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ESTABLISHMENT OF FRAME OF REFERENCE FOR MANAGEMENT AND REUSE OF DEMOLITION CONCRETE WASTE

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Abstract - *Demolition of old structures to make way for new and modern ones is common features in metropolitan areas due to rapid urbanization. The strict environmental laws and lack of dumping sites in urban areas are making the disposal of demolition waste problematic. To overcome this problem, the demolition concrete waste can be recycled and reused. The work will presents a frame of reference for the management and reuse of demolition concrete waste. For this an experimental study will be conducted to find out the properties of concrete with demolished concrete waste as coarse aggregate replacement. In these studies different percentage will be used to replace natural coarse aggregate and the strength is evaluated. The results compared with the natural coarse aggregate concrete. And to obtain a workable ratio of recycled coarse aggregate in concrete .This study will help in identify the usage of demolished concrete waste in construction and helps to save the environment by effective waste management*

Key words: *Demolition concrete waste, Partial replacement, recycled coarse aggregate*

1. INTRODUCTION

1.1 GENERAL

Concrete is the world's second most consumed material after water, and its widespread use is the basis for urban development. It is estimated that 25 billion tonnes of concrete are manufactured each year in our country. Twice as much concrete is used in construction around the world when compared to the total of all other building materials combined. In India 27% of the total waste generated is construction and demolition waste (C&DW). Many countries have recycling schemes for C&DW to avoid dumping to landfill, as suitable landfill sites are becoming scarce particularly in heavily populated countries. Charges on landfill dumping often make recycling concrete aggregate a preferred option. Aggregate typically processed from demolition waste concrete is termed as Recycled Concrete Aggregate (RCA). The reuse of hardened concrete as aggregate is a proven technology. It can be crushed and reused as a partial replacement for natural aggregate in new concrete construction.

The hardened concrete can be sourced either from the demolition of concrete structures at the end of their life – recycled concrete aggregate, or from leftover fresh concrete which is purposefully left to harden – leftover concrete aggregate. All these processes avoid dumping to landfill whilst conserving natural aggregate resources, and are a better environmental option.

2. LITERATUREREVIEW

A thorough library research and find out current journals and papers that are relevant to the project topic .The literature review presents the current state of knowledge and examples of successful uses of alternative materials in concrete and in particular, the use of Recycled Concrete Aggregates

Karthik Obla et.al., (2007) The compressive strength and elastic modulus of concrete containing CCA is lower than that of the control concrete. However, the decrease in strength is not substantial and the strength drop RMC REF Report: Crushed Returned Concrete as Aggregates for New Concrete can be compensated for by normal mixture adjustments to achieve the desired strength. However, concrete containing 100% coarse Pile 1 CCA had significantly lower strengths.

S. Muthu Lakshmi et.al.,(2015) Optimum replacement of NCA and NFA with RCA and RFA respectively was found to be 10% from compressive strength point of view. Recycled concrete with 10 to 20% recycled aggregates can be used in the construction of compression members like concrete blocks, concrete pavements etc. as the compressive strength developed is higher than that of natural concrete.

Compressive strength of concrete with RFA was found to be higher than that of concrete with RCA. From tensile strength point of view, optimum replacement of NCA and NFA with RCA and RFA respectively was found to be 20%. Tensile strength of concrete with RCA was found to be higher than that of concrete with RFA.

Flexural strength of recycled concrete was found to be lower than that of PCC and was found to be decreasing with increasing percentage of recycled aggregates. As recycled concrete cannot take flexure, reinforcements can be incorporated to increase the flexural strength so that the recycled concrete can be utilised in the construction of structural members like concrete slabs, beams, columns etc.

The present study shows that construction and demolition wastes can be effectively utilised as an alternative for partial replacement of natural aggregates in construction sector. Also construction and demolition

wastes are easily available and exist in abundance everywhere, thus its use reduces the cost of construction, conserves the space required for its disposal and also prevents the depletion of natural resources like river sand thus preserving our environment.

Rajat Palya et.al., (2017) Use of recycled aggregate up to 30% does not affect the functional requirements of the structure as per the findings of the test results. Various tests conducted on recycled aggregates and results compared with natural aggregates are satisfactory as per IS 2386. Due to use of recycled aggregate in construction, energy & cost of transportation of natural resources & excavation is significantly saved. This in turn directly reduces the impact of waste material on environment

Katam Avinash1 et.al., (2016) This paper focuses on the feasibility of construction waste aggregate to making new green concrete. Various standard tests were carried out using recycled aggregate such as water absorption, sieve analysis, impact value, abrasion value, crushing value, workability and compressive strength of the mixes using 150mm standard cubes. The use of alternative material (demolished or recycled waste) for new construction which is beleaguered with normal waste in terms of debris, dust, rubbish etc. in place of conventional material. Tests were conducted by using 0% ,10%,20%,30%,40%,50%replacement of fresh aggregate with recycled aggregate to determine the physical and mechanical properties.

