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A Review Paper on Recycle Aggregate in Concrete

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ABSTRACT

In this rapid urbanization of world, recycle of Construction & Demolition (C&D) materials plays a key role to prevent natural resources. In the last few decades a variation of recycling method for C&D wastes has been established. One of the key components in C&D waste concrete aggregate has been use to replace with natural aggregate (NA) after being treated, which is known as recycle coarse aggregate (RCA). The different properties of RCA and C&D wastes affect the mix design and also affect the fresh properties and harden properties of the resulting concrete, when the replacement of RCA beyond a certain percentage of natural aggregate. Various studies show the recycle aggregate concrete required comparatively lower water-cement ratio as compared to parent concrete to gain particular compressive strength. This paper represents the analysis of the different research paper on the topic of Recycle Aggregate Concrete. Study found that the setting time of recycled aggregate concrete are slightly less as compare to the natural concrete and rate of workability is slightly less in recycled aggregate concrete than for a natural aggregate concrete and recycled aggregate concrete requires more water than fresh concrete to retain the same slump without use of adhesions and the creep of recycled aggregate concrete is comparatively higher then natural concrete.

Keywords: Construction & Demolition (C&D), Recycle coarse Aggregate (RCA), Recycle Aggregate Concrete (RAC), Natural Concrete (NC), water cement ratio (w/c).

I. INTRODUCTION

Rapid urbanization and development will cause consequential effects all over the world, i.e., consumption of natural aggregates etc. It generates heavy amount of waste material from constructing and demolishing activities. For the reduction of this problem, it has to be replaced and recycled in place of natural aggregates in the production of concrete and on the other hand Recycle coarse aggregate(RCA) is key constituent of the old concrete and for numerous reasons; it is required to reuse them.

As per increasing environmental concerns, rising scarcity of landfills, quick consumption of natural aggregates with the rising haulage and growing landfill costs are forced to promote the recycling of construction and demolished wastes in new production of concrete. The recycling of construction and demolished waste can be assisting to maintain natural materials and to decrease the cost of waste treatment unit from collection to disposal.

Construction and demolished waste are generally collected from old structure such as plastics, tiles, sands, bricks, timbers, dust, papers, metals, rubbers,

etc. In which amount of aggregates is very large. Crushed rubbers are separated from construction and demolished waste and sieved, and it can be applicable as a replacement of natural coarse aggregate in production of concrete. This type of recycled materials is called as recycled aggregates. The C&D wastes cycle are shown in the "Fig. 1".

Fig.1 C&D wastes cycle

Untreated RCA can be applicable as many type of general bulk fill, sub-basement, bank protection, road construction, embankment, noise barriers and also treated RCA can be applicable to new concrete, for shoulders, pavement, side walls, median barriers, gutter and curbs, and foundation dam, bridges. It is also useful in structural grade concrete, lean concrete, base of soil cement pavement, bituminous concrete etc.

Numerous remarkable researches have been gone through to prove that recycle coarse aggregate (RCA) could be dependable alternative as aggregate in concrete production. As widely submitted, recycled aggregates are suitable for non-structural concrete implementation and also can be implemented in making of normal structure concrete.

Shape of recycle aggregate is more illegitimate than the natural aggregates. Requirement of water is more in Recycled concrete aggregates for the same workability as compared with parent concrete aggregates. Compressive strength, density, modulus of elasticity of RCA is generally smaller than parent concrete. For given water-cement ratio, rate of carbonation, risk of corrosion of reinforcement steel and permeability are more. The variation in strength between parent concrete and Recycled aggregate concrete rises with strength of concrete. Generally recycled aggregates have greater water absorption and lower specific gravity. The density of recycled aggregate concrete is lower than density of parent aggregate porosity of recycled aggregate. This review paper reports the properties of recycled aggregate concrete produce with different types and size of aggregates leads to different strength of parent concrete.

II. LITERATURE REVIEW

R. 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. The control of the free water-to-cement ratio (w/c) and the workability

of fresh concrete is difficult and results in a greater shrinkage and creep value of the hardened concrete when compared with the concrete prepared with natural aggregates.

A.K. Padmini et al. (2008) has gone through the properties of recycled aggregate distinguish from natural concrete of three strength of compression, tension, flexure strength & has examined that RAC required nearly lower w/c ratio as compare to natural concrete to gain a sufficient compressive strength. Study shows the variance in strength between natural concrete & RAC increase with the concrete strength.

