefore watch for special days. Make clear what the hours of work are and how much they will be paid before starting. Our differences, however, were resolved with forgiveness all around as Christians should do, with the help of a "peacemaker" spirit.

All in all the experience was not that unusual. Challenges came at every turn. Plans were continually in flux to accommodate surprises. It tests the metal of a team for sure, but, in the end the project will be successful. The house will be finished. It will meet the requirement of earthquake resistance. It has a roof that should not blow off even in a hurricane. It will be cool due to excellent ventilation and a good breeze due to it's mountaintop location. Hopefully it will have a pleasing appearance. The home owner is happy and will be safe along with her husband, father and seven children who will share the 13ft x 13 ft home.

Source : <http://www.earthbagstructures.com/articles/kayespwa.htm>