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### Partial Replacement of Recycled Waste Glass by Fine Aggregate in Concrete

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**ABSTRACT-** The study provides details regarding exploratory examination on the suitability of squashed glass as partially replaced for fine total in solid generation. With the use of waste glasses available around the world at low costs, the use of Waste Glass seems to offer the best short term solutions for rising river bed and demand. The global warming is caused by the emission of greenhouse gases, such as CO<sub>2</sub>, to the atmosphere. Among the greenhouse gases, CO<sub>2</sub> contributes about 65% of global warming. The global cement industry contributes about 7% of greenhouse gas emission to the earth's atmosphere. In order to address environmental effects associated with cement manufacturing, there is a need to develop alternative binders to make concrete. Efforts have been made in the concrete industry to use waste glass as partial replacement of coarse or fine aggregates and cement. In this study, finely powdered waste glasses are used as a partial replacement of fine aggregate in concrete and compared it with conventional concrete. The objective of this project work is to study the effects of using waste glass as partial replacement for fine aggregate. Different concrete mixes were prepared by varying the amounts of crushed waste glass. The waste glass was used to replace fine aggregate in the proportions of 10% , 20% , 30% . The study indicated that waste glass can effectively be used as fine aggregate replacement without substantial change in strength.

**Keywords:** *Waste Glass, Workability, Compressive Strength.*

#### I. INTRODUCTION

Concrete is one of the chief constituents of construction and the most important. It is obtained by mixing calcareous & argillaceous materials with water, sand and coarse aggregate. But at present time the biggest issue is increasing CO<sub>2</sub> and demolition waste. This major issue can be solved by using alternative resources like fly ashes, blast furnace slag, coke breeze, waste glass etc. Using waste glass in the concrete construction sector is advantageous, as the production of cost of concrete will go down. Unlike other forms of wastes like paper or organic constitutes, glass waste will remain stable because glass is a non-degradable material.

#### II. OBJECTIVE

1. To study the behaviour of concrete after the replacement of fine aggregate up to 10%, 20%, 30% replacement level.
2. To study the workability of concrete using glass waste as partial replacement of fine aggregate.

- To study the compressive strength of concrete using glass waste as partial replacement of fine aggregate.
- To attain more strength while comparing to the normal concrete.

### III. EXPERIMENTAL PROCEDURE

#### 1. Cement

Ordinary Portland cement of 53 grade was used in this work and it is stored in the air light container. The cement used in this work is fresh i.e., used within three months of manufacture and it should satisfy the requirement of IS 12269.

#### 2. Fine aggregate

Fine aggregate or sand is distinguished from crushed stones by the size of grains or particles. Normally fine aggregate used to prepare the concrete is river sand confirming zone II. It should satisfy the requirement of IS 383-1970. Its size should be passing through IS sieve 4.75mm and retaining on 150 $\mu$  with specific gravity of 2.6.

#### 3. Coarse aggregate

Coarse total are the squashed stone utilized for the making concrete as a part of this study. The state of the coarse total utilized is rakish. The extent of the coarse total was utilized as going through IS strainer 20mm and holding on 4.75mm with gravity of 2.7.

#### 4. WASTE GLASS

Quantities of waste glass have been on the rise in recent years due to an increase in industrialization and the rapid improvement in the standard of living. In the wake of utilizing of these glass items they are dumped into landfill destinations; the area gets contaminated because of these glass items are not biodegradable materials this prompts natural irregularity. Glass waste is very hard material. Before adding glass powder in the concrete it has to be powdered to desired size in this studies glass powder ground in ball pulveriser for a period of 30 to 60 minutes and after that sieved through IS Sieve 4.75mm and holding on 150 $\mu$ m.



#### CRUSHED WASTE GLASS

#### CHEMICAL COMPOSITION OF WASTE GLASS

COMPONENTS	PERCENTAGE (%)
Silica (SiO <sub>2</sub> )	70.4
Alumina (Al <sub>2</sub> O <sub>3</sub> )	1.9

Iron oxide (Fe <sub>2</sub> O <sub>3</sub> )	1.2
Magnesium oxide (MgO)	10.3
Sodium oxide (Na <sub>2</sub> O)	14.0
Potassium oxide (K <sub>2</sub> O)	0.4

### III. MIX DESIGN AND MIXING OF CONCRETE

Crushed waste glass in the order of 10%, 20% and 30% is used in concrete with the mix ratio of M25. As per Indian standard Guidelines the mix design was carried out. The mix proportions of the concrete were 1:1.1:2:0.4 (Cement, Fine aggregate, Coarse aggregate and water/cement ratio). The mixing can be done by manual.

