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Retempering of Concrete Made by using Artificial Sand Containing Superplastciser & Retarder

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Abstract- **Unforeseen concrete casting delays at construction site result in loss of workability, fluidity and consistency of the concrete and such a concrete batch generally gets rejected on the grounds of insufficient workability. Mixed concrete is a costly material and it cannot be wasted without any regard to cost.So delay in the production and delivery of ready-mixed concrete is inevitable which is influenced by the location of construction sites in relation to the central batching plant and traffic conditions on the route. In order to increase the workability of the concrete, an addition of superplasticiser and an addition of water with proportional amount of cement can be adopted and this could adversely affect the concrete performance in the fresh and hardened state. Retempering is defined as 'addition of water and remixing of concrete or mortar which has lost enough workability to become nonplaceable or unstable'. In this paper an attempt is made to study the strength characteristics of concrete containing super plasticizer and retarder at retempering time of 15 min up to 90 min. The study also focuses to determine the relative performance of concrete by using artificial sand.**

Keywords- Artificial sand, compressive strength of concrete, Retempering of concrete, superplasticiser, retarder.

I. INTRODUCTION

Concrete is the most widely used material of construction all over the world. A huge quantity of concrete is consumed by construction industry all over the world. Concrete which manufactured in a mixing plant to be delivered to construction site in unhardened and plastic stage but today industries are faced with a common problem known as casting delay. Improper methods of handling, lack of site organization, work scheduling and breakdown of equipment are some causes of unexpected long delays. The process of retempering performed to restore the initial slump and keep concrete workable at construction sites. Concrete is either wasted or delivered in small batches at increased cost to the contractor and client. If they are not followed, additional water must be added to the concrete to restore the slump and provide sufficient workability for proper placing and compaction. The water is simply added together with a corresponding amount of cement which is required to keep the w/c ratio unchanged. The amount of water for retempering is to be taken as 5% from the total quantity and to maintain w/c ratio in proportion, the amount of extra cement of 5% from its total amount were taken [6].

Sand is a common aggregate used in construction work as a fine aggregate. In this study the main concern is to find an alternative of sand.
Nowadays the conventional concrete is produced by using natural sand obtained from riverbeds use as a fine aggregate. Dwindling sand resources poses the environmental problem and hence goverment restrictions on sand quarrying resulted in scarcity and significant increase in its cost hence it is being replaced by artificial sand [5]. Super plasticisers behave much like conventional water reducing admixtures in that they reduce the inter-particle forces that exist between cement grains in the fresh paste, thereby increasing the paste fluidity [1]. Retarder is a chemical admixture added to concrete during the batching process to offset the accelerating effect of high ambient temperatures associated with hot weather. It extend the time in which concrete can be transported, placed, and finished [4].

A. Research significance

Concrete casting delays remain a major issue as far as the concrete industry is concerned. These unexpected delays are usually the results of among other factors congested traffic when delivering the concrete, breakdown of concreting equipment, poor assembly of scaffolding and formwork, disputes between labours and their employers. In such circumstances, where there is a delayed time between mixing and placing the concrete there will be a considerable loss of workability, fluidity and consistency of concrete which results in loss of slump value of concrete.It was of great importance to establish the influence of retempering concrete with different superplasticisers and retarders as this will demonstrate the influence when they are applied or used as retempering agents to concrete subjected to casting delays.

II. MATERIALS USED

A. Cement

Ordinary Portland cement 53 grade, confirming to IS 12269-1987 has been used in the production of concrete for all mixes.

Table I. Physical properties of cement

Characteristics	Test results
Fineness	*4.47%*
Standard consistency	*28%*
Setting Time (minutes) a. Initial b .Final	 *155* *275*
Compressive strength (28 days)	*60.05N/mm²*

B. Aggregates

Crushed stones with size of 10 mm and 20 mm have been used; it is confirmed to I.S. 2386 (Part 1):1963.

C. *Crush Sand*

Artificial sand confirming to table 4, Zone-I of I.S. 383-1970 was used for the experimentation.

Table II. Properties of aggregates and crush sand

Properties	Crush sand	Coarse aggregate
Fineness modulus	3.02	4.77
Silt Content	10%	---
Specific gravity	*2.81*	*2.72*
Water absorption	*1.54%*	*3.30%*

D. Water

Portable tap water has been used for making the concrete and it has also been used as retempering agent. The pH value of water used in experimentation work obtained using ph meter is 7.9.

