Contents.

Introduction.

Posterity is demanding that we avail our Country men our experience in the use of mud called laterite or filling sand for building durable, beautiful and long lasting houses. This publication will gather details of the technologies available to us in a bid to passing them on to interested persons. Africa has abundant deposits of this very useful material that combine gravel, sand, clay and silt to give us a combination that may be used with or without the addition of ordinary portland cement. It is our hope that lots of us will consider the use of mud called laterite if we have adequate knowledge about its quality and effectiveness for building of our houses.

We are able to confirm its acceptability worldwide and its strength, even, as ours Standard Organization of Nigeria (SON) have written the standard guide for its application. We are happy to present you a detailed compilation of the technologies and our experience in this book titled "A hand book on the Technologies of mud blocks and cement stabilized soil blocks/bricks.

We believe that the informations contained in it will highly enrich the readers and be beneficial to human kind.

Elder Rufus B. Akinrolabu.
14th August, 2012.

ABOUT THE PUBLISHER.

ELDER RUFUS BAMBOLA AKINROLABU. graduated from the College of Engineering, Madras-India and have worked as an Engineer in- Training, Structural Engineer, Technical Manager and General Manager in Delta Steel Structures Ltd, Warri and Neptune Constructions Company Ltd, Lagos between 1980-1987. He has been the Managing Director /C.E.O. of Bolyn Constructions Company Limited since 1987. Elder Akinrolabu attended several post graduate training courses such as the 1985-Plant management course of the University of Ibadan, Department of Industrial Engineering, the 1995 Amelioration/Improvememnt of Brick presses - a course conducted by centre for Earth Technology and held at the Polytechnic, Barkinladi, Jos Plateau and the 1998-UNDP sponsored "Small Scale Energy Efficient Brick Making Technology" conducted by the Ceramic Research Institute of Indonesia in Bandung, Indonesia. He has undergone numerous management and leadership training courses. He was conferred with the title "Champion of Indigenous Technology" in the Nigerian Tribune of June 30, 1998. Elder Akinrolabu was elected in 2004 the first President of the Building Materials Producers Association of Nigeria (BUMPAN) a federal Government of Nigeria facilitated Association. He was appointed to a seat on the Presidential Committee on Alleviation of Housing deficit in Nigeria in 2005 and he also sat on the Standard Organization of Nigeria (SON) Technical Committee to ratify the Standards for cement stabilized bricks for Nigeria use in 2006.

Elder Akinrolabu got an Award of Excellence for meritorious service to the growth of Nigeria Housing Sector at the 2004 Lagos Housing Fair. He was also honoured in December, 2005 by the Nigerian Television Authority, Channel 10 as a

"Real Lifetime Achiever" under their "Personality Platform" programme. Elder Akinrolabu has travelled widely in Nigeria since 1991 in the course of the exhibition of technologies of low cost housing to the generality of our people.

OUR COMPANY.

BOLYN CONSTRUCTION LIMITED was established and registered in Nigeria on the 15th June, 1987 and have since 1991 been promoting the use of Local Materials especially Laterite called Mud for low cost and affordable housing construction in Nigeria. The Company have the highest range of housing equipments/ machineries for the making of Walling Bricks (Standard Brick, Dry Stacked Interlocking Brick), Flooring and Floor paving Bricks and Fibre concrete Roofing Tiles and Super Semi - Roofing Sheets. We acknowledged that our First Brick Machine Design was given to us by GATE-Germany Appropriate Technology Exchange, F.R of Germany. Bolyn Constructions Company Ltd won several Awards among which are the 1995 Nigerian Institute of Architect Best Merit- in Local Materials Souring and in 1996 as Best in Innovative Technology. We have trained thousand of Nigerian since 1991 in many aspect of the "Low Cost Housing Technologies"

BOLYN CONSTRUCTIONS COMPANY LIMITED: have become a household reference in the field of Affordable Housing Delivery through the use of Local Materials. We are happy to state that we have continued to act as consultants to all and sundry in this field of Appropriate Technology as it relates to Housing delivery. Bolyn Constructions Company Ltd. have exhibited our range of products in more than 200 Exhibitions (Local Trade Fairs, Specialized Exhibitions, Housing Expos, Solo Exhibitions and International Trade Fairs etc) We have traverse the length and

breadth of Nigeria, and visited about 30 states in the Federation of Nigeria teaching, disseminating, demonstrating and training clients and the general public the art of using Local Material for Housing Construction.

OUR COMPANY HAVE NUMEROUS CUSTOMERS AMONG WHICH ARE:-

Unicef (Kaduna and Bauchi zone), National Directorate of Employment, National Youth Service Corps, Federal Housing Authority, State Housing Corporations (Ogun, Oyo, Osun, Kebbi, Niger, Kaduna, CRS and Enugu); Arc. Mbanefo, a former President of the Nigeria Institute of Architects, Engineers, Educational Institutions, Churches, Community Development Associations, Co-operative Societies, Builders and thousands individuals self builders.

THE FOLLOWING SERVICES ARE THE AREA OF OUR SPECIALISATION:-

A. Sales and After Sales Maintenance of Brick Presses and Roofing Tiles/ Sheet machines.
B. Assembly, Installation, Commissioning and training in all aspect of machine operation and use.
C. Production and supply of Bricks and Roofing Tiles / Sheets.
D. Building Construction, Supervision and Consultancy.
E. Organizing Seminars and Educational programme to empower prospective house owners.

TECHNOLOGY OF SOIL CEMENT MAKING.

EXTRACT FROM BOOKS & JOURNALS ON CEMENT STABILIZED SOIL BLOCKS USING CINVA RAM PRESSES.

We have for over 20 years now been obliging our customers with the above title that is 34paged. In the first page of the 34paged handbook, we acknowledge the fact that we "Bolyn Constructions company Limited" are not the originator of most of the details in the handbook, rather we have only facilitated the compilation of the facts from various books and journals written elsewhere that we are opportune to have read. We are only happy to share some salient points that will generally be of interest to mankind since the intentions of ALL is to bring back Africa's lost glory through the re-introduction of technologies of affordable housing. Countries whose tittles we have gotten most of these are Ghana, United Kingdom, Belgium, India, Nigeria, Indonesia, Thailand, South Africa, Kenya, France etc.

INTRODUCTION:

This book tells how to make building blocks from soil, using a hand-operated block press.

Soil has been used to make houses for a long time, but the walls often break or are washed away in the rain. Pressing the soil into blocks makes the walls easier to build, strong and more resistant to water. Adding some cement or lime to stabilize the soil makes even better blocks. The basic materials, soil, costs nothing and is usually available on most site. It is easy to find good soil for building, or to mix in sand or clay to make it good.

The basic steps of operation are fairly simple. First good soil is found and tested; then it is prepared for the block press, mixing in Cement or Lime if you have it. The soil is put in the block machine and pressed. Then the new block is raised out and removed for

curing or sun-drying.

CEMENT STABILIZED SOIL BLOCK FOR LOW COST HOUSING CONSTRUCTION – USING THE MULTI-PURPOSE V.S.CINVA RAM BLOCK PRESSES.

ADVANTAGES OF BUILDING MADE OF LATERITE SOIL – CEMENT BLOCK.

1. The international labour organization in Geneva in its Technical Memorandum No. 12 has this to say:-

a. Properly processed Cement-soil Block is as good as, even better than most modern materials e.g. concrete block.

b. The use of Laterite soil should facilitate home ownership and minimize government subsidies for low cost housing projects.

c. Houses made of cement stabilized soil often offer a more pleasant environment in terms of protection against outside heat or cold than houses made of so called "Modern" materials.

d. The use of Soil Block for all types of buildings:- low and middle income housing: luxury houses, office buildings etc. should be vigorously promoted in the developing countries.

REQUIRED EQUIPMENTS.

a. Block Press with proper platform and a lever pole.

b. Box for shrinkage test where there is need to understand the soil.

c. Headpan, box or bucket for batching.

d. Pick-axes and shovels for digging, mixing and filling.

TESTING AND CHOOSING THE SOIL.

Most soil is suitable for making blocks, but it must be tested first

to find out how much sand, silt and clay it contains.

Dig a small pit for testing. First remove and set aside the top soil where plants or grasses may be growing (25 to 50cm deep). This soil should not be used for blocks. Dig out the soil under the top soil. The deeper soil may be sandier, which is usually better for making blocks.

Now make these tests: a Drop test.

DROP TEST: Take a hand ful of soil which is wet enough to form a ball and squeeze it in your hand, but not so tightly that the water is squeezed out.

Drop the ball from about one metre high onto hard ground. If it breaks up into only few places, the block-making quality is good. If it breaks completely up, there is either not enough water in it or not enough clay, and the quality is bad.

BOX TEST: This test shows the quality of the soil and allows you to determine the amount of Cement you should use with it. Use an open wooden box with inside measurements of 60cm by4cm (Fig. 1). Oil or grease the inside of the box.

Fill the box with very wet soil. Compact it well, especially in the corners and level off the top with a stick or the edge of your trowel (fig 2).

Put the box in the sun for three days to dry or in the shade for seven days. It should be protected from air. The soil will shrink as it dries. Do not use soil for blocks if it has many cracks in it (Fig. 3)

or it has arched up out of the box. Don't use soil if it has shrunk more than 5cm. Either find some better soil, or improve the soil by adding sand, since it is the clay which causes shrinkage.

Measure the shrinkage by tapping one end of the box on the ground so that all the soil slides down to one end (Fig. 4) The cracks will close and you can measure the shrinkage space at the top end (Fig. 5).

The amount of shrinkage tells you how much cement you should use. The more shrinkage, the more cement is needed. Use the table below as a guide for the amount of cement to be added to the laterite.

TEST TABLE:-

Shrinkage	Cement to soil.
0-10mm	1.35
10-20mm	1:30
20-30mm	1:25
30-40mm	1:20
40-50mm	1:15

BOX TEST- Shrinkage Test.
The amount of clay in the soil is useful information but it must be understood that some clays shrink more than others as they dry. The range of measured shrinkage is wide and measurements must be made on a soil sample taken from the trial holes. These measured will determine the suitability of the soil for block making and allow estimates to be made of the amount of stabilizer to be added.

Fig. 1

OIL THE INSIDE OF THE BOX

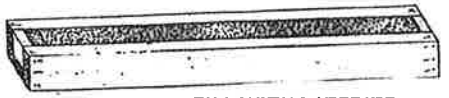


Fig. 2

FILL WITH LATERITE

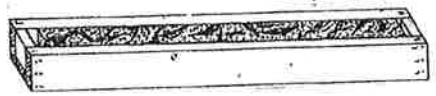


Fig. 3

DO NOT USE THIS SOIL

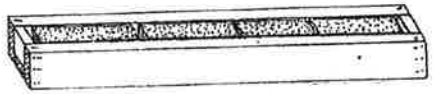


Fig. 4

CRACKS OCCUR

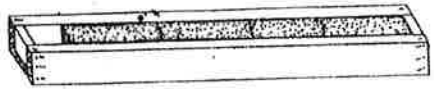


Fig. 5

MEASURE THE SHRINKAGE SPACE

ANALYSIS OF TEST RESULTS.
(Guidance is based on information in the CINVA RAM Block making machine field manual and confirmed by BRE experience with only minor amendment).

(BRITISH STANDARD).
Shrinkage.
Less than 15mm – There is probably insufficient clay. Soil is not recommended for Block-making unless more clay is added.
15mm to 30mm – 1 part cement to about 20 parts of soil by volume is recommended.
30mm to 45mm- 1 part cement to about 15 part of soil or 1 part lime to 7 parts of soil by volume is commended.
45mm to 60mm – 1 part cement to 12 parts of soil or 1 part lime to 6 parts of soil by volume is recommended.
More than 60mm-insufficient sand. Soil is not recommended for

block-making unless more sand is added "carry out further shrinkage tests if more clay or sand is added to the soil.

CAUTION:
When considering hydrated lime as a stabilizer remember that it must be of good quality. It may be more expensive than cement. Careful handling is needed whenever lime is added to water. Do not allow the liquid to come into contact with the skin. Particularly protect eyes. Quick lime is not recommended for use as a stabilizer.

"GHANA STANDARD"
Guidance is based on information in the research findings of the Department of Housing and Planning Research, Faculty of Environmental and Development studies, University of Science and Technology, Kumasi-Ghana as contained in their Block press Handbook with a little modification based on field experiences.

Shrinkage.

Less than 15mm (½")	-	3% Cement (i.e) 1 part cement to 33 part soil.
15mm to 25mm (1")	-	1 part Cement to about 25 parts of soil by volume is recommended (4% of Cement).
25mm to 35mm (1 ½")	-	1 part Cement to about 20 parts of soil by volume is recommended (5% of cement).
35mm to 50mm (2")	-	1 part cement to 17 parts of soil by volume is recommended (6% of cement).
More than 50mm (2")	-	1 part cement to 12 part soil by volume is recommended for block –making (8% of cement).

Carry out further shrinkages tests if more clay or sand is added to the soil.

MAKING BLOCKS.
PREPARATION OF THE MIXTURE: After you have found good soil and correct amount of cement to use with the help of the box test, the soil mixture must be prepared for the block press. If you have no cement and must make laterite blocks, you follow the same sequence as described below:-

a.	-	Remove the top layer of soil.
b.	-	Dig out the soil you want to use and pile it.
c.	-	Measure the required proportions of laterite and cement.
d.	-	Make a dry mix of the batch.
e.	-	Add water and make a wet mix.
f.	-	Check the moisture content using the drop test.

If you are making laterite blocks, steps (c)and (d) are of course left out. Before you start batching, the laterite must be broken up so that no lumps remain. This is usually done by beating the soil with the back of a shovel or with a piece of wood. Large stones are removed.

MIXING: Use flat, hard ground for mixing. If no such place is available, prepare a mixing platform before you start working. Spread the laterite out until it is about 10cm thick, spread the cement evenly over all the soil. Mix the cement and soil with a shovel until the mixture is of an even colour throughout.

Spread the heap again, sprinkle a little water over it and mix. At this point, test the mixture for moisture with the drop test. If it is too dry, spread it out again and add more water.

The soil-cement mixture is now ready for the block press. There should be enough mix for about 7 or 8 blocks in one batch at a time.
NOTE: Never prepare more than you can use up within 30minutes (about three batches). It is better to mix small amounts more often.

STEPS IN MOULDING A CINVA RAM BLOCK USING BOLYN BRICK PRESSES.

a. Fill the mould with slightly moist soil cement.
b. Compact edges and close the mould lid.
c. Raise the lever to the top of the mould lid.
d. Press the lever down to the horizontal position.
e. Bring the lever out to the resting position and open the lid.
f. Raise out the freshly made block by pressing down the lever.
g. The newly made block is now completely out of the box.
h. Carefully remove the Block to the Drying area.

