

RESEARCH ARTICLE



**EFFECT OF RETEMPERING ON THE PROPERTY OF CONCRETE SUBJECTED TO A 'CIDIC' ATTACK**

**S.B. PHARANDE<sup>1</sup>, DR. D.K. KULKARNI<sup>2</sup>**

<sup>1</sup>Post Graduation Student (Civil Structural Engineering), Rajarambapu Institute of Technology, Sakharale (Sangli) M.S., India

<sup>2</sup>Professor of Civil Engineering Department, S.D.M. College of Engineering and Technology, Dharwad

Article Received: 02/01/2014

Article Revised on:24/01/2014

Article Accepted on:28/01/2014



**S.B. Pharande**



**Dr. D. K. Kulkarni**

**ABSTRACT**

In situation of delayed in delivery of concrete, loss of workability and undue stiffening of concrete may take place at the time of placing on work site. Thus many a times reject the concrete partially set and unduly stiffened due to the time elapsed between mixing and placing. Mixed concrete is a costly material and it cannot be wasted without any regard to cost. It's required to see whether such a stiffened concrete could be used on work without undue harm with use of retempering. The process of remixing of concrete, if necessary with addition of just the required quantity of water is known as 'retempering of concrete'. Sometimes, a small quantity of extra cement is also added while retempering.

In this paper an attempt was made to study the effect of durability property of concrete at different retempering time of 15 min up to 90 min. subjected to acidic attack.

**Key words:** retempering, concrete, durability, compressive strength, acidic solution, acidic attack

**INTRODUCTION**

In the circumstances like breakdown of any concreting equipment or quarrels between the labors or suddenly erupted strikes on the site may put the green concrete into difficult situation. In such above situations the concrete which is already mixed may have to wait for a longer time before entering into the formwork. This causes the loss of plasticity and if such concrete is used, the strength, durability and other characteristics of concrete are affected. Such concrete has to be either discarded or used with little addition of extra water and cement so that a part of plasticity is regained, and such concrete is called retempered concrete. "Addition of water and remixing of concrete or mortar which has lost enough workability to become

unplaceable or unsaleable” is also known as Retempering. Retempering inevitably results in some loss of compressive strength compared with the original concrete strength. Laboratory research and field experience shows that strength reduction and other detrimental effects are proportional to the amount of retempering water and cement added.

The slump loss of fresh concrete at construction site is responsible for the strength and durability aspects of concrete. Truck mixer at prolonged mixing, accelerates stiffening of concrete, results in the rate of slump loss and the increased rate of the slump loss. Particularly when long hauling periods are involved, generally it is the case for ready-mixed concrete deliveries.

Reduction in the free water due to the long time involved in the handling of the ready-mixed concrete and temperature rise took place, resulting reduced slump in prolonged mixing. As a result of a slump loss, concrete begins stiffening, which this in turn results in appreciable losses in consistency, workability and fluidity. To maintain the consistency of the concrete to a desired level just before placement in the production of ready-mixed concrete is the main dilemma. Since concrete poor in workability is difficult to be place and compacted so as to have strength high enough to comply with the specified requirements. Concrete is exposed to aggressive environments with the consequences of easy permeation of deleterious external species through the concrete particularly when concrete have low strength and poor durability.

Adding water to a plastic mix to increase slump is an extremely common practice, even though it is not recommended because it increases the porosity of concrete. Concrete often arrives on site more than half an hour after initial mixing. Placement operations can take anywhere from 10 to 60 minutes, depending on the field conditions and the size of the load. When the slump decreases to an unacceptable level during the operations, water is added to the mix and very often, experienced field inspectors will tolerate what can be termed ‘reasonable’ retempering, i.e., enough to increase slump by 50 or 60 mm.

Strength and durability are the two important properties of concrete. It is now recognized that strength of concrete alone is not sufficient the degree of harshness of the environmental condition to which concrete is exposed over its entire life is equally important. Therefore it is essential to study the durability properties of retempered concrete subjected to acidic attack.

