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Study of Super Plasticizer on Concrete

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ABSTRACT: *Concrete has been the leading building material since it was first used and is bound to maintain its significant role in the upcoming more due to adaptability to any size and shape, wide range of structural properties, durability, maintenance free service life and cost. The concrete must be strong enough to withstand all the imposed stresses without injury and the required factor of safety. It is obtained by mixing cementations material, water and aggregates (sometimes admixtures) in required proportions. The strength, durability and other characteristics of concrete depend upon the properties of its ingredients, proportions of mix, the method of compaction and controls dating placing, compaction and curing.*

The influence of various types of super plasticizers on the behavior of concrete has, been investigated in the present study. Three concrete mix proportion (1:1.5:3), (1:1.25:2.5), (1:1:2) have been prepared with keeping the different amount of water cement ratio (0.48, 0.5, 0.42, 0.45 and 0,4). The superplasticizers content has been taken in the range of 0.5 - 1.0% by weight of cement. Six superplasticizers (R-522LN, R-522NS, G-30 GP.G-141, P-1671 and C-432 BS) based on polycarboxilic ether, lignosulphonated polymer and sulphonatednaphathlene polymer has been used in the present studies. Workability, split tensile strength and compressive strength tests at 28 days of age have been carried out.Workability of the fresh mortar has been determined using slump test and compaction factor test. It has been observed from experimental results that workability increased with the addition of SPs.

Keywords: Polymer ,Naphathlene, Polycarboxile.

INTRODUCTION: The word concrete‖ originates from the Latin world concrete. Which means to grow together [Latin looks up retrieved Oct 1, 2012]. Concrete is the most widely used man made Construction material. The strength, durability and other characteristics of concrete depend upon the properties of its ingredients, proportions of mix, method of compaction and controls during placing, compaction and curing. The ingredients can be classified into two groups active and inactive. The active group consists of cement and water where as inactive group consists of fine and coarse aggregates. Addition of Concrete admixtures is a frequently used application in concrete production. Although the use of concrete admixtures is not obligatory in concrete nowadays, concrete production without any admixture decreases with every passing day. The use of admixtures becomes inevitable in terms of improving the characteristics of both fresh and hardened concrete such that not only single admixtures but also more than one admixture is used concurrently for the production of concrete. [MS Shetty, 2003 and M.L Gambir, 2004]

Due to the industrial revolution people of the rural areas have been shifting in huge numbers to urban areas. Land costs in preferred areas have become almost prohibitive. Due to the shortage of land, high rise buildings are constructed and for the construction of these high rise buildings flowable concrete is required. In the present study high range water reducing admixtures have been used to make the concrete more workable.

Need and scope of present study

The objective is to investigate the effect of different superplasticizers (SPs) on the fresh and hardened properties of concrete. In this context six types of SPs are utilized. From six types of SPs two Spspolycarboxylate based two sulphonated naphthalene polymer based and two lignosulfonate based were used. The various properties of concrete to be studied in the present investigation are:-

To investigate the behavior of superplasticizers in both fresh and hardened state with different mix proportions so as to produce the desired strength of concrete Effect of super plasticizers on compressive strength of concrete Type and amount of super plasticizer To investigate the workability of concrete with the addition of

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superplasticizers in different percentage of dosages (0.5% and 1.0%) To observes compressive and split tensile strength of hardened concrete.

METHODOLOGY:MATERIALS AND EXPERIMENTAL PROGRAM

Introduction

The materials and experimental program are described in this section for both the laboratory and field test programs. Mix proportion variables, experimental procedures, and fresh and hardened concrete tests are set forth.

Materials

Portland Cement. One type of portland cement was used throughout the entire project. A commercially available ASTM Type I portland cement meeting ASTM

Concrete Aggregates. The limestone aggregate had a bulk specific gravity at SSD of 2.54and the river gravel aggregate had a bulk specific gravity at SSD of 2.62.