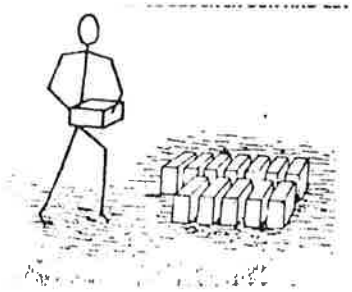
OR

PRESSING THE BLOCK.

a. Place the block press in its rails on flat, solid ground near the mixing platform.
b. Open the mould box by swinging.
c. Half fill the mould box with the laterite cement mix.
d. Press the mix firmly into the corners with a piece of wood.
e. Fill the mould to the top and compact the corners again.
f. Add a little more so that the mould is filled flush to its top edge.
g. Swing the handle quickly over to the other side and press the block until the handle has reached a horizontal position.

If the mix is too dry, the handle will not go all the way down to the horizontal position. In this case do not force it, as the handle may break. Instead, eject the unfinished block so that you can refill the mould box after adding a little water to the mix. On no account should more than one man at a time work the handle!

PLATFORM + FIRST DAY BRICK
SHED + WETTING OF BLOCKS



BLOCK WITH CEMENT

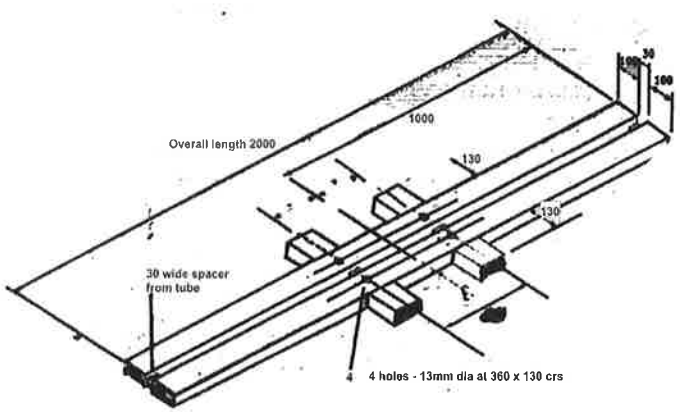
STACKING FOR FURTHER CURING

FIG. 2

SURVEY OF SOIL BLOCK MAKING MACHINES.
Block Making Machines.

Name	Country of Origin	Approx. year introduced	Manual (M) or Power (P) Operation	Gross Weight (kg)	Compacting Pressure (MN/m2)	Max. Daily Production Rate	No. of Workers	Approx. Price (Uss, 1985)	Maximum Block Size (mm)
Astram	India	Mid 1970s	M	110	5.0	n.a	3-4	375	300x230 x100
Brepak	United Kingdom	1979	M	140	10.0	300	3	1,300	290x140 X100
Ceta-Ram	Guatemala	Mid 1970s	M	80	2.4	250	3	450	290x140 X90
Cinva – Ram	Colombia	Early 1950s	M	75	2.0	350	3	300	290x140 x 90
Consolid AG	Switzerland	Late 1970s	P	1,600	0.8	3,500	6^2	20,000	250x120 X75
Ellson Block-Master	India	Early 1970s	M	210	7.0	750	10^2		290x190
Landcrete	Belgium	About 1950	M	320	4.0	1,000	7^2	1,000	295x140

Terataram			and P		2,100		2,000	18,000	x90
Latorex system	Denmark	Mid 1970s	Factory	—	5.0	12,000	—	—	230x110 x 55
Maquins	Colombia	Early 1970s	M	170	1.8	180	4	—	200x150 x40
Meilli	Switzerland	Late 1970s	M and P	120 1,700	5.0	500 7,000	—	700	250x125 X80
Supertor	Brazil	Mid 1960s	P	1,000	6.0	20,000	—	—	230x110 x50
Tecnor	Brazil	Late 1970s	M and P	85 2,500	2.5	2000	6	—	230x110 x 50
Tek-Block	Ghana	Early 1950s	M	90	2.0	250	3	240	290x215 x 140
Terrablock	USA	1985	P	5,350	—	4,800	—	80,000	300X250 x100
Winget	United Kingdom	1948	P	1,100	9.5	1,150	5	—	300X150 X100
Zore	United	1982	M	230	19.0	—	—	3,000	280x125



Welded assembly from 100 x 50RS Channel

LANDCRETE BLOCK.

One of the smallest but must important members of the structure is the block. Almost all walls in Rural Building are erected with blocks, preferable landcrete blocks.

LANDCRETE:- This word comes from the words laterite, land and concrete. The land on which we live provides us with the laterite; the first syllable is a combination of the first two letters of laterite and the last two letters of land. Concrete as well as contains Cements. In order to show this, the last syllable of the word concrete is used, making the word LANDCRETE.

Landcrete is a low cost, long –lasting and attractive building product. We will discuss making of the landcrete blocks using a hand operated press.

LATERITE:- This type of soil is found throughout the tropics. Its colour can vary from white –grey to a dark red, depending on the iron content, laterite consists mainly of fine and coarse sand mixed with clay. Laterite has been used to make house for a long time, but such walls break down easily and get washed away by rain. Pressing the soil into blocks makes it easier to build the wall, and they are stronger and more resistant to rain. By adding some cement to the laterite it is stabilized and makes even better blocks. The basic materials, laterite, costs nothing and is usually found on the building site.

It is easy to find good soil for building or to mix with sand or clay to make it good.
The basic steps of the operation to make landcrete blocks are fairly simple:- first good soil is found and tested; then it is prepared for the block press, with the addition of cement if available. The soil or soil-cement is put into the press and

compacted, raised out and removed for curing.

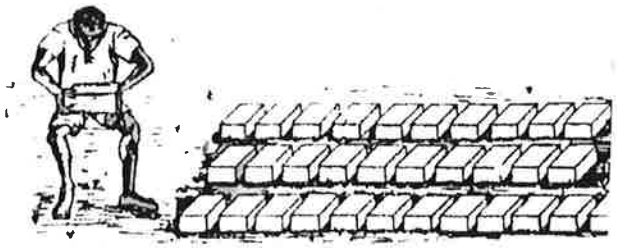
Note: If the blocks do not contain cement they are not called landcrete; they are simply called "laterite blocks"

REQUIRED MATERIALS.

a. Laterite soil: composed of sands, slit and clay.
b. Water: to wet the soil: it should be clean.
c. Cement: to stabilize the soil.

NOTE: If you have no cement you can use lime (twice as much as the amount recommended) or else just make plain laterite blocks.

FIG. 1



SUNDRIED BLOCKS WITH NO CEMENT.
PLACE BLOCKS IN SUN AND LET DRY COMPLETELY.

DIGGING OUT THE SOIL.

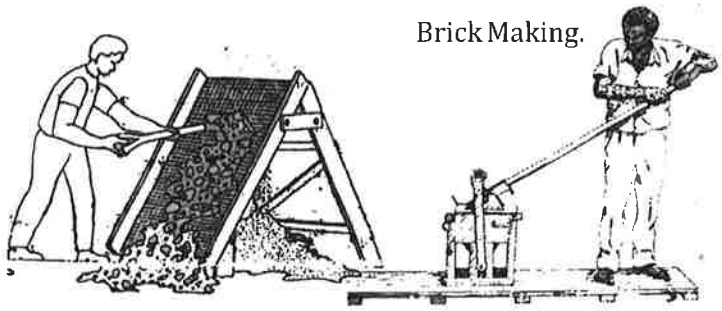
When tests have shown that a suitable soil has been found and you have decided on the amount of stabilizer to use. Then:-

(a) Remove all top soil from the pit area. Remember, that the depth may vary from a few centimeters to a metre or more. All top soil should be put to one side. It is valuable for growing crops but not for block making.

(b) As you are digging clay and sand from the ground, spread it out to dry in the sun, large lumps should be broken down to ensure quick drying.

© Stabilised soil blocks require a mix of fairly fine sand and clay. Stones and large lumps of materials are unsuitable. Therefore, ideally use a sieve with a 6mm mesh as shown in Figure 2 to separate the dry coarse and fine material. If you do not have a screen then some improvisation may be needed. As a last resort, stones and coarse materials can be removed by hand. Several factors can be important in deciding what sort of digging pits you will have. If the good soil goes deep, all the soil can come from one pit. However such a large pit might be ugly and undesirable; several small pits could be a better solution in some cases. The possible future uses of the pits should also be considered. They could form a part of a drainage system, a water storage tank, a sewage pit, a soak-away and so on. This of course, provided that the planning is done before hand.

Brick Making.



Soil Seiving.

CURING:- This is a term originally used to describe the chemical change in glue when they set, meaning when they become strong and hard.

As far as cement products are concerned, curing simply means

the after-treatment of any of those products.
If the blocks contain cement, we talk about "curing". If the blocks don't contain cement, we talk about "sun-drying".
The blocks with cement must now be cured for about two weeks while the cement sets. It is important to follow the directions for curing. If you do not, the blocks may be weak and full of cracks, and therefore unstable for building.

(a) Remove the block from the block press, holding it carefully.
(b) Place it on leaves, grass or boards on flat ground. The block should not touch the ground. (Fig. 1).
(c) The blocks should be under shelter or covered with polythene nylon so that they are out of the rain and sun for at least the first day.
(d) Let the blocks dry like this for a day.
(e) After one day the blocks are a little stronger so that they can be stacked for further curing.
Stack the blocks on boards or on very flat, hard ground up to five blocks high. Place them so that they touch each other. Make the stacks under a cover if possible, to keep them out of the sun (Fig 2).
(f) The blocks must be kept moist by sprinkling water on them twice a day. Put grass or leaves on top to help keep them moist (Fig 2)
(g) After two weeks of watering the cement has set properly and the blocks can dry completely. They are now ready for use. Blocks without cement simply need to be dried in the sun, let the blocks dry in the sun for two weeks: then they are ready for building.
Workers should relieve one another in their job every few hours to prevent boredom with the work. After a few days of such rotations, the workers will each become skilled and efficient at three or four of the different steps of block-making.

It is important to share the work fairly to keep up the morable and enthusiasm among the workers.

NUMBER OF BLOCKS:- You should know from the start approximately the number of blocks that will be needed for the building. This is necessary to be able to schedule the block-making, curing and building.

MAINTENANCE AND REPAIR.
Maintenance = Oiling.
Oiling can be done with refuse oil, palm oil etc, Oil every mobile part preferably twice a day. It will facilitate your work and double the life of the press. Grease the interior of the Press every 10 bricks. That way you will fabricate smooth bricks which can be pulled out easily. If you do not use the machine during a longer period of time, paint it so as to prevent rust. If the press gets out of order, have it repaired in a local workshop.


Batching.


Mixing.


Wetting.

NOTE:-
When sprinkling water, a second operator can continuously turn over the mix to achieve the best result.

MIXING THE SOIL WITH CEMENT OR LIME AND WATER.

Dry soil has been put through a sieve and lies in a stock pile with bags of cement or hydrated lime nearby. The two ingredients of soil and stabilizer must be brought together in measured amounts and mixed thoroughly before adding water. This measuring and carefully mixing is vital to the production of good quality stabilized blocks.

MEASURING:-

Adopt a simple volume method of measurement. For example use buckets or purpose made boxes. If it has been decided to use a mix of 1 part of cement to 15 parts of soil then using buckets, you would spread 15 bucketfuls of dry soil over the mixing area and add 1 bucketful of cement. The desired proportions will be obtained and incidentally a large enough batch of the mix for about 1 hour block-making will have been measured out.

[A standard 9 litre (2 gallons) capacity bucket holds about 15kg of dried soil. 14 bucket s of soil and 1 bucket of cement result in 240kg of mixture. Experience has shown that this quantity will allow about 30 blocks to be made and will take about ¾ of an hour for one man to batch and mix].

Boxes can be made to speed up the mixing process.

(1) Level fill a large bottomless box.

(2) Lift off the box, replace box on a clear part of mixing area and refill. Repeat until enough soil has been placed.

(3) To measure conveniently the much smaller quantity of cement needed, make a smaller suitable box this time with a bottom to it.

* Alternate use of mixing areas to maintain continuous production.

* Suggested working area-10 metres by 10meters.

Batching.

Mixing.

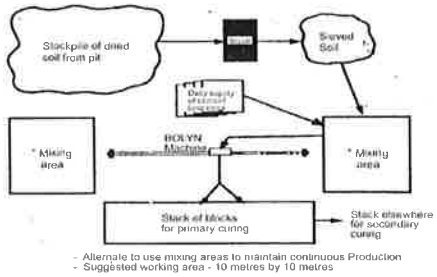
NOTE:-
When sprinkling water, a second operator can continuously turn over the mix to achieve the best result.

Wetting.

MIXING.

Spread out the soil and sprinkle the cement evenly over the soil. Mix the cement and soil thoroughly until the mixture is all one colour. Remember that poor mixing will result in poor blocks. Sprinkle water onto the soil/stabilizer mix, just moistening the surface. Turn the mix over before adding more water to the soil. This operation will have to be done several times until a sample taken from the soil mix passes the 'drop" test.

BRICK MAKING SITE.



- Alternate to use mixing areas to maintain continuous Production
- Suggested working area - 10 metres by 10 metres

CAUTION: DO NOT:-

(i) make a hollow in the middle of a heap of soil mix and pour water to make a pool. An unsatisfactory and wet mix will result.

(ii) make great heaps of the soil/stabilizer mix. When water is added, particles of damped soil will roll down the pile growing in size. These damp lumps will hinder good mixing. Spread the soil/stabilizer mix out over the mixing area so that contact of the water with the soil/stabilizer mix is even and widespread.

NOTE:

When sprinkling water, a second operator can continuously turn over the mix to achieve the best result.

CURING THE BLOCKS.

When blocks are taken from the Cinva Ram machine they must be handled with care. At this stage they are weak and easily damaged. They will grow stronger with time as the stabilizer plays its part. Any excess moisture in the blocks should come out slowly and evenly – the blocks are said to be "curing" during this period. A careful procedure should be followed for efficient curing. Much effort has been put into stages of soil selection, mix preparation and block making and this work can easily be destroyed without proper curing.

The curing operation consists of two distinct phases; primary curing and secondary curing.

Primary curing normally takes a maximum of about 5 days which time the moisture in the block is largely retained. If the blocks are exposed to the sun the surface of the blocks will rapidly dry out causing surface cracking. A weak block will be the result.

Whether primary curing takes as little as 2 days or as much as 5 depends on the soil, ambient conditions and choice of stabilizer and it is a matter of judgment on the part of the supervisor. A good indication that the primary curing period has been completed is when the blocks have changed to a lighter colour when compared with freshly moulded block. If lime is used as a stabilizer then the full 5 days are indicated. Generally allow twice the time for primary and secondary during when lime is used.

