UTILIZATION OF CONSTRUCTION AND DEMOLISHED WASTE MATERIAL IN CONCRETE: A REVIEW

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ABSTRACT: In India, recent years construction and demolished concrete waste handling and management is the challenging issue faced by several area. It is very challenging and hectic problem that has to be tackled in an indigenous manner, Due to strict environmental laws and lack of dumping sites in urban areas, demolished waste disposal is a great problem. It is desirable to completely recycle demolished concrete waste in order to protect natural resources and reduce environmental pollution. In this review paper a study is carried out to investigate the feasibility and recycling of demolished waste concrete for new construction. The present investigation to be focused on recycling demolished waste materials in order to reduce construction cost and resolving housing problems faced by the low income communities of the India. The crushed construction and demolished concrete wastes is segregated by sieving to obtain required sizes of aggregate, several tests were conducted to determine the aggregate properties before recycling it into new concrete. The compressive strength test results of partial replacement and full recycled aggregate concrete and are found to be higher than the compressive strength of normal concrete with new aggregate.

Keywords: Construction and demolished concrete, recycling, workability, recycle aggregate, compressive strength.

1. INTRODUCTION

Construction and demolition waste is generated whenever any construction and demolition activity takes place, such as, building roads, bridges, flyover, subway, remodeling etc. Demolished waste obtained from a structure mainly made up of concrete has several foreign matter such as various type of finishes, cladding materials, lumber, dirt, steel, hardware's, woods, plastics etc, attached to them directly or indirectly. It consists mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics etc. A part of this waste comes to the municipal stream. These wastes are heavy, having high density, often bulky and occupy considerable storage space either on the road or communal waste bin/container. It is not uncommon to see huge piles of such waste, which is heavy as well, stacked on roads especially in large projects, resulting in traffic congestion and disruption. Waste from small generators like individual house construction or demolition, find its way into the nearby municipal bin/vat/waste storage depots, making the municipal waste heavy and degrading its quality for further treatment like composting or energy recovery. Often it finds its way into surface drains, choking them. It constitutes about 10-20 % of the municipal solid waste (excluding large construction projects). It is estimated that the construction industry in India generates about 10-12 million tons of waste annually. Projections for building material requirement of the housing sector indicate a shortage of aggregates to the extent of about 55000 million cu.m. An additional 750 million cu.m. Aggregates would be required for achieving the targets of the road sector. Recycling of aggregate material from construction and demolition waste may reduce the demand-supply gap in both these sectors. Demolition of old structures to make way for new and modern ones is common features in metropolitan areas due to rapid urbanization. Very little

demolished concrete is recycled or reused. Thus it is very important how to use it in new construction.

Literature Review and previous works:-

R. Kamala, B. Krishna Rao (2012) studied the reuse of solid waste from building demolition for the Replacement of Natural Aggregates. In their study, they use various mix proportion for partial replacement of conventional aggregate is studied by casting 3 cubes, 3 cylinders and 3 beams for each and every replacement and compressive strength and split and flexural strengths were conducted at the end of 7, 28, 56 days. The compressive strength of the ceramic concrete has been varied from 32.88-46.88 M pa and the split tensile strength is varied from 2.47-3.72Mpa and flexural strength is varied from 5.33-7.82Mpa for 28 days. It is observed that the strength decreases from 50% replacement of coarse aggregate. Hence until 40% we can use ceramic tiles collected from building demolition as replacement of coarse aggregate

Asif Husain, Majid Matouq Assas(2013) studied the Utilization of Demolished Concrete Waste for New Construction. In their study they replaced coarse aggregate by recycled aggregate at various percentages and perform many tests on them. The minimum 30 specimens were cast for each w/c ratio i.e. 0.60, 0.625 and 0.65 for the two mixes (M15 & M20), thereby making more than 180 specimens, Five sets of cubes were cast replacing fresh aggregate by coarse aggregate from demolished waste @ 0%, 25%, 50%, 75% and 100% by weight. With different w/c ratio as recommended in IS456-2000 compressive strength of mix increases by 26.75% when fresh aggregate is replaced by 75% dismantled aggregate, however slump decreases to 2/3rd value. Increasing w/c ratio from 0.60 to 0.625 i.e. by 4.16%, slump increases from 21mm to 60mm when fresh aggregate is replaced by 75% dismantled with 12.68% increase of compressive strength of the mix. For 0.65 w/c ratio (IS 456-2000) compressive strength of M15 & M20mix replacing fresh aggregate by 75% dismantled aggregate , increases up to 40%, however slump decreases to half.

