EXPERIMENTAL BEHAVIOUR OF WASTE RUBBER REPLACED IN HOLOW BLOCK

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Abstract—*In recent years the wastage of rubber material is abundant. So handling and managing these waste tyres is the major issue faced by the countries all over the world. They adopted many techniques in disposing the wastage one among them is land filling, but this technique was in vain. Next they adopted a method of burning these wastage known as incineration, but this created air pollution this in turn led to global warming. In this project we wish to attempt an experimental study to evaluate the behavior and failure characteristics of a rubber replaced Hollow Block Masonry. Analyzing the behavior and failure characteristics of rubber based composite material with nominal hollow block materials. Correlating the results obtained from destructive testing of the rubber replaced Hollow Block and ordinary block with different mix design, which are kept under curing for 28 days. Minimizing the cost incurred in the traditional materials used in Hollow Block. The nominal mixing ratio for M20 grade concrete is 1: 1.5: 3 and required amount of water is added. The raw materials used for the manufacture of hollow block are crusher chips, crusher powder, cement and water. This is the normal mixture made for the hollow blocks in the size of 400x200x200mm. The ratio of rubber replaced in fine aggregate for the mixture of 0%, 5%, 10%, 15%, 20%, 25% and 30%.*

Keywords— Waste Rubber, Hollow Block, Concrete

1. GENERAL

In recent years waste handling and management is the primary issue by the countries all over the world. It is very challenging and hectic problem that has to be tackled in an indigenous manner. On the basis of statistical data provided by the Environmental Protection Agency (EPA) 270,000,000 millions waste tyres are produced each year. The disposal of the waste tyres in the landfills is the major issue handled by the local and government bodies.

The statically study also gives an estimate that with in the next decade the majority of the landfills used for the waste tyre disposal shall be closed and this posses the problem of need for land waste humping.

The discharge of waste into expensive and the continuously decreasing numbers of landfills generates significant pressure to the local bodies identifying the potential application for these waste products.

EFFECT OF RUBBER ON THE ENVIRONMENT

Waste rubber is becoming a major problem! Today worn out tyres and other rubber products have become one of the largest and technically challenging problem in rubber waste management.

It's durability, flexibility, strength and elasticity are the qualities that make rubber ideal as a material to manufacture tyre.

The same qualities make it difficult to break down and recycle. Presently it is reported that 900 million to 1 billion tyres are scraped annually throughout the world. Other waste rubber accounts for an additional 3 millions tones. Tyres may trap water, and have become breeding grounds for mosquitoes,bacteria, excellent habitats for snakes and rodents. They present a real fire hazard, producing toxic fumes with health implications.

IMPORTANCE OF RECYCLING

For any kind of industry, the resources and its handlings are the important and basic requirement for its proper functioning.

Since the non-degradable waste tyre rubbers leads to reduction of water table and other consequences, They should be recycled or reused instead of damping them on earth surface.

The non-availability of sufficient raw materials and high transportation cost incurred in purchasing the same, the residue disposal any industrialist to go for methods of recycling the waste obtained after the process.

OBJECTIVES

Analyzing the behavior and failure characteristics of rubber based composite material with well accepted destructive testing technique.

Correlating the result obtained from destructive testing of the rubber replaced hollow blocks and ordinary blocks with different mix design, which are kept under curing for 28 days.

Minimizing the cost incurred in the traditional materials used in hollow block.

To complement the usage of fine and coarse aggregate with that of the waste tyre rubber.

HOLLOW BLOCKS

Hollow block is one of the important materials used for the construction of temporary and permanent structures. Based on the usage it is manufactured at various sizes such as 4" , 6" and 8" .Normally 4" hollow blocks are used for the construction of compound walls. The 6" and 8" hollow blocks are used for the construction of walls of the buildings. The raw materials used for the manufactured of hollow blocks are crushed powder, crusher chips, cement and proportionate water required.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

Fig.1 Waste Tyre Rubb

Fig.2 Size of Rubber 4.75mm

TEST ON MATERIALS

- Fineness modulus of fine aggregate=2.38
- Fineness modulus of coarse aggregate=4.16
- Fineness modulus of crusher powder= 3.7
- Specific gravity of cement=3.14
- Specific gravity of fine aggregate= 2.63
- Specific gravity of coarse aggregate= 2.77
- Specific gravity of crusher powder= 2.77

MIX DESIGN

The raw materials used for the manufacture of hollow blocks are crusher chips, crusher powder, cement and water. The mix proportion for various percentage of replacement are given the table.

Mix Proportion For Various Percentage of Replacement of Tyre

Ingredients	Mix Proportion(%)						
Crusher Chips	55	50	45	40	35	30	25
Crusher Powder	35	35	35	35	35	35	35
Cement	10	10	10	10	10	10	10
Tyre	0	5	10	15	20	25	30

TYPE OF CASTING

- It is one of the most important materials used for the construction of temporary and permanent structures.
- The following materials are used for casting of hollow blocks is given below,
    1. Cement (OPC)
    2. Fine and Coarse aggregates
    3. Crusher powder
    4. Water
    5. Waste tyre rubber
- At first the crusher powder, crusher chips and cement are mixed with specified water ratio in the mixture machine.
- In that the waste rubber is partially replaced in coarse aggregate in some specific percentage(i.e,5%,10%,15%, 20% ,25% and 30%).
- Then the mixture is dropped into the moulds.
- The size of casting is 400x200x200mm
- Finally, we get the result of compressive strength of this specimen after 3,7 and 28 days of curing.

