PERFORMANCE ANALYSIS OF SELF CURING CONCRETE USING POLYMER

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INTRODUCTION

GENERAL

Concrete is a composite material composed of fine and coarse aggregate bonded together with fluid cement that hardens over time. Curing of concrete is the one of the most important activities required to be taken in the process of construction. The curing plays a very significant role in concrete performance There should be sufficient water available in concrete so that the chemical reaction take place between water and cement called “HYDRATION” It will increases temperature inside the concrete and concrete become dry. The object of curing is controlling the temperature inside the concrete. Lack of availability of good water has forced to determine alternative method like self-curing Technology.

LITERATURE REVIEW

Various journals, articles and conference papers related composite construction, materials used in the construction, etc. have been referred for the purpose of developing ideas for the research work. Data from websites of the kind of informative types, advertisement types, blogs, groups, etc. have been considered and incorporated in the report work as well. Some of the informative data collected from certain journals and conference papers are summarized and given below.

THARSHINI &MARY (2014) Have investigated the effect of the concrete mix proportions on the performance of self-curing concrete were such as, cement content and water/cement ratio., there are two major methods available for internal curing of concrete. The first method uses saturated porous light weight aggregate (LWA) in order to supply an internal source of water, which can replace the water consumed by chemical shrinkage during cement hydration. Compressive strength of conventional curing concrete (CC) is 11.1N/mm2 when compared to self-curing concrete (SC) of 13.2N/mm2. This is 15.9% is higher than the conventional curing concrete at the end of 3 days. Similarly, there was a greater compressive strength at the end of 7 and 28 days namely 17.7 and 23.8N/mm2

Iffat et al. (2016) Have investigated that around 18% higher compressive strength and 15% less chloride permeability was found from samples with POLYMER as compared to control samples when kept under similar curing conditions. POLYMER can be recommended as an effective internal curing material. POLYMER was adopted from baby diaper. And it was act as an internal curing agent. It was added 1.6 gm/kg of cement. Compressive strength of sample with POLYMER using polythene cover with no external curing is very close to compressive strength of normal cured concrete. Also, its strength is much higher than control samples placed at similar curing conditions. So, for internal curing, POLYMER can be a good alternative agent.

Ryouand &Lee (2014) Have investigated on Recycled aggregate has lower density and great absorbance and crushing index than the natural aggregate due the composition of recycle aggregate. The results show that the control concrete had the highest penetration resistance and that RCA 100 % had the lowest. It was also shown that RCA had lower penetration resistance than normal aggregate, and that the mixtures with CRCA had similar carbonation depths regardless of the replacement

Patiletal. (2013) have studied how we can recycle the resource from demolished concrete. The aggregates collected by sieve analysis are washed by pressure washing. This is done so as to remove the mortar adhered to the aggregates. The pressure at which water is applied is 500 psi for about 15 to 20 mins. The strength of recycled concrete with replacement of 50% of RCA was higher than the split tensile strength of the control concrete. The split tensile strength of recycled concrete with replacement of 100% RCA was less than split tensile strength of control concrete

O. Mejlhede Jensen (2013) Has a detailed study on the addition of just 0.4% POLYMER relative to the cement weight will lead to a lowering of the free w/c by 0.06. This change in w/c will cause the yield stress to triple and the plastic viscosity to increase by 25% for a concrete with an initial w/c of 0.4. Based on an air-void analysis of the hardened concrete, the porosity generated by the POLYMER addition (entrained air content) is about 2.8% of the concrete volume

V.Karthikeyan(2018) Have a detailed study on the use of an optimum amount of Sodium Polyacrylate as a POLYMER in ordinary plain concrete. One of the major improvements that the POLYMER can contribute to the concrete is by providing internal water source. Polymer ranges from 0.1% to 0.4% by weight of cement mechanical properties of concrete that compressive strength, split tensile strength, flexure strength shear strength and impact strength the optimum dosage of POLYMER for addition for maximum strengths was found to be 0.3% for M30 grade of concrete. Addition of POLYMER leads to a significant increase of Compressive, tensile and flexure strengths. The self-cured concrete using POLYMER was more economical than conventional cured concrete. Self-curing concrete is reducing the improper curing problems

ADMIXTURE

POLYMERs are a group of polymeric materials that have the ability to absorb a significant amount of liquid from the surroundings and to retain the liquid within their structure without dissolving. POLYMERs are principally used for absorbing water and aqueous solutions; about 95% of the POLYMER world production is used as a urine absorber in disposable diapers.

POLYMERs can be produced with water absorption of up to 5000 times their own weight. However, in dilute salt solutions, the absorbency of commercially produced POLYMERs is around 50 g/g. They can be produced by either solution or suspension polymerization, and the particles may be prepared in different sizes and shapes including spherical particles. The commercially important POLYMERs are covalently cross-linked polyacrylates and copolymerized polyacrylamides/ polyacrylates.

Because of their ionic nature and interconnected structure, they can absorb large quantities of water without dissolving. From a chemical point of view, all the water inside a POLYMER can essentially be considered as bulk water. POLYMERS exist in two distinct phase states, collapsed and swollen. The phase transition is a result of a competitive balance between repulsive forces that act to expand the polymer network and attractive forces that act to shrink the network.

