RESEARCH ON INTER LOCKING STABILISED SOIL BRICKS (I.S.S.B.) A LITERATURE SURVEY

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Abstract

This article present a literature study of research & development on Interlocking Stabilised Soil Bricks. The different developed conceptional design for interlocking systems of blocks which is used for construction of brick walls described and various working principles related to the Interlocking Stabilised Soil Bricks systems concepts are outlined. This is followed by & overviewed of research work that has been related to I.S.S.B. by several research articles. The research work under taken which is received categorised according to proposed I.S.S.B. systems concepts (types of materials, of moulds, various compacting equipments, economical consideration & others as per section 3 to 5 based on basis of this literature study, recommendation for future work.

Keywords: - *Literature review, Interlocking Stabilised Soil Bricks, ISSB, Bricks, Soil, Laterite Soil, Sand.*

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1. INTRODUCTION

House is the third need of human in the world. While considering about India the population is increasing day by day which required Food, Cloths & shed / house for living. Our country which is on developing stage the demand of house is more, means the supply of economical & eco friendly construction material is needed. Now days in construction industry various alternative materials are available for construction of various structural members. I.S.S.B. is one of the alternative for the normal Bricks. I.S.S.B. is getting more popular in Indian market because of its economy both in methods of production & construction. Interlocking Stabilised Soil Bricks are bricks made up by mixing of soil with water ,(with different strength improving materials like fly ash, cement etc.) & Compact this mix by use of mechanical or Hydraulic compaction machine. I.S.S.B. is not only helps in raising the speed of construction but also it reduces the time required for completion of particular work or project. I.S.S.B. having the simple technology & it mainly depends on the raw material which is available in surrounding area of construction this is the benefit which will help to complete the project/construction in short period. This I.S.S.B. method will give the 35% - 40% reduction in the construction cost than using other construction methods. Now a day's different types of Modified/compacted machines are available in the market which required less area for their setup & produce large nos. of production.

I.S.S.B. material will allow to construct the small section of wall which provides the good quality of strength and resistance to water. Cement + Soil stabilised bricks will require the proper curing @ 3 – 4 weeks after the curing. Then it can be used as a common brick. Sandy soil is good than clayey soil for casting purpose. A Good soil for casting bricks having some proportion:

Good Soil is the composition of Gravels 15% + Sand 50 % + Silt 15 % + clay 15%. This percentage will get after some field test carried on site according to this composition we will define that which type of soil is available.

2. MATERIALS

RED SOIL (LATERITE SOIL) **:** Because of having high amount of Iron & Aluminium the soil is called as red soil. This laterite soil is the disturbed sample of Laterite. Francis Buchanan Hamilton - Scottish Physician gave this name as Lateritic soil to red soil. Amana Ocholi & Manasseh joel, Makurdi they was used laterite soil which was collect from Ikpayongo, at a distance of 22 km from Makurdi state. This soil available in South west region in India, West portion of South America, South western portion of Africa, The desert Region of North central Africa & Interior of Australia. One of the author Simion Hosea Kintingu gives his opinion that the less shrinkage soil having high sand content are better stabilised with Portland cement & give good compressive strength range between 3 – 4 Mpa. Where high shrinkage soil having high clay content are better stabilised with lime & Low power pressing machines which produce brick having compressive strength @ 1.5 – 2 Mpa.

CEMENT : The Ordinary Portland Cement was used by various researchers. One of the author Ogunbiyi, Moses A, from Nigeria he was used Elephant cement (Ordinary Portland Cement) which is confirmed BS 12 (1978) from cement depot in Oke bale, Nigeria. Amana Ocholi & Manasseh joel used Ordinary Portland Cement which was collect from open market in Makurdi.

WATER : Water used for mixing the soil should be free from dissolved contaminants, suspended particles, & it should be fit for drinking purpose as specified by BS 3148 (1980), given by Ogunbiyi, Moses A. As per study we

observed that various researchers performs various tests on water like pH test, Hardness test, Chloride content test, etc.
SAND : One of the author Samson R. Akinola, & Osun state, Nigeria, describe that they used River sand collect from river beds which was used for mixing with soil which was proper graded in conformity, free from clay particles & free from various organic matter etc.

3. METHODS

For casting the Interlocking Soil Bricks two methods are widely popular on a field are as follows: 1) Manual casting & 2) Casting by Hydraulic Press Machines.

Selection of method for casting of interlocking bricks are depends upon site conditions and owners financial budget. The CINVA RAM, a Makiga press machine with economy, Low cost in investment & manually operating press machine shows in figure as below which produce both side interlocking bricks. Where in other side the production of bricks are done by using Hydraulic press machines, with set of mould is fitted with machine having various sizes like 230mm * 100mm*100mm, 230mm * 150mm * 100mm (L * B * H). The production of ISSB brick include Batching, Mixing & Compaction of Soil. This Batching, Mixing & Compaction is done as stated in following Table no.01.

Table No. 01: The batching information stated for soil with cement & water.