E. Admixtures

Admixtures are chemicals which are added to the mix at the mixing stage to modify properties of mix these admixtures confirmed to I.S. 9103:1999[16].

III. EXPERIMENTAL PROGRAMME

The main aim of this experimentation work is to find the effect of addition of superplasticiser and retarder admixtures on the properties of retempered concrete. Portland Pozzolona cement and locally available aggregates and crush sand used in the experimentation. Compressive strength of concrete cubes (Size: 150mmx150mmx150mm) to be taken after 28 days of curing. A vibrating table was used to achieve full compaction of the molded specimens. Noting that the mixer was nearly operating all over the period of retempering while during the standing period, slump test and cast of specimens are carried out. The experiments were conducted on a mix proportion of 1:2.34:3.57 with w/c= 0.55 which corresponds to M20 grade of concrete.The concrete mix design procedure to be adopted using as per IS 10262:2009[1].

First stage of the experimentation work consisted concrete without admixture and with addition of cement and water, after thoroughly mixing all the ingredients in dry state the required
quantity of water was added in the mix, the concrete was mixed at a normal mixing speed in mixer. Then a mixer was stopped and a small batch
of concrete was taken out of the mixer which was large enough to yield 3 specimens for compressive strength test and 3 slump samples. This forms retempered concrete for 0 minutes then remaining concrete mix is 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 pour into the moulds and the specimens are cast with sufficient compaction through vibration. This forms retempered concrete for 15 minutes. 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, this process was carried out up to 90 minutes at 15 minutes time interval. After that concrete batch retempered with superplasticiser. In third stage of experimentation work concrete batch that was retempered with retarder.In final stage of experimentation work retempering work carried out with combination of superplasticiser and retarder.

Table III. Admixtures and their chemical content with dosages used in the Experimentation

Admixture	Dosages used (by weight of cement) Percentage		
Superplasticizer	0.15	0.3	0.45
Retarder	0.2	0.4	0.6
Superplasticizer + Retarder	0.15+0.2	0.3+0.4	0.45+0.6

Table IV. Results of compressive strength for 20 N/mm^2 concrete

Sr. No.	Retempering time (min.)	Average Compressive strength(N/mm^2)									
		Mix with 5% water and cement (without admixture)	Mix with superplasticiser and with 5% cement & water			Mix with retarder and with 5% cement & water			Mix with superplasticiser and retarder		
			0.15 %	0.3%	0.45%	0.2 %	0.4%	0.6%	(0.15+ 0.2) %	(0.30+0. 4)%	(0.45+ 0.6)%
1.	0	22.40	27.20	27.62	27.94	26.15	26.48	25.70	24.80	25.65	25.30
2.	15	23.14	27.30	27.70	27.98	26.58	27.40	26.09	25.20	24.42	26.15
3.	30	24.82	27.60	27.84	28.16	27.44	27.74	26.80	27.28	25.60	26.46
4.	45	26.21	27.87	27.91	28.36	28.08	28.52	28.10	27.72	27.20	28.36
5.	60	26.90	25.34	26.14	27.70	28.42	28.84	29.21	28.04	29.80	30.43
6.	75	24.20	24.85	24.55	26.90	25.55	26.20	25.70	27.90	28.22	27.50
7.	90	21.30	22.10	24.23	24.40	25.14	25.90	24.28	26.55	25.70	26.06

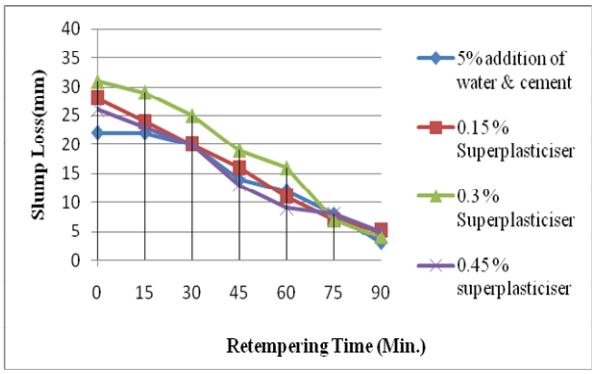

Fig.1 Variation of Slump vs. Retempering Time for addition of 5% water and cement and for superplasticiser

