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An experimental investigation on cement mortar brick by partial replacement of cement by WHA and fine aggregate by seashell

K.M.Padmapriya[1], S.Dhanalakshmi[2], V.Dharani[3], R.Shubashni[4]

[1]*Assistant professor, Department of Civil Engineering.*

[2,3,4]*UG Students, Department of Civil Engineering,*

Adhiparasakthi College of Engineering, Kalavai, Vellore District, TamilNadu.

Abstract - *The most basic building material for construction of houses is the conventional brick. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. A number of studies had taken serious steps in manufacturing bricks from several of waste materials. However, the traditional mean of bricks production which has brought hazardous impacts to the context has not yet been changed or replaced by more efficient and sustainable one. This paper aims to compile this state of the art work of manufacturing bricks in the past and the current trend in the bricks industry with respect to the raw materials, ways of manufacturing and the out comings. Moreover, the hazardous impacts of the conventional brick manufacturing will be wholly covered as well as the attempts of the previous researches in treating the problem properly. This paper is an attempt to fill the gap of the past studies and suggest more sustainable and sophisticated methods of brick manufacturing in the future. Brick making consumes larger amount of clay which leads to top soil removal and land degradation. The main aim of this project was to compare the compressive strength of the bricks, so for this purpose different percentage of WHA 3%, 6% and 9% by the weight of cement and sea shell 10%, 12% and 14% by the weight of fine aggregate were separately added and also leather is added as an admixture. From this test it was concluded that the brick gives minimum compression test after 28 days. Hence, the leather and seashell gives good workability and durability than conventional brick.*

Keywords—Cement mortar brick, WHA, Seashell, leather.

1.INTRODUCTION

1.1 General

Cement mortar is the most used man-made construction material in the world. Its popularity as a construction material is due to its durability, insulation property, thermal property and ability to mould in to desire shapes. Cement mortar is defined as the combination of fine aggregate and binding materials such as cement with convenient prescribed quality of water. During manufacturing of 1 tonne of OPC, we need 1-10 tonne of earth resources like limestone, etc. Further during manufacturing of 1 tonne of Ordinary Portland Cement an equal amount of CO_2 are released into the atmosphere. The CO_2 acts as a silent killer in the environment as various forms. In this backdrop, the investigation for cheaper substitute to OPC is a needful one.

However, these estimates of carbon affects the global where the food materials produce the least

waste. Thus to reduce the uses of cement we can replace relatively new material. However, the OECD countries (are better equipped in solid waste management than African or South Asian countries). Having said that, the conventional waste management techniques employed in these countries has their own problems. The thousands of incinerators employed raise concerns about ash disposal and pollutions, landfill and uncollected waste, also contribute to climate change through the production of methane. This scenario is even grim in developing countries of the African and South Asian regions. Thinking along that line, they have used ash in the concrete mixture to reduce the waste and cement content with sand or soil or landfill dirt or mud and are used as bricks to construct houses and even water tanks.

The technology was quickly adopted in different countries including India. By following the process of ash we are using wheat husk ash for the partial replacement of cement .When mixed with the sand wheat husk ash work as cement material in bricks and can be used in walls or pillars replacing conventional bricks. These walls can be of different sizes and orientations.

The cement mixture used to hold the ash and sea shell powder in place to build these bricks in wall. And the most common problem faced now-a-days are scarcity of fine aggregate. where fine aggregate consist of natural sand or crushed stone with most particles passing through a sieve. The general ratio for the brick used is 1:3 or 1:4 for the brick construction .

1.2 OBJECTIVE

- To reduce the carbon dioxide emission in the concrete by partially replacing cement with rice husk ash and fine aggregate with sea shell powder.
- For the purpose of workability leather (chrome waste) is used as a admixture.
- To investigate the utilization of wheat husk ash and sea shell as a supplementary cementitious material and fine aggregate are going to be done with different percentage of replacement levels.

1.3 NEED FOR THE PROJECT

Due to the cement production greenhouse gases are emitted in the atmosphere. Hence, to reduce greenhouse gases in the atmosphere and to reduce usage of the materials by replacing the suitable material for this wheat husk ash and seashell with leather as an admixture . which will reduce the cement and sand .

