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FIBER REINFORCED CONCRETE SELF-CONSOLIDATING CONCRETE INCORPORATED WITH SINTERED FLYASH AGGREGATE EXPOSED TO ELEVATED TEMPERATURES

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Abstract: The development of new kind of high performance concretes, such as self-consolidated concrete (SCC) or lightweight concrete (LWC) responds to some requirements of the construction industry. Lightweight concrete has been used for a number of applications and is known for its good performance and durability. In structural applications the dead load of a concrete structure is important Sintered fly ash aggregate is the best for the use in structural applications. In addition to the light weight aggregate fibres which are best known for resisting cracks, fatigue , bending , durability etc are also included to get more effective outputs from the members. Specimen were casted with fibres and sintered fly ash aggregate , allowed to cure for a period of 28 days . After the curing period of 28 days specimens are allowed for temperature study of different temperatures at 100˚C, 300˚C, 600˚Cand 900˚C . Then allowed to heat in high temperature furnace equipment which has a capacity of 1000˚C for 3 hours at each standard temperatures. Compressive strength is known after cooling by using compressive testing machine and then results are compared with normal SCC mixes of M2o and M3o grade of partially replaced with 10,20,30 and with coarse aggregate concrete and consulate produced with sintered flyash aggregate and fibres . Reduction in dead load, cracking, fire resistance of the structure using these light weight aggregate combined with fibres.

Index Terms **- Component, formatting, style, styling, insert.**

I. INTRODUCTION

In plain concrete, there is weakness due to the presence of micro cracks in the mortor – aggregate interface. This weakness can be removed or can be made negligible by the inclusion of steel fibers in the mixture. Different types of fibres such as polymer, glass, ect., can also be used in composite materials which can be introduced in to the concrete mixture to increase its toughness, or ability to resist to crack growth. The concrete in which the fibres help to transfer loads at the internal micro cracks is called as fibre – reinforced – concrete (FRC).In plain concrete, structural cracks develop even before loading particularly due to drying shrinkage cracks may be caused even due to other volume change due to expansion and shrinkage. The width of these initial cracks is in the range of microns. When concrete is loaded this micro crack will propagate and pen up. Due to stress concentration, additional micro cracks are formed. The micro cracks are the main cause for elastic deformation in concrete

II APPLICATIONS

Current conditions on application of self – compacting concrete in Japan. After the development of the prototype of self – compacting concrete at the University of Tokyo, intensive research was begun in many places, especially in the research institutes of large construction companies. As a result, self – compacting concrete has been used in many practical structures. The first application of self – compacting concrete was in a building in June 1990. Self – compacting concrete was then used in the towers of a pre stressed concrete cable – stayed bridge in 1992. Since then, the use of self-compacting concrete in actual structures has gradually increased.

III Materials in SCC

In this chapter, Mechanical properties and durability studies on lightweight aggregate of self-compacting concrete of different grades of M20, M30 and M40 were examined. For this experimental investigations were carried out on the fresh and hardened properties of pumice lightweight aggregate of self-compacting concrete. The experimental program was conducted in the various steps to achieve the following studies.

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 (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete

Coarse Aggregate

Aggregates whose particles does not pass through 4.75mm termed as coarse aggregates Coarse aggregates are generally considered as a inner material and only its physical properties like shape, size, water adsorption and specific gravity is studied. Crushed granite material which is used as coarse material is locally available in the market

Fine Aggregate

Aggregates whose particles pass through 4.75mm sieve is termed as fine aggregates. **S**and is a naturally occurring granular material composed of finely divided rock and mineral particles. The most common constituent material of sand is silica, usually in form of quartz. River sand is locally available in the market which should pass IS Sieve 4.75mm were tested as per IS: 2386-1963 conforming specifications.

Sintered fly ash aggregate

Sintered fly ash light weight aggregate substitute's natural stone aggregate in concrete, reducing dead weight. It can also be used in production of light weight precast concrete blocks for use in load and non load bearing elements. The fly ash nodules made with the help of water are fired at 1200˚C. The fine particles of fly ash melt at the surface and are welded together. The nodules crumble during the sintering process. Mixing 5, 10 & 20% plastic clay in fly ash produce good quality aggregate. The sintered fly ash aggregate concrete is spherical in shape, possessing 5-20 mm size and light grey colour. Water absorption is 15-20% in uncrushed material and 40-50% in crushed material; bulk density: 640-750 kg/m3, aggregate crushing strength

