SPETIAL ANALYSIS OF EFFECT ON COMPRESSIVE STRENGTH OF CONCRETE DUE TO DIFFERENT CURING METHOD

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Abstract

Concrete in general is the most Very frequently used building material and It comprise of cement, aggregate both fine as well as course and water in a fixed proportion in order to make concrete. The concrete which is made in grade has to full fill the prime requirement of fresh concrete as well as hardened concrete when it is transported form mix station to the working site. The main requirement of freshly prepared concrete is compaction which means removing of air voids and the grade of concrete that is prepared should be cohesive so that it can easily be place at the desired point without any problem.

The objective of this project is to study the behaviour of concrete under different curing conditions at hot areas, with emphasis on the strength and shrinkage. The investigation includes the effectiveness of using different curing techniques in the hot and dry environment of India where temperature fluctuates between (9-50)^{o}C. It is also intended to study some parameters related to the properties of concrete to achieve better understanding of the behaviour of concrete. Normal concrete was prepared with a water-cement ratio of 0.50. cube specimens were cast for testing the compressive strength at 7 and 28 days of curing respectively using three curing methods namely immersion, sprinkling and Plastic sheeting, curing to cure the cube specimens until the day of testing. Test results indicates that water curing (WAC) as well as sprinkling (spraying) curing provided much better results than membrane (Plastic Sheeting) method of curing. The rate of drying was significant when the specimens were subjected to membrane (Plastic sheeting) method of curing. This thus hampered the hydration process and thus affected the compressive strength property of the hardened concrete. The overall finding of this study suggests that concrete should be cured by water curing to achieve a better compressive strength.

Keyword: *concrete, course aggregate, cement, curing, compressive strength test.*

1. Introduction

Concrete is the very commonly and frequently used building construction material which comprise of four building material they are, cement, course aggregate, fine aggregate and water. Cement act as a binding material or binder in the cement and water plays a very crucial role in it. Water is mix to gain the setting of concrete and it also help to balance the heat of hydration while course aggregate and fine aggregate are mixed to gain strength in the concrete. The freshly prepared concrete has to fulfil certain parameter such as when transported through RMC mixer it should not set. The other parameter that is required with fresh concrete are the consistency in order to get

compacted when it is placed and desired cohesion force should be offer, slump and no segregation. While the concrete which has got set has to full fill certain parameter such as hardness of concrete and compressive, flexural and tensile strength and density as well as durability of concrete are considered. The selection of more suitable and economical mix can be made, using mix design to give concrete with specified conditions and any defect in the mix ingredient may cause some problems in the concrete mix, such as segregation, bleeding and may cause shrinkage and creep after hardening. In warm to hot weathers, in-site concrete quality will vary for many reasons other than selection of materials and design characteristics. Surface cracking of fresh concrete occurs due to drying shrinkage caused by rapid loss of water in hot and dry climates. The rate at which concrete will dry depends on temperature of air, temperature of concrete, humidity and velocity of wind. The absence of proper curing affects the quality of concrete in both the states of concrete. Concrete hardens and gains strength because of a reaction in cement with water. If concrete dries prematurely, there will be insufficient water for that reaction, i.e. .no water, no hydration, no strength gain. According to the standards, ponding is a most used method of water curing but it is seldom used in the field because it is difficult and cumbersome. Fog spring or sprinkling with nozzles provides excellent curing, but it requires constant vigilance. Burlap, wet sand and saw dust, usually provide good curing when fully saturated. Material used for sealing are sheets or type of membranes kept on the Concrete to reduce the loss of mixing water. Use of plastic films is one way to protect the fresh concrete and can be spray the moment water has evaporated from the surface. Liquid membrane curing compounds are one of the methods for curing of concrete. White curing compounds reflect the radiant energy of the sun and are desirable in many controlled mixes. They have been carried out in order to study the effects of the different parameters evolved, like method of curing and length of Curing period (Ahmed et al, 1999).

