iJRASET
International Journal For Research in Applied Science and Engineering Technology

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

**Volume:** 9 **Issue:** VI **Month of publication:** June 2021

**DOI:** https://doi.org/10.22214/ijraset.2021.35278

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue VI Jun 2021- Available at www.ijraset.com*

# Strength Characteristics of Concrete with Partial Replacement of Cement by Waste Glass Powder

Harsh Vaghela[1], Moon Nayak[2], Nilesh Chauhan[3], Saurav Parmar[4], Adil Saiyed[5], Akshay Sarang[6], Prof. Govind Tivadi[7]
[1, 2, 3, 4, 5, 6, 7]*Civil Engineering Department, Mahavir Swami College of Engineering & Technology*

***Abstract:*** ***In this examination an endeavor is made to contemplate the impact of waste glass power in Concrete utilizing waste glass, which is non biodegradable and not reasonable to landfill. This examination is done to utilize such waste materials into development enterprises with the goal that our current circumstance is free to one of the significant contamination created by the assembling ventures. The primary point of this investigation is to use of waste glass power as a halfway substitution of fine total. In this examination the point is to decide the level of glass substitution, bringing about ideal compressive strength. Substantial ostensible blend of M20 with various rates of Glass power has been assessed according to IS 2386(part IV) and IS 383. Squander glass powder was supplant with fine total in different rates, for example, 5%,10%,15%. Reference substantial blend is likewise made for relative reasons.***

***Keywords: Compressive Strength, Flexural Strength, Waste Glass Powder, Substantial Blend, Glass Substitution***

## I. INTRODUCTION

Concrete is a combination of concrete, coarse total, fine collection and water. Concrete is restored for 28 days to get great strength. Mobile Toe To build versatile creation, huge amounts of utilized glass powder should be discarded properly. Various properties are related with concrete: effectiveness is viewed as the property of new concrete, where compressive, pliable and adaptable strength are identified with the properties of solidified concrete. Works to fill and densify coarse and fine total materials utilized in concrete. There is a potential utilization of glass powder particles rather than course and found in total in concrete. The utilization of glass in concrete by incomplete substitution concrete doesn't build the compressive and elasticity contrasted with customary cement yet the proper strength for use in constructions can in any case be obtained. Glass can be reused based on coarse mass size just as fine total. An arising reuse is the creation of concrete, where squander glass particles to some degree supplant concrete. This has the additional advantage of safeguarding the normal conglomeration utilized in concrete construction. Its benefits are various like decrease in concrete and removal costs, counteraction of ecological debasement and increment the life expectancy of landfill areas. By fractional supplanting of concrete with glass, adequate adaptability can be accomplished and warm changes can likewise be diminished. Notwithstanding, such cement can be utilized for non-load bearing purposes like protection. Indeed, even lost strength can be remunerated by other factors. Glass has a lower explicit gravity than substantial parts. It has been tracked down that the unit weight of glass concrete is diminished by about 4% for each 5% substitution of concrete. It is accounted for that with the expansion of glass, effectiveness diminishes and air content increments.

## II. AIM

Add concrete M20 grade to study the compressive strength of the strength behaviour of glass concrete, and M20 grade of general concrete and M20 grade to study the comparative strength of glass powder.

## III.OBJECTIVES

The principle goals of the current examination are:

*1)* Glass Strength Behavior of Glass Concrete Study of compressive strength.
*2)* To test the crude material of standard cement.
*3)* Create a plan of a combination of standard cement and glass concrete.
*4)* Concrete to test substantial solid shapes.

## IV.SCOPE OF WORK

First we cast a normal M20 cube of concrete, and test the compressive strength there. After that, we will add glass powder instead of 5%, 10%, 15% and cement respectively and test the strength there. We will then compare the strengths of both glass concrete and ordinary concrete

## V. ADVANTAGES OF GLASS CONCRETE

A. Glass Glass concrete is moderate and compelling.
B. It opposes high pressing factor, effect and temperature.
C. It has low retention, improved corrosive obstruction, low shrinkage, high effect opposition, and great water opposition with incredible sound and warm protection.
D. If we use magnesium chloride concrete rather than Portland concrete, it gives more compressive and elasticity.
E. Also, on the off chance that we respond this glass concrete with hot sulfur under a temperature of about 140oCit it shows an expansion in the strength of the substantial.

