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Experimental Studies on Comparative Study of Replacement of Fine Aggregate with Toughened Glass.

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Abstract:

In order to make concrete industry sustainable, the use of waste materials in place of natural resources is one of the best approaches. An enormous quantity of waste glass is generated all around the world. In India, 0.7% of total urban waste generated comprises of glass. This paper summarized the behavior of concrete involving replacement of fine aggregates by waste glass as 10%, 20%, 30% by weight which may help to reduce the disposal problems of waste glass and enhance properties of concrete. From the experimental study it is concluded that, For water curing, the 20% and 30% replacement of Fine Aggregate by Toughened glass, it is clearly seen that compressive strength increases as compare to 0%, 10% and 20% replacement for 14 days and 28 days respectively. In water curing for 20% replacement of Fine Aggregate by Toughened glass, compressive strength is 17.56% greater than that of 0% of replacement. In behavior of Toughened glass concrete, it is observed that the crack width goes on increasing as the % replacement of the Toughened glass increa*ses.*

Keywords- **Waste glass, Toughened Glass, Compressive strength, and Crack Width etc…**

1. INTRODUCTION:

Glass is one of the oldest man-made materials. It is produced in many forms such as packaging or container glass, flat glass, and bulb glass, all of which have a limited life in their manufactured forms and therefore need to be recycled so as to be reusable in order to avoid environmental problems that would be created if they were to be stockpiled or sent to landfills. Quantities of waste glass have been rising rapidly during the recent decades due to the high increase in industrialization and the considerable improvement in the standards of living, but unfortunately, the majority of these waste quantities are not being recycled but rather abandoned causing certain serious problems such as the waste of natural resources and environmental pollution.Recycling of this waste by converting it to aggregate components could save landfill space and also reduce the demand for extraction of natural raw material for construction activities. Theoretically, glass is a fully recyclable material; it can be recycled without any loss of quality.

1.2 Physical Properties ofToughened glass–
Toughened glass of car rear window. Variations in glass stress are clearly seen when photographed through a polarizing filter.Toughened glass is physically and thermally stronger than regular glass. The greater contraction of the inner layer during manufacturing induces compressive stresses in the surface of the glass balanced by tensile stresses in the body of the glass.

1.3Chemical properties of Toughened glass–
Chemically strengthened glass is a type of glass that has increased strength as a result of a post-production chemical process. When broken, it still shatters in long pointed splinters similar to float glass. For this reason, it is not considered a safety glass and must be laminated if a safety glass is required. However, chemically strengthened glass is typically six to eight times the strength of float glass. The glass is chemically strengthened by a surface finishing process.

1.3 Mechanical Properties: Processed toughened glass has favorable mechanical properties for aggregate use, including good abrasion resistance, good soundness characteristics, and high bearing strength.

2. Design Mix Propotion For M30 Grade Concrte:

2.1.1. From Indian Standard method of mix design adjustments the mix proportion is

Table No.1.1 Adjustment in mix proportion

Cement (Kg/m^3)	Water (Kg/m^3)	Sand(fine Aggregate) (Kg/m^3)	Coarse Aggregate (Kg/m^3)
492.5	197	782.87	1119.56

2.2.2 Mix proportion for 0% replacement of Fine Aggregate by Toughened glass.

Table No.1.2 Mix proportion for 0% replacement

Cement (Kg/m^3)	Water (Kg/m^3)	Sand(fine Aggregate) (Kg/m^3)	Coarse Aggregate (Kg/m^3)
492.5	197	782.87+00.00	1119.56
1	0.43	1.58	2.273

2.2.3 Mix proportion for 10% replacement of Fine Aggregate by Toughened glass.

Table No.1.3 Mix proportion for 0% replacement

Cement (Kg/m^3)	Water (Kg/m^3)	Sand(fine Aggregate) (Kg/m^3)	Coarse Aggregate (Kg/m^3)
492.5	197	704.59+78.28	1119.56
1	0.43	1.58	2.273

2.2.4. Mix proportion for 20% replacement of Fine Aggregate by Toughened glass.

Table No.1.4 Mix proportion for 20% replacement

Cement (Kg/m^3)	Water (Kg/m^3)	Sand(fine Aggregate) (Kg/m^3)	Coarse Aggregate (Kg/m^3)
492.5	197	626.3 + 156.57	1119.56
1	0.43	1.58	2.273

2.2.5. Mix proportion for 30% replacement of Fine Aggregate by Toughened glass.

Table No.1.5 Mix proportion for 0% replacement

Cement (Kg/m^3)	Water (Kg/m^3)	Sand(fine Aggregate) (Kg/m^3)	Coarse Aggregate (Kg/m^3)
492.5	197	548.01 + 234.861	1119.56
1	0.43	1.58	2.273

2.2.6. Experimental Program for casting of cubes.

Table No.1.6 Experimental Program for casting of cubes.