## MATERIALS AND METHODS

The main aim of this experimentation work is to find the effect of different retempering time on the properties of concrete subjected to acidic attack.

Ordinary Portland cement and locally available sand and aggregates were used in the experimentation. The specific gravity of fine and coarse aggregate was 2.50 and 2.86 respectively. The experiments were conducted on a mix proportion of 1:2.15:3.26 with  $w/c = 0.45$  which corresponds to M<sub>20</sub> grade of concrete.

After thoroughly mixing all the ingredients in dry state, the required quantity of water was added in the mix and thoroughly mixed. This concrete mix was poured into the moulds and the specimens were cast with sufficient compaction. This forms fresh concrete for 0 minutes. Similarly for another set, after thoroughly mixing all the ingredients in dry state, the required quantity of water was added in the mix and thoroughly mixed. This concrete mix was poured into the moulds and the specimens were cast with sufficient compaction. This concrete mix was covered with gunny bags for 15minutes. The time was reckoned, this moment the cement and water was added to the concrete mix. After 15minutes the mix was poured into the moulds and the specimens were cast with sufficient compaction. This forms retempered concrete for 15 minutes. Similarly the specimens were prepared with retempered concrete with a retempering time of 30 minutes, 45 minutes, 60 minutes, 75 minutes and 90 minutes.

All the specimens were demoulded after 12 hours of their casting and were transferred to curing tank to cure them for 28 days. After 28 days of curing the specimens, For test of durability like acidic attack the

specimens immersed in 3% HCL solution for 30 days, 60 days and 90days. After removing from the solution weight was noted and the specimens were tested for compressive strength as per IS specifications.

For compressive strength test, the cubes of dimensions 150 X 150 X 150 mm were cast and were tested under compression testing machine as per IS 516: 1959.

## RESULTS AND DISCUSSIONS

Table 1 gives the compressive strength test results for different retempering time of concrete when immersed in acidic media. It also gives percentage increase or decrease of compressive strength w. r. t. without retempering concrete of 0 minute.

The variation of these strengths is depicted in the form of graphs as shown in fig.1.

- a) It has been observed that the concrete produced from the retempering shows higher strength as compared to without retempering. The percentage increase in compressive strength for the retempering time of 15 min., 30 min., 45 min., 60 min., 75min., 90min. are 6.18%, 20.29%, 20.88%, 23.24%, 15.88%, 2.65% as compared to without retempering concrete of 0min.
- b) This may be due to the evaporation of water up to 75 min. resulting slump loss and reduction in w/c ratio. Thus the concrete well compacted thus not allowing any acidic media to penetrate. Thus it can be concluded that the retempering can produced a concrete of higher strength as compared to without retempering when subjected to acidic attack.

**Table 1: Results of compressive strength for different retempering time when immersed in acidic media**

Retempering Time (Minutes)	30 days immersion		60 days immersion		90 days immersion	
	Compressive strength MPa	Percentage increase of compressive strength w.r.t. 0 min.	Compressive strength MPa	Percentage increase of compressive strength w.r.t. 0 min.	Compressive strength MPa	Percentage increase of compressive strength w.r.t. 0 min.
0	26.52	-	25.78	-	25.19	-
15	27.48	3.63	27.41	6.32	26.74	6.18
30	31.85	20.11	30.89	19.83	30.30	20.29
45	31.48	18.72	31.19	20.98	30.44	20.88
60	32.59	22.91	31.56	22.41	31.04	23.24
75	30.74	15.92	29.26	13.51	29.19	15.88
90	26.96	1.66	26.30	2.01	25.85	2.65

