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Utilization of Paper Waste and Fly Ash in Cement Concrete

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Abstract: ***In India, waste in waste disposal across the country is confronted with a serious challenge. Deposit disposal leads to elevated waste disposal expenses and potential environmental issues. If the present course continues, waste will be generated 5% annually, which will ultimately lead to saturated site capability by 2025. This study reports the results of an inquiry into the use of paper waste as extra material for concrete admixtures to be used for housing projects to ensure the mechanical strength of the resulting concrete. Concrete mixtures containing different waste content have been prepared with fundamental features such as compressive strength, workability and fire resistance compared to the control mix. The additional materials for M30 concrete is prepared for three concrete mixtures of 5%, 10% and 15% of paper waste and fly ash. The result shows that utilization of waste paper & fly ash is comparatively better than control concrete, on the basis of environmental impacts. The waste paper & fly ash utilized concrete is light weight, cost-effective & eco-friendly.***
Keyword: Paper Waste, Cement concrete, Fly Ash, Compressive Strength.

I. INTRODUCTION

This study is aimed at analyzing the problem of paper waste on concrete strength and developing mixing ratio for concrete paper waste. Paper waste has been used for decades as a construction material, particularly in cement matrices. Since then a considerable amount of research has been undertaken to prepare the mechanical properties of the composite such as compressive strength, workability and fire resistance. The role of paper waste in structural concrete could become a cost-effective replacement for sites, incinerators, or other user choices. The survey on the use of paper waste as a fresh recycled fabric in concrete production can be further confirmed. An option to the disposal of sites of waste is the use of paper-mill pulp in concrete formulations. In many sites across the country, India faces a serious challenge in the disposal of waste. The waste disposal condition leads to elevated waste disposal expenses and possible environmental issues. With waste manufacturing forecast to grow five percent each year, sites would be able to have the complete ability by 2025 if the present trend continues.

The objectives of the study are as follow-

A. Research of the use of paper waste and fly ash as additional material in concrete mixes for different construction projects to ensure that the resulting concrete is properly compressed.
B. Prepare mixtures with different proportions of the fly ash and paper waste.
C. To see fundamental concrete features such as compressive strength, workability, water absorption, fire resistance and analysis of costs.
D. Comparison of outcomes with the control combination of different features.
E. To minimize the costs of concrete production by adding concrete mixed paper waste and fly ash.

II. MATERIAL AND METHODOLOGY

In this research project, Pozzolonic Portland cement (based on Fly Ash) is used. Fine aggregate with a specified weight of 2.67, water absorption of 0.90 percent, and Natural River Sand Zone II. The coarse aggregate with water absorption of 1.10%, Specific gravity of 2.90 and the nominal size of coarse aggregate is 20mm. The paper waste used in this research project are newspaper waste and office paper waste. This paper was dried and then pulverized in the light of the sun. Paper pulp clearly show irregular pores and fibrous characteristics. In these pores, the paper pulp retains the moisture. Fibrous nature gives the ability to absorb very high energy as a result of high compressive strength. The dried paper was soaked in water for 24 hours and mechanically agitated to achieve consistency. By blending all the elements into a mixer a dry concrete mix was prepared. The mixing conditions for all combinations were based on the M-30 concrete weight ratios. On the basis of preliminary tests, the water to cement ratio for paper waste mixes was established to produce an operable mixture with sufficient water due to high water absorption of the paper waste.

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The paper waste quantity increased in four trials, such as T-1, T-2, T-3 and T-4. This corresponds to 0%, 5%, 10%, and 15%. Newly mixed concrete's properties were observed and test specimens were cast for assessment of concrete durability. Each percentage increase in paper waste was tested at seven days and 28 days after treatment for three cube specimens for compressive strength and water absorption. Determined that the compressive strength of normal concrete and special concrete in a different temperature in a 0^{o} C to 250^{o} C of various four tries 0%, 5%, 10%, 15% at 28 days of curing. Then find out the cost of production of concrete by different mixes of fly ash and waste paper.

