Effect of Water to Cement Ratio and Curing Condition On Compressive Strength of Recycled Aggregate Concrete

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Abstract

The waste material produced from the demolition of concrete structures every day throughout the world. This concrete waste includes the recycled aggregates and the best way of use of this waste is to use as coarse aggregates in the production of fresh concrete. The millions of tons of coarse aggregates is use for the production of concrete and the rocks are the source of aggregates (whether natural or broken)..In the new production of concrete the recycled aggregates is used as the coarse aggregates. In this research work from the experimental work performed on the recycled aggregates concrete and the compressive strength of the recycled aggregates was determined by using the different water to cement ratios. For to determine the compressive strength of the recycled aggregate concrete the Lawrancepur sand is used as a fine aggregate, from a demolished concrete the recycled aggregates is collected and used as coarse aggregates and the DG Cement is used as a binding material. The different water to cement ratios has a effect on the recycled aggregates concrete compressive strength. W/C 0.50, 0.55, 0.60 was examined in our research work and the results found that W/C 0.50 gave greater compressive strength. The results show that submerged treatment gives greater compressive strength compared to the coagulant because in the case of submerged treatment, there is no loss of moisture from concrete samples and enhances water reaction. Therefore, to achieve high pressure is recommended submerged treatment. The properties of recycled aggregates was determined and compared with the properties of natural aggregates. After the experimental work its was determined that the water absorption capacity of the recycled aggregates was more as compare to fresh aggregates due to the attachment of cement particles.

Keywords: Recycled concrete, Water cement ratio, Aggregate, Compressive strength.

1. INTRODUCTION:

The concrete which is produced by the use of natural aggregates has better quality as compare to the concrete which is produced by the use of recycled aggregates as coarse aggregates. Because the recycled aggregates have greater water absorption capacity due to the attachment of cement particles with the aggregates and have a porous mortar matrix around the surface of aggregates this make the lower bond in concrete. The quality of the recycled aggregates is low as compare to natural aggregates, however the recycled aggregates have been used in different construction works for the cost benefit analysis and to reduce the waste material produced from demolished of concrete structures.
The properties of recycled aggregates are low so the use of recycled aggregates is limited and used for only low strength concrete and low grade concrete. And if the recycled aggregates have good properties then can be used in the production of high quality concrete such as structural concrete. The research and the experimental work provided good guidance on quality control of recycled aggregates and then use in high quality concrete.

2. EXPERIMENTAL PROCEDURES:

2.1 Test Standards

All the experimental work performed by the used of ASTM standard.

