Construction Training Facility

(ESSU Philippines)

A Senior Project
Presented to
James Mwangi from the Department of Architectural Engineering

By
Omar Ramirez
May 2016

© 2016 Omar Ramirez
<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>Page 3</td>
</tr>
<tr>
<td>Background</td>
<td>Pages 4-6</td>
</tr>
<tr>
<td>Background Figures</td>
<td>Pages 6-7</td>
</tr>
<tr>
<td>Background Quantity Takeoff and Structural Plans</td>
<td>Pages 8-45</td>
</tr>
<tr>
<td>Training Station Layout</td>
<td>Pages 46-49</td>
</tr>
<tr>
<td>Training Station Layout Figures</td>
<td>Pages 50-54</td>
</tr>
<tr>
<td>The Outcome</td>
<td>Pages 55-57</td>
</tr>
<tr>
<td>The Outcome Figures</td>
<td>Pages 55-62</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>Page 63</td>
</tr>
</tbody>
</table>
ABSTRACT:

The purpose of this project was to work hand in hand with the engineers and construction managers from the non-profit organization Build Change in order to build a training facility in The Philippines. Thus, this project is consistent of three major components and a general image album for every section. The three major components are as follows:

The first section (Background) of this report exposes the finding and inspiration of this project. This section also includes estimating the cost of the project and reviewing the structural details to ensure that all of the necessary components are included. Along with this there is also a brief summary of the challenges faced when coordinating a project that is being constructed over 7,000 miles away.

The secondary focus of this report (Training Station Layout) describes in essence the role that every layout of the training facility and gives a detailed description of the importance that every step in this training has.

The third section of this report (The Outcome) describes what the experience of working with Build Change was like. There are also more descriptions about preparing for construction and how my participation in the project concluded. Lastly it describes the benefits of overcoming the challenges and the personal growth that I have seen in myself as a professional.
BACKGROUND:

Throughout the past five years in the Architectural Engineering program at California Polytechnic State University I have experienced a multitude of great life changing experiences. These experiences include challenges anywhere from learning how to cook to learning how to manage the time to work full time while also attending school full time. From all my life changing experiences in this program there are two that are the most memorable. One is the Structural Engineering Students for Humanity (SESH) trip to Haiti in the summer of 2014, and the other is my senior project. For my senior project I had the opportunity to work with the Build Change non profit organization in the Philippines. Even though both projects were in very different locations, they both resemble one another very much. Both projects served one purpose and this purpose was to help those who are in greater need than us.

After being a part of SESH I decided that I wanted to focus my senior project on something that would be more geared towards helping the less fortunate. Figure 1 is an image of my trip to Haiti. The simplicity of an image discloses that the need of the people from third world countries is greater one can imagine. With this in mind, I knew the right person to approach for something like this. Professor James Mwangi has been the one professor in the Architectural Engineering department who has seen it all. He was there right after the Haiti Earthquake helping assess buildings and he was also there supporting the people in Nepal after their recent earthquake.

After discussing with him what my goal was with my senior project he contacted me with the right people. My direct contact for my senior project would be Michael Collins. Michael is the Director of Education for The Build Change Group and the person behind the construction
and design of all of the training centers that are built by Build Change. The first live chat that I had with Michael was when he was in Bogota, Colombia. During this FaceTime chat with Michael, He gave me a general overview of Build Change and then expanded by asking me several questions about myself.

As mentioned by Michael, Build Change is an organization dedicated to serve the communities in third world countries by educating the locals with better building techniques. The Build Change group focuses their efforts to establish a consistent building pattern that is broken down into different phases which include: determining suitable construction material, establishing a stable building foundation, reinforcing appropriately in accordance to the use of the facility, assuring quality control throughout the extent of the construction, and lastly tracking costs during construction amongst other essentials tied in with construction management.

Michael then proceeded by asking me what my interests were and what he could do to make a project more interesting for me. I then expressed to him my interest in construction management along with my interest in making an impact on the lives of people. He immediately knew exactly what project to place me on. Michael expressed how there was an Eastern Samar State University (ESSU) project that was expected to start in Guiuan which is located in The Philippines. The ESSU project consists of building a facility to better train local construction workers to perform greater quality construction. This construction includes the basic tips to improve building performance during catastrophic events such as hurricanes and earthquakes. The goal of Build Change in the Philippines is to push the locals to construct a safe room in case a catastrophic event occurs. Build Change understands the cost behind constructing a strong stable home and they know that the locals will not be able to afford such a drastic modification but they will definitely be able to afford something smaller and still efficient such as a safe room.
When I became a part of this project, there was already a general structural design made for this safe room. Therefore my first task would be to do a takeoff for the design in order to get quantities for the construction material. This task was conducted by using a general template that was sent to me by Michael and which can be at the end of this section. Michael was very specific about using their template because this would allow anyone on the design team to make any necessary changes at any time. During the time that I was doing my takeoff I ran into several conflicts. I encountered issues with the spread sheet, I had to do research on the currency used in The Philippines, I had to keep in touch with Michael while he was on a different zone, and lastly I had to begin using metric units for all of my quantity calculations and this is something that I was not familiar with.

In the documents attached after this section there are copies of the structural plans and details that were designed and drafted by Build Change engineers as a reference for this project. The majority of these plans were provided to me after my initial talk with Michael and it was stated to reference these plans to complete a quantity takeoff for what would be an individual unit (safe room). I will state that I replicated some of the structures in these plans with Revit in order to obtain a greater understanding of the building but all of the structural design credit goes to Build Change. The preliminary models that I created can be seen in Figures 2, 3, and 4 and they were created in an effort to find any design flaws and to assure that the rebar in the safe room would fit accordingly.
Figure 1: This is an image taken in Haiti during the 2014 Structural Engineering Students for Humanity (SESH) trip. 
(From left to right: James Mwangi, Omar Ramirez, Haitian Children)

Figure 2: This model was made by using the set of plans provided by Build Change and an Autodesk software product called Revit 2015 to provide further detail of the building itself. I made sure to incorporate the rebar in this model to ensure that the spacing would not be too congested for when real construction began.
### Bill of Quantities - Basic Design Inputs

**TECHNICAL ASSISTANCE & TRAINING FOR FAMILY-DRIVEN RECONSTRUCTION IN SULANGAN**

**Homeowner:** DARIO BAGOYORO  
**Address:** S1-12 (PUROK1, SULANGAN PROPER, GUIUAN)  
**Engineer/Architect:** Clement

<table>
<thead>
<tr>
<th>Design Code</th>
<th>front</th>
<th>back</th>
<th>left</th>
<th>right</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1 CV CU 1.02 CU 1.02 CU 1.02 E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Wall Pier Lengths for Block Units (m)

**3.5m Front and Back**

<table>
<thead>
<tr>
<th></th>
<th>SW</th>
<th>CU</th>
<th>EU</th>
<th>EF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check front wall pier:</td>
<td>1 OK</td>
<td>2 OK</td>
<td>3 OK</td>
<td>4 OK</td>
</tr>
</tbody>
</table>

**4m Front and Back**

<table>
<thead>
<tr>
<th></th>
<th>SW</th>
<th>CU</th>
<th>EU</th>
<th>EF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check front wall pier:</td>
<td>1.02</td>
<td>1.64</td>
<td>1.85</td>
<td>2.06</td>
</tr>
</tbody>
</table>

**3.1m Side Elevation (TV)**

<table>
<thead>
<tr>
<th></th>
<th>CU</th>
<th>EU</th>
<th>EF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check rear wall pier:</td>
<td>1.02</td>
<td>1.65</td>
<td>2.06</td>
</tr>
</tbody>
</table>

**2.9m Side Elevation (CV)**

<table>
<thead>
<tr>
<th></th>
<th>CU</th>
<th>EU</th>
<th>EF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check rear wall pier:</td>
<td>1.02</td>
<td>1.65</td>
<td>2.06</td>
</tr>
</tbody>
</table>

#### Building Info

- **Footprint Area:** 16.4 m²

#### Price of the House

- **₱167,262**
- **₱10,199 /m²**
<table>
<thead>
<tr>
<th>Item</th>
<th>Last Price (Php)</th>
<th>Unit</th>
<th>Qty</th>
<th>Cost (Php)</th>
<th>Qty</th>
<th>Cost (Php)</th>
<th>Qty</th>
<th>Cost (Php)</th>
<th>Qty</th>
<th>Cost (Php)</th>
<th>Qty</th>
<th>Cost (Php)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cost of Labor</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holdback: 25% of the cost of labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount Provided for Labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cost of Transport</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sub-Total</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>CGS for unforeseen costs</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental unforeseen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TRANCHE 1</strong></th>
<th><strong>TRANCHE 2</strong></th>
<th><strong>TRANCHE 3</strong></th>
<th><strong>TRANCHE 4</strong></th>
<th><strong>TOTAL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of Labor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Holdback: 25% of the cost of labor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Amount Provided for Labor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost of Transport</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CGS for unforeseen costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supplemental unforeseen</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TRANCHES</strong></th>
<th><strong>COST</strong></th>
<th><strong>FROM</strong></th>
<th><strong>CORDAID</strong></th>
<th><strong>FROM</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **TOTAL**            | **167,262**      | **160,000**    | **167,262**    | **160,000**  |