PROCEDURE.

(i). Choose a hard, flat and level site near to the press for stacking the blocks. The ideal site would be a covered concrete slab.

(ii). Protection for the newly moulded blocks can be provided in a number of way. They must be shielded from direct sunlight and covered by polythene sheet or other materials or placed in bags or sacks. If less than complete cover is provided then it is advisable to lightly sprinkle the blocks with water once a day.

(iii). Stacks of blocks should not be more than 5 high, remember they are still weak. Black polythene sheet should be used for covering Blocks undergoing primary curing while a stack of blocks is being prepared for secondary curing.

SECONDARY CURING:-

The objective is to allow the blocks to further achieve strength and to more conveniently stack them nearer to construction site.

(iv) Again choose a hard, flat and level surface near to the construction site.

(v) Stack blocks- no more than 1.25 metres high.

(vi) Cover stacks with polythene sheets (or other materials that will provide protection from direct rainfall).

(vii) Each time a layer of blocks is added to the stack the top layer should be sprinkled with water.

(viii) Blocks are normally ready for use 2 to 3 weeks after moulding. Again it is a matter of judgment taking account of the soil, weather conditions and the choice of stabilizer. When lime is used it could be 4 weeks before blocks have attained sufficient strength.

Continuous footings which run under all outside walls and load bearing partition walls are most commonly used with single storey building. Figure 6 shows a footing of concrete with a concrete block or solid concrete wall resting on it. figure 7 is a rubble foundation made from large stones or other solid materials and cement together. It is constructed in one solid piece which tapers so that the width at the top of the wall is the width of a solid block. There are other variations.

Foundations must be deep enough to withstand the building load and not be affected by seasonal ground movement. A good guide on depth is to note the depth of foundation used for local building which have stood for years without serious problems but if in doubt seek professional advice.

A damp proof course (DPC) membrane built into the walls just above ground level is recommended to prevent the chance of moisture in the form of rising dampness affecting the stabilized soil blocks.

SETTING OUT THE BUILDING.

Place the first course of blocks on the concrete floor, as in Figure 8 to outline the shape of the building leaving a 10mm space for each mortar joint. Slight adjustment of the mortar joint space will ensure that the perimeter is completed in full blocks, cutting blocks is wasteful and time consuming.

It is unlikely that this simple outline in blocks is all that is needed. For example openings must be carefully marked. Also check the level of the concrete floor.

The arrangement of blocks as they are built in walls is called the "bond". Figure 9 shows laying with stretcher bond, which is commonly used. Remember that the total length of block to be considered is 300mm (block length plus thickness of mortar joint). Thickness of walls can be 140mm or 290mm if double thickness is required.

BUILDING THE WALLS.

Stabilised soil blocks are laid in mortar in the same way as concrete blocks or fired clay bricks. The mortal thickness on both bed and vertical joint should be about 10mm. Joint should be completely filled for waterproofing and should present a regular appearance.

FOUNDATIONS.

It is not the intention here to consider in detail the design of foundation. However, because the quality of a building will to a large extent depend on a good foundation some mention must be made.

FOUNDATION TYPES.

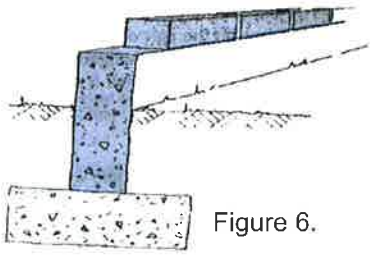


Figure 6.

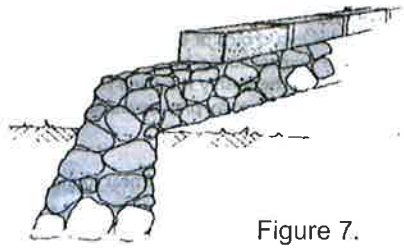


Figure 7.

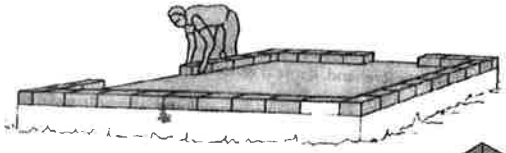


Figure 8.

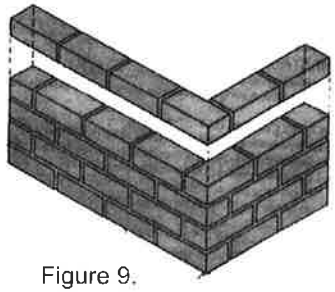


Figure 9.

Building the House.

Demonstration house

SOIL - CEMENT PAVEMENT

WHAT MORTAR MIX IS TO BE USED?

The soil and stabilizer mix designed for the production of blocks can be used as mortar. However, better resistance to rain penetration will be achieved by increasing the proportion of stabilizer and as general rule about twice the amount of stabliser is required in the mortar mix. A good mortar will be easily spread and the addition of lime in mixes of cement and soil helps the workability.

Once again experience of working with local soils will determine the best mortar mix. Avoid making mortar from soils which have

a high clay content, shrinkage cracks in the joints can be expected to affect water proofing. Use low clay content soil or find a source of clean sand as a substitute. Sand is recommended if strength and porosity are problems.

TRY:

1 Part cement :	4-5 parts sand, or soil if a weaker mix is required then use
1 part cement	6-7 parts sand or soil

All ingredients in the chosen mix must be dry. Measure out the quantities in buckets or gauge boxes and thoroughly mix them together using shovels.

Add water gradually until a good consistency is reached. A good test of a satisfactory mortar is that it will just hang on the mason's trowel and will spread easily on the surface of the blocks.

BEDDINGTHE FIRST BLOCKS.

Remember that both blocks and foundation walls are dry and moisture from the mortar will be absorbed quickly by blocks and walls unless they have been splashed with water beforehand. If much water is lost by the mortar mix into the blocks, the blocks may not bond together.

On the other hand too wet a mix will result in greater mortar shrinkage (and cracking), lower strength and a poor appearance on the finished work as mortar runs down the blocks.

Avoid working in the full sun and keep work damp for 24 hours after laying to allow for slow curing of the mortar join.

THE STABILISED SOIL BLOCKS.

Stabilized soil blocks when taken from the PRESS may look good but how can you ensure that they are going to be durable. A simple test can be carried out on site to partly answer the question.

WET-DRY CYCLING TEST.

Wet-dry test are carried out on fully cured specimens.

- Completely immerse 5 specimen blocks in water for at least 12 hours (overnight).
- Remove them from the water and leave to dry in the sun during the day;
- Repeat the procedure for 7 days (7 cycles of wetting and drying).
- examine the samples for any damage.

If the block slake or fall to pieces, crack or flake or even burst this would clearly indicate that the mix must be modified or the stabilizer is at fault. As a last resort, a different soil should be found.

This test does not tell you how strong the blocks are and if this information is needed send sample blocks away to a testing laboratory.

A table lists some of the problems that could occur when making stabilized soil blocks. The cause of the problems are identified and remedies are suggested.

BUILDING THE WALLS

Lay several courses of blocks at the corners of the building and door openings as shown, it provides a guide for infilling with blocks

1. This string lines should be stretched between corners to ensure accurate laying, course by course.

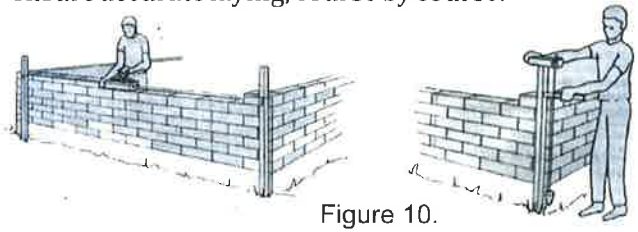


Figure 10.

Check that walls are vertical with a plum bob.

The building construction can now be completed.

An example of good block laying is shown in Figure 10. The building must have a good roof overhand and the course of blocks near ground level are protected with render coat. Stretcher bond has been used and it will be noted that:-

(1). Joints between blocks are of uniform thickness.

(2). Window frame and top of door frames tie in with course levels.

(3). The blocks present a good appearance.

SOIL CEMENT HOUSE.

PROBLEMS	CAUSES	REMEDIES
Surface appearance of Blocks. (I) Porous Surface. (ii) Sides of the Blocks Scored.	Underfilled mould. - roughness of metal on sides of mould.	- closer supervision of mould filling.
(iii) Surface Cracking (a) Horizontal cracks seen as blocks are ejected from the mould.	- suspect slow demoulding operation (the soil blocks try to expand).	Carefully remove any projections and roughness from face of the mould. Ensure mould is brushed with oil before pressing blocks.
(b) Cracks developing during primary curing.	Poor curing – rapid loss of moisture.	Ensure soil blocks are completely covered during primary curing.
(c) Cracks developing during secondary curing.	Insufficient stabilizer or poor mixing of stabilizer with soil.	Check mixing procedure or check mix design.

An increase in number of blocks damaged or broken.	- Poor mixing or change of soil structure. Or Careless handling	- closer supervision of mixing - repeat site soil test and if necessary the linear shrinkage test. - closer supervision of workers.
Depth of blocks are less than 100mm (or 100mm minus the thickness of any insert baseplate).	- mould base plate does not return to bottom of the mould or under filled mould.	- see check on the operation of the machine.
Great effort needed to eject blocks from the machine.	Mould overfilled or lack of mould oil.	- closer supervision of mould filling - closer supervision of mould filling Brush side of mould more often

MANUFACTURE OF STABILISED SOIL BLOCKS.

If a minimum wet compressive strength of 2.8 MN/m2 is achieved, a single wall thickness of 140mm would be sufficient to carry vertical and lateral loads in a single storey building (and probably two storeyed buildings), provided the foundations are sufficient.

Pages 65, International Labour Office Technical memorandum N0. 12.

1. 40cm x 200mm x 200mm (or thereabout) adopted for sandcrete Blocks is not feasible for stabilized soil blocks because the production of good quality blocks of the size require relatively high compacting forces not now available in manually operated Block making machine.

2. Secondly, how can a Bricklayer be expected to lift a Block about 20kg to height of say 3.00m high. The Block size 290mm x 140mm x100mm is a universally acceptable standard for cement-soil block and weigh about 8kg. This size is suitable for all type of construction on its own or convenient combinations. No greater size than 290mm x 140mm x 100mm is recommended or feasible.

WALLING BRICK PRESSES

BCC/01/ V.S. CINVA RAM PRESS (MULTI-PURPOSE)
SINGLE BRICK SIZE: 290MM X 140MM X 100MM

BCC/02/ BOLYN DOUBLE BRICK PRESS (MULTI-PURPOSE
DOUBLE BRICK SIZE: 2 NOS X 290MM X 140MM X 100MM.

BCC/03/ BOLYN SUPER BRICK PRESS (ADJUSTABLE MOULD)
SUPER BRICK SIZE 1 X 290mm X 230mm x 100mm
or 1 X 290mm X 140mm X 100mm.

BCC/04/ BOLYN INTERLOCKING BRICK PRESS AFTER AIT, THAILAND (MODEL)
INT(Thai) LIQUID MORTAR IN VERTICAL HOLES.
BRICK SIZE: 300MM X 150MM X 100MM.

BCC/05/ BOLYN INTERLOCKING BRICK PRESS.
NO MORTAR JOINT.
BRICK SIZE: 230MM X 115MM X 120MM-Half Brick.
or 230mm X 230mm X 120mm

Below we answer some of the questions usually asked by the public about using Cement –stabilized laterite soil block for building low cost-quality Houses:-

1. How safe is a house built by this system?
Research finding in Europe, Asia, United State, I. L. O., Geneva, Ghana and even in Nigeria attested to the fact that it is quite safe to use laterite soil stabilized with about 4-5% cement to make good quality building blocks.
2. Any Example of a House already built this way?
Yes, the Federal Housing Authority have constructed some prototype Units at the Festival Town, they can be viewed at 712/722 Road, in the 7th Avenue, Lagos. They were built since 1990. We now have too numerous example around
3. Why is the machine very cheap if it is as good as you proclaim it is?
Our prices shown in the product information booklet are only introductory and subject to review from to time. This same machine cost about N300,000 from overseas but we are able to offer it cheaply because of 100% Local content which made it possible for us to acquire our components locally without resort to foreign exchange market for fund, for importation of components. Imported Machine attract freight charges etc.

FLOOR TILES:-
Floor tiles of sizes 29x14x5cms (12"x5-3/4"x2") can also be produced on the Block Press using the same block mould and employing a soil: cement mix of richer proportion. The objective being to make the tiles more resistant to the wear to which they may be subjected. Still better results can be obtained, if a fine layer of sand: cement (2:1) is uniformly spread on the bottom of the mould box before filling it with the soil-cement mix. The floor

tile is compressed in the usual manner of block making. The resultant compressed tile will have a sand: cement facing and a soil: cement backing. After curing the tiles are laid as flooring tiles (with the sand: cement facing on top) over a layer of lime concrete and the floor surface s finally completed with a spread of cement grout followed by finishing and string impressions along the joints. Reduction in block height to produce floor tiles can be realized by placing a suitable packing under the pressure platen working in the mould.

USE TO WHICH THE VS CINVA RAM BLOCK MACHINE CAN BE PUT TO:-
A. A must for all Housing Corporations and Property Developers.
B. Suitable for Block Making industries for the moulding of blocks for sale.
C. Suitable for Local Government Building Departments to provide Low cost offices, schools & houses for indigenes of the L.G.A.
D. Suitable for loan to Rural Dwellers for their self help projects and housing projects.
E. Suitable for Co-operative Union & Organisations for loan to their members to help in their Building Construction or self help projects sites.
F. Individual House owner need it.

TECHNICAL DETAILS
Size of machine (length x width x height
.....45x30x70cm(18x12x28in)
Weight of machine..... .80kg.
Size of crate of shipment..... 60x40x80cm (24x16x32in)
Weight of packed machine..... 100kg
Standard block size (single mould).....29x14x10cm

(11.5x5.5x4.inches)
Maximum nominal compaction force.....8 tonnes
Normal compaction pressure 1.9 N/mm2 (280.p.s.i)
Compression Ratio.....1.50:1
Energyinoutput/transmission.....manual/ mechanical
No. of blocks per cycle/output rate.....1/40 blocks per hour
Labour force required (inch. Excavation and mixing).....3 men

Price (ex works) VS Cinva ram (depending on size of order).....500/ 550 US$
Valid June 2012 (Single).

VS CINVA RAM.

DESCRIPTION:

The VS Cinva Ram which was developed by Thomas Kubby, GATE is a modified version of the famous Latin American machine, it was named after. The modifications were developed on the basis of observations of local working conditions in Tanzania and problems encountered with other block making machines. The main design objectives of the VS Cinva Ram were high resistance to rough use, prevention of overloading and simplication of manual operations.

