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COMPATIBILITY OF SUPERPLASTICIZER BS FUTURA PCX 107 WITH PPC CEMENT FOR M35 GRADE OF CONCRETE

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Abstract - *Plasticizers are being employed for enhancing the concrete properties and thus the importance of checking its compatibility with the cement is required to get desirable results. For this paper we have chosen BS FUTURA PCX 107 (allows for higher workability and strengths at lower water cement ratios.) Concrete mix designs were performed for 6 (0.5%, 0.55%, 0.6%, 0.65%, 0.7%, 0.8%) different percentages of plasticizer content with respect to weight of cement (within the range specified for super plasticizer). The compatibility was checked in two phases:*

1. Slump values: It was checked that with the increase of plasticizer content whether slump values are increasing or not. This was done to ensure desired levels of work abilities. The plasticizer was employed satisfactorily in it.

2. 28 days strength test: strength tests were performed on the concrete cubes being casted after they were left for curing and it was found that plasticizer performed satisfactorily.

Thus we can conclude that the plasticizer that we have employed is compatible with the cement within its prescribed limits.

Key Words: Slump Test, Super plasticizer, compression test, mix design

1. INTRODUCTION

The demand of concrete is increasing day by day in India, as it is developing country. The increase in demand has come up with number of challenges in concreting, retaining the slump of the concrete for higher duration and pumping the concrete at greater height. Efficiently these requirements can be fulfilled by utilization of proper admixture like plasticizer or super plasticizer. An admixture is basically added to enhance the properties of concrete. Plasticizers give high performance concrete at lower water cement ratios. Multiple brands of admixtures are available in the market, even though these cements and admixture comply with the respective codal provisions their performance is not as expected in the concrete. This has created a lot of confusion among the user about what type of admixture is used with what type of cement and what should be optimum dose of admixture.

2. MATERIALS

The material used in this experiment were cement, aggregate, BS FUTURA PCX 107, water.

2.1 CEMENT

Cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. In our experiment we used PPC cement, which has the properties mentioned in table 1.

Table -1: Properties of PCC cement

S.NO	PHYSICAL PROPERTIES	TEST RESULTS
1	Specific Gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min

There are mainly eight main ingredients in the cement. The general percentage of these ingredients are mentioned in table number 2

Table -2: Ingredient of cement

S.NO	Ingredient	Percentage
1.	Lime	60-65
2.	Silica	17-25
3.	Alumina	3-8
4.	Iron Oxide	0.5-0.6
5.	Calcium Sulfate	0.1-0.5
6.	Sulfur Trioxide	1-3
7.	Alkaline	0-1
8.	Magnesia	1-3

2.2 AGGREGATE

Aggregates form the major portion of the pavement structure. Bear stresses occurring on the roads and must resist wear due to abrasive action of traffic. Aggregates are also used in flexible as well as in rigid pavements. Therefore, the properties of aggregates are of considerable importance to highway. Aggregates are available in nature in different sizes. The size of aggregate used may be related to the mix proportions, type of work etc. the size distribution of aggregates is called grading of aggregates.

There are two types of aggregates, fine aggregates and coarse aggregates. Aggregates of size less than 4.75mm are generally considered as fine aggregate. The aggregates which are retained on the IS sieve of 4.75mm are regarded as coarse aggregate.

2.3 BS FUTURA PCX 107

BS FUTURA PCX is an advanced next generation polycarboxylic ether polymer for creating high performance concreting at the site It is a chloride free nontoxic and non-flammable material and compatible with all commonly available cements of various blends. It comes as a light liquid and is designed to deliver high range water reduction at low doses and to achieve higher strength than normally casted concrete.

Specific Gravity	1.03 Kg/l
Solid Contents	45%
Viscosity B4 Cup @30C	17 ± 1 sec
Shelf Life	2 Year from MFG Month
pH Value	8 as per DIN EN ISO 2114
Type	High Performance Plasticizer
Solubility	Soluble in Water

Fig-1: Properties of BS FUTURA PCX 107

Use of BS FUTURA PCX ensures that same high quality of concrete is maintained that is designed and specified from batching plant to placement on site. BS FUTURA PCX allows ready mix units to deliver high quality concrete whenever required for the job site.BS FUTURA PCX allows for production of very low water cement ratios that meets guidelines of high performance concrete without any reduction in workability. Allows for faster placement and early strength development in the concrete mass .There is visible improvement in the finishing of placed concrete. It allows consistency of every batch of concrete delivered.

