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Behavior of Concrete using Super-Plasticizer under different Dosage

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Abstract: *The research seeks to advance proper guidelines on the optimal usage of super plasticizers with local cement paste in ready mix concrete. Major challenges of ready mix concrete in Kenya are as a result of slump loss when the normal setting time of cement is exceeded due to traffic delays or incompatibility between the super plasticizer and the cement paste. Jabalpur City is the most affected, with the longest delays in transportation of ready mix concrete and with the highest variety of cement brands. To compensate for the slump loss in ready mix concrete, additional water is often added at the job site which results in a weaker and less durable concrete. There is therefore need to carry out research on the setting times of ready mix concrete in Kenya in order to ensure that the quality is not compromised by re-dosing with water during transportation or at the site.*

Keywords: *Super plasticizer, Compressive Strength, Flexural Strength, Workability Test, Slump Test.*

I. INTRODUCTION

Super-plasticizers constitute of a relatively new category and improved version of plasticizer, the use of which was developed in Japan and Germany during 1960 and 1970, respectively. They are chemically different from normal plasticizers. The use of plasticizers permits reduction of water to an extent up to 30% without reducing the workability in contrast to the possible reduction up to 15% in case of plasticizers. There are a number of super-plasticizers available in the market, out of which three super-plasticizers will be used in this research to study their effect on workability and mechanical properties of concrete mixture in both fresh and hardened state. Super-plasticizers produce a homogeneous, cohesive concrete generally without any tendency for segregation and bleeding. A series of tests thus carried out, analyzed and compared to concrete manufactured With different dosage (0.5%, 1%, 1.5% by the weight of cementitious material) of super plasticizer.

II. RESEARCH SIGNIFICANCE

Previous study proved that Super plasticizer can be successfully used in the concrete up to 1% by mass of cementitious material without adversely affecting the workability, strength & durability of concrete. In past researches about the super plasticizer they mainly focused on the advantages of super plasticizer and investigated the relationship between cement and super-plasticizer. Due to decrease in water-cement ratio no undue segregation and bleeding of concrete occurs in water reduced super plasticizer concrete.

III. OBJECTIVES

To study the variation of workability, compressive strength and flexural strength of Concrete Cube with addition of super-plasticizer.

IV. MATERIAL & METHODOLOGY

- 1) **Cement:** Ordinary Portland Cement (OPC) conforming to IS 8112-1989 was used for this study; The OPC UltraTech of 43 grade has been used.
- 2) **Fine Aggregate:** River Sand Conforming to Zone-II of IS 383-1970 has been used.
- 3) **Coarse Aggregate:** Two fractions of nominal size as 20mm & 10mm were used in this study.

The following laboratory tests were performed on aggregates as per relevant IS code & mix Design of M40 grade of concrete containing super plasticizer as an admixtures will be carried out. The laboratory test programme was proposed as under.

- a) Physical properties of coarse aggregate (20mm and 10mm)
 - i. Sieve analysis and fineness modulus.
 - ii. Specific gravity.
 - iii. Water absorption.

- b) Physical properties of fine aggregate
 - i. Sieve analysis and fineness modulus.
 - ii. Specific gravity.
 - iii. Water absorption.
 - iv. Silt Content.
- c) Mix design proportion of M-40 grade as per IS 10262:2009 containing OPC and Super Plasticizer.
- d) Addition of super plasticizer @0.5%, 1%, 1.5% by the weight of cementitious materials in concrete.
- e) Study of Workability of fresh concrete.
- f) Study of Compressive Strength @7, 14 &28 days.
- g) Study of Flexural Strength @7, 14 & 28days.

Table 1: Properties of Super plasticizer

PRODUCT PROPERTIES	SPECIFICATIONS
Appearance	Dark Brown Liquid
Specific Gravity	1.2
pH	7
Solid Content	42

Table 2: Properties of material used

S.NO.	PARAMETERS	TEST VALUE
1	Sp. Gravity of CA	2.88
2	Sp. Gravity of FA	2.591
3	Water Absorption of CA	1.1 %
4	Water Absorption of FA	0.67 %
5	Silt Content	3.03%

V. EXPERIMENTAL PROCEDURE

In this study M40 Grade of concrete was designed as per IS code. In this study super-plasticizer was added in different proportions 0%, 0.5%, 1% & 1.5%.

For each dose 3 sets of cube and 2 sets of beam were casted, in each set 3 cube were casted and 4 beams were casted. And later on the compressive strength at 7, 14 & 28 days and flexural strength at 7 days and 28 days was checked.