<table>
<thead>
<tr>
<th><strong>Date</strong></th>
<th><strong>Signatory</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>02/10/2015</td>
<td>Clement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Remark</strong></th>
<th><strong>Contact</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>02/10/2015 Clement</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** All costs are in Philippine Piso (Php).
STRUCTURAL AND ARCHITECTURAL DRAWINGS FOR THE

DARIO BAGOYORO FAMILY RESIDENCE (S1-12)

PUROK 1, SULANGAN, GUIUAN

HOME OWNER INFORMATION

NAME: DARIO BAGOYORO
PHONE NUMBER:

DRAWINGS LIST

T-100 TITLE PAGE
G-100 GENERAL NOTES
G-101 GENERAL NOTES
A-001 SITE PLAN
A-100 GROUND FLOOR PLAN
A-200 EXTERIOR ELEVATIONS
A-201 EXTERIOR ELEVATIONS
S-100 FOUNDATION PLAN
S-101 ROOF PLAN
S-300 LONGITUDINAL SECTION
S-500 DETAILS
S-501 DETAILS
S-502 DETAILS
S-503 DETAILS
S-504 DETAILS
S-505 DETAILS
S-506 DETAILS
S-507 DETAILS
S-509 DETAILS
S-510 DETAILS
S-511 DETAILS
S-512 DETAILS
S-513 DETAILS
S-514 DETAILS
S-515 DETAILS

LOCATION

GENERAL BUILDING INFORMATION

<table>
<thead>
<tr>
<th>AREA</th>
<th>GROUND FLOOR (M²)</th>
<th>UPPER LEVEL (M²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HABITABLE AREA</td>
<td>17.3m²</td>
<td>0.0</td>
</tr>
<tr>
<td>INTERIOR AREA</td>
<td>12.5m²</td>
<td>0.0</td>
</tr>
<tr>
<td>VENTILATION AREA REQUIRED</td>
<td>1.25m²</td>
<td>0.0</td>
</tr>
<tr>
<td>VENTILATION AREA PROVIDED</td>
<td>6.786m²</td>
<td>0.0</td>
</tr>
</tbody>
</table>

TECHNICAL ASSISTANCE AND TRAINING FOR FAMILY DRIVEN RECONSTRUCTION IN SULANGAN

RESIDENCE OF DARIO BAGOYORO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-12

TITLE PAGE
DATE: 05/02/2015
SCALE: N/A
DRAWN BY: MLB
Page 10 of 63
I. GENERAL
A. An Dezinyo Han Balyan in Nabase Han Requirements Han 2010 National Structural Code of the Philippines (NSCP)
B. An Maghuhuni Han Balyan in Responsible Han Pag-Coordinate Han Mga Trabaho Ngan Pag-Check Han Mga Dimensions, Isgumat Han Engineer Ngan Mayda Pagpakabaha Han Dimension Ngan Mayay Hiya Bag O Mag Pag uit Han Tiyanhan
C. An Dezinyo Han Balyan Han Balyan in Magdiyeb Han Pare Bigma sa An Estruktura, Dapat Gumatim Mga Bracing Han Shoring Pare Han Bag At Han Estruktura
D. An Maghuhuni Han Balyan Han Balyan Han Tag Balyan Han Magisumat Han Engineer Han Mga Natawado Na Sa Site D ire Naya Nyon Han Drawing
E. An Maghuhuni Han Balyan Han Balyan in Dapat Isiguro Han Signidad Sa Site Base Varay Maghuhuni Na Tako

II. PUNDASYAN
B. Design Pundasayan Parameters:
1. GRAIND: An Isipka Ngula Allowable Soil Bearing Capacity Uc An Permitted 139 Mga Pagkatasaan Han Loading An Transient Loads Sugod Han Nigay O Di Kaya An Unis
2. An Friction Coefficient: Pare Han Sliding In 0.45 An Isipmat Pare Mapadpadign Han A nalateral Loads
C. Para Masauno An NCPC, Site Preparation Naisa Foundation Work In Dapat Shoring Han Mga Manado
1. Dapat Malinsa Malinsa An Pagtratrabahuhan Bag O Digma Level Han Tuna
2. Waray Waray Bato Bag O Mga Masnakau Han P200 Han 30cm Bag O Mga Anda Anda Han Pagtratrabahuhan
3. An Tambak In Pagkatasa: Na Mga Ritama Han Magtakas An Digma Han 20 Mga May Masakatang Kakaiktang Kaya Kadakmulo In 1.0 Mga May Digma Anodong Naisa In Wara Pare Mga Anda Anda Han Mga Masihiro Han Mga Maparang Mga No
4. Paglay Out Han Pundasyanan Naisa Lokasyon Gast An Amoy Nyon Han Kanyo
D. Foundation Trenches In Dapat Shoring Base Han Mga Manado
1. Magkaroon An Mga Trenching Gast Han Chika O Nyon Para Han Mga Odnong Laki O Nyon Han Mga Marangga Gast An 60cm Ula Ula
2. An Mga Uin Uldag Pare Pundasynan In Dapat Malinsan Malinsan Pare Waray Waray Bag O Magtakas Mga Madlo Madlumot
3. An Panikahalan Han Guin Uldag Pare Naka Pare Naka: Level, Malinsa Malinsa Naisa Trabahang Tuna
5. Tangali An Mga Datu Pare Ya Footing, Utilities Etc Mga Possible Maka Higayakit Hap O Digma Construction, Pera Naya Naisa Makabuhat Han P2000
6. Paggumtuan Han Engineer Naisa Mayda Makat An Mga Naisa Estruktura Sugad Han Cesposo, Cesterns, Pandasayan Han Moraga Han Plano.
7. An Maghuhuni Han Balyan Han Responsible Han Pag Pac Uldag Uin Uldag Na Linya, Sucing, Underrunning Naisa Pagsisipit Han Aninga Naisa Guinbinuhit.
I. Dapat Matanigang An Na Excavate Han Tuna, Naisa Negayubong Han Mya Dimau The Balyan O Mga Basunoan Han Construcons
II. PORMA
A. An Porma In Dapat Malaypa Naisa Klase, Tagadng Naisa O Di Brok Bukol

> "..."
GENERAL NOTES

K. DIN AN KABILYA ISLOLOTANG NGADA HAN CHB
1. NGADA HAN BUTANG NGADA HAN HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG HANG H
10X10CM TIMBER POST

15 CM THICK FULL-HEIGHT HOLLOW CONCRETE BLOCK WALLS, GROUTED AND REINFORCED, SEE STRUCTURAL DETAILS

WINDOW OPENING WITH TIMBER FRAME
EXTEND BARS COVERED WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION

20X20 CM CONCRETE COLUMN

FOUNDATION BELOW

SCALE: 1:50

DATE: 05/02/2015

DRAWN BY: MT

RESIDENCE OF DARIO BAGOYORO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-12

A-200
EXTEND BARS COVERED WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION

20X20 CM CONCRETE COLUMN

FOUNDATION BELOW

REAR ELEVATION

LEFT ELEVATION
RESIDENCE OF DARIO BAGOYORO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-12

DESIGN CODE: B1 - CV - CU 1.02 - CU 1.02 - CU 1.02 - CU 1.02 - E

FOUNDATION PLAN

S-100

DATE: 05/02/2015
SCALE: 1:50
DRAWN BY: MT
1.20

2.89

0.25

12CM THK CONCRETE ROOF SLAB
RING BEAM LINE
FINISH T.O. SLAB WITH 1% SLOPE TOWARDS EDGE
(12CM THICK MIN, 14CM THICK MAX)

Ø12 MM BARS @0.2 M FOR LONGITUDINAL AND @0.4 M FOR TRANSVERSE. LONGITUDINAL BARS TO BE 6CM FROM THE BOTTOM OF SLAB AND TRANSVERSE BARS PLACED ABOVE

4.00

0.15M MAX (TYP)

4CM CONCRETE COVER OVER BARS (TYP)

FINISH T.O. SLAB WITH 1% SLOPE TOWARDS EDGE (12CM THICK MIN, 14CM THICK MAX)

12CM THK CONCRETE ROOF SLAB

SEM REBAR EXTENSION PROTECTED BY STRUCTURAL CONCRETE, FOR FUTURE EXPANSION

BEAM REBAR EXTENSION PROTECTED BY STRUCTURAL CONCRETE

COLUMN REINFORCEMENT EXTENDS ABOVE T.O SLAB (TYP)

4.50

COLUMN REINFORCEMENT
EXTENDS ABOVE T.O SLAB (TYP)

ROOF PLAN

RESIDENCE OF DARIO BAGOYORO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-12

DATE: 05/02/2015 SCALE: 1:50
REV: DRAWN BY: MT
20X30CM CONCRETE RING BEAM IN FRONT OF VERANDAH
RING BEAM AT BOTH SIDES OF VERANDAH TO BE AT 30CM
15 CM HOLLOW CONCRETE BLOCK, FULLY GROUTED WITH 15MM VERTICAL BARS @42CM OC MAX, AND HORIZONTAL BARS EVERY 3 COURSES OF BLOCKS
EXTEND BARS AND GROUT WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION
EXTEND SLAB AND BEAM BARS FOR FUTURE EXPANSION
EXTEND WALL REINFORCEMENT BARS FOR FUTURE EXPANSION
EXTEND TIE BEAM BARS FOR FUTURE EXPANSION
EXTEND FOUNDATION BARS FOR FUTURE EXPANSION
CONCRETE STRIP FOOTING WITH (2) CONTINUOUS 12MM BARS, SEE PLAN. ALTERNATE DIRECTION OF VERTICAL WALL REINFORCING HOOKS
12CM THICK CONCRETE SLAB
COMPACTED SOIL
COMPACTED SOIL
WALL REINFORCEMENT LAYOUT

MINIMUM BENDING OF BAR WITH NO PARAPET IS 40CM

DO NOT LAP WALL REINFORCING WITHIN MIDDLE THIRD OF WALL LENGHT BETWEEN COLUMNS, OR WITHIN MIDDLE 1.2M OF WALL LENGHT.