The macromolecular matrix of a POLYMER is a polyelectrolyte, i.e., a polymer with ionizable groups that can dissociate in solution, leaving ions of one sign bound to the chain and counter-ions insolution

Need of recycled coarse aggregate:

There is a critical shortage of virgin aggregate and hence availability of RCA is increasing. Using the waste concrete as RCA conserves virgin aggregate, reduces the impact on landfills, decreases energy consumption and can provide cost saving. Crushed concrete is available nowadays in large quantities, which results from the demolition of old structures and waste concrete from new structures. A report presented in 1999 to the European Commission estimated the amount of nonrecycled construction waste to be 130 million t / year. The area required for land filling this amount of waste is equivalent to the accumulation of waste, 1.3 m high, over the entire central Paris area (Symonds 1999. In the present study recycled coarse aggregate have been used to replace virgin coarse aggregate. The properties of fresh as well as hardened concrete made of partial/full replacement of recycled coarse aggregate are found out and the results are compared with that of concrete using virgin coarse aggregate.

MIX DESIGN

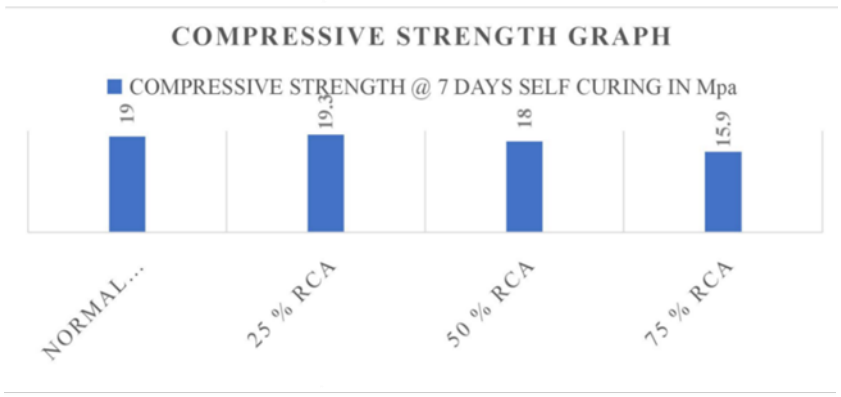
The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required strength, durability, and workability as economically as possible, is termed the concrete mix design. The proportioning of the ingredient of concrete is governed by the required performance of the concrete in 2 states, namely the plastic and the hardened states. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of the workability, therefore, becomes of vital importance.

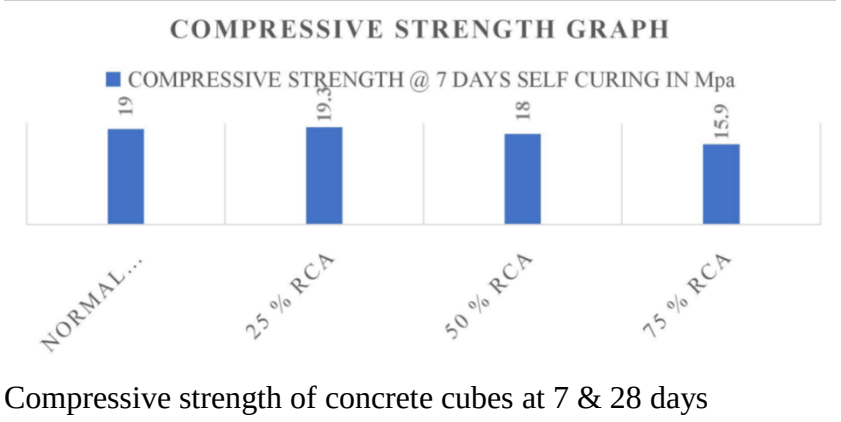
STRENGTH TEST

COMPRESSIVE STRENGTH TEST

Compressive strength test on cube

RESULT:



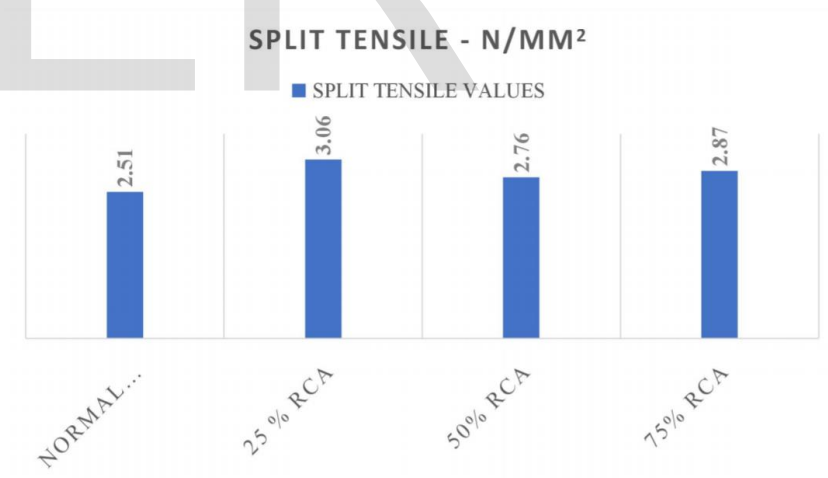


Compressive strength of concrete cubes at 7 & 28 days

SPLIT TENSILE TEST:

Split Tensile Strength Test on Cylinder

RESULT:



Split tensile strength of concrete cylinders at 7 & 28 day

CONCLUSION:

It has been observed that 7 days compressive strength of conventional concrete is achieved when 25 % of RCA is been used whereas 28 days compressive strength of conventional concrete in close proximity when 50% of RCA is used.

Primary reason for the strength reduction may be due to the adhered mortar to the RCA and other non-aggregate materials. This can be corrected by using proper cleaning technique of RCA under skilled supervision.

It has also been observed that split tensile test for 25 % RCA has a higher value compared to the 50% & 75% replacement of RCA. Finally, with the above test it can be concluded that replacing 25% of RCA is optimum that replacing is best suited for self-curing concrete using POLYMER.

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