## VI. LITERATURE REVIEW

A. *Studies on Glass Powder as Partial Replacement of Cement in Concrete Production , Dr. G.Vijayakumar, Dr. D. Govindarajulu, February 2013*

Experiments were performed on concrete prepared by partial replacement of cement by micro-sized waste powder. The waste glass powder was replaced by 10%, 20%, 30% and 40% binder and the composition of the mixture was prepared. Physical and chemical characteristics were studied and the chemical components of glass powder used in concrete were also determined by XRF (IIker bekir topcu and mehmet canbas, 2004).

B. *Replacement of Fine Aggregate with Glass Powder in High Performance Concrete, MANNAVA ANUSHA, T. RAM PRASANNA, 2 October 2016*

The development of concrete with glass powder has been successfully completed as a nice mix and the results have also been given in previous chapters and analyzed. Subsequent findings are drawn to the check results of M50 concrete: a. General Findings 1. Glass powder is likely to be exchanged.

C. *Studies on Glass Powder as Partial Replacement of Cement in Concrete Production, Er. Manoj Kumar Meena1, Er. Jagriti Gupta, Dr Bharat Nagar, September 2018*

The experiment investigated the properties of glass powder as a partial replacement of cement. The main parameter examined in this study is M30 glass concrete in which glass powder is partially replaced by cement by 0%, 5%, 10%, 20%, 25%. This 25% glass powder achieves maximum compression strength of 7 and 28 days. Is. Replacement level.

D. *Waste glass powder as partial replacement of cement for sustainable concrete practice, Snega S, Prasitha T, October 2016*

The chemical composition of clear and stained glass powder is very similar and the material can be declared as pozzolanic material as per ASTM standard. Being cleaner in nature, the flow of glass-replaced mortar has been found to be slightly increased by the content of glass powder. The maximum glass content is 20% considering the compressive strength of mortar and concrete at 90%. The compressive strength of this era was slightly higher (2%) than that of the control concrete sample.

## VII. METHODOLOGY

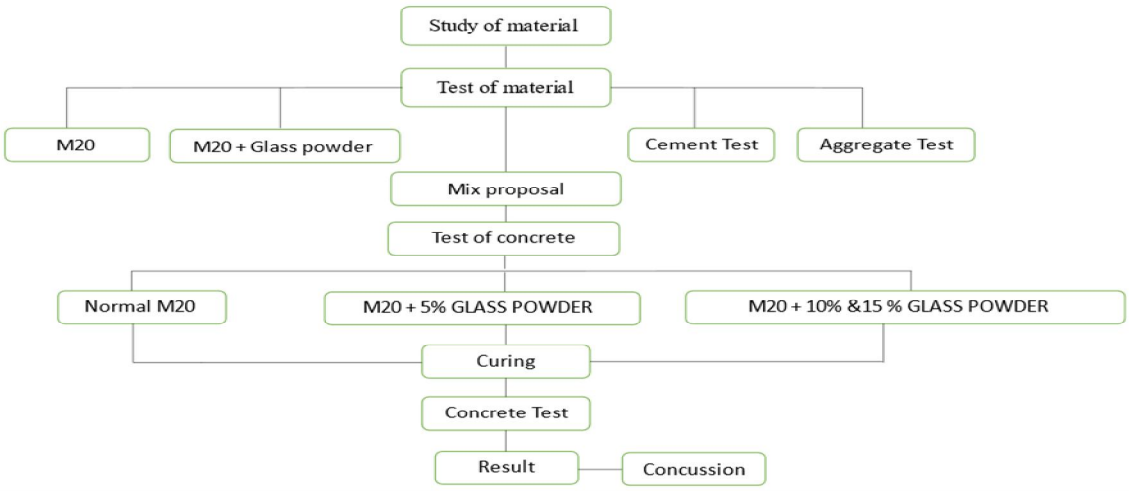



Fig. 1 Methodology

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue VI Jun 2021- Available at www.ijraset.com*

## VIII. CASTING OF CONCRETE BLOCKS FOR COMPRESSIVE STRENGTH TEST

This molten material is then poured into a mould cavity that takes the form of the finished part. The molten material then cools, with heat generally being extracted via the mould, until it solidifies into the desired shape.