Sr. No.	Name of Test	No. of Days	% Replacement of Fine Aggregate by Toughened glass.				Total no. of Cubes
			0%	10%	20%	30%	
1.	For Normal Water Curing	14	3	3	3	3	15
2.		28	3	3	3	3	15
Total number of cubes							**30**

3. RESULT AND DISCUSSION

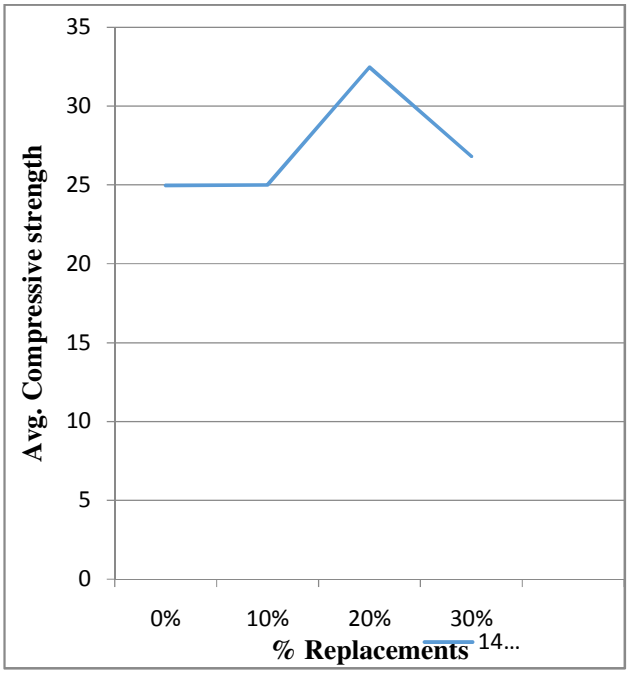
3.1 Compressive strength for 14 days water curing:

3.1.1 Compressive Strength of water curing for various % replacements:

Table No.1.7 Compressive strength for 14 days water curing

Sr. No.	% Replacement of Fine Aggregate by Toughened glass.	Compressive Strength for 14 days (N/mm^2)			Average Compressive Strength (N/mm^2)
		I	II	III	
1	0%	25.34	26.80	22.75	**24.96**
2	10%	25.84	24.28	24.88	**25.00**
3	20%	33.74	32.13	31.55	**32.47**
4	30%	27.33	25.52	27.60	**26.81**

Graph 1: For 0%, 10%, 20% & 30% replacement of Fine Aggregate by Toughened glass.



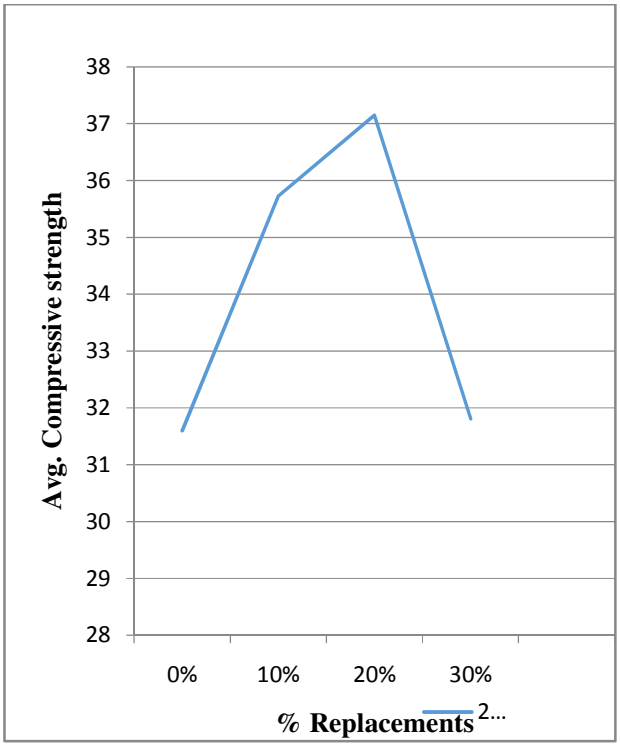
3.2 Compressive strength for 28 days water curing:

3.2.1 Compressive Strength of water curing for various % replacements:

Table No.1.8 Compressive strength for 28 days water curing

Sr. No.	% Replacement of Fine Aggregate by Toughened glass.	Compressive Strength for 14 days (N/mm^2)			Average Compressive Strength (N/mm^2)
		I	II	III	
1	0%	31.96	30.33	32.51	**31.60**
2	10%	33.90	35.15	38.16	**35.73**
3	20%	38.15	37.10	36.20	**37.15**
4	30%	32.40	31.33	31.70	**31.81**

Graph 2: For 0%, 10%, 20% & 30% replacement of Fine Aggregate by Toughened glass.