MINERAL ADMIXTURES

Mineral admixtures are used for the requirement of flowability. These mineral admixtures must have the fineness to that of cement. Mineral admixtures will have different morphology and size distribution. This may improve in particle friction, viscosity deformability and stability of self-compacted concrete
Chemical admixtures
In chemical admixtures, SCC incorporates in every study according to HRWRA. This HRWRA helps to achieve good water content and due to VMA it reduces bleeding and improves the stability of concrete mix. The usage of VMA gives more stability to SCC
The commonly used chemical admixtures are

- High range water reduces (HRWRA)
- Viscosity modifying agents (VMA)

Fly ash

Fly ash is one of the most uneconomical used by-product materials in the construction field. It is an inorganic, non-combustible finely divided residue which is collected from exhaust gases of any industrial furnace. The particle size of fly ash is about 20 microns which is commonly similarly to average particle size of Portland cement. The physical and chemical properties of fly ash are used as investigation confirms to grade I.

Fibres

Fibres are usually used in concrete to control plastic shrinkage cracking and drying shrinkage cracking. They also lower the permeability of concrete and thus reduce bleeding of water. Some types of fibres produce greater impact, abrasion and shatter resistance in concrete. Generally fibres do not increase the flexural strength of concrete, so it cannot replace moment resisting or structural steel reinforcement. Some fibres reduce the strength of concrete.

IV Mix Proportions

Grade	Percentage replacement	Cement Kg/m^3	FA Kg/m^3	CA Kg/m^3	SFA Kg/m^3	Fly-ash Kg/m^3	S.P % Kg/m^3	Water Kg/m^3
M20	10%	263.87	960	594	17.5	316.7	17.3	248.3
	20%	263.87	960	528	35	316.7	17.3	248.3
	30%	263.87	960	462	52.5	316.7	17.3	248.3
M30	10%	374.95	942.6	617.85	18.2	383.1	22.7	206.2
	20%	374.95	942.6	549	36.4	383.1	22.7	206.2
	30%	374.95	942.6	480.48	54.6	383.1	22.7	206.2

V Workable Properties

Type of mixes	Grade of Concrete	Coarse Aggregate %		Hardened properties					
		Gravel %	SFA %	Compressive Strength		Flexural Strength		Split tensile strength	
				7 days (MPa)	28 days (MPa)	7 days (MPa)	28 days (MPa)	7 days (MPa)	28 days (MPa)
NW SCC	M20	100	-	18.3	27.2	4.3	6.8	3.7	5.1
	M30	100	-	23.9	38.9	6.6	8.6	4.1	6.1
LW SCC	M20	90	10	15.6	28.5	3.9	6.2	3.5	5
		80	20	21.85	30.7	3.5	64.5	3.9	5.3
		70	30	19.2	30.3	4.4	6.6	3.7	5.1
	M30	90	10	20.9	36.5	6.6	8.4	4.1	6
		80	20	23.8	39.4	6.71	8.8	4.2	6.3
		70	30	29.2	38.2	6.5	8.6	4	6.1

M20 Grade at 100˚C, 300˚C, 600˚C temperatures

M30 Grade at 100˚C, 300˚C, 600˚C temperatures

Compressive strength of LWSCC for 28 days at 300˚C

Type of mixes	Grade of Concrete	Coarse Aggregate %		Hardened properties
		Gravel %	SFA %	Compressive strength
				28 days (MPa)
NWSCC	M20	100	-	27.2
	M30	100	-	38.9
LWSCC	M20	90	10	26.3
		80	20	25
		70	30	24.7
	M30	90	10	35
		80	20	36.1
		70	30	34.5

Compressive strength of LWSCC for 28 days at 600˚C

Type of mixes	Grade of Concrete	Coarse Aggregate %		Hardened properties
		Gravel %	SFA %	Compressive strength
				28 days (MPa)
NWSCC	M20	100	-	27.2
	M30	100	-	38.9
LWSCC	M20	90	10	23.1
		80	20	24
		70	30	23.3
	M30	90	10	29.1
		80	20	29.5
		70	30	20.8

VI CONCLUSIONS

In M20 grade of concrete at 20% replacement of SFA aggregate resulted 11.4% increase in compressive strength, 1.4% increase in flexural strength, 3.7% increase in split tensile strength.
In M30 grade of concrete at 20% replacement of SFA aggregate resulted 2.27% increase in compressive strength, 2.3% increase in flexural strength, 3.2% increase in split tensile strength
In M20 grade of concrete at 20% replacement of SFA aggregate resulted in 6.6% increase in compressive strength at 100˚C, 7.5% decrease at 300˚C, 15.1% decreases at 600˚C and fails at 900˚C temperatures.
In M30 grade of concrete at 20% replacement of SFA aggregate resulted in 1.28% increase in compressive strength at 100˚C 10.3% decrease at 300˚C, 21.03% decreases at 600˚c and fails at 900˚C temperatures

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