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HIGH STRENGTH CONCRETE USING PURIFIED FLY ASH

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Abstract – For the shelter requirements of widely spreading population civil industry also spreading enormously. With different and advanced construction techniques numbers of materials used in this construction procedure are also developed and used in general practice. Cement is base product for every type of construction. It is made from natural material with special factory procedure. This cement or cementitious material has strength up to 53 MPa. But while practicing higher grade concretes which has strength more than 65 MPa we have to use some special processed material mixture with cement. During this material study we have to use material purified fly ash. This fly ash possess some good qualities like extra silica percentage, more fine and better surface area. So it is better option than factory waste fly ash and silica fume to achieve desired strength of concrete. With different trial mixes we can use it in general practice.

***Key Words*:** fly ash, silica fume, super plasticizer, purified fly ash,

I. INTRODUCTION

Since 19th century cement prove itself as a base construction material for every type of structure. It is famous due to its mixing ability with other reactive and inert material in cement to develop new product as per our requirements and standards. High performance concrete is a concrete mixture that has high strength and durability than conventional concrete. As different types of materials are used in modern concrete practices HPC also continues this list. This concrete mix consists of one or more cementatious material such as fly ash, silica fume, GGBS and purified or processed fly ash. Polycarboxilin ether based super plasticizers can lower w/c ratio greatly enhance strength, durability and practical properties.

1.1 Objectives and significance

The main objective of present study is to develop High strength concrete by varying mix proportions of replacements of mineral admixtures with varying dosage of super plasticizer and follow the provisions given in IS codes regarding mix design. Here the investigation is carried out for M100 grade concrete to produce High strength concrete using mineral admixtures to obtain good strength and workability of designed mix.

II. MATERIAL

2.1 Cement: Cement is the primary constituent for manufacturing concrete. Here Ordinary Portland Cement (53grade) confirming to IS12269-1987 was used. Specific gravity of cement is 3.15.

2.2 Fine aggregate: Locally available river sand free of silt confirming to IS 383-1970 with specific gravity 2.7 is used.

2.3 Coarse aggregate: Crushed stone aggregate of 10-12 mm size is added from nearby quarry with specific gravity 3.01 confirming to IS 383-1970

2.4 Super plasticizing Admixture: The hyper plasticizers shall be ADDMIX 389and ADDMIX 345R , high range water reducing, Superplasticizer based on polycarboxylic ether formulation. The products shall have specific gravities 1.08 and 1.14. Solid contents not less than 40% by weight.

2.5 Purified Fly Ash: purified fly ash is highly pozzolanicaly active in nature. It has particle size less than 45 and 25 microns. It also has high percentage of silicon. It is produced in Kupwad MIDC, sangli by SP Concare limited.

2.6 Fly Ash: This is produced from thermal power plant in the form of dry powder confirming to IS 3812-1981

2.7 Silica Fume: Silica fume is very fine non crystalline silica. It is produced in electric arc furnace having specific gravity 2.2 is used.

2.8 Water: Water used for mixing and curing should be potable and free from any harmful material.

III. METHODOLOGY

In this investigation we replace the cement with mineral admixture such as purified fly ash, Silica fume and Fly ash in various percentages. We take W/c ratio in varying percentage. Here super plasticizer is used for better workability. By using cube of 150 x 150 x 150 mm size, different concrete mixes is cast and test is conducted to find compressive strength at 7 days and 28 days curing period.

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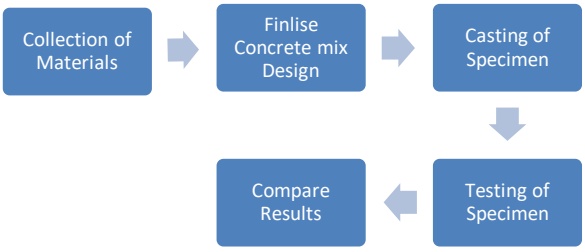


Chart -1: Methodology chart

3.1 Compression test
The compression test on Concrete is done on the standard size of cube 150 x 150 x 150 mm. The test is performed after 7and 28 days curing. The Compression strength is calculated as follows.

fck = P/A

Where,

P = Load at Failure (N)

A = Cross sectional area (mm^2)

fck = Compressive Strength (N/mm^2)