Fig. 2 Group members casting concrete blocks

## IX. CURING PROCESS OF CONCRETE BLOCKS

Curing of Concrete is a method by which the concrete is protected against loss of moisture required for hydration and kept within the recommended temperature range. Curing will increase the strength and decrease the permeability of hardened concrete. The blocks are tested for compressive strength test after 7,14 and 28 days respectively.

Fig. 3 Concrete blocks placed for curing in curing tank

Fig. 4 Placing the blocks for curing

*ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429*
*Volume 9 Issue VI Jun 2021- Available at www.ijraset.com*

Fig. 5 Checking the compressive strength


Fig. 6 Compression testing machine

## X. COMPRESSIVE STRENGTH TEST RESULTS

### *A. Result of Normal Concrete*

The normal concrete of grade M20 are tested for their performance by determining their compressive strength at different ages of $7^{th}$, $14^{th}$ and $28^{th}$ days

TABLE I

| Sr no | Age of cube | Area (mm2) | Load (KN) | Compressive strength (KN/mm2) | Average (KN/mm2) |
|---|---|---|---|---|---|
| 1 | 7 days | 22.5 | 407.1 | 18.09 | |
| 2 | 7 days | 22.5 | 412.1 | 18.31 | 18.72 |
| 3 | 7 days | 22.5 | 444.9 | 19.77 | |
| 4 | 14 days | 22.5 | 529.5 | 23.53 | |
| 5 | 14 days | 22.5 | 628.3 | 27.92 | 25.5 |
| 6 | 14 days | 22.5 | 563.8 | 25.05 | |
| 7 | 28 days | 22.5 | 505.7 | 22.47 | |
| 8 | 28 days | 22.5 | 756.9 | 33.64 | 26.30 |
| 9 | 28 days | 22.5 | 514.3 | 22.8 | |

*B. Result of 5% Glass Powder Replacement by Cement*

TABLE III

| Sr no | Age of cube | Area (mm2) | Load (KN) | Compressive strength (KN/mm2) | Average (KN/mm2) |
|---|---|---|---|---|---|
| 1 | 7 days | 22.5 | 460.3 | 20.45 | |
| 2 | 7 days | 22.5 | 402.7 | 17.89 | 19.3 |
| 3 | 7 days | 22.5 | 440.3 | 19.56 | |
| 4 | 14 days | 22.5 | 608.5 | 27.04 | |
| 5 | 14 days | 22.5 | 548.6 | 24.38 | 25.88 |
| 6 | 14 days | 22.5 | 590.5 | 26.24 | |
| 7 | 28 days | 22.5 | 656.7 | 29.10 | |
| 8 | 28 days | 22.5 | 581.3 | 25.83 | 27.95 |
| 9 | 28 days | 22.5 | 651.9 | 28.93 | |

*C. Result of 10% Glass Powder Replacement by Cement*

TABLE IIIII

| Sr no | Age of cube | Area (mm2) | Load (KN) | Compressive strength (KN/mm2) | Average (KN/mm2) |
|---|---|---|---|---|---|
| 1 | 7 days | 22.5 | 373.5 | 16.60 | |
| 2 | 7 days | 22.5 | 342.3 | 15.21 | 16.48 |
| 3 | 7 days | 22.5 | 392.0 | 17.65 | |
| 4 | 14 days | 22.5 | 553.1 | 24.58 | |
| 5 | 14 days | 22.5 | 501.2 | 22.27 | 22.76 |
| 6 | 14 days | 22.5 | 482.4 | 21.44 | |
| 7 | 28 days | 22.5 | 655.3 | 29.12 | |
| 8 | 28 days | 22.5 | 672.2 | 29.87 | 29.29 |
| 9 | 28 days | 22.5 | 657.0 | 29.2 | |

