Replacement of Coarse Aggregate with Locally Available Brick Aggregate

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***Abstract*-Due to the abundant usage of concrete as a construction material, there is a fast dwindling source of aggregates. There are regions where there is scarcity of coarse aggregate, so to resolve this problem, Bricks Aggregates (BAs) can be used as coarse aggregate. A concrete mix ratio of 1:2:4 having characteristics strength of 3000 psi has been used in this experimental work. Compressive and tensile strength of concrete mix where 50% coarse aggregate is replaced with brick aggregate and concrete mix where 100% coarse aggregate is replaced with brick aggregate and addition of silica fume as a supplementary cementing material have been evaluated at 7, 14 and 21 days of age. The experimental test results revealed the compressive and tensile strength of concrete where coarse aggregate is replaced at 50% is almost the same as that normal concrete at the 7, 14, 21 and 28 days.**

Keywords-concrete; brick; aggregate; coarse; compressive; strength; tensile; silica fume

I. INTRODUCTION

The rigorous use of aggregates in constructions is a very vital environmental apprehension. In a county like Pakistan, the ease of use of aggregates becomes a severe problem. In order to decrease the exploit of natural aggregates from natural resources and for energy preservation, the use of recycled aggregates may be employed. Plentiful studies illustrate the possibility of recycling aggregates such as ceramics [1], rubber [2, 3], glass [4], and demolition wastes, i.e. bricks and concrete. Because of the high quantity of concrete from demolition wastes, this material was studied as substitution of natural aggregates by several researchers [5–8]. Nevertheless, these aggregates are highly porous, and contain a high amount of impurities [8, 9]. Limited studies were conducted on the possibility of fresh concrete waste. These aggregates are mainly composed of over ordered fresh concrete. The benefit of this waste is that it contains limited quantity of impurities in contrast with other recycled aggregates. A concrete batching plant receives from numerous construction sites a huge amount of over ordered fresh concrete. Currently, the practice of managing over ordered fresh concrete is to use it in road or to dump it into landfill, which is deemed as a non-advantageous solution. Moreover, it will be of high cost in the close future because of the saturation of landfill areas [10]. Recycling this material is of particular consideration due to its use it can significantly trim down the problem of waste storage, and simultaneously it helps the conservation of natural aggregate resources. Recent successful studies on the use of fresh concrete waste as aggregates in concrete have been reported [11, 12]. In this experimental study, concrete mixes with fine and coarse aggregates recycled from brick bates as a substitution of natural aggregate and addition of silica fume as a supplementary cementing material have been studied.

II. EXPERIENTIAL PROCEDURE

OPC was used throughout in this experimental work. The concrete ratio of 1:2:4 having designed strength of 3000 psi and along with silica fume, coarse aggregate having maximum size of 25 mm, brick aggregate having 25 mm and fine aggregate having maximum size of 4.75 mm were used. The compressive and tensile strength of concrete replacing coarse aggregate 50% by brick aggregate and concrete mix where coarse aggregate is replaced by 100% brick aggregate and with the addition of silica fume (SF) as a supplementary cementing material at the ages of 7, 14, 21 and 28 days. A total of 120 specimens were prepared with mixes designed as shown in Table I.

III. RESULTS AND DISCUSSION

Figure 1 shows the mean compressive strength of the normal concrete, concrete replacing 50% coarse aggregate with brick aggregate (BA) and concrete replacing 100% coarse aggregate with (BA) with the addition of 10% SF. As shown in the figure, the concrete having 50% BA is achieving almost the same strength as the specified strength of 1:2:4 concrete mix. However the strength of the concrete mix where coarse aggregate is replaced by 100% and with the addition of 10% silica fume reaches somewhat below the 28-characteristic strength of the concrete mix. This decrease in strength clearly points out the importance of aggregate in concrete in terms of strength irrespective of the addition of silica flume as a supplementary cementing material. Furthermore, the decrease in the strength may be due to the reason of more absorption capacity of brick aggregate and silica fume. The 28-days tensile strength of the concrete depicts same behavior as that of the compressive strength of the concrete mixes at the different ages.

TABLE I. MIX PROPORTION OF CONCRETE

S. No	Concrete Mix	Cement (Kg/m^3)	S.F (Kg/m^3)	Water (Kg/m^3)	F.A (Kg/m^3)	B.A (Kg/m^3)	C.A (Kg/m^3)	Slump (mm)
1	Normal Concrete	346	0	173	692	0	1384	25- 50
2	50% Replacement of CA with BA	346	0	173	692	692	692	25-50
3	100% Replacement of CA with BA +10% SF	346	34.6	173	692	1384	0	25-50

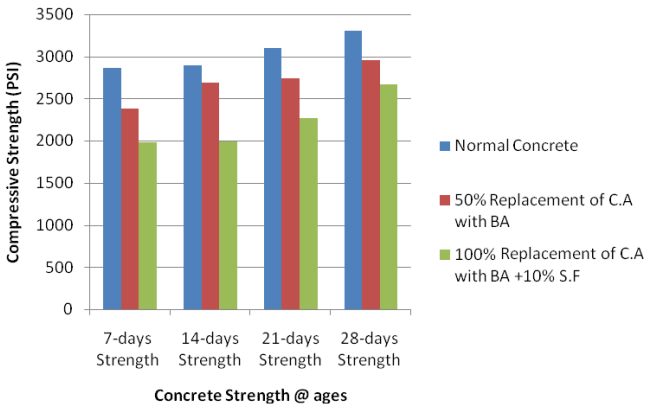

Fig. 1. Elemental composition of RHAs sample

IV. CONCLUSION

In this study, the characteristics of concrete mixes with fine and coarse aggregates recycled from brick bates with the addition of silica fume as a supplementary cementing material have been studied. Results show that coarse aggregate could be replaced by brick aggregate up to 50% by weight in the production of normal use of concrete without any loss of strength and other basic properties of the concrete.

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