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Synopsis of Engineers Without Borders (EWB) trip, Guatemala May 18 to May 29, 2012

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Synopsis of May 2012 Guatemala EWB Trip

By Willis D. Weight PhD PE Carroll Student Chapter Faculty Advisor

Introduction
This was a historic trip because it was the first implementation trip in Guatemala. There had been approximately four assessment trips prior to this and in March 2012 the EWB TAC committee approval was given to construct three shear walls to strengthen the east wall of the library. The plan was to have the foundations prepared beforehand so we could assist with wall building and tie the wall to the second floor of the library. When we arrived two very large excavations were completed with no concrete poured. It made sense to construct the two walls and abandon the idea of excavating a third hole, although the tile and concrete floor were disturbed to do so. Six thousand dollars had been sent previously and spent to obtain materials and an additional $2500 was to arrive by the Monday of our work week. In the end we could see the wisdom of Denver EWB’s Peter Waugh’s comment to figure out what you could do in one trip and then “cut it in half”. The trip was a success on almost all fronts and important lessons were learned.

May 18, 2012 Friday
Our departure from Helena was without incident. Stephanie and I were the only ones who departed from there. All other participants except Jonathan Kujawa (who left from Sacramento, CA) met in SLC where we gathered for our flight to LAX. Jennings Anderson came from Colorado, Brian Murphy and Whitney Miller came in from Billings, Sara Carlson and Kaitlyn Holyfield came in from Missoula, Evan Tremaine and Kegan Cunniff came in from Washington and Great Falls. Our professional mentor Kurt Keith of Morrison-Maierle came in from Bozeman. We were a group of 10 in the flight from SLC to LAX and we arrived local time 10:30 PM. Jonathan Kujawa had arrived about 7:30 PM so the 11 of us boarded our red-eye flight to Guatemala City about midnight. We arrived at 5:30 am local time (same as our Mountain daylight savings time) after 4 ½ hrs of flight time. Sheila McShane, her driver Ciruilo, and Hector the driver of our minibus were there to greet us.

May 19, 2012 Saturday
Once one has deplaned the usual procedure is to hand in two pieces of paper document forms as one passes through customs (a description of the trip’s purpose and contact information and one per family sheet) and shows one’s passport. Once the bags are located a random selection for rechecking the baggage by local personnel with a green light vs. red light system. We managed to get the green lights, while a red light means another delay.
Our Driver Hector Rene Ponciano was quite the tour guide full of information about the local culture and flora. I tried to take some notes and convey translations to those who were awake. One interesting item was that volcano Fuego erupted that morning at 3:30 am and the plumes of gases and ash were still rising into the air. The change in vegetation and geology from “the City” to the lower elevation coastal highway is prominent. Guatemala City has more varieties of pines and eucalyptus trees giving way to more tropical Ceiba, palms, Hule, and Acacia trees (matrimony trees from red flowers). They say matrimony because they look good at full flower and then they drop away and become plainer. The geology near the City consists of limestone and sandstone while the coastal highway shows mud flows and river deposits. About 9 am or so we had a most excellent breakfast at Sarita near where the highways diverge into four directions. Continuing on the coastal highway northward we stopped at a local fruit stand to learn about the fruits that are not common in the States. Muchin – is a pod-like fruit about 9 inches long with a white stringy fruit outside a large dark seed. One sucks the white fruit off the pod. Mamey – a large (6-inch diameter) brown outside is trimmed off to reveal an orange tangy fruit with a one-inch core that looks like a large walnut. We also tasted sugar cane and purchased some pineapples and mangos as they were in season.

About 11:30 am we arrived at the Clinic in Santo Tomas La Union. Each was introduced to their quarters by Sister Mary and then had a wonderful spaghetti lunch. After lunch Jake Nistler took us up to the La Asunción School. Only Kurt, Jennings and I had been there before so everyone got a simple tour including a view from the third floor. Below in the foundation excavations specialized workers from out of town were breaking very large basalt rocks with a hand chisel and large pry bars into pieces that could be lifted out. Some were a meter across and likely weighed more than 300 kg. We found ways to leave the largest ones in place. We all rode back down standing in the back of the pickup equipped with a riding bar to hang onto. We changed our clothes before attending the 5 PM mass, which all of us attended. After dinner we stopped at the local ATM (Cajero) to obtain local money.

