Shearing Strength and Reliability of Recycled Concrete Beam

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Abstract **– Recently, there has been great interest on the applicability of Recycled Concrete Aggregate (RCA) as a new ecological construction material that can be sustainable in a gradually expanding construction industry. This reports the structural performance particularly on shear behavior of high strength reinforced recycled concrete beams. Compressive cube strength of the tested beams ranged from 65-74 MPa at the age of 28-days [1]. In this project recycled concrete aggregates from site tested concrete specimens were used. These consist of 28 days concrete cubes after compression test obtained from a local construction site. These concrete cubes are crushed to suitable size and reused as recycled aggregate. The compressive strength of recycled aggregate concrete is found to be higher than the compressive strength of normal concrete. The experimental program compared conventional concrete mix with concrete mix having substitution of 25% recycled concrete aggregates of grade 25-30 MPa [2]. At the same time, large number of old buildings and other structures have reached the end of their service life and are being demolished, resulting in generation of demolished concrete. Some of this concrete waste is used as backfill material, and much being sent to landfills. Recycling concrete by using it as replacement to new aggregate in concrete could reduce concrete waste and conserve natural sources of aggregate. In the last two decades, varieties of recycling methods for construction and demolition wastes have been explored and are in well-developed stage.**

Keywords – Recycled, Aggregate, Backfill

I. INTRODUCTION

Recycling is the act of processing the used material for use in creating new product. The usage of natural aggregate is getting more and more intense with the advanced development in infrastructure area. In order to reduce the usage of natural aggregate, recycled aggregate can be used as the replacement materials. Recycled aggregate are comprised of crushed, graded inorganic particles processed from the materials that have been used in the constructions and demolition debris. These materials are generally from buildings, roads, bridges, and sometimes even from catastrophes, such as wars and earthquakes. Concrete aggregate collected from demolition sites is put through a crushing machine. Crushing facilities accept only uncontaminated concrete, which must be free of trash, wood, paper and other such materials. Metals such as rebar are accepted, since they can be removed with magnets and other sorting devices and melted down for recycling elsewhere. The remaining aggregate chunks are sorted by size. Larger chunks may go through the crusher again. After crushing has taken place, other particulates are filtered out through a variety of methods including hand-picking and water flotation.

Fig.1: Recycled Aggregate

II. LITERATURE REVIEW

The compressive Strength of recycled aggregate concrete was relatively lower and variation was depended on the strength of parent concrete from the obtained aggregate [3]. The recycled concrete aggregate had 7 to 9%lower relative density and 2 times higher water absorption than natural aggregate [4]. According to their test results, it shown that there was no effect with the replacement of 30% coarse recycled concrete aggregate used on the ceiling strength of concrete. It also mentioned that recycled concrete aggregate could be used in high strength concrete mixes with the recycled concrete aggregate content in the concrete. Segue, Brown and Taylor (2002) stated that the difference between the characteristic of fresh and hardened recycled aggregate concrete and natural aggregate concrete is relatively narrower than reported for laboratory crush recycled aggregate concrete mixes. There was no difference at the 5% significance level in concrete compressive and tensile strength of recycled concrete and control normal concrete made from natural aggregate. In the same year, Poon (2002) reported that there were not much effect of the compressive strength of brick specimens with the replacement of 25% and 50% of recycled aggregate. But when the percentage of recycled aggregate replacement increased, the compressive strength of the specimens was reducing.

III. NEED FOR RESEARCH

The field of study exploring the properties of recycled aggregates and the basic properties of recycled concrete has developed over the last few decades, leading to a number of countries establishing standards or recommendations supporting their use. However, as a result of the small number of investigations carried out in the field of structural behavior (behavior under flexing conditions, shear, adherence, torsion, etc.), further work is required.

The aim of this particular study was therefore to explore the structural shear behavior with concrete manufactured using recycled aggregates from demolished structures (RC mixes). Investigations were also made into the affect of the addition of silica fume on the structural properties of recycled concretes (RCS mixes). Both materials were compared with conventional concrete as a reference (CC mixes), which was also modified at some doses with the addition of silica fume (CCS mixes).

A further aim was to determine the suitability of current theoretical shear models and standards with the new materials.

IV. METHODOLOGY

The main stages involved in the project are collection of aggregate sample, collection of aggregate location details, laboratory analysis and comparison.

