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INVESTIGATION OF STRENGTH AND PROPERTIES ON SELF-CURING CONCRETE USING POLYETHYLENE GLYCOL (PEG-400)

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ABSTRACT: Basically, in present generation mounting of water shortage plays very important role in construction for the purpose of curing. While curing process water plays major role in construction. To increase the durability and performance curing of material is very important. As well as in construction self curing agents are used as water-soluble polyethylene glycol and in the same way granite as light weight aggregate. Hence in this paper investigation is done on curing agent polyethylene glycol (PEG-400). In this different percentages are utilized to the weight of cement they are 1%, 2% and 3% in the chemical agent PEG. Concrete workability is improved by glenium which is a Super plasticizer. For M40 mixes about 7 days and 28 days, both split tensile strength and compressive strength is examined with self curing and normal curing. Hence from results it can observe that for M40 grade 2% of maximum strength is found to PEG 400. Compared with conventional curing of concrete 12% increment of compressive strength is obtained from self curing of PEG 400. In the same way for tensile strength 12% increment is obtained for Self-curing concrete for PEG 400 compared with conventional concrete.

Index Terms: Split Tensile Strength, Compressive strength, Self-Curing Concrete and PEG 400.

I.INTRODUCTION

Restoring plays a central capability in the development of substantial properties all through development. Relieving is frequently used to give the strategy by which pressure driven concrete cement mature and increment solidified property more than time as a result of the steady hydration of the concrete in the event of enough water (ACI, 2008). The capability of relieving is to diminish water vanishing from cement and keep satisfactory dampness content, particularly all through early ages, for the duration of the hydration technique that is fundamental for the development of concrete microstructure. This will prompt better class concrete cement and cement and will assist with achieving the favored properties. However great restoring isn't reasonable in heaps of cases and various scientists have addressed whether it is doable to set up self-relieving concrete. It was laid out that the improvement of purpose self-restoring specialist is to decrease water blurring from concrete, subsequently rising its water protection capacity contrast and that of moderate concrete and that water-solvent polymers might have this strong.

At the point when the mineral admixtures respond totally in a consolidated concrete device, their call for relieving water (outside or inward) can be substantially more than that in a customary typical Portland concrete cement. At the point when this water isn't exactly essentially to be had, because of depercolation of the hairlike porosity, as an occasion, inescapable autogenous twisting and (early-age) breaking can likewise

result. There will be early age of breaking when concrete is hydrated by shrinkage process. Because of this void pores are obtained from the inner side.

Because of HPC shrinkage is obtained and concrete is hydrated in conventional cement. To overcome this better material is used for concrete substance and it is demolished with proper water content and proper mixtures should be added to improve the strength of properties of cement. The power achieved via IC might be extra than that suitable under soaked relieving circumstances. Frequently explicitly in HPC, it isn't generally easily plausible to propose to fix water of the top surface at the rate expected to satisfy the proceeding with substance shrinkage, due to the remarkably low penetrability's routinely wrapped up.

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Today substantial innovation has been going through quick improvement. Concrete has number of attributes that can further develop the maintainability execution of working of design. For better execution and solidness, appropriate restoring of cement is significant. Relieving of cement is one significant region that needs due consideration and due significance in the development field, particularly in India.

II.LITERATURE SURVEY

Tyagi [1] expressed that, a few measures should be assumed to keep the deficiency of water from the outer layer of cement. Hence, the relieving can be considered as making of a positive climate during the early period for continuous hydration.

Junaid et al. [2] expressed that, self-restoring concrete is one of the exceptional cements which is acquiring significance lately as it evades mistakes. This is obtained from the property of cement which contains mostly fluoride. This is mostly bought by human structures which troubles the cement.

Azhagarsamy and Sundaraman (2016) [4] concentrated on the strength and toughness properties of substantial utilizing water solvent polyethylene glycol (PEG 400) 0.5% as self-relieving specialist utilizing M20 grade concrete. The compressive strength at 3, 7 and 28 days have been gotten with typical restoring and self-relieving condition. It was found that a normal expansion in compressive strength of 12.73% and parted rigidity 13.31% with 0.5% of PEG-400. This shows that self-relieving concrete showed a preferred presentation over the ordinary cement.

