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Comparative Study and Analysis of Retempering of Concrete to Improve the Workability and Strength

Ravindra Kolekar[1], Shubham Patil[2], Sourabh Magdum[3], Prakash Jagtap[4], Harshad Upadhye[5], Prof. V.G. Awasare[6]
[1, 2, 3, 4, 5, 6] *Department of civil engineering, Vishveshwarya technical campus, Patgaon, Miraj, India*

Abstract: The Concrete loses its plasticity after passing of its initial setting time & starts to get harden. Due to delay in placing, workability of concrete reduces & also slump losses are possible. Due to addition of only water workability of concrete increases but it creates adverse effects on strength. With addition of water along with cement by maintaining constant water/cement ratio that adverse effect on strength of concrete will be reduced.
Keywords: - RMC – ready-mixed concrete/c ratio – Water Cement Ratio, OPC - Ordinary Portland Cement ,re-tempering.

I. INTRODUCTION

Re-tempering is defined by ACI as the "Addition of water and remixing of concrete or mortar which has lost enough workability to become unplaceable or unsalable". Re-tempering inevitably results in some loss of strength compared with the original concrete.
One of the adverse effects of hot weather concreting is loss of slump. Delay in the delivery of ready mixed concrete has the same result and leads many people in the concrete industry to regain the original slump by adding water, a process known as "re-tempering". The mixing operation can be described as two types depending on process and place of mixing. These are plant mixing and hand mixing. By using appropriate methods, ready mixed concrete can be avoided from the unwanted effects of prolonged mixing. On the other hand these methods have some disadvantages, because of some economical and technical aspects. The re-tempering of prolonged mixed concrete which is produced at plant can be said to be the most economical solution for the problem. For this method the best performance from concrete is taken with minimum hauling time. But sometimes delays being caused by site conditions and other environmental reasons do not permit this.
The time passed for mixing operation of concrete components is called mixing time. The mixing time of concrete is limited with maximum and minimum values of time and revolution by standards. The optimum mixing time depends on type of mixer, condition of the mixer, speed of rotation, size of the charge and nature of the constituent materials.
Concrete loses its plasticity after passing of its initial setting time & starts to get harden. Due to this workability of concrete reduces & also slump losses are possible. Due to addition of only water workability of concrete increases but it creates adverse effects on strength. With addition of water along with cement by maintaining constant water/cement ratio that adverse effect on strength of concrete will be reduced.

II. METHODOLOGY

A. Collection of Data

Data is collected and analysed from the the below mentioned authors and their research views. The other data to conduct research work is collected from the actual test carried out on the available material that is on the sand (Crushed sand) and aggregates. The test carried out on the sand and aggregates are sieve analysis and specific gravity. This data is collected from the basic principles of the properties of the materials.

B. Finding Situation Of Re-Tempering

The effect of re-tempering on the strength of ready-mixed concrete (RMC) in Riyadh was investigated. This investigation covers 12 construction sites and represents 11 ready-mixed concrete (RMC) plants operating in Riyadh. The addition of water was found to correlate well with the increase in slump. Also, the reduction in strength was found to be proportional to the increase in slump. In cases where controlled amount of water is added to restore the slump within the specifications limits (100 ± 25 mm), the reduction of strength was below 10%. However, when the amount of water added is not controlled, reduction of strength may be as high as 35%. Based on these findings, it is strongly recommended that the practice of adding water to RMC at the job site to restore or increase slump should be prohibited. Super plasticizer can be used instead of water to adjust slump. This recommendation has been adopted by the Municipality of Riyadh and communicated to all RMC factories operating in Riyadh to abide by it. (Reference-

:Abdulrahman M. Alhozaimy and Abdulaziz I. Al-Negheimish(2002), "Retempering Of Ready-Mixed Concrete In Riyadh, Saudi Arabia", The 6th Soudi Engineering Conference KFUPM, Dhahran, Vol. 3. Pages 137-146.)

C. Testing of Material Properties

The cement used of grade 53 grade of Ordinary Portland cement of Initial setting time for cement used was 60 min.
The specific gravity of cement used was 3.15. The crushed sand used from the passing from 1.76 mm of specific gravity of sand used was 2.72. Specific gravity of sand is found out by the Pyconometer test.
The Aggregates are used passing through 20 mm size sieve and retained on 12.5 mm size sieve are used of specific gravity of aggregates used were 2.83.