**May 21, 2012 Sunday**

During breakfast the main constructor at La Asunción School David Cua met me to see if I could pay Q1000 to the workers from out-of-town who broke up the rocks. I did so. The students went to the Mercado and to a local soccer game until lunch time. We arrived once again at the school about 2 PM to assess what needed to happen this week. We all participated in removing the rocks from the excavations, some of which took three men. We did so without incident and then measured the holes. The northern most excavation was 21 ft by 10 ft by 4 ft deep, and the other hole to the south was 20 ft long by 9’ 8” wide and 4 ft deep. They were supposed to be 16 ft by 9 ft by 4 ft. After a few calculations of the remaining funds and an assessment of the remaining time we quickly realized that going for the construction of two walls instead of three was the prudent thing to do. Kurt verified that if we could construct both walls it would make a significant difference to the east side of the building.

We provided a translated version of the TAC PowerPoint to Angel and David in Angel’s office. The tone of the presentation was to praise them for the work that had been done but what we are proposing would greatly improve the safety of the library building. This included a U-Tube video of the ground shaking...
motions of an earthquake. They had exceeded Guatemalan construction practices for vertical loading but were vulnerable to lateral loads, like from an earthquake.

We evaluated the materials in place in the bodega (room with cement, lime and #5 rebar). The concrete blocks were stacked outside, all 615 of them. Our plan was to have most of the students and Kurt prepare the rebar mats on Monday so that the first foundation could be poured on Tuesday. Jake, Stephanie, Angel, and I would head to Mazatenango (Mazate) to negotiate returning 95 sacks of lime that could be traded for other materials needed. One lesson here was Kurt did not check the estimate of materials needed and fortunately they (Angel and Jake) ran out of money before more sacks of lime could be purchased the previous week. Kurt reaffirmed the need to return the lime and see what other materials we could work out. We agreed on a recipe for concrete of 3 parts sand, 3 parts gravel, 1 cement, and some Sika, a water reducer.

**May 22, 2012 Monday**

Kurt and the students got to work cutting rebar to length and preparing the rebar mats while four of us went to Mazate. We gave the invoices to Angel and waited outside while Angel did the negotiating. He came back out and they (Penki) would take the lime. This provided us with the ability to obtain materials for the concrete mixer, gravel for the concrete, and other items so we could get going on Tuesday with a pour. Shielia was very gracious in sending Q2000 of her personal money to make sure we have what we needed to keep things moving. (I returned this back to her later and met with Father Kevin after dinner to obtain a summary of expenditures). We drove up to the school in time to provide rebar tie materials and get the first mat ready. We would get up early and meet for breakfast about 5:30 am the next day. This was a successful day. The gravel was to be delivered by 8:30 am or 9:00 am along with a load of 10 m³ of sand in the morning.

**May 23, 2012 Tuesday**

We arrived about 6:30 am and the first rebar mat was lifted into place (it took about 7-8 people). Some chairs (or spacers) were constructed and the second mat was laid on top. This was a bit tricky because we had to have people in the southern most excavation to carry the rebar mat to the north and then hand it off to others to bring it into the northern most excavation. Then ones footing between the bars of the first mat and chairs had to be negotiated to get it into place. This was successfully done by about 9:30 am. Julio from Santo Tomas delivered the load of sand around 8:30 am but the gravel from Penki source in Mazate did not arrive until almost 11 am. This was a bit stressful as the rains looked like they would arrive soon enough. We fired up the concrete mixer (Jose ran this mostly). What was required for the concrete mixer was 5-gallon buckets of gravel and sand, and sacks of cement to be readied for a very intense 3-hour mix and pour session. Other workers were also present including Angel Cua who outlasted all of us in physical ability.