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Jagannadha Rao and associates (2012) [5] use the shrinkage lessening admixture PEG 400 in substantial which helps in self curing and helps in better hydration. For both M20 and M40 concrete grades spilt tensile strength, compressive strength results are fluctuated in PEG 400 from 0% to 2%. While self curing and casting process is assisted in PEG 400. Hence for M20, PEG 400 is weighted about 1% and for M40, PEG 400 is weighted about 0.5%.

Patel and Pitroda (2013) [6] utilized PEG 400 in regular concrete as an admixture for better hydration For both M20 and M40 concrete grades spilt tensile strength, compressive strength results are fluctuated in PEG 400 from 0% to 2%.. The experimental outcome shows that utilization of water solvent polymers in concrete has further developed execution of cement. For M20 grade of concrete PEG 400 in incremented around 1% to accomplish more strength. In some cases works are completed set up where there is intense deficiency of

water and the utilization of water relieving isn't feasible because of reasons of economy. Anticipation of dampness misfortune from the outer layer of level substantial works, for example, roadways and air terminals have been testing task for development chiefs. To beat these challenges, self-restoring concrete was chosen for this current work since self relieving substantial will address a recent fad in substantial development.

III. MATERIALS AND METHODS

Materials Used

Cement Portland pozzolona cement (PPC) conforming to IS 1489-part 1 was used and tested as per the Indian Standards IS 4031-1988. The below table (1) shows the cement properties.

Table 1. Cement Properties

S. no	Property	Result	Permissible limit
1	Specific gravity	2.8	2.9 (confirming to IS 4031-1988 part 11)
2	Normal consistency	32%	(confirming to 4031-1988 part 4)
3	Initial setting time final setting time	30 mins 600 mins	30 mins to 10 hours (confirming to 4031-1988 part 5)
4	Fineness of cement (by 90 micron sieve)	5% retained	Not exceed 10%confirming to 4031-1988 part 3)

Polyethylene Glycol PEG-400, Basically for PEG this is a low grade of molecular weight. This is a colorless, viscous liquid and clear. Based on the Formulations of pharmaceutical usage of PEG 400 is done in very wide way. The molecules which are soluble in aliphatic hydrocarbons are glycerin, water, aromatic hydrocarbons, benzene and acetone. 2nH4n+2On+1 is the chemical formula for PEG-400. 128 g/cm3 is the density and 4 to 8ºC (39 to 46ºF; 277 to 281K) is the melting point

Water

Usage of IS 456-2000 standards are done for confirming Portable water requirements.

Preparation is done based on the specifications of IS 10262-2009 for specimens M40 grade concrete mix. Ratios for M40 mix 1:1.89:3.6. By using the drum type concrete mixture machines different mixes of ingredients are done and weighed. While mixing the ingredients uniformly precautions should be taken. By using tamping rod specimen is compacted and by using steel mold specimen is casted.

The specimens of 150 mm × 150 mm × 150 mm size of cubes and 150 mm diameter × 300 mm. To determine the both split tensile strength and compressive strength high cylinder specimens are prepared for about 7 and 28 days. When the surface of concrete begins stiff then curing procedure will be started. To easily identify the mixes, CC stands for conventional concrete, SCC 1 for self curing concrete with 1% of PEG, SCC 2 for self-curing concrete with 2% of PEG and SCC 3 for Self Curing Concrete with 3% of PEG.

IV. EXPERIMENTAL INVESTIGATION

Workability:

Based on the slump cone test, determination of fresh concrete properties is done. Consistency of concrete is employed based on the method of slump cone test. This process is based on the standards of IS 7320-1974 in the laboratory. Based on batch to batch the concrete should maintain uniformity and this is also known as control test. Height 30 cm is maintained for cone in the slump cone test. 20 cm bottom diameter is maintained for cone in the slump cone test. 10 cm top diameter is maintained for cone in the slump cone test. On the clean and smooth surface mold is placed. Based on the tamping rod 25 times is tamped on the each layer and basically mold is of four layers. By using tamping rod and trowel concrete is leveled in the top layer of filling. In the vertical direction mold is removed by raising it carefully. Measurement is done on the highest point of the subsided concrete and height of the mold. Hence slump test is nothing but difference in height measured.

