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Study on Utilization of Building Materials from Demolished Structures

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A B S T R A C T

Buildings, roads, bridges, viaducts, subways, intersections, etc. All construction and demolition projects result in the production of waste. Only stone, plaster, metal, wood, plastic, etc. It contains inert and non-biodegradable materials such as It is estimated that the construction industry in India generates around 10-150 million tons of waste every year. Estimates of demand for residential construction materials point to a deficit of around 55 billion cubic meters. Add 750 million cum. Aggregates are essential to achieve the goals of the road sector. Recycling aggregates from construction and demolition waste can reduce the gap between the needs of the two industries.

The use of recycled materials (RCA) can be used to protect the environment because the demand for aggregates used in construction materials has increased by 1 billion tons per year. We are investigating the use of RCA in construction to reduce the growing demand for natural materials (NA) and reduce the amount of waste going to landfills.

This article shows the properties of recycled materials and compares them with composite materials (specific gravity, water absorption, abrasion value, crush value, impact value surprise). All significant changes in aggregates are identified and their effects on results are briefly discussed. Similarly, concrete blocks are manufactured and tested to IS standard specifications. Evaluation of the combination of natural aggregates and RCA aggregates in concrete (20% and 40% NA, replaced by RCA) determined the properties of the concrete, such as the compressive strength of the Ballston. In addition, the implications of guidelines for the use of recycled concrete under the IS policy on concrete placement are discussed. Overall, this article discusses the current and future use and needs of RCA in India and its full potential for effective use.

Keywords: Construction and Demolition waste, Recycled Concrete Aggregate, Natural Aggregate, Environmental Protection

1. Introduction

1.1 General

The urban economy in India began to accelerate after independence as the country adopted a mixed economic system that fostered the growth of the private sector. According to the 1901 census, 11.4% of India's population lived in urban areas, which increased to 28.53% in 2001 and 34% in 2017, according to the World Bank. According to the United Nations research, from 2030, 40%.

In this era of development, construction plays an important role in creating a new environment. In the face of this global challenge, sustainable construction using recycled materials (RCA) is another solution to reduce the footprint of construction waste. Fast construction requires a lot of land and building materials. Stone buildings are preferred for such developments due to their longer life, lower maintenance costs and better performance. To enable this urban growth, old small structures were demolished, and new large projects were built.

As a result of the demolition, the waste stone is thrown into the landfill and is not used for any purpose; this waste makes the land barren. According to the CSE report, India is estimated to generate 150 million tons of C and D waste per year; unofficial estimates are three to five times higher. Of the total waste in C and D, 40% is stone, 30% is ceramic, 5% is plastic, 10% is wood, 5% is metal and 10% is other waste.

is made of concrete with about 70-75% aggregate (fine and fine) used. According to a recent study by the Indian Cement Review, the demand for construction aggregates will be around 3 percent in 2021.

India alone accounts for 4 billion tons, with the largest users making this claim with China, Europe and the United States. India is still top 10 users. In terms of environmental safety, 1 ton of natural aggregate production releases approximately 0.045 million tons of carbon, while 1 ton of recycled aggregate production releases only approximately 0.025 million tons of carbon.

Making concrete structures more "green" and environmentally friendly is one of the primary justifications for using RCA in concrete construction. Some of the main environmental concerns relate to construction, which "takes 50% of its raw materials from nature, uses 40% of its total energy, and produces 50% of its waste". Large-scale use of RCA can be facilitated by recycling waste. and prevent further NA harvesting to mitigate the effects of construction on these conditions.

According to IS 383:2016 Annex A, using construction and demolition (C and D) wastes to produce aggregate is a step towards waste management and use. Recycled Aggregate (RA) stone, brick, tile, stone, etc. C and D are made from waste materials, while Recycled Concrete Aggregate (RCA) is made from required post-construction concrete. RA generally has higher absorption and lower specific gravity than composite material. This solution reduces specific absorption and increases porosity compared to similar songs.

The primary stages of the production processfrom C and D waste may be:

a) Receive and inspect Factory C and D waste.

b) Mechanical and manual separation and sizing.

c) Dry and wet.

