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EXPERIMENTAL INVESTIGATION OF HIGH STRENGTH SELF-CURING CONCRETE WITH ROBO SAND AS FINE AGGREGATE

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Abstract – *Curing is the most important factor which influences the hardening of concrete. It is carried out to maintain the moisture content and continue the hydration process in concrete which ensures the concrete in gaining its designed strength. Water is used as the conventional curing process since a long time. Due to high demand in concrete in modern era urban civilization, adopting water curing can be difficult in many areas and poses many challenges in nature/environment. Hence, many different methods are considered for curing process. Even river sand has become a huge demand and also leads to reduction of riverbeds, in the given situation robo-sand came as a solution which can be environmentally friendly substitute as fine aggregate.*

The current study investigates the how curing compound PEG-400 have an influence in concrete where robo-sand is used as fine aggregate. The experiments are conducted on high strength concrete grades say, M70 and M80 using GGBS and alccofine as cementitious substitutes, with varying dosages of PEG-400. Compression test, Split Tensile test, flexural strength test are different mechanical tests are conducted on concrete.

Key Words: PEG-400, Robo-sand, High-Strength concrete, GGBS, Alccofine

1.INTRODUCTION

Concrete is made by blending aggregates and binding material together. It has been in use since many ages and over course of period different materials are used in making concrete. To develop the strength and durability of concrete, curing is carried out for concrete. Water curing is most used curing method since a long time. Water scarcity is a huge problem in many areas hence different curing methods are adopted like using chemical curing agents, light weight aggregates, bio admixtures...etc. In previous studies it is proved that using of different curing agents in concrete have enhanced different properties of concrete. In modern urbanization, high performing concrete are of huge demand in high rise structures. By using different supplementary cementitious materials in concrete helps in gaining high strength at early stage and some materials like ggbs helps in maintaining later strength that helps the concrete last long. Using SCM's in concrete will also help in reducing carbon footprint and use of microfines in concrete aid to improving hydration reaction and build condensed binder paste. As stated early, the growing high-rise buildings, demand for fine aggregates will also be greater. Robo sand came as better substitute of river sand as fine aggregate which can be available cheaper than river sand. Studied has shown that there is no compromise in concrete properties when robo sand is used as fine aggregate.

1.1 Scope and objectives

The scope of this experimentation is to finding the influence of internal curing agent PEG-400 in high strength concrete while replacing the river sand with robo sand as fine aggregate.

2.MATERIALS USED

2.1. Cement: Ordinary Portland Cement (OPC) 53 grade is used having 3.15 specific gravity is used.

2.2. GGBS: GGBS specific gravity of 3 and bulk density of 1350kg/m3 complying with IS code is used.

2.3. Microfine: Alccofine-1203 microfines with 2.86 specific gravity having particle size ranging from 2.5 to 10 microns is used.

2.4. Fine Aggregate: Robo-sand with 2.66 specific gravity, 2.6% water absorption which is of zone-II as per IS: 383-2016 is used

2.5. Coarse Aggregate: Different sizes of coarse aggregate are used. 20mm and 12.5mm size having specific gravity 2.74 and 0.6% water absorption complying as per IS: 383.

2.6. Self-curing agent: Polyethylene glycol (PEG-400) is used as curing agent having 1.125 specific gravity which is transparent in appearance. Different dosages of PEG-400 say, 0.5%, 1%, 1.5% by weight of cementitious content are used for the experiment.

2.7. Super-Plasticizer: Auramix-400 is based on polycarboxylic ether polymer used as super plasticizer which helps in workability(flow) of concrete. It has specific gravity 1.05.

3.MIX PROPORTION

Mix designs are carried according to the IS: 10262-2019.

Mix Design 1 M70

Total cementitious content = 690 kg/m3
Cement = 450 kg/m3
GGBS = 200 kg/m3
Alccofine = 40 kg/m3
Fine aggregate = 591 kg/m3
Coarse aggregate, 20mm = 604 kg/m3
Coarse aggregate, 12.5mm = 402 kg/m3
Water = 170 kg/m3
Super plasticizer = 4.83 kg/m3
w/c ratio = 0.25

Mix Design 1 M80

Total cementitious content = 750 kg/m3
Cement = 450 kg/m3
GGBS = 250 kg/m3
Alccofine = 50 kg/m3
Fine aggregate = 600 kg/m3
Coarse aggregate, 20mm = 543 kg/m3
Coarse aggregate, 12.5mm = 316 kg/m3
Water = 180 kg/m3
Super plasticizer = 5.25 kg/m3
w/c ratio = 0.24

Fig – 1 Casting of Concrete in mixer

3.EXPERIMENTS AND RESULTS

3.1. Workability

PEG-400 %	0%	0.5%	1%	1.5%
M70	187 mm	203 mm	211 mm	218 mm
M80	195 mm	208 mm	217 mm	221 mm

3.2. Compression Test

Fig – 2 Compression test

PEG-400 %	0%	0.5%	1%	1.5%
M70	84.63 Mpa	77.52 Mpa	80.1 Mpa	75.15 Mpa
M80	92.8 Mpa	86.05 Mpa	89.2 Mpa	84.51 Mpa

3.3. Split Tensile Test

Fig – 3 Spilt tensile test

PEG-400 %	0%	0.5%	1%	1.5%
M70	5.69 Mpa	5 Mpa	5.37 Mpa	4.53 Mpa
M80	6.15Mpa	5.51 Mpa	5.77 Mpa	4.97 Mpa

3.4. Flexural strength Test

Fig – 4 Flexure test

PEG-400 %	0%	0.5%	1%	1.5%
M70	7.16 Mpa	6.51 Mpa	6.70 Mpa	6.41 Mpa
M80	7.63Mpa	7.26 Mpa	7.51 Mpa	7.13 Mpa

4.CONCLUSIONS

- Bleeding of concrete is reduced with the increase of PEG-400 percentage.
- Using different sizes of coarse aggregates has helped in good flow of concrete. Where small size aggregates can fill between the large size aggregates which minimizes the voids in concrete.
- With the increase of self-curing agent PEG-400, the workability of concrete is increased.
- The super plasticizer Auramix-400 gives a good non-viscous flow in concrete and also assisted in increasing the strength of concrete.
- It is found out that 1% dosage of PEG-400 gives the maximum strength in mechanical property tests conducted.
- Hence, 1% dosage of PEG-400 can be said as the optimum dosage.

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