Fig. 1 Soaked paper waste

Fig. 2 After prepare paper pulp.

III. COMPRESSION STRENGTH

Graph and table show the compressive strength of concrete fly ash and paper waste is more in it. Compression strength is finished in compression strength testing machine, constant rate pressure is applied in concrete cube specimen of 150mm size. By taking a look at the result it's been determined that initially 5 percent and 10 percent paper waste added to increase the compressive strength than an increase of paper waste more than 10 percent then compressive strength of concrete decreases.

Percentage Replacement	Mix Name	Compressive Strength	
		7 Days	28 Days
0%	P1	17.42	34.24
5%	P2	19.65	36.43
10%	P3	20.87	37.21
15%	P4	15.93	32.37

Table-2 Compressive Strength result of concrete.

Fig. 3 Concrete cube under compression testing.

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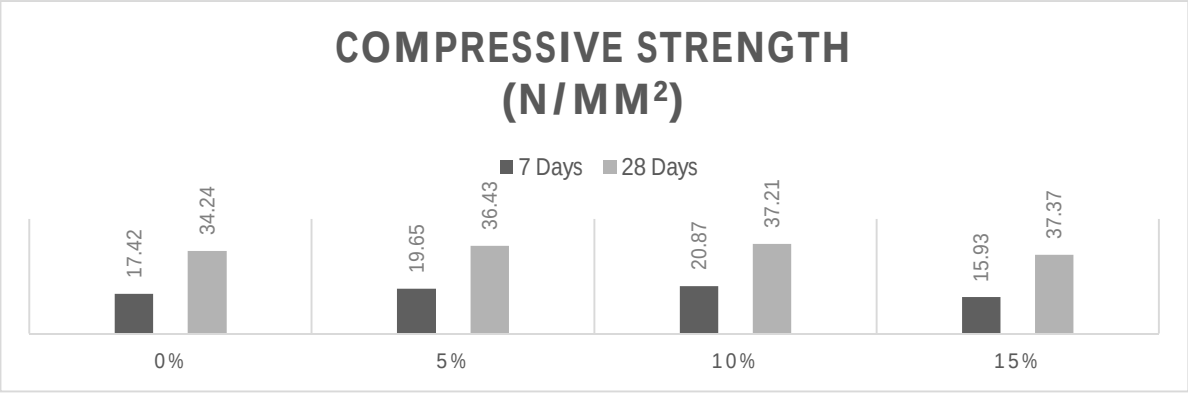
Fig. 3 Concrete cube after compression testing.



Graph-1 Compressive Strength result of concrete

IV. WORKABILITY

Table and graph offer workability check results of fresh concrete when paper waste and fly ash is accessorial. Workability is checked by the slump cone test. By check result, it's been ascertained that workability of the concrete slashed with inflated within the percentage of paper waste in concrete.

Percentage Replacement	Mix Name	Slump cone (mm)
0%	P1	83
5%	P2	84
10%	P3	82
15%	P4	80

Table-3 Slump Cone result of concrete.

V. FIRE RESISTANCE

Table a pair of offers the main points of the number of specimens forged for various temperatures. Cubes sizes were 150mm x 150mm x 150mm. The test is using for the compressive strength machine.

Temperature (^oC)	Compressive Strength (N/mm^2)			
	0%	5%	10%	15%
30	32.84	33.26	34.95	30.61
50	31.65	35.49	35.41	31.86
100	33.94	34.37	33.97	29.75
150	32.56	32.94	31.72	29.14
200	30.24	32.82	31.46	28.54
250	30.16	31.51	30.11	27.58

Table-4 Fire Resistance and Compressive Strength result of concrete.