Cement %	Soil (Laterite) (Kg)	Cement (Kg)	Water (Kg)
6	265	15.90	20
8	265	21.20	20

Amana Ocholi, Manasseh Joel (2014)
As stated above in table the red laterite Soil & Cement is mix with the help of labor on clean and plain hard surface. The quantity of water should be add during the mixing of soil & cement up to the optimum moisture content of the whole mixture was Obtained. The optimum moisture content of mixture was determine by wetting the soil & compress in hand and dropped down on hard flat surface on ground from the height of 1.0 M. When the Soil break into 4 – 6 parts then the quantity of water used was consider right.(National Building Code, 2006.). After this the mould should be internally coated by the talcum powder or lubricated with grease or oil. Then the mixture of Soil, Cement & Water should be fill into the mould and compress at a pressure at 150 Kpa. These bricks are kept for curing under sun rays on open flat ground surface with sprinkling of water once or twice a day. This sprinkling of water started 24 hours after casting for 28 days in line with Adam (2001). After curing process these bricks are kept in oven at various temperature like 100 ^{o}C, 200 ^{o}C, 300^{o}C per hours, For fire resistance reported by Mosely et al (2008) Specified for Residential buildings. Then these bricks are collect from oven and kept for cooling purpose for @ 5 – 6 hours on open environment. Five bricks are use for dry compression test & 5 bricks are used for Wet compression test in lab. The brick was kept in between two metal plates one at the top of brick and other one kept at bottom of brick. Then these plates and brick insert in the compartment of compaction machine. The failure load then record and divide it by sectional area of the brick for getting the compressive strength of brick. As per study we observed that the Hydraulic Press Machines are widely popular Shows in Fig. 01 as below for casting of interlocking bricks which gives large quantity of production with less consumption of time than Manual method.

4. TESTING MACHINES

Figure No. 01 Hydraulic Compaction Machines

Figure No. 02 Manual Operated Soil Compacting Machines

5. TESTS :

5.1 Water Absorption Test

As per previous data available research survey observed that the amount of water absorption of interlocking stabilized brick was increased from 1.90% to 2.0% at a 35 ^{o}C (room temp.) & 21.70% to 17.00% when temp. is 500 ^{o}C. (Amana Ocholi & Manasseh Joel, IJET - 2014.)

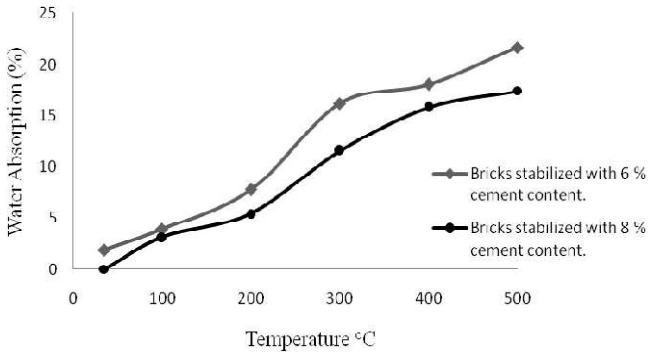

Fig.3: Varitation of Water Absorption with Temperature.

Source: Effect of temperature on soil bricks, Amana Ocholi & Manasseh Joel (IJET)

5.2 Compressive Strength

The compression test was carried out as per code BS 1881 part 116, 1983 by using universal testing machine. At a time of test the standard size of brick was first weight and keep proper position in machine, Then The maximum load recorded at which brick was failed that stated as follow: With using 0 % cement content in stabilized bricks gives 0.37, 1.01, 1.42, 1.45 Mpa with respect to 3rd, 7th, 14th & 28th days compaction result. For 5% cement content stabilized bricks gives 0.58, 1.38, 1.51, & 1.69 Mpa. with respect to 3rd, 7th, 14th & 28th days of compaction result & 10 % used of cement content in stabilized bricks gives 0.60, 1.58, 1.69 & 2.42 Mpa with respect to 3rd, 7th, 14th & 28th days compressive strength result.

But here research survey observed that the National Building Code (2006) was recommended that the 7 days dry compressive strength for 5% & 10 % cement content used in stabilized soil brick should not be less than 1.6 Mpa. & 2.13Mpa. Which was not satisfied by above bricks samples.

6. RESULT

As per available previous data the required compressive strength (4 – 5 Mpa.) can be achieved when the percentage of cement content should used more than 12% of quantity of soil. This will give un economical conditions for casting of bricks.

CONCLUSION

Research survey conclude that if we made production of ISSB bricks on site then it reduce the transportation which will save cost of transportation, fuel, time & money. This product is energy efficient & environment friendly because it required 15 – 20 % less energy consumption per m^3 than energy consumed by Fired bricks per m^3. This research survey also conclude that the construction of a interlocking bricks are easy & time saving with less investment of money which increase the speed of construction . Also one of the benefit is that it need not required firewood for production of ISSB which will automatically saves the forests. Sometime lack of knowledge about soil, Unskilled labors, Bad quality of equipments & soil may responsible for bad quality of product. where in other side this type of constructions have some draw backs like it cannot use for long spans walls, high & long buildings structures. For improving the quality of bricks the mix proportions required to do for particular soil which is available in particular area. Required to do the design the economical & compact compressing machines.

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