Ø10 MM VERTICAL BARS (Ø42 CM OC MAX. TYP) WITH 15 CM STANDARD HOOK INTO FOOTING AND BEAM. BARS TO BE INSERTED AT THE 1ST OR 3RD CELL OF BLOCKS

Ø10 MM HORIZONTAL REINFORCEMENT IN BED JOINT EVERY 3 COURSES OF BLOCKS (TYP) THROUGH COLUMN. WITH MIN 40CM OVERLAP AT THE CONNECTION

(2) Ø10 MM VERTICAL AND HORIZONTAL BARS AT EDGE OF OPENING MIN (4) COURSES OF BLOCKS BELOW WINDOW

NOTE: DO NOT LAP WALL REINFORCING WITHIN MIDDLE THIRD OF WALL LENGHT BETWEEN COLUMNS, OR WITHIN MIDDLE 1.2M OF WALL LENGHT.
STRUCTURAL AND ARCHITECTURAL DRAWINGS FOR THE

FRANCISCO CABERIO FAMILY RESIDENCE
(S1-24)

PUROK 1, SULANGAN, GUITLAN

OWNER INFORMATION

NAME: FRANCISCO CABERIO
PHONE NUMBER: 09265390622

DRAWINGS LIST

<table>
<thead>
<tr>
<th>DRAWING</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-100 TITLE PAGE</td>
<td></td>
</tr>
<tr>
<td>G-100 GENERAL NOTES</td>
<td></td>
</tr>
<tr>
<td>A-001 SITE PLAN</td>
<td></td>
</tr>
<tr>
<td>A-100 GROUND FLOOR PLAN</td>
<td></td>
</tr>
<tr>
<td>A-200 EXTERIOR ELEVATIONS</td>
<td></td>
</tr>
<tr>
<td>S-100 FOUNDATION PLAN</td>
<td></td>
</tr>
<tr>
<td>S-300 LONGITUDINAL SECTION</td>
<td></td>
</tr>
<tr>
<td>S-500 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-501 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-502 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-503 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-504 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-505 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-506 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-507 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-509 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-510 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-511 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-512 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-513 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-514 DETAILS</td>
<td></td>
</tr>
<tr>
<td>S-515 DETAILS</td>
<td></td>
</tr>
</tbody>
</table>

LOCATION

GENERAL BUILDING INFORMATION

<table>
<thead>
<tr>
<th>AREA</th>
<th>GROUND FLOOR (M2)</th>
<th>UPPER LEVEL (M2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HABITABLE AREA</td>
<td>18.40</td>
<td>0.0</td>
</tr>
<tr>
<td>INTERIOR AREA</td>
<td>12.40</td>
<td>0.0</td>
</tr>
<tr>
<td>VENTILATION AREA REQUIRED</td>
<td>2.00</td>
<td>0.0</td>
</tr>
<tr>
<td>VENTILATION AREA PROVIDED</td>
<td>7.00</td>
<td>0.0</td>
</tr>
</tbody>
</table>

TECHNICAL ASSISTANCE AND TRAINING FOR FAMILY DRIVEN RECONSTRUCTION IN SULANGAN

RESIDENCE OF FRANCISCO CABERIO FAMILY
PUROK 1, SULANGAN, GUITLAN
HOUSE NO. S1-24

BUILD CHANGE
BUILDING FLOURISHING COMMUNITIES

T-100
Page 21 of 63
I. GENERAL
A. THE DESIGN OF THIS HOUSE IS BASED ON THE REQUIREMENTS OF THE 2010 NATIONAL STRUCTURAL CODE OF THE PHILIPPINES.
B. THE BUILDERS IS RESPONSIBLE FOR COORDINATING THE WORK OF ALL WORKERS AND FOR CHECKING DIMENSIONS. NOTIFY THE ENGINEER OF ANY DISCREPANCIES AND RESOLVE BEFORE PROCEEDING WITH THE WORK.
C. THE CONTRACTOR SHALL PROVIDE MACHINES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MACHINES INCLUDE, BUT MAY NOT BE LIMITED TO, BRAINGS AND SHOVELS FOR LOADING CONCRETE.
D. THE CONTRACTOR SHALL REPORT TO THE ENGINEER ANY CONDITIONS ON THIS CONTRACT WITH THE DRAWINGS.
E. THE CONTRACTOR SHALL ASSURE THAT SITE SAFETY IS RESPECTED TO PREVENT INJURY OF PERSONS OR DAMAGE.

II. FOUNDATIONS

B. FOUNDATION DESIGN PARAMETERS:
1. AN ALLOWABLE SOLID BEARING CAPACITY OF 250kPa was used, with a permitted 13% increase for load cases including transient loads, such as wind or earthquake.
2. A FRICTION COEFFICIENT FOR SLIDING OF 0.45 was used to RESIST LATERAL LOADS.
C. IN ACCORDANCE WITH THE NSCP, SITE PREPARATION AND FOUNDATION WORK SHALL CONFORM TO THE FOLLOWING:
1. CLEAR THE SITE OF ORGANIC MATERIAL PRIOR TO LEVELING THE SOIL.
2. NO ROCK OR SIMILAR IRREDUCIBLE MATERIAL WITH A MAXIMUM DIMENSION GREATER THAN 20CM SHALL BE PLACED IN FILLS.
3. ALL SWALE SHALL BE COMPACTED IN UPLITS NOT EXCEEDING 20CM IN THICKNESS TO A MINIMUM OF 95% PERCENT OF MAXIMUM DRY DENSITY.
4. LAYOUT THE FOUNDATION GEOMETRY AND LOCATION USING NYLON STRING ACORDING TO THE DIMENSIONS SHOWN ON PLAN.

D. FOUNDATION TRENCHES SHALL BE CONSTRUCTED WITH THE FOLLOWING REQUIREMENTS:
1. MARK THE FOUNDATION TRENCH LOCATIONS WITH CHALK OR STRING LINE ACCORDING TO THE DIMENSIONS SHOWN ON PLAN.
2. TRENCHES SHALL BE FREE FROM ORGANIC MATERIAL.
3. THE BOTTOM OF THE TRENCH MUST BE LEVEL, CLEAN AND FREE OF LOOSE SOIL.
4. LOCATE AND PROTECT EXISTING UTILITIES TO REMAIN DURING AND/OR AFTER CONSTRUCTION.
5. REMOVE ABANDONED FOOTINGS, UTILITIES ETC. WHICH INTERFERE WITH NEW CONSTRUCTION, UNLESS OTHERWISE INDICATED.
6. NOTIFY THE ENGINEER IF ANY BURIED STRUCTURES NOT INDICATED, SUCH AS CESSPOOLS, CISTERNS, FOUNDATIONS, ETC. ARE FOUND.
7. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR EXCAVATION PROCEDURES INCLUDING LAGING, SHORING, UNDERPINNING AND PROTECTION OF EXISTING CONSTRUCTION.
8. KEEP LOOSE SOIL AND STANDING WATER FROM FOUNDATION EXCAVATIONS PRIOR TO PLACING CONCRETE.