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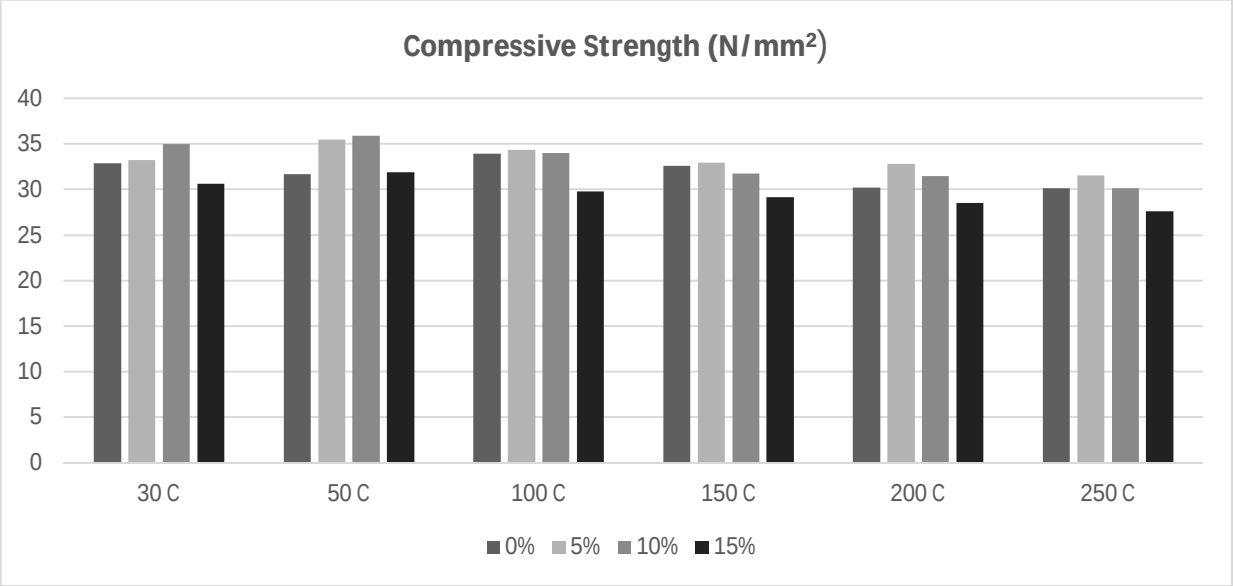

Graph-2 Fire Resistance and Compressive Strength result of concrete.

A. Effect of Temperature on Compressive Strength

It has been determined that the compressive strength of normal concrete and special concrete in a different temperature in a 300° C to 250° C temperature they do not any larger effect in a both of concrete. After an increase a temperature they reduce the strength of special concrete. when temperatures reach the 200° C the hydrated lime within the cement can begin to dehydrate, generating a lot of vapor and additionally delivery regarding important reduction within the compressive strength of the standard concrete and special concrete in a vary of 300°C.

VI. COST ANALYSIS

The cost of concrete by adding fly ash and paper waste with 5%, 10%, and 15% was calculable at Rs 4249/-, Rs 4066/- and Rs 3928/- severally as against Rs 4538/-, the value of M30 concrete while not paper waste for the one cubic meter work. The cost of production of concrete are reduced by 2.037%, 6.29% and 9.44%.

Percentage Replacement	Mix Name	Cost (In Rupees)
0%	P1	4538
5%	P2	4249
10%	P3	4066
15%	P4	3928

Table 5- Cost Analysis of Concrete

VII. CONCLUSION

A. Concrete mixes containing 5% and 10% of fly ash and paper waste, have shown an increase compressive strength of 3% and 1.9%, respectively, when compared to control mix and there was a decrease of 1.9% on addition of 15% of paper waste.

B. Workability of concrete mix was increase by 1.2% with 5% addition of fly ash and paper waste while it remained constant at 1.27% decrease on addition of 10% of fly ash and paper waste compared to control mix but it decreased by 3.75% with 15% addition of fly ash and paper waste.

C. As the temperature is increased at 200° C the compressive strength of concrete is decreased for special concrete, the reduction in compressive strength. After reaches the temperatures at 250° C concrete are, generating a lot of vapor and additionally delivery regarding important reduction within the compressive strength.

