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Review Use of Demolished Concrete in Pavement Construction

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ABSTRACT

Recycled aggregates consist of crushed, graded inorganic particles processed from the material that have been used in the constructions and demolition debris. The target of the present thesis work is to determine the strength characteristic of recycled aggregates for the application in concrete pavement construction. The scope of the thesis is to determine and compare the compressive strength, flexural strength and sulphate resistance of concrete by using different percentages of recycled aggregates. The investigation was carried out by using workability test, compressive strength test, flexural strength test and sulphate resistance test. A total of five mixes with replacement of coarse aggregates with 0%, 10%, 20%, 30% and 40% recycled coarse aggregates were studied. The water cement ratio was kept constant at 0.38. It was observed that workability of concrete was decreased with the increase in recycled aggregates in concrete. For the strength characteristics, the results showed that the strengths of recycled aggregate concrete were comparable to the strengths of natural aggregates concrete.

I. INTRODUCTION

In the era of construction, concrete has been the leading building material since it was discovered and found viable for future due to its durability, easy maintenance, wide range of properties and adaptability to any shape and size. Concrete is the composite mix of cement, aggregates, sand and water. Concrete gets hardened like stone on mixing water with cement and aggregates. Concrete have two type ingredients namely active and inactive. The active group consists of water and cement. The inactive part consists of sand and coarse aggregates. Concrete have high compressive strength and low tensile strength. To overcome this shortcoming, steel reinforcements are used along with the concrete. This type of concrete is called reinforced cement concrete (RCC).

Concrete structures that are designed to have service lives of at least 50 years have to be demolished after 20 or 30 years because of deterioration caused by many agents. Old buildings require maintenance for better and higher economics gains. The rate of demolition has increased and there is a shortage in dumping space and also increase in cost of dumping. Instead of dumping this demolished concrete, use of demolished as recycled concrete would not only reduce the cost but also will conserve the non renewable energy sources. The use of demolished concrete will further result in reduction in use of natural aggregates. The usage of natural aggregates is causing damage to natural resources resulting in imbalance in environment. Recycled aggregates consist of crushed, graded inorganic particles obtained from the materials that have been used in constructions. Recycled aggregates are generally obtained from buildings, roads and bridges which are demolished due to completion of life, wars and earthquake.

II. REVIEW OF LITERATURE

➢ Compressive Strength

The ability to resist compression loads is called Compressive strength. It is found that the use of RCA in the concrete mix decreases compressive strength compared to natural aggregate. But it is also found that, at 28 days, all mix designs usually exceed 50MPa compressive strength [Shayan 2003]. In one study it is found that the compressive strength of natural concrete was 58.6 MPa, and the RCA concrete ranged from 50.9 to 62.1 MPa. The compressive strength for 50% RCA concrete was higher than 100% RCA concrete [Poon 2002]. In other study it is found that the loss of compressive strength is in the range of 30-40% for the concrete made with RCA at 28-days [Katz 2003]. There was very less reduction in 28- and 56-day compressive strength when natural aggregate was partially replaced with RCA and a much greater reduction when RCA was used in full [Abou-Zeid 2005].

The compressive strength is most affected by the w/c ratio [Lin 2004]. Other influential parameters include fine recycled aggregate content, cleanness of aggregate, interaction between fine recycled aggregate content and crushed brick content, and interaction between w/c ratio and coarse RCA content [Lin 2004]. At a constant w/c ratio, air-dried RCA containing concrete had the highest compressive strength compared to oven-dried and saturated surface dry RCA [Poon 2003]. Particularly at lower w/c ratios, unwashed RCA reduces compressive strength. Compressive strength is 60% of virgin concrete at 0.38 w/c and 75% at 0.6 w/c [Chen 2003]. In 2008, Tabsh,Sami W.et.al investigated the strength concrete with use of recycled aggregates. The main objectives of study were the sources of recycled aggregates and the strength of recycled concrete . Test results showed that the losses as 50% for toughness and 12% for soundness test which are within acceptable limits. From this study it was found that recycled aggregates concrete required more water than the virgin concrete to maintain the same slump without use of admixture. It was also found that the strength was reduced to 10-25% with the use of recycled aggregates.

➢ Flexural Strength

The ability to resist tension resulting from bending is called flexural strength. There are doubtful or conflicting results about how RCA use affects flexural strength. In some studies it was found that RCA decreases the flexural strength [Zaharieva 2004, Katz 2003, Salem 2003] and some other studies showed that RCA caused increase in flexural strength [Poon 2002]. One study showed a decrease in flexural strength between 10-20% [Zaharieva 2004]. Other studies found comparable flexural strength results between RCA concrete and the control [Tavakoli 1996a, Abou-Zeid 2005].

➢ Sulphate Resistance

The ability of concrete to resist penetration of sulphates from soil or water that reacts with the hardened cement paste resulting in strength loss is called sulphate resistance of concrete. According to ASTM C 157, the standard for sulphate resistance is expansion should be less than 0.1% at six months, or for high resistance expansion should be less than 0.05% at 6 months and 0.1% at one year [Shayan 2003]. RCA has better sulphate resistance than virgin aggregate. Generally expansion is below 0.025% at one year [Shayan 2003].

