A Case Study on the Application of Modified Concrete Hollow Blocks and Coco net systems for soil erosion

I. Introduction

The socialized housing sector was identified as the most viable sector for the implementation of a demonstration project “Green Jobs promotion in the Socialized Housing Sector” under the Green Jobs in Asia Project of the International Labour Organization (ILO). Two green building products for green jobs promotion were chosen for the demonstration project. These are Modified Concrete Hollow Blocks (mCHB) using coco fiber reinforcement and Coco Coir based erosion control systems. The pilot project site is the NHA managed resettlement area in Rodriguez town, Rizal Province. About 64 male and 51 female participants of the green material application project came from the Southville 8-B Housing Projects of Bgy. San Isidro, Rodriguez Rizal.

Modified concrete hollow blocks are fibre reinforced concrete masonry units that may incorporate alternative inert materials such as Polyethylene Terephthalate (PET) or ligno cellulosic fibers such as coco coir. For the case of the mCHB used for the demonstration project, it uses coco coir as alternative material. Modified concrete hollow blocks have environmental, economic and social advantages such as lower cost of production compared to regular concrete hollow blocks, substitution of concrete and sand by coco coir leading to possible decrease in GHG emissions from cement usage, and that coconut fiber reinforced concrete has sound absorbing characteristics (Zulkifli, M.J., et. al., 2008; Mahzan, S., et. al., 2010). It is clear that mCHB is a better alternative based from these advantages but the question is whether mCHB is comparable or even better than regular concrete hollow blocks in terms of its functional characteristics. Functional characteristics, such as strength of the materials, ease of application, the amount of materials used and drying time, could be compared for regular CHB and mCHB to determine if using mCHB has an edge for such important functional characteristics.

Coco net systems on the other hand have a clear cost advantage over shot-crete and riprap system technologies for soil erosion control. It is also more effective and literally greener, vegetation-enhancing, and is environmentally friendly since it minimizes the use of concrete.

II. Objectives

The application of mCHB to a prototype walling system of a low cost house and the use of coco net systems for soil erosion control in the project site aims to:

- Validate the advantages of these two green products as against their conventional counterparts through the application
• Use the output of the trainees for both products during the training cum production for the application to show that the output of the trainees could really be used for their intended purpose

III. Achievements

a. Modified Concrete Hollow blocks

• About 825 m3 of CHBs were produced as of end of August 2012
• mCHB outputs during training cum production were successfully applied to build a prototype low cost house in Kasiglahan village during the last week of August to the 1st week of September
• mCHBs initially passed the load requirements when applied to a walling system of a house but further laboratory tests are ongoing in the formulation of the generic mix
• Overall dimension of mCHB and regular hollow blocks are the same but mCHB is lighter
• An initial value engineering analysis was also conducted by the field personnel of NHA to compare the use of mCHB as against regular concrete hollow blocks. This is shown in the Appendix.

b. Coco net systems

• Total production of coco coir twines exceeds 10,000 pieces as of end of August 2012
• Trainees were successful in producing coco coir twines and are now moving towards coco net weaving
• Cocotech started training activities for net making which lasted for about one week
• The initial sessions were held first in Kasiglahan Village and the weaving machine was later moved to an empty unit in Block 11, Lot 4 in Southville 8B where Coco Tech continued the training.
• There were 8 trainees, most of them officers of the newly formed worker’s association of coco coir twiners and who are also actively doing twinning work
• As of the third week of September 2012, the trainees had already finished over five-50 meter long coco nets (the coco coir twines that were produced by the trainees were used as the raw materials for the coco nets)
• The application of Coco net systems took place last Sept 26, 2012 in Southville 8 Rodriguez, Montalban. There were 16 trainees that worked for 2 hours that installed around 4 coco nets in the slopes of the project site covering around 80 sqm. The activities conducted during the application were: a) Preparation of sloping terrain, b) Rolling of
Coco net systems, c) Stacking of Coco net systems and coco fibre logs, d) Stitching of coco net systems, e) Installation of interlocking blocks at the bottom portion, f) Planting the vetiver plants in interlocking blocks, and g) spreading seeds of cover plants or bagging (vines)

IV. Prospective

Prospective activities for the application of the two green products would be to mainstream them to the entire construction industry through the dissemination of the information gathered and the achievements of the demonstration project under the Green Jobs in Asia project of the ILO.

Comparing the two green products, it seems that the coco net systems for soil erosion is already an established technology through the promotion and application of Cocotech but mCHB is a rather emerging technology that still need further development. Some of the strengths and weaknesses of the two green products can be seen below.

CCS strengths
- Reliable source of materials and reliable demand for coco net systems
- Coco tech seeks to promote and protect its product
- Coco tech was able to transfer knowledge and technology to trainees
- Private public partnership where the private partner showed heart and dedication paved the way for better results for coco net systems

CCS and mCHB Weakness
- Storage of materials
- Fall out of participants

The good practices that were observed during the application of the green materials are as follows:
- Partnership with private entities that has a tested and established product and training program
- Workplace accessible to women (home based) in CCS
- Revolving fund were made available to pay for the production expenses
- A local community leader doing regular monitoring of the training cum production supplementing trainers with the CCS
- Reward system such as food allowance during training to motivate trainees
- The set-up of training cum production was effective in motivating trainees
- Feasibility study before implementation
- Assign a skilled personnel to stay in with the trainees to continuously guide and supervise their skills development

Some of the lessons learned that could be used for further improvement of the application of green materials are:
- The training should be able to connect with the motivation of participants to ensure that they continue with the training
- Gradual build-up of the skills of trainees is vital for the mastery of green material production
- It is evident that Public Private Partnership is needed for the project to move forward
- Training cum production should also consider production requirements such as facilities, equipment, incentives and capabilities of trainers

**Appendix: Value Engineering of mCHB vs. Regular CHB**

<table>
<thead>
<tr>
<th>Description</th>
<th>Ordinary concrete hollow blocks</th>
<th>Modified concrete hollow blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>4”</td>
<td>4”</td>
</tr>
<tr>
<td>Weight</td>
<td>18 Kg</td>
<td>16 Kg</td>
</tr>
<tr>
<td>No. of pcs. used in 1 unit</td>
<td>532 pcs.</td>
<td>532 pcs.</td>
</tr>
<tr>
<td>Volume of Mortar</td>
<td>0.056 cu.m (20 layer CHB)</td>
<td>0.294 cu.m (20 layer CHB)</td>
</tr>
<tr>
<td>Cement</td>
<td>6 bags</td>
<td>3.528 bags</td>
</tr>
<tr>
<td>Sand</td>
<td>0.506 cu.m</td>
<td>0.294 cu.m</td>
</tr>
<tr>
<td>Area of Plastering</td>
<td>28.512 sqm.</td>
<td>28.512 sqm.</td>
</tr>
<tr>
<td>Cement</td>
<td>5.474 bags (same)</td>
<td>5.474 bags (same)</td>
</tr>
<tr>
<td>Sand</td>
<td>0.456 (same)</td>
<td>0.456 (same)</td>
</tr>
<tr>
<td>Shape of core shell</td>
<td>rectangle</td>
<td>ellipse</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>rough</td>
<td>smooth</td>
</tr>
<tr>
<td>Curing time</td>
<td>21 days</td>
<td>15 days</td>
</tr>
<tr>
<td>CHB laying time</td>
<td>8 hrs.</td>
<td>7 hrs.</td>
</tr>
</tbody>
</table>

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