

Effect of Glass Powder on Bond Strength in Reinforced Concrete

Tejashri Shinde, Jayshri Katkade, Shubham Thorat, Jaywant Nimbalkar, Shivsiddha Somawanshi
HSBPVT's College of Engineering Kashti, Savitribai Phule, Pune University, Maharashtra, India

ABSTRACT

Bond strength plays major role in the structural performance of Reinforced Concrete (RC) element. Compressive and tensile strength of conventional concrete; influences bond strength of RC element. Glass powder with particle size less than 75 micron when used as cement replacement material; enhances compressive and tensile strength of concrete. In the research work it is proposed to investigate the effect of glass powder as a cement replacement material on compressive and tensile strength of concrete and bond strength in reinforced concrete. The replacement percentage is proposed to be 0% to 30% with an increment of 10%.

Keywords : Reinforced Concrete, Crystallization, Compressive Strength, Tensile Strength, Bond Strength

I. INTRODUCTION

A glass is defined as an inorganic product of fusion which has been cooled to a rigid condition without crystallization. According to this definition, a glass is a non-crystalline material obtained by melt quenching process. Wastes are produced by the industries irrespective of the nature of their products. Glass is a material which has an ancient history. Glass production was already known in ancient Egypt since 9000year B.C it was used in decorations and jewellery. From ancient Egypt glass making craft passed to ancient Rome in the 1 century B.C. Glass production was very limited till 18 and 19 century due to its high cost. Nowadays glass is one of the most popular materials used in day today's life in various forms; bottles, jars, windows and windshields, etc. The products have limited lifetime. Every year million tonnes of glass waste is generated. It is the usual practice to dispose of this waste in landfills. Glass being non-biodegradable material does not provide healthy environment.

Disposal of this waste is a complex problem for many countries in the world. Many governmental and non-governmental organizations are dealing with this problem, but in spite of the efforts, the recycling of glass in many countries is insufficient. For example, in 2005 in the USA the amount of waste increased to 12.15 million tonnes and only 2.18 million were recycled. In Poland the amount of waste glass was around 900 thousand tonnes in 2004 and 300 thousand tonnes were recycled. Typical problem for the Baltic States is that many glass producing and recycling companies have bankrupted and only part of the imported glass is exported for recycling; therefore there is no complete statistics on glass waste. According to the data of 2009 42.6 thousand tonnes of glass were imported to Latvia and the recycling of glass waste Was 12.5 thousand tonnes. Typical problem for the Baltic States is that many glass producing and recycling companies have bankrupted and only part of the imported glass is exported for recycling; therefore there is no complete statistics on glass waste. According to the data of 2009 42.6 thousand tonnes of glass were imported to Latvia and

the recycling of glass waste Was 12.5 thousand tonnes. Another problem is with non-recyclable waste glasses like fluorescent lamp glasses which contain heavy and toxic metals and therefore landfills do not provide an environment-friendly solution for these wastes. There is only one Demercurisation Company in the Baltic States which yearly partially recycles from 300 to 500 tonnes of fluorescent lamp glass. Recycled fluorescent glass is exported to fluorescent lamp producers and part of this non recycled waste can be utilized in concrete production. Recycling of glass has numerous indirect benefits such as reduction in landfill cost, saving in energy, and protecting the environment form possible pollution effects.

II. Problem Statement

- The ordinary Portland cement is acknowledged to be the most widely used construction material throughout the world
- The cement production is known to be one of the most environmental unfriendly processes because it releases of CO₂ gases to the atmosphere. Studies suggest that one ton of cement clinker production releases one ton of CO₂
- 7% of world carbon dioxide coming up from Portland cements industry .

III. Objectives

- To study bond mechanism in RC.
- To study of bond failure in RC.
- To experimentally investigate the effect of GP on compressive strength of concrete
- To experimentally investigate the effect of GP on tensile strength of the concrete.
- To experimentally investigate the effect of GP on bond strength of the reinforced concrete.

IV. Scope of project work

- Grade of concrete (M30).
- Grade of steel TMT (fe500).

