Effects of Mixing M-Sand And GGBS As A Partial Replacement of Fine Aggregate And Cement on Properties of Concrete

Anshul kumar Shrivastava[1], Kamlesh kumar Choudhary[2]
[1]Dept of civil engineering
[2]HOD& Assistant Professor, Dept of civil engineering
[1, 2] Saraswati Institute of Engineering & Technology, Jabalpur, India

Abstract- *In The demand for cement is rising at an alarming rate as a result of rapid industrialization and urbanization. On the other hand, thermal plants produce a lot of GGBS and M-Sand, which pollutes the environment. GGBS can be used in high strength concrete as a partial replacement for cement to solve the aforementioned issues. Due to the high cementitious material content and potential for higher shrinkage and heat of hydration, high-strength concrete mixtures are more likely to crack. Compared to normal-strength concrete, it transports loads more effectively. By reacting with Portland cement hydration products to produce more C-S-H gel, the component of the paste that gives concrete its strength, these materials increase the concrete's strength. Only with large doses of high range water reducing admixtures are these low w/c ratios possible. These experimental studies demonstrated that GGBS can partially replace cement in construction, reducing cement scarcity and construction costs overall. Cement, GGBS and M-Sand used as fine aggregate, coarse aggregate, and sodium silicate are used to make concrete of the M35 grade. For M35 grade, tests were conducted for Tensile strength, Compressive strength (cubes and cylinders) and Flexural strength up to 28 days and 7 days of age were compared with those of concrete made with natural sand.*

Keywords- Cement, GGBS, M-Sand (Fine Aggregate), Coarse Aggregate, Compressive Strength, Flexural Strength.

I. INTRODUCTION

Environmental In cement concrete, natural sand has long been a popular choice for fine aggregate. Numerous environmental effects result from the significant sand depletion in river beds. Alternatives to natural sand are being investigated. M-sand and GGBS are two alternatives. M-sand and GGBS are subjected to experimental analysis to determine their qualities, characteristics, and potential to replace natural sand in cement concrete. The specific gravity, workability, and compressive strength of these materials are evaluated.

River sand is in short supply due to modern river erosion and environmental concerns. Finding new substitute materials to replace river sand is therefore necessary in order to avoid excessive river erosion and environmental harm. The construction industry will be impacted by the lack of or shortage of river sand. Different materials are being discovered by many researchers to replace sand. GGBS (ground granulated blast furnace slag) and M-sand are two of the main components (manufactured sand). The required concrete mix can be made using various ratios of these GGBS and sand.

Finding the concrete strength of M35 Grade by partially substituting GGBS and sand is one of the project's main goals. To determine the compressive strength of concrete at various levels of fine aggregate with GGBS and M-sand, concrete cubes were cast for different replacement levels at intervals.

II. OBJECTIVES

The main objective of this study is to experimentally investigate the effects of mixing M-Sand and GGBS as a partial replacement of fine aggregate and cement on properties of concrete and compare it with conventional concrete. The following were also considered:

1. To investigate the properties of M-Sand and GGBS as a partial replacement of fine aggregate and cement on concrete.
2. To determine the percentage that gives the maximum workability of multi-blended concrete when compared to conventional concrete.
3. To overcome the above problems, our experimental study is done on the partial replacement of fly ash and pond ash in cement to reduce scarcity of cement and the environmental pollution (CO2 emission, ash dumping. etc) which is utilized in high strength concrete.
4. Standard grade concrete has compressive strength above 35 Mpa. The methods and technology for producing

standard grade concrete are not substantially different from those required for normal strength concrete.

5. Different trail mixes were made to obtain optimum use of M-Sand and GGBS as a partial replacement of fine aggregate and cement on concrete. standard grade concrete has reduced the overall cost of the construction and scarcity of cement.
6. To determine the percentage that gives the maximum Compressive strength of multi-blended concrete when compared to conventional concrete at 7 and 28 days.
7. To determine the percentage that gives the maximum Flexural strength of multi-blended concrete when compared to conventional concrete at 7 and 28 days.

III. METHODOLOGY

In this experiment the take a look at of usage of GGBS in concrete in area of cement is performed. first of all, cement and river sand become collected and the take a look at are performed for physical properties like gradation, specific gravity, fineness, and many others. GGBS become amassed from Laxmi metallic manufacturing facility JABALPUR. The water contents must be taken into consideration because they are distinct in special samples. Then blend turned into designed for M35 concrete. sparkling concrete houses had been determined by means of mixing concrete. The waste product GGBS at the proportions of zero%, 5%, 10% ,15%,20% and 25 % become partially replaced for cement for the curing length of 7 and 28 days.

The performance of concrete in which the cements are changed by means of GGBS by means of zero%, 5%, 10% ,15%,20% and 25 %, are as compared to that of predictable concrete and the maximum favorable percent of GGBS is observed.

MANUFACTURED SAND (M-SAND). Artificially manufactured sand acquired by processing quarry dust. Grey in colour, cubical in shape, manufactured as per IS, BS, ASTM standards.

There are no oversized particles, no marine products, or clay and silt particles in M-sand unlike natural sand. It has similar chemical composition as natural sand.

To collect the materials and find out Physical properties.

- Cement
- GGBS
- M-sand
- Coarse aggregates
- Water
- Admixtures

Then to mix the design and perform the results by experimental work.

for fresh concrete to find out its workability.

For hardened concrete to find out the strength of concrete.

Compressive strength

Mould: Cube size 150mm*150mm*150mm

Compared to the results of conventional concrete and multi-blended concrete.