Understanding how different properties of different properties affect the property is important to understand how property owners behave. It is impossible to determine how effective RCA concrete is without knowing how the change in properties with the addition of RCA will affect the overall performance of the size. This is mostly a short review of RCA production, equipment/quality, optimization and usage. It is then compared with natural concrete aggregate (NCA). It can be improved with some solutions, including mixing with natural aggregates, additives and others. Often times the quality will be lower, but the result is still good as part of a green solution. Especially the use of RCA has a positive effect on the use of non-standard concrete and even gives good results in this process.

One of the biggest environmental problems caused by civil engineering and construction is the large amount of construction and demolition waste (C and D) that is produced each year, mostly in landfills. Therefore, in terms of environmental concerns, one way to reduce dependence on composite materials is to use recycled composite concrete (RCA). RCA was chosen as the solution for greenhouse cultivation. The aim is to reduce waste generated during construction and demolition. It is estimated that 70% of C and D wastes will need to be reused, recycled and analyzed by 2020.Recycling aggregates will reduce the quarrying and mining process for stone production. In this case, the earth's surface can be protected and the ecological impact reduced.

1.2Advantages of RCA

1. for the construction of prefabricated and cast-in-place gutters and curbs

2. Cost savings: Dependence on cement costs can be reduced by reducing the cost of recycled materials (RCA) without affecting the concrete.

3. Protect the environment: - No excavation and less transportation.

4. Save time: No need to wait for consumables.

5. Less carbon emissions due to less fragmentation.

6. According to the Dutch standard VBT 1995, up to 20% RCA or remixed product (RMA) change for mixed products is allowed without further testing for the whole package mill with a force of 65 MPa.

1.3Limitations of RCA

1. Poor quality (10-30% reduction in compressive strength).

2. The timing of procurement will affect the lifecycle of the project.

3.Extraction requires terrain, specialized equipment and machinery, resulting in higher costs

4. Greater water absorption (up to 6%).

5. excessive shrinkage and creep after drying.

1.4 Objective of the study

The main purpose of this article is to analyze the feasibility of using RCA from construction and demolition waste in concrete buildings.

1. Examine the properties of RCA and natural aggregates by experiment and comparison according to IS code.

2. Use of RCA as partial replacement for coarse aggregate in concrete composites. Reducing the impact of waste on the environment.

1.5 Application

1. Streams, walkways, etc. can be used to create

2. Large crushed aggregates can be used to build pavements that are very helpful in controlling soil erosion.

3.Recycled crushed stone can be used as coarse aggregate in concrete.

4. RAC production also produces soil improvement materials, concrete additives, asphalt fillers, etc. produces many products with many uses.

2. Review of Literature

Y. P Gupta (2021) discusses that normally coarse aggregate is the fractured stone obtained from rocks in hills or pebbles from river bed, and because of depletion of good conventional aggregate in certain regions, the need for development of Recycled Aggregate technology should be taken up commercially. It is similar to fly ash, which is available from electrostatic precipitators of various super thermal power stations which is an industrial waste material. It is chemically reactive when, mixed with cement for use in concrete. This is also useful as partial replacement of cement, as it gives concrete having better impermeability. Thus, it has a wider use in construction industry. He also notifies large scale recycling of demolished waste will offer the solution of growing waste disposal problem and energy requirement and also help construction industry in getting aggregates locally.

Parekh D.M, et al. (2011) discuss the issues relating to sustainability and limited natural resources. They also suggest use of recycled and secondary aggregates (RSA), for example crushed concrete and asphalt and industrial by-products such as fly ash and blast furnace slag. Then products now reused in different material production. There are many studies that prove that concrete made with this type of coarse aggregates can have mechanical properties similar to those of conventional concretes and even high-strength concrete is nowadays a possible goal for this environmentally sound practice.

Brett, et al. (2010) insist that the use of recycled aggregates in concrete is both economically viable & technically feasible. In addition to demolition waste sources, RA can also be composed of excess Concrete materials returned to the plant. Mirza and Saif3 have studied the effect of silica fume on recycled aggregate concrete characteristics. The percentages of recycled aggregate replacements of natural aggregate used by weight were 0, 50, and 100%, whereas the percentages of silica fume replacements of cement used by weight were 5, 10, and 15%. The results show that the compressive and tensile strengths values of the recycled concrete aggregate increase as the recycled aggregate and the silica fume contents increase. The study also indicates that in order to accommodate 50% of recycled aggregate in structural concrete, the mix needs to incorporate 5% of silica fume.

