

# Utilization of Paper Waste in Concrete

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**Abstract**— India is confronting a severe challenge in casting aside the waste in landfills throughout the state. The landfill disposal is resulting in high disposal costs and potential environmental problems. If the current course continues, waste production will produce by 5% each year, which will finally result in the saturated capacity of landfills by 2020. This report reports on the outcomes of an investigation of utilization of paper waste as additional material in concrete admixtures to be utilized for housing projects, for which it must be guaranteed that the resulting concrete has the proper mechanical strength. Concrete mixes containing various contents of the waste were prepared and basic features such as compressive strength and water absorption were determined and compared with a control mix. Four concrete mixes with 0%, 10%, 15%, 20% and 25% of paper waste as an additional material to the concrete were prepared for M-40 concrete.

**Key words:** Compressive Strength, Density, Water Absorption, Slump Test, Concrete Mix, Paper Waste

## I. INTRODUCTION

This research is directed to analyze the issue of paper waste on the strength of concrete and to develop mixture proportions for concrete containing paper waste. Paper waste has been applied as building material for decades, especially in cementation matrices and since then a great deal of research has been acted to prepare the mechanical properties of the composite like compressive, tensile and flexural strength. Most of the published works on recycling of papers are from paper mill (Bai et al., 2003; Chin et al., 1998; Chun et al., 2006; Gallardo, 2006; Kraus, 2003; Naik et al., 2004), or from manufacture cement board (Fuwape et al., 2007; Okino, 2000). Role of Paper waste in structural concrete could become an economical and a profitable substitute to landfills, incinerator, or other user choices. The inquiry on the utilization of paper sludge can be further borne out in concrete manufacturing as a new recycled fabric. The use of paper-mill pulp in concrete formulations was investigated as an alternative to landfill disposal. India is confronting a severe challenge in disposing waste in many landfills throughout the state. The landfill situation is resulting in high disposal costs and potential environmental problems. If the current trend continues, with waste production projected to grow by 5% each year, landfills would be at total capacity by 2020.

The aims of the field are:

- Investigation of utilization of paper waste as additional material in concrete mixes to be utilized for various construction projects, insuring that the resulting concrete has proper compressive strength.
- To prepare mixes containing various proportions of the paper waste.
- To determine basic characteristics of the concrete such as compressive strength, density, water absorption and slump value.

- Comparison of results of various characteristics with control mix.
- To minimize the cost of production of concrete by adding paper waste with concrete mix.

## II. MATERIAL AND METHODOLOGY

Pozzolonic Portland cement (Fly Ash based) is utilized in this project was used in this research project. Natural river sand of Zone II is used as a fine aggregate with specific gravity 2.60 and water absorption 0.90%. Natural crushed stone of 20 mm maximum size is used as a coarse aggregate with water absorption 1.10% and specific gravity 2.70, the paper waste used in this research project was collected from Paper Mill near Hoshangabad, MP, India. This collected paper was dried in sunlight and then pulverized. SEM images below for paper pulp clearly shows that irregular pores and fibrous nature is present. The paper pulp holds the moisture in these pores. Fibrous nature gives very high energy absorbing ability as result it possess high compressive strength. Dried paper waste was soaked in water for 24 hours and was agitated mechanically to attain consistency.

A dry mix of concrete was prepared by blending all the elements in a mixer. The mixture ratios for all mixes were based on weight proportions of M-40 concrete. The water to cement ratio for the mixes containing the paper waste was based on preliminary testing to get a workable mix with enough water because of high water absorption of the paper waste. The quantity of paper waste was increased in four tries as T-1, T-2, T-3 & T-4 Corresponding to 0%, 10%, 15% & 20% increase of paper waste. The properties of newly mixed concrete were seen and test specimens were cast for the evaluation of the durability of concrete. For each percentage increment of paper waste, three cube specimens were tested for compressive strength and water absorption each at 7days and 28 days of curing period.

