Report:

Dadaab Training on Hydraform Building System

Production and Installation of Hydraform ISSBs

Date: 29.02.2012

Introduction:

Hydraform, which started in 1988, has been operating and exporting ISSBs-making machines worldwide with over 1500 machines being used on community projects, commercial projects and various housing projects worldwide.Over 15 000 homes and buildings have been built worldwide with the Hydraform Building System.

The Hydraform Building System has had an Agremènt Certificate since 1996 and the building system conforms to the National Building Regulations of South Africa.

The Hydraform ISSB is manufactured using local sand-based soil with less than 35% fines content (fines are the fraction of soil below 0,075mm, mainly clay) and a plasticity index below 15. The soil is mixed with 5 to 8% Portland cement by volume (Class II 32.5 or higher) which results in block strengths of 4 MPa and 7 MPa respectively.

Hydraform provides full training on the equipment and building system in South Africa or on site world-wide and also provides a full construction service.

DadaabHydraform Building System Training:

The training was organised by NRC, UNHCR and Hydraform Company. It lasted for 4 weeks in February 2012. First 2 weeks were devoted for ISSBs production under a shelter near JEB centre in Dadaab. Last 2 weeks were devoted for building a sample house in the UNHCR compound.

Tow trainers were sent by Hydraformcompany:

1- Dr. Architect/ Ahmed Elgoni(to give 4 weeks training)
2- Architect/ Kristopher Tarus (to give 2 weeks training)

The training has covered the following operations:

a. Theory of soil stabilization
b. Soil testing
c. Mix designing / cement ratio
d. Water moisture content OMC
e. Soil mixing
f. Block making
g. Block curing and recording
h. Block testing / quality control
i. Block stocking and counting
j. Block installation
k. Machine operation
l. Machine maintenance
m. Safety percussions
n. Supervision

Block production training was attended successfully by around 80 trainees. Block installation/building training was attended successfully by around 40 trainees (see attached list).

Trainees attended the training came from the following agencies:

1- DRC
2- GOAL
3- CRS
4- IOM
5- LWF
6- NCCK
7- NRC
8- UNHCR
9- RRDO
10- PWJ


Suitability of Soil:

6 types of soil out of 7 supplied for the production of ISSBs during the training were suitable. The grain size of these soils is relatively fine that is way addition of coarse sand is recommended.

NRC shelter unit is noted to document the sources of these soils and to keep samples in dry store forfurther research and supply purposes.

3 Hydaform block-making machines (M7 without mixer) were used for the training. Compression in machines was adjusted to standard 100 to 110 bar to suite the soil.


Cement Problem:

For Dadaab trainingPozzolanic cement-32 has been supplied and used to produce Hydraform ISSBs instead of Portland cement.

Pozzolanic cement-32.5 is a sub-standard cement and much weaker than Portland cement. It also needs much longer curing period as Portland cement.

After 2 weeks from the beginning of the training, compressive strength/crushing test haverandomly been conducted for the blocks using Hydraform block tester.

9 block (2 weeks) old have been tested and compressive strength results were as follows:

1- Sample 1 2 Mpa
2- Sample 2 0 Mpa
3- Sample 3 0 Mpa
4- Sample 4 5.8 Mpa
5- Sample 5 3 Mpa
6- Sample 6 2.8 Mpa
7- Sample 7 2.9 Mpa
8- Sample 8 1.4 Mpa
9- Sample 9 2 Mpa

Average compressive strength is 2.2 Mpa. This is almost 50% less compressive strength than what could be achieved if standard Portland cement was used.

For verification, 5 blocks (1 week old) have been tested and results were as follows:

1- Sample 1 1 Mpa
2- Sample 2 1.5 Mpa
3- Sample 3 1 Mpa
4- Sample 4 1.4 Mpa
5- Sample 5 1.4 Mpa

Average compressive strength is 1.3 Mpa (also 50% less as required).

Hydraform Sample House in UNHCR Compound:

Block installation training took place in the UNHCR compound in the last 2 weeks of February 2012. Around 40 trainees from the different agencies have attended the training.

The house built during the training was according to shelter proto-type design, but with some amendments in the foundation and the roof (see attached BOQs).

Obviously the blocks used for the sample house in UNHCR are by 50% weaker thanHydraform standard blocks. Weakness of compressive strength of the blocks is due to the usage of pozzolanic cement instead of Portland cement in block production. For the sake of the training those blocks were used, but definitely not satisfactory for Hydraform standard.

Performance of Trainees:

The technology of soil stabilization (SSBs production) is very scientific in terms of soil testing/selection, identification of clay, silt and sand content, plasticity index, identification of optimum moisture content (OMC), adjustment of compression, mix design, curing process, …etc. Therefore most of the trainees, who were a mixture of different professional backgrounds, from engineers to unskilled laborers and people from other disciplines had difficulties in understanding the theoretical part. May be only 20% of the trainees have understood the theory (mainly engineers).

