# Retempering of Concrete Made by Using Artificial Sand

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(Received on 05 September 2011 and accepted on 12 March 2012)

***Abstract* - 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. Objective of this paper to study the strength characteristics of retempered concrete made by using artificial sand. Usually the retempering process is used with normal concrete or with ready mixed concrete; an attempt is made to check the compressive and flexural strength of normal retempered concrete with an addition of retarder in three different percentages as 0.2%, 0.4% and 0.6% at retempering time of 15 minutes to 90 minutes. Presently there is scarcity of the natural sand. Hence it is being replaced by artificial sand. This is replaced by manufactured sand. The artificial sand is manufactured by breaking stone into smaller and smaller particles in such way that the gradation of particle will match with Zone-II of I.S. 2386- part-II.**

***Keywords:* Retempering of Concrete, Flexural Strength of Concrete, Compressive Strength of Concrete Slump of Concrete**

## I. Introduction

Retempering is defined as "Addition of water and remixing of concrete or mortar which has lost enough workability to become unplaceable". Retempering inevitably results in some loss of strength compared with the original concrete. Concrete is like material obtained by mixing cement, fine aggregate , coarse aggregate and water in specific proportions[1] .Water is added for chemical reaction and gives workability to fill in the form of shape and dimension for structure. The chemical interaction between cement and water bonds the aggregate into solid mass [2].

## II. Effects Of Prolonged Mixing On Slump Loss

The most important result of prolonged mixing is on slump value of concrete. Fresh concrete mixes stiffen with time, particularly if continuously mixed. This stiffening effect is reflected in a reduced slump and accordingly, this phenomenon is reflected as slump loss. This loss of slump value at prolonged mixed concrete is caused by a number of reasons. The main reasons are simply that some water from the mix is absorbed by the aggregate if mix is not saturated, some water is lost by evaporation and some water is removed by initial chemical reactions The higher water absorption rate of aggregates as a result of longer mixing time is a reason for slump loss of prolonged mixed concrete. The grinding effect caused by extra mixing of fresh concrete causes greater amount of fine aggregate than the one determined during design process. This situation results in a decrease in slump value, since increase in finer aggregate increases the water demand for same consistency of concrete [3].

## III. Need For Manufactured Sand

As the supplies of suitable natural sand near the point of consumption are becoming exhausted, the cost of this sand is increasing. This concrete ingredient is available from natural resources as sand is found at the bank of river. But in rainy season as the flow of water in river is large these small sand particles flow away and hence there is shortage of sand. To overcome this situation engineers are diverting their efforts to find some alternate for natural sand. Since last few years research is being carried out on the crush stone material as a replacement for natural sand. Besides the dredge process, creates following undesirable impacts on the environment.

a) Dredge can create disturbance to aquatic ecosystem;
b) Dredge spoils may contain toxic chemicals, that may adversely affect on the disposal area;
c) Dredge affects the self purification system of stream, disturbing the river beds which act as filter media for purification of stream water;
d) Due to the dredge process, turbidity increases, this will affect aquatic ecosystem [4].

## IV. Research Significance

Ready-mixed (RMC) 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[5] [6].

## V. Experimental Programme

The main aim of this experimentation work is to find the effect of addition of retardering admixtures on the properties of retempered concrete. Portland Pozzolona Cement and locally available aggregates and crushed sand were used in the experimentation. The specific gravity of fine and coarse aggregate was 2.76 and 2.87 respectively. The experiments were conducted on a mix proportion of 1: 1.26:2.1 with water cement ratio (w/c) equal to 0.54 which corresponds to M 20 grade of concrete.

TABLE I FLEXURAL STRENGTH OF CONCRETE

| Sl. No. | Retempering Time in Minutes | Flexural Strength in N/mm$^2$ | | | |
|---|---|---|---|---|---|
| | | 0.00%Retarder | 0.2%Retarder | 0.4%Retarder | 0.6%Retarder |
| 1 | 0 minute | 4.62 | 4.69 | 4.73 | 4.70 |
| 2 | 15 minutes | 4.32 | 4.61 | 4.61 | 4.56 |
| 3 | 30 minutes | 4.09 | 4.23 | 4.52 | 4.43 |
| 4 | 45 minutes | 3.47 | 4.36 | 4.29 | 4.19 |
| 5 | 60 minutes | 2.96 | 3.29 | 4.11 | 4.01 |
| 6 | 75 minutes | 2.67 | 2.93 | 4.08 | 3.96 |
| 7 | 90 minutes | 2.58 | 2.68 | 3.99 | 3.87 |

TABLE II COMPRESSIVE STRENGTH OF CONCRETE

| Sl.No. | Retempering Time in Minutes | Compressive Strength in N/mm$^2$ | | | |
|---|---|---|---|---|---|
| | | 0.00%Retarder | 0.2%Retarder | 0.4%Retarder | 0.6%Retarder |
| 1 | 0 minute | 34.31 | 38.39 | 36.79 | 36.11 |
| 2 | 15 minutes | 34.71 | 36.76 | 35.59 | 34.09 |
| 3 | 30 minutes | 33.38 | 34.39 | 35.58 | 34.01 |
| 4 | 45 minutes | 30.27 | 31.92 | 33.69 | 33.59 |
| 5 | 60 minutes | 26.73 | 30.07 | 33.58 | 33.38 |
| 6 | 75 minutes | 23.34 | 26.79 | 33.42 | 33.22 |
| 7 | 90 minutes | 21.34 | 22.89 | 32.08 | 32.01 |

After thoroughly mixing all the ingredients in dry state, the required quantity of water was added in the mix and thoroughly mixed. At this stage the homogeneous concrete mix was obtained. This concrete mix was covered with gunny bags for 15 minutes. The time was reckoned,

Another set of retempered concrete specimens were cast by adding 0.2% retarder and the required extra amount of water to balance a w/c ratio of 0.54. All the specimens were demoulded 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 and flexural strength as per IS specifications.

