RESEARCHERID
THOMSON REUTERS

[Jitender, 6(6): June 2019] ISSN 2348 – 8034
IDSTM-2019 Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

USE OF RECYCLED CONCRETE AGGREGATES AS A REPLACEMENT OF COARSE AGGREGATES IN CONCRETE – A REVIEW

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ABSTRACT

Recycling of demolished concrete as aggregates in place of natural aggregates is much required for environmental balance and utilization of demolished wastes. Demolition waste is increasing day by day which is to be utilized to prevent environmental pollution. Various research, practical experiments and studies carried on the use of in concrete shows that RCA (Recycle concrete aggregate) can be replaced with the natural aggregates and gives satisfactory results. This study is about the review of existing literature work for use of RCA in concrete.

Keywords: *Recycle Aggregate, Natural Aggregate, Replacement, Compressive Strength, Demolition waste, Dumping..*

I. INTRODUCTION

Concrete is main construction material widely used across the world for all construction works. With rapid modernization demolition waste is also increasing rapidly. Demolition waste is generated due to demolition of existing structures for reasons like war, earthquake, floods, change in plans, change in land use, degradation of structure due to weathering agents, old unsafe structures etc. This demolition is either used as landfill material or dumped to dumping grounds which leads to huge heaps of demolished concrete wastes (DCW) which is hazardous to environment. It was found that the RCA are valuable building material in environmental, economical and technical aspects. It was found from research that the use of recycled aggregate is an appropriate solution to the problem of dumping and transportation of demolished concrete. Initially recycled aggregates were used as landfills but now a day they are also used for constructions for building and roads. As we all know aggregates are biggest constituent (Approx. 75%) of concrete by its volume hence use of recycled aggregates in place of natural aggregates provide a solution to the problem of environmental pollution and decomposition or dumping of demolished waste. Initial cost of the setting up a crushing plant for demolished concrete waste is more but the cost of recycled concrete aggregates is 30-40% less than the natural aggregates which are to be quarried and transported from the mines. Countries like Germany, England, Netherland and other European countries have tried to use recycled concrete in new construction and made a lot of investigations over it for its environmental, economical and technical aspects. Some countries have developed code of practice for the use of recycled aggregates. In India recycled aggregates are not much used, but its future seems bright and one can predict remarkable contribution of recycled aggregates to reduce the demolished concrete waste. The demolition waste is increasing day by day and rate of transportation of demolished waste to dumping sites is significantly high which leads to increase in total cost of construction. Use of demolished waste as RCA is necessary for sustainable development.

II. LITERATURE REVIEW

Tam C.M (2005), proposed a new approach in concrete, namely, “two-stage mixing approach (TSMA)”, intended to improve the compressive strength for recycled aggregate concrete and hence lowered its strength variability. The study revealed that the quality of aggregate is classified according to the absorption rates. The experiments showed that the compressive strength of RAC was enhanced by two-stage mixing approach. This two stage mixing approach

gave way for the cement slurry to gel up the recycled aggregate by which a stronger ITZ is provided and as a result cracks and pores within the recycled aggregates were filled.

Etxeberria M., Mari A. R.& Vazquez E. (2007), Four different recycled aggregate concretes were produced; made with 0%, 25%, 50% and 100% of recycled coarse aggregates, respectively. The mix proportions of the four concretes were designed in order to achieve the same compressive strength. In general the workability of recycled aggregate concretes is affected by the absorption capacity of the recycled aggregates. Concrete crushed by an impact crusher achieves a high percentage of recycled coarse aggregates without adhered mortar.

Falkner H. and Xiao J. (2007), investigated the bond behavior between recycled aggregate concrete and steel rebars. This paper considered thee RAC replacement percentage and the steel rebar style as the main experimental parameters. Pull out test was carried out. The monotonically increased load was applied by the testing machine. The bond between recycled aggregate concrete and deformed rebars depended much more on the mechanical anchorage and friction resistance, whereas the bond between recycled aggregate concrete and plain rebars mainly depended on the adhesion between steel and concrete, which was strongly influenced by RCA replacement percentage. For the recycled aggregate concrete, the bond strength between deformed steel rebars and concrete was approximately 100% higher than the one between plain steel rebars and concrete, coefficient of variation for the bond strength of the plain steel rebar was much higher than the one for the deformed steel rebar.

Padmini A.K., Ramamurthy K. & Mathews M.S. (2009), studied about the influence of parent concrete on the properties of recycled aggregate concrete. As per the results the water absorption capacity of recycled aggregates increased with increase in strength of parent concrete from which recycled aggregates was derived. The resistance against mechanical actions was lower than fresh crushed granite aggregate. In order to achieve a design compressive strength, recycled aggregate concrete requires lower water-cement ratio and higher cement content with respect to fresh granite aggregate.

Padmini A.K., Ramamurthy K. & Mathews M.S. (2002), investigated the water absorption of recycled aggregate increases with an increase in strength of parent concrete from which the recycled aggregate is derived, while it decreases with an increase in maximum size of aggregate. For achieving a design compressive strength, recycled aggregate concrete requires lower water–cement ratio and higher cement content to be maintained as compared to concrete with fresh granite aggregate.

Wai H. K., Ramli M., Kam K.J. and Sulieman M.Z. (2012), studied about some parameters like compressive strength, ultrasonic pulse velocity, shrinkage, water absorption and intrinsic permeability .The results indicated a decreasing compressive strength towards the high level of the recycled concrete aggregate content which is due to the poor quality of the adhered mortar. It was observed from the experiment that recycled aggregate concrete was "good" in terms of its ultrasonic pulse velocity value.

Deshpande, N. & Kulkarni, S. & Patil, N. (2011), emerged out with a promising technique for predicting compressive strength of concrete. In the study back propagation were used to predict the 28 day compressive strength of recycled aggregate concrete (RAC) along with two other data driven techniques namely Model Tree (MT) and Non-linear Regression (NLR). Recycled aggregate was the current need of the hour owing to its environmental friendly aspect of re-use of the construction waste. The study observed that, prediction of 28 day compressive strength of RAC was done better by ANN than NLR and MT.

III. CONCLUSIONS

RCA can be used in proportion with the natural aggregate and gives satisfactory results upto a proportion of 40%. Higher proportion of Recycle aggregate effects the properties and strength of mix prepared. Absorption capacity of RCA is higher than the natural aggregates which effects water cement ratio workability and strength of concrete. It will promote sustainable growth and reduce dependence on natural aggregates.

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