2. Materials and Methods

Materials:

Cement -

Portland Pozzolana Cement (fly ash based) brand name Birla Gold confirming to IS 1489 (Part 1) - 1991 was used in this study.

Fine Aggregate -

River sand available in Allahabad confirming to IS 383-1970, zone II used in the study. It was completely passed by 4.75 mm IS sieve. Fineness modulus and specific gravity was 2.76 and 2.3 respectively.

Coarse Aggregate -

Locally available coarse aggregate having two fraction 20mm and 10mm sizes individually sieved was used in the present study. One fraction completely passed through 20 mm sieve and another 10 mm sieve. For mix the ratio of these aggregates was 60:40 respectively.

Methods

All the building material which was required for the present study such as course aggregate, fine aggregate and cement is purchased from market and then bring to the concrete technology laboratory as the all the work has to done there only. About 50 kg of cement were bought and 15 kg of course aggregate as well as fine aggregate were bought. After Bringing all the construction material to the concrete technology laboratory, sample will be prepare for making M20 grade

concrete and the ratio of M20 is 1:1.5:3 so all the construction material are mixed in the specified ratio by volume and water is mixed in the mixture of building material and the paste is thoroughly mix by the help of trowel. After the preparation of concrete, about 50 cubes of concrete in the size of 15 cm X 15 cm was casted and tempting rod is used for removing air voids. The cube casting was done by the help of cube mould of standard size which is easily available in the market. This casted cubes were left in the mould for about 12 hours in order to archive the setting time of cement then it is taken out of the mould by removing nut and bolt which was used to attached the plates of mould together and then kept in water for curing. After Casting of cubes they were allow to settle down first and for achieving this the concrete was left in the mould for about 12 hours and when they get set the cubes were taken out of the mould by removing nut and bolt and then the cubes were directly subjected to different types of curing. Here three types of curing was used in the current study namely Ponding, Spreying, Covering hold water. After the curingCompressive strength test will be performed on the casted and cured cube on the 3, 7, 14, 21 & 28 days. The days that were selected for compressive testing of concrete cube were according to Indian Standard (IS 456:2000) and the test procedure that were followed were according to Indian Standard codes.

Results

The sample preparation as well as analysis of the cured concrete cubes were done according to the IS 456:2000.

Result for the analysis on the concrete cubes are as follows:-

Types of curing / Testing days	Cover Hold Water	Ponding	Spraying
3 day	7.89 N/mm^2	6.54 N/mm^2	5.82 N/mm^2
7 day	12.43 N/mm^2	11.29 N/mm^2	10.84 N/mm^2
14 day	18.00 N/mm^2	17.15 N/mm^2	16.00 N/mm^2
21 day	18.69 N/mm^2	17.71 N/mm^2	15.73 N/mm^2
28 day	19.82 N/mm^2	17.93 N/mm^2	16.58 N/mm^2

Conclusion-

The conclusion for the present investigation is:-

- After casting and curing of concrete cube for 3, 7, 14, 21 & 28 days. The cubes are subjected for compressive test and the result is tabulated above.
- Curing with water is very effective method. It balance the heat of hydration and helps in gaining compressive strength in concrete. This all happens due to the pore structure and low porosity cause due to heat of hydration which cause loss of moisture in concrete.
- Covering hold water method of curing provide good compressive strength than the ponding and spraying method. As we can see in the table above the

ponding provide its maximum strength on 14 day and spraying provide at 21 day but covering hold water provide at 14 and 28 days.

- When spraying and ponding are considered, the ponding performance is better than spraying as it provide good compressive strength. This is because the moisture movement from the concrete specimen is higher in spraying method, which did not provide and any protection against early drying out of concrete. Hence hydration of cement reaction was abated.
- The extent of moisture movement was greatly dependent of the method of curing. Greater moisture movement occurs under spraying method, and it significantly affected the strength property of the concrete.
- Normal concrete should be cured by water curing method in order to achieve good hardened properties. Water curing produces no loss of moisture, and therefore enhances cement hydration reaction. In case of water shortage, in covering hold water immediate sprinkling can be adopted instead.

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