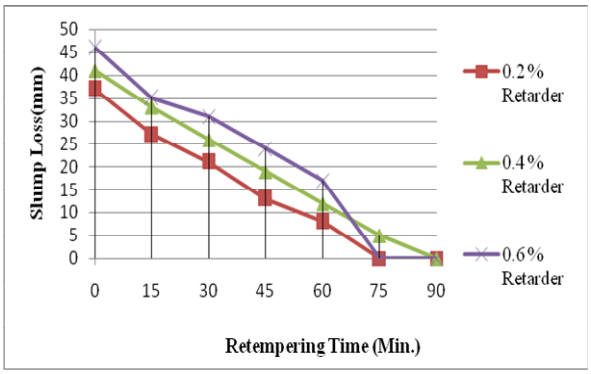

Fig.2 Variation of Slump vs. Retempering Time for addition of retarder

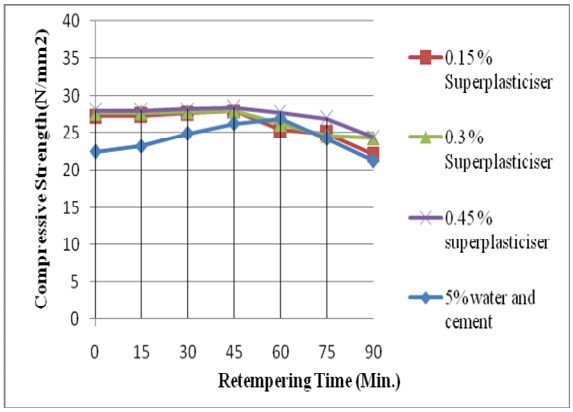

Fig.3 Variation of Compressive strength vs. Retempering Time for addition of 5% water and cement and for superplasticiser

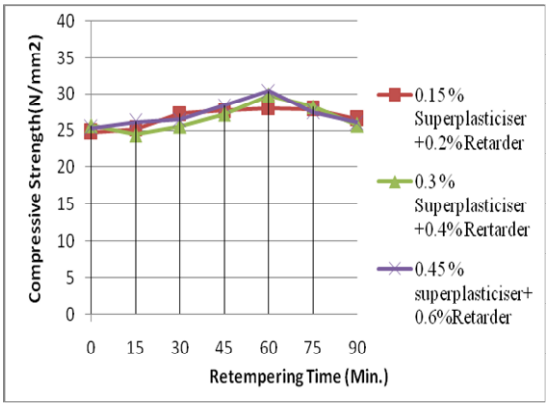

Fig.4 Variation of Compressive strength vs. Retempering Time for addition of superplasticiser and retarder

IV. RESULTS AND DISCUSSION

1) It has been observed that the concrete produced with addition of 5% extra cement and water show higher compressive strength. Obviously this may be due to the fact of presence of 5% excess cement. Thus it can be concluded that the concrete produced with addition of 5% extra cement and water yields more strength than without addition of cement and water. Also compressive strength of concrete with addition of 5% extra cement and water reduced beyond 60 minutes of retemprering time.

2) From experimental work it has been observed that the compressive strength of concrete produced with the combination of superplasticiser and retarder is higher than that without any admixture. This is true for all the retempering times. This may be due to the fact that the addition of superplasticizer and retarder.

3) From experimental work it has been observed that Slump values of 20 mpa concrete retempered with combination of 5% extra water and cement goes on reducing from 0 to 90 minutes.

4) It has been observed that the Slump values of 20 mpa concrete retempered with combination of 5 % extra water and cement lower than concrete which was retempered with 0.15, 0.3, 0.45 percentage of superplasticiser.

V. CONCLUSION

The following conclusions were drawn from the the experimental work that was performed.

1) The concrete without any addition of admixture and with addition of 5% cement & water show maximum strengths at a retempering time of 60 minutes.

2) Compressive strength of concrete produced with combination of superplasticizer and retarder yields more strength for retempering time of 60 minutes, than for other other categories of retempered concrete.

3) The concrete produced with the superplasticiser show higher compressive strengths than that of without admixtures for all the retempering times.

4) From From economy and environmental point of view this experimental programme encourages replacement of natural sand by artificial sand, due to the irregular particle shape of the artificial sand in addition to the reduced amount of water cement ratio.

5) The effectiveness of superplasticiser and retarder to maintain the slump level found to be much better as compared to the addition of 5% cement and water.

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