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RECYCLED AGGREGATE CONCRETE

Akhil Kumar, Anurag, Ashwani Kumar Tripathi,

Anupam Kumar, Baijnath Nishad

[1,2,3,4] Undergraduate Students, [5] Asst. Prof.

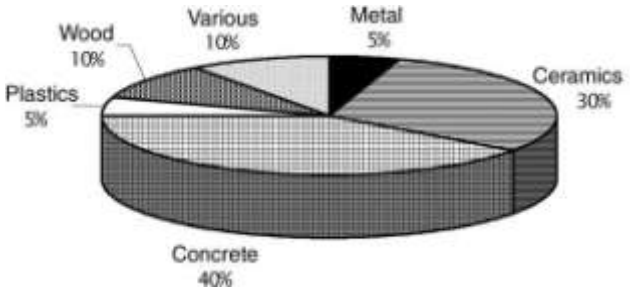
Abstract – A number of investigations have been carried on the mechanical properties, *durability and structural performances of recycled aggregate concrete (RAC). The application of recycled aggregate to use in construction activities have been practice by developed European countries and also of some Asian countries. We know that concrete is the main construction material across the world and the mostly used in all types of civil engineering works. As aggregate represents about 70-80% of concrete components, so it will be beneficial to recycle the aggregate for construction works and also to solve the environmental problems. In this paper a study has been made on the past researches carried out by the different scholars and their results have been studied. Concrete is the favorite choice in the construction material in the civil engineers around the global decade.*

Keywords: Recycled aggregate concrete, Compressive strength, Environmental, Performance of aggregate concrete.

I-INTRODUCTION:

The need and importance of concrete in construction industry is ever increasing. Recycled Aggregate Concrete (RAC) is concrete that using Recycled Aggregate (RA) as partially or fully replacement in coarse and fine aggregate. It is believed RA have been used from 1945 in concrete producing and started when World War II damaged a large quantity of concrete structures and the high demand of aggregate to rebuild the structures. Concrete is the favorite choice as a construction material among civil engineers around the globe for decades. It is preferred for its better performance, longer life and low maintenance cost. To achieve rapid urbanization every year smaller structures are demolished and newer and bigger ones are constructed. These demolished materials (majority of which is usually concrete) are often dumped on land and is not reused for any purpose. This practice affects the fertility of land. With the wave of sustainability also impacting the construction industry, scientist and engineers through

One such material is recycled aggregate concrete. Utilizing recycled aggregate is certainly an important step towards sustainable development in the concrete industry and management of construction waste. Recycled aggregate is variable properties. Quality of the recycled aggregate depends upon the collected material quality and its delivery to the plants. Construction materials are very significant in our lives, because we spend 90% of our time in buildings or infrastructures (roads, highways, bridges, etc.). The section of construction materials corresponds to 3–4% of the total product in Europe, and the construction industry, as well as construction works, occupy millions of people. However, in a parallel manner the con- struction section is responsible because it.



Material Used

Concrete is a composite material composed of water, coarse granular material (fine and coarse aggregate) embedded in a hard matrix (cement or binder) that fills the space among the aggregate particles and glues them together.

Aggregate:

Aggregates used in concrete are divided into three categories.

Fine Aggregates: These aggregates passes through 4.75 mm I.S. sieve and retained on 150 micron. **Coarse sand,** it contains 90% of particles of size greater than 0.6 mm and less than 2 mm. **Medium sand**, it contains 90% of particles size greater than 0.2 mm and less than 0.6 mm**, Fine sand,** it contains 90% of particles of size greater than 0.06 mm and less than 0.2 mm. Proper selection of sand is critical in the durability and performance of concrete mixture

Coarse Aggregate:

These aggregates passed through 63 mm I.S. retained on 4.75 micron. Coarse aggregates are particles greater than 4.75 mm, but generally range between 9.5 mm to 37.5 mm in diameter.

Mixed Aggregate:

Mixed aggregate is sometimes used for unimportant work without separating into different sizes.

Cement:

Another important material in concrete manufacture is cement. Cement is a fine ground material consisting of compound of lime, silica, alumina and iron.

Properties of RCA:

1. Shape and Texture-

RCA aggregates, both coarse and fine, tend to be very angular and rough due to the crushing of the virgin aggregate particles and the presence of cement paste that continues to cling to the surfaces of the aggregate.

2. Absorption Capacity-

The amount of water that an aggregate can absorb is called absorption capacity. The porous nature of the cement paste portion of the recycled aggregates increases its absorption capacity. Limiting the use of recycled fine aggregate will also reduce the absorption capacity of the aggregate.