2.2 Test Performed on Concrete

- Slump test
- Temperature test
- Compressive strength test

Figure 1: View of RCA in Boulder and Crushed form

2.2 Research Methodology

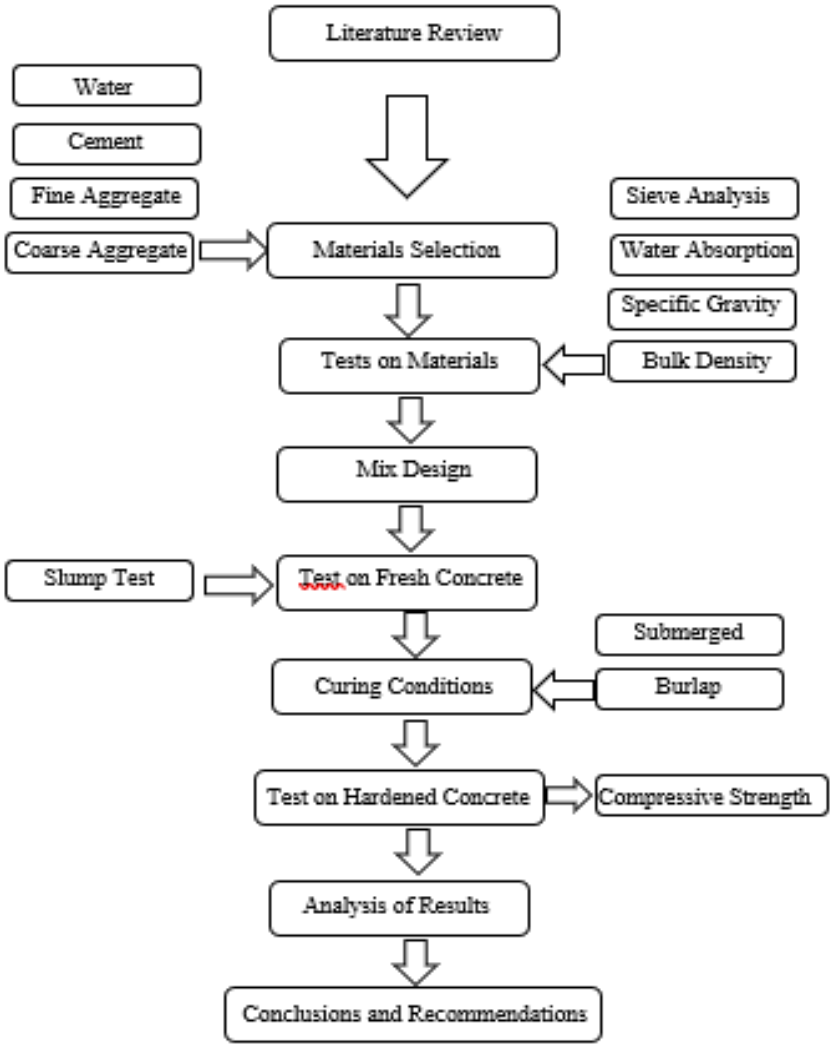


Figure No.2 Flow Diagram of Research methodology

2.3 Slump Test

On the fresh concrete the slump test was performed according to ASTM C-143 procedure for or to check the slump value of fresh concrete the slump cone apparatus was used. The slump cone was filled in three equal layer with considering height of the slump cone and was compressed with 25 strokes using the steel tamping rod after each layer. The diameter of the temping rod is 5/8in and have 24 inches long. The slump value gives the indication about the water content and ease in working on concrete.

Figure 3: Slump test

2.3.1 Procedure

- The slump cone base plate is provided on flat surface, the base plate is lubrication is provided and the base plate is made of steel.
- The slump cone is filled up to 1/3 level and then provided the 25 equal strokes by the used of tamping rod.
- Then in second layer the slump cone is filled to 2/3 and the 25 strokes equally provided by the used of tamping rod
- Then the last layer upto the top level of the slump cone was filled and then removed the concrete outer on the top of the slump cone and provided the 25 strokes equally on top layer of the concrete.
- Then the slump cone was removed carefully in the vertical direction (it takes about five seconds).
- Then the slump cone is placed near to the sloping concrete, then place the temping rod horizontally across the slump cone and the sloping concrete, and measured the slump value in inches by the used of scale. Figure 3.8 above is shown that the slump test of fresh concrete in inches.

2.3 Compression Test

Due to the high compressive strength of concrete it has commonly used to carry compressive loads. ASTM C 39 specifies is the standard test method for to check the concrete compressive strength. The cylinder size of 6"×12' was used to check the compressive strength. The uniformly load applied on the specimen. The compressive strength of the specimen was determined at 7 and 28 days.

Figure No 4: Compression Testing setup

2.3.1 Procedure

- The bearing plates provided on the platen of the machine with hard face up and wipe clean the upper and lower plate of the machine.

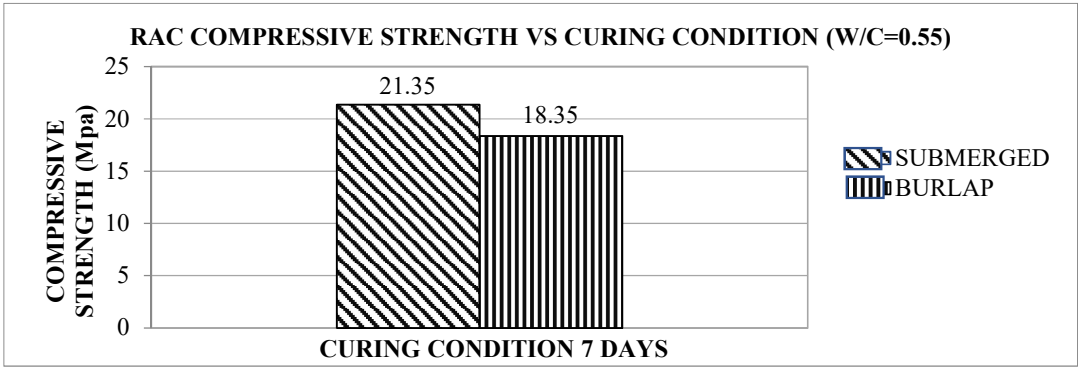
- The specimen with accurate alignment was placed in the compressive strength apparatus and then at the centre of the specimen between the plated the load was applied.
- The apparatus applied the uniform load on the specimen with the constant loading value of 35± 7 psi/s.
- The apparatus was applied compressive load on the specimen until the load was reduced steadily and specimen displays a well define load fracture pattern.

