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EXPERIMENTAL STUDY ON THE USE OF BASALT AGGREGATE IN CONCRETE

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Abstract:

The use of recycled aggregates in concrete opens a whole new range of possibilities in the reuse of materials in the building industry. This could be an important breakthrough for our society in our endeavours towards sustainable development. The trend of the utilisation of recycled aggregates is the solution to the problem of an excess of waste material, not forgetting the parallel trend of improvement of final product quality. The utilisation of waste construction materials has to be related to the application of quality guarantee systems in order to achieve suitable product properties. Therefore, the complete understanding of the characteristics of new material becomes so important in order to point out its real possibilities. My thesis aimed to focus on the possibility of structural use of recycled aggregate concrete by studying the mechanical properties and durability aspects of conventional aggregate concrete, recycled aggregate concrete and fibre reinforced recycled aggregate concrete.

Keywords: Recycled Aggregate Concrete; Fibre Reinforced Recycled Aggregate Concrete, Strength Properties; Durability Characteristics; Non-Destructive Assessment.

1. INTRODUCTION

For thousands of years, the improvement of the quality of life has been the indicator of any developed society. This indicator has always been associated to the presence of elements and infrastructures, which facilitate the development of daily activities without taking into account the impact that they could have. History has taught us that society has made the recovery and use of rejected elements a habitual practice. Numerous civilisations have reused building materials of earlier civilizations of their own destroyed architecture (either through war or natural causes) to construct new buildings. The remains of ruined Romanesque churches supplied the stone for various farmhouses. Construction and demolition waste is not dangerous from an environmental point of view, the control of this becomes indispensable from the moment that statistics refer to the waste‟s volume approaching an unsustainable level. According to information obtained from Central Pollution Control Board, the annual quantityof construction and demolition waste in India is approximately 120,00,000 tons. Management of such high quantum of waste puts enormous pressure on solid waste management system. The present work is aimed to analyse and give technical specifications on strength characteristics of Recycled Aggregate Concrete with and without fibres. The main objective of the experimental investigation is to assess the utility of recycled coarse aggregates in the production of structural concrete. Recycled aggregate is a stone or gravel which has been previously used in construction and has been crushed and separated from contaminants. Concrete is a vital component of everyday life and is being extensively used for all types of structures, right from the smallest dwelling to a

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huge sky scrapers or a bridge. So every day millions and millions of cubic meters of concrete is being made and used all over the world. Of the three basic components of the concrete, only cement is manufactured and the aggregates both fine and coarse are obtained naturally. This has resulted in large scale quarrying of rocks for obtaining coarse aggregates and removal of sand from river beds for fine aggregates. The reutilization of these aggregates will conserve both the natural aggregates and landfills from the excess construction and demolished waste material.

2. RELATED WORK

Recycled aggregate is a stone or gravel which has been previously used in construction and has been crushed and separated from contaminants. Concrete is a vital component of everyday life and is being extensively used for all types of structures, right from the smallest dwelling to a huge sky scrapers or a bridge. So every day millions and millions of cubic meters of concrete is being made and used all over the world. Of the three basic components of the concrete, only cement is manufactured and the aggregates both fine and coarse are obtained naturally. This has resulted in large scale quarrying of rocks for obtaining coarse aggregates and removal of sand from river beds for fine aggregates. The reutilization of these aggregates will conserve both the natural aggregates and landfills Traditionally, the application of recycled aggregate is used as landfill. Nowadays, the applications of recycled aggregate in construction areas are wide. The applications are different from country to country. Recycled aggregate can be used in embankment fill. The reason for being able to use in embankment fill is same as it is used in granular base course construction. The embankment site is on the wet sub grade areas. Recycled aggregate can stabilize the base and provide an improved working surface for the remaining works. The relative density decreases progressively as particle size decreases. The percentage reduction to compressive strength of recycled aggregate concrete as compared to original concrete is reported to range between 5%-32%. Concrete made with recycled coarse aggregates can obtain an adequate compressive strength. Generally the recycled aggregate has a higher absorption and a lower relative density than conventional aggregate concrete.

3. PROPOSED SYSTEM

This results from the porous mortar and hardened cement paste adhered to the recycled aggregates. Absorption values typically range from 3% to 10%, depending on the concrete being recycled. The use of recycled fine aggregate can result in compressive strength reductions. The recycled aggregate concrete shows less workability because of its increased demand of water. These aggregates also show reduced tensile and flexuralstrengths. Also, the static modulus of recycled aggregate concrete is lower. However, drying shrinkage and creep of concrete made with recycled aggregates is up to 100% higher than concrete with a corresponding conventional aggregate. This is due to the large amount of old cement paste and mortar especially in the fine aggregate. Recycled concrete used as coarse aggregate in new concrete possesses some potential for alkali-silica-reaction if the old concrete contained alkali-reactive aggregate. The alkali content of the cement used in the old concrete has little effect on expansion due to alkali-silica- reaction The Netherland produces about 14million tons of buildings and demolition wastes per annum in which about 8 million tons are recycled mainly for unbound road base courses. The 285 million tons of construction waste produced in Germany per annum, out of which 77 million tons are demolition waste. Approximately 70% of it is recycled and reused in new construction work. It has been estimated that

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approximately 13 million tons of concrete is demolished in France every year whereas in Japan total quantity of concrete debris is in the tune of 10- 15 million tons each year.

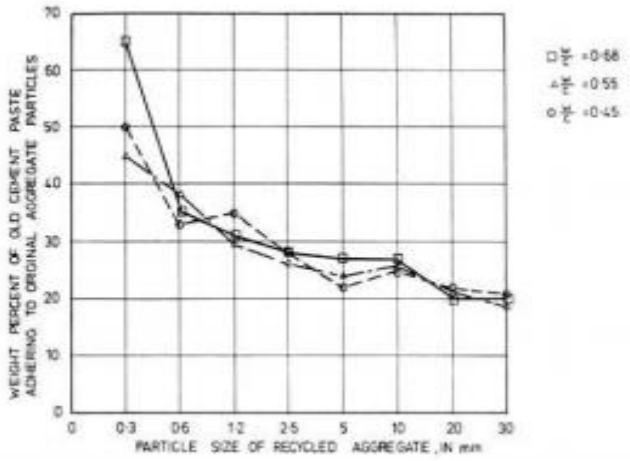

Fig.1.Concentrate Adhere

The Hong Kong generates about 20 million tons demolition debris per year and facing serious problem for its disposal. USA is utilizing approximately 2.7 billion tons of aggregate annually out of which 30-40% is used in road works and balance in structural concrete work. A recent report of Federal Highways Administration, USA refers to the relative experience from European data on the subject of concrete and asphalt pavement recycling. The rapid development in research on the use of RCA for the production of new concrete has also led to the production of concrete of high strength/performance.

4. ANALYSIS

The test program was planned in accordance to the objective of the experimentation. The grade of concrete adopted for all concrete mixes was M20 since it is the widely used structural concrete all over the world. All the concrete mixes are designed to have the same compressive strength.

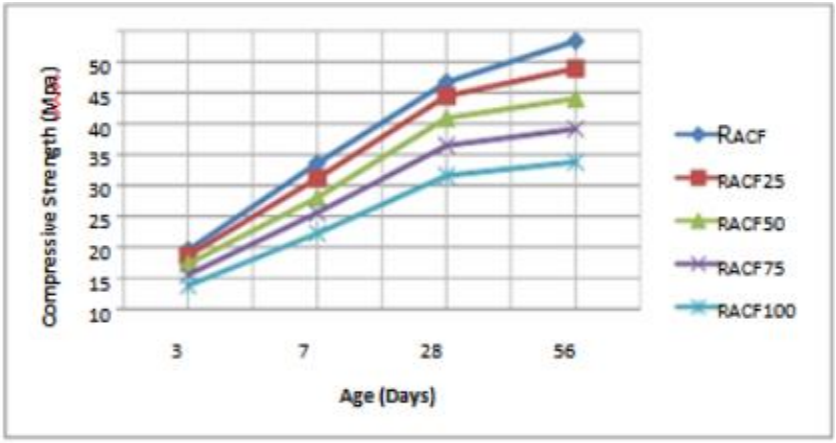

Fig.2.Output Analysis

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Cubes, cylinders, prisms were casted to arrive at the strength parameters and durability parameters. The strength parameters were studied at the ages 3 days, 7 days, 28 days and 56 days. The durability parameters were studies for 30 cycles of chemical environment after 28 days of normal curing. Concrete mix with 0% recycled aggregates forms the basic reference mix to compare the results of mixes with different percentage of replacement of recycled aggregates.

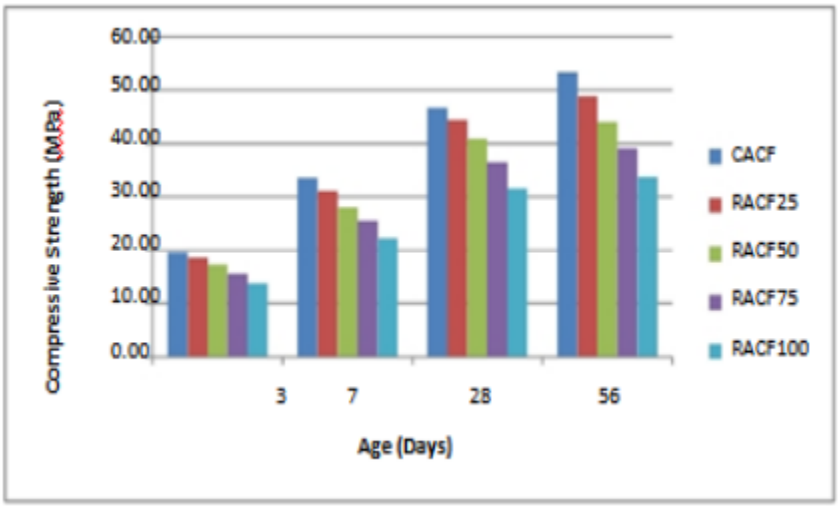

Fig.3. Output

Recycled aggregates are obtained from the waste crushed concretes. From quality point of view, the aggregates are heterogeneous in composition being derived from different materials and adhered mortar. The properties of recycled aggregates must be determined if the aggregates are to be used in concrete. The main aim of the present experimentation is to analyse the structural behavior of concrete made with different percentages of recycled aggregates, all of which were designed to have the same compressive strength. The strength and durability properties of the concrete produced by replacing conventional aggregates with recycled coarse aggregates in various percentages are evaluated. The objective of the experimental investigation is to assess the utility of recycled aggregate in the production of structural concrete. Serious of test specimens comprising of cubes, cylinders and prisms of standard dimensions were cast for concrete mixes produced with different percentage replacement (0%, 25%, 50%, 75% and 100%) of conventional coarse aggregates with recycled concrete aggregates to study the strength and durability parameters. Similarly five concrete The compressive strength test was conducted on cube test specimens for concrete mixes made with conventional aggregates and recycled coarse aggregates.

CONCLUSION

Assessment of the mechanical properties of recycled aggregate concrete and conventional aggregate concrete was made through series of destructive test like compressive strength test, split tensile strength test and flexural strength test. Nondestructive tests such as Rebound hammer test and Ultrasonic Pulse Velocity test were performed on test specimens to arrive at the strength characteristics of concretes produced with recycled coarse aggregates and conventional aggregates. Similarly the above tests were conducted on test specimens of concrete mixes fibres along with Recycling and reuse of building wastes

have been found to be an appropriate solution to the problems of dumping hundreds of thousands tons of debris accompanied with shortage of natural aggregates. The use of recycled aggregates in concrete proves to be a valuable building material in technical.

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