II. FORMWORK
A. FORMWORK SHALL BE OF GOOD QUALITY, STRAIGHT AND UNWARPED.
B. FORMWORK BELOW SLABS SHALL CONSIST OF 1/2 L.P. RADIUM OF MAXIMUM. THE PANELS SHALL BE SUPPORTED BELOW BY 250X400MM SLEEPERS AT 1 METER MAXIMUM SPACE, SUPPORT EACH WOOD BEAM WITH METAL POSTS, 250X400MM POSTS OR 6CM MINIMUM DIAMETER WOOD LOGS AT 1 METER MAXIMUM SPACING. PROVIDE SHADS AT THE POST BASES AS REQUIRED FOR STABILITY.
C. FORMS SHALL BE PROPERLY BRACED OR TIED TOGETHER TO MAINTAIN POSITION AND SHAPE.
D. FORMS AND SUPPORT SHALL NOT DAMAGE PREVIOUSLY BUILT STRUCTURE.
E. IMMEDIATELY BEFORE NEW CONCRETE IS PLACED, ALL CONSTRUCTION JOINTS SHALL BE WETTED AND STANDING WATER REMOVED.
F. INSTALL FORMWORK AT THE VERTICAL TIES AFTER THE WALL CONSTRUCTION IS COMPLETE AND USE A LEVEL TO CHECK THAT THE FORMWORK IS INSTALLED PLUMB.
G. CONDUITS, PIPES AND SLEEVES PASSING THROUGH A SLAB, WALL OR BEAM SHALL NOT IMPAIR SIGNIFICANTLY THE STRENGTH OF THE CONSTRUCTION. THEY SHALL NOT BE LARGER IN OUTSIDE DIMENSION THAN ONE THIRD THE OVERALL THICKNESS OF SLAB, WALL OR BEA IN WHICH THEY ARE EMBEMBED.
H. USE BRACES AS REQUIRED TO MAINTAIN ALL FORMWORK FIRMLY IN THE CORRECT POSITION.
I. DO NOT REMOVE FORM WORK AND supports SOONER THAN THE TIMES INDICATED AFTER CASTING THE CONCRETE:
1. VERTICAL TIES AND HORIZONTAL RING BEAMS DIRECTLY SUPPORTED ON WALLS: 24 HOURS.
2. FOUNDATIONS: TWO DAYS.
3. SUSPENDED SLABS AND BEAMS NOT DIRECTLY SUPPORTED ON WALLS: FOURTEEN DAYS.
4. REINFORCEMENT STEEL:
   A. REINFORCEMENT SHALL BE DEFORMED REINFORCEMENT.
   B. REINFORCEMENT TO HAVE A MINIMUM STRENGTH OF 40,000 PSI 280 MPA (GRADE 40).

C. BARS INDICATED IN THE DRAWINGS SHALL CONFORM TO THE FOLLOWING MINIMUM DIMENSIONS:
   - Ø8MM
     - LAP LENGTH:
       - Ø250MM: 8.00MM 300CM
       - Ø100MM: 10.00MM 400CM
       - Ø125MM: 12.00MM 500CM
       - Ø160MM: 16.00MM 650CM
   D. STEEL SHALL BE RUST FREE. CONCRETE FROM PREVIOUS POURS SHALL BE REMOVED WITH A WIRE BRUSH PRIOR TO PLACING CONCRETE.
   E. TERMINATE REINFORCEMENT STEEL IN STANDARD HOOKS, UNLESS OTHERWISE SHOWN.
   F. PROVIDE REINFORCEMENT SHOWN OR NOTATED CONTINUOUS IN LENGTHS AS LONG AS PRACTICABLE.
   G. PROVIDE MEASURES NECESSARY TO STABILIZE REINFORCING ASSEMBLIES PRIOR TO PLACING CONCRETE.

V. CAST-IN-PLACE CONCRETE, MORRIT AND CEMENT PLASTER
A. THE DESIGN IS BASED ON CONCRETE COMpressive STRONG, FC, AT 28 DAYS TO BE 2500 PSI OR 17.0 Mpa.
B. CEMENT: PORTLAND CEMENT, TYPE 1, DRY AND UNPACKED BAGS.
C. SAND: BLACK SAND, CLEAN AND WASHED. FINE FOR CEMENT PLASTER AND MORTAR.
D. AGGREGATE: CRUSHED, ANGULAR GRAVEL LESS THAN 2CM IN SIZE FOR CONCRETE.
E. WATER: CLEAN, NOT SALT OR MUDDY
F. CONCRETE SPACERS SHALL BE PLACED AT 0.8M ON CENTER MAXIMUM AND SECURED WITH BINDING WIRE TO THE REINFORCING BARS PRIOR TO PLACING CONCRETE.

G. MIX DESIGN PROPORTIONS SHALL BE AS FOLLOWS:
   - USE CEMENT:
     - SAND:
     - AGGREGATE:
     - WATER (MAX):
   - CONCRETE:
     - MORTAR:
     - GROUT:
     - PLASTER:
   - 1
   - 2
   - 3
   - 4
   - 5
   - 5
   - 6

H. PROPORTION, MIX, TRANSPORT AND PLACE CAST-IN-PLACE CONCRETE AS NOTED BELOW:
1. MIX ON A CLEAN CONCRETE OR ASHALT SURFACE, NOT ON SOIL.
2. MIX DRY UNTIL MATERIALS REACH A CONSISTENT COLOR, THEN ADD WATER.
3. ADD WATER ONLY AS NEEDED TO REACH DESIRED CONSISTENCY, NOT EXCEEDING THE AMOUNT NOTED IN THE MIX DESIGN PROPORTIONS BELOW.
4. CONSISTENCY SHALL RESULT IN SLUMP OF 50CM TO 20CM, OR A HAND TEST THAT RESULTS IN NO WATER SQUEEZING OUT WHEN CONCRETE IS HELD TIGHTLY IN THE HAND, BUT THE CONCRETE DOES NOT HOLD ITS FORM WHEN RELEASED.
5. AT LOCATIONS WHERE BLOCKS OR NEW CONCRETE WILL BE PLACED ABOVE CONCRETE, SCRAPE THE SURFACE AT ALL INTERFACES AFTER CASTING TO CREATE A ROUGHENED SURFACE.
6. AT LOCATIONS WHERE CONCRETE IS CAST OR CEMENT PLASTER APPLIED AGAINST MASsory, WET SURFACES PRIOR TO PLACEMENT AND CLEAN OF LATANCE, FOREIGN MATERIAL, AND LOOSE PARTICLES WITH A WIRE BRUSH OR BY CHIPPING.
7. WET FORMWORK AND STEEL PRIOR TO PLACING CONCRETE.
8. PLACE CONCRETE WITHIN 60 MINUTES AFTER MIXING, WITH THE EXCEPTION OF COLUMNS WHICH CAN HAVE A SINGLE COLD JOINT AT THE INTERMEDIATE BEAM LEVEL, PLACE AN ENTIRE ELEMENT (E.BEAM) IN ONE DAY.
9. USE A VIBRATOR OR HAMMER AND ROD TO CONSOLIDATE CONCRETE AROUND REINFORCING.
10. AFTER REMOVING FORMS, CURL THE CONCRETE BY HETTING FIVE TIMES PER DAY FOR THREE DAYS MINIMUM.
11. CHIP OUT CONCRETE FOR THE ENTIRE ELEMENT AND REPAIR ALL CONCRETE ELEMENTS THAT CONTAIN ANY OF THE FOLLOWING: EXPOSED STEEL REINFORCEMENT, CRACKS LARGER THAN 3MM, NUMEROS CRACKS IN A LOCALIZED AREA, OR DIAGONAL OR VERTICAL CRACKS IN A BEAM.

VI. CONCRETE MASONRY
A. THE PURCHASE OF GOOD QUALITY BLOCKS IS THE HOMEOWNERS RESPONSIBILITY. PRIOR TO THE PURCHASE OF CONCRETE, THE HOMEOWNERS SHALL CONFIRM VIA TESTING, THE QUALITY OF THE BLOCKS MADE BY THE PRODUCER WHO WILL SUPPLY BLOCKS FOR THE HOUSE CONSTRUCTION.
B. THE DESIGNS ARE BASED ON BLOCKS WITH A MINIMUM COMPRESSION STRENGTH OF 4 MPa AND OVERALL DIMENSIONS OF 15X20X60CM AND AT LEAST 55% NET AREA, WITH THREE CELLS.
C. ALL BLOCK CELLS TO BE GROUTED SOL.
D. PROVIDE CEMENT PLASTER FINISH TO ALL MASONRY WALLS. PLASTER TO BE AT LEAST 1 5CM THICK AND APPLIED AT EACH SIDE OF THE WALL, UNLESS OTHERWISE NOTED.
E. THE VERTICAL AND HORIZONTAL JOINT THICKNESS SHALL BE BETWEEN 2CM MINIMUM AND 2CM MAXIMUM.
F. USE A MINIMUM OF 3/2 BLOCK LENGTH BINDING.
G. MORTAR AND GROUT, FIRST MIX SAND AND CEMENT AND THEN ADD WATER, USE WITHIN 30 MINUTES OF MIXING OR 0SCARD.
H. WET BLOCKS WITH CLEAN WATER PRIOR TO PLACING.
I. DO NOT USE DAMAGED BLOCKS. IF USING PARTIAL BLOCKS, USE AT LEAST 1/2 BLOCK.
J. PLACE BLOCKS SO THAT THE UPPER FACE IS LEVEL BEFORE PLACING MORTAR OR GROUT.