M.Saravanan1 et.al., (2018) M25 grade of concrete is used in study and the tests are conducted for various properties of demolished concrete waste can be replaced with 50% RCA, 50% RCA & 10% RFA and 50% RCA & 20% RFA in concrete. Based on the experimental investigation following conclusions are drawn. Optimum level of replacement of demolished concrete waste of RCA found to be 50% and the results are nearer to the conventional concrete.

Also replacement of fine aggregate by RCA 10% is additional to 50% RCA results are nearer to the conventional concrete. But in additional of replacement of 20% RFA the compressive strength is gradually decreased. This problem can be overcome by adding mineral admixtures. The Flexural strength of all three sets of replaced concrete is also nearer to the value of Flexural strength of Conventional concrete . The splitting tensile test value of 50% RCA replaced concrete is nearer to the value of Conventional concrete

Mudasir Liaquat Shah1 et.al., (2018) According to the test which has been carried out in the laboratory, results shown by testing the multiple samples that good quality concrete could be produced with recycled aggregates. The use of aggregates produced from recycled construction and demolition waste should be further promoted. Based on the experimental investigation reported in the work, the following conclusions are drawn:

Test results of recycled aggregates has shown good strength according to standards, i.e; mean abrasion value of RA is 30.32%, impact value is 8.84% & water absorption is 1.95% and all are under the limits. So it is clear that there is no issue of using the recycled aggregates instead of natural aggregates in the implementations where compression is concerned.

Recycled aggregate concrete has been proved to perform adequately and in a manner as good as to the concrete containing natural aggregates. It is likely that this study may lead to a greater use of Recycled Concrete Aggregate materials and its diversion from landfills

N V V S S L ShilpaK et.al.,(2017) The test values of compressive strength of cubes of demolished concrete aggregate for 7days, 14days, 21days, and28daysare obtained and the values are compared with standard concrete. The test values of compressive strength 25% and 50% of demolished concrete aggregates are near to the value of standard concrete or conventional concrete.

As we observed that the difference in compressive strength of standard and demolished concrete aggregate for a 28days is about 12%. The compressive strength of demolished aggregate concrete is relatively lower up to 20% than standard concrete.

From the above investigations it can be hence concluded that the optimum replacement for this particular mix for high strength concrete is in between 25-50%. Up to this replacement good compressive strength can be achieved using recycled aggregates. Beyond this replacement the strength acquired reduces gradually and does not cross the target strength and in order to overcome this problem, suitable adjustment in mix design is required.

Vijayvenkatesh Chandrasekaran et.al.,(2016) The use of recycled aggregates from construction and demolition wastes is showing prospective application in construction as an alternative to primary (natural) aggregates. Recycled aggregates are found to possess a relatively lower bulk density, higher crushing and impact values and higher water absorption as compared to natural aggregate.

The compressive strength of recycled aggregate concrete is relatively lower than natural aggregate concrete. However, these variations are dependent on the original concrete from which the aggregates have been obtained.

Mohd Monish1 et.al.,(2013) . Recycled aggregate concrete may be an alternative to the conventional concrete. Water required producing the same workability increases with the increase in the percentage of demolished waste. Up to 30% replacement of coarse aggregate with recycled aggregate concrete was comparable to conventional concrete .Up to 30% of coarse aggregate replaced by demolished waste gave strength closer to the strength of plain concrete cubes and strength retention is in the range of86.84-94.74% as compared to conventional concrete

Ravi patel1 et.al.,(2013) After detailed study of the result and analysis the following conclusions were made for M40 grade concrete. The experimental results show that the early compressive strength of concrete made of natural coarse aggregate and recycled coarse aggregate is approximately same. In compaction factor test at the replacement of 40% of Recycled Aggregate the compaction factor value is maximum, the highest compacting factor ratio is 0.90. So we can say that at the replacement of 40% recycled aggregate concrete is more workable.

The compression test result indicates an increasing trend of compressive strength in the early age of the concrete specimens with 60% recycled aggregates. However, it shows that the strength of recycled aggregate specimens were gradually increase up to 40% replacement of recycled aggregate & then it decreases at the 100% replacement of recycled aggregate after 28 days. The target strength for M40 grade is 48.25MPa that are achieved for all the specimens tested in the study.

The results also show that the concrete specimens with 40% replacement of recycled aggregate get the highest strength when compared to the concrete specimens with different percentage of recycled aggregate. From the obtained result, it is possible to use 40% recycled aggregate for higher strength of concretes. Hence the recycled aggregate can be used in concrete with 40% replacement of natural coarse aggregate.

Arul Gideon.R1 et.al., (2011) From the discussion it is concluded that, the tests have been conducted for the prepared RCA and the results have beenverified. The test results for the RCA and conventional concrete have been examined and compared. It is to be concluded that the compressive strength, split tensile strength and flexural strength are in the decreasing order when the percentage of RCA replacement increases.