The recipe was slightly modified by David. A bucket of water, 2 buckets of gravel, two buckets of sand, a cup of Sika, half a sack of Portland, more water two more gravel, two more sand, the other half of cement, a 1-minute mix and pour down a makeshift canal-shaped chute into the excavation. Forms were placed to reduce the length of the footings to 16 feet but the width was left as is. There were folks filling buckets, folks carrying buckets about 200 feet, others who lifted the buckets to the mixer, while
Kegan and Jonathan mostly raked and pushed the concrete around. This was a fast-paced, total physical experience to learn the work ethic of the Guatemalans, led by superman Angel. We did the (11.5 yard) 2-foot thick pour and completed the work so we could eat about 2:30 PM a wonderful lunch prepared at the clinic and brought up by Sheila and Estefa. Everyone was hurting to maneuver the 500 plus buckets, 94-lb cement sacks, and other tasks. We were satisfied and happy with the success but to face another pour similar to this one led me to ask Angel to hire four more men to help us for the pour for tomorrow. The rains came and we prepared the first rebar mat of the second excavation as much as possible.

**May 24, 2012 Wednesday**

We got up early again with a similar schedule as the day before. We were wondering best how to make chairs for the second lift. David asked me if we were using some shorter pieces (36 inch or so) for anything. He measured and then he and Jose showed us how to make wonderful chairs using the rebar benders. These were put into place and tied. Again the group lifted the rebar mat into place, this time leaving a couple of the #5 bars not tied until after it was in place so the lifters could escape more easily from the excavation. About 9:30 am we were ready once again but the mixer broke down after a few runs. It was necessary for David to go on his motorcycle to get the correct welding electrodes.

The repairs were made and a prayer offered and we got going again. We came up with a better system of using wheel barrows to bring buckets of material rather than carry and run with each one singly. This was more efficient and a bit less wear and tear. The whole experience was once again very physical but the footings were poured. The last batches were thicker with minimal water as the rains had already begun to fall once again. We also carried some blocks down to be ready for the morning. It was a good idea to hire the additional workers and helped lift our spirits. In all over 1000 5-gallon buckets were moved representing approximately 45 tons of concrete and 23 yards for the two footings.

Jose had marked out the location of the blocks for the first course on the north wall. Some of the rebar from the footings had to be bent somewhat to make the blocks work.

**May 25, 2012 Thursday**

The pressure was on to get two walls up four feet. Some of the women were not able to work so hard physically so I recommended that Sara, Kaitlyn, and Stephanie stay down at the clinic after we descend for lunch. We collected water samples from the school sink in outside and inside the kitchen and later at the clinic. Our idea was to come down to the clinic to have lunch after having collected water samples and gone up with the first wall four feet. This was not communicated to David, Jose, and Edgar (Chino) until late morning. They were not so happy to have to fend for themselves for lunch (a bit awkward) but we worked through it.

David and Jose were very meticulous about setting vertical and horizontal lines so the walls would be straight and plumb. They use a round wooden piece that is placed against the wall with an attached brass weight that hangs down. If the wall is straight the weight will hang with the appropriate space between it and wall. This is a very simple but elegant method. The walls were only up about three courses before lunch. David asked me if they were supposed to teach us how to lay block or if we were
supposed to help them. I affirmed that we were here to help them and that we would get more out of the way. They continued while we descended the hill for lunch.

Once we returned David and his crew had completed setting the blocks of the second wall. It was time for them to teach us how to mix grout. David showed me how. This was the recipe: (25) 5-gallon buckets of sand, (5) 94-lb sacks of cement, and water. The sand was poured into a large pile with the cement dumped on top. Shovels were used to overturn the mixture into two volcano hills. The two volcanoes were then shoveled toward each other to make a large mixed hill. A hole was excavated in the middle for water to be added. Again shovels turned the mixture along with a large hoe to scrape the materials into the middle. Grout was shoveled into buckets and taken to the 4-foot wall. Beforehand 60-inch #5 rebar were placed in every other hole in the blocks and the slurry was poured by rolling the bucket along the top edge of the wall. The rebar was plunged up and down to settle the grout downward and fill every crack. The overlapping of the bar from the footings and the extended pieces upward would make a single reinforced unit structurally. Once the grouting was completed a horizontal #5 bar beam the length of the wall was added and buried into the mixture.