RESIDENCE OF FRANCISCO CABERO FAMILY
PURUK 1, SULANGAN, GUINAN
HOUSE NO. S1-24
K. WHERE BARS ARE PLACED WITHIN THE BLOCKS:
1. CENTER THE VERTICAL REINFORCING IN THE WALL, UNLESS OTHERWISE NOTED.
2. VERTICALLY ALIGN THE BLOCK CELLS.
3. FILL ALL CELLS WITH GROUT.
4. CLEAN THE CELLS OF MORTAR AND DEBRIS PRIOR TO PLACING THE GROUT.
5. BARS IN THE FOUNDATION SHOULD CORRESPOND WITH THE SIZE AND LOCATIONS OF THE WALL REINFORCING WITHIN THE BLOCKS.

L. CURE THE WALL BY LIGHTLY WETTING 3 TIMES PER DAY FOR 3 DAYS.

VII. CARPENTRY
A. STRUCTURAL WOOD FRAMING: LAWAAI, MAHAGONY, HARD COCO LUMBER OR APPROVED EQUAL.
B. ROUGH HARDWARE:
1. NAILS: COMMON WIRE (ASTM F1667):
   a. LENGTH AT STRAP-TO-WOOD CONNECTION: 1.5"
   b. LENGTH AT WOOD-TO-WOOD CONNECTION: 3.5"
   ROOFING NAILS WITH 1cm DIAMETERS:
   c. LENGTH AT METAL DECK-TO-WOOD CONNECTION: 2.5"
2. METAL STRAPS: 18 GAGE, EMBED STRAPS IN RING BEAM OR COLUMN, PASSING THE STRAP AROUND THE REINFORCING STIRRUP OR BAR.

VIII. METAL ROOFING
A. THE METAL DECKING SHOULD BE AT LEAST 26 GAGE (0.48mm) OR THICKER.

IX. STRUCTURAL OBSERVATIONS
X. THE ENGINEER WILL PROVIDE VISUAL OBSERVATION OF THE STRUCTURAL SYSTEM FOR GENERAL CONFORMANCE TO THE APPROVED CONSTRUCTION DOCUMENTS. THE HOMEOWNER SHALL ENSURE ACCESS FOR THE FOLLOWING STRUCTURAL OBSERVATIONS:
1. FOUNDATIONS (PRIOR TO PLACEMENT OF CONCRETE)
   a. EXCAVATION PREPARATION
   b. REINFORCEMENT PLACEMENT
   c. PLACEMENT OF DOWELS
2. CONCRETE, PRIOR TO PLACEMENT
   a. FORMWORK LAYOUT AND DIMENSIONS
   b. REINFORCING STEEL SIZE AND PLACEMENT
   c. REINFORCING COVERS/SPACERS USED
   d. EMBEDDED STRAPS
   e. SLABS AND SLABS ON GRADE
3. MASONRY
   a. WALL MATERIALS - BLOCK AND MORTAR
   b. WALL SIZES AND LENGTHS
   c. WALL REINFORCEMENT STEEL SIZE AND PLACEMENTS
   d. MORTAR JOINT SIZE
4. METAL STRUCTURES
   a. METAL DECKING INSTALLATION
   b. ROOFING INSTALLATION
   c. CONNECTIONS BETWEEN FRAMING ELEMENTS
   d. CONNECTION TO THE METAL DECK
   e. CONNECTIONS TO THE WALLS AND FRAMING
B. IF INITIAL OBSERVATIONS MADE BY THE ENGINEER REVEAL THAT ANY PORTION OF THE WORK DOES NOT COMPLY WITH THE DRAWINGS AND SPECIFICATIONS, THE NECESSARY REPAIRS WILL BE MADE AT THE BUILDER'S EXPENSE.

X. DESIGN CRITERIA
A. THE DESIGN OF THIS HOME WAS PERFORMED FOR TWO CASES. THE DESIGN WAS PERFORMED CONSIDERING A HORIZONTAL EXTENSION TO THE REAR OF THE HOME WHICH IS 3M LONGER THAN THE FLOOR PLAN INCLUDED IN THESE DRAWINGS AS WELL AS A VERTICAL EXPANSION OF ONE 2m LEVEL WITH EITHER A FLAT CONCRETE SLAB ROOF OR LIGHT-WEIGHT 30-DEGREE MAX GABLE ROOF ABOVE. THE DESIGN WAS ALSO VERIFIED FOR THE REDUCED SIZE OF THE BUILDING PRESENTED IN THESE DRAWINGS.
B. OCCUPANCY CATEGORY IV
C. GRAVITY LOADS:
1. DEAD LOADS - VARY BASED ON ACTUAL BUILDING WEIGHTS
   CONCRETE SLABS: 4.0kN/m²
   LIGHT WEIGHT ROOFS: 0.34kN/m²
   MASONRY WALLS: 3.53kN/m²
2. LIVE LOADS: ROOF 1.0 kPa, FLOOR 1.9 kPa
D. SEISMIC DESIGN
SEISMIC ZONE FACTOR: Z=0.40, SOURCE TYPE A > 15KM DISTANCE
SOIL TYPE = D
Na=1
Vv=1
C=0.44
Cv=0.64
R-FACET = 0.5
BASE SHEAR, V = 0.32xW
E. WIND DESIGN
EXPOSURE CATEGORY = C
IMPORTANCE FACTOR = 1.0
BASIC WIND SPEED = 250 kPa
ENCLOSED STRUCTURE
LEGEND

10X10 CM TIMBER POST

15 CM THICK FULL HEIGHT HOLLOW CONCRETE BLOCK WALLS, GROUTED AND REINFORCED, SEE STRUCTURAL DETAILS

WINDOW OPENING WITH TIMBER FRAME

VERTICAL FUTURE EXTENSION CONNECTION

VERANDA

PARAPET WITH DECORATIVE BLOCKS

TIMBER BENCH WITH DECORATIVE BLOCKS BELOW
RESIDENCE OF FRANCISCO CABERIO
PUROK 1, SULANGAN, GUJIAN
HOUSE NO. S1-24
REAR ELEVATION

EXTEND BARS COVERED WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION

20X20 CM CONCRETE COLUMN

FOUNDATION BELOW

1.64 4.00 1.00

RIGHT ELEVATION

EXTEND BARS COVERED WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION

20X20 CM CONCRETE COLUMN

FOUNDATION BELOW

1.64 4.00 1.00
CONCRETE STRIP FOOTING
2 COURSES OF 15CM THICK CONCRETE BLOCKS
20X20CM CONCRETE COLUMN
50X50CM CONCRETE BASE FOOTING, SEE DETAIL D1.3 & D1.4
80X80X26CM CONCRETE FOOTING SEE FOUNDATION DETAIL
50CM WIDE, 26CM THICK CONCRETE STRIP FOOTING
FOUNDATION REBAR EXTENSION PROTECTED BY LEAN CONCRETE, FOR FUTURE EXPANSION

RESIDENCE OF FRANCISCO CABERIO
PUROK 1, SULANGAN, GUIJIAN
HOUSE NO. S1-24

DATE: 01/12/2015
SCALE: 1:50
REV: 
DRAWN BY: MT
3.10 12CM THK CONCRETE ROOF SLAB
RING BEAM LINE Ø12 MM BARS @0.2 M FOR LONGITUDINAL
AND @0.4 M FOR TRANSVERSE.
LONGITUDINAL BARS TO BE 6CM FROM
THE BOTTOM OF SLAB AND TRANSVERSE
BARS PLACED ABOVE

0.04 4CM CONCRETE COVER
OVER BARS (TYP)

TERMINATE SLAB FLUSH WITH
FACE OF BEAM, HOOK DOWN
SLAB BARS INTO BEAM AT FRONT

2X4" FLAT BRACE NAIL WITH (2) 3.5" NAILS
TO TOP OF EACH RAFTER AND (3) 3.5" NAILS
TO TOP OF POST AND END (TYP)

2X2" PURLIN AT 0.9M MAX SPACING

PERIMETER 2X4" WITH
(2) 3.5" NAILS TO EACH PURLIN

2X4" RAFTER AT EVERY 1 M

FINISH T.O. SLAB WITH 1% SLOPE
TOWARDS EDGE (12CM THICK MIN,
14CM THICK MAX)

RING BEAM LINE

COLUMN REINFORCEMENT
EXTENDS ABOVE T.O SLAB (TYP)

Ø12 MM BARS @Ø2 M FOR LONGITUDINAL
AND @Ø0.4 M FOR TRANSVERSE.
LONGITUDINAL BARS TO BE 6CM FROM
THE BOTTOM OF SLAB AND TRANSVERSE
BARS PLACED ABOVE

ROOF PLAN

RESIDENCE OF FRANCISCO CABERIO
PUROK 1, SULANGAN, GUJUAN
HOUSE NO. S1-24

DATE: 01/12/2015  SCALE: 1:50
REV:  DRAWN BY: MT
CONCRETE STRIP FOOTING WITH (2) CONTINUOUS 12MM BARS, SEE PLAN. ALTERNATE DIRECTION OF VERTICAL WALL REINFORCING HOOKS.

EXTEND BARS AND GROUT WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION.

EXTEND SLAB AND BEAM BARS FOR FUTURE EXPANSION.

12CM THICK CONCRETE SLAB.

EXTEND WALL REINFORCEMENT BARS FOR FUTURE EXPANSION.

