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Partial Replacement of Clay by Waste Foundary Sand in Brick Manufacturing

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Abstract - *The primary aim of this project is to make use of waste foundry sand (WFS) from the foundry industry in the production of bricks. The entire process, from mixing clay to forming bricks, drying, and firing, was carried out under local conditions. By incorporating up to 30% WFS in clay compositions, it was feasible to create bricks with desired characteristics using minimal processing. Bricks containing 30% WFS exhibited a minimum average wet compression resistance of 5.54Mpa and a maximum average water absorption of 20.76% when fired at 900°C. When compared to commercial bricks, there was little difference in apparent porosity, water absorption, and specific gravity of WFS-containing bricks. The inclusion of WFS led to a decrease in the bulk density of the bricks, resulting in a reduction in compressive strength. According to the recommendations of IS 1077 standard specification, WFS bricks can be categorized as class II bricks. These bricks are suitable for use in single-story load-bearing structures as well as in the construction of infill walls in multi-story framed structures.*

1.INTRODUCTION

Since 80% of India is still undeveloped in 2030, it was projected that the country's building construction industry will expand at a 6.6% annual pace through that time. Bricks and other building materials will become more and more in demand as the construction industry continues to expand.

The usage of agricultural clay to make bricks, which is crucial for farmers, is a significant issue that India is currently facing. The Indian government forbids the use of agricultural land for brick production, promoting the use of substitute materials in order to preserve the land. With a long and rich history of manufacture dating back to, clay burned bricks are one of the most popular walling materials in India.

1.1 Methodology used

This study was carried out for the purpose of having a detailed understanding of the effect and uses of waste foundry sand in bricks and to determine its compressive strength. To achieve the objectives stated previously, several laboratory tests were conducted. By using appropriate apparatus and methods, testing was conducted on the required materials, standard bricks and the bricks with waste foundry sand. The following steps were followed in this project study.

1.2 Grading of Bricks and Its parameters As per IS: 1077-1957 and 1970 code specifications.

a) Bricks with compressive strength not less than 110kg/cm2 – First class bricks - Grade A-A.
b) Bricks with compressive strength not less than 75kg/cm2 – Second class bricks - Grade A.
c) Bricks with compressive strength not less than 50kg/cm2 – Third class bricks - Grade B.
D) Bricks with compressive strength not less than 30kg/cm2 – Fourth class bricks - Grade C

1.3 TESTING OF BRICK MATERIAL (SOIL)

We will follow different tests on soil as mentioned below
1.Plastic limit
2.Liquid limit
3.Water absorption
4.Soundness test
5.Colour test

1.4 TESTING OF BRICK

Using different proportion, we would follow different tests as mentioned below
1.Absorption test
2.Crushing strength test
3.Shape and Size test
4.Soundness test
5.Colour test

Table -1: COMPRESSIVE STRENGTH TEST

SRNO	Sample proportion	Area(cm²)	Load (KG)	Compressive Strength (Kg/cm²)	Compressive Strength (N/mm²)	Average Compressive Strength (N/mm²)
1	5% WFS 95% Soil	264.5	29095	110	10.79	10.95
			29492	111.5	10.93	
			30036	113.46	11.14	
2	10% WFS 90% Soil	264.5	25974	98.20	9.63	9.55
			25757	97.38	9.55	
			25540	96.56	9.47	
3	20% WFS 80% Soil	264.5	21982	83.11	8.15	7.98
			20940	79.17	7.76	
			21684	81.98	8.04	
4	30% WFS 70% Soil	264.5	14753	55.78	5.47	5.54
			15425	58.32	5.72	
			14666	55.45	5.43	
5	40% WFS 60% Soil	264.5	6800	25.71	2.52	2.78
			7639	28.88	2.83	
			8083	30.55	2.99	
6	Normal brick	264.5	30035	113.55	11.13	11.04
			29495	111.51	10.94	
			29800	110.02	11.05	