1.4 BENEFITS OF MATERIALS:

- By using the wheat and sea shell may increase the compressive and tensile strength of the cement specimens.
- Wheat is the one of the material which absorbs silica from the soil and assimilates it into structure which can be replaced with the cement .

- Which it reduces the amount of the materials and obtain strength with simple waste materials in low cost . Wheat husk is the outer covering of the grain of wheat plant with concentration of silica ,generally more than 80%. where wheat husk is produced as the million tons per year as a waste material in agricultural and industrial process.

1.5 BRICKS

In India, the history of making bricks is almost 5000years old. The Indus valley civilization was discovered by the archaeologists with the help of old bricks found during the construction of railway track from Karachi to Punjab 19th century. Fired clay brick being one of the most important building materials, India is the second largest producer of bricks, accounting for over 10% of the global production. It is estimated that India has more than 100,000 bricks kilns producing about 250 billion bricks annually, employing about 15million workers and consuming about 35million tones of coal annually . The brick industry is growing as the demand for bricks is increasing in the towns and village due to the fast economic growth , urbanization and consumed for burnt production in about 60 years. Usually, brick kilns are situated in rural and urban areas in the country .

Brick is the basic building unit which is in the form of rectangular block. For India, a brick of standard size 190mm*90mm*90mm is recommended by the BIS. With mortar thickness, the size of the modular brick 200mm*100mm*100mm and it is known as the nominal size of the modular brick. Thus the nominal size of the brick includes the mortar thickness. It is found that the weight of the 1 cu.m of brick is about 18kN. Hence the average weight of the brick is 30 to 35 N. The art of laying bricks in mortar in a proper systematic manner gives homogeneous mass which can withstand forces without disintegration called brick masonry.

First class bricks:

These bricks are made from good quality raw materials. Color of first class brick is uniform. These are regular in size and shape and doesn't absorb more than 20% water of its own dry weight when immersed in fresh water for 24 hours . The crushing strength of this type of brick should be 105Kg /cm2.

PROPERTIES : Well burnt , sound , sharp edges, proper shape and size.

1.6 CHARACTERISTICS OF BRICK:

- Brick will not burn, buckle or melt.
- Brick will not and allows termites to invade
- Brick will not fade from the sun UV rays
- Brick will not be damaged by high winds rains or hail
- Brick will not require constant maintenance.
- Brick will not devalue
- Brick will not limit your personal expression.
- Brick will not limit your design options.
- Brick will not rust and corrode.
- Brick will not brick

PROPERTIES OF MATERIALS

1.LEATHER

Leather is a durable and flexible material which is created by tanning animals raw hide and skin. Leather contains a great deal of air, which is a poor conductor of heat. This is an important comfort consideration. Permeability to water vapour.

Leather fibers will hold large quantities if water vapour. This is property enables leather to absorb precipitation, which is later dissipated. A significant factor on comfort. where leather will be warm in winter and cool in summer . Leather can be moulded and will retain in new shape. It has both elastic and plastic properties in wear. Leather is a inherently resistance of heat and flame. Modern leather are tanned and dressed to resists the harmful chemicals like sulphur dioxide and burning of carbon fuel .Chromium is the chemical which is used to create thought resistance of surface on leather. And the lime is used to remove hair on the leather surface .

LEATHER

2.SEA SHELL

The sea shell are formed by limey secretions from a tiny calcium carbonates, they can be used to increase soil pH . The effective of raising soil pH depends on the degree of fineness to which they are crushed. The finer particle the greater is this effectiveness because of greater surface area of reaction. The calcium (Ca) in the form of silicates may have value primarily as a liming material and can correct acidity. CaCo3 calcium which is more in the seashell. It can be used upto 20% of material. where it gives low workability. There are types of the sea shell like oyster, calm, mussel and scallops.

SEASHELL

3. WHEAT HUSK ASH:

Among the wastes, wheat husk has been used as a novel silica source due to its worthy silica contentthat was obtained from earth during the growth process.

Wheat is triticum aestivum is a principle source food because of its important role in nourishment and it is one of the oldest cultivated cereals .