*D. Result of 15% Glass Powder Replacement By Cement*

TABLE IVV

| Sr no | Age of cube | Area (mm2) | Load (KN) | Compressive strength (KN/mm2) | Average (KN/mm2) |
|---|---|---|---|---|---|
| 1 | 7 days | 22.5 | 329.5 | 14.64 | |
| 2 | 7 days | 22.5 | 378.0 | 16.80 | 15.80 |
| 3 | 7 days | 22.5 | 344.5 | 15.31 | |
| 4 | 14 days | 22.5 | 535.6 | 23.80 | |
| 5 | 14 days | 22.5 | 627.7 | 27.89 | 24.91 |
| 6 | 14 days | 22.5 | 518.5 | 23.04 | |
| 7 | 28 days | 22.5 | 694.0 | 26.40 | |
| 8 | 28 days | 22.5 | 685.0 | 30.44 | 30.11 |
| 9 | 28 days | 22.5 | 754.0 | 33.51 | |

## XI. FLEXURAL STRENGTH TEST

It is the ability of a beam or slab to resist failure in bending. It is measured by loading unreinforced 150x150 mm concrete beams with a span three times the depth (usually 450mm). The flexural strength is expressed as " Modulus of Rupture" (MR) in MPa. Flexural Strength is about 12 to 20% of compressive strength. However, the best correlation for specific materials is obtained by laboratory tests.

Fig. 7 Flexural strength testing machine

*A. Casting of Concrete beam for Flexural Strength*

Fig. 8 Casting of concrete beam

*B. Flexural Strength test Results*

TABLE V

| SR.NO | % OF GLASS POWDER REPLACED | MEAN STRENGTH IN N/mm2 |
|---|---|---|
| 1. | M20 | 4.03 |
| 2. | M20+5% | 4.1 |
| 3. | M20+10% | 4.3 |
| 4. | M20+15% | 4.8 |

## XII. CONCLUSION

The material test - Cement Test Initial and Final Setting time. Total effect esteem test, Flakiness list test ,Elongation record test result is given satisfactory. As per perception, the substantial has low functionality and the example of droop is appeared as obvious droop. the functionality demonstrates the substantial stream and inappropriately blend design. The compressive strength of M20 evaluation of glass powder concrete for 5 % concrete supplant by glass Powder are close to equivalent to the typical M20 concrete. The compressive strength of M20 evaluation of glass powder concrete for 10 % &15% concrete supplant by glass Powder are seen to be expanded in correlation with ordinary m20 concrete following 14 and 28 days of restoring separately. The pillars were tried utilizing Universal Testing Machine (UTM) of limit 1000 tons. The flexural strength is noticed 4.8 N/mm2 at end of 28 days when glass powder is supplanted by 15% to that of concrete. The flexure strength at 28 years old long stretches of glass powder concrete ceaselessly expanded regarding ordinary cement and arrived at a greatest worth of 15% trade level for M20 evaluations of cement.

