AN EXPERIMENTAL INVESTIGATION ON THE EFFECT OF RECYCLED AGGREGATE ON CONCRETE PROPERTIES

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ABSTRACT

In many urban areas , shortage of natural aggregate for production of concrete is developing very fast , world over. At the same time increasing quantity of demolished concrete from deteriorated and obsolete structure is generating waste material in all the areas. It would be a great advantage if this demolished concrete could be used to yield quality aggregate for production of concrete.

The paper presents an experimental investigation in which strength and flow properties of concrete made by using natural and recycled concrete are compared. Comparative study revels that with slight control on grading of recycled concrete good quality concrete can be made by using recycled aggregate.

INTRODUCTION

In the recent years in all most all big cities the numbers of concrete structures demolished is increasing rapidly and disposal of this waste is becoming a problem as the conventional method of using it for land reclamation is becoming more difficult. Therefore if this waste can be converted in to a useful material for construction this will not only solve the problem of disposal but at the same time will solve the problem of pollution created by disposal of this on land . One possible utilization of this waste is making aggregate for use in concrete , thus it will also conserve our diminishing natural resources.

Researchers have tried to relate the quality of recycled aggregate concrete to the original concrete. It is generally accepted that the cement paste from original concrete that adhered to the recycled aggregate plays an important role in determining the performance of recycled aggregate concrete. From the above background experiments were performed to examine the effect of recycled aggregate on the strength and workability of concrete.

MATERIALS AND MIX PROPORTIONS

Ordinary Portland Cement of 53 grade (specific gravity 3.15 , ignition loss 1.4 % , initial setting time 107 minutes , final setting time 227 minutes , 3 , 7 and 28 day strength 29.2,39.1 and 54.1 N / mm 2 respectively) was used in investigation. The fine aggregate used was river sand (specific gravity 2.63 , water absorption 1.68 %, fineness modulus 2.98) . The coarse aggregate used were normal aggregate (NA – obtained by mixing 20 mm max size and 12.5

mm size aggregate in proportion of 60:40 to get grading conforming to IS – 383 for 20 mm size aggregate) and recycled aggregate (RC – obtained by mixing 20 mm max size broken recycled aggregate and 12.5 mm size normal aggregate in proportion of 60:40 to get grading conforming to IS – 383 for 20 mm size aggregate). The physical properties of normal aggregate and recycled aggregate are shown in table –1. As chemical admixture high range water reducing admixture supplied by M/S Choksey Chemicals was used. Mix proportions for M-25 grade concrete were obtained as per IS method of mix design for both the category of aggregate mix proportions were 1:1.51:3.43 with a w/c of 0.52.

Table 1: Properties of Normal and Recycled Aggregates

Type / Property		Normal Aggregate - NA	Recycled Aggregate – RC
Specific Gravity		2.66	2.49
Absorption %		0.85	2.75
Unit Wt Kg / m^3		1620	1540
Aggregate Impact Value		13.80	14.10
Grading as per IS 383			
Sieve Size mm	Cumm % passing		
40	100		
20	95-100	100	100
10	25 - 55	95.0	96.10
4.75	0 - 10	26.33	30.20
		6.33	8.75
FM		6.72	6.65

EXPERIMENTAL METHODS

In order to examine the effect of recycled aggregate on strength of concrete concrete cubes of size 150 mm x 150 mm x 150 mm were cast and cured in water for 28 days compressive strength and 150 mm dia and 300 mm long specimens for splitting tensile strength. The measurement of compressive and splitting tensile strength was carried out according to IS specifications. To examine the effect of high range water reducer on workability and strength of concrete three different doses of admixture were used.

RESULTS AND DISCUSSION

The splitting tensile strength and the compressive strength of concrete using recycled and normal aggregate at w/c = 0.52 are as shown in Figs 1 and 2. It can be seen that compressive strength and splitting tensile strength of concrete increases with increase in doses of HRWR upto 1% after that there is decrease in strength of concrete. The cracking position was observed here on a specimen, it is noticed that crack propagated through mortar adhered to recycled concrete aggregate. Fig 3 shows the variation of compacting factor with doses of HRWR for both type of concrete , from figure it can be seen that with increase in doses of HRWR compacting factor increases for both type of concrete but it is more for normal concrete as compared to recycled concrete. This is due to the fact that in case of recycled concrete some water absorbed by the adhered mortar which reduces workability of concrete.