Wheat is planted limited extent as a forage crop for livestock and the roofing. Wheat husk is a lingo cellulosic waste product which is about 15-20% of wheat husk used as a cattle food.

WHA

TEST FOR MATERIALS

1. TESTING OF CEMENT

S.No	Type of test	Values obtained
1	Fineness test by sieving	10%
2	Standard consistency test	24%
3	Initial setting time	30 minutes
4	Final setting time	10Hours
5	Specific gravity test	1.30

2. TESTING OF FINE AGGREGATE

S.No	Type of test	Values obtained
1	Specific gravity test	2.49
2	Fineness modulus test	1.98
3	Water absorption	0.68
4	Bulkiness of sand	10%

3. TESTING OF WHEAT HUSK ASH

S.No	TYPE OF TEST	VALUES OBTAINED
1	Fineness test by sieving	8.5%
2	Standards consistency test	20%
3	Initial setting time	15min
4	Final setting time	1hours
5	Specific gravity test	2.50

4. TESTING OF SEA SHELL

S.NO	TYPE OF TEST	VALUES OBTAINED
1	Fineness modulustest	3
2	Bulkiness of sea shell	9%
3	Specific gravity test	3.10

RESULT ANALYSIS

COMPRESSIVE STRENGTH : Place the specimen with flat faces horizontal and mortar filled face facing upwards between plates of the testing machine.

Apply load axially at a uniform rate of 14 N/mm^2 per minute till failure occurs and note maximum load at failure.

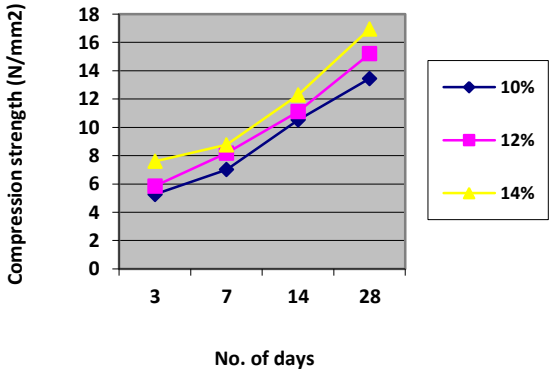
The load failure is maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine.

Compressive strength of brick formulae:

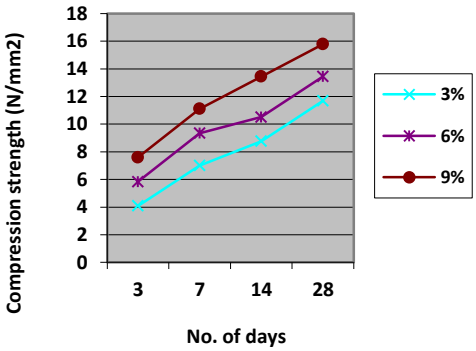
$$= \frac{maximum\ load\ at\ failure\ (N)}{average\ area\ of\ bed\ face\ (mm^2)}$$

The mean compressive strength required at a specific age, usually 3days, 7 days . 14 days and 28days. Compressive strength of brick is usually found by testing brick specimen. Brick of size 190*90*90mm were casted .specimens with wheat husk ash, sea shell and leather as an admixture is used in the brick .The specimen where tested for compressive strength as per IS code using calibrated compression testing machine of 2000KN capacity.

SEASHELL



WHA



CONCLUSION

This project has reviewed the existing work on the mean and materials of the brick manufacturing. This project work is based on the usage of leather waste (industrial by product), WHA and seashell . These materials improve the properties of the brick. Cement bricks are eco friendly. The experimental investigation will be based on the results obtained from the test conducted. From this test it was concluded that the slight difference in the compression strength between wheat husk ash and seashell. The leather added in the brick above 2%, loses its strength. Hence, we use upto 1.5% of leather

for brick as an admixture which gives workability. The strength and durability characteristics of brick in which sea shell is added with 10%,12% &14% and wheat husk ash is added with 3%,6% & 9% which gives minimum compression strength.

From the test conducted the result obtained are as follows:

The colour, shape, size and texture of the bricks were found to be satisfactory. The brick gives a perfect sound when banged with each other . The hardness and crushing strength of the brick are found to be satisfactory .

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