3. Specific Gravity-

It is a measure of the density of an aggregate. The lower specific gravity of RCA is due to the crushed mortar present in and on the aggregate particles which makes it less dense than NA because of its porosity and entrained air structure.

4. L.A. Abrasion Mass Loss-

The loss for RCA is usually higher than NA. In general, the greater the loss the softer the aggregate and the less suitable it is for concrete.

5. Chloride Content-

There is concern that RCA with high chloride contents may affect the durability of the new concrete and the corrosion of steel in new concrete.

METHODOLOGY:

Data required for the casting of specimens and mix designs were collected. Mix designs prepared using IS 10262-2009 and on the basis of trials final mix designs were formulated. Procured materials were tested for different properties.

Cubes were casted for different grades of mix (i.e. M40, M50, M60) and they were immersed in curing tank for 28,56,90 days for compression test and 28 days for water penetration test, RCPT. After completion of curing period cubes were removed from curing tank and were left there to dry. Compressive testing was done on these cubes to determine the compressive strength. In same manner the cubes casted for durability test were removed from the curing tank and were tested for water penetration test and rapid chloride penetration test. i.e. for durability test. After testing compressive strength of natural concrete and recycle concrete were compared. Different materials were obtained from different sources and the laboratory tests were performed. The recycled aggregates were obtained from a demolished house which was about 30 years old. The concrete used in Mauritius is usually M20 grade one. The slab, columns and beams of the demolished building were made of this grade of concrete and. For each mix specimen, the quantity of materials required for concrete mixing has been calculated and tabulated.

Comparison of Past studies-

Year	Test Carried	Results
2009	6 mixes were made and the various test has been conducted	The size of RA will affected the strength in compressive strength, the results shows the 10mm and 14mm size of RA is better than 20mm size.
2011	Study of Assessment of Recycled Aggregate Concrete	RA can be used in concrete and that there is few (if any) applications issue related to its use.
2014	Properties of recycled aggregate and their comparison with natural aggregate has been studied	The specific gravity, water absorption and Los Angeles abrasion clearly indicate that RCAs are of lower quality than NCAs as they contain mortar.
2017	Quarry dust is used in place of natural river sand and then compressive strength test and tensile strength has been carried out	The compressive strength and tensile strength of 45% replacement gives 31.92 N/mm^2 and 3.85 N/mm^2 respectively at 28th day of curing.
2018	Recycled aggregate containing silica fume was used as the partial replacement of cement and various tests has been carried out	The increase of recycled aggregates content beyond 30% has a negative effect on compressive strength of recycled aggregates concrete. The reduction in compressive strength after 28 days is about 10% when 50% recycled aggregates are used.

RESULT:

Aggregates from recycled aggregate (RCA) are al- ready used in all countries in various applications of civil engineering works, as road pavement materials, sub- basements, soil stabilization, improvement of sub- ground, production of concrete of many categories, etc. The existence of temporary Greek specifications for testing the suitability of RCA is a basic factor of their use, especially for the production of new concrete.

The new European specifications for the aggregates, which are made by CEN TC 154 Committee which must become official by the end of year 2003, do not sub- stantially refer to the RCA subject. This gap which will possible continue to exist until the end of the year 2010 is possible to be solved with the help of the national organization of standardization. A relative example exists in the United Kingdom [20], where a protocol is in power for the production of new concrete, where the substitution with up to 20% of RCA coming from pro- duction waste is permitted.

Finally, it is very important for the Games to prove to be not only an athletic and touristic action but also a success in environmental field. Sydney has already set the example.

CONCLUSION:

This paper has discussed properties of RCA, the effects of RCA use on concrete material properties, and the large scale impact of RCA on structural members. Aggregate properties are most affected by the residual adhered mortar on RCA. Because of this, RCA is less dense, more porous, and has a higher water absorption capacity than NA. While RCA and NA have similar gradation, RCA particles are more rounded in shape and have more fines broken off in L.A. abrasion and crushing tests. Replacing NA in concrete with RCA decreases the compressive strength, but yields equivalent or superior splitting tensile strength. The modulus of rupture for RCA concrete was less that of conventional concrete, likely due to the weakened interfacial transition zone from residual mortar. The modulus of elasticity is also lower than expected, caused by the more ductile aggregate. Full scale beams did not seem to be as affected by RCA content as small scale materials tests. Beams with RCA did experience greater midspan deflections under a service load, but the deflections were still much less than the codified maximums. Crack spacing was closer and crack widths were greater.

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