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EXPERIMENTAL INVESTIGATION OF FERRO CEMENT WITH PARTIAL REPLACEMENT OF CEMENT AND NATURAL SAND BY WASTE BRICK POWDER AND M-SAND

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Abstract:

The aim of the research was to investigate the performance of ferrocement by using waste brick powder as a partial replacement of cement and using M sand as a partial replacement of sand. By using the M sand in the construction erosion of river can be greatly reduced. Study was conducted to perform the various test on the ferrocement by making the panels of ferrocement. And then The various test like flexural test, impact test, tensile test. To minimize environmental pollution resulting from carbon dioxide (CO2) emissions during cement manufacturing processes and disposal of waste brick. For this purpose firstly optimum percentage of waste brick powder as a partial replacement to the cement was obtained by making the cube with replacement of cement by waste brick powder from the demolition work in different percentage like 0%, 5%, 10%, 15% and 20%. The optimum replacement level of brick powder was obtained by performing compressive strength test on these cubes. After obtaining the WBP percentage sand was replaced by M sand in different percentage of 25%, 50%, 75%, 100% and replacement percentage were found out. The conclusion is that the brick powder can be used as a partial replacement in the concrete and mortar up to 15 %

Keywords: Ferro cement, Waste Brick Powder, M-Sand, Environmental pollution

Introduction:

Ferrocement is a composite material which rehabilitation of structure, housing, water is made up of rich cement mortar and supply, sanitation.etc. Reinforcement which is in the form of wire mesh.

Ferrocement was first developed in the mid-19th century by the French engineer Joseph- Louis Lambot, who used it to build small boats. However, it was not until the mid- 20th century that the material gained widespread popularity, particularly in developing countries where it was seen as a low-cost alternative to traditional building materials.

This project is based on concept of ferrocement. which is used to construct the building or various construction element in low cost and also thin size. The use of the ferrocement was started with boats building but recently ferrocement is used in various area of the civil engineering like repair and the partial experiment based replacement of cement and sand by waste brick powder from the demolition work and M sand respectively. It will not only reduce the cost of the project but also reduces the

CO2 gas emission.



Fig1: ferrocement with the mesh

It will also reduce the treatment of waste bricks from the demolition work. The method of handling the waste brick from the construction and demolition work is landfilling, but landfilling method is very expensive method and for this method large area is required.

India is the second largest cement producer in the world. Cement production in India in 2021 was 296 million tons and it is increased to 356 million tons in 2022. Cement production is increases with the time due to development and increase in the population & their demands. According to various survey cement manufacturing causes around 8 % of the worlds CO2 emission. Cement production causes the huge emission of CO2 gas in the atmosphere and as we know CO2 causes the environmental pollution and harmful to the nature . Cement is the main ingredient in the concrete and there is not any another ingredient like cement to replace the cement completely. But we can replace the cement partially, and by replacing the cement partially we can reduce the cement production in some amount. In this experiment we have done the replacement in the ferrocement it will reduce the cost of the ferrocement and also increase the strength .

MATERIALS USED IN THIS EXPERIMENT

1. Cement

- 2. Fine Aggregate
- 3. Wire Mesh
- 4. Waste Brick Powder
- 5. Sand
- 6. Water
- 7. M Sand

Some of the researchers have done their research on the partial replacement of cement by the brick powder in the concrete and mortar. And they found that the strength of concrete improved due to the partial replacement of cement by brick powder. The partial replacement of sand by M sand will reduce the cost and also increase the durability of ferrocement.

