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Study the Effect of Retempering with Fly Ash on Prolonged Mixing of Concrete

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Abstract—**Retempering is typically done to restore concrete slump back to specified limits. The practice is known to result in some loss of strength which is proportional to the amount of water added. When retempering of concrete is done only to restoure slump as per ACI 116 defination, it causes a loss in compressive strength. Sometimes in situations like delivery of concrete from central mixing plant, in road construction, in constructing lengthy tunnels,in transportation of concrete by manual labour, in hilly terrain long hauling of concrete is required. Loss of workability and undue stiffening of concrete may take place at the time of placing on actual work site. In such situations engineers at site, many a time reject the concrete partially set and unduly stiffened due to the time elapsed between mixing and placing. 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 the attempt has been made to study propertites of concrete after 28 days for a retempringtime15,30,45,60,75,90,110,120,and150 minutes.with and without adding fly ash and 10% extra cement.**

*Keywords:***retempering time,flyash,extra cement,characteristics**

I. INTRODUCTION

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 "retempering". Ready-mixed concrete, which is mixed at the plant, using a normal, well-designed concrete mix, should arrive at its destination with sufficient workability to enable it to be properly placed and fully compacted. In such circumstances, where there is a significant period of time between mixing and placing the concrete, there will be a noticeable reduction in the workability of the fresh concrete. If for any reason, the placement of the concrete is unduly delayed, then it may stiffen to an unacceptable degree and site staff would normally insist on the rejection of a batch or otherwise good concrete on the grounds of insufficient workability. If not rejected, excessive vibration would be needed to attempt to fully compact the concrete, with the risk of incomplete compaction, expensive repair, or, at worst, removal of the hardened concrete. If abnormal slump loss is anticipated or if transport times are significant, then the intelligent use of admixtures can alleviate the potential workability difficulties, although at additional cost, and this practice is common place. However, in cases where unforeseen delay or some other cause has lead unexpectedly to poor workability, retempering of the concrete by water, while normally considered to be bad practice, may, in reality, be contemplated as a possible course of action. The increase in the water content of. the concrete immediately prior to discharge will improve the consistency, but it is widely held that there must be a subsequent increase in the water/cement (w/c) ratio which will be detrimental to the hardened concrete. 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.

II. RESEARCH SIGNIFICANCE

In the circumstances like breakdown of any concreting equipment or quarrels between the labours 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 makes concrete stiffened and if such concrete is used, it affects the compressive strength of concrete. 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. Therefore it is essential to study the compressive strength of retempered concrete with different retempring time.

III. EXPERIMENTAL PROGRAME

A.Methodology

The quality of retempered concrete was checked w.r.t the following two different cases

- Retempered concrete without any addition.
- Retempered concrete with extra 10% cement + extra 10% water. Retempered concrete with fly ash (25% replacement by cement).

The main object of this work is to find the effect of retempering time on propertites of concrete. Ordinary Portland cement of grade 53 and locally available sand

and aggregates were used in the experimentation. The specific gravity of fine and coarse aggregate was 2.68 and 2.75 respectively. The experiments were conducted on a mix proportion of 1: 2.01: 2.967 with w/c = 0.50 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 covered with gunny bags for 15 minutes. The time was reckoned, the moment the water was added to the concrete mix. After 15 minutes the mix was poured into the moulds and the specimens were cast with sufficient compaction through vibration. This forms retempered concrete for 15 minutes. Similarly the specimens were prepared with retempered concrete with a retempering time of 30, 45, 60, 75, 90,100,110,120,and150 minutes.

