

# A Review Paper on Recycled Aggregate Concrete

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## ABSTRACT

As we all know that natural resources are being depleted and are in a very limited amount, recycle of Construction & Demolition materials play a vital role in preventing these natural resources. There are various methods of recycling construction wastes which are being used throughout the world in the past decade. Waste concrete is the primary component which will replace the conventional concrete (Natural Aggregates). There are however some limitations in the use of RAC. This review paper focuses on the known benefits of both conventional and recycled aggregates. This technique will definitely reduce the construction cost and at the same time it protects the environment. The different properties of RAC affects the mix design and also the hardened properties of the resulting concrete, when the RAC which replaces the natural aggregates exceeds the limit (33%). This paper represents the evaluation of the different research paper on the topic of RAC. The study found that if we replace 33% of NA with 33% of recycled aggregates, then only it will give us the best required properties.

**Keywords:** Recycled Aggregate Concrete (RAC), Natural Aggregates (NA).

## 1. INTRODUCTION

To achieve sustainable issue in construction area, researcher and companies focus on using waste concrete as a new construction material. It is called recycled aggregate which can be produced by a concrete crusher. The aggregates are categorized by size as coarse and fine aggregates. The final product collected from crushing and separated from other contamination obtained from construction and demolition wastes such as concrete wastes, broken bricks, gravel, road pavements, concrete roadbeds etc. That has been previously used in construction are recycled aggregate.

Due to increasing environmental concerns, huge consumption of NA with the rising cost of transportation & growing costs of landfills, we as Civil Engineers are forced to promote the

recycling of construction and demolished wastes in new production of concrete. This recycling of C&D waste can be very helpful to maintain natural materials & to decrease the cost of waste disposal.

C&D waste are generally generated from old structures, here the amount of aggregates is very high. Unwanted materials are separated, and then recycled aggregates are sieved and it can be used as replacement for natural aggregates (not more than 33%) in the production of concrete. This type of recycled materials are known as recycled aggregates.

Smaller pieces of concrete are used as gravel for new construction projects. Sub-base gravel is laid down as the lowest layer in a road with fresh concrete or asphalt poured over it.

The US Federal Highway Administration uses this technique to build new highways from the material of old highways. Crushed recycled concrete can also be used as the dry aggregate for brand new concrete if it is free of contaminants. Also, concrete pavements can be broken in place and used as base layer of an asphalt pavement through a process called Rubblization.

When recycled aggregate is used it reduces the number of virgin aggregates, which are created, thus it means less use of natural resources. RAC can be used for constructing gutters, pavements etc. Large pieces of crushed aggregate can be used for building revetments which in turn is very useful in controlling soil erosion. Recycled concrete rubbles can be used as coarse aggregate in concrete. Production of RAC also results in generation of many by-

products having many uses such as a ground improvement material, a concrete addition, an asphalt filler etc. Used for the construction of footpaths etc.

The acceptability of recycled aggregate is impeded for structural applications due to the technical problems associated with it such as weak interfacial transition zones between cement paste and aggregate, porosity and transverse cracks within demolished concrete, high level of sulphate and chloride contents, impurity, cement remains, poor grading, and large variation in quality.

In a world that is increasingly emphasising on sustainable construction particles; recycle aggregate have major role to play. Recycle concrete is in fact recognized by the LEED green building rating system.

## 2. LITERATURE REVIEW

Sri Ravindrajah et al. (1987) has analysis, the characteristic of recycle aggregate relatively varies from natural aggregate because of the pressure of appreciable proportion of mortar bonded to natural aggregate & loses mortar, modulus of elasticity & strength are decreases about 10% & 35% are respectively, when the recycled aggregate are used in place of natural aggregate in sufficient mixes, then dry shrinkage is almost doubled. Properties of fresh concrete are only slightly affected by the application of recycled aggregate. Relationship between strength in compression & water/cement flexure & tension are not effectively affected by application of types of aggregate.