CEMENT STABILISED BLOCKS.

THE CONCEPT.

The stabilized soil blocks offer an economical energy efficient and simple alternative to conventions burnt bricks and concrete blocks. If this concept is implemented, it not only saves denudation of forest wealth which otherwise is destroyed for burning bricks in kilns and pressure on already scarce river sand

but also provides employment opportunities in rural and urban areas for unskilled labour. Importantly, the concept makes use of locally available material for their production.

The cement stabilized blocks are easily made by pressing mixture of soil and cement in machine with suitable moisture content. VS Cinva Ram is a manually operated machine capable of producing high density blocks of cement stabilized soil; This concept has been extensively used in advanced countries like Australia, France, Germany, Britain etc. and in developing countries in Asia, Africa and Latin America.

GENERAL ACCESSORIES COMMONLY SUPPLIED WITH ALL BLOCK PRESSES

1. Soil Scrapper.
2. Soil scoop (for carrying soil).
3. Oiling Brush.
4. Holding down Bolts/Nuts.
5. Operation Manual.
6. One illustration Video CD.
7. Half Block metal.
8. Several Wooden Pallets.

SIMPLE TESTING PROCEDURE THAT CAN BE CARRIED OUT ON BRICKS.

COMPRESSIVE STRENGTH.

Dry and wet compressive strength can be tested in the laboratory on sample bricks using conventional testing presses or on site using lever presses fitted with manometers. The latter can generally only be used to test cylindrical or cubic samples (with a 5cm diameter or dimensions respectively). Bricks should be tested after 28 days and compressive strength values of more than 2MPa for a material to be used for normal building purposes

(i.e. a two storey building) are considered good. The ratio of dry to wet compressive strength should be in the order of 0.5, bearing in mind that this could be as low as 0.3 under certain conditions of use (such as single-storey building or in favourable climatic conditions) and for very traditional, unstabilized materials (such as rammed earth and adobe) which are hardly or not at all water-resistant.

COMPRESSIVE STRENGTH TEST-CETECH.

This test enables one to determine the approximate compressive strength of a brick. The test is carried out on well cured bricks with a site brick breaker that can be easily manufactured on site. Five bricks or more should be tested to get an average.

To build a brick beaker, you need:-
1 plank of wood (= 2 half planks).
3 iron rods (length = 30cm).
2 hinges
15 nails (3 inches).
1 piece of wood to connect the 2 planks,
(30 x 12x 6cm) (= 1 feet x 5 inches x 2 inches).

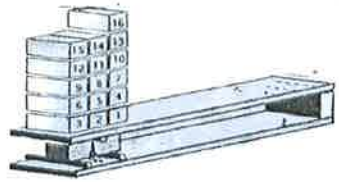
This brick is placed perpendicular across the iron rods, compression face downwards. Close the cover and control the position of the third rod that should lay in the centre of the brick parallel to the two supporting rods. The brick breaker is loaded until the sample breaks. The load, ("L' in the formula) is obtained by multiplying the number of bricks placed on the brick breaker by their average weight.
L= Number of bricks x av. weight.

CALCULATION OF THE STRENGTH.

The compressive strength is given by the formula below:

COMPRESSIVE STRENGTH (Kg/cm^2) L =LOAD (kg) D=DISTANCE BETWEEN The Iron Rods (cm).

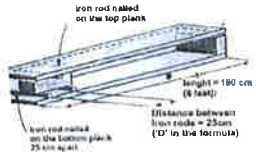
$$Ó c = \frac{10 \times L \times D}{W \times h}$$



Width of the brick (cm). h=Average heights of the brick.

L: The sample has broken after pilling up 25 bricks on the "brick breaker"
The average weight of a brick is 6.8kg.
The load (L) is: L=6.8 x25 =162.5kg.
D= The distance between the rods (D) is 25cm.
W= The width of the brick (W) is 14cm.
H= The average height of the brick (h) is 9.5cm

$$Ó c \ \frac{10 \times 162.5 \times 25}{14 \times 9.5} = 32 kg/cm$$

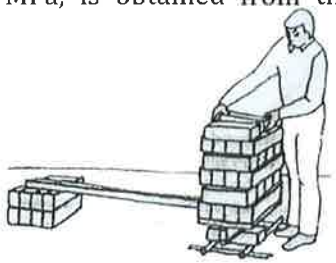


TENSILE STRENGTH.

This test can be carried out on site using a piece of equipment made of wood which is fitted with a loading plate and metal tubes. A dry earth brick (after 28 days) is placed lengthways across 2 parallel tubes 20cm apart. The wooden plate, which has another, identical tube underneath it, is placed on the brick in such a way as to locate this third tube exactly half –way between the two supporter tube. The wooden plate is then loaded (the load should be evenly spread) with other bricks at a rate of 250kg/minute until the brick being tested fails. The tensile

strength, expressed in MPa, is obtained from the following formula:-

$$Ó = \frac{k3 \times L \times D}{2 \times W \times h}$$



Where:-

k is equal to a coefficient which varies with each type of brick (1 for a full brick with the common dimensions 29.5 x 14x 10cm):

L= The breaking load applied to the tested brick:

D= The distance between the supporting tubes (20cm).

W= The width of the brick (14cm).

h= the height of the brick (10cm or slightly under).

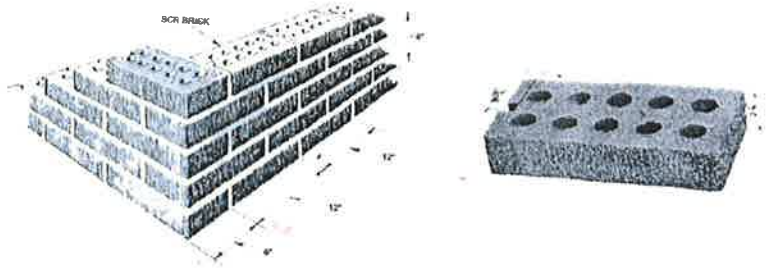
Average tensile strength results falling between 0.5 and 1 mpa are considered good.

SCR BRICK.

Most single-family homes being erected today have only one-storey load-bearing exterior walls. Because of the sizes of standard brick, such house are ordinarily built with 8" walls. A wall of that thickness possesses sufficient strength for a three-storey structure and is unnecessarily heavy for a dwelling of one storey. This is emphasized by the fact that nationally recognized building codes approve 6" masonry walls for one storey residence. (The wall height must not exceed 9ft to the eaves or 15fit to the peak of the gables).

Many local building codes have long recognized the adequacy of 6" masonry walls for one –storey building. With the increasing popularity of this type of construction, additional local codes

have extended their approval. A variety of 6" clay building products have appeared for use in one –storey residential and industrial buildings. Some of these are hollow units classed as tile, whereas others are considered as solid units, or brick. In this section, we shall treat in some detail a representative example, the SCR brick. The data presented can be regarded as fundamental to the use of similar products.



SIMPLE WALL CONSTRUCTION WITH SCR BRICK.

Paving Presses.

Double Tee

Hexa

Clover

Roman

Wave

Mag

Brick Press

STABILISATION.

The system of Stabilisation.

Stabilization is a way of improving the properties of a soil, this system allow a permanent restructuring that will make a hitherto unstable soil now stable. Stabilization is bound to affect the porosity, permeability and mechanical strength of the soil. In bricks for walling in building we do need to achieve a better cohesion between materials of Brickmaking, we needed to

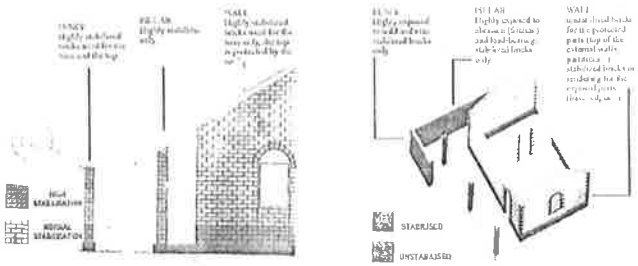
reduce the ability of the soil to shrink, or to swell or to take in too much water, we needed to prevent the bricks from being easily eroded by wind or by driving rain that can cause the brick to quickly disintegrate. Compacting the soil, grading the soil either by removal or addition of needed particle sizes in excess or that is lacking are bound to assist the ability of the soil to be compressed, the strength of the bricks, resistance to water or air and cause it density to improve. Compacted soil closes holes in the bricks, adding fibrous materials such as plants or animal fibres re-inforces the brick and gives it additional strength to resist shrinkages. Cement stabilization enables particles of the soil to stay and act together to jointly resist erosion and permeability. It is a cause that helps to improve the mechanical strength of the Bricks. There is however a need to carry out a test to determine and know how much cement to be used in an economical production system. The test could tell us which soil needed stabilization, the percentage to use, the effect which the stabilization is capable of causing in the Bricks etc.

This guide about stabilization is contained in the Book 2 – Brick production of CEC Tech, National Museum, Jos. It is of immense importance to readers at it is a guide to why we need to stabilize the earth/ soil.

PROPORTION OF STABILISER.

Highly stabilized bricks (stabilized with more than 8% cement) are used to protect the parts of the house that are highly exposed to abrasion, water erosion (wind and rain), and capillarity absorption. These parts are the pillars, the base of the wall and also the top of the wall in case of fences. The average stabilization for the less exposed parts is 4 to 5% cement.

Example



UNSTABILISED BRICKS.

In some cases, the use of unstabilised bricks is possible, considerably reducing the wall's cost. Those bricks, weaker than stabilized ones, should not be left exposed to water and shouldn't be used for heavy load bearing walls. They are especially suitable for partition walls. When used for external walls, these bricks should be either rendered, thus preventing abrasion and water erosion, or protected by a large overhang if the wall is not exposed to driving rains.

MUD –CEMENT BRICKS/BLOCKS CAN BE USED FOR MULTI-STOREY BUILDINGS.

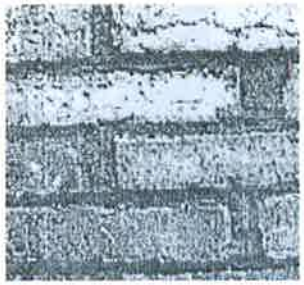
Often it has been asked by lots of people if it is possible to use Mud Bricks/ Blocks in the construction of a Multi Storey, Buildings.

The answer to this question is YES. Like every other walling materials such as Concrete/Sandrete blocks, Burnt bricks etc., that are used for partitioning, the Mud brick or Cement Stabilized soil block/bricks serve equivalent purposes. The construction / building of a multi-storey structure follow a sequence as laid out in the Architectural/Structural Engineering Design Drawings that must be approved by the Government Agencies such as Town Planning Authority. These design drawings will give details

of an adequate foundation, specify the numbers and sizes of columns called pillars, give the size and specification of beams, slabs etc. that are of re-inforced cement concrete (i.e) mild steel rods, gravel, sand and cement. These are a prerequisite in the building of a multi-storey building, once the foundation, columns, beams and slabs are in place the mud bricks, cement blocks etc. are only used as infills and partitioning materials.

Cement stabilized bricks that are solid are load bearing bricks that can be used independently to build a one storey house (i.e) with 2 (two) floors of ground and first floor. We advise that you consult your Architect and Structural engineer who will specify any needed re-inforcement or double brick wall for the ground floor and single brick for the first floor. We plan to show the photographs of some of the multi-storey buildings that was built with mud-cement bricks in this manual.

Multi Storey Mud House.



Mud Brick Wall.

TESTING OF BLOCKS.

To ascertain the quality of stabilized soil blocks, carry out a 7-day compressive strength test after immersion in water. Depending on the wet strength the stabilized block can be classified as follows:-

Grade	Wet strength (kg/cm2)
A.	20
B.	12
C.	7

Grade (A) blocks may be used for two storey houses. Grade (B) blocks may be used for single storey houses. Grade (C) can be used for single storeyed and light roofed buildings. The moisture absorption after dipping in water for 48 hours should be below 20%.

BONDING.

Bricks should be fully bonded at all intersections of adobe walls including corners and cross walls and on alternate courses with half-bricks provided where necessary.

EXTRACTED FROM SOIL-CEMENT TECHNOLOGY FOR LOW-COST HOUSING IN RURAL THAILAND (AN EVALUATION STUDY) By Marleen Iteebeke & Paul Jacobus.

Among the objectives of this publication is to make a valuable contribution towards more comprehensive, rationalized, yet simple rural house construction. The study is in search of appropriate technologies in Rural Housing and potential of earth construction technology as an alternative for housing construction.

The solid, plain soil-cement block is mainly referred to as CINVA-RAM block as it is produced by the soil –cement block introduced in Thailand. The blocks are utilized in the construction of both load-bearing and non-load-bearing walls. Ordinary Portland Cement mortar (1:4) or a special mortar.

LOAD-BEARING WALL MATERIALS.
The CINVA –Ram Block.

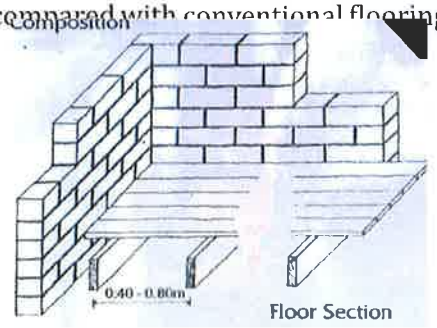
Assembly.
The blocks are assembled in the same way as burnt bricks on a mortar bed most often in a simple running bond, or stack bond in case of non-load-bearing construction. The vertical joints are filled with mortar and the joints are approximately 10mm thick.
Most often an ordinary cement –sand mortar of 1:4 ratio is used. However, sand can be replaced by laterite, in the proportion of 1:1:5. (i.e) 1 Cement: 1 sand: 5 soil.
No special finishing or rendering is applied.
A slightly modified solid CINVA-Ram block was designed to provide a better adhesion between block and mortar. However soon the load –bearing block was used as infill block on its narrow side in order to achieve a 'nicer' texture of the wall. These blocks were also produced with the CINVA –Ram machine and the insertion of a wooden form. In practice this block has not been applied often and is no longer in use.

A modified CINVA-Ram Block.

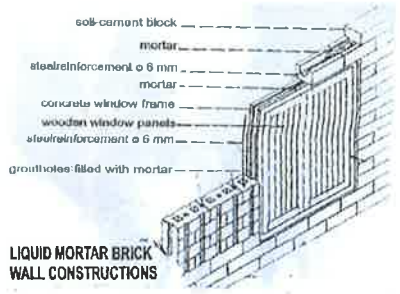
SERVICE LIFE AND DURABILITY.
Even though rendering is rarely applied and no special attention is paid to architectural details such as roof overhang, base course etc. to protect the building materials, its durability is good. Even the first soil-cement building, built in Thailand in 1969, is still in good condition. Blocks which are fully exposed to the rain erode, but to a lesser extent than has been noted in some other countries. Nevertheless, more attention should be paid to architectural detailing so as to prolong the service life, material and building. Presently, the life time of a soil-cement building in Thailand is estimated to be good (60 years). The first soil –cement construction was built over 40 years ago. The public option on the subject is divided. On the one hand, those who advocated and apply the material consider it to be a permanent solution. Others rate it as a semi or non-permanent building material.