D. The cost of production of concrete, when compared with control mix gets reduced by 2.037%, 6.29% and 9.44% with the addition of 5%, 10% and 15% of fly ash and paper waste respectively.

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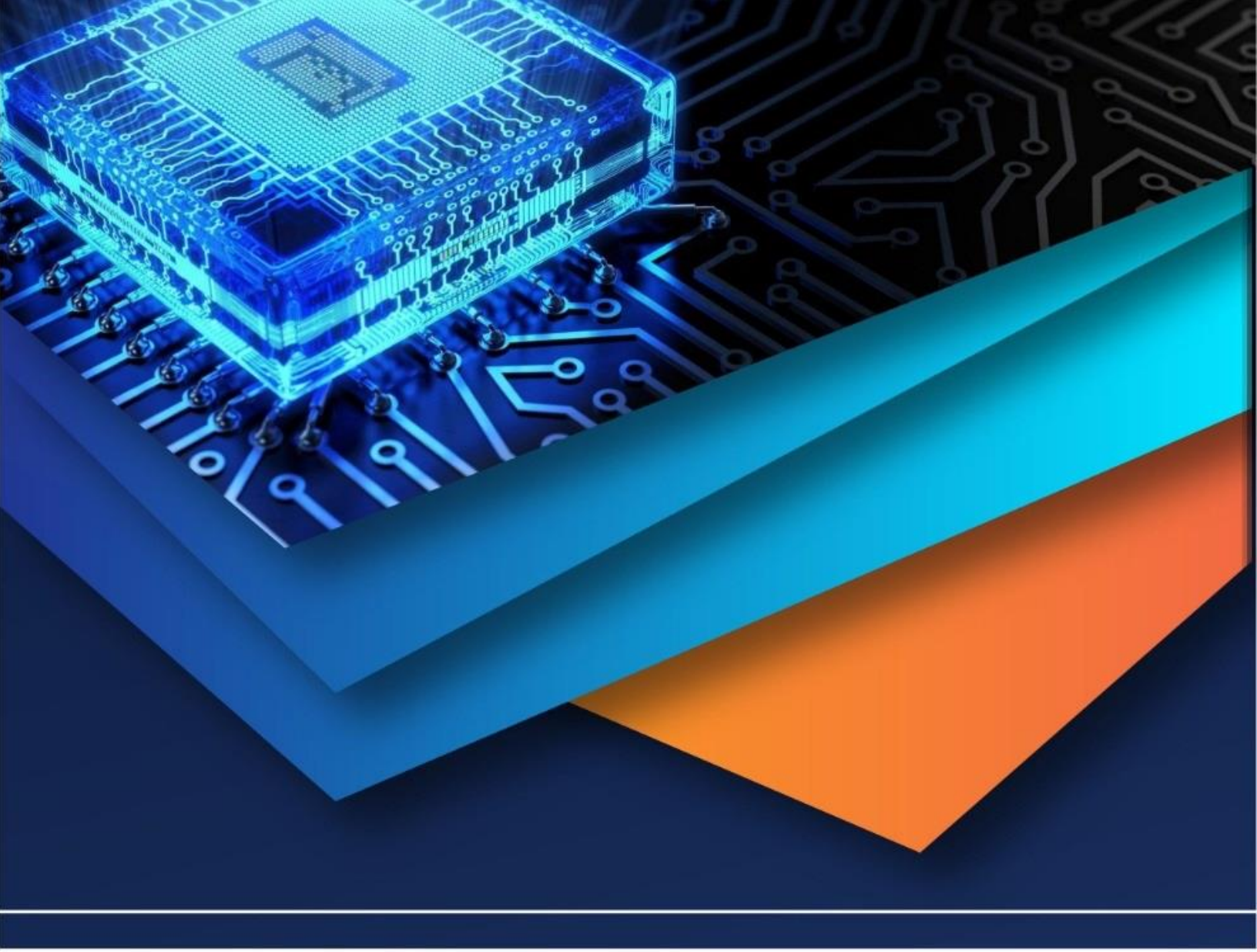

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