R. Sri Rvindrarajah (1987) studied that Utilization of Waste concrete for new construction, in his study he get compressive and flexural strength at full replacement of natural aggregate by recycled aggregate. The value for compressive strength varies from28-33.2 mpa and flexural strength varies from4.15-4.88 mpa at 28 days testing.

Young,P.C ,Teo, D.C.L.(2009) studied the Utilization of Recycled aggregate as coarse aggregate in concrete. The natural aggregate and recycled aggregate are used to produce concrete cubes for compression test. The compressive strength of recycled concrete with 50% replacement of RCA is in close proximity with the control concrete

Ayed Ahmad Zuhud(2008) studied the Performance of Recycled Aggregate Concrete. In his study he used various mix proportion for evaluating the compressive strength at various mix proportion. According to him the most important parameters of the aggregate affecting compressive strength are its shape, texture, maximum size and the strength of coarse aggregate which is one of the dominant factors in classification of concrete aggregate as he has done in various specimens by increasing and decreasing the ratio of different material. As the various test is done on specimen result of compressive strength for water cement ratio 0.67 varies from 212.5-383.9 kg/cm^2, result for water cement ratio 0.54 it is varies from 245-458.8 kg/cm^2.

Aditya Kumar Anupam(2012) studied influence of recycled fines obtained from demolished concrete slabs for use in pavement quality concrete construction. In this he replaced the fine aggregate by the recycled aggregate at the various ratios, Concrete mixes containing recycled fines showed lower compressive strength in comparison to control mix. Decreased in compressive strength were more prominent for higher percentage replacement levels. However, strength obtained at 28 days moist curing for 25% partial replacement of river bed sand by recycled fines showed higher than 45 MPa and 50 MPa for control mix. This strength was read 43 MPa for 50% replacement levels. All above value is given by him according to test results perform

in the laboratory on cubes at different percentage.

Nitish Puri, Brijesh Kumar, Himanshu Tyagi (2013) studied the Utilization of Recycled Wastes as Ingredients in Concrete Mix. In this laboratory experimentation was carried out to analyze the performance of M25 concrete made by partially replacing aggregates with waste materials like construction debris, PVC scrap and leather waste. The resultant concrete was tested for parameters like weight, compressive strength, slump and workability and compared with conventional plain cement concrete.

A significant increase in compressive strength was observed when natural aggregates were replaced with recycled concrete aggregates. However a decrease in compressive strength was observed when natural aggregates were replaced with PVC aggregates but characteristic strength was achieved successfully. Very poor results were shown by concrete in which fine aggregates were replaced by pulverized leather waste. Values of compressive strength for various percentages of recycled wastes were reported is 9.07-33.14kn/m^2 for 28 day testing. Test shows values of flexural strength determined by performing 3-Point method. A significant increase in flexural strength was observed when natural aggregates were replaced with recycled concrete aggregates. However a decrease in flexural strength was observed when natural aggregates were replaced with PVC aggregates. Very low flexural strength has been shown by concrete in which fine aggregates were replaced by pulverized leather waste. Values of flexural strength for various percentages of recycled wastes were 0.381-5.04.