SECOND FLOORS OR ELEVATED FLOORS.
Many people opt for timber flooring which is a very attractive solution but not termite-free. Two recently introduced experimental solutions are also described. The first one is a concrete floor composed of prefabricated concrete joists on which a 6cm concrete floor is cast; a solution which may be up to two to three times cheaper compared with conventional flooring (1).

TIMBER FLOOR.
Composition.



Mortar
Concrete window frame.
Wooden window panels.
Steel reinforcement 6mm.
Groutholes filed with mortar.



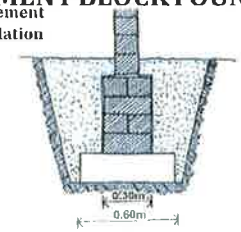
LIQUID MORTAR BRICK WALL CONSTRUCTIONS

SOME FOOTING TYPES.
Good peripheral drainage, essential to keep water away from the building, is usually not provided. In a few cases the soil outside the building is specially arranged and a cement pavement with some gradient (2cm/m) or gutter is built, facilitating the surface water to run off.

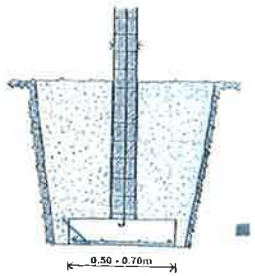
MOISTURE BARRIERS.
In none of the buildings surveyed a moisture barrier in the form of either water repellent cement or a bituminous product is provided. In spite of the lack of a moisture barrier no problems were observed. This can be attributed to the following factors:-
- the water table in the rural areas surveyed is usually low.
- the nature of the soil is such that water quickly seeps through.
- the durability of the soil-cement blocks is high with an absorption capacity lower than 15%.

SOIL –CEMENT BLOCK FOUNDATION.

Soil cement Foundation



Concrete strip Foundation with Soil cement Foundation wall



Extracted from The Punch, Monday July 31, 2006

BUILDING A HOUSE WITH LATERITE IS CHEAPER.


R. B. AKINROLABU

The number of those who sleep under the bridges is swelling. Those who are tenants, for sure, far outnumber those who are landlords. Even some tenants, one way or the other, find themselves homeless at some point. It's either that the landlord has ejected them, or that their building has collapsed, recent reports of collapsed building in Nigeria are a good case in point.

According to the Managing Director of Bolyn Constructions Limited, Mr. Rufus Akinrolabu, Nigerians are 16 million house short of their housing requirement. The major reason for this is poverty and the high cost of building materials.

At the inception of the present government, Akinrolabu notes a committee was set up to, among others, determine how to bring down the cost of housing delivery in Nigeria. One of the conclusions of the committee, he notes, is that building materials constitute between 60 and 70 percent of the cost of a house.

He says if one can do something about one's materials, one will have brought down the cost of building one's house. One way of bringing down this cost is to look inwards. "we have, over the years, been used to cement based materials and lots of imported building components that have continued to add cost to our houses in view of inflationary trends and scarcity of the foreign exchange for the purchase of the items." We have refused to develop, improve or consider for use our God-given , abundantly –available materials for housing. Akinrolabu, who spoke at a

recent seminar organized by Reality Point Limited, regrets.

He says our forefathers built with mud, called laterite soil or filling sand, which we jettisoned because of some technological defects. Those building, he adds, never had a good foundation, damp roof course and good roof.

He describes laterite soil as the type of soil that contains gravel, sand, clay and silt. It is commonly found in tropical countries. This laterite, he submits, is also called mud and can be used with or without cement to make some bricks.
Some of such bricks are what Akinrolabu, an engineer, calls cement stabilized standard bricks. There are solid bricks, lintel bricks, half bricks etc. the solid bricks, he explains, are load bearing bricks that are strong and durable. The quantity of cement required to be added is between three and eight percent.
Besides, there are cement stabilized paving brick. These one, Akinrolabu notes, require about 10 percent cement because of the wear and tear that floors are subjected to. He adds that they are a replacement for the "German Floor" that is usually made of gravel sand and cement.
No –mortar interlocking bricks, he explains, are to be dryly stacked. This means there is no need to mortar join the walls of the house. Liquid mortar interlocking bricks on the other hand, involves using liquid mortar that is poured in brick holes after laying 10 courses.

Akinrolabu says there are also lintel bricks, fence wall bricks and mud bricks. When you use lintel bricks, you save on materials such as gravel sand, cement and iron rods. Bricks used as fence wall, he explains are beautiful, strong and durable. They do not need plastering as well. Mud bricks can be used essentially for internal partitions.

When you use any of these walling brick types, Akinrolabu says, you could save between N50,000 naira and N100,000 naira in transportation as it is produced from the site. Direct labour production, he adds, will save builders the profit that block makers would have charged. Moreover, less quantities of cement in the bricks result in reduced price. You could also save some money from the non-plastering and non-painting of the external walls.

"In managing our building cost, we should learn that it is best to build a smaller but functional house that can have a plan for a future extension," Akinrolabu advises.

He suggested using cooperative societies as a vehicle for reducing the cost of land, fence walls, security and some other services, "It is cost saving and economically wise if the group can jointly own their brick production equipments and tools such as wheel barrows, shovels etc. they can organize a workforce that will take charge of their building construction activities under a single supervisor while sharing all the associated cost among themselves instead of individually, he further advices.
He says it makes a lot of economic sense if you can produce all the items that can be site-produced near the site. This cuts transportation cost, discourages diversion of materials and makes for effective monitoring.

EXTRACT FROM THE INTERNATIONAL LABOUR OFFICE, GENEVA PUBLICATION, TECHNICAL MEMORANDUM NO. 12 TITLED SMALL SCALE MANUFACTURE OF STABILISED SOIL BLOCKS.

The above title was prepared by the international labour office and the United Nations Industrial Development Organisation. The Technical Memorandum is supposed to be of particular importance to developing countries in view of severe shortages of shelter for a majority of their people. Slums in the Urban centres of the developing countries is about 80 percent of its settlements. Identifying least costly solutions, involvement of direct contribution from potential home owners (contribution of their labour /self help housing). Use of alternative building materials such as soil needed to be encouraged and promoted. It is known that it is for reasons of modernity and financial buoyancy that people prefer concrete structure to Mud/Soil Building even though properly processed Soil/Mud can provide good or better building than the supposedly modern materials.

Houses should be less expensive when built with soil called mud than those of concrete etc., this is capable of turning many people into house owners. No import and No foreign exchange is required for use when Soil/Mud is used in Building and a lot of employment generation will result either directly or indirectly.

A big advantage offered by stabilized soil block house is the effect of moderation of temperature against outside heat or cold, better than Concrete Houses. It is seen that technically, culturally, environmentally and financially soil is to be preferred as a building materials. Most of the earlier problems militating against the continuous use of Mud Building such as erosion by rain water etc., have been resolved by researches and

improvements in the making by presses and stabilization of mud soil bricks. Among problems still making the use of earth bricks not to be popular is the non-patronage by Governments and Housing Agencies and lack of adequate information to the public about the usefulness, quality and international acceptability of the materials. Presently the ILO, several countries in both of developed and developing countries of the world spanning all continents use mud soil to build low and medium cost housing and luxury houses, offices, religious, educational and all other types of building. The lots of information available in this publication is enough for all sector of the economy to be able to take decision about using the technology. We have decided to extract some of the useful information in the book to sensitize and get Nigerians and other readers to know and be informed of the advantages of using mud for building.

Housing is one of the most important basic needs of the low income group in developing countries and various governments are unable to meet other essential needs of the citizens talk less of providing houses for them. It is known that traditional building materials such as Mud exist close to the site of building, making it possible to produce the Brick locally. It is advisable that the various governments in the developing countries emulate France where the system of "ADOBE" (i.e.) sun dried brick is being promoted and used. With the design of simple,. manual/mechanical brick presses lots of improvements have been brought to bear on Buildings/Houses built with this Alternative materials. Cement stabilization makes the compressive strength of the Bricks to compare favourably with acceptable standards. Even unstabilised soil brick houses which have good foundation and damp proof courses plus a good roof will offer a satisfactory habitable structure.

Laterite soil/mud is a tropical soil abundantly available below top soil or at Quarry site where the tipper lorries can take them from. Some basic test such as Thread Rolling Test (Cigar/Pencil Test), Particle size distribution test, Sedimentary bottle test and Linear mould tests can be used to confirm some of the characteristics of the soil. There are methods of stabilization which are methods of improving the strength and durability of the soil. e.g. Animal dung, Crushed ant hill materials, Plant juices. This was practiced in time past while in these modern days Machine/Brick Press stabilization and Cement stabilization are the most practiced.

The soil may require some breaking down although we will say that such soil should be avoided in view of the high cost of labour. Admittedly, where labour is cheaper and better soil are not found, pulverization and sieving is necessary. Having found the soil, basic test should be carried out to ascertain suitability for soil, a Brick press should be found with a stabilizer before brick moulding operation is commenced. The operation of the Brick presses are found in the manufacturers manual. The Brick sizes have been standardized and the temptation for bricks to be requested to be made of the size of concrete blocks should be avoided. Some of the Brick Preses are the Cinva Ram, Ceta Ram, Terstaram, Tek-Block Presses, Ellison Block master, Brepak press, Astram Press, Zora Hydraulic Block presses to mention just a few. Bricks with cement are to be cured by wetting, if they are not cured they may be weak and have cracks. A simple site compressive strength test is possible to determine and ensure that the ideal strength of 2.8MN/M is achieved. There are other test such as water spray test, abrasive wear test, long term exposure test, all these help to determine the durability of the brick. Bricks made from stabilized earth are to be mortar jointed in the usual manner with combinations of sand and cement or

laterite soil and cement. There are other type of mortar which are not so popular or are more expensive/unavailable here.
Stabilized Earth bricks are supposed to be cost effective but it must be known that cost will differ from place to place and will equally be dependent on availability of soil, ease of getting it, type of stabilizer used, prices of all other inputs, wages of the workmen, equipment cost and how productive is the labour force.

EXTRACT FROM COMPRESSED EARTH BLOCK (PRODUCTION EQUIPMENTS) ISSUED BY CENTRE FOR THE DEVELOPMENT OF INDUSTRY ACP-5U & CRATERRE – EAG BASIN – EAS.

Raw Earth has been used for building construction from the ancient time but it seemed to have been forgotten when cement concrete was introduced. We abandoned earth construction as we criticize its ease of been affected by water which hitherto makes Earth not durable. It is now known that well prepared, compressed and stabilized earth can provide comfortable, durable and low cost accommodation plus the followings:- locally and cheaply available, creating employment and small scale industries, economical in energy and foreign exchange conservation.
Compressed Earth blocks made using mechanical presses are particularly consistent in quality, now, questions has been asked why we have not motorized our Brick Press. Please find some considerations to be used in determining the utilization of motorized presses:-

a). Do you have ample financial resources?
b). Do you require urgently higher quantities of bricks?
c). Do you require bricks that are extra strong?
d). Do you have power supply always?

e). Can you find a ready maintenance technician if required and at any time?
f). Is labour cost very expensive or scare?
g). Can you afford a higher quality training for the operators?

PROJECTS THAT SHOULD DO WITH MANUAL BRICK PRESSES.

i). Where there is abundance of labour force that is cheap.
ii). Where there is a limited amount of financial resources.
iii). If the project is located in remote areas where there cannot be power supply always.
iv). If a project does not have a large working space for its installation.
v). All small projects especially all self-help projects.

MOTORIZED PRESSES.

The technology of motorized presses is foreign and will only have to be imported. In Nigeria, there is scarcity of foreign exchange, the Nigeria Naira is undervalued and is lowly priced against most major countries currencies thereby putting the populace in a major disadvantage to source motorized presses. A situation where one will have to part with $5,000 US to $15,000 US which amounts to N850,000:00 to N2,650,000:00 to purchase one is not the best. However, considering other criteria, individual will have to make their choices.

Appro-Techno –Belgium.
Semi-Terstamatique

Electric Motor/Diesel Engine.

Appro-Techno-Belgium.
Terstamatique.

Electric Motor/Diesel Engine.
900 Bricks/ hour.

Extract from New Age Newspaper (Property Page 20)

BUMPAN FLAYS GOVT. OVER LOW PATRONAGE OF LOCAL MATERIALS.

Successive governments in the country have over the years paid lip services to the provision of affordable and mass houses for the vast majority of Nigerians.

Besides, despite the availability and abundance of locally sourced materials for building construction every Nigerian government has looked the other way, not ensuring the popularization and use of these materials for the production of large-scale housing for the mass of the people.

Indeed, this government's carefree bug has bitten the laterite material (interlocking block), thus impinging negatively on its usage and acceptability in building construction in the country.

The president, Building Materials Producers Association of Nigeria (BUMPAN), Rufus Akinrolabu made the submission in an interview with New Age in Lagos, adding that government could popularize the use of local materials through advertorials in the various media of communication as well as building prototype houses using these materials in all the local government areas in the country.

Elder Akinrolabu added that increased government patronage of these materials would go a long way in sensitizing the people about their importance and availability as that according to him would make housing affordable to the low income earners in Nigeria.

Akinrolabu, who is also a member of the Presidential committee on reducing cost of housing delivery in Nigeria opined that the use of interlocking block had not received the necessary fillip in the country because the ones before it were yet to gain popular acceptance.

Said he:- Interlocking blocks have just arrived in Nigeria. If the ones that arrived about say 10 to 15 years before them are not being patronized nation wide, they will have the same problem of

non-patronage like their forerunners.

Interlocking blocks have not being popularized and government is to blame. Because if government knows it is by these local materials that the cost of housing delivery in the country can be brought down, it ought to by now, have led by example.

"If housing is important to the Nigerian government, then let there be enough publicity in all the states of the federation. Government could also facilitate this process through acquisition of simple equipments/machineries. Manual mechanical machines that do not require fueling or electricity or batteries. Until that is done, we can not make any head way in our clamour for mass housing".

He posited that localness did not mean inferiority, arguing that underdeveloped countries did not have the monopoly of producing substandard materials as they were also available in the supposed advanced countries of the world.

In his words: "To say local materials are inferior to the imported ones is pure ignorance. If somebody is ignorant of a thing he can say whatever he likes. Local is not synonymous with inferior. The cassava Nigeria is now exporting abroad is produced locally and the people outside the shores of the country are making good use of it.