In a study by **P. Kathirvel et.al on effect of sulphate on self compacting concrete it was concluded that compressive** strength of replacement of 10% Lime was 5 percent higher than the control specimens. It was found that addition of limestone powder increases the sulphate resistance up to 10% which is 0.5 percent higher than that of virgin concrete. Density was reduced to 1.5 percent lesser for replacement of cement by 10% lime when compared to of concrete without replacement of cement by limestone. The reduction in density was 1 percent lesser for replacement of cement by 10% quarry dust when compared to of concrete without replacement of cement by quarry dust. The reduction in density was 1 percent lesser for both replacement of cement by 10% lime and quarry dust powder. The result of the study indicated that the replacement of cement with 10% lime improved the durability of Self–compacting concrete. The losses in mass and compressive strength of cubes were found to be negligible under Sulphate attack. It was observed that limestone and quarry dust powder resists Sulphate attack within tolerable limits

III. MATERIAL AND DESIGN METHODOLOGY

➢ Workability

Workability of concrete was checked by using slump test and compaction factor test.

➢ **Size of the Test Specimens**

Moulds of cast iron were used to cast test samples, in shape of cube. Dimensions of cube were 150mm×150mm×150mm

➢ **Casting of Specimens**

Cubic moulds were well cleaned before pouring concrete in them. Mould oil was applied to inner sides of mould to avoid the sticking of concrete to sides of mould. Side plates were tightly assembled after application of mould oil between the joints. Concrete was poured in them and tamped with tamping rod.

➢ **Compacting of Concrete Samples**

Compacting of concrete was done by table vibrator. Vibrating was done till desired compaction was reached.

➢ **Capping of Samples**

Even after vibrating the samples, the top of the cubes were not plain. Capping was done to make this side plain. The plainness of top side was checked by means of straight edge and filler gauge. Caps were made thin as practicable they could be. It was taken into consideration that capping did not cause fracture while testing the samples.

➢ **Testing For Compression Strength**

Testing Machine

Compressive strength testing machine was used to test the samples for compressive strength. The test samples were tested at the age of 7, 28, 56 and 90 days. The ages of samples were considered from the time water was added to dry materials. Three samples for each batch were prepared and their average value was taken for final compressive strength.

IV. OBJECTIVES OF THE STUDY

The study on use of demolished concrete in pavement construction consists of conducting laboratory investigations on cement concrete prepared by using demolished concrete to estimate its suitability for pavement construction. The main objectives of study are:

1. To prepare mix design for M40 concrete with varying proportions of recycled aggregates.
2. To determine the compressive strength of the samples at the end of 7, 28, 56 and 90 days.
3. To determine the flexural strength of the samples at the end of 7,28, and 90 days
4. To determine the sulphate resistance strength of samples at the end of 7, 28 and 56 days.

The purpose of this research was to study the behavior of recycled coarse aggregates when it was included in Plain Cement Concrete. Slump test was performed on freshly mixed concrete, and compression test was performed on hardened concrete. 135 samples of concrete were prepared with RCA and natural aggregate, changing their mixture design parameters, including coarse aggregate proportion..

REFERENCES

1) Abou-Zeid, M.N., Shenouda, M.N., McCabe, S.L., and El-Tawil, F.A. (2005). “Reincarnation of Concrete,” Concrete International, V. 27, No.2, February 2005, pp. 53-59.
2) Ajdukiewicz, A., and Kliszczewica, A. (2002). “Influence of Recycled Aggregates on Mechanical Properties of HS/HPS,” Cement and Concrete Composites, V. 24, No. 2, 2002, pp. 269-279.
3) Bairagi, N. K., Vidyadhara, H. S., and Ravande, K. (1990). “Mix Design Procedure for Recycled Aggregate Concrete,” Construction and Building Materials, V. 4, No. 4, December 1990, pp. 188-193.
4) Buyle-Bodin, F., “Influence of industrially produced recycled aggregates on flow of properties of concrete.” Materials and structures/ Mate’riaux et. Construction, Vol. no. 35, September-October 2002,pp 504-509.
5) Chen, H.J., Yen, T., and Chen, K.H. (2003). “Use of Building Rubbles as Recycled Aggregate,”Cement and Concrete Research, V.33, No.1, pp. 125-132.
6) FHWA. (2004). “Transportation Applications Of Recycled Concrete Aggregate: FHWA State of the Practice National Review September 2004,” U.S. Department of Transportation, Federal Highways Administration, Washington, DC.
7) GTAA. (2007). “Reducing, Reusing and Recycling Terminal 2,” Toronto Pearson Today: Terminal 2, Terminal 2 Commemorative Issue, Greater Toronto Airports Authority, Toronto, ON.
8) Hansen, T.C., and Hedegard, S.E. (1984). “Properties of Recycled Aggregate Concretes as Affected by Admixtures in Original Concretes,” ACI Journal, January-February 1984, pp. 21-26.