On the other hand block production work is physically-intensive, especially with hand mixing, thereforemost of the trainees, especially the Somalis, have repeatedly expressed the difficulty of this work. The maximum number of blocks produced by one machine in one day during the whole training was 250 blocks (in normal production conditions 1200 to 1500 blocks can be produced with the same machine).

Among all the trainees, there were only 2 trainees with mechanical background, so most of them had difficulties in machine maintenance.

During the sample house building, only few trainees, who have experience with masonry, have worked on building, while most of them have acted as casual laborers or observers.

At management level, there was some delay in supply of soil during block production and lack of building tools during building the sample house.

During both parts of the training, LWF team was outstanding followed by DRC team and NRC team.

Recommendations:

1- Obviously, this training was a good beginning, but was not sufficient. More training sessions should be organized. And because of the scientific nature of soil stabilization technology, preferably people with engineering or technical background should be recruited.
2- Supervisors of block production and building should be engineers or alike.
3- Workers for block production should be physically fit.
4- Machine maintenance should be done by people with mechanical background
5- In the future, portland cement-42.5 is strongly recommended for production of standard Hydraform ISSBs for shelter projects. The sample house in UNHCR compound could be

seen as trail Nr.1 (a product of pozzolanic cement-32.5). Trail Nr.2 (a product of Portland cement 42.5) is recommended.

6- Mass production of Hydraform ISSBs should be done, preferably, in centralized locations for the following reasons:
   A- Grouping of machines will give better monitoring system in terms of quality and delivery.
   B- Regular machine maintenance will be easier
   C- In rainy season block production becomes very problematic. Soil sieving and control of water moisture content (OMC) become a big challenge. In centralized locations, soil could be piled under a shelter and processed systematically.
   D- In centralized block yards operations like soil sieving, soil crushing and soil mixing could be mechanically set-up.
   E- Centralized block yards could be used as on-going training centers for further capacity building.

For proper set-up of mass production line, the following operations and duties should be properly consulted and implemented:

Proposal for Establishing Centralized Block Yard for Mass Production of Hydraform ISSBs:

1- <u>Design for centralized block yards (block production line), that includes:</u>
   1-1- Room / lab for soil testing and sampling
   1-2- Space for soil piling / raw material and access roads
   1-3- Space for soil sieving
   1-4- Space for soil crushing
   1-5- Platform for soil mixing under shelter
   1-6- Ramps to feed mixers with soil using wheelbarrows
   1-7- Space for mixers under shelter
   1-8- Space for block making machines under shelters
   1-9- Space for block curing for each machine separately / production of 7 days
   1-10- Space for blocks stocking
   1-11- Space for blocks loading on trucks and access roads
   1-12- Store for cement / and cement container beside each machines
   1-13- Water Supply and storage / and water container beside each machines
   1-14- Store for daily production tools
   1-15- Store for diesel, oil and spare parts
   1-16- Workers station including showers and toilets
   1-17- Office for admin.
   1-18- Office for supervisors
   1-19- Guard room
   1-20- In and Out Main gates
   1-21- Power generator

1-22- Fence

2- Supervising the gradual implementation of the above proposed centralized block yards.
3- Supervising the temporary block production while implementing the centralized block yards.
4- Estimates for material supply, at daily, weekly, monthly and annual rates, that include:
    4-1- Soil
    4-2- Cement
    4-3- Water
    4-4- Diesel
    4-5- Machine and hydraulic Oil
    4-6- Tools, Hydraform machinery, spare parts (molds, filters, mixer plates, etc.)
    4-7- Extra machines (fork lifts, pick-up, water truck, water pumps, etc.)
    4-8- Safety materials
5- Proposals for staff / manpower, that include:
    5-1- Supervisors / engineers
    5-2- Mechanics
    5-3- Foremen
    5-4- Machine and mixer operators
    5-5- Workers
    5-6- Admin.
    5-7- Guards
    5-8- Suppliers
6- On-going training / Capacity building for all categories of staff on the following:
    6-1- Soil logistics
    6-2- Soil testing
    6-3- Mix designing
    6-4- Water moisture content OMC
    6-5- Soil mixing
    6-6- Block making
    6-7- Block curing and recording
    6-8- Block testing / quality control
    6-9- Block stocking and counting
    6-10- Block loading, transporting and uploading / delivery on Time
    6-11- Block installation / building (offices and stores in the block yard could be built with Hydraform blocks)
    6-12- Block costing
    6-13- Machine operation
    6-14- Machine maintenance
    6-15- Safety recursions
    6-16- Supervision
    6-17- Admin.
    6-18- Co-ordination
7- Liaison with Hydraform Co. International:
    7-1- Order for additional machinery, block machines, mixers, crushers, mechanical sieves …etc.

7-2- Order for annual spare parts
7-3- Arrangement of mechanical trainings
7-4- General technical back-up issues

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Dadaab, 29.02.2012