Once the first wall was finished at 4-feet the local workers left because they had not eaten. It was 3:30 PM so Kurt led the charge to grout the second wall. This was completed and we were feeling pretty good about the progress. The walls sweated from the liquid-like grout but no blocks blew out from plunging the rebar up and down. We covered with plastic and boards to keep the rain off. That night the skies seemed to explode with rain coming down very heavy on our tin roofs. The silicone ear plugs were very helpful to keep the noise at a manageable level. Dinner was excellent and served with ice-cream for desert.

May 25, 2012 Friday
Sara, Kaitlyn and Stephanie worked on preparing their community health projects. The results of the water samples showed that contamination is still prevalent at the school but the ONIL filters were working and the bottled water seems to be OK.

Microbe samples
Sheila had located the old incubator at the clinic lab so it was “played with” to get the temperature near 35 °C. It worked great! We were able to keep the temperatures between 33 and 37 °C over 24 hours (we checked it regularly). The next step was to prepare all the samples for microbes.

A 1 ml sample was pipetted from the 100 ml sample bottles and placed in the center of a 2-inch diameter Petri-film plate containing agar. A plastic flap was laid down over the sample and a plastic press was used to fill the 2-inch diameter platting field. The samples were all taken in triplicate. All samples were placed in the incubator until we could read them the next day. After dinner we set our plan for the following day.

Construction Activities
Our goal today was to get as close as possible to finishing one wall. In David’s words he said “If you show me how to completely finish one wall I can do the other one”. This was exactly our goal with
sustainability and music to our ears. We concentrated our efforts on the northern wall. The first step in the morning was to set scaffolding for each wall. This was done by setting blocks up about 5 feet. On top of that planks were laid and bound with tie materials (alambre). Reinforcements were made to the planks laterally and the scaffolding was firm and reasonably safe.

It was necessary to drill holes upward (6-inch holes and 30-inch bars placed so they hung down 2-feet) and use the epoxy with enough space to lift and set blocks between the rebar extending upward and those hanging down. The Hilti epoxy dispenser worked for one round of 4 bars and then failed. The rest of the epoxy (12 more bars) was mixed by hand in a discarded plastic water bottle container. I wore leather gloves as the reaction was exothermic and we stationed two students at each of the four pillar areas at the ends of each wall. Kurt would hand the dabbed bar to the student and they would shove the bars into place and hold them a minute or two until they set. The next 4-foot course was set and grouted. The northern wall was now 8-feet high.

We made sure lunch was brought up from the clinic today so we could all eat together once again. After lunch two block courses were set at the pillars and three block courses were set between. Forms were set and the last task the next day would be to drill the holes and secure the bolts and iron.

May 26, 2012 Saturday

It took a while to cut the bolts from 1-m lengths into 4 pieces. We had the angle iron at the top of the inside of the north wall. Holes had been drilled through the floor of the library. We had issues lining up the holes and getting all four bolts for each of the 3-8” thick angle iron to line up but eventually got it done. In the library the flat plates are joined with the angle iron below by the bolts. Other horizontal bolts from the angle iron extend inward into the wall space. Another horizontal bar was tied near the top of the wall and a thick mixture of grout was made for hand-packing. The recipe was three sacks of cement to (9)-5-gallon bucks of sand and very little water. This was hand packed by everyone and the wall was completed! David said “Bueno, ya se como hacerlo” Very good I know how to do this!

David informed us that they only work half-days on Saturday so we were done. He consented in showing us where their new spring was that they are looking at (Spring X). We rode up to just above the cell tower and crossed someone’s yard to see the spring. It was flowing from rocks about 150 to 180 gpm (4 feet wide by 0.1 ft deep and about 1 ft/sec velocity. Importantly David said the flow was steady even during the dry season. We were very happy to have one wall completed and the second wall with scaffolding in place with a partial second course above the four foot level placed.