RUBBER REPLACEMENT DETAILS

- The ratio of mix proportion is 1: 1.506: 3.27 is followed.
- The ratio of rubber replaced in coarse aggregate of this mixture is 0%, 5%, 10%, 15%, 20%, 25%, 30%. The quantity of usage of coarse aggregate gets reduced and its volume is tabulated below.

REPLACEMENT RATIO OF COARSE AGGREGATE IN HOLLOW BLOCK MASONRY

Percentage of rubber replaced on coarse aggregate	Volume of rubber material (Kg/m^3)	Volume of crusher powder (Kg/m^3)	Volume of crusher chips (Kg/m^3)	Volume of cement (Kg/m^3)
0	0	3	4.00	0.50
5	0.05	2.875	4.00	0.50
10	0.10	2.75	4.00	0.50
15	0.15	2.50	4.00	0.50
20	0.20	2.425	4.00	0.50
25	0.25	2.35	4.00	0.50
30	0.30	2.25	4.00	0.50

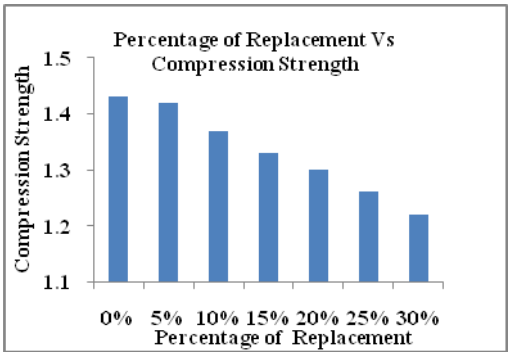
EXPERIMENTAL INVESTIGATION

Casted Hollow Block Details

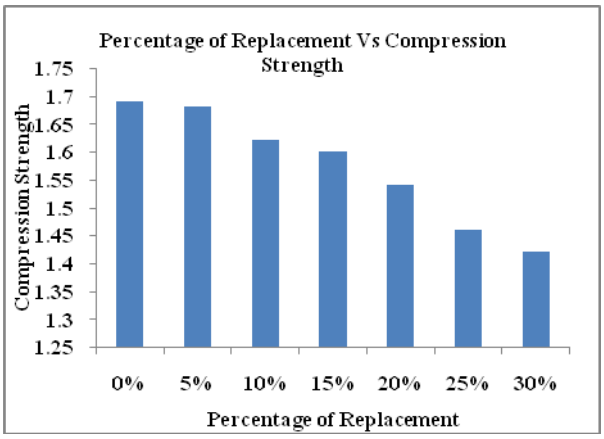
S.NO	TYPE OF REPLACEM -ENT	SIZE OF HOLLOW BLOCK	PERCENTAGE OF RUBBER	No OF BLOCK S
1	Coarse aggregate	400x200x200	0	3
			5	3
			10	3
			15	3
			20	3
			25	3
			30	3

RESULT

A total 21 numbers of blocks are casted and tested at compressive strength with a help of compressive testing machine. Three conventional blocks are to be prepared in the size of 400x200x200 for the purpose of referring with other hollow blocks which has partially replaced rubber with coarse aggregate in various percentages and undergone curing for 3days. Then the results are discussed below.



Compression Strength of Hollow Blocks After 3 Days Chart



Compression Strength of Hollow Blocks After 7 Days Chart

DISCUSSION

- The 5% replacement of rubber in fine aggregate in the hollow block shows minor variation in compressive strength to the conventional hollow block.
- The 15% replacement of rubber in fine aggregate, the hollow block shows the10% declination in compressive strength to the conventional hollow block.
- The 20% replacement of rubber in fine aggregate, the hollow block shows the 12% declination in compressive strength to the conventional hollow block.
- The 25% replacement of rubber in fine aggregate, the hollow block shows the 15% declination in compressive strength to the conventional hollow block.
- The 30% replacement of rubber in fine aggregate, the hollow block shows the 20% declination in compressive strength to the conventional hollow block.

CONCLUSION

Percentage in Replacement (%)	Age of Test (day)	Size of Cube (mm)	Compression Load at Failure (KN)	Compression Strength (N/mm^2)
0	3	400x200x200	115	1.43
5	3	400x200x200	114	1.42
10	3	400x200x200	110	1.37
15	3	400x200x200	107	1.33
20	3	400x200x200	104	1.30
25	3	400x200x200	101	1.26
30	3	400x200x200	98	1.22

With the back ground discussion we have decided to reinforce our result by the concluding remark.

Replacing waste tyre rubber up to 5% in the fine aggregate of hollow block masonry is affordable. Thus it can be used for both load bearing and non load bearing structures.

Replacing 10% in the fine aggregate is suggested for minor loaded area and recommended for non load bearing walls.

Replacing 15% to 30% is not comfortable for load bearing structures and hence it can be used for compound walls, flooring for the ground and pavements for garden.

By this we can adopt 5 to 10% replacement of waste rubber in the Hollow Block. So that it will be affordable.

Scrap tyre is a waste product so utilizing this can reduces the cost of production of hollow blocks.

Reutilizing the waste rubber can prevent the depletion of river sand.

Utilizing waste tyre rubber can be a effective methodology for solid waste management and it can prevent global warming.

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