Akmal S.A, et al. (2011) insist that the available resources should be used appropriately and whenever recycled it should be done at the national level with the help of GULF COOPERATION COUNCIL (GCC) and ENVIRONMENT PROTECTION INDUSTRIAL CO (EPIC). They observe that GCC countries produce more than 120 million tons of waste every year out of which 18.5% is related to solid construction waste. Results from Dubai municipality indicate that out of 75% of 10,000 tons of general waste produced, 70% is of concrete demolition waste. The author strongly advocates that a strong commitment and investment by government bodies as well as private bodies make this necessary for sustainability. Some materials are reused for recycling such as plastic, glass etc. In the same way concrete can also be used continuously as long as the specification is right. Recycling solid waste materials for construction purposes becomes an increasingly important waste management option, as it can lead to environmental and economic benefits.

3. Methodology

3.1 Properties of aggregates

Plain Cement Concrete (PCC) and Reinforced Cement Concrete (RCC) is collected from the site (Alamuri Ratnamala Institute of Engineering and Technology, A.S. Rao Nagar, Sapgaon, Shahpur, Maharashtra). This collected material is crushed by hammer to separate the aggregates and reduce their sizes in smaller fraction. On these separated aggregates various testes are conducted in laboratory as per Indian Standard code and their results are compared with natural aggregates. Compressive Strength test is performed on concrete blocks of size 15 x 15 x 15 cm on Compression Testing Machine (CTM) to evaluate the compressive strength of prepared concrete. The environmental impact of waste is lessened by recycled aggregate. By using some percentage in construction sector, cost is saved, due to reduction of transportation and manufacturing process.

3.2 Test performed Aggregates.

Water absorption, specific gravity of aggregate and Impact value test was conducted on both Natural and Recycled concrete aggregate.

Water absorption:

The amount of water absorbed gives information about the internal structure of the aggregate. More porous, more absorbent aggregates are generally not considered suitable unless found suitable according to strength, impact and hardness tests.

Impact value of aggregate:

In comparison to its resistance to slow compressive loads, an aggregate's aggregate impact value provides a measure of how resilient an aggregate is to sudden impact or impact.

Specific Gravity:

Specific gravity is defined as the ratio of the weight of the mixture to the weight of an equivalent amount of water. The specific gravity of an aggregate is considered a measure of the strength or mass of the material. Aggregates with low specific gravity are generally weaker than aggregates with high specific gravity. This tool facilitates the identification of aggregate.

3.3 Test performed on concrete blocks:

The blocks are subjected to pressure tests to determine their compressive strength. Compression tests were performed on a compression tester. Tested according to IS 516:1959.

Compressive Strength Test:

The compressive strength of RCA concrete can be affected by the nature and amount of recycled material. Many factors affect the compressive strength of RCA concrete, including the water/cement (w/c) ratio, the percentage of coarse aggregate replaced by RCA, and the amount of mortar adhered to the RCA. Most studies show that up to 25% or 30% of the coarse mix can be replaced with RCA before adjusting the water-cement ratio before the strength of the ceiling is affected.

The mean compressive strength of cast cubes was determined at days 3, 7 and 28 using RCA and natural aggregates according to IS 516 and is reported in Table 4.2. As expected, the compressive strength of RCA poured concrete is slightly lower than that of concrete made from similar mixtures. For M-30 grade concrete, the reduction of RCA compared to NA is about 8-14%. Energy reduction cost, level of demolished concrete, replacement cost, water-cement ratio, processing of recycled materials etc. depends on parameters

3.4 Summary

In this chapter, properties if NA and RCA, all the material requirements, design requirements as well as the methodology incorporated to carryout casting of cubes with 25 % RCA are briefly discussed. Along with that, the tests which are required to be carried out on cubes with RCA are discussed.