Use of recycled aggregates in concrete provides a promising solution to the problem of C&D waste management. In conclusion, up to 40% of WCA along with polypropylene fibre and natural (coir) fibre respectively with 10% replacement of cement by silica fume gives good results over compressive tensile and flexural strength. Recycling WCAs in concrete production may help solve a vital environmental issue apart from being a solution to the problem of inadequate concrete aggregates in concrete.

Srinivas Angadi et.al.,(2017) The Study is conducted on the partial replacement of Recycled Coarse Aggregate in making high strength concrete M40 and the following conclusions are drawn on the limited study carried out: From Compressive strength test results, it is observed that 40% replacement of 10 mm aggregates in RCA mixing attains more than the conventional concrete And also 40% replacement of 20 mm aggregates in RCA mixing attains more strength when compared to conventional mix at 28 days.

It is also found that, Compressive strength of 20% Replacement of 10 mm, 20 mm and combination of 10 mm and 20 mm in RCA mix cubes were attain strength closer to the compressive strength results of conventional concrete at 12 hours, 3 days, 7 days, 28 days. Compressive strength is decreased while replacing recycled coarse aggregates of 30% in mix at 28 days. But the earlier strength is same as like conventional concrete mix. Finally, overall results are equal to sthe conventional concrete results at all ages.

D.V. Prasada Rao1 et.al.,(2015) Based on the test results of the present investigation, the following conclusions are drawn. Recycled aggregate concrete (RCA) has compressive strength comparable to the natural coarse aggregate concrete compressive strength for all grades of concrete at 3, 7, 28 and 90 days. This can be attributed to the cement mortar coat of RCA participates in hydration process and contribute additional strength. Along with strength, concrete should also be durable.

The durability property of concrete is determined using RCPT on the concrete specimens prepared with natural coarse aggregate and recycled coarse aggregate. It is observed that as per ASTM C1202, the chloride penetrating rate is “high” for RCA concrete and “moderate” for NCA concrete for all grades of concrete. Based on the test results, it can be recommended for the full replacement of NCA concrete with RCA concrete in structural concrete. RCA concrete can be effectively used to meet the objective of disposal of waste and also to meet the replacement for the depleting natural coarse aggregate.

S. K. Singh et.al.,(2016) Recycled aggregate possess relatively lower bulk density, crushing and impact values and higher water absorption as compared to natural aggregate. The compressive strength of recycled aggregate concrete is relatively lower up to 15% than natural aggregate concrete. The variation also depends on the original concrete from which the aggregates have been obtained. The durability parameters studied at SERC(G) confirms suitability of RCA & RAC in making durable concrete structures of selected types.There are several reliable applications for using recycled coarse aggregate in construction.

P. Pal, S. Shukla et.al.,(2011) This paper presents the characteristics of pervious concrete with optimum quantity of recycled concrete aggregate (RCA). Six different types of pervious concrete mix equivalent to M-15 grade of concrete containing 0%, 20%, 25%, 30%, 35% and 40% of RCA are prepared to estimate the compressive strength, the flexural strength and the permeability. The compressive strength of the pervious concrete with optimum replacement of primary coarse aggregate (PCA) by 35% of RCA is achieved up to 100% characteristics strength of the M-15 grade of concrete. The findings of this study may help the designers in the design of pervious concrete.

Veeraselvam et.al.,(2017) Recycle the Demolished Concrete has reduces the environmental pollution and protect the natural resources. This research is focused on utilising the Demolished Concrete waste and reduces the generation of construction waste. This research included a collecting a Demolished Concrete from the demolition of building at site, Crushing Demolished

Concrete waste and is separated with different sizes using sieve analysis. Various sizes of Aggregate is treated with heating and chemical process. Finally the Demolished Concrete Aggregate (DCA) is replaced by various percentages of 10 %, 20 %, 30 % adding with fibre and test can be conduct and compared with nominal Concrete.

3. CONCLUSION

Due to the critical shortage of natural aggregate, the availability of demolished concrete for use as recycled concrete aggregate (RCA) is increasing. Using the waste concrete as RCA conserves natural aggregate, reduces the impact on landfills, decreases energy consumption and can provide cost savings. Recycled aggregates are the materials for the future. The application of recycled aggregate has been started in many countries for construction projects. In this reports the basic properties of recycled coarse aggregate concrete will be evaluated and it also compares these properties with natural aggregates concrete.

Research on the usage of waste construction material is very important due to the material waste is gradually increasing of population and urban development. The reasons that many investigation and analysis had been made on the recycled aggregate are because recycled aggregate is easy to obtain and the cost is cheap.

- obtain a workable ratio for reuse of demolished concrete.
- study of natural materials.
- reduce wastage.
- study of properties of recycled concrete aggregate.
- conservation of natural material.
- effective resource management.

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