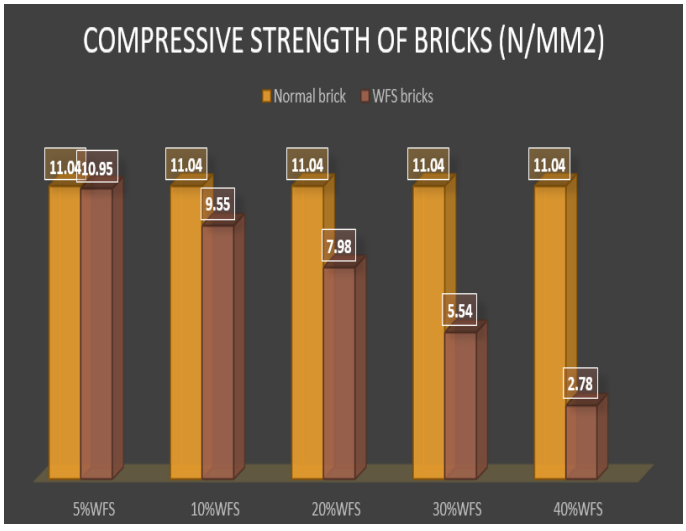

Chart -1: COMPRESSIVE STRENGHT

Table-2: Water Absorption Test

SR NO	Sample proportion	Weight	Weight brick	Water Absorption (%)	Average Water Absorption(%)
1	5% WFS 95% Soil	2.65	3.01	13.58	14.85
		2.70	3.13	15.92	
		2.67	3.08	15.35	
2	10% WFS 90% Soil	2.67	3.13	17.22	16.78
		2.72	3.15	15.80	
		2.71	3.18	17.34	
3	20% WFS 80% Soil	2.81	3.28	16.72	17.66
		2.75	3.25	18.18	
		2.82	3.33	18.09	
4	30% WFS 70% Soil	2.40	2.90	20.83	20.76
		2.45	2.98	21.63	
		2.47	2.96	19.83	
5	40% WFS 60% Soil	2.25	2.75	22.22	23.3
		2.28	2.81	23.24	
		2.25	2.80	24.44	
6	Normal bricks	2.70	3.13	15.92	14.57
		2.65	3.01	13.58	
		2.67	3.05	14.23	

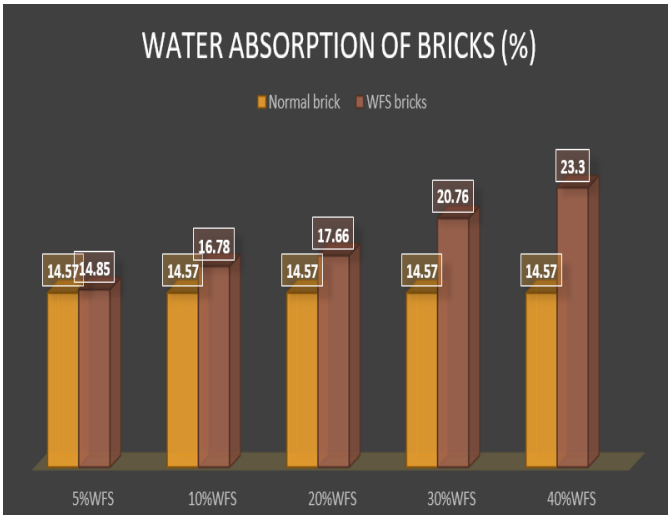

Chart-2: Water Absorption Test

SUMMARY:

In our project study, we made statistical analysis between normal bricks and bricks With waste foundry sand. There is major difference between standard bricks & bricks With waste foundry sand like compressive strength value, water absorption and amount of salts presents in bricks etc.

3. CONCLUSION

1. With minimum material processing and adopting local conditions, it was possible to introduce WFS as a raw material in production of bricks.

2. The maximum desirable replacement proportion of WFS is 30%.

3. The addition of WFS reduced the bulk density of the bricks, which has also caused reduction in compressive strength. The reduction in bulk density can be attributed to the poor packing ability of bricks containing higher content of WFS.

4. The average compressive strength of 30%WFS replacement is 5.54N/mm^2 and water absorption is 20.75% of dry weight, when fired at 900°c.this brick can be classified as a class lll brick, based on recommendation of is 1077-1957 standard specification. These bricks can be used in single storied load bearing structures, and also in the construction of infill walls in multi- storied framed structures.

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