Table 1 quantities per cubic meter of concrete are			
Cement	**Water**	**Fine aggregate**	**Coarse aggregate**
kg/m^3	kg/m^3	kg/m^3	kg/m^3
370	**160.43**	**705.84**	**1157.46**
1	**0.43**	**1.9**	**3.13**

Table 2 The Final Trial Batches Quantities of GGBS and M-sand with used Concrete M35

Mix Code	**Cement (kg/m^3)**	**GGBS (kg/m^3)**	**Fine Aggregate (kg/m^3)**	**Coarse Aggregate (kg/m^3)**
M-0	370.00	0	705.00	1157.00
M-1	351.50	18.50	705.00	1157.00
M-2	333.00	37.00	705.00	1157.00
M-3	314.50	55.50	705.00	1157.00
M-4	296.00	74.00	705.00	1157.00
M-5	277.50	92.50	705.00	1157.00

IV. RESULT AND EXPERIMENT WORK

Property of Fresh concrete in workability

Table No. 3: Workability of various concrete mixes design for slump cone test of conventional concrete

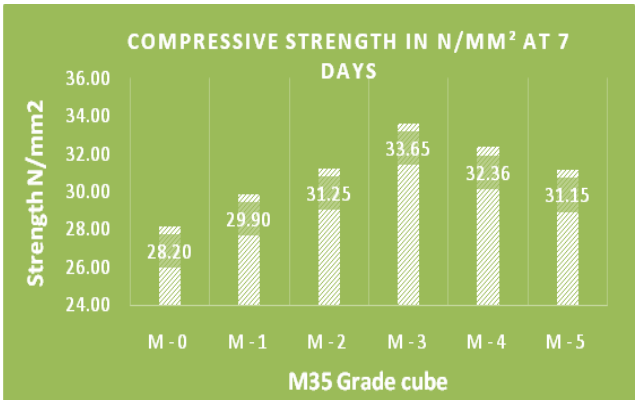
Mix design codes	**Slump cone test in mm.**
M-0 (normal concrete)	78
M-1 (Multi Blended Concrete)	80
M-2 (Multi Blended Concrete)	84
M-3 (Multi Blended Concrete)	86
M-4 (Multi Blended Concrete)	83
M-5 (Multi Blended Concrete)	82

Property of Hardened concrete in Compressive Strength (IS: 516-1959)

Mix Code	**Compressive strength in N/mm^2 at 7 days**	**% Increase in strength at 7 days**
M-0	28.20 N/mm^2	0.00%
M-1	29.90 N/mm^2	6.03%
M-2	31.25 N/mm^2	10.82%

M-3	33.65 N/mm²	19.33%
M-4	32.36 N/mm²	14.75%
M-5	31.15 N/mm²	10.46%

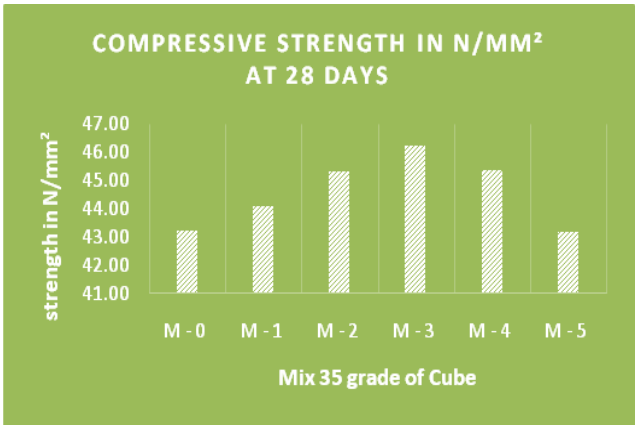
I.



Graph No. 1: Compressive strength in N/mm² at 7 days

Table No. 6.4: Compressive strength in N/mm² at 28 days

Mix Code	**Compressive strength in N/mm² at 28 days**	**% Increase in strength at 28 days**
M-0	43.25	0
M-1	44.10	1.97
M-2	45.35	4.86
M-3	46.25	6.94
M-4	45.40	4.97
M-5	43.20	-0.12



Graph No. 2: Compressive strength in N/mm² at 28 days

V. CONCLUSIONS

The following conclusions can be drawn from the experimental investigations conducted on the behavior of concretes by using of mixing M-sand and GGBS as a partial replacement of fine aggregate and cement on properties of concrete.

1. Due to the partial replacement of fine aggregate and cement by M-sand and GGBS, the properties of concrete are improved while also lowering construction costs.
2. Comparing GGBS and M-sand multi-blend concrete to conventional concrete, it is more workable.
3. We get the maximum compressive strength at 15% M-sand and GGBS as a partial replacement of fine aggregate and cement on properties of concrete.
4. maximum compressive strength of mix code is 33.65 MPa with 19.33 % Percentage Increase in Strength At 7 Days
5. maximum compressive strength of mix code is 46.25 MPa with 6.94 % Percentage Increase in Strength At 28 Days

REFRENCES

[1] Vajrala Kavya Sameera, Lakshmi Keshav(2023) Mechanical And Durability Behaviour Of GGBS, M-sand Based Concrete With Varying Percentages Of Two Crystalline Admixtures – An Experimental Study" ITSCMSI-2022 IOP Conf. Series: Earth and Environmental Science 1130 (2023) 012026 IOP Publishing doi:10.1088/1755-1315/1130/1/012026

[2] 2. Dr.M Manikandan, Hu Theachai, T Arun Kumar, T Suresh Kumar, S Hariharan (2021) "UTILISATION OF M-SAND AND GGBS AS A PARTIAL REPLACEMENT OF FINE AGGERGATE AND CEMENT" www.ijcrt.org © 2021 IJCRT | Volume 9, Issue 6 June 2021 | ISSN: 2320-2882 IJCRT2106649 International Journal of Creative Research Thoughts (IJCRT) www.ijcrt.org

[3] 3. P. Priya Rachel (2019)"Experimental Investigation on Strength and