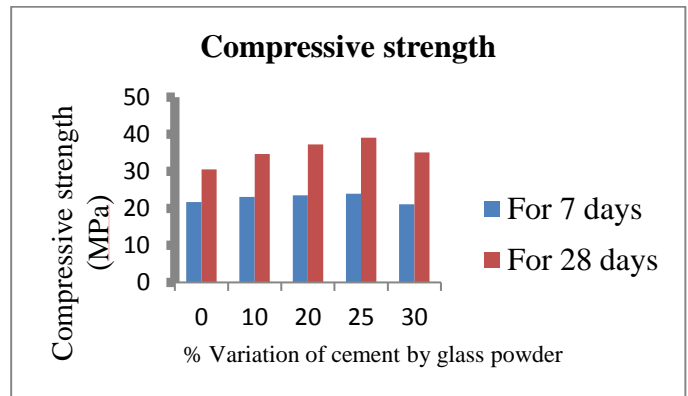
- Glass powder 0% - 30% (with an increment of 10%)
- To find out Compressive strength
- To find out Tensile strength
- To find out Bond strength

V. RESULTS AND DISCUSSION

Compressive strength of cubes.

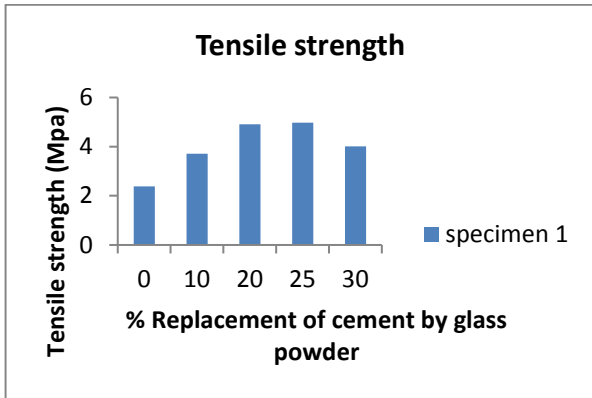
Chart of comparison of compressive strength of various mixes at 7 and 28 days

	Conventional N/mm ²	10% N/mm ²	20% N/mm ²	25% N/mm ²	30% N/mm ²
Fcu at 7 DAYS	21.73	23.04	23.52	23.92	21.10
Fcu at 28 DAYS	30.50	34.66	37.25	39.06	35.07



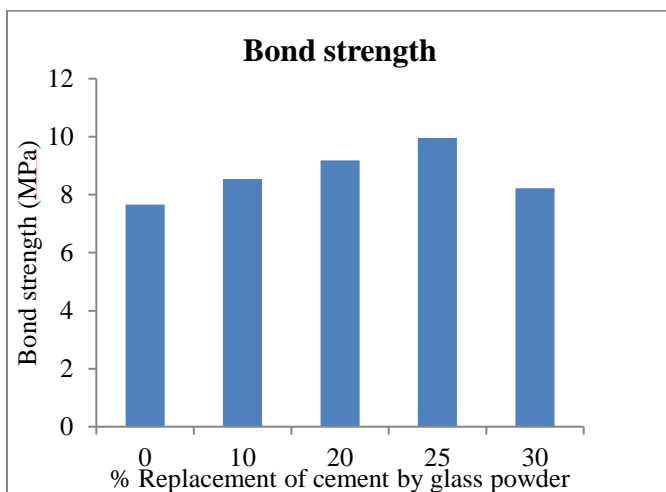
Split tensile strength

	Conventio nal N/mm ²	10% N/mm ²	20% N/mm ²	25% N/mm ²	30% N/mm ²
Fcu at 28 DAY S	2.38	3.71	4.91	4.98	4.01



Bond Strength

	Conventional N/mm ²	10% N/mm ²	20% N/mm ²	25% N/mm ²	30% N/mm ²
28 DA YS	7.66	8.54	9.18	9.96	8.22



VI. CONCLUSION

- As percentage of glass powder increases workability decreases.
- 7 days & 28 days cube compressive strength of concrete increases with increases in percentage replacement of cement by glass powder up to 20% ; latter on decreases
- 28 days spilt tensile strength of concrete increases with increases in percentage replacement of

cement by glass powder up to 25% ; latter on decreases

- Bond strength continuous decreases with increase with increases in percentage replacement of cement by glass powder up to 25% ; latter on decreases

VII. REFERENCES

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Cite this article as :

Tejashri Shinde, Jayshri Katkade, Shubham Thorat, Jaywant Nimbalkar, Shivsiddha Somawanshi, "Effect of Glass Powder on Bond Strength in Reinforced Concrete", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 6 Issue 3, pp. 86-88, May-June 2019.

Journal URL : <http://ijsrset.com/IJSRSET196322>