Compressive Strength Test:

As per IS 516-1959 specifications compression testing is performed on the mixes of HPFRC using compression testing machine with the capacity of 3000 kN. Based on the size required the steel molds are filled with fresh concrete. To get better concrete compaction and finish ability vibrating table is vibrated about 3 minutes. About 24 hours the drying procedure is allowed by preparing concrete cubes about 150 mm × 150 mm × 150 mm. After the procedure of drying 7 and 28 days cubes will be demolded from the steel molds and tested for compression. Based on the formula of

$$fc = P/A$$

Based on compressive strength specimens are tested.

Here N/mm2 is used as compressive strength of specimen and it is represented as fc and Based on kN maximum load applied is represented as P and Based on mm2 cross sectional area of the specimen is represented as A.

Split Tensile Strength:

By using steel molds at the size of 300 mm × 150 mm preparation of test cylindrical specimens are done. After the process of demolding, in curing tank specimens were immersed. After the 7 and 28 days from the curing tank specimens were taken out. After taken out it is tested using split tensile strength which is shown in figure (1). Based on the IS 5816-1999 standards testing is placed out. Cylindrical specimen is placed between loading surfaces of a compression testing machine. The below shows the equation for Split tensile strength

$$T=2P/\pi LD$$

Here compressive load (kN) is represented as P, split tensile strength (N/mm2) is represented as T and length of the cylinder (mm) is represented as L.

V. RESULTS AND DISCUSSION

Fresh concrete workability is determined by the Workability Slump test. The slump value of the conventional concrete is 25 mm. When 1% and 2% of PEG used in concrete, i.e. for SCC 1 and SCC2, 25 mm slump value was obtained. For SCC3, the slump value is reduced to 24 mm. When 3% of PEG used in concrete, workability is increased than other mixes.

Compressive Strength Test Compressive strength test results of 7 days conventional concrete has attained strength of 21.1% and self-curing concrete with 2% of PEG has attained higher strength of 22 N/mm2 when compared to other dosages. At 28 days testing of concrete, conventional concrete has attained strength of 37.3 N/mm2. Self-curing concrete with 2% of PEG has attained strength of 42.06 N/mm^2 as per in the Figure 1.

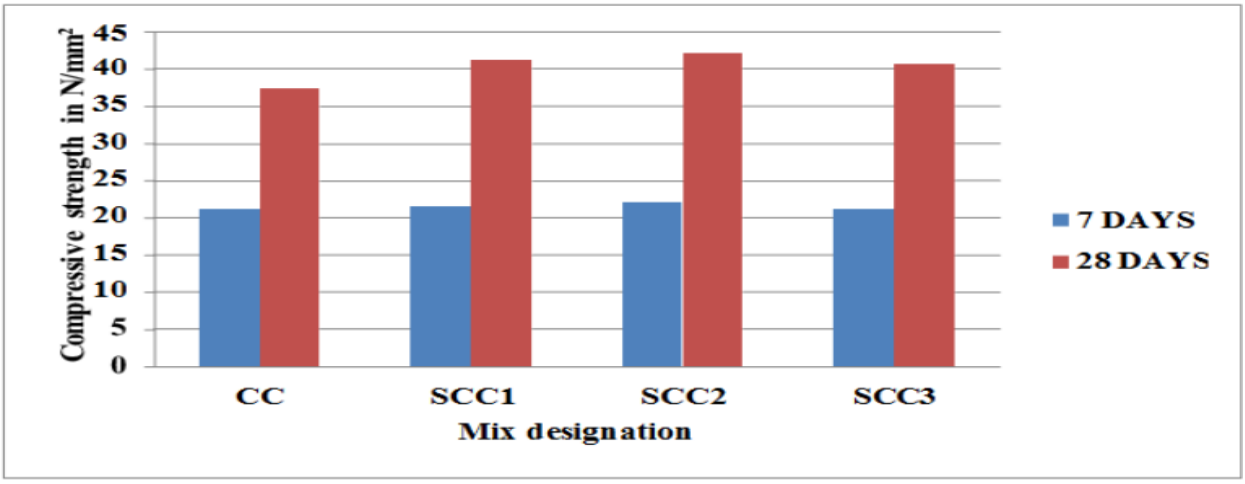

Fig.1. Compressive strength of SCC specimens

Split Tensile Strength Test Conventional concrete has attained a tensile strength of 4.5 N/mm2 at 7 days. Tensile strength for self-curing concrete increases at 2% dosage of PEG. The test results are shown in Figure 2. Hence it is shown that from results conventional concrete has attained a tensile strength of 6.5 N/mm2 . Tensile strength for self-curing concrete attains 7.1 N/mm2 for 2% dosage of PEG. From figure 2 test results are shown.