D. Mix Design For M20 Grade Concrete

Proportion
Mass of cement: Mass of fine aggregate : Mass of coarse aggregate
1 : 1.73 : 3.49

E. Casting Of Cubes

In casting of M20 cubes the required quantity of material is calculated and taken as per calculations , then dry mixing of material is done and then the required water quantity is added in the mixpraportion and mixed throughtly .Three fresh concrete blocks are casted and remaining concrete is kept for 60 minutes ,then10% of water is added in total casting once in all and 5% extra cement by its remaining weight of concrete is added in it and, then it is mixed properly and 3 more cubes are poured with it, then more 5% of cement is increased in remaining concrete and mixed and 3 more bloks are casted , then last 5% of cement increased in remaining concrete and remaing 3 bloks are casted.Hence total15% cement is increased with 10% of water once.
All the blocks are kept for drying for24 hours and then it kept for curing of 7 days and simmiler procedure for 28 days curing blocks are carried out.

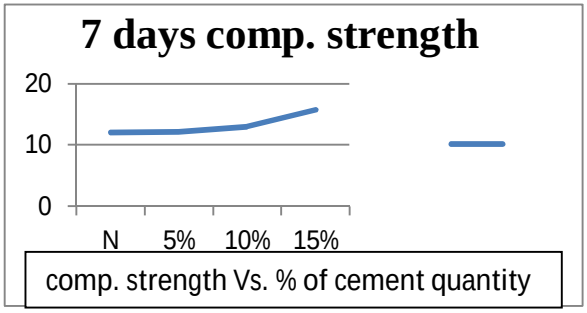
III. CONCLUSION

A. Compressive Strength for M20 Cube (7 Days)

In this point the comparison of compressive strength of various sets of re-tempered concrete were made by the results obtained after the 7 days curing of cubes in fresh water. The results for compressive strengths of cubes for various sets of cubes cured in fresh water are given in table 3.1

Table 3.1 - 7 day's compressive strength of M20 concrete of cube

Description	Compressive strength of re-tempered concrete in kn/mm^2	Without Re-tempering strength of concrete kn/mm^2	% of strength gained
5%	12.25		0.98
10%	13.01	12.13	7.25
15%	15.73		29.67



Graph 1- 7 days comp. strength

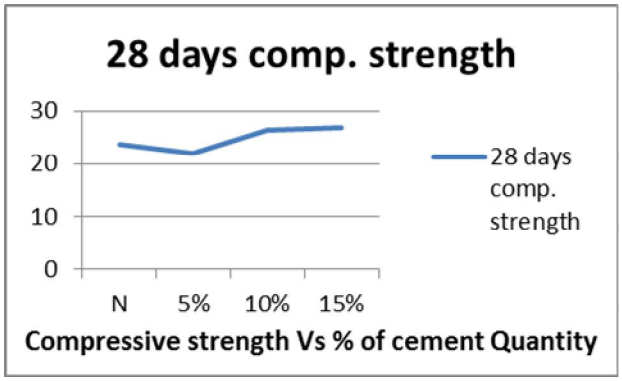
B. Compressive Strength For M20 Cube (28 Days)

In this point the comparison of compressive strength of various sets of retempered concrete were made by the results obtained after the 28 days curing of cubes in fresh water.

The results for compressive strengths of cubes for various sets of cubes cured in fresh water are given in table 3.2

Table 3.2 -28days Compressive strength for fresh water curing

Description	Compressive strength of re-tempered concrete in kn/ mm^2	Without Re-tempering strength of concrete kn/ mm^2	% of strength gained
5%	21.92		-7.9
10%	26.29	23.81	10.41
15%	27		13.39



Graph 1- 28 days comp. strength

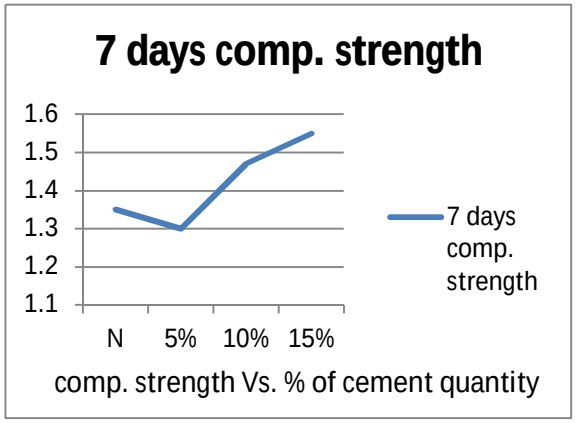
C. Compressive Strength for M20 Cylinder (7 Days)

In this point the comparison of compressive strength of various sets of re-tempered concrete were made by the results obtained after the 7days curing of cylinders in fresh water.