4. Result and Discussions

4.1 Results of Test conducted on Aggregates

Table 4.1 Test Results of properties of Aggregate

Test performed	Natural aggregates	Recycled concrete aggregates
Specific Gravity	2.977 kg/m^3	2.882 kg/m^3
Water Absorption	1.01 %	3.061 %
Impact Value	28.655 %	31.9 %

The adhesive residue of the aggregate is the main influence on the density and water absorption of the RCA. RCA has a higher density than NA because the waste material has a higher density than the underlying rock. Porosity and water absorption are properties closely related to RCA having higher porosity than NA. Crush and impact values are indicative of stability, and RCA has more crush and impact values than NA. This indicates that mortars can also form weak bonds in concrete.

4.2 Results for Compressive Strength of Cubes

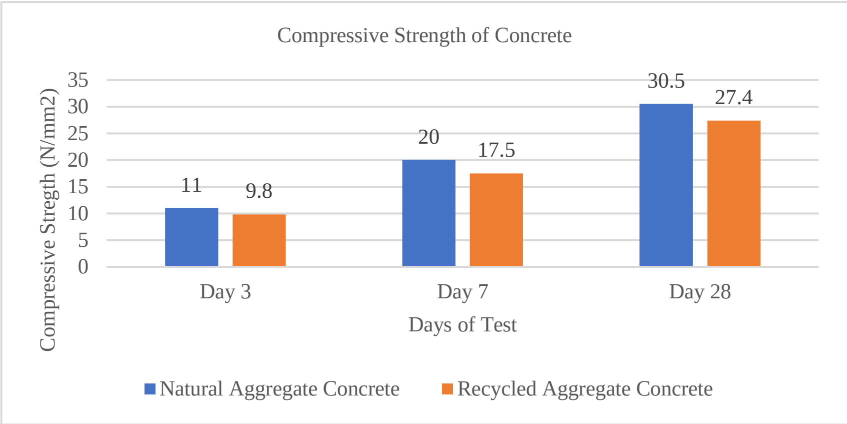
Table 4.2 Test results of Compressive Strength of Concrete

Concrete Grade	Day	Natural aggregates	Recycled concrete aggregates
M30	3	11 N/mm^2	9.8 N/mm^2
M30	7	20 N/mm^2	17.5 N/mm^2
M30	28	30.5 N/mm^2	27.4 N/mm2

The compressive strength of RCA infused concrete is slightly lower than conventional concrete, with a reduction of 8-14% for M-30 grade. This decrease in strength is the result of higher water absorption in RCA and lower crushing and impact strength.

4.3 Graphical Representation of the test report.

Fig 4.1 Graphical Representation of the test report



5. Conclusion

5.1 General

According to IS 2386, the results of various tests on recycled materials and compared with natural composites are satisfactory. found that RCA has a specific gravity of 2,882, which is lower than that of NA, but the results are satisfactory. Indian Standard does not specify the water absorption limit of coarse aggregates. CA cannot be used in ventilation construction because its water absorption is greater than 3.

The compressive strength of RCA poured concrete is 8-14% lower than that of NA Baton . Some studies have shown that crushed and crushed concrete can absorb CO2 through carbonation. We discuss the properties of RCA, the effect of RCA on concrete material and the main effects of RCA on structural elements. Integrated components are often affected by components remaining in the RCA. Therefore, RCA is smaller, more porous and more absorbent than NA. Although RCA and NA have similar trade-offs, RCA products are more common in shape and produce more richness in evaluation.

Recycled concrete aggregate is one of the solutions to make the temple green. This approach can help reduce the carbon footprint and maximize the use of natural resources. In construction, energy costs for transporting and mining natural resources will be saved through the use of RCA. Unfortunately, RCA files need to be evaluated and checked for unstable results every cycle, especially for high-performance applications. However, according to general research, the characteristics of RCA will depend on many factors such as where the rock was collected in the past, its quality, age and processing.

5.2 Scope for further study

The quality of RCA can vary greatly, so there is always room for more experimentation. This document is limited to concrete M30, future research may include M40, M50 etc. It can be expanded to more complex combinations such as the effect of chemical use in composite design can also be examined and some studies have shown that the use of fly ash in concrete composites increases the strength and durability of the stone. RCA replacement works handcrafted stones, colored stones, concrete stones, etc. It can also be made with special stones.

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