C.S. Poon et.al (2002) has aimed to expand a technique for manufacturing concrete bricks and paving blocks using recycled aggregates founded from construction and demolished waste and his study shows that replacement of Natural aggregate by recycle aggregates at the level of 25 % to 50% had less effect on the compressive strength of the specimens, however higher level of incorporation reduces the compressive strength. The limited utilization of recycled aggregate in structural concrete is due to the inherent deficiency of this type of material. With comparison of natural normal weight aggregates, recycled aggregates are weaker, more porous and have greater values of water absorption.

Sami W. Tabsh et.al (2008) has examine the investigation on strength of concrete made with recycled concrete and concrete aggregates in which toughness and soundness gives higher percentage on the recycled concrete aggregates as compared to natural aggregates. The spilling tensile and compressive strength of natural concrete continued with recycled coarse aggregate depend upon a mix proportion. The strength of recycled concrete can be 10.25% less than that of normal concrete made with natural coarse aggregate. He had founded that the compressive strength of recycled concrete is bonded with the water cement ratio of the original concrete if other factors are left similar. When the water cement ratio of the parent concrete is the similar or lower than that of the recycled concrete, the new strength will be as good as or better than the original strength, and vice versa. He had also shown that the addition of a plasticizing, an air entraining, a retarding, and an accelerating admixture to the original concrete had less or no effect on the properties of recycled concrete.

Chen et al. (2002) studied the use of rubble of building generated from demolished structures as an aggregate. This material might function as a recycled aggregate (RA) in concrete, after crushing and screening. Several experiments utilizing RA of assorted compositions from these martials were made. The check results displayed that the rubble of buildings could be turned into helpful RA through the right process. Its strength will be affected when alien materials are present in RA in concrete is used. This is going to be additional obvious at lower w/c ratio of about (0.37), the strength of compressive of RAC most effective 61.0% that of ordinary concrete. When the RA was washed, these negative effects were greatly enhanced to be

over 75.0% when the (w/c) ratio is larger than 0.60. This is often very true for strength of flexural of the RA concrete. A recycled coarse aggregate was a weakest phase (at a low (w/c) ratio). This effect will take control the strength of RAC. This mechanism doesn't occur during a recycled mortar. The amount of recycled fine aggregate will rule the mortar strength.

Jasim (2009) proposed converting the waste plastic to plastic hollow aggregate (PHA) of a certain shape. This plastic hollow aggregate can be used in non-structural Concrete Masonry Units (CMU) mix to produce plastic hollow aggregate concrete masonry units (PHACMU). The PHACMU mix designed to be composed of plastic hollow aggregate, sand, cement, and water( without any additive). Zero-slump concrete mixes of cement: sand volume proportions of 1:2, 1:2.5, and 1:3 and plastic hollow aggregate content of 10, 20, and 30% by volume of the hardened concrete had been moulded in 15 cm cube specimens, cured, and tested to obtain density and compressive strength. The obtained density of the test specimens ranged from 1892 to 1550 kg/m<sup>3</sup> and the compressive strength ranged from 16.37 to 3.73 MPa (non-structural). The concrete specimen's density classified as lightweight and medium-weight CMU according to the standard specifications of CMU (IQD 1129, ASTM C90, and ASTM C129). The compressive strength of some specimens had met the requirements of compressive strength of the standard specifications of CMU of both load-bearing and non-load-bearing CMU (IQS 1077, IQD 1129, ASTM C90, and ASTM C129). The plastic hollow aggregate produced by a set of devices specially designed and fabricated by the researcher for the purpose of this research.

23\_1163–1167. : june 2009, American University of Sharjah

### 3. CONCLUSION

1. RAC has higher compressive strength and higher tensile strength as compared to natural aggregate concrete.
2. Setting time of RAC is slightly less as compared to natural concrete and rate of workability is slightly less in RAC than for a natural aggregate concrete.
3. Recycled fine aggregate decreases the elastic modulus and increases drying shrinkage as compared to recycled coarse aggregate.
4. RAC requires more water than fresh concrete to retain the same slump without use of adhesions and the creep of RAC is comparatively higher than natural concrete.
5. The structural behaviour of RAC members is marginally weaker in differential to that of members made with NA.
6. The C&D debris waste can be termed as “raw material to generate economic resources in future”. These materials have been adopted by some developed countries and also used by the student in laboratory.

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