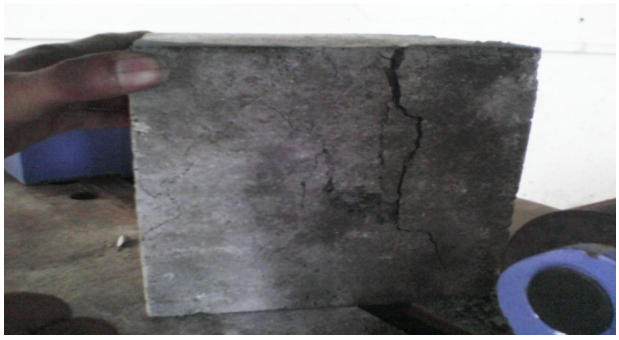


4.BEHAVIOUR OF TOUGHENED GLASS CONCRETE:

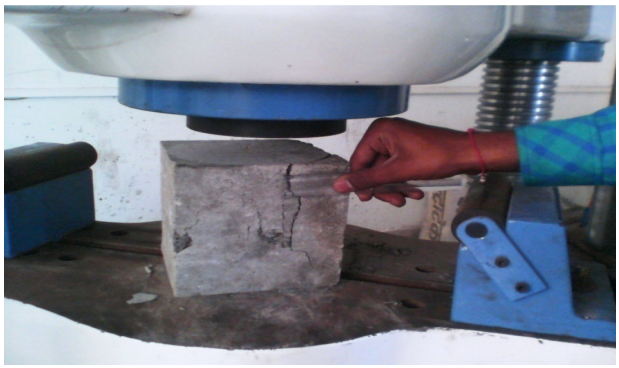
6.1For water curing, 14 days and 28 days respectively:

a) For 10% replacement:

a) For 20% replacement:



a) For 30% replacement:



In water curing, For 14 days and 28 days, the crack width of Toughened glass concrete goes on increasing as the percentage of Toughened glass increases. As compare to 10%, 20% and 30% replacement, the crack width shows greater thickness for 40% replacement of Fine Aggregate by Toughened glass.

5.CONCLUSION:

From the experimental study it is concluded that,

1. For water curing, the 20% and 30% replacement of Fine Aggregate by Toughened glass, it is clearly seen that compressive strength increases as compare to 0%, 10% and 20% replacement for 14 days and 28 days respectively.
2. In water curing for 20% replacement of Fine Aggregate by Toughened glass, compressive strength is 17.56% greater than that of 0% of replacement.
3. In behavior of Toughened glass concrete, it is observed that the crack width goes on increasing as the % replacement of the Toughened glass increases.

6.FUTURE SCOPE:

The future scope of work may as follows,

1. To study effect on compressive strength of concrete by variation in replacement of Fine Aggregate by the Toughened glass separately.
2. To study the compressive strength by taking different days of curing as like 90,120 days etc.
3. To study effect of temperature on Toughened glass concrete onwards 100^{o}C for same replacement of Fine Aggregate by Toughened glass.
4. To study effect of Toughened glass on high performance concrete.

7.REFRENCES:

1. B.Naga Niranjan Kumardr.M.Ashok Kumar
2. Department of Civil Engineering, Dr. K. V. Subba Reddy Institute of Technology, Kurnool, Andhra Pradesh, India Department of Mechanical Engineering, Dr. K. V. Subba Reddy Institute of Technology, Kurnool, Andhra Pradesh, India
3. Study of Concrete Involving Use of Waste Glass as Partial Replacement of Fine Aggregates
4. M. Iqbal Malik, Muzafar Bashir, Sajad Ahmad, Tabish Tariq, Umar Chowdhary Students, B-Tech Civil Engineering, IUST, Awantipora, J&k, INDIA.
5. Paper Number 15-0152
6. .J.D.Chaitanyakumar, G.V.S. Abhilash, P.Khasim Khan, G.Manikantasai,V.Taraka ram
7. Assistant professor- B. Tech Students, Department of Civil Engineering, K L University, Green fields, Vaddeswaram-522502, Guntur (D. t), A. P, India
8. I.S.456:2000, I.S. 10262:2009.
9. Concrete technology by M. S. Shetty.