Anyway, there are people who think derogatory of things being sourced locally. They will always look at some thing local or homemade as inferior but it is not so, because those of us who are producing this things are at home with what obtains elsewhere. So, wherein lies the inferiority or superiority of foreign over local". He conceded that the advanced countries were sophisticated but added: that "our own advancement had to commence with using and designing with our own materials, by using, perfecting and improving them overtime.

"However, use of local materials does not in anyway contribute to

the shortness or longevity of a building. There are Standards. If the Standards Organisation of Nigeria (SON)has certified, wherein lies collapses of building? Even these materials we are talking about now are routinely and regularly being certified by SON.

"I have said several times that collapse of buildings may not be directly linked with the materials used. It may still be the same qualitative materials but somebody somewhere has decided to cut corners", he said. BUMPAN president opined: that "reduction in the cost of housing delivery in Nigeria would put in place quality. If we are greatly being able to produce more, the law of economics simply says that when you have large –scale production then you have low prices". He disclosed that the report of the presidential committee on reducing cost of housing delivery in the country, which will be rounded off at the end of this month, would look at the problems militating against mass housing production in the country.

Though the report of the committee has not been submitted, he said it might tend to look at the areas where Nigeria could increase housing production as well as empower more people to produce.

"But that is not the only parameter. We have to also look inwards for local materials that are abundantly and cheaply available in the country, so that we can take their availability and nearness to site to be able to reduce the cost of housing, thereby, making more Nigerians afford simple shelter over their heads" he stressed.

He pointed out that the message for the use of local materials was not directed at the well-to-do in the society, as they have the financial muscles to order for imported buildings materials from anywhere in the world to satisfy their taste.

QUOTE
"Anywhere there are people who are derogatory of things being sourced locally. They will always look at some thing local, home made as inferior but it is not so, because those of us who are producing this thing are at home with what obtains elsewhere. So, wherein lies the inferiority or superiority of foreign over local"

BOLYN BRICK PRESSES
(CINVA RAM/INTELOCKING TYPES)
VS CINVA RAM

BCC/01/V.S. CINVA RAM PRESS
(MULTI-PURPOSE0 SINGLE BRICK SIZE:
290mm x 140mm x 100mm

BCC/02/BOLYN DOUBLE BRICK PRESS
(MULTI-PURPOSE) DOUBLE BRICK SIZE:
2NOS x 290mm x 140mm x 100m

TECHNICAL SPECIFICATION.	**Single / Double Press. Press.**
Nos of blocks per 5Cu.yd Tipper	= 500 Nos
Nos of blocks per bag of cement	= 100 / 150 Nos.
Weight of each block	= 7.5 / 8.5kg.
Unit Price per block	= N35.00 to N50.00
Nos of Men/8hr work	= 2 men/3 men.
Nos of block per day	= 400 nos/600 nos.
Working hours per day	= 8 hours
Brick size	= 290mm x 140mm x 100mm. (Approx. 12" x 6" x 4")

Bricks (Produced by type 01 & 02 Brick presses).

Multi-Purpose Brick Press

BOLYN SINGLE & BOLYN DOUBLE PRESS (BOTH ARE MULTIPURPOSE)
These two machine types are our most regular presses, they are the types that make the standard CINVA RAM type Bricks. These two presses are capable of been used to make the following types of bricks: solid frog faced bricks, lintel bricks, half bricks, kerb bricks, floor / paving bricks and fence wall cap bricks. It is noted that these presses can also be adopted for other types of brick production. Below are briefs on the different types of bricks:-

a. SOLID BRICKS:- These are fully load bearing, strong and recommended for use where strength is of essence. The frogged face is a means of better keying effect with the wall as more cement mix are used, it can also be a means of beautification for fencing wall.
b. LINTEL BRICKS:- It is possible to adopt this alternative system of laying a channel brick called Lintel brick facing upward at the Lintel level and they run round the entire building, a single rod of 12mm diameter is inserted which re-inforces the section. A concrete mix of sand, cement of 3:1 or 2:1 is then poured in the channel to fill it, the resultants is the creation of a ring beam that tie the building together and help in distributing the loads upon the openings to all the walls.
c. HALF BRICKS:- It is possible to have the Half bricks from the Brick Presses thereby reducing time, energy and material wastage due to bricklayer cutting Bricks on site with a knife or trowel.
d. KERB BRICK:- Bricks of kerb type that is useful as stop ends in gutter/pathways and sundry purposes are created on the Brick Presses.
e. FLOOR/PAVING BRICKS:- A rectangular brick of 50mm

(2") thickness is possible to be made using the formular available in our paving interlocking brick machine section.

f. FENCE WALL CAP BRICK:-It is usual to want to finish a fence wall with a cap called Coping. This brick will enable us achieve a protective top on our fence wall without resorting to concreting.

Dry stacked building interlocking blocks used in Ondo town.

Construction work at a site in Lagos.

A WELL FINISHED HOUSE.

A building built with dry stacked interlocking bricks/blocks

Some participants during one of our seminar

Some brick machine operators collecting laterite soil for use on our Brick Press.

ADVANTAGES OF USING BOLYN EQUIPMENTS AND 100% LOCALLY SOURCED MATERIALS.

a. A saving of between 20% to 50% is possible in Housing Construction (Walls, Flooring and Roofing).
b. Materials for construction are cheap or can be obtained free from the site of construction.
c. Interlocking Bricks require NO-MORTAR to join the walls.
d. All external walls require no plastering as they remain aesthetically pleasant and beautiful.
e. External painting is not required for walls facing outside.
f. Building Components are site fabricated thus removing heavy cost of transportation of building components.
g. A lot of Do-it yourself is possible thereby eliminating middlemen and over profiteering by suppliers.

12 MONTHS GUARANTEE

We are reputable, quality conscious in our production. We guarantee our equipments against any defective manufacture and shall replace damaged parts up to entire equipment without cost to the customer.

BCC/13 BOLYN-SUPER SEMI - ROOFING SHEET VIBRATION TABLE.

COMPARATIVE COST ADVANTAGES (BRICKS/CONCRETE BLOCKS).				
	DESCRIPTION	Sandcrete Blocks.		Landcrete Blocks.
a.	Size	Hollow 18" x 9" x 9"	Hollow 18" x 6" x 9"	Solid 12" x 6" x 4"
b.	Nos of Blocks Per sq. metre	10 Nos	10 Nos	30 Nos
c.	Cost of Blocks Per sq. metre	N1,800	N1,400.00	N1,200
d.	Percentage (%) savings or increase in cost of equivalent strength block types	Above 25% increase over landcrete blocks.		Not less than 25% saving in costs over sandcrete blocks.
e.	Strength & Durability	Strong & very good blocks if moulding operation is very well supervised.		SOLID compact strong & very good load bearing blocks
f.	Other Remarks.	Sandy soil only cannot be used to make Blocks without the addition of cement.		Laterite soil only blocks can be made an used in dry season.

GENERAL ACCESSORIES COMMONLY SUPPLIED WITH ALL BLOCK PRESSES.

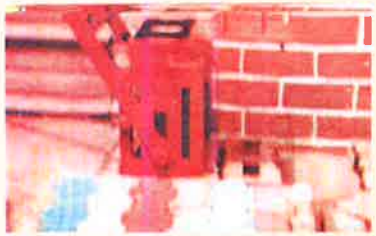
Soil Scrapper.
Soil Scop (for carrying soil).
Oiling Brush.
Holding down Bolts / Nuts.
Operation Manual.
One illustrative Video CD
Half Block Metal.
Some wooden pallets.

THE QUANTITIES OF CEMENT STABILISED LATERITE BRICKS/BLOCKS REQUIRED FOR SOME BUILDING TYPES.
Standard Rom Size 12 feet x 12 feet (3.6m x 3.6m).

BOLYN (CINVA RAM BRICK) - 290mm x 140mm x 100mm.

House Types	One Room/ Shop	One Bed Room flat (i.e) One sitting room + One Room + One Toilet/Bathroom	Two Bed Room flat (i.e) One sitting Room + Two Rooms + One Dinning Area + One Kitchen + Bath + Toilet	Three Bed Room flat (i.e) Three Bed Rooms + One Sitting Room + One Dinning Area + One Kitchen + One Toilets + One Bath Rooms	Four Bed Room House (i.e) Four bed Rooms + two Sitting Rooms + One Dinning Area + One Kitchen + Two Toilets + Two Bath Rooms
Nos of Bricks/Blocks Required.	1000 Bricks/ Approx.	2500 Bricks/ Approx.	4000 Bricks/ Approx.	5000 Bricks/ Approx.	6000 Bricks/ Approx.
5CU Yd tipper Lorry of laterite Required	2 Nos Tipper lorry loads.	5 Nos Tipper Lorry loads.	8 Nos Tipper Lorry loads.	10 Nos Tipper Lorry loads.	12 Nos Tipper Lorry loads.
Nos of Bags of Cement required	6 or 8 or 10 Bags of cement.	15/20/25 Bags of cement.	24/32/40 Bags of cement.	30/40/50 Bags of cement.	36/48/60 Bags of cement.

PAVING BRICK PRESSES

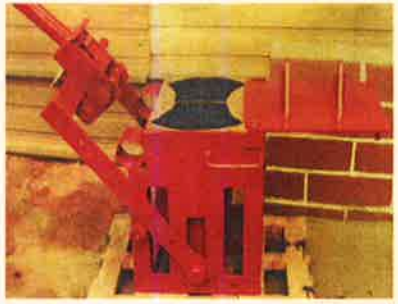


BCC/06/ BOLYN PAVING BRICK PRESS.
P.D/TEE (DOUBLE TEE PAVER.

BCC/07/ BOLYN PAVING BRICK PRESS
P.HEXA (HEXA PAVER).

BCC/08/ BOLYN PAVING BRICK PRESS
P.CLOV. (CLOVER PAVER).

BCC/09/ BOLYN PAVING BRICK PRESS
P.MAG (MAG. PAVER).



BCC/10/ BOLYN PAVING BRICK PRESS.
P.ROM. (ROMAN PAVER).

BCC/11/ BOLYN PAVING BRICK PRESS.
P.WAVE (WAVE PAVER).

MIXING RATIO OF CEMENT PLUS
LATERITE SOIL BRICKS.
WALLING BRICKS/PAVING BRICKS.

Percentage of Stabilisation.	Ratio.	Size of bricks.	No. of Bricks/Bags of cement.
10% cement stabilization.	Ratio 1:10	290mm x 140mm x 50mm.	100 Nos
5% cement stabilization.	Ratio 1:20	290mm x 140mm x 10mm.	100 Nos.
4% cement stabilization.	Ratio 1:25	290mm x 140mm x 100mm.	125/130 Nos.
3% cement stabilization.	Ratio 1:33	290mm x 140mm x 100m.	160 Nos.
Bricks without cement.	Soil only	290mm x 140mm x 100mm.	Not Applicable.

N.B: The measurement is done using headpans. One headpan can hold Half bag of cement.

CONVERSION TABLE (ft to mm)

4' 0"	6' 0"	8' 0"	10' 0"
1,219mm	1,820mm	2,438mm	3,048mm
12' 0"	14' 0"	16' 0"	18' 0"
3,660mm	4,270mm	4,877mm	5,486mm
20' 0"	22' 0"	24' 0"	28' 0"
6,096mm	6,706mm	7,315mm	8,534mm
30' 0"	32' 0"	36' 0"	38' 0"
9,144mm	9,754mm	10,973mm	11,582mm
40' 0"	42' 0"	44' 0"	48' 0"
12,192mm	12,802mm	13,411mm	14,630mm
50' 0"	52' 0"	54' 0"	58' 0"
15,240mm	15,850mm	16,459mm	17,678mm
60' 0"	80' 0"	90' 0"	100' 0"
18,288mm	24,384mm	27,432mm	30,480mm

STANDARDS ORGANISATION OF NIGERIA

DIRECTORATE / SECTION

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www.sonnigeria.org.ng

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E-mail: info@sonnigeria.org.ng
sonnig_ng@yahoo.com
Website: www.sonnigeria.org.ng

Our Ref: SON/CB/10/54 Your Ref:

Date: 10th October, 2006

Elder Rufus Akinrolabu
Dolyn Construction Limited,
74 Olateju Street, Mushin, Lagos.

Dear Sir,

INVITATION TO ATTEND A TECHNICAL COMMITTEE MEETING.

As a follow up to the Technical Committee meeting on the Draft Standards for Stabilised and Compressed Earth Bricks held on the 6th of July, 2006, you are hereby invited to attend the next Technical Committee meeting on the following draft standards:

1 Draft Standards for Compressed Earth Blocks (Parts 1-11)
2 Draft Code of Practice for Production and Assembly of Compressed Earth Blocks.
3 Draft Code of Practice for preparation of Earth Mortars.

Venue: SON operational headquarters, Lekki, Lagos.

Time: 10:00 prompt.

Date: 2nd November, 2006

The corrected draft copies of the standards to be deliberated on during the meeting are as attached. Also attached is the SON template for comments and secretariat observations. Please photocopy the template and enter your comments on the template for each draft standards.

Please bring along these draft standards and the completed template for comments.

Thank you.

Yours Faithfully,

Adewole Kazeem Kayode,
For: Director General/Chief Executive,
Standards Organisation of Nigeria

ALL CORRESPONDENCE TO DIRECTOR - GENERAL

BCC/01/ SINGLE. V.S. CINVA RAM PRESS (MULTI-PURPOSE).
BRICK SIZE: 290mm x 140mm x 100mm.

Production dimensions	:	400mm x 300mm x 700mm (L x W x Ht).
Transportation dimensions	:	500mm x 400mm x 900mm.
Package Weight	:	100kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.55 : 1.
Compression Mechanism	:	Vertical Stroke Piston.
Number of Moulds/Table	:	One (1).
Number of Blocks/Cycle	:	One (1).
Theoretical Output	:	1/40 per Hour.
Daily Theoretical Output	:	320 per Day.
Categories of Blocks	:	Solid, Half, Floor & Lintel Blocks.
Dimensions of Blocks	:	290mm x 140mm x 110mm
Factory Price (EXW)B	:	$500 US – 2012.

BCC/02/ DOUBLE. BOLYN DOUBLE BRICK PRESS (MULTI-PURPOSE).
BRICK SIZE: 2 Nos 290mm x 140mm x 100mm.

Production dimensions	:	460mm x 420mm x 700mm (L x W x Ht).
Transportation dimensions	:	550mm x 550mm x 900mm.
Package Weight	:	130kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.7 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	Two (2).
Number of Block/Cycle	:	Two (2).
Theoretical Output	:	1/70 per Hour.
Daily Theoretical Output	:	560 per Day.
Categories of Blocks	:	Solid, Half, Floor & Lintel Blocks.
Dimensions of Blocks	:	290mm x 140mm x 100mm.
Factory Price (EXW)B	:	$700 US – 2012.

