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RESEARCH ARTICLE

EFFECT ON THE STRENGTH OF BRICKS USING WASTE MATERIALS.

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Abstract

The dumping of wastes comprises as one of the major worldwide environmental problems as these wastes deliver the environment unfriendly. The growing demand for waste utilization has made solid wastes and demolition waste an essential composition of this paper. The possibility of reduction of the construction expenditure provides a strong reason for use of this waste. This paper involves the usage of structural and demolition waste as an important ingredient. These wastes were checked for its physical characterization such as compressive strength and water absorption percentage.

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Introduction:-

Structural and demolition waste are usually found whenever any construction or demolition activity takes place such as construction of bridges, buildings, roads etc. it comprises mostly of sand, gravel, concrete, metal, plastic, glass, etc. Demolition wastes are heavy, bulky and have high density and take up loads of land and space. So what if try recycling of these wastes.

These wastes can be used as landfill, base or sub base in road construction, embankment fill, and railway ballast and most importantly in aggregate replacement method for the formation of recycled concrete

Utilization of wastes in making of light weight, artificial aggregate and cement like properties is a fine strategy as it not only recycles the waste product, but also alleviates the problem of waste disposal. Recycling such wastes by incorporating them into building materials is a practical solution for pollution trouble.

Structural & Demolition Waste:

Structural & demolition wastes need to be handled & disposed of properly, so that the aesthetics of the place is maintained. Landfill method is not the most efficient method for the disposal, as precious land is used up as landfill site. Also, with the growing demand, landfill sites are getting more difficult to manage. Development of a novel method for the disposal is required so that these can be utilized as construction materials, thereby lowering the price of construction and making low income housing possible.

The various importance of structural & demolition waste are as follows:

1. Preserve the natural resources, so as to preserve the natural resources like fine particles (river sand)
2. Shortages of dumping sites, The major important thing Land gets wasted due to dumping of these wastes

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3. Reducing the construction cost, and also to reduce the construction cost thus resolving housing problems faced by the low income society of India.
4. Ingredients, The very basic solid coarser aggregates Ingredients are available already in these wastes.

Solid Wastes (sludge):

On account of its high organic content and good wet ability, sludge makes for an ideal additive to the clay-shale mix of bricks. So the various importance of sludge are:

1. In many ways sludge is the ideal additive to the clay-shale mix of bricks. Because it is an organic material with the added advantage of being wet. Organic additives improve laying qualities of bricks.
2. From the weathers point of view, pure clay makes for a less-than-ideal brick. They accepted mortar more readily, providing a suction that held the brick in place while the mortar began to set.
3. For most though not all brick manufacture. Sawdust and coal fines are commonly used.
4. Apart from manufacture better quality bricks, an organic additive has several other important advantages for brick manufacture. Using such material lengthens the life of a brick manufacture plant. Clay is never brought to a brick manufacture plant; the plant is sited where the clay is.

Advantages:

The main advantages were related to the amount of energy saved and the environment friendly way to dispose the sludge waste. They are as follows:

1. Increased plasticity due to the fibrous nature of the waste added makes brick moulding easier. thus basically the workability of the brick mixture increases.
2. The advantages of incorporating the waste are reduction in mass due to the paste and muggy nature of the sludge, lower water absorption value and shorter natural drying process due to the presence of organic component.
3. The waste also saved the fuel due to the flaming of the organic substances inside the waste during the firing process.

Objectives:

1. To manufacture brick using sludge along with fly ash as a binding material & mixed with structural & demolition waste in various ratios.
2. To compare the compressive strength, water absorption assigned by the Indian Standard Specifications for load bearing bricks.
3. Comparison of the designed brick with conventional clay brick.

Process of Making Brick Samples:

The process was as follows.

1. The first step is to prepare a mixture or sample.
2. A particular ratio of the elements are taken for example a ratio of 3:2:3:2 was taken for fly ash, cement, Solid waste (sludge) & demolition waste. The sludge was then dried at atmospheric temperature for 48hrs.
3. Now the demolition waste was crushed using hammer & then sieved through a sieve size of 1.75mm. The sand was sundried & also sieved through the same.
4. The mixture was then added in thoroughly and placed in the mould compactly and was left to dry in atmospheric condition.
5. The sample when dry enough was taken out of the mould. The sample was now cured for 7days, with continuous supply of water.
6. This method was repeated with different other ratio of varied sludge content, fly ash, cement, sludge & demolition waste.
7. The weight mentioned is the weight of the brick that was found after it was taken out of mould.
8. The weight of the samples ranged from 2.5-3kg & the samples were casted in a mould of size 23cm x 9.5cm x 7.5cm.
9. Independently all the components varied from 04 to 1.2kg in range in terms of weight.