Fine Aggregate. A natural river sand from the Colorado River was used for all readymix batches. It met all the performance requirements of ASTM C33-86 and had a bulk specific gravity at SSD of 2.62. A gradation analysis of samples was carried out in accordance with ASTM C136-84a, *Standard Method* for *Sieve* and The resulting fineness modulus calculations were 2.88 and 3.21, respectively, for the fine aggregate samples. Though significantly different, each sample met the gradation limitations set forth in ASTM C33-86.

Water. The water was drawn either directly from the Colorado River or from a well. The supply meets the criteria set forth in ASTM C94-86b, *StandardSpecification for Ready-Mixed Concrete.*

Superplasticizers. Two commercially available superplasticizers were utilized for this study.

MIX PROCEDURE

Each mix was hatched at a local readymix concrete plant. The author was present during hatching of each readymix concrete load produced for this project.Each day the same procedure was followed. The readymix truck driver was asked to thoroughly rinse and clean the inside of the drum. Aggregates were weighed and all admixtures were added to the mix water. Weighing, dispensing, and mixing were all carried out in accordance with ASTM C94-86b, *Standard Specification* for *Ready-Mixed Concrete.* Samples of coarse and fine aggregates were taken directly from the plant silo storage.

After hatching of all the materials, the driver then proceeded to rinse the exterior of the drum and the outermost fins. After completion of 5 to 10 minutes of initial mixing time, a slump test was carried out at the readymix plant. Water was added by the driver from the on board supply if the slump was not the desired target value. After the desired slump was achieved, the concrete was transported to the laboratory

EXPERIMENTAL RESULTS

The results of workability (slump and compaction factor), compressive strength and split tensile strength of different concrete mixes are given in Tables

Variation in compressive strength and split tensile strength is calculated by standard deviation and coefficient of variation. Standard deviation increases with increasing variability. Gambhir has given the standard deviation &coefficient of variation for different types of quality control for concrete mixes.

Workability, Compressive strength and Split tensile strength results of

Mix 1: 1.5:3, W/C = 0.5, Dosage = 0.5% by cement mass

S. No	Name of super-plasticizer	Slump Value(mm)	Compaction factor	Compressive strength(MPa) at 28 days	Split tensile strength (MPa) at 28 days
1	Control Mix	25	0.75	30.37	1.996
2	R-522 LN	150	0.92	30.23	2.004
3	R-522NS	140	0.92	29.39	2.00
4	G-30GP	170	0.94	34.04	1.81
5	G-141	175 [1]	0.92	32.26	1.94
6	P-161	150	0.92	31.50	2.182
7	C-432BS	140	0.92	32.86	2.16

DISCUSSIONS OF TEST RESULTS

Discussion of mean compressive strength vs. Standard deviation andcoefficient of correlation. Minimum standard deviation and coefficient of variation has been observed for G-30 GP indicating higher mean compressive strength i.e. excellent quality control and workmanship.Also maximum standard deviation and coefficient of variation has been observed for G-141 indicating moderate increase in mean compressive strength i.e. good quality control and workmanship

CONCLUSIONS

As a result of this experimental study, the following conclusions have been made:

- With addition of SPs workability increases rapidly. In the present study polycarboxlic ether based SPs especially G-30 JP have given maximum slump and compactor factor value.
- It has been observed that with addition of SPs the valve of compressive strength varies in the range of 27.41 to 39.73 MPa.It has also been observed that with addition of G-30 GP compressive strength increases with both 0.5% and 1% dosage. With 0.5% dosage of P161, compressive strength increases but reduces after addition of 1.0% dosage.

Effect of increase in percentage of superplasticizers for 0.5% to 1.0%. It has been observed that workability and compressive strength increased with G-30 GP (0.5% and 1%) but the split tensile strength decreased. P-161 increased the compressive strength with the 0.5% dosage but reduced compressive strength with addition of 1.0% dosage.

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