A.N.Dabhade,Dr.S.R.Choudhari, Dr.A.R.Gajbhiye(2012) studied the Performance evaluation Of Recycled aggregate used In Concrete. In this they are presented an idea about conventional coarse recycled aggregate is being replaced with recycled aggregate**.**

There were total of sixth batches of concrete mixes, consists of every 20% increment of recycled aggregate replacement from 0% to 100%.Moreover, 100% of recycled aggregate mix batches included, different water/cement ratio of 0.5,0.6 and 0.7. The workability of concrete considerably reduced as the amount of recycled aggregate increased. The various experiments on the concrete have been performed. From the experiments it was found that the replacement of 100% NA by RCA can be possible. The replacement of aggregate was carried out by 0, 20,40,60,80 and 100%. The different ratios of the water-cement ratio were used. Significant potential is required for growth of recycled aggregate. From the study of test result it was found that 40% of recycled aggregate can be effectively used in conventional coarse aggregate for making the M20 grade concrete for 0.5 water cement ratio and 20% replacement is efficient for 0.6 and 0.7 water cement ratio. It is observed that in all the tests, strength of concrete is gradually decreased as percentage of recycled aggregate increased.

Tara Lani Cavalline(2012) studied the Recycled brick masonry aggregate concrete: use of recycled aggregates from demolished brick masonry construction in structural and pavement grade Portland cement concrete. The testing is done at various percentages of recycled coarse aggregate, recycled bricks masonry aggregate and on many cubes, beams.

Average twenty-eight day compressive strengths for the baseline RBMAC mixtures ranged from 3,675 psi (25.3 MPa) (BAC 5.0) to 6,497 psi (44.8 MPa) (BAC 6.0). The average 90-day compressive strength of BAC 6.2 reached almost 7,350 psi (50.6 MPa) with a cement content of only 575 pcy (341 kg/m3), which is within the range of typical cement contents used in commercially available concrete mixtures. As discussed in Section 5.2.2, Final Mixture Proportions, compressive strengths obtained from the baseline RBMAC mixtures were reasonable for commercially available 4,000 132 psi (27.6 MPa) and 5,000 psi (34.5 MPa) concrete. Mixtures of these strengths would be suitable for use in pavement and structural applications.

The 3-day, 7-day, 28-day, and 90-day compressive strengths in Tables 5-1, 5-2, and 6-2 are typically the average of three test cylinders. As would be expected, some variability was observed in the compressive strengths of the mixtures. Figures 6-13 to 6-16 are plots of the average compressive strength results and the range of the test results used to compute the averages for the baseline RBMAC mixtures (BAC 5.0, BAC 6.0, BAC 6.1, and BAC 6.2).

Flexural strength tests were performed on two beams at 7 days of age. The average 7-day modulus of rupture for BAC 5.0 was 519 psi (3.58 MPa), while the average modulus of rupture values for BAC 6.0, BAC 6.1, and BAC 6.2 were all over 700 psi (over 4.83 MPa). The average modulus of rupture of BAC 6.0 was almost 800 psi (almost 5.52 MPa), the highest value obtained from the mixtures.

CONCLUSION

As early in this review paper many research paper of different authors is studied and thus the conclusion is following as-

- **I.** Construction and Demolished waste is used as the coarse aggregate as well as fine aggregate also in new concrete.
- **II.** Above, in many research, it is shows that 20% replacement of recycled aggregate as natural aggregate gives a good comparatively result.
- **III.** It is seen that for different grade mixes at different water cement ratio the percentage of replacement of recycled aggregate varies.
- **IV.** Recycled aggregate concrete may be an alternative to the conventional concrete.
- **V.** Water required producing the same workability increases with the increase in the percentage of demolished waste.
- **VI.** Optimum replacement level of fine aggregate with recycled aggregate is 10%.
- **VII.** Use of the waste aggregate in the new concrete as the recycled concrete aggregate reduces the environmental pollution as well as providing an economic value for the waste material.
- **VIII.** Usage of recycled aggregates can not only preserve the finite raw materials, but also reduce energy consumption and overall construction costs.
- **IX.** The higher water/cement ratios, the compressive strength of recycled concrete is similar to that of normal concrete. At lower water/cement ratios, the compressive strength of recycled concrete is much lower than that of normal concrete.

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