BCC/03/ BOLYN SUPER 1 BRICK PRESS (ADJUSTABLE. MOULD).
SUPER BRICK SIZE: 1 x 290mm x 225mm x 100mm.
Alternatively: 1 x 290mm x 140mm x 100mm.

Production dimensions	:	460mm x 440mm x 700mm (L x W x Ht)
Transportation dimensions	:	550mm x 550mm x 900mm.
Package Weight	:	120kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.7 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	One (1).
Number of Block/Cycle	:	One (1).
Theoretical Output	:	1/35 per Hour.
Daily Theoretical Output	:	280 per Day.
Categories of Blocks	:	Solid, Hollow, Floor & Lintel Blocks.
Dimensions of Blocks	:	290mm x (140mm or 230mm) x 100mm.
Factory Price (EXW)B	:	$550 US – 2012.

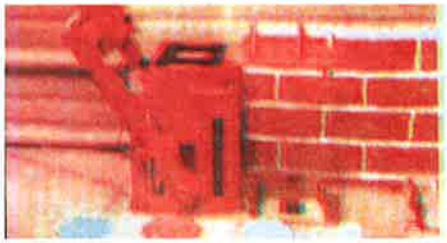
BCC/04/ BOLYN INTERLOCKING BRICK PRESS
INT. (THAI) LIQUID MORTAR IN VERTICAL HOLES.
BRICK SIZE: 300mm x 150mm x 100mm.

Production dimensions	:	400mm x 300mm x 700mm (L x W x Ht)
Transportation dimensions	:	500mm x 400mm x 900mm.
Package Weight	:	100kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.70 : 1.
Compression Mechanism	:	Vertical Stroke Piston.
Number of Moulds/Table	:	One.
Number of Block/Cycle	:	One.
Theoretical Output	:	1/40 per Hour.
Daily Theoretical Output	:	320 per Day.
Categories of Blocks	:	Blocks with Circular Holes.
Dimensions of Blocks	:	300mm x 150mm x 100mm.
Factory Price (EXW)B	:	$550 US – 2012.

BCC/05/ BOLYN INTERLOCKING BRICK PRESS.
- STANDARD TYPE.
INT. (STAN) DRY STACKED NO. MORTAR JOINT.
BRICK SIZE: 230mm x 230mm x 120mm.
Category : Manual press .

Production dimensions	:	570mm x 400mm x 860mm (L x W x Ht).
Transportation dimensions	:	650mm x 500mm x 900mm.
Package Weight	:	150kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Available Force	:	15 Tonnes.
Compression Pressure	:	2.5N/mn^2
Available Pressure at the end of compression	:	2.o N/mn^2
Compression Mode	:	Simple.
Compression Ratio	:	1.66 : 1.
Compression Mechanism	:	Vertical Stroke Piston.
Number of Moulds/Table	:	1 Nos/Table.
Number of Block/Cycle	:	1 Nos/Cycle.
Theoretical Output	:	60 Nos/Hour.
Daily Theoretical Output	:	480 per Day.
Categories of Blocks	:	External Wall & Partitioning Wall Blocks.
Dimensions of Blocks	:	1 x 230mm x 230mm x 120mm.
Factory Price (EXW)B	:	$800 US – 2012.

BCC/06/ PDTEE. BOLYN PAVING BRICK PRESS I. (DOUBLE TEE PAVER).



Production dimensions	:	400mm x 460mm x 700mm (L x W x Ht).
Transportation dimensions	:	500mm x 560mm x 900mm.
Package Weight	:	120kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.85 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	Two.
Number of Block/Cycle	:	Two.
Theoretical Output	:	1/50 per Hour.
Daily Theoretical Output	:	400 per Day.
Categories of Blocks	:	Full and Half Bricks/Blocks.
Dimensions of Blocks	:	Double Tee Paver
Factory Price (EXW)B	:	$700 US – 2012.

BCC/07/ P.HEXA. BOLYN PAVING BRICK PRESS II. (HEXA PAVER).

Production dimensions	:	450mm x 550mm x 700mm (L x W x Ht).
Transportation dimensions	:	550mm x 650mm x 900mm.
Package Weight	:	140kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.85 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	Two (2).
Number of Block/Cycle	:	Two (2).
Theoretical Output	:	1/50 per Hour.
Daily Theoretical Output	:	400 per Day.
Categories of Blocks	:	Full and Half Bricks.
Dimensions of Blocks	:	Hexagonal Paver
Factory Price (EXW)B	:	$700 US – 2001

BCC/08/ P.CLOV

BOLYN PAVING BRICK PRESS III. (CLOVER PAVER).

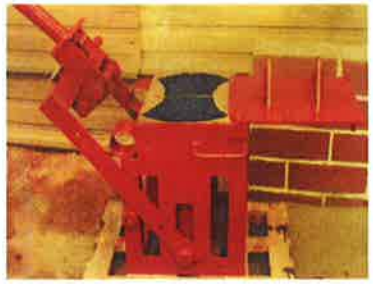
Production dimensions	:	450mm x 550mm x 700mm (L x W x Ht).
Transportation dimensions	:	550mm x 650mm x 900mm.
Package Weight	:	160kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.85 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	Two (2).
Number of Block/Cycle	:	Two (2).
Theoretical Output	:	1/40 per Hour.
Daily Theoretical Output	:	320 per Day.
Categories of Blocks	:	Full and Half Bricks
Dimensions of Blocks	:	Clover Paver
Factory Price (EXW)B	:	$750 US – 2012.

BCC/09/ P.MAG

BOLYN PAVING BRICK PRESS IV. (MAG. PAVER)

Production dimensions	:	400mm x 460mm x 700mm (L x W x Ht).
Transportation dimensions	:	500mm x 560mm x 900mm (L x W x Ht).
Package Weight	:	120kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.85 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	(2) Two.
Number of Block/Cycle	:	(2) Two.
Theoretical Output	:	1/50 per Hour.
Daily Theoretical Output	:	400 per Day.
Categories of Blocks	:	Full and Half Bricks/Blocks.
Dimensions of Blocks	:	Mag Paver
Factory Price (EXW)B	:	$700 US – 2012.

BCC/10/ P.ROM — BOLYN PAVING BRICK PRESS V (ROMAN PAVER).



Production dimensions	:	450mm x 550mm x 700mm (L x W x Ht).
Transportation dimensions	:	550mm x 650mm x 900mm (L x W x Ht).
Package Weight	:	130kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.85 : 1.
Compression Mechanism	:	Vertical Stroke Piston.
Number of Moulds/Table	:	Two (2).
Number of Block/Cycle	:	Two (2).
Theoretical Output	:	1/50 per Hour.
Daily Theoretical Output	:	400 per Day.
Categories of Blocks	:	Full and Half Sizes.
Dimensions of Blocks	:	Roman Pavers.
Factory Price (EXW)B	:	$700 US – 20012.

BCC/11/ P.WAVE — BOLYN PAVING BRICK PRESS VI. (WAVE PAVER).

Production dimensions	:	400mm x 460mm x 700mm (L x W x Ht)
Transportation dimensions	:	500mm x 560mm x 900mm (L x W x Ht).
Package Weight	:	120kg.
Energy Source	:	Human.
Energy Consumption	:	Not Applicable.
Compression	:	Static.
Compression Mode	:	Simple.
Compression Ratio	:	1.85 : 1.
Compression Mechanism	:	Vertical Stroke Piston
Number of Moulds/Table	:	Two (2).
Number of Block/Cycle	:	Two (2).
Theoretical Output	:	1/50 per Hour.
Daily Theoretical Output	:	400 per Day.
Categories of Blocks	:	Full and Half Sizes.
Dimensions of Blocks	:	Wave Pavers.
Factory Price (EXW)B	:	$700 US – 2012.

DESCRIPTION OF ALL OUR BRICK MAKING MACHINES.

BCC/01/ SINGLE — **V.S. CINVA RAM PRESS (MULTI-PURPOSE).**
BRICK SIZE: 290mm x 140mm 100mm.

BCC/02/ DOUBLE — **BOLYN DOUBLE BRICK PRESS (MULTI-PURPOSE).**
BRICK SIZE: 2 Nos 290mm x 140mm x 100mm.

BCC/03/ SUPER — **BOLYN SUPER (I) BRICK PRESS (ADJUSTABLE MOULD).**
BRICK SIZE: 1 x 290mm x 225mm x 100mm
Alternatively: 1 x 290mm x 140mm x 100mm

BCC/04/ INT. (THAI) — **BOLYN INTERLOCKING BRICK PRESS**
LIQUID MORTAR IN VERTICAL HOLES.
BRICK SIZE: 300mm x 150mm x 100mm

BCC/05/ INT. (STAN) — **BOLYN INTERLOCKING BRICK PRESS STANDARD TYPE NO MORTAR JOINT**
BRICK SIZE: 230mm x 230mm x 120mm

BCC/06/ PDTEE — **BOLYN PAVING BRICK PRESS I.**
(DOUBLE TEE PAVER).

BCC/07/ P.HEXA — **BOLYN PAVING BRICK PRESS II.**
(HEXA PAVER).

BCC/08/ P.CLOV — **BOLYN PAVING BRICK PRESS III.**
(CLOVER PAVER).

BCC/09/ P.MAG — **BOLYN PAVING BRICK PRESS IV.**
(MAG. PAVER).

BCC/10/ P.PROM — **BOLYN PAVING BRICK PRESS V.**
(ROMAN PAVER).

BCC/11/ P. WAVE — **BOLYN PAVING BRICK PRESS VI.**
(WAVE PAVER).

BCC/14/ SU. II — **BOLYN SUPER II PRESS.**
325mm x 155mm x 200mm.

BCC/15/ SPEC. INT. — **BOLYN SUPER INT.**
BOLYN SUPER INTERLOCKING BLOCK PRESS (DRY STACKED – NO-MORTAR JOINT).
300mm x 230mm x 120mm.

BCC/16/ MUD. — **BOLYN MUD BLOCK PRESS.**
300mm x 230mm x 180mm.

BCC/17/ OVEN. — **BOLYN OVEN BRICK PRESS.**
250mm x 100mm x 100mm.

BCC/18/ HI. — **HI - BOLYN (HI) PAVING PRESS.**
2 NOS PER CYCLE.

THE MACHINE.

The VS Cinva Ram, which was developed by Thomas Kuby, GATE, it is a modified version of the famous Latin American machine, it was named after. This machine originated from Colombia in the fifties (1950"s), it was designed at the Inter-American Housing and Planning Centre (CINVA) and was recently modified by the German Appropriate Technology Exchange with the followings as some of its advantages:-

1. Producing good quality Building Blocks.
2. It can also make Soil only Block (i.e) without the addition of Cement or any other additive.
3. Can be used to produce about 350/400 Nos Building Blocks per day using 2 people (i.e) I Supervisor / Operator plus one Helper.

The following block sizes are possible in VS Cinva Ram.
Recommended size:-
290mm x 140mm x 100mm - (SOLID) Walls.
290mm x 140mm x 50mm (SOLID) Floors.

Different block sizes are obtained by changing moulds complete with accessories. While it is possible to manufacture other mould sizes if required, we do not recommend blocks larger in volume than those indicated above.

SOIL SELECTION:-
Generally Laterite Soils are ideal for stabilized soil blocks. The most important ingredients of good soil are clay (10 to 20%) and sand (60 to 70%). If this proportion is difficult to find, then, they could be artificially prepared.

(a) Cost of 8kg soil (including digging sieving/ transportation = N10.00
(b) Cost of labour (block pressing & curing) = N10.00
(c) Cost of 5% cement (450 gms) = N15.00
Total cost of block = N35.00
Note:- Cost of water not considered and profit (if need be).
Cost may vary due to different local conditions. The soil cement block is 2.5 times in volume compared to normal burnt brick size 230 x 110 x 75mm. The following types of soil are to be avoided
(a) soils with over 30% clay.
(b) soils with more than 9.5% organic mater.
(c) soils with clay high proportion of gravel and silt.

CHOICE OF STABILIZER.
The Cement Stabilizer prevents softening of soil on absorption of moisture. The commonly available stabilizers is Cement. Cement is generally recommend for soil blocks. The percentage can vary from 3.0% by weight to 10% by weight depending upon performance requirements. If black cotton soils or high clay soils are used, addition of sand may be considered.

THE PROCESS OF BLOCK MAKING:-
(a). Sieve the soil in a 6mm sieve to remove gravel, roots and dirts etc.
(b). Take about 20 to 30 scoops of dry soil and spread it flat on the ground.
(c). Spread the right quantity of cement thinly on the soil.
(d). Mix the soil and cement thoroughly.
(e). Gently sprinkle water on the soil-cement mixture and mix thoroughly by shovel. Stop adding water if you can make
a ball of soil in your hand and if the soil does not stick to the hand.
(f). Take a scoop of soil – cement (do not heap the soil in scoop) and pour it into the mould box.
(g). After pouring all the soil into the mould box, compact the edges of the mould, swing the lid to close it.
(h). Raise up and press the toggle lever down till it reaches horizontal position.

Further economy is possible with ideal soil mixture (60 to 70% sand, 10 to 20% clay and balance silt) in which case the quantity of cement could be suitably altered.

TROUBLE SHOOTING HINTS:-
(a). Use only field tested, reliable and modified VS CINVA RAM' soil block machines supplied by 'BOLYN CONSTRUCTIONS COMPANY LIMITED only. Do not use spurious soil block machines/ mould boxes.
(b). Use correct quantity of soil in the scoop.
(i). Bring back lever to starting position, open the lid and press the lever further down till the block is ejected.
(j). Remove the block for stacking and repeat.

The stacked block must be cured for 14 days (7 days in stack plus 7 days in wall) by gently sprinkling water. Curing should be carried out in shade (use grasses, stack or gunny bag if there is no shade). A good block should have density of 2.00gms/cc when weighed immediately after its productions.

TESTING OF BLOCKS:-
To ascertain the quality of stabilized soil blocks, carry out a 7-days compressive strength test after immersion in water for 48 hours. The frogs on both the block faces must be filled with mortar and cured before immersion in water. Depending on the wet strength, the stabilized block can be classified as follows:-

Grade	wet strength (kg/cm2).
A.	20
B	12
C.	7

Grade (A) blocks may be use for two storeyed houses. Grade (B) blocks may be used for single storeyed houses. Grade (C) can be used for single storeyed and light roofed buildings. The moisture absorption after dipping in water for 48 hours should be below 20%.

Blocks size 290 x 140 x 100mm
To achieve a fresh block density of 2.00 gms/cc.
(c) Always complete the compaction stroke.
(d) Do not use soil with:-
(i) High silt:-
(ii) High organic matter:-
(iii) Low ph:-

Use clayey soil to reduce silt.
(e) Do not use lime in highly sandy soil, but use cement instead.
(f) Reduce clay content in highly clayed soil by adding sand and use combination of cement and lime (If available).