For compressive strength test, the cubes of dimensions 150 mm X 150 mm X 150 mm were cast and were tested under compression testing machine as per I S 516-1959. For flexural strength test the beams of dimensions 150 mm X 150 mm X 700 mm were cast and were tested on an effective span of 500 mm with two point loading as per I S 516-1959.

## VI. Test Results

Table No 2 gives the compressive strength test results of retempered concrete. Table No 1 gives the flexural strength test results of retempered concrete. The variations of these strengths are depicted in the form of graphs as shown in Fig. No 1& Fig. No 2 and the variation of these slump & compaction factor are depicted in the form of graphs as shown in Fig. No.3 & Fig. No 4.

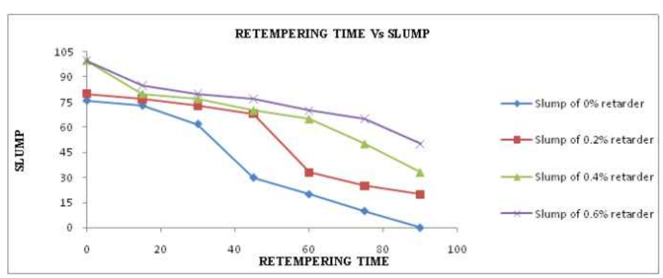


Fig. 1 Variation of the Slump vs. Retempering Time

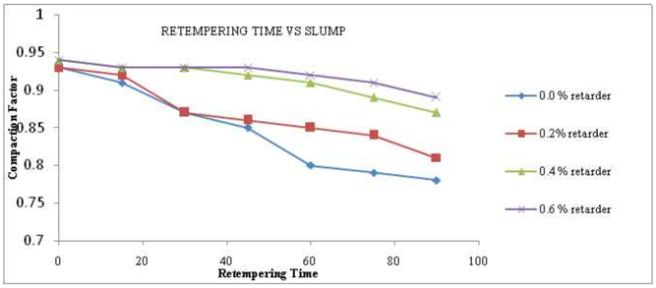


Fig. 2 Variation Compaction Factor vs. Retempering Time

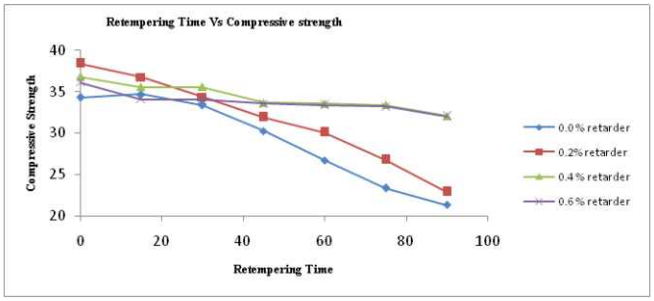


Fig. 3 Variation Compressive Strength vs. Retempering Time

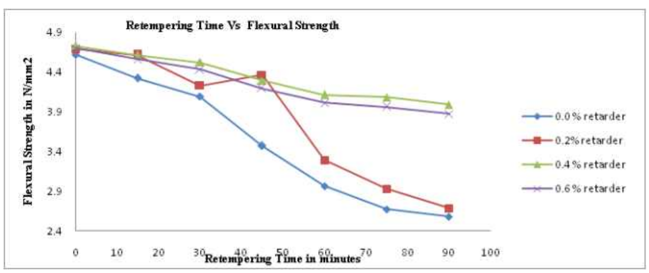


Fig. 4 Variation Flexural Strength vs. Retempering Time

## VII. Discussion of Test Results

It has been observed that the concrete without any retarder shows maximum compressive strength, flexural strength, at retempering time of 45 minutes.

Observations: The concrete without any retarder shows maximum strengths, at retempering time of 45 minutes.

1. The concrete with 0.2% retarder, 0.4% retarder & 0.6% retarder concrete shows Target Compressive Strength, Flexural Strength, up to retempering time 60 minutes, 90 minutes & 90 minutes respectively.
2. With the addition of 0.2% retarder, 0.4% retarder & 0.6% retarder concrete the demoulding period is 24 hours, 36 hours & 48 hours respectively.
3. For 0.0% retarder Slump of concrete decrease as the retempering time vary from 0 minute to 90 minute.
4. Degree of workability of concrete is medium for without retarder, 0.2% retarder, 0.4% retarder & 0.6% retarder concrete is for retempering time 45 minutes, 60 minutes, 90 minutes & 90 minutes respectively.

## VIII. Conclusion

The concrete without any retarder shows target compressive strength, flexural strength, up to retempering time 45 minutes. Compressive Strength & Flexural Strength of the concrete is increase as percentage of the retarder is increases. Demoulding time is increase as percentage of the retarder is increases. Target Compressive Strength & Flexural Strength is depend upon Degree of workability of concrete.

## References

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