A. Collection of Aggregate Samples

Collection of aggregate samples is the first and foremost step involved in the project. It is the Most difficult and time consuming part of the project. Two kinds of aggregate samples are required for the project. They are Fresh/Virgin aggregate sample and Scrap/Used aggregate sample. We collected about 25kg of each aggregate sample which was required for this project. Recycled Aggregate samples were also needed for the project which were obtained by combining fresh and used aggregate samples

B. Laboratory Analysis of Aggregate Samples

Compressive strength for hardened concrete was determined by using compression machine. Strength of concrete is commonly considered its most valuable property in the mechanical properties because the strength usually gives an overall picture of the quality of concrete that is directly related to the structure of the hydrated cement paste. Based on figure 6-8, gives the values of compressive strength for RAC and NAC according to the aggregate sizes and days of testing. The difference in compressive strength of two types of aggregate is clearly seen when comparing the 28-day compressive strength. It can be seen the RAC is lower workability and compressive strength compared to NAC. The RAC crushed at 3 days produced the similar strength by the all size of RA. At the age of 14 days, the RAC was quite similar value when compared to NAC in size 10 mm and 14 mm, but in 20mm size of RAC, this effect was different; the RAC was 10% weaker than NAC. At the age of 28 days, the results of RAC which is well within the same range of compressive strength value for NAC except in 20 mm sizes the several past researchers have conducted study for determining compressive strength of RAC compared to NAC.

FOR FRESH CONCRETE

1. Take Ingredients in the ratio (1:1.5:3).

Table 1: Mass of ingredients

Cement	6kg
Sand	9kg
Aggregates	18kg

2. Add the water for proper mixing by using water cement ratio is 0.45.

3. Mixing the ingredients properly.

4. Filled the mould in three layers with 35 blows in each layer.

5. Vibrate the cube on rotator vibrator till 15 shots

6. Keep the cube in dry place for 24 hour.

7. After 24 hour cube replace in water tank for curing.

8. After the 3, 7 and 28 days check the compressive strength by using compressive testing machine (CTM).

FOR RECYCLED CONCRETE

Repeat the above same process again and examine the compressive strength of recycled concrete

V. TEST RESULTS

Table 2: Compressive strength of fresh concrete

S.NO.	COMPRESSIVE STRENGTH	DAYS
1	8 KN /mm^2	3
2	18.45 KN/ mm^2	7
3	24.70 KN/ mm^2	28

Table 3: Compressive strength of recycled concrete

S.NO.	COMPRESSIVE STRENGTH	DAYS
1	10 KN / mm^2	3
2	18.02 KN/ mm^2	7
3	21.79 KN/ mm^2	28

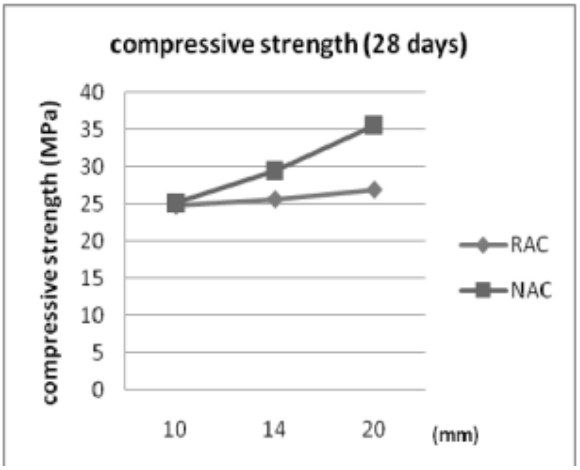

Fig.1. Comparisons the compressive strength b/w recycled concrete and natural concrete

VI. CONCLUSION

The use of RCAs in civil construction works will reduce environmental pollution, and reduce the cost of production of natural resource as well as solving the problem of construction-waste management by putting into use this waste. Adding RCAs to concrete resulted in increased water demand, reduction in workability and reduced strength compared to the control sample. This results show reduction in strength of concrete within percentage replacement of RCAs. Here, we can say that up to 20% RCAs utilized for economical and sustainable development of concrete. Uses of RCAs in concrete can save the construction-waste disposal costs and produce a 'greener' concrete for sustainable construction. In this study, the compressive strength properties of concrete were investigated by completely replacing natural aggregate with recycled concrete aggregate.

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