EXTEND TIE BEAM BARS FOR FUTURE EXPANSION.

EXTEND FOUNDATION BARS FOR FUTURE EXPANSION.

CONTRACTED SOIL.

CGI METAL ROOF WITH TIMBER STRUCTURE.

15 CM HOLLOW CONCRETE BLOCK, FULLY GROUTED WITH 10MM VERTICAL BARS @42CM OC MAX. AND HORIZONTAL BARS EVER COURSES OF BLOCKS.

TIMBER BENCH WITH DECORATIVE BLOCKS.

CONCRETE SLAB 12CM THICK.

EXTEND BARS AND GROUT WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION.

EXTEND SLAB AND BEAM BARS FOR FUTURE EXPANSION.

12CM THICK CONCRETE SLAB.

EXTEND WALL REINFORCEMENT BARS FOR FUTURE EXPANSION.

EXTEND TIE BEAM BARS FOR FUTURE EXPANSION.

15 CM HOLLOW CONCRETE BLOCK, FULLY GROUTED WITH 10MM VERTICAL BARS @42CM OC MAX. AND HORIZONTAL BARS EVER COURSES OF BLOCKS.

TIMBER BENCH WITH DECORATIVE BLOCKS.

CONCRETE SLAB 12CM THICK.

EXTEND BARS AND GROUT WITH LEAN CONCRETE FOR FUTURE 2ND STOREY EXPANSION.

EXTEND SLAB AND BEAM BARS FOR FUTURE EXPANSION.

12CM THICK CONCRETE SLAB.

EXTEND WALL REINFORCEMENT BARS FOR FUTURE EXPANSION.

EXTEND TIE BEAM BARS FOR FUTURE EXPANSION.

15 CM HOLLOW CONCRETE BLOCK, FULLY GROUTED WITH 10MM VERTICAL BARS @42CM OC MAX. AND HORIZONTAL BARS EVER COURSES OF BLOCKS.

TIMBER BENCH WITH DECORATIVE BLOCKS.

CONCRETE SLAB 12CM THICK.
(4) Ø12 MM COLUMN BARS, WITH 20CM HOOK INTO FOOTING, SEE COLUMN DETAIL FOR BARS PLACING

Ø10 MM VERTICAL BARS @42 CM OC (TYP) WITH 15 CM STANDARD HOOK INTO FOOTING, ALTERNATE POSITION

50CM WIDE, 26 CM THICK CONTINUOUS CONCRETE STRIP FOOTING

(2) 12MM BARS

12MM BARS

C footing

C footing

C footing

(4) Ø12 MM COLUMN BARS, WITH 20CM HOOK INTO FOOTING, SEE COLUMN DETAIL FOR BARS PLACING
EF - 1.64

Ø10 MM VERTICAL BARS @42 CM OC MAX (TYP) WITH 15 CM STANDARD HOOK INTO FOOTING AND BEAM. BARS TO BE INSERTED AT THE 1ST OR 3RD CELL OF BLOCKS

Ø10 MM HORIZONTAL REINFORCEMENT IN BED EVERY 3 COURSES OF BLOCK (TYP) THROUGH COLUMN, MIN 40CM OVERLAP AT TOP CONNECTION

MIN (4) COURSES OF BLOCKS BELOW WINDOW

WALL REINFORCEMENT DETAIL

NOT TO SCALE

RESIDENCE OF FRANCISCO CABERIO
PUROK 1, SULANGAN, GUJIAN
HOUSE NO. S1-24

SECTIONS
DATE: 01/12/2015
SCALE: 1:50
REV: 
DRAWN BY: MT

S-503
Ø10 MM HORIZONTAL REINFORCEMENT EVERY 3 COURSES OF BLOCKS (TYP) THROUGH COLUMN, WITH MIN 40CM OVERLAP AT THE CONNECTION

0.15
15 CM THICK BLOCKS,
ALL CELLS GROUTED

0.20
0.20
0.055
0.11
0.035
0.11
0.035
0.015
0.015
0.03
0.03
0.18

Ø10 MM VERTICAL BARS @0.42M OC MAX (TYP), CENTERED IN WALL

MINIMUM OVERLAP 40CM (TYP)

(4) Ø12 MM BARS

CEMENT PLASTER, EACH SIDE OF WALL,
1.5CM MIN

Ø10 MM HORIZONTAL REINFORCEMENT EVERY 3 COURSES OF BLOCKS (TYP) THROUGH COLUMN, WITH MIN 40CM OVERLAP AT THE CONNECTION

15 CM THICK BLOCKS,
ALL CELLS GROUTED

(2) Ø10 MM BARS, AT EDGE OF OPENING, SEE DETAIL D2.1

CEMENT PLASTER, EACH SIDE OF WALL,
1.5CM MIN

15CM THICK CONCRETE BLOCKS,
ALL CELLS GROUTED

Ø10 MM VERTICAL BARS @0.42M OC MAX (TYP) WITH 12 CM STANDARD HOOK INTO FOOTING. BARS TO BE INSERTED AT THE 1ST OR 3RD CELL OF BLOCKS, CENTERED IN WALL

WINDOW FRAME, REFER TO WINDOW DETAIL

REINFORCEMENT SECTION DETAIL AT OPENING

D2.2 COLUMN SECTION DETAIL

D2.3

RESIDENCE OF FRANCISCO CABERIO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-24

DETAILS
DATE: 01/12/2015
SCALE AS NOTED
REV:
DRAWN BY: MT

S-504
Page 35 of 63
0.20
15 CM THICK WALL WITH Ø10 MM VERTICAL BARS @42 CM OC (TYP) WITH 12 CM STANDARD HOOK INTO FOOTING

(2) COURSES OF BLOCKS BELOW TO FOUNDATION

4 CM CONCRETE COVER (TYP)

135° HOOK, 5 CM LONG, ROTATED (TYP)

(4) Ø12 MM BARS

Ø8 MM STIRRUPS

INSIDE

D3.1 TIE BEAM SECTION DETAIL

D3.2 20X20CM RING BEAM SECTION DETAIL

D3.3 20X30CM RING BEAM SECTION DETAIL

SLAB WITH Ø12 MM BARS @0.2 M FOR LONGITUDINAL AND @0.4 M FOR TRANSVERSE

135° HOOK, 5 CM LONG, ROTATED (TYP)

12 CM THICK REINFORCED CONCRETE SLAB

(4) Ø12MM BARS

Ø8 MM STIRRUPS

RESIDENCE OF FRANCISCO CABERIO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-24
1.6M MAX

ADDITIONAL (2) Ø12 MM BOTTOM BARS WITH 90-DEGREE HOOK INTO COLUMN AT EACH END

20X20CM CONCRETE COLUMN

1.6M MAX

OPENING

20X20CM CONCRETE COLUMN

RING BEAM ELEVATION AT OPENING WITH MAX 1.6M WIDE

0.20

20X20CM RING BEAM

0.20

SOLID WALL

20X20CM CONCRETE RING BEAM

ADDITIONAL (2) Ø12 MM BOTTOM BARS WITH 90-DEGREE HOOK INTO COLUMN AT EACH END

0.20

SOLID WALL

20X30CM CONCRETE COLUMN

20X20CM CONCRETE COLUMN

2.50m MAX

OPENING

RING BEAM ELEVATION AT OPENING WITH MAX 2.5M WIDE

0.20

SOLID WALL

20X20CM CONCRETE RING BEAM

20X20CM CONCRETE RING BEAM

DETAILS

RESIDENCE OF FRANCISCO CABERIO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-24

DATE: 01/12/2015
REV:
DRAWN BY: MT
D3.11
SCREEN ELEVATION AT STRUCTURE PROVISION FOR FUTURE EXPANSION

40CM HORIZONTAL REINFORCEMENT WALL EXTENSION PROTECTED FROM WEATHER BY LEAN CONCRETE, FOR FUTURE EXPANSION

2X2 TIMBER
1X2 TIMBER OR BAMBOO
50CM SLAB REBAR EXTENSION PROTECTED FROM WEATHER BY STRUCTURAL CONCRETE, FOR FUTURE EXPANSION

50CM TIE BEAM REBAR EXTENSION PROTECTED FROM WEATHER BY LEAN CONCRETE, FOR FUTURE EXPANSION

TIE BEAM

EXPANSION STRUCTURE PROVISION PLAN

EXPANSION STRUCTURE PROVISION WITH SCREEN

EXPANSION STRUCTURE PROVISION ELEVATION

RESIDENCE OF FRANCISCO CABERIO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-24

S-509
Page 39 of 63
(4) Ø12MM DOWELS TO LAP WITH TIE BEAM REINFORCING, COVERED WITH LEAN CONCRETE.

50CM FOUNDATION REBAR EXTENSION PROTECTED FROM WEATHER BY LEAN CONCRETE 10CM THICK BLOCKS UNDER TIE BEAM EXTENSION.

PROVIDE BLOCK OUT AT TOP OF FOUNDATION AT COLD JOINT BETWEEN STRUCTURAL AND LEAN CONCRETE.