CONCLUSIONS

The paper presents the effect of recycled aggregate and HRWR on strength and workability of concrete. The following conclusions are obtained from the present investigation.

1. The strength and quality of concrete is not affected by replacement of natural aggregate by recycled aggregate.
2. The workability of concrete increases with increase in HRWR content , the optimum dose is 1% of HRWR by wt of cement .

ACKNOWLEDGEMETS

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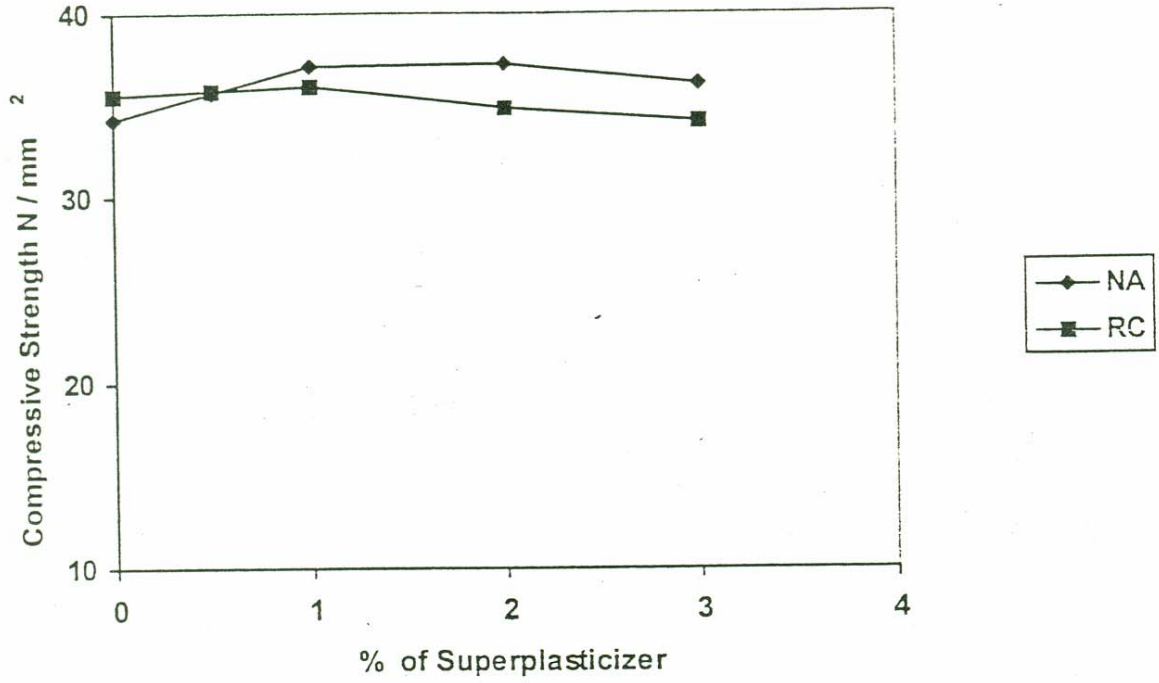