Onsite or lab trials will establish the dose of BS FUTURA PCX ranging from 0.25% to .70% by weight of cement in normal mix design conditions the dose will vary from site to site and plant to plant based on type of application type of cement type aggregates etc.

If BS FUTURA is dosed in an incorrect over dose in the concrete mix it will create problems. For example the setting time of initial and final set will be too much delayed, the mix will bases out and rapidly loose workability .Plastic shrinkage will increase leading to cracks

In case of little overdose there will not be much negative effect on the final strength of concrete in fact it will achieve final better than normally admixed concrete from older category of plasticizer but it has to be carefully compacted and regularly cured.

2.4 WATER

Normal portable water obtained from the Municipal water supply was used for the experiment.

3. MIX DESIGN OF M35

For 0.5% admixture (by weight of the cement)

Target Strength=43.25 N/mm^2

Total water content=186kg

Therefore cement content =413kg

Minimum cement content=531kg

Water cement ratio = 0.35

Volume of cement =0.1691m^3

Volume of water = 0.186m^3

Volume of admixture=0.002577m^3

Volume of total aggregate=0.6423m^3

Ratio of coarse aggregate and total aggregate=0.15

Volume of coarse aggregate=0.4174m^3

For pump able concrete, coarse aggregate decrease by 10%.

Volume of coarse aggregate=0.3756m^3

Volume of fine aggregate=0.2666m^3

Weight of coarse aggregate=1010.364m^3

Weight of fine aggregate=717.154m^3

For casting of 4 cubes, considering one of the four cubes as waste, the quantity of the ingredients are mentioned in table number 2

Table -3: Ingredient quantity of concrete

S.NO	Ingredient	Quantity(kg)
1.	Cement	7.13
2.	Fine aggregate	9.63
3.	Coarse aggregate	13.55
4.	water	2.5

4. SLUMP TEST

Concrete slump test is done to determine the workability or consistency of concrete mix prepared at the laboratory or the construction site during the progress of the work. Concrete slump is carried out from batch to batch to check the uniform quality of concrete during the construction.

In our experiment, hand mixing of constituents was done with proper tools and equipment. Additional water was added to counter the evaporation losses

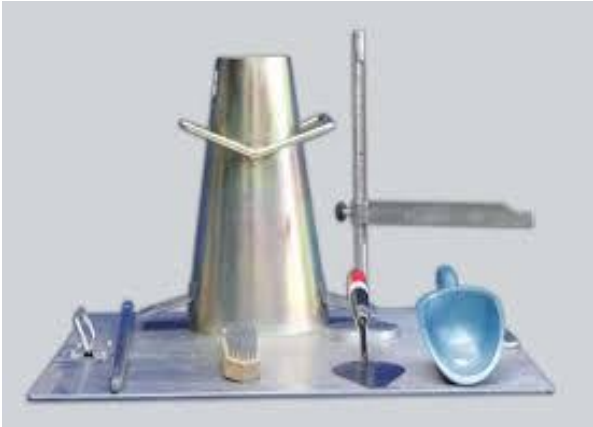

Fig-2: Slump Test equipment

Slump test was done immediately after mixing to examine the workability of freshly prepared concrete and corresponding slump value is noted down for each mix. In this test the concrete was filled in a slump cone in three layers, each layer being tampered 25 times.