Another set of retempered concrete specimens were cast by adding 10% extra cement and by adding 25% fly ash. The required extra amount of water to balance a w/c ratio of 0.50. All the specimens were demoulded after 24 hours of their casting and were transferred to curing tank to cure them for 28 days. After 28 days of curing the specimens were tested for their compressive strength, tensile strength, flexural strength and as per IS specifications. For compressive strength test, the cubes of dimensions 150 x 150 x 150 mm were cast and were tested. For splitting tensile strength test, the cylinders of 150 mm diameter and length 300 mm were cast and were tested under compression testing machine as per IS: 5816-1999 [9]. For flexural strength test, beams of dimension 100 x 100 x 500 mm were cast and were tested on an effective span of 400 mm with two point loading as per IS: 516-1959 [8].

B. Mix design : As per IS 10262 (2009)

- **Specific gravity of fine aggregate**

As per IS 2386 (Part III): 1963 specific gravity of fine aggregates has been carried out, and the specific gravity of fine aggregate is 2.68

- **Water absorption of fine aggregates**

As per IS 2386 (Part III): 1963) water absorption of fine aggregates has been worked out,and the water absorption is 1%

- **Specific Gravity Of Coarse Aggregates**

As per IS 2386 (Part III): 1963 specific gravity of fine aggregates has been carried out, and the specific gravity of fine aggregate is **2.75**

- **Water Absorption Of Coarse Aggregates**

As per IS 2386 (Part III): 1963) water absorption of coarse aggregates has been worked out,and the water absorption is 0.80%

- **Fineness Modulus of fine aggregate** = 3.13
- **Fineness Modulus of coarse aggregat** 2.26

Table -1: Physical properties of OPC cement 53 grade.

Sr. No.	Characteristics	Test Result
1	Fineness (m^2/kg)	297
2	Standard Consistency	29.25 %
3	Setting Time (minutes)	
	a. Initial Setting Time	160 min
	b. Final Setting Time	235 min
4	Compressive Strength (MPa)	
	a. 3 days	37.9
	b. 7 days	49.3
	c. 28 days	70.0

Table -2: Final mix proportion

Cement kg/m³	Water l/m³	Sand kg/m³	Coarse Aggregate kg/m³
383.16	191.58	771.84	1135.2
1	0.50	2.01	2.967

IV. RESULTS AND DISCUSSION

Table -3: variation in compressive strength of retempered concrete with and without adding extra cement and fly ash

Retempering time (minutes)	without any additions	with fly ash (25% replacement by cement) and extra 10% cement + extra 10% water
0	22.27	23.25
15	22.56	23.75
30	23.12	23.89
45	23.15	24.27
60	24.01	24.87
75	23.00	24.61
90	22.59	23.89
110	22.23	23.00
120	21.23	22.81
150	20.24	22.27

Table -4: variation in split tensile strength of retempered concrete with and without adding extra cement and fly ash.

Retempering time (minutes)	without any additions	with fly ash (25% replacement by cement) and extra 10% cement + extra 10% water
0	3.45	3.72
15	3.60	3.98
30	3.98	4.17
45	4.70	5.36
60	5.33	5.98
75	4.37	5.56
90	4.28	4.70
110	4.10	4.12
120	3.88	4.00
150	3.50	3.72

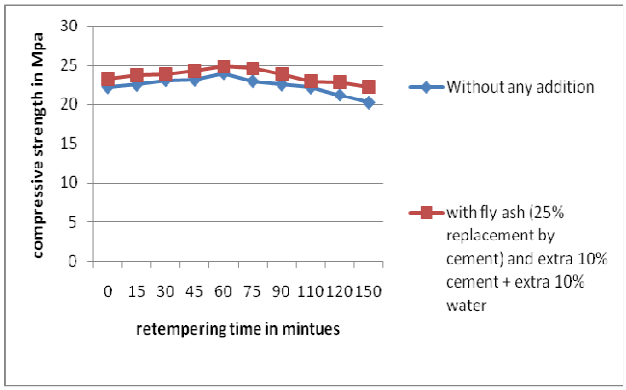

Figure 1:showing variation of compressive strength

Table -5: variation in flexural strength of retempered concrete with and without adding extra cement and fly ash.