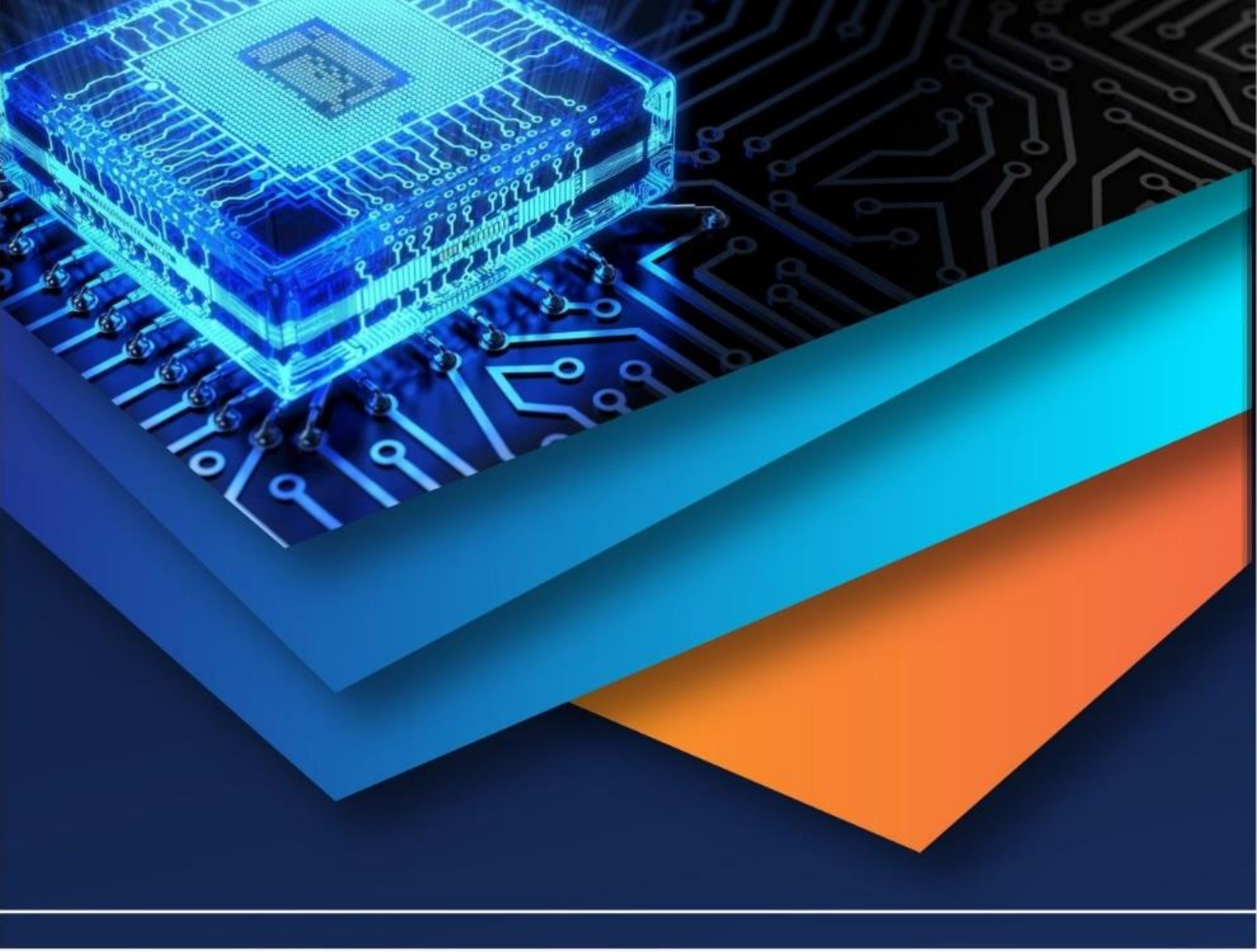
## XIII. ACKNOWLEDGEMENT

We are appreciative to our guide Prof. Govind G. Tivadi, Engineering Department, Mahavir Swami College of Engineering and Technology for him valuable help, consistent consolation, direction and testing our endeavors inside the correct heading without which this undertaking wouldn't have achieved the current structure. We profoundly express our earnest as a result of to our Head of

Department Prof. Mehul Mojidra for urging and permitting us to introduce the task regarding the matter "Strength Characteristics of Concrete with Partial Replacement of Cement by Waste Glass Powder". An exceptional thank of our goes to my partner who assisted me with going finishing the venture, where every one of them traded their own fascinating thoughts, musings and made this conceivable to finish our task with all exact data. We'd wish to thank our folks for their own help or consideration who propelled us to head out in a different direction. Finally however not the least we need to thank our companions who prized us for our diligent effort and urged us lastly to God who made every one of the things feasible for us till the top.

## REFERENCES

[1] IS: 8112-1989 - This code is used for the method of testing cement to determine the initial and final setting time of cement.
[2] IS: 516-1959 - This code is used for methods of testing the strength of concrete.
[3] IS: 10262-2009 - For mix design.
[4] IS: 2386 (Part 2) - This code is used for the method of testing sand to determine the specific gravity of sand.
[5] IS: 2386 (Parts 3 and 4) - This code is used for the method of coarse aggregate testing to determine the specific gravity and crushing value.
[6] IS: 2720 (Part 3) - This code is used for the method of testing the soil to determine gravity
[7] M.S. Shetty,(2005)Concrete Technology Theory And Practices published by S.Chand and Company Ltd. Ram Nagar, New Delhi
[8] P. C. Varghese fourth edition “Building materials” text book may 2009.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY