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Effect of Retempering on the Properties of Concrete Subjected to Alkaline Attack

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Abstract

Due to 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 properties of concrete at different retempering time of 0 min up to 90 min. subjected to alkaline attack.

***Key words*:** alkaline attack, retempering, durability.

Introduction

In the manufacturing and delivery of ready–mixed concrete, the mixture is continuously mixed for different periods. And the hauling time is minimize for the technical and economical considerations, where prolonged mixing cannot be avoided in some cases, such as the distances involved or delays in placing [3, 7].

The mix is stiffening due to prolonged mix, i.e., slump loss or consistency change. Particularly in hot weather i.e. temperature rises, increase in the mixing period of concrete prior to discharging which causes rapid loss of moisture due to evaporation and accelerates cement hydration, leading to increased slump loss that needs to be compensated by adding water at worksites. Retempering with water is a common practice to restore the initial workability. The amount of water required to produce a slump increases with the extended mixing time. However without proper adjustments the addition of water in mix proportions adversely affects the ultimate quality of concrete[6, 7].

Sometimes, a small quantity of extra cement is also added while retempering to maintain workability. Many specifications do not permit retempering. I.S. 457-1957 did not permit retempering of partially hardened concrete or mortar requiring renewed mixing, with or without addition of cement or water. However, many research workers are of the view that retempering with the addition of a small quantity of water and cement may be permitted to obtain the desired slump provide the designed water/cement ratio is not exceeded[1, 4].

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[2, 5].

Research Significance

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. 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 alkaline attack.

Experimental Programme

The main aim of this experimentation work is to find the effect of different retempering time on the properties of concrete subjected to alkaline 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 M20 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 alkaline attack the specimens immersed in 3%NaOH 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 alkaline 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., 75 min., 90 min. are 3.20%, 6.89%, 7.85%, 9.01%, 5.81%, 0.87% as compared to without retempering concrete of 0 min.

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 alkaline 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 alkaline attack.

Conclusions

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

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Annexure

Table 1: Results of compressive strength for different retempering time when immersed in alkaline 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	26.74	-	26.37	-	25.48	-
15	27.70	3.60	26.44	0.28	26.30	3.20
30	28.15	5.26	27.93	5.90	27.26	6.98
45	28.52	6.65	27.78	5.34	27.48	7.85
60	28.22	5.54	28.07	6.45	27.78	9.01
75	29.33	9.70	28.81	9.27	26.96	5.81
90	27.04	1.11	26.59	0.84	25.70	0.87

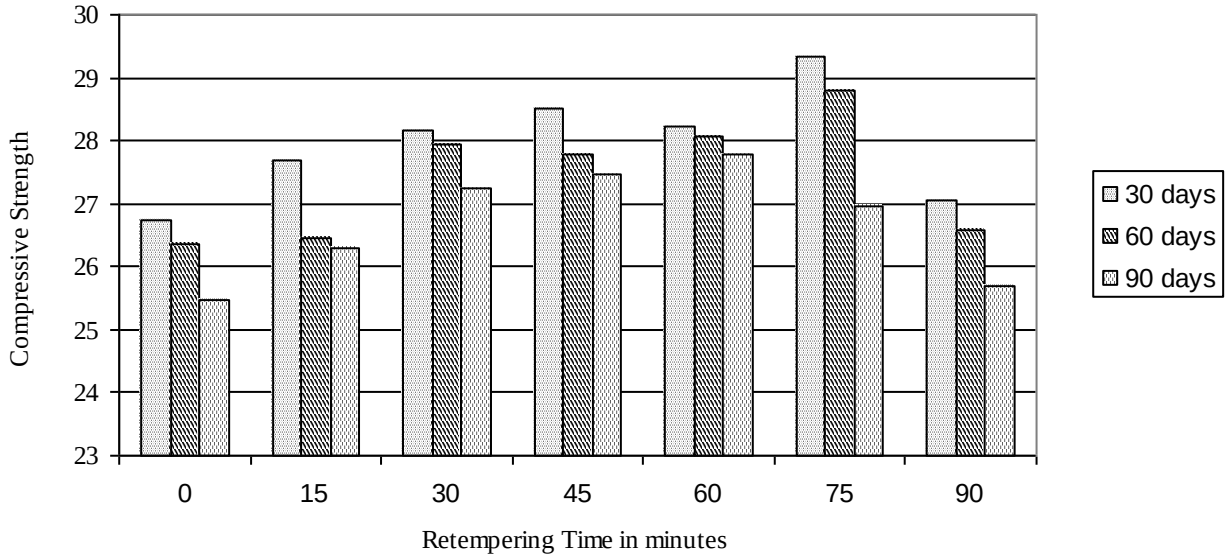

Figure 1 Variation of compressive strength w. r. t. different retempeing times.