Retempering time (minutes)	without any additions	with fly ash (25% replacement by cement) and extra 10% cement + extra 10% water
0	2.25	3.00
15	2.88	3.34
30	3.00	3.98
45	3.30	4.27
60	4.70	5.87
75	3.65	4.18
90	3.1	3.27
110	2.27	2.98
120	1.60	2.17
150	1.15	1.86

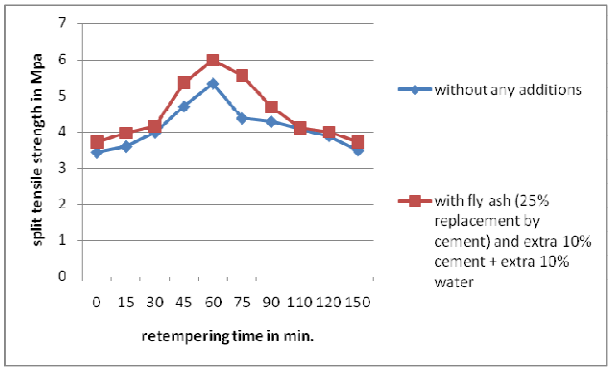

Figure 2:showing variation of split tensile strength.

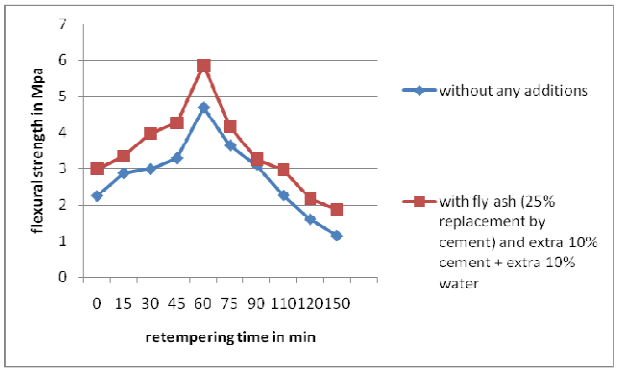

Figure 3:showing variation of flexural strength.

From above table , it has been observed that, It is observed that compressive strength, tensile strength, and flexural strength of retempered concrete goes on increasing up to 60 minutes of retempering time. Thereafter all the strengths start decreasing. This is true for retempered concrete produced without any additions, produced with extra 10% cement and water, produced with 25% replacement of cement by fly ash ,This is due to the fact

that above 60 minutes of retempering time the concrete looses the plasticity seriously and remixing the concrete beyond 60 minutes will not reunite the concrete particles to adhere together. Thus it can be concluded that compressive strength, tensile strength, and flexural strength of retempered concrete goes on increasing up to 60 minutes of retempering time. Therefore retempering can be allowed up to 60 minutes.

It has been also it is observed that compressive strength, tensile strength, flexural strength of concrete is more for retempered concrete produced with 25% replacement of cement by fly ash with extra 5% cement and water as compared to other categories. This is true for all the retempering times. This is due to the fact that addition of fly ash and extra 10% cement and water will help in keeping the concrete in plastic state which helps in thorough compaction of concrete resulting in higher strength. Thus it can be concluded that compressive strength, tensile strength, and flexural strength of concrete is more for retempered concrete produced with 25% replacement of cement by fly ash with extra 10% cement and water as compared to other categories.

V. CONCLUSIONS

Following conclusions can be made based on the experimentations conducted on the retempered concrete.

1. Compressive strength, tensile strength, and flexural strength of retempered concrete goes on increasing up to 60 minutes of retempering time. Therefore retempering can be allowed up to 60 minutes.
2. Compressive strength, tensile strength, and flexural strength of concrete is more for retempered concrete produced with 25% replacement of cement by fly ash with extra 10% cement and water as compared to other categories.
3. Hence by avoiding wastages of bulck concrete we can recommend to use a retempered concrete with addition of fly ash and 10% extra cement.

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