The test was repeated for 6 times for different value percentages of plasticizer added to the concrete (by weight of cement)

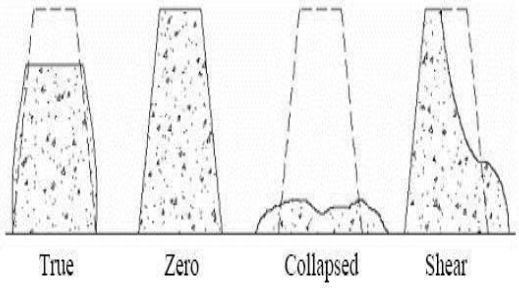

Fig-3: Types of Slumps

Table-4: Slump Test result

S.No	Plasticizer (%)	Slump(ml)	Water for evaporation loss(ml)
1.	0.5	10	400
2.	0.55	20	400
3.	0.6	20	400
4.	0.65	20	400
5.	0.7	30	400
6	0.8	20	400

5. COMPRESSION TESTING

The concrete cubes were casted by using 150mm concrete specimen mould. The interior of the mould was lubricated. For each percentage of the super plasticizer to be added in the concrete (by the weight of the cement) 3 samples were casted. And in total 18 total cubes were casted.

The casted moulds were kept on vibrating table for proper packing and arrangement of concrete in the mould. The curing was done to maintain the moisture and temperature conditions of concrete for the normal occurrence of hydration reaction.

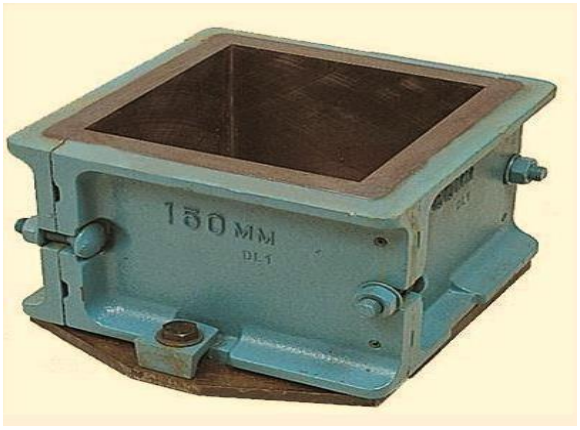

Fig-4: Concrete specimen mould

Fig-4: Compression testing machine

Table-5: Compression Strength Result

Cube No.	Plasticizer Content %age	Attempted Area Mm^2	Achieved Area Mm^2	Force KN	Pressure N/mm^2
1	0.5	22500	21700	531.5	33.622
2	0.5	22500	22000	466.5	36.733
3	0.5	22500	21900	425.5	35.911
4	0.55	22500	21800	462	45.533
5	0.55	22500	21300	325.3	37.124
6	0.55	22500	21600	434	39.288
7	0.6	22500	21800	420	38.666
8	0.6	22500	21400	515	37.888
9	0.6	22500	21600	371	36.488
10	0.65	22500	21000	418.5	38.6
11	0.65	22500	21600	505	42.444
12	0.65	22500	21700	486.7	31.643
13	0.7	22500	22100	529	41.511
14	0.7	22500	21500	593	40.355
15	0.7	22500	22000	595	36.44
16	0.8	22500	21900	715	38.778
17	0.8	22500	21600	736	39.711
18	0.8	22500	21800	703.5	37.266