50CM FOUNDATION REBAR EXTENSION PROTECTED FROM WEATHER BY LEAN CONCRETE 7.5CM MIN CONCRETE COVER.

40CM STRUCTURAL CONCRETE 60CM LEAN CONCRETE.

COLUMN CENTER LINE
TIE BEAM LINE

RESIDENCE OF FRANCISCO CABERIO FAMILY
PUROK 1, SULANGAN, GUIUAN
HOUSE NO. S1-24

DETAILS

DATE: 01/12/2015
SCALE: AS NOTED
REV: 
DRAWN BY: MT

S-510
Page 40 of 63
0.20
1% SLOPE
50CM RING BEAM REBAR EXTENSION PROTECTED FROM WEATHER BY STRUCTURAL CONCRETE
40CM HORIZONTAL REINFORCEMENT EXTENSION PROTECTED FROM WEATHER BY LEAN CONCRETE
(5) Ø8MM TIES
40CM VERTICAL BARS EXTENSION, HOOK DOWN AND PROTECT WITH LEAN CONCRETE
50CM COLUMN REBAR EXTENSION PROTECTED FROM WEATHER BY LEAN CONCRETE AND (2) ROWS OF CONCRETE BLOCKS
RESIDENCE OF FRANCISCO CABERIO FAMILY PUROK 1, SULANGAN, GUIUAN HOUSE NO. S1-24
20x20 CONCRETE COLUMN

18GA 5X15CM METAL STRAP WITH 1.5" NAILS TO FRAMING

(4) 3.5" NAILS TO COLUMN

4x4" POST

2X4" TOP PLATE

2X4" FLAT BRACE

2X8" BEAM

2X6" BEAM

4X4" POST

20x20CM CONCRETE COLUMN

18GA 5X15CM METAL STRAP WITH 1.5" NAILS TO FRAMING

0.025

8

5/8" Ø BOLT WITH WASHER EACH SIDE

TOP PLATE - CONCRETE COLUMN CONNECTION DETAIL

PLAN

SECTION

BEAM - POST CONNECTION DETAIL

1:10
ROOFING NAILS, NAILED AT EVERY WAVE (15CM OC MAX) AT ROOF EDGES, OVERHANGS, AND RIDGES. NAILED TO THE PURLIN AT EVERY TWO WAVES ELSEWHERE.

2X4" WOOD RAFTER AT 1M SPACING MAXIMUM.
18GA X 4 CM METAL STRAP ON BOTH SIDES TO CONNECT WITH RAFTER. USE (4) 2" NAILS TOTAL AT PURLIN AND (4) TOTAL AT RAFTER.

15CM OVERLAP CGI / METAL SHEET ROOF AT MINIMUM 26GA THICK. PLACE SHEET STRAIGHT AND IN LINE WITH ONE ANOTHER.

18GA X 4 CM METAL STRAP ON BOTH SIDES TO CONNECT WITH RAFTER. USE (4) 2" NAILS TOTAL AT PURLIN AND (4) TOTAL AT RAFTER.

2X2" WOOD PURLIN AT MAXIMUM 90 CM SPACING.

2X4" WOOD RAFTER AT 1M SPACING MAXIMUM.

PLAN

SECTION A-A

SECTION B-B

MATERIAL SHEET ROOF AT MINIMUM 26GA THICK. PLACE SHEET STRAIGHT AND IN LINE WITH ONE ANOTHER.

ROOFING NAILS, NAILED AT EVERY WAVE (15CM OC MAX) AT ROOF EDGES, OVERHANGS, AND RIDGES. NAILED TO THE PURLIN AT EVERY TWO WAVES ELSEWHERE.

2X4" RAFTER

PURLIN AT 90 CM SPACING MAXIMUM, SEE D4.4

S-514
Page 44 of 63
Ø12 MM COLUMN BARS, EXTEND TO 50 CM FOR FUTURE UPPER STOREY EXPANSION, COVERED WITH LEAN CONCRETE

CONCRETE ROOF SLAB EDGE LINE, UNLESS OTHERWISE STATED

9CMX9CM LEAN CONCRETE COVER

 Ø12 MM COLUMN BARS, EXTEND TO 50 CM FOR FUTURE UPPER STOREY EXPANSION, COVERED WITH LEAN CONCRETE

DRIP MOLD
0.04 X 0.04 M CONCRETE SPACER, 4 CM THICK CONCRETE COVER (TYP)

Ø12 MM BARS
(4) Ø12 MM BARS

Ø10 MM VERTICAL BARS @0.2 M OC FOR LONGITUDINAL AND @0.4 M OC FOR TRANSVERSE

Ø10 MM HORIZONTAL REINFORCEMENT EVERY 3 COURSES OF BLOCKS (TYP) THROUGH COLUMN, WITH MIN 45CM OVERLAP AT THE CONNECTION

Ø10 MM VERTICAL BARS @42 CM OC (TYP) WITH 12 CM STANDARD HOOK INTO FOOTING, BARS TO BE INSERTED AT THE 1ST OR 3RD CELL OF BLOCKS

Ø8 MM STIRRUPS FIRST 5 @0.1 M
Ø8 MM STIRRUPS @0.2 M (TYP)

CONCRETE ROOF SLAB EDGE LINE, UNLESS OTHERWISE STATED

Ø12 MM SLAB BARS @0.2 M OC FOR LONGITUDINAL AND @0.4 M OC FOR TRANSVERSE

40CM VERTICAL BARS EXTENSION HOOK DOWN AND PROTECT WITH LEAN CONCRETE

0.09

Ø12 MM HORIZONTAL REINFORCEMENT EVERY 3 COURSES OF BLOCKS (TYP) THROUGH COLUMN, WITH MIN 45CM OVERLAP AT THE CONNECTION

Ø10 MM VERTICAL BARS EXTENSION, HOOK DOWN AND PROTECT WITH LEAN CONCRETE

Ø10 MM VERTICAL BARS @42 CM OC (TYP) WITH 12 CM STANDARD HOOK INTO FOOTING, BARS TO BE INSERTED AT THE 1ST OR 3RD CELL OF BLOCKS

Ø6 MM STIRRUPS FIRST 5 @0.1 M
Ø6 MM STIRRUPS @0.2 M (TYP)

SMALL PARAPET WITH LEAN CONCRETE
The concept behind The ESSU Training Center is to have qualified people training builders to use their local materials in an effort to build structurally stable buildings. The sequence of training at this center has been set up to assimilate every day construction. By dividing the learning phases into seven different training stations, Build Change believes that the locals will be able to have a better understanding of what building seismically sound building consists of.

The first training station of the facility addresses site lay-out along with assuring the appropriate material usage before starting. Laying out the site, which is often done through a surveyor in this country, is essential to getting a project started at the correct location. Figure 5 shows the local Build Change engineer showing the locals how to lay-out a site. Keeping in mind that most of these less fortunate countries use masonry for the majority of their construction, Build Change has found ways to provide both builders and suppliers with the appropriate information to determine whether or not their material is adequate for seismically stable construction.

In order to select a good material for construction, the builder must know where the aggregates for the supply are being pulled from. A lot of times the sand used sill contain corrosive materials which will affect the chemical reaction within the aggregates during the CMUs cure time. Having CMUs that look good but do not perform as they should, determines whether a building will stand or collapse during severe weather conditions and other natural disasters.

The second training station, and probably one of the most critical is the placement of the rebar reinforcement in the foundation (Figures 6, 7, and 8 for more details). As I learned in my
Masonry Design Class at California State University San Luis Obispo with Professor James Mwangi, CMU is mainly strong in compression. Knowing and understanding a materials strengths and weaknesses is important. Logically we believe that a heavy material such as a CMU will be strong in every way due to its appearance but what we do not see is what makes it strong. In order to make CMUs the amazing material that it is, one must place rebar inside during construction. Assuring that rebar is securely placed is just as important as assuring that it is properly tied. Rebar is the strengthening component that allows a greater tolerance when tension is applied to the members. It is important to know that when a building is standing still the majority of its components act in compression. However, when movement is incorporated into the equation, the CMU components begin to fluctuate between compression and tension forces. This is when a materials real strength is tested. How much force can be applied on a material before failure, and when failure occurs will this failure be detrimental to the stability of the remainder of the structure. In simpler terms, will a falling wall make the entire building collapse?

Rebar placement is so crucial that the third station continues to address the handling of rebar in beams and columns (See Figure 9). As previously mentioned, setting up rebar appropriately and tying it accordingly can go a long way. The main structural designers in this case are the engineers from build change. I had no input on the actual structural designs implemented on this project; however, I did manage to obtain essential knowledge about the importance of blending two materials such as rebar and CMUs.

Fourthly, the continuing station is dedicated to the masonry layout. Placing CMU in a proper fashion is a crucial step in construction. In accordance to the engineering knowledge obtained from the various material classes that I participated in throughout my college career, I can affirm that in order to appropriately design masonry, one must consider the joint thickness of
the CMU placement during the structural design phase. Setting an appropriate joint thickness and making sure that this joint thickness is consistent during construction will give assurance that the building is acting in accordance to its design. In order to comply with this necessity, the walls must be string lined during erection. By string lining, the mason laying down the CMUs will be able to maintain a level wall both vertically and horizontally. The term string lining is generally setting up a string that runs on the upper portion of the CMU blocks that are being placed. This string line will already have the appropriate joint thickness taken into account and when laying down the blocks the mason must align the blocks to the string line by taping the corners accordingly until the block is leveled.