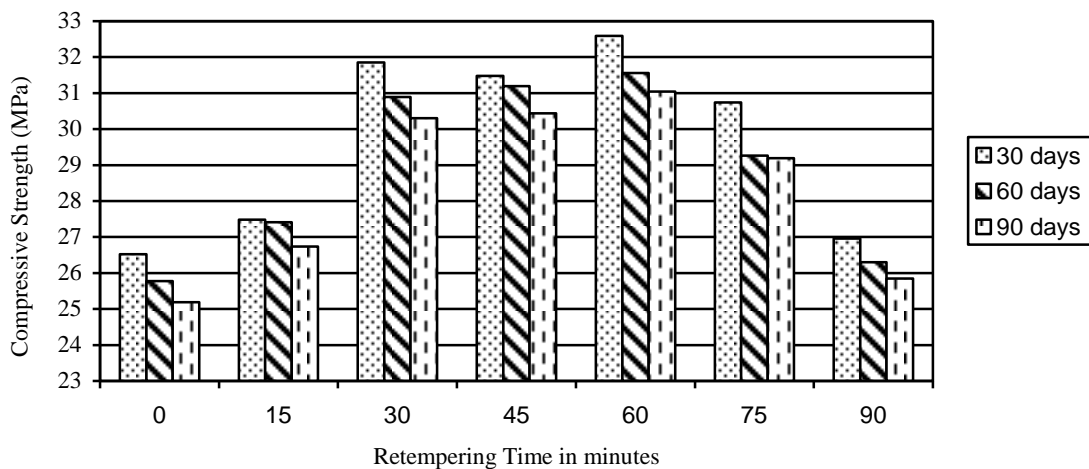


Figure 1 Variation of compressive strength w. r. t. different retempering times

#### CONCLUSIONS

The concrete produced at different retempering time of 15min., 30min., 45min., 60min., 75min., and 90min. strength are reduced when subjected to acidic attack for 30, 60 and 90days. The higher strength of concrete is obtained with concrete produced with addition of five percent extra cement and water with retempering at 15min. to 90min., when subjected to acidic attack for 30, 60 and 90days. Hence it can be recommended to use the retempered concrete has to resist acidic attack.

#### Acknowledgements

The authors would like to thank Dr. D.K. Kulkarni and Principal of Rajarambapu Institute of Technology, Sakharale for giving all the encouragement needed which kept our enthusiasm alive. Thanks are also due to Mahendra Ready Mixed Plant, Satara for permitting me to conduct my experimental work and others who constantly boosted our morale by giving us all the help required.

#### REFERENCES

- [1]. M. S. Shetty, Concrete Technology, S. Chand and Company Ltd., New Delhi, 2004
- [2]. Abdulrahman M. Alhozaimy and Abdulaziz I. Al-Negheimish, 'Retempering of Ready-Mixed Concrete in Riyadh, Saudi Arabia', 'The 6th Saudi Engineering Conference', KFUPM, Dhahran, Vol. 3, December 2002, Pages 137.
- [3]. A.M. Alhozaimy, 'Effect of rettempering on the compressive strength of ready-mixed concrete in hot-dry environments', 'Cement and Concrete Composites', Vol. 29, Issue-2, February 2007, pp. 124-127.
- [4]. Erdogdu, Şakir, 'Effect of Retempering with Superplasticizer Admixtures on Slump Loss and Compressive Strength of Concrete Subjected to Prolonged Mixing', 'Cement and Concrete Research', Vol.35, 2005, pp. 907– 912.
- [5]. D.K. Kulkarni and Dr. K.B. Prakash, 'Effects of Addition of More than two Chemical Admixtures on properties of Retempered Concrete', NBMCW, August 2007, pages 6.
- [6]. Yazan, Kazim, A thesis 'Effects of rettempering with superplasticizer on properties of prolonged mixed mineral admixture containing concrete at hot weather conditions' 'The graduate school of natural and applied sciences of Middle East technical university' November 2005, pages 125.

- 
- [7]. Onder Kirca, Lutfullah Turanli, And Turhan Y. Erdogan, 'Effects of Retempering on consistency and compressive strength of concrete subjected to prolonged mixing', 'Cement and concrete research', Vol. 32, 2002, pp. 441-445.
- [8]. Dr. D.K. Kulkarni and S.B. Pharanade, 'Effect of Retempering on the Properties of Concrete subjected to Alkaline Attack', 'Global Journal of Engineering, Design and Technology', Vol. 2, No. 6, December, 2013, pp. 39-41.
-