3. RESULTS:

3.1 Strength at different Curing conditions

Figure No.5 Strength vs Curing Condition for RAC at 7 days

On 7 days curing in different conditions the results are being compared as shown in figure



above. In submerged condition the strength is greater as compared to BURLAP curing.

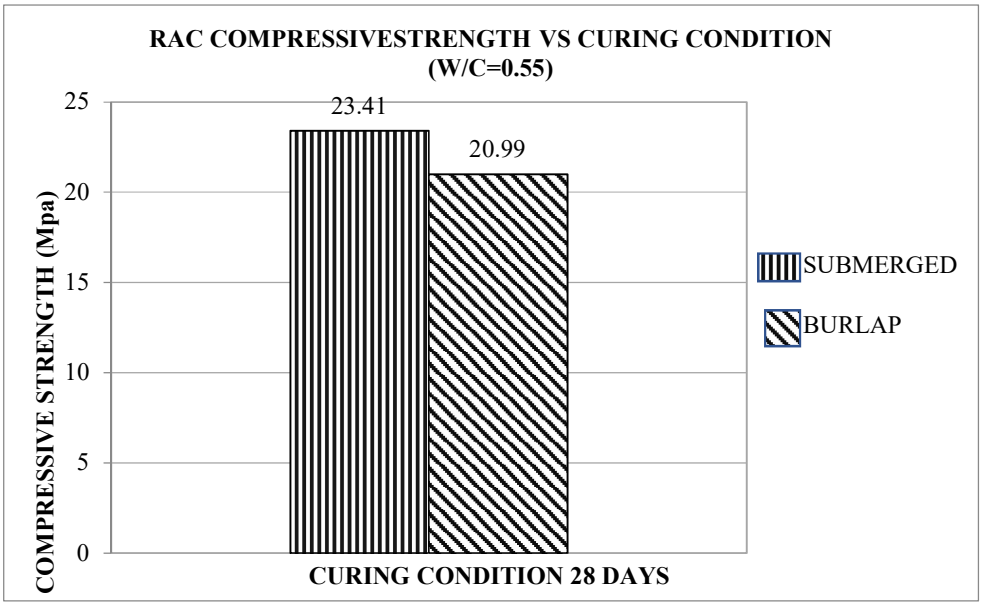


Figure No.6 Strength vs Curing Condition for RAC at 28 days

In figure no 6 there is a compression of the strength of 28 days curing. It can be clearly observed the strength of the submerged curing in competitively more than the other curing.

4. FUTURE RECOMMENDATIONS:

- For this project the strength should also be checked for steam curing condition.
- For 0.50 w/c ratio where the concrete was not workable, admixtures should be used to increase the workability.
- At the same water cement ratio, the workability of Recycled concrete is higher than that of control concrete. The reason for which is the smooth impervious surface of recycled aggregate.

5. CONCLUSIONS:

The results of experimental work have been analysed and conclusions drawn from this study are presented below.

- For the same w/c ratio and changing curing condition the compressive strength obtained by submerged curing at 28 days is 11.5 % higher than burlap curing.
- For the same w/c ratio and changing aggregate type the compressive strength obtained by natural aggregate at 28 days is 7.13 % higher than recycled aggregates.
- The highest compressive strength was obtained by immersion of specimens in water tank, submerged curing gives more strength as compared to burlap curing because of enough water for hydration process.

6. ACKNOWLEDGEMENTS:

The authors would like to thank every person/department who helped thorough out the research work.

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