LITERATURE REVIEW

1). PERFORMANCE OF CEMENT MORTAR AND CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT WITH CLAY BRICK POWDER – AN EXPERIMENTAL APPROACH

(B.V.Ramanamurthy, N.Himabindu)

In this experimental study they have investigated about the performance of brick powder as a partial replacement of cement in the mortar and concrete. The objective of their study was to evaluate the soundness and compressive strength of cement mortar and determination of workability and some mechanical properties of concrete like compressive strength and split tensile test by using brick powder as a partial replacement of cement. The soundness test result does not show any effect on control mix

and remaining mixes. the compressive strength and split tensile strength are increased by 7% to 9% as compare to control specimen in the concrete. they have suggested the replacement up to 20 % in the mortar and 15 % in the concrete



Fig2: Materials required for ferrocement

3). Effect of Brick Dust on Strength and workability of Concrete (Muhammad Nasir, Ayaz Khan, Nabeel Liaqat, Ibrar Ahmed, Badul Basit, Muhammad umar, and Muhammad Aftab khan)

In this research they have used the brick dust in the plain cement concrete to check its fresh and harden properties. In this research they have checked the workability and strength of concrete by using the brick dust as a partial replacement of cement by using the 0.55 water – cement ratio. Water –cement ratio was constant during the research. Three samples were casted for each 3,7,14, 28, and 56 days with the 0%,

5%, 10%, 15% and 20% replacement of brick dust. According to their results compressive strength and split tensile strength tends to increase by increase in brick dust content up to 15%.

4). Effectiveness of replacing cement partially with waste brick powder in mortar - Saif Saad Mansoor , Sheelan Mahmoud Hama , Dhifaf Natiq Hamdullah

In this experiment they have done the partial replacement of cement by brick powder in the mortar and they have conducted various test on it. Properties (flow test and fresh density), mechanical properties (dry density, compressive strength, and flexural strength), and transport properties (water absorption ratio, rate of water absorption, i.e., sorptivity, and permeable void ratio). Also, an ultrasonic velocity impulse test was made. According to the results flowability and density of fresh mix is decreases linearly but the density of harden state was slightly higher than the reference Mix (mixture without using Brick Powder). Higher strength was examined in the 15 % of WBP for compressive strength. According to permeability test results the brick powder reduced the ability of mortar to transfer liquid.

OBJECTIVES

- > To find the optimum replacement level of waste brick powder (WBP) and M-sand as a partial replacement of cement and natural sand.
- To reduce environmental pollution resulting from carbon dioxide (CO2) emissions during cement manufacturing processes and disposal of waste brick.
- ➤ To compare the compressive, flexural and impact strengths of ferrocement (using partially replacement of cement and natural sand by waste brick powder and Msand) specimens with plain ferrocement (without any replacement) specimens.
- \blacktriangleright To reduce the overall cost of the Ferrocement

METHODOLOGY

1. Making the conventional mortar with partially replacement of cement by the different percentages of WBP of 0%, 5%, 10%, 15%, 20%

2. Determining the optimum replacement percentage of WBP from the results.

3. Using that % of WBP for making the samples with M-sand of different percentage 0%, 25%, 50%, 75% and 100% for the replacement of Natural sand.

4. After determining both the optimum percentages of WBP and M-sand from the results we will use it in the construction of conventional ferrocement.

5. We will make the samples of wall panels, blocks specimens by using the ferrocement of WBP and M sand.

Sr no	Brick replacement Percentage	Compressive st	Compressive strength	
		7 days	28 days	
1.	0%	25.07	33.25	
2.	5%	24.57	33.60	
3.	10%	24.60	34.67	
4.	15%	24.67	35.56	
5.	20%	23.09	32.56	

Table 2. compressive strength

Conclusions:

According to the research waste brick powder and M sand can be used as the partial replacement of cement and sand and it has some advantages like, First, it reduces the amount of cement and sand needed to produce the same amount of ferrocement, which reduces the cost of production. Second, it reduces the environmental impact associated with producing cement and sand, since these materials are typically mined from natural resources. Third, it increases the strength and durability of the ferrocement due to the increased surface area provided by the waste materials. Finally, it increases the fire resistance of the ferrocement due to the increased thermal insulation provided by the waste materials.

Scope Of Future Work

As years passed by the requirements for better infrastructure is on the rise and we are running short of the available natural raw resources which has forced the civil engineers to think about alternate materials without compromising the strength. Natural river sand is being replaced by M sand and hence the effect of bentonite clay on the mechanical properties of mortar with M sand has to be studied. Ferrocement which is good in tensile strength and consumes less raw materials should be encouraged and the effect of bentonite clay on the properties of ferrocement need to studied.

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