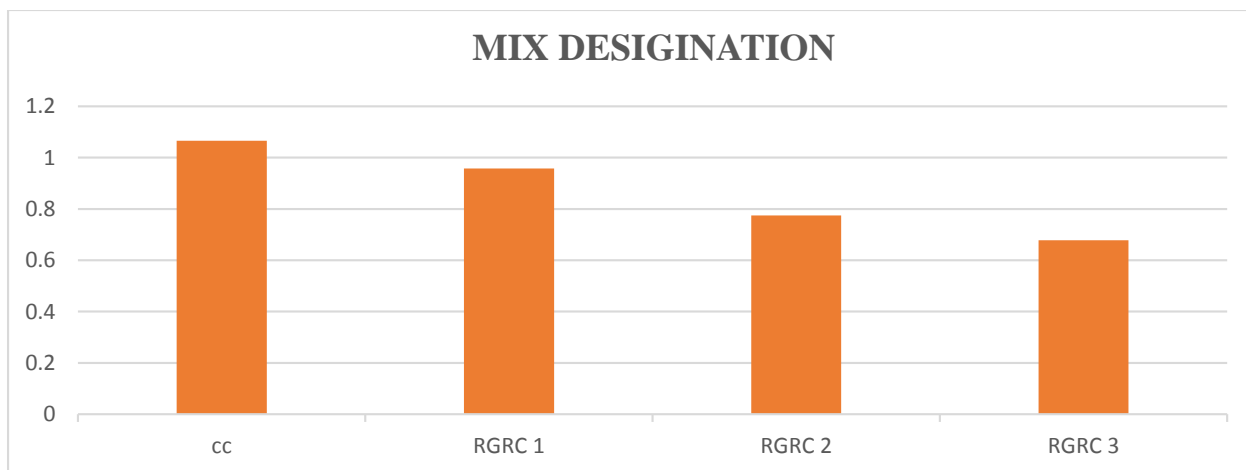
### IV. TEST RESULTS

#### 1. WORKABILITY TEST

S.NO	TYPE OF CONCRETE	SLUMP VALUE (mm)
1	CC	100
2	RGRC 1	112
3	RGRC 2	118
4	RGRC 3	128

#### 2. WATER ABSORPTION TEST

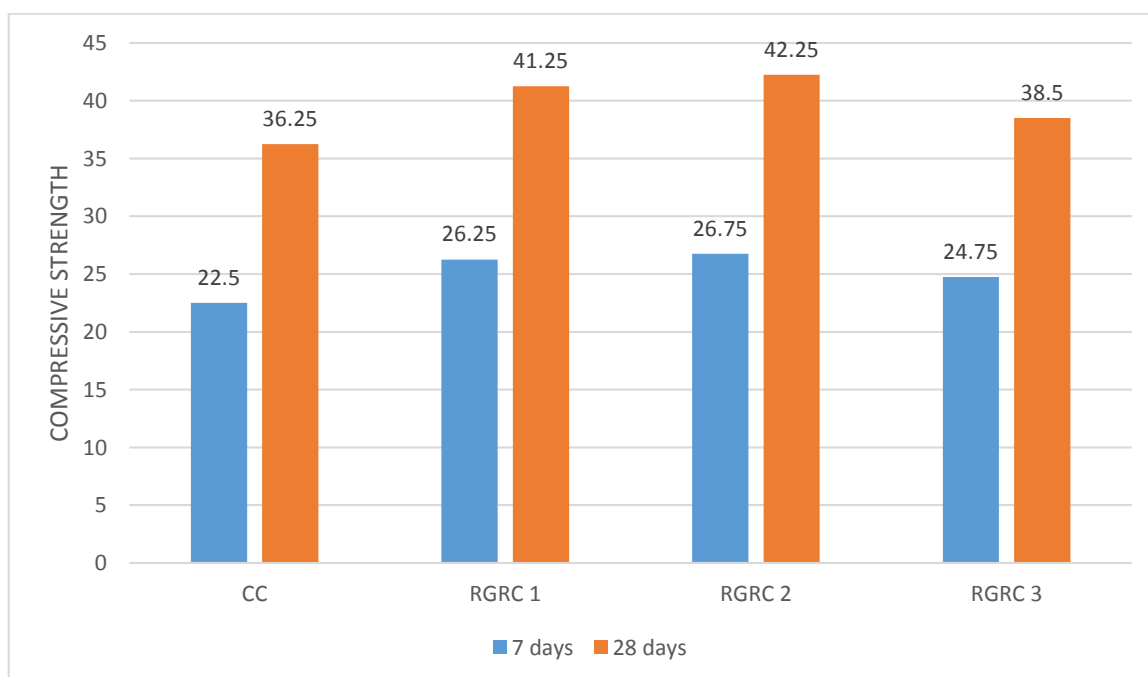
MIX DESIGNATION	AVERAGE DRY wt. BEFORE CURING (g)	AVERAGE WET wt. AFTER CURING OF 28 DAYS (g)	WATER ABSORBED (g)	WATER ABSORPTION (%)
CC	8628	8720	92	1.066
RGRC 1	8135	8213	78	0.958
RGRC 2	8121	8184	63	0.775
RGRC 3	8104	8125	55	0.678



### 3. COMPRESSIVE STRENGTH TEST

S.NO	MIX DESIGNATION	COMPRESSIVE STRENGTH AFTER 7 DAYS (MPa)	COMPRESSIVE STRENGTH AFTER 28 DAYS (MPa)
1	CC	22.50	36.25
2	RGRC 1	26.25	41.75
3	RGRC 2	26.75	42.25
4	RGRC 3	24.75	38.50

COMPRESSIVE STRENGTH TEST FOR 7 DAYS AND 28 DAYS



## V. CONCLUSION

Replacement is done in concrete with crushed waste glass in fine aggregate with different percentages of 10%, 20% and 30% respectively. To find the mechanical properties of concrete mix design for M25 had been carried out and cubes were casted.

Maximum compressive strength for 7 and 28 days is obtained in conventional mix is of 22.50 N/mm<sup>2</sup> and 36.25 N/mm<sup>2</sup>. Maximum compressive strength for 7 and 28 days is obtained in replacement mix is of 26.25 N/mm<sup>2</sup> and 42.25 N/mm<sup>2</sup>. There exist high potential for the use of crushed glass as fine aggregate into the concrete for the saving of natural aggregate. With increasing of crushed glass particles into the concrete the workability should be increased gradually as compared to normal concrete. Crushed glass replaced as fine aggregate into the concrete the compressive strength should be increased up to 20% replacement level and after 30% replacement level it goes to decreasing.

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