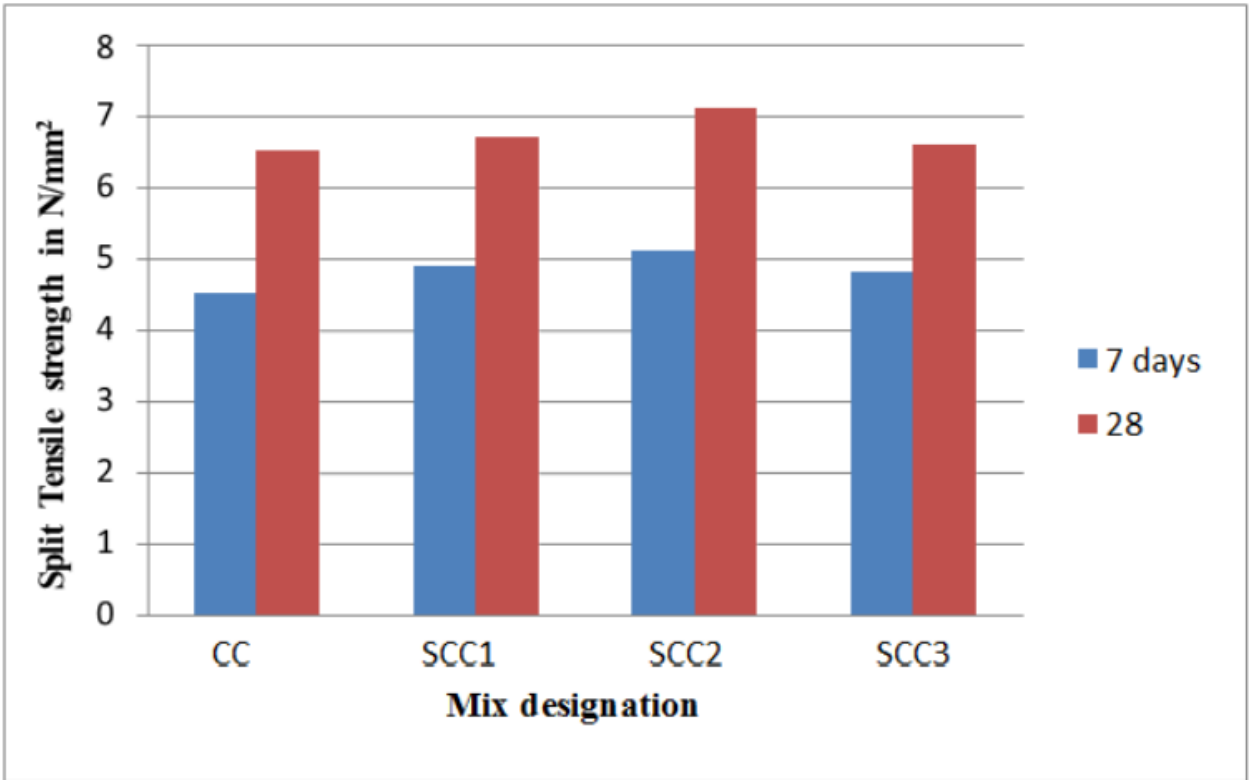

Fig.2. Tensile strength of SCC specimens.

VI. CONCLUSION

- Based on M40 grade maximum strength for PEG400 was found to be 2%.
- There is increment in the workability for workability test about 3.3% for glenium dosages.
- Concrete curing is done after the age of 7 days where there is 2.25% improvement in the compressive strength of concrete of PEG 400.

- Concrete curing is done after the age of 28 days where there is 12% improvement in the compressive strength of concrete of PEG 400
- Compared with conventional concrete, Self-curing concrete is has 1.5% higher tensile strength.
- Therefore self-curing concrete can be effectively used where there is scarcity of water and inaccessible difficult terrains.
- Due to lack of proper curing Self-curing concrete plays major role to solve the problems.

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