The results for compressive strengths of cylinders for various sets of cylinderscured in fresh water are given in table 3.3

Table 3.3 - 7 Days Compressive Strength For M20 Cylinder

Description	Compressive strength of re-tempered concrete in kn/mm^2	Without Re-tempering strength of concrete kn/mm^2	% of strength gained
5%	1.3	1.35	-3.70
10%	1.47		8.88
15%	1.55		14.81



Graph 1- 28 days comp. strength for Cylinder

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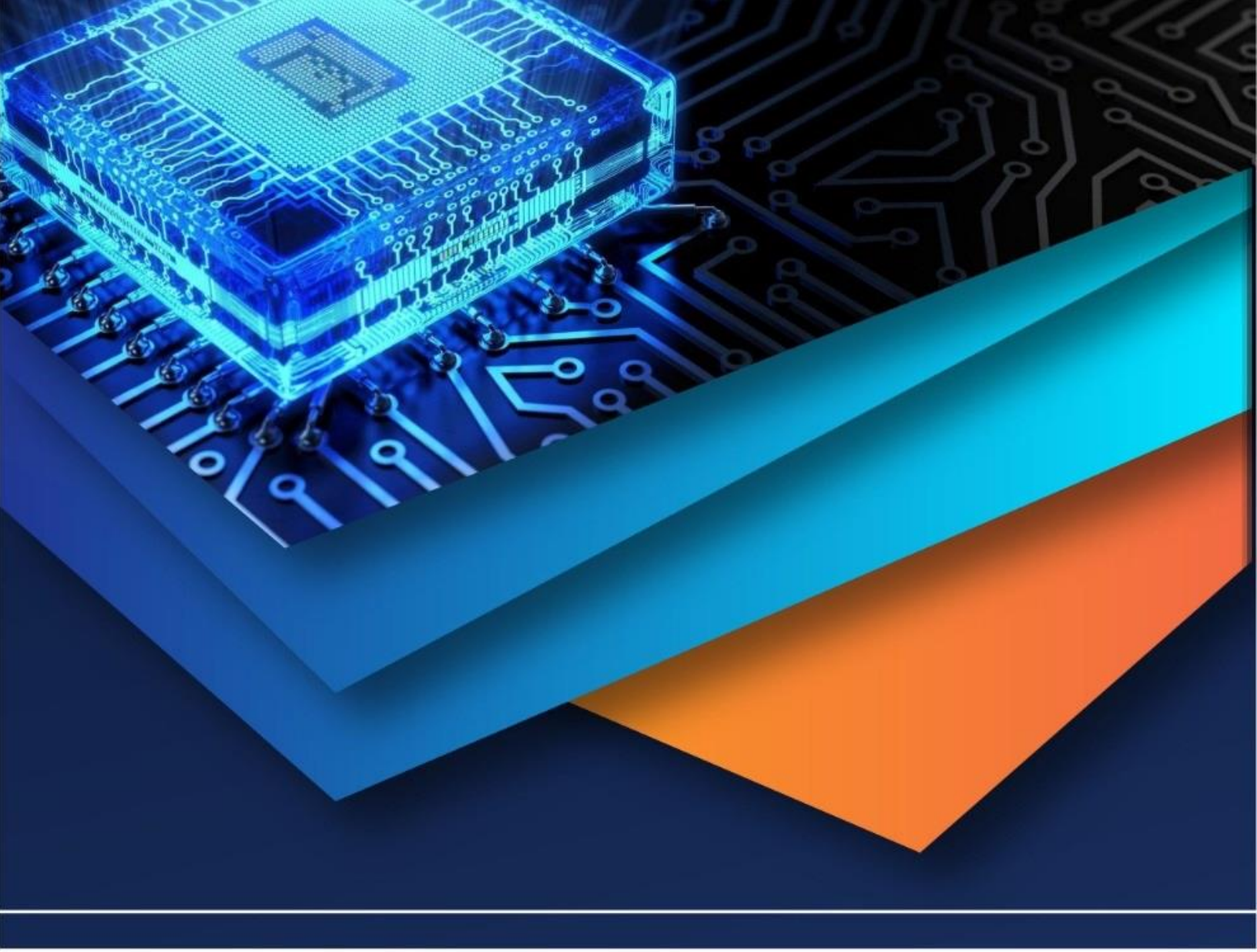

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