VI. RESULTS

The test results obtained are summarized in Table 3, Table 4 & Table 5 shown below and the variation is shown in the figure-1, figure-2 & figure-3

Table 3: Workability

Super-plasticizer	W/C Ratio	Slump
0 %	0.39	40
0.5 %	0.39	70
1 %	0.39	110
1.5 %	0.39	160

Table 4: Compressive Strength

Dosage of SP	No. of Curing Days	7days	14days	28days
0 %	Compressive strength	36.44	42.22	51.11
0.5 %		40.74	47.85	55.11
1 %		39.99	50.37	57.04
1.5 %		39.11	45.58	48.3

Table 5: Flexural Strength

Flexural Strength	
mix with different percent SP	flexural strength N/mm ²
Nil	7.18
0.50%	7.91
1.00%	8.16
1.50%	6.92

Figure-1 Slump value with different dosage of SP

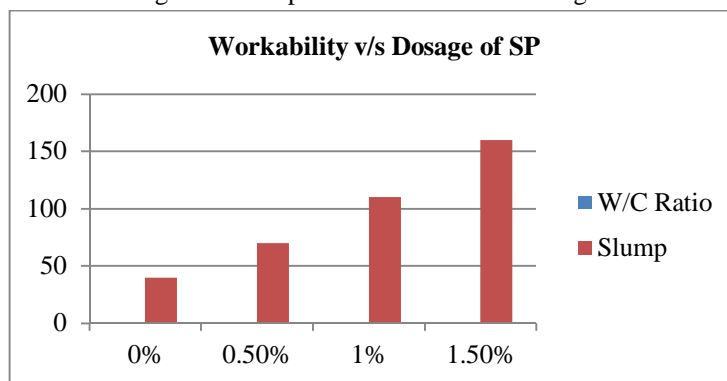


Figure-2 Compressive Strength at different Dosage of SP

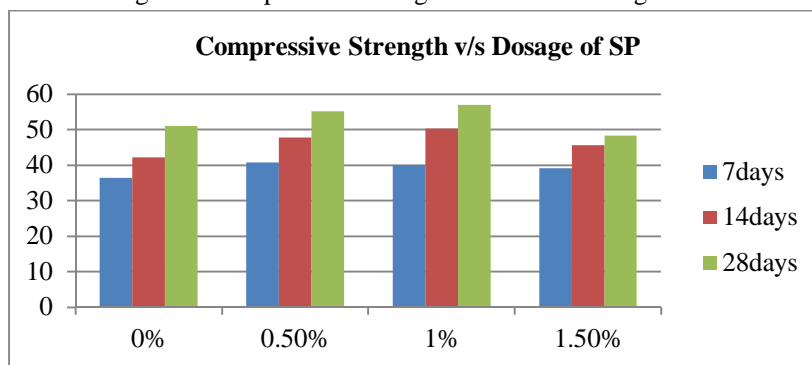
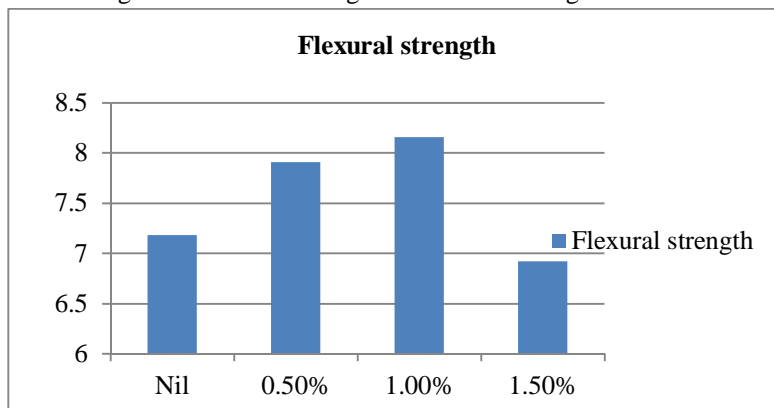


Figure-3 Flexural Strength at different Dosage of SP



VII. CONCLUSION

Concrete cubes of different mixes, were prepared & tested at the age of 7 day, 14 day & 28 day. Flexural strength of the concrete was also determined as per relevant IS code of practice. Based on the experimental results the following conclusion can be drawn-

- A. The optimum dosage of super plasticizer was found to be 1% of the weight of cement at this % of super plasticizer strength at all ages 7 days, 14 days & 28 days was found to be maximum.
- B. The 28 days compressive strength at 1% super plasticizer content was increased from 51.11mpa (at 0% super-plasticizer) to 57.03mpa (at 1% super plasticizer) that is about 11.6% increase in compressive strength was observed.
- C. Similarly the flexural strength was also increased from 7.18mpa (at 0% super plasticizer) to 8.16mpa (at 1% super plasticizer) that is approximately 13.6% increase in flexural strength was observed.

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