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HIGH STRENGTH CONCRETE USING ADMIXTURES

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Abstract: *In todays world there is challenging works are dene in civil and Infrasture industry. The concrete is most widely used construction material due to its economy and workability. A Cement is Most important ingredient in concrete. Pozzolanic material gives strength to concrete. In some situations, we require good strength and workability for concrete in special structures. Various types of mineral admixtures such as Fly ash, Silica Fume, Metakaolin etc are used along with cement in some percentages to enhance properties of Cement concrete.*

Hence an attempt has been made in the present investigation on replacement of cement with mineral admixtures in some percentages and we achieve target strength and to develop High strength concrete.

Key Words: *High Strength, Fly Ash, Silica fume, Metakaolin Super plasticizer etc.*

1. INTRODUCTION

Concrete is commonly used material in construction industry. For more than 30 years.Concretes with compressive strengths of excess of 41mpa have been used in the construction of high-rise structures. While the availability of (High Strength concrete) HSC was limited initially to a few geographic locations, opportunities to use these concretes at more locations across the world has arisen. With the increase of this opportunity's material producers have accepted the challenge to manufacture with high compressive strengths. Although this technology is developed firstly for the use in high rise buildings, the same technology is now applied for the concretes for bridge girders and decks. High strength concrete can be defined as A concrete meeting Special collage of performance and uniformity requirement that cannot always be accomplished routinely using conventional constituents and normal mixing, placing and curing practice. High strength concrete can be developed using Cementous material with lower w/c ratio and super plasticizer.

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 at constant dosage of super plasticizer and follow the provisions given in IS codes regarding mix design. Here the investigation is carried out for M80 grade concrete to produce High strength concrete using mineral admixtures to obtain good strength and workability of designed mix.

2. MATERIAL

2.1 Cement: Cement is the primary constituent for manufacturing concrete. Here Pozzolana 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 2.65 is used.

2.3 Coarse aggregate: Crushed stone aggregate of 10-12 mm size is added from nearby quarry with specific gravity 2.74 confirming to IS 383-1970

2.4 Super plasticising Admixture: The hyper plasticiser shall be ADDMIX 389, high range water reducing, Superplasticizer based on polycarboxylic ether formulation. The product shall have specific gravity of 1.1 & solid contents not less than 40% by weight.

2.5 Metakaolin: Metakaolin is highly pozzolanic in nature.It is primary product generated from dehydroxylation of kaolin clay under temperature 700-850 ° C It is obtained from Minal Chemicals Ahmadabad Gujarat

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

3. METHODOLOGY

In this investigation we replace the cement with mineral admixture such as Metakaolin, Silica fume and Fly ash in various percentages. We take W/c ratio in constant

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.

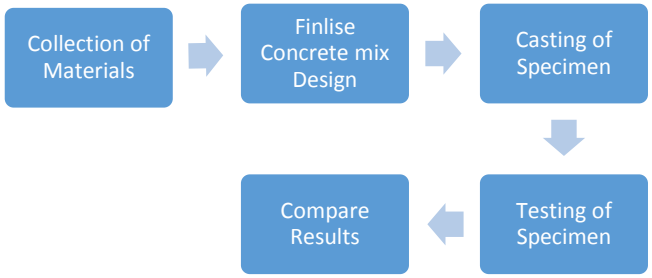

Chart -1: Methodology chart

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)

4. CONCRETE NIX DESIGN

Mix Design 1 M80 + 20% Fly ash

Cement = 433.6 kg/m3
Fly ash = 108.4 kg
Water = 151.76 kg/m3
Fine aggregate = 788.69 kg/m3
Coarse aggregate = 957.30 kg/m3
Chemical admixture = 2.76 kg/m3
w/cm = 0.28

Mix Design 2 M80 + 15% Fly Ash +10% Metakaolin
Cement = 406.5 kg/m3
Fly ash = 81.30 kg.
Metakaolin = 54.2 kg/m3
Water = 151.76 kg/m3
Fine aggregate = 789.91 kg/m3
Coarse aggregate = 958.78 kg/m3
Chemical admixture = 2.76 kg/m3
w/cm = 0.28.

Mix Design 3 M80 + 10% Metakaolin
Cement = 487.8 kg/m3
Metakaolin = 54.2 kg.
Water = 151.76 kg/m3
Fine aggregate = 988.60 kg/m3
Coarse aggregate = 1199.95 kg/m3
Chemical admixture = 2.76 kg/m3
w/cm = 0.28

Mix Design 4 M80 + 15% Fly Ash +5% Silica fume
Cement = 433.6 kg/m3
Fly ash = 81.30 kg.
Silica fume = 27.1 kg/m3
Water = 151.76 kg/m3
Fine aggregate = 788.69 kg/m3
Coarse aggregate = 957.30 kg/m3
Chemical admixture = 2.168 kg/m3
w/cm = 0.28.

Table -1: Compressive strength at 7 days

Sr.No	Mix Proportions	Compressive strength at 7 days	
		fck	Average fck
A]	M80 + 20% FA	47.11	
		53.33	48.29
		44.44	
B]	M80 + 15% FA + 10%MT	50.60	
		44.45	49.46
		53.32	
C]	M80 + 10% MT	37.78	
		42.67	48.29
		44.44	
D]	M80 + 15% FA + 5% SF	59.11	
		43.56	52.89
		56.00	

Table -2: Compressive strength at 28 days

Sr.No	Mix Proportions	Compressive strength at 28 days	
		fck	Average fck
A]	M80 + 20% MT	81.44	
		80.89	82.07
		86.22	
B]	M80 + 15% FA + 10%MT	82.67	
		79.11	83.11
		87.56	
C]	M80 + 10% MT	82.67	
		879.11	83.11
		87.56	
D]	M80 + 15% FA + 5% SF	88.44	
		80.89	85.18
		86.22	

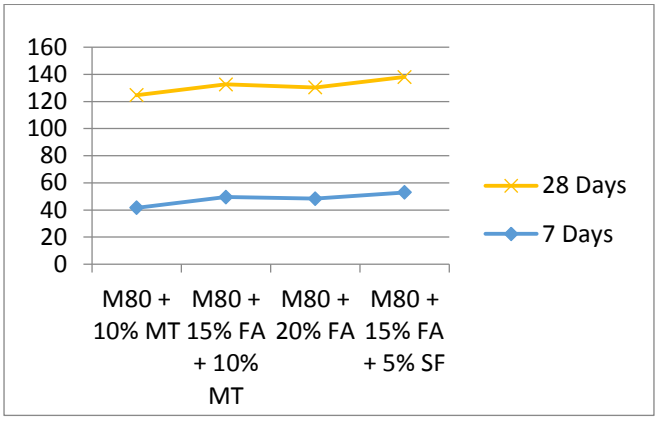

Chart -2 Compressive strength at 7 and 28 days

Fig -1: Concrete block after 28 days curing

3. CONCLUSIONS

- As w/c ratio is low superplasticizer is required for better workability.
- For High strength concrete 10 – 12 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 85.12 Mpa with replacement of mineral admixture 15% Fly ash + 5% Silica fume to cement.
- The percentage of mineral admixtures such as Fly ash, Metakaolin, Silica fume 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 10-15%

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