**RESEARCH PAPER ON STUDY OF CONCRETE USING AGGREGATE FROM THE DEMOLISHED CONCRETE**

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***ABSTRACT***

The continued use of natural resources, non-availability of local materials at reasonable transportation charges, increasing volume of waste materials resulting from demolition of structures, rural-development programmes and low-cost housing projects etc. have justified the consideration of alternative material sources. One of these alternative is; the use of recycled concrete as fine & coarse aggregate. In the present investigation, an attempt has been made to study the strength characteristics of recycled concrete as coarse aggregate and natural aggregate. Local sand is used as fine aggregate.

An attempt has also been made to study the performance of recycled aggregate concrete by making a new type of concrete using 60% recycled concrete aggregates and 40% of natural aggregates and vice-versa.The workability is also reported in terms of compaction factor with respect to water-cement ratios of 0.50, 0.55, 0.60, and 0.65. The workability of recycled aggregate concrete is marginally lower than that of natural aggregate concrete at the given water-cement ratios.

The study shows that the compressive strength of recycled aggregate concrete is comparatively lower while a similar trend is reported in case of split tensile, flexural & shear strengths at generally used water-cement ratio of 0.5.The present investigation, which studies the strength characteristics of recycled aggregate concrete, looks forward to popularize the use of recycled concrete as aggregates in constructions.

***Keywords:-*** *dilapidated structure, demolished, transportation cost, aggregate, binding medium, coarse aggregate*

**INTRODUCTION**

Of the five chief materials comprising reinforced concrete, cement is the most important as it provides the binding medium, although cement constitutes only about 10 per cent of the volume of concrete mixture. Concrete can be considered as an artificial stone obtained by binding together the particles of relatively inert and coarse aggregate.

Concrete aggregates usually consist of naturally available gravel or crushed rock or mixture of these materials. Natural sand and gravels are the most common and are used whenever they are of satisfactory quality and can be obtained economically in sufficient quantity. River sand is undoubtedly the best as it will contain particles of varying sizes and is cheaply procurable, but the quantities found may be limited. Such a difficulty was encountered for example at the Grand Couler Dam, U.S.A., the largest dam in the world. As it could not be quarried from the river, it was quarried from the ground.

Crushed aggregates are widely used for coarse aggregate and as fine aggregate, where natural sand is not available in abundance. Although production of workable concrete from the sharp, angular, crushed fragments usually requires more care and more cement than that of concrete made with well rounded sand and gravel.

**MATERIALS USED IN MAKING CONCRETE**

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**EVOLUTION OF RECYCLED AGGREGATES FOR CONCRETE**

After the Second World War, due to bombing, a considerable amount of concrete debris were available for rebuilding. At that time there was a massive job of recycling waste material especially building rubble in to new concrete construction with good success. As soon as need for this action was satisfied such recycling was generally abandoned.

Now recycling of concrete from demolition waste to produce useful aggregates for new concrete, a contribution can be made to the solution of two problems of increasing magnitude. In many areas (in the plains of river Ganga, in metropolitan and industrial cities), concrete aggregates are locally not available, therefore, it becomes necessary to transport these bulky and heavy aggregates from increasingly longer distances at a cost which equals or exceeds that of recycling the aggregates.

In large metropolitan cities, there is a problem of disposal of waste debris. Previously these debris were a source of land-fill. The disposal of these materials is becoming increasingly difficult and expensive due to shortage of dumping grounds and environmental problems. Thus, for pressures of environmental & economic problems justify the use of recycled concrete as coarse aggregates as an alternative.

**LITERATURE REVIEW**

The first extensive and well-documented use of materials from the demolition of buildings as aggregates in fresh concrete was during and just after the Second World War. At this time the rubble left after the bombardment of cities especially after aerial bombing was used in concrete for rebuilding particularly in Britain and Germany. Later when wartime fortifications were being demolished, the rubble from these were used. Most of the literature from this time describes the use of brick rubble as this was the predominant building material. There are however at least two reports from the immediate post-war period describing the use of concrete rubble and these are described below:

Since that post- war period there has been little research until quite recently when the increasing numbers of concrete buildings being demolished and a possible future scarcity of natural aggregates in some areas has reawakened an interest in the use of concrete rubble as an aggregate. About the findings of conventional concrete, there is a lot of literature available. Hence, here the findings on concrete made with crushed concrete as coarse aggregate (recycled concrete) are quoted.