In station five, the locals are trained to properly stage the construction of the building. It is obvious that a building cannot be started at the roof and work its way down to the foundation, but there are other steps that are not as obvious. An example is displayed in Figure 10 found in the image section of this report. In this image you can see the difference between two column designs. One is a typical square concrete column that is formed and poured straight from the foundation and then the masonry is placed to fill in the holes. This is in fact the way that Build Change opted to design these trainings. The other is an example of an interlocking system that requires the CMU wall placement before the column can be poured. This system, even though very effective, was not necessary in this project. From both of these examples it is possible to see how one will require columns to be poured prior to laying down a wall and the other requires a wall to be placed before a column can be poured. Once all of the walls are poured there comes the part that most people are skeptical about during an earthquake; the roof.

The sixth training station elaborates on the construction and assembly of the roof. After experiencing the fear in the people of Haiti of being trapped under the collapse of a heavy roof,
many people have opted to go back to a light weight roof which is of course not as efficient during a hurricane if the anchorage is not designed accordingly. Studies have shown that with the proper fasteners and the proper assembly, a light weight roof can perform just as good as a heavy solid roof. It is conceptually important to know how both roofs are assembled because a well-designed solid roof/ceiling must be in place if the owner intends to ever use it as a floor for an additional story. A brief engineering explanation for this would be that a second story floor will experience larger loads that a typical roof, therefore the structural design for this would possibly require additional rebar and possibly a thicker slab in order to support the loads.

The last station is more of an observational station. Station seven explicitly demonstrates a finished product allowing the trainees to view a finished product of what they are training for. By observing and knowing the importance of every component of a building the trainees will be able to make appropriate decisions during construction. Without a good understanding of what is being built it is hard to have a nice deliverable product. With something as simple as the connection from the foundation to the walls and the connections from the walls/beams to the roof, it is possible to maximize the structural performance of a building during a seismic event. In essence a good structural design is one that ensures that all of its connections will yield before they fail. Yielding is an important factor in structural design because it allows the different components to give a warning before failure. In essence a yielding connection will allow for two things such as a roof and a wall to remain connected even though there might be signs of deformation. Allowing this connection to remain acting as one is important because if this connection were to fail, then roof and the walls would act as separate components and then the roof would most likely collapse as it is separated from its only vertical support, the wall.
**Figure 5:** Build Change Resident Engineer Gilbert Appa wearing a white hard hat and a black shirt is explaining the site specific dimensions to begin construction.

**Figure 6:** This rebar is for the column foundation which will be poured after the CMU is placed on the sides as seen in some of the following figures.
Figure 7: Local Pilipino mason places foundation CMU blocks and is getting ready to place the horizontal rebar above the CMU. The horizontal rebar can be seen laying besides the CMU.

Also a good idea to observe the string line method used to keep the CMU lined up correctly.
Figure 8: This image shows the initial digging of the foundation trenches. Pay close attention to the small work area of the work station as it plays a huge roll in the design of the general site layout.
Figure 9: In this image the locals are observing how rebar should be tied in columns. On the right side of the picture there is column steelwork that is all tied up and ready for concrete. Notice that the column steelwork has been leveled out and supported with wood cross braces in preparation for the concrete pour.
Figure 10: This is a demonstration of two types of columns in masonry. To the left is a column poured before the placement of any CMU. To the right is a column poured after the placement of concrete. Note that the interlocking pattern on the left helps to keep the walls united to the column and it also creates a better lateral support for the walls by creating moment connections on the sides.
THE OUTCOME

Building the ESSU Training Facility was not an easy task. One of the largest challenges to begin the project was cleaning the rumble that was found in the existing site. The existing rumble can be seen in Figures 11 and 12 at the end of this section. Aside from the entire rumble, the chosen site was also a very compact site. This means that the majority of the work during the stripping of the site was manual labor.

While the cleaning of the site was being done, Michael and myself coordinated together to establish the best fit for the training station layout. In order to do this we had to take into account the necessary spacing between each station to allow for appropriate movement when constructing. This site layout planning also entailed incorporating accessibility to transfer material in and out of the site during construction. The proposed and final layouts can be seen in Figures 13, 14, and 15. Once our general layout was established, the takeoff that was originally done had to be manipulated accordingly to account for the building material in each training station. Once all of the material was accounted for the following step was trying to find the material through the websites of the local vendors. This is when Google Translator came in handy.

Throughout the project, maintaining communication with Michael out of Colombia was challenging enough. Later in the project, maintaining communication with Gilbert Appa, the resident engineer in The Philippines, became even more challenging. In occasions our calls would be at 3:00am just so that all three of us could be in the call at once. Managing waking up at that time while having to manage going to school, doing homework, and working early shifts on a daily basis really helped me become a better organized person. Another challenge that expanded my knowledge and made me a more resourceful person was fact that I had to learn the
use of software programs such as Sketchbook, which is the primary aesthetic design program used by Build Change.

Prior to this project the majority of my experience with drafting had been done through Revit and AutoCAD. When I initially started this project I modeled the safe room in Revit and then I made typical details in AutoCAD. After a couple of weeks the majority of my work was being performed in Sketchup.

Being a part of the College of Architecture and Environmental Design was a great benefit for me. Luckily while doing my project I was taking an interdisciplinary class with a few architects and construction managers. These people really helped me out to learn such programs. The one architect student who helped me out the most through this entire project was Thomas Husser. Thomas was a foreign exchange student from France who was attending CalPoly for a year and who had a clear understanding of the project and an extensive knowledge of all of the programs that I was using.

Right after the clearing of the site and prior to the official start of construction, Thomas asked me if he could assist with doing anything else for the project. He then volunteered to model out some of the sketch up model while I assisted Michael and Gilbert with assuring that the material that would be ordered would meet quality standards for building. Once the visual model was finished and presented to Michael we all agreed that some necessary changes had to be made to the overall project. Having a visual understanding of what the site would look like through the model, we were able to point out some flaws and downsides to the elected order of the construction phasing. In addition to the changes in phasing, Gilbert noted that it would be best if we incorporated a station to demonstrate the construction of light weight roofs. The reason being is because the material cost for building a light weight tin roof is typically cheaper than a
heavy solid roof. These substantial changes obligated us to start redesigning the layout from scratch.

As imagined, these design changes caused frustration amongst many of us. Thomas was no longer able to create another model due to availability issues, contacting the material suppliers to change the original orders became hectic, and the intended time of completion for the project had to be extended. Even though these changes caused frustration they were also a great learning experience. It has been proven through this project that even though the changes caused frustration, the right decisions were made by making these changes. Overall the purpose of this project was to help the locals to improve their building skills and by expanding their training through the changes made, the locals were able to obtain more out of the learning experience.

In conclusion I can state that the experience of being a part of a project focused on saving lives through proper living was great. The outcome of the project has had and will continue having a positive impact in my life and in the life of those that go through the training of this program. Attached in Figure 16 it is possible to see the attentiveness in which the locals grasp all of the given information. It is because of images like this that this project was worth the time, effort, and stress to complete.
**Figure 11:** This image displays the rubble that had to be cleared from the site location for the ESSU Construction Training Facility in Guiuan, the Philippines. Mini Excavator in the back (Northeast Corner)

**Figure 12:** This image displays the rubble that had to be cleared from the site location for the ESSU Construction Training Facility in Guiuan, the Philippines. (South Side)
Figure 13: This is the general site plan dimensions that were given to me by Gilbert to begin working on a site layout. The usable space for the Training Facility would be a 16 meter by 30.3 meter lot.
Figure 14: This is the proposed site layout plan for the training stations that I submitted to the Build Change staff for approval.
Figure 15: This was the final site plan position of training stations that was approved by Build Change and that was constructed as part of the ESSU Construction Training Facility.
Figure 16: This image reveals the eagerness in learning as Gilbert Appa, The Build Change Resident Engineer, explains the structural details of the foundation to the locals.
ACKNOWLEDGEMENTS:

I would like to express my deepest appreciation to all of those who provided me the possibility to complete this project. A special gratitude I give to my Senior Project Advisor Professor James Mwangi for contacting me with the right people and for being my foundational support throughout my years at Cal Poly.

In addition I would like to also acknowledge the crucial role of the Staff of Build Change, who gave me the permission to use all of the required material to make this project possible. A special thanks goes to the Director of Education of Build Change, Michael Collins, and the Build Change Resident Engineer in The Philippines, Gilbert Appa. Without these two people, The HSSU Training Facility would not exist.

One last acknowledgment goes to Thomas Husser, a Cal Poly colleague, for providing his time and dedication to this project without asking for anything in return. Without the people listed above, this project could not have been made possible. Thank you all for sharing your time, knowledge, and passion for this project.