Physical & Chemical Tests on Bricks:

Compressive Strength Test

The strength test was then carried out on these bricks and the Crushing Strength of the bricks was duly noted as below. It was calculated using the following equation-1.

$$\text{Compressive Strength} = \frac{P}{w \times t} \quad \dots (1)$$

Where,

P = Load on the material

w = width of the sample

t = thickness/height of the sample



Fig 1:-Compressive test

Water Absorption

Water Absorption was calculated for the following samples using the Archimedes' principle. The weights of the sintered products were taken (dry weight, D) & then this was followed by soaking the samples in water. Soaking was done by Water Boiling method.

The weight of the samples suspended in water was taken after which the soaked weight (W) of the samples was measured. Using the equation no. 2 the water absorption percentage can be calculated.

$$\text{Water Absorption} = \left(\frac{W-D}{D} \right) \times 100 \quad \dots (2)$$

Where,

W = Soaked Weight

D = Dry Weight

Results:-

Compressive Strength Test

The strength test was then carried out on these bricks and the Crushing Strength of the bricks was duly noted as below.

The study showed that with the increase in %age of Solid waste (sludge) content the strength decreased. This is because the strength of a material greatly depends on the sludge content and the temperature it's being applied to. It was also seen that with the increase in amount of cement the strength increases. This is mainly due to the properties of the cement.

Table 1:-Compressive Strength of Sample-I with various ratios

Solid Waste (%)	Sample-I	Strength (N/mm ²) of Sample-I
20%	3:2:3:2	12.67
30%	1:3:4:2	11.59
40%	2:1:5:2	9.93

Table 2:-Compressive Strength of Sample-II with various ratios

Solid Waste (%)	Sample-II	Strength (N/mm ²) of Sample-II
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20%	2:3:3:2	14.72
30%	2:3:4:1	14.65
40%	2:2:5:1	13.27

Table 3:-Compressive Strength of Sample-III with various ratios

Solid Waste (%)	Sample-III	Strength (N/mm ²) of Sample-III
20%	2:2:3:3	13.68
30%	3:2:4:1	13.29
40%	1.5:1.5:5:2	12.16

Table 4:-Compressive Strength of Sample-IV with various ratios

Solid Waste (%)	Sample-IV	Strength (N/mm ²) of Sample-IV
20%	3:2:3:2	12.71
30%	3:1:4:2	14.01
40%	1:2:5:2	11.94

Water Absorption

The bricks made with clay have lower water absorption value than those made from sludge. This can be one of the demerit of the designed bricks. As workability is an important factor in concrete mixing & is equally responsible for determine the strength and other characteristics of the brick.

Table 5:-Water Absorption for 20% Sludge content

For 20% Sludge	Dry weight (g)	Soaked Weight (g)	Water Absorption	Average
A1	1978	2328	0.176	0.228
A2	2086	2583	0.238	
A3	2194	2755	0.255	
A4	2303	2864	0.243	

Table 6:-Water Absorption for 30% Sludge content

For 30% Sludge	Dry weight (g)	Soaked Weight (g)	Water Absorption	Average
B1	2477	3102	0.252	0.258
B2	2519	3175	0.260	
B3	2627	3348	0.274	
B4	2736	3413	0.247	

Table 7:-Water Absorption for 40% Sludge content

For 30% Sludge	Dry weight (g)	Soaked Weight (g)	Water Absorption	Average
C1	2813	3591	0.276	0.269
C2	2926	3848	0.315	
C3	3036	3776	0.243	
C4	3129	3895	0.244	

Conclusion:-

The experimental results carried out during the present work would lead to the following conclusions.

1. The water absorption of a normal brick ranges from 15-20% while the absorption % for designed sludge brick was found to be from 22.8-26.9%
2. The samples with Sludge content of 20-30% was found to be vitrified.
3. A ratio of 2:3:3:2 containing fly ash, cement, and Solid waste (sludge) and demolition waste, respectively was found to be the better suitable ratio in manufacturing.

4. Brick made of sludge and demolition waste along with fly ash and also has a potential to be used as instead of normal bricks.
5. While some of the properties of the designed brick with the ratio of 2:3:3:2 was found to be completely fine.
6. Compressive strength of the brick was 14.72 N/mm^2 , whereas the normal brick strength lies in the range of $7.5\text{-}10 \text{ N/mm}^2$.

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