**Stamatia Frondiston – Yanas** studied the variation of strength with water-cement ratio of concrete made with crushed concrete coarse aggregate. The old concrete was made with a granite gravel. In general, he confirms the findings of previous authors that the concrete containing the recycled aggregate has a lower compressive strength.

He also studied the aggregate matrix bond strength for fresh granite gravel, granite gravel sorted from the crushed concrete, granite gravel with adhering mortar and of crushed mortar from the concrete. His results showed a decreasing bond strength with increasing proportion of mortar, emphasizing the desirability of reducing the proportion of mortar in recycled concrete aggregate.

Frondiston- Yanas has also measured the modulus of elasticity of concrete at different water- cement ratio made with recycled concrete coarse aggregate and natural sand fines.

**Malhotra V.M.** also studied the recycled concrete aggregates by optical and scanning electron microscopy. He found that the particles of crushed concrete tended to be more rounded.

He prepared concrete at low, medium and high strength levels using crushed concrete from discarded test cylinders. He also confirms the observation of Buck that concrete made with recycled concrete aggregate has a lowercompressive strength than a controlled concrete but he does not give any further information on the effect of the original strength. This is because the aggregate was not made from concrete of known strength but was rather made from a mixture of discarded cylinders.

He also observed that the mixer containing crushed concrete as both coarse and fine aggregates had a lower slump and required a higher cement content than the control mixes. When he used crushed concrete fines he found a sharp increase in water requirement.

**Ravindrarajah R. Sri et al.** studied the various properties of recycled concrete as fine and coarse aggregate. His tests showed that recycled concrete aggregate had lower specific gravity, higher absorption capacity than the virgin aggregates. The resistance to mechanical actions such as impact, crushing and abrasion for recycled concrete aggregates was also lower. The compressive strength of concrete using recycled aggregates was lower up to 25 per cent and reduction in modulus of elasticity up to 30 per cent. He observed that the fresh concrete properties were only marginally affected by the use of recycled aggregates. Setting times of recycled aggregate concrete were marginally less and the rate of workability loss was marginally more than for a comparable natural aggregate concrete.

He also studied the properties of concrete made with crushed concrete as coarse aggregate and concluded that it is possible to produce higher strength concrete with recycled aggregates as coarse aggregates produced from a lower grade concrete. The quality of original concrete from which the recycled aggregates are produced seems to have little influence upon strength, modulus of elasticity.

**Nixon, P.J.** compared the work done by various researchers workers and found that most of them had concentrated on uncontaminated materials obtained from old laboratory test specimens. The most marked difference in the physical properties of the recycled concrete aggregate is the higher water absorption and it seems likely that this is due to absorption by cement paste adhering to the old aggregate particles. There is general agreement that the compressive strength is somewhat lower (upto 20%) compared with control mixes. There is evidence, however, that when concrete fails, it is adhering mortar on the crushed concrete aggregate that is the weakest link.

**CONCLUSIONS**

Based on the test results of the present investigation, the following major conclusions can be drawn.

 i) Recycled concrete as coarse aggregate can be used in place of natural aggregate for concrete of acceptable quality for practical uses.

 ii) The concrete with recycled concrete as coarse aggregate will not impose any problem in workability in fresh state and strength development in hardened state for W/C ratio more than 0.5 for different ages.

iii) The variation of the various strengths of the concrete with age for fully and partially recycled aggregate concrete follows the same trend as that of natural aggregate concrete. iv) At W/C ratio above 0.5 and upto 0.6 various strength of the concrete with fully and partially recycled aggregate concrete increase at different ages in comparison to the corresponding strengths of concrete with natural aggregate.

v) At W/C ratio more than 0.6, the strength of concrete made with both types of aggregate follows the same trend.

**Scope for Further Study**

The strength characteristics of recycled aggregate concrete can be further studied by taking into account the following parameters.

(i) Using different grades of cement i.e 33 and 43 grade.

(ii) With different types and grading of sand.

(iii) By varying the mix proportions.

(iv) By using the fine aggregate also as recycled concrete aggregate.

(v) By varying the percentage of recycled and natural aggregate (Coarse as well as fine aggregate).

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