The all steel block press is designed to incorporate components that can be made in local workshops equipped with flame cutter, arc welder, metal saw, drill and lathe. Repairs can thus be carried out in any local metal workshop.

Some interesting details are, for instance, the absence of a latch to hold together the lever arm and yoke, which instead has a handle on one side to pull the yoke and lever arm onto the mould cover. A short handle on the mould cover makes it easy to swing it back for filling. A welded on stop, however, prevents it from being turned too far back, in which position distortion and breakage are inevitable.
The lever arm is a length of pipe with one end curved, to avoid inserting the wrong end into the socket and minimize the risk of injuries associated with straight projecting parts with sharp corners. Transportation is greatly facilitated by pushing the lever arm through two projecting rings at the side of the press. The machine is carried between two workers, each holding one end of the lever pole with one hand, and a handle at the side of the mould box with the other.
Operating the CINVA RAM.
In the vertical position, the lever arm is fixed to the yoke by means of a latch. These are pulled back together and the mould covers swung open.
After greasing the sides of the mould, the soil mix is filled in,

making sure that the corners are properly filled and slightly compressed by hand. When swinging back the mould cover, the surplus soil is removed.

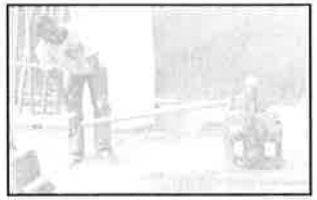
The lever is brought back to the vertical position and the latch released. The lever arm is then pulled down on the side opposite to its previous position, to compress the block. When the block is fully compacted, the lever arm is swung back over the mould to its position during filling.
The mould cover is opened and the lever arm depressed further until the block is completely ejected and held in this position until

STEPS IN MOULDING A CINVA RAM BLOCK & BOLYN BRICK PRESSES.

(a) Fill the mould with slightly moist soil cement.

(b) Compact Edges and close the mould lid.

(c) Raise the lever to the top of the mould lid.



(d) Press the lever down to the horizontal position.

(e) Bring the lever out to the resting position and open the lid.

(f) Raise out the freshly made block by pressing down the lever.

(g) The newly made block is now completely out of the box

(h) Carefully remove the block to the Drying area.

GENERAL REQUEST/COMPLIANT OF CUSTOMERS AND ANSWERS TO THEM.

Question (a). Can you send a trainer to train my workers?

Answer Yes, but you will pay his transport and accommodate him (if need be). You will be encouraged to pay him an allowance of about N1,500 for the one day training.

Question (b). Can you make my bricks for me?

Answer Certainly No. We cannot make bricks for hundreds of customers. You are encouraged to seek and find young and energetic men in your locality that we will train for you.

Question (c). Why is the brick from my machine weak and not as strong as the one I saw with you during your exhibition? My machine does not seem to have enough compression.

Answer (i). All our machines (brick presses) are tested and having adequate compression. You probably have underfilled the mould box(es), press the edges with a small wooden plank that will ensure that mould box(es) accept more soil than you have used previously. Continue to add more and more until the optimum level is found.

(ii). Ensure the water level used in the mixing is adequate, the soil must not be too dry.

Question (d). Can I test run the machine without fixing it down on a strong plank or concrete floor?

Answer No. Absolutely No. The machine cannot be operated without been fitted down-firmly.

Question (e). Can I use Diesel Oil as a lubricating oil instead of the black-waste oil from automobiles?

Answer Do not use Diesel oil, it will not work. All other oil-

engine oil (used one); palm oil etc can serve.

Question (f). How do I secure the machine from theft?

Answer This machine will not usually or easily be stolen because (i). it is heavy for one person to carry. (ii). Its operation is not common. (iii). It cannot be used in hiding. (iv). It can only be taken away in a vehicle. However, ensure it is fitted firmly down, the thieves will usually not have the time to loosen it as someone must see him before he finish his act.

Question (g). What do I do in case of breaking or damaging any of the part of the machine?

Answer No part of the machine will easily be damaged. However, most breakable parts will easily be fitted back by any local welder.

Question (h). What do I do in case there is a major defect in my machine?

Answer Bolyn Constructions Co. Ltd. will replace the whole unit of the brick press or the defective part in case any is noticed.

Question (i). My bricks are broken or cracked during ejection. What is the cause?

Answer Check that your soil is laterite or clayey. Non-clayey soil will not have good sticking/ gumming ability (ii) Check that your machine is firmly fitted and it does not shake or move or bounce when being operated as this could cause the bricks to be wounded at ejection.

Question (j). My machine is very difficult in operation, it is hard for the brick to come out. Infact, the brick is not coming out at all.

Answer You may have not oiled the piston track and inside the mould/s or you have over filled the moulds. Ensure adequate oiling and avoid overfilling as it

can cause the brick not to eject easily.

Question (k). The brick coming out of my machine is not neat and strong. It is very soft (i.e.) not hard like the one I saw at your exhibition.

Answer Do a test of the water content of your material (i.e.) Soil, is there too much water; is it enough or not enough water? Check the page detailing how to carry out a **DROP TEST.**

Question (l). The wooden plank on which I fixed my machine is always breaking.

Answer Only a strong 2" hard wood of mahogany standard (12 feet long) will ensure that you have a rest of mind. Don't compromise.

Question (m). Why is my brick not smooth on the surface?

Answer Smoothness of surface can be further enhance with sieving your soil or better still sourcing finely grained, laterite soil and more frequent oiling of the mould internal surface.

Question (n). Why is the edge of my brick not perfectly straigth?

Answer The problem could be that you have not taken time to remove soil cement left over on the internal face of the mould box(es) of the machine especially at the 4 (four) corners. Too much water can equally cause roughness of edges.

FORMULAE FOR THE MAKING OF CEMENT PLUS MUD SOIL BRICK.

A lot of people do desire to have a formula that can give them instantly the various quantities of materials e.g. Laterite soil (Mud), Cement and Water that they needed to mix together to form their bricks/blocks. It is for those people that we include this details. We hasten to say that this formula is not RIGID as it can be varied to accommodate an increase OR reduction to

satisfy some special needs. The nature of some Laterite Soil (Mud) can equally necessitate an upward or downward review of these formula in order to guarantee the best mix.

We shall give the formula under these headings:-

(a). BRICKS/BLOCKS TO BE USED FOR FLOORING INTERNALLY OR EXTERNALLY.

The floors are usually subjected to lots of Wears and Tears, Abuse and Extensive Uses e.g. vehicular traffic, this will necessitate a higher percentage of stabilisation. We recommend the use of 10% cement stabilisation for floors. The bricks/blocks for floor are usually 290mm x 140mm x 50mm thick.

QUANTITIES OF MATERIALS REQUIRED FOR 10% CEMENT TO 90% LATERITE SOIL = 1:10 RATIO.

(i). Cement = 1 head pan (i.e.) half bag of cement (25kg).

(ii). Laterite Soil (mud) = 10 head pans of slightly heaped soil.

(iii). Water is to be showered using a wetting can to make the mixture of laterite soil and cement moist, but not too wet. Required water will be about 25 litres – but NEVER POUR this theoretical value on your dry mix, rather wet gradually and allow the continuous turning of the mix to attain the necessary wetness. 50 nos. floor bricks/blocks can be gotten from half bag cement, plus 10 head pans of laterite soil, while 100 floor blocks/bricks will come out from the mixture of one bag of cement plus 20 head pans of laterite soil.

(b). BRICKS/BLOCKS TO BE USED AT GROUND LEVEL AND TOP OF EXPOSED WALLS.

There may be a need to differentiate these areas in a building (if) feasible, necessary and possible. 6.5% cement that is appropriately 1:15 will required the followings:-

(i). 1 Head pan of cement OR half bag of cement (25kg).
(ii). 15 Head pans of laterite soil (mud).
(iii). Theoretically about 40 litres of water may be required for the mix if the soil is totally dry, but never pour this quantity on the mix but wet with a wetting can for a moist mix. 40 bricks/blocks of the size of 290mm x 140mm x 100/110mm will result from half bag of cement (25kg) and 80 nos from a full bag of cement.

(c). <u>FENCE WALLS AND HOUSE WALLS BRICKS/BLOCKS THAT MAY NOT BE PLASTERED WITH CEMENT MORTAR.</u>

This type of walls can make do with 5% cement (i.e.) a ratio of 1:20 (1 head pan of cement plus 20 head pans of laterite soil called mud).

<u>MATERIALS QUANTITIES REQUIRED (1:20).</u>

(1). Cement quantity - 1 head pan of cement (half bag of cement = 25kg).
(2). Laterite Soil (Mud) – 20 head pans of laterite soil.
(3). Water = Approximately 50 litres of water if the soil is totally dry. 50 nos 290mm x 140mm x 100/110mm can be made from half bags of cement and 100 nos from a full bag of cement, plus the laterite soil.

N.B: Water should not be poured on the cement soil mixture rather a wetting can should be found and used.

(d). <u>WALLS OF HOUSES/BUILDINGS UNDER A ROOF - TO BE OR NOT TO BE PLASTERED.</u>

4% Cement stabilisation is enough for all walls that are under the protection of a roof covering. This type of building may be or may not be plastered on the external surface.

However, it is compulsory to plaster with cement-sand mortar the underside of the walls immediately after the ground level to about 1.0m or 3 feet. This is to protect the wall base against erosion by rain water.

<u>MATERIALS QUANTITIES REQUIRED (1:25).</u>

(a). Cement quantity – 1 Head pan of cement (half a bag of cement = 25kg).
(b). Laterite Soil (mud) – 25 Head pan of soil.
(c). Water - Approximately 60 litres of water is required if soil is totally dry.

A half bag of cement can be used to produce 60/65 nos bricks while a full bag of cement can produce about 130 bricks of size 290mm x 140mm x 100/110mm.

(e). <u>OTHER WALLS OF BUILDINGS/HOUSES VERY WELL PROTECTED BY A ROOF THAT MUST OVERHANG. THIS WALL MAY REQUIRE PLASTERING EVENTUALLY.</u>

3% Stabilisation with cement is permissible for a low-cost house that must have a reasonable protection from rain, water and wind erosion.

These walls may require to be plastered internally and externally.

<u>MATERIALS QUANTITIES REQUIRED (1:33).</u>

(a) Cement - One head pan (half bag of cement = 25kg).
(b) Laterite Soil (mud) - 33 Head pans of soil.
(c) Water - Approximately 80 litres of water that must be showered lightly on the cement soil mix (if) totally dry is required.

N.B: Don't pour water on the mix or in a hole created in the mix.
A bag of cement can be used to produce 160 nos full size bricks of size 290mm x 140mm x 110mm.

(f). <u>LATERITE/MUD/EARTH ONLY BRICK WALLS FOR WELL PROTECTED WALLS.</u>

It is feasible, possible and a good practice to build with mud or laterite soil. Bricks of laterite/mud only materials are to be sundried for at least 14 days when there MUST BE NO RAINS at all. It is to be made in a totally dry period, protected from excessive sun that can also cause it to crack.

The buildings that incorporate mud bricks for its constructions must be built in dry season, and mortar jointed with cement-sand mortar and roofed during the same period. The buildings must be cement mortar plastered eventually.

EXAMPLE OF REQUIRED QUANTITY OF MATERIALS.

(a) Laterite Soil - 30 Head pan of soil.

(b) Water – Shower about 70/75 litres of water on the soil if it is totally dry

VERY IMPORTANT

1. Blocks with cement must be watered (i.e.) cured by wetting at least 7/8 days while blocks without cement is to be sun dried only.
2. In wet and raining season the laterite soil/mud/earth will be wet. The soil should be covered if you will need to work on days immediately following the rainy days.
3. When laterite is WET, do not attempt to add the theoretical quantity of water stated for mixing dry soil-cement mixture, if you do, you will not be able to press into blocks/bricks such mixture that will be messy, gummy and pastry/watery.

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Elder R.B. Akinrolabu,
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WE GIVE TRAINING/SEMINAR IN:-

CEMENT – STABILISED SOIL BLOCK TECHNOLOGY.

1. The concept of cement stabilized laterite soil block.
2. Local Sourcing of Building Materials.
3. Testing methods – Good laterite, soil test, soil shrinkage test, how to determine the requirement quantity of cement and water in soil – cement block.
4. Labour and site planning for block moulding operation.
5. Batching of cement, soil, dry mixing and watering, wet mixing and mould filling.
6. Operating the Multi-purpose V.S. Cinva Ram Block Press and tools to produce:-
   (a). Solid Block – Frogged faced and plain faced.
   (b). Lintel Block.
   (c). Paving/Floor Tiles.
   (d). Half Blocks.
   (e). Kerb Blocks.
   (f). Wall coping Blocks.
7. Drying and Curing method of Cement stabilized laterite soil blocks.
8. Placement and Handling methods for the different types of blocks.
9. Mortar and plastering composition and application.
10. Building Construction methods (i.e) Foundation, Walling up to Roofing level.
11. Simple estimation and costing of walls.
12. Maintenance of machine and trouble shooting of the Multi-purpose V.S. Cinva Ram Block Press.
13. How to achieve a truly Low Cost Housing for the masses.
14. How to achieve housing for all by the year 2015.

PRACTICAL TRAINING:- participants will be made to physically participate in Testing of soil, Batching and Mixing of Soil-cement, making of various Blocks types, Operating the Multi-purpose V.S.

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We acknowledge and confirm that most of the items (i.e) pictures, photographs and detailed informations supplied in this publication are gotten from materials receieved from Nigeria, Ghana, Thailand, UK, Germany and so on, Some of the Institutions or Publications are listed underneath:-

1. Soil Cement Technology for low cost housing in rural Thailand by Marleen Iteebebek & Paul Jacobul.
2. Brick Production of CECTECH, National Museum Jos.
3. Breapak Operations Manual Prepared by the Overseas Development Administration of the Building Research Establishment, UK.
4. Small Scales Manufacture of Stabilised soil blocks by ILO and UNIDO.
5. Publications of GATE-GTZ Germany including a Design Drawing of our First Brickpress.
6. Many other newspaper, Magazines and publications too numerous to be all remembered or mentioned.
7. Compressed Earth Bricks Masonry - Part 2 - Brick Production - CecTech, Jos.
8. Rural Building Course by Bro. John V. Winden, Wolfram Pforte and Fritz Hohneriein.
9. Production of Dirt - Cement Bricks by B.W. Schippert Germany Project.
10. Appropriate Building materials - A Catalogue of Potential Solutions by Roland Stulze and Kiran Mukerji .
11. Block Press Handbook for making soil Blocks by Dept. of Housing & Planning Research, Kumasi, Ghana