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

Yong, P.C. et al. (2009) has studies on the RCA from field-tested concrete samples. RCA consist of 28 days concrete cubes after the test of compressive determined on the basic of local site of construction. The concrete cubes are crushed to sufficient size, shape & reuse as recycled coarse aggregate. The quality of RCA applied in the studied, is near by 200 kg. The recycled aggregate that are bounded from site-tested concrete sample make relatively good quality concrete. The compressive strength of recycled aggregate is comparatively higher than the compressive strength of normal aggregate & split tensile strength, weight density, & flexural strength is nearly same. The compression of properties on Gravel and recycled coarse aggregate (RCA) are shown in the "Table 1".

Table 1 Compression of properties on Gravel and Recycled aggregate.

Aggregate Properties	Gravel	RCA	% differences
Bulk specific gravity, dry	2.55	2.09	18.0
Bulk specific gravity, SSD	2.56	2.14	16.4
Apparent specific gravity	2.63	2.3	12.5
Absorption (%)	1.54	6.4	4.8
Bulk density (kg/m^3)	1469.8	1325.93	9.8
Moisture content (%)	1.9	4.46	2.6

Jian Yang et al. (2010) has studied, which is based on examination of mechanical & physical properties of recycled concrete with high incorporation level of recycle coarse aggregate and crushed clay bricks and possible to inspect or restriction of this types of recycled aggregate in supreme structure. Even after long process of proper cleaning procedure at recycled aggregate treatment plant, small amount of waste impurities, e.g. approximately 1.4%, still can be discovered after the manually sorting process. Higher water absorption percentages are discovered for crushed clay brick (CCB) compared to RCA and NA.

Present of cement mortar on attached aggregate and CCB in the recycled aggregate gives much effect on

the physical and mechanical properties of fresh and hardened concrete.

Raz-Ud-Di Nassar et.al (2011) has worked on secondary cementitious material such as milled waste glass towards production of recycled aggregate concrete with better strength and durability allots. Milled waste glass was also obtained to extinguish alkali-silica reaction. Also use of recycled aggregate helps to reduce the large amount of landfill-bound combined with colour waste glass so as to produce recycled aggregate concrete with milled water glass.
Monalisa Behera et al. (2014) has summarizes, censoriously studies sum of the most critical research obtaining over the past years respecting the material characteristic. It also ventures to illumination the approaches for superior performance in the current knowledge & also he has arisen a question regarding the promising technology has not become broadly accepted by the construction industry. The actual problems with use of recycle aggregate in concrete also explored.

He had also shown the chain between parent aggregate, concrete and C&D waste which is given in fig. 2

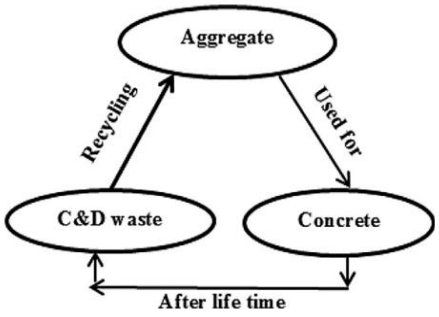

Fig.2 Representation of recycling technique.

R.V. Silva et.al (2014) has studied the factors affecting the mechanical, physical, chemical permeation characteristics of recycled aggregates obtained from construction and demolished works. And he also concludes that experimental mean of measuring the quality of recycled aggregate, which can be applicable to manufacture concrete with performance.

III. CONCLUSION

1. Recycled aggregate concrete has higher compressive strength and higher tensile strength as compared to newly control concrete.
2. Setting time of recycled aggregate concrete are slightly less as compare to the natural concrete and rate of workability is slightly less in recycled aggregate concrete than for a natural aggregate concrete.
3. Recycled fine aggregate decreases the elasticity modulus and increases drying shrinkage as compare to recycled coarse aggregate.
4. Recycled aggregate concrete requires more water than fresh concrete to retain the same slump without use of adhesions and the creep of recycled aggregate concrete is comparatively higher then natural concrete.
5. The structural behavior of recycled aggregate concrete members is marginally weaker in differential to that of members made with natural aggregate.
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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