May 27, 2012 Sunday

We arose early to a wonderful breakfast of scrambled eggs with tomatoes, tortillas, beans, yogurt, and papaya juice and so on. Hector picked us up and Sheila and Ciruilo went with us in a gray pickup. We were headed to the town of Santiago on the west side of Lake Atitlan. Hector explained that this lake has a circumference of 125 km and is 370 m deep (1200 feet deep). Lake Atitlan is similar to Crater Lake in Oregon, in that it is a caldera lake. He said there is a Mayan City submerged beneath the Lake surface. Hector added that there are 12 towns around the lake with the names of saints. Three large
volcanoes are near the lake (Atitlan, Toliman, and San Pedro). One environmental issue is the
surrounding towns are draining their wastewater into the lake and “killing it” in Hectors words. Later I
observed the duck weed that is an indicator of waste pollution. We drove to San Lucas first and
continued on to Santiago. We arrived at the Internet Hotel? ($11 US per night) and did some shopping
along the main road. There is an excellent Taco eatery across the street and some of us tried out the
restaurant up the road where they have a special. We went through the market and visited the church
where a priest from Oklahoma was murdered. His heart remains at the church while his body was
shipped back to the States. They have a memorial there. One unwise thing I did (dragging Kurt along)
was to get a view of the lake by getting off the beaten path. Later Sheila said that being by the main
roads was the only safe place to be. A couple of youth noticed our son glasses and said in Spanish “here
come the X-men”. It was a pleasant and relaxing place to stay.

May 28th, 2012 Monday
Monday morning we left near 7 am to head toward Antigua. The idea was to travel for a couple of hours
and then have breakfast. It was a good plan and we enjoyed the ride down to the coastal highway. Part
way the guys rode in the back of the pickup to get a different view. This worked well until we ran into
the clouds of mosquitoes. We purchased three cocos (coconuts) and tried them out at breakfast.
Breakfast was wonderful, a nice variety of egg choices with juice and coffee. Mine had cabbage and
cheese on the eggs which sat on an English muffin. We went a bit farther up the coastal highway and
then turned east toward Antigua. We reached the Ancient City (City Viejo) just after 11:30 am. Our
timing was good because they blew off fireworks shortly after arriving. We got into Antigua about noon.
We were able to wander around until about 3 PM where we would meet for lunch. We ate at the La
Cuevita de Los Urquizu. It has excellent Guatemalan food. We arrived at Noval Hostel about 5:30 PM
where Lupita was waiting for us. The cost was $25 per person US. Later father Kevin came over and
stayed until near midnight.

May 29th, 2012 Tuesday
We had breakfast about 4:45 am and were loaded up in the minibus with Hector by 5:10 am. We
arrived at the airport where Sheila and Ciruilo bid us goodbye (that was very nice). We had time to
check in, obtain our boarding passes, and then go through customs and wait for the plane. We had to
wait about an hour before departing at 7:20 am. We arrived at LAX about 11:20 am local time. We had
until 1 PM to get through customs and so on. For awhile there it was looking tough as we were moving
so slowly, but then we broke free and make our connections. Everyone reached their final destinations
and it all worked out.

Conclusions
A successful implementation trip was achieved by the Carroll Guatemala EWB team. We set out to
construct three shear walls. In the end poured 23 yards for the footings of two and completing one wall
completely and more than half of a second wall. We taught the local constructors how to build a
structurally sound shear wall and discussed with them where they might put another one. They have
enough blocks and rebar to construct one more wall somewhere else. We recommended that the new dormitory might be a good place to consider. We learned a lot about Guatemalan work ethics and have a better appreciation for the methods used in the States. Implementation projects are possible only if there are people on the ground like those at the clinic (Jake Nistler and Father Kevin) and others at the La Asunción School (Angel and David) with whom we have established a report.