## III. EXPERIMENT AND RESULTS

### A. Compressive Strength

Table 1 and graph 1 shows the compressive strength result of concrete when paper waste is added in it. Compression strength is done in compression strength testing machine, constant rate pressure is applied in concrete cube specimen of 150mm size. By test result it has been observed that initially 5% and 10% paper waste increased compressive strength than increase of paper waste decreased compressive strength of concrete.

Percentage Replacement	Mix Name	Compressive Strength (Mpa)		
		7 Days	14 Days	28 Days
0%	PW1	44.56	47.34	50.12
5%	PW2	45.74	49.14	52.54
10%	PW3	43.7	47.775	51.85
15%	PW4	42.65	46.195	49.74

20%	PW5	42.11	45.58	49.05
25%	PW6	41.26	44.795	48.33

Table 1: Compressive Strength result of concrete

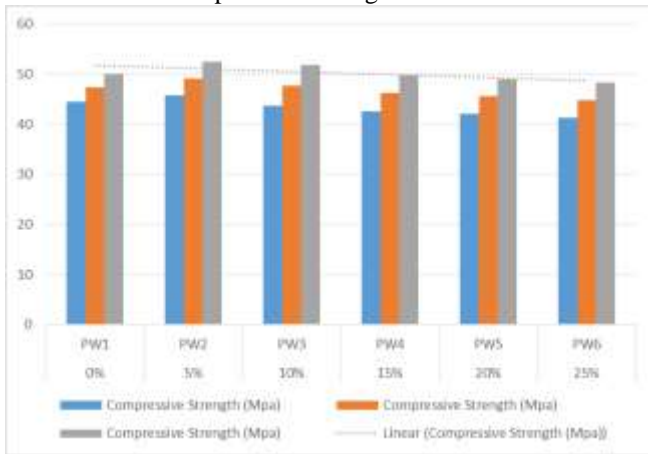


Fig. 1: Graph 1: Compressive Strength result of concrete

### B. Workability

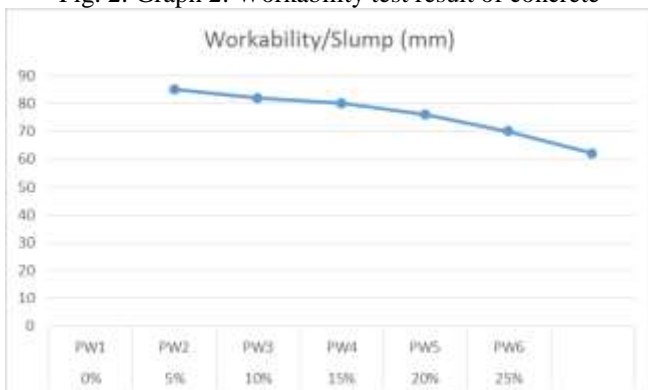
Graph 2 and table 2 gives workability test result of concrete when paper waste is added in it. Workability is checked by slump cone test. By test result it has been observed that workability of the concrete decreased with increased in the percentage of paper waste in concrete.

Percentage Replacement	Mix Name	Workability/Slump (mm)
0%	PW1	85
5%	PW2	82
10%	PW3	80
15%	PW4	76
20%	PW5	70
25%	PW6	62

Table 2: Workability test result of concrete



Fig. 2: Graph 2: Workability test result of concrete



## IV. CONCLUSION

Following conclusion are drawn from the present study:

- 1) Concrete mixes containing 5% and 10% of paper waste, have shown an increase of 4.60% and 3.34% in compressive strength respectively, when compared to control mix and there was a decrease of approximately 1.9% in addition of 25% of paper waste.
- 2) By test result it has been observed that workability of the concrete decreased with increased in the percentage of paper waste in concrete. it has been observed that paper waste decreased workability of concrete is continuously. Upto 25% additional mix approximately 27% decrease in workability is observed.
- 3) By the present study we concluded that 10% paper waste can added to concrete.

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