Figure 1: Variation of 28 days Compressive Strength with % of Superplasticizer

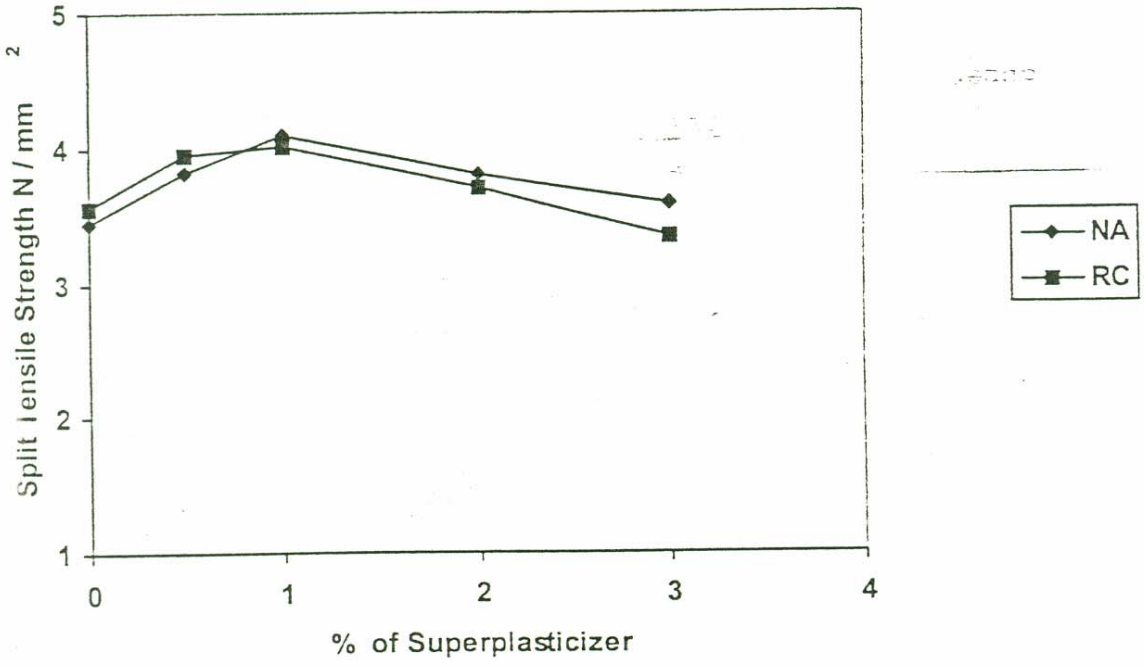

Figure 2: Variation of Split Tensile Strength with % of Superplasticizer

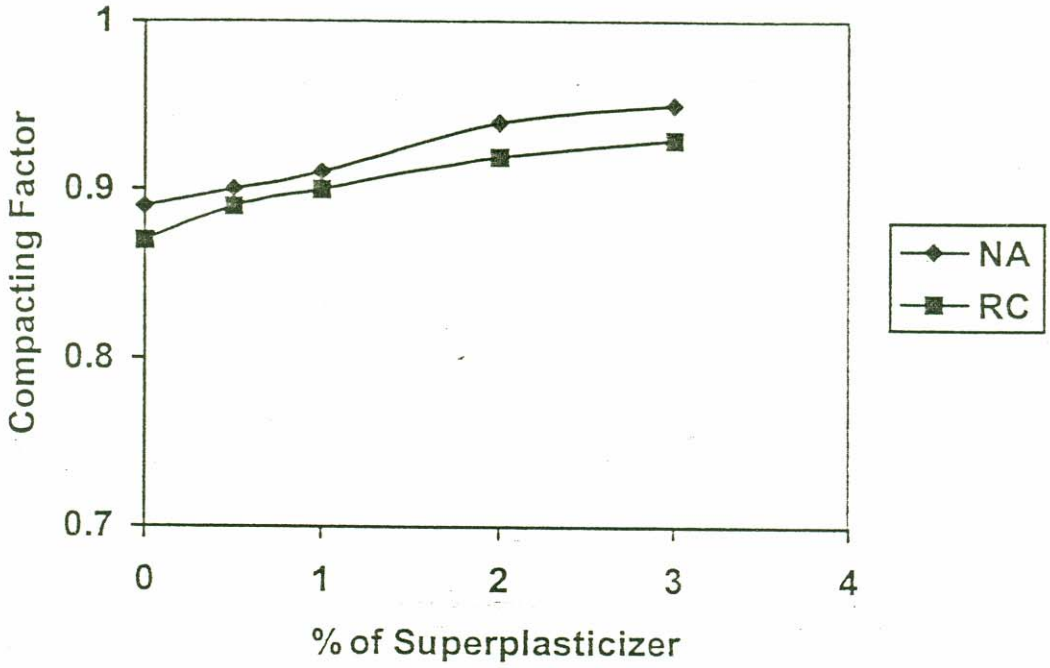

Figure 3: Variation of Compacting factor with % of Superplasticizer