IV. CONCRETE MIX DESIGN

Mix Design 1
15% Fly ash, 10 % Silica Fume, 2% Admixture
Cement = 581.675kg/m^3
Fly ash = 116.325 kg/m^3
Silica Fume = 77.5 kg/m^3
Water = 141 kg/m^3
Fine Aggregate = 514.38 kg/m^3
Coarse Aggregate = 1133.23 kg/m^3
Admixture = 14.36 lit/m^3
W/C Ratio = 0.20
Revised W/C Ratio = 0.18

Mix Design 2

25% POZZOCARE SP 45, 10% POZZOCARE SP 25, 1.4 % Admixture
Cement = 504 kg/m3
POZZOCARE SP 45 = 193.88 kg/m3
POZZOCARE SP 25= 77.5 kg/m3
Water = 141 kg/m3
Fine Aggregate = 514.33 kg/m3
Coarse Aggregate = 1133.23 kg/m3
Admixture = 10.053 lit/m3
W/C Ratio = 0.2
Revised W/C Ratio = 0.18

Mix Design 3

15% Fly ash, 10% Silica fume, 0.6 % Admixture
Cement = 440 kg/m3
Fly ash = 69 kg/m3
Silica Fume = 44 kg/m3
Water = 141 kg/m3
Fine Aggregate = 672 kg/m3
Coarse Aggregate = 1100 kg/m3
Admixture = 4.74 lit/m3
W/C Ratio = 0.25

Table -1: Compressive strength at 7 days

Sr.No	Mix Proportions	Compressive strength at 7 days	
		fck	Average fck
A]	M100 + 15% Fly ash + 10% Silica Fume +2% Admix-389	57.7 62.3 57.5	59.16
B]	M100 + 15% POZZOCARE SP 45 + 10% POZZOCARE SP 25 + 0.6 % Addmix-345R	57.4 57 56.9	57.1
C]	M100 + 25% POZZOCARE SP 45 + 10% POZZOCARE SP 25 + 1.4 % Addmix-345R	60.3 58.9 62.6	60.6

Table -2: Compressive strength at 28 days

Sr.No	Mix Proportions	Compressive strength at 28 days	
		fck	Average fck
A]	M100 + 15% Fly ash + 10% Silica Fume +2% Admix-389	62.1 70.1 60.2	64.1

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B]	M100 + 15% POZZOCARE SP 45 + 10% POZZOCARE SP 25 + 0.6 % Addmix-345R	93.4 88.7 90.4	90.8
C]	M100 + 25% POZZOCARE SP 45 + 10% POZZOCARE SP 25 + 1.4 % Addmix-345R	66.3 71 69.8	69

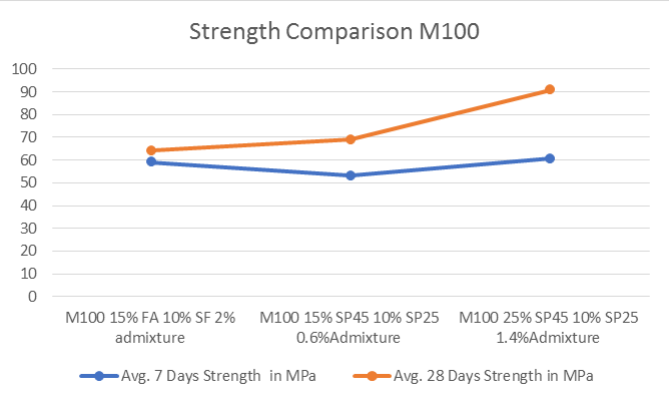


Chart - Compressive strength at 7 and 28 days



Fig -1 : Casting of Concrete blocks

V. CONCLUSIONS

- As w/c ratio is low super plasticizer is required for better workability.
- For High strength concrete 8 – 10 mm size coarse aggregate gives better results than 20 mm size aggregate.
- For higher the strength of concrete lower the w/c ratio required.
- The max strength achieved at 28 days is 90.8Mpa with replacement of mineral admixture 25% POZZOCARE 45 + 10% POZZOCARE 25 to cement.
- The percentage of mineral admixtures such as POZZOCARE 45, POZZOCARE 25 are gives better results in combination of two admixtures than single.
- It observed that workability of concrete decreases when adding mineral admixtures.
- The optimum dosage of replacement mineral admixtures to cement is 30-35%

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