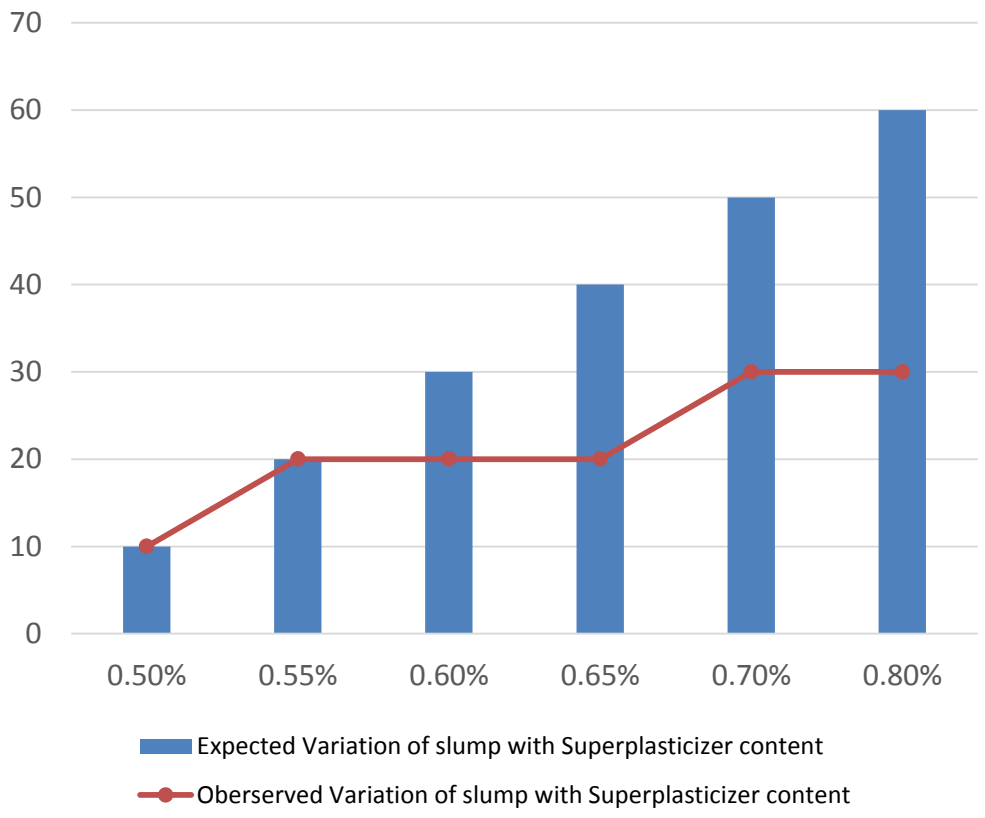

Chart -1: Expected and Observed variation of Slump with Super plasticizer

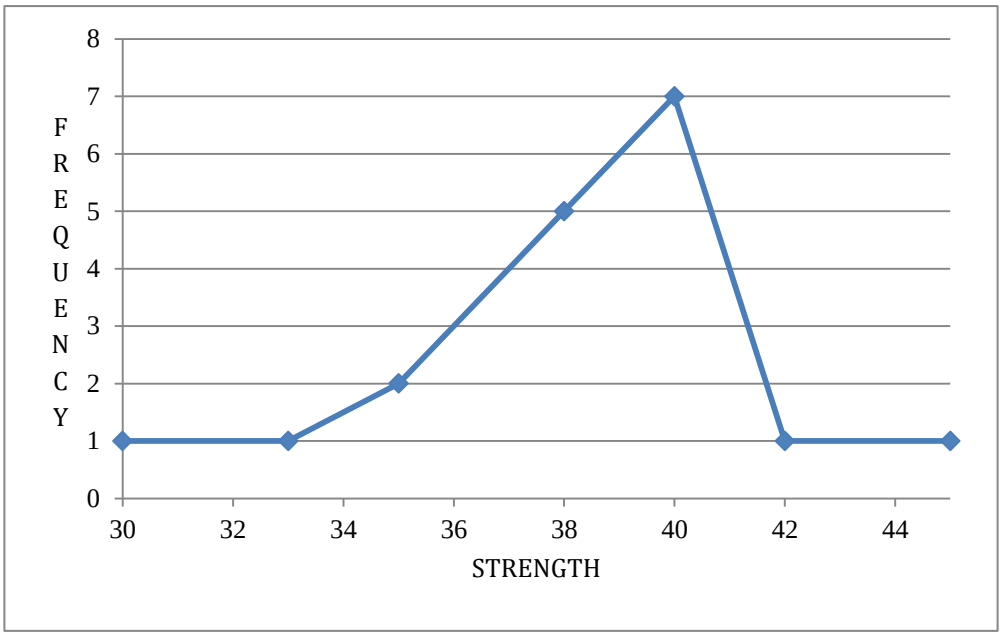

Chart -2: Strength of cube and its frequency

6. CONCLUSION

The Super plasticizer that we employed failed to provide desired strength of concrete also the workability variations that were expected for different percentage of plasticizer was not observed. Thus either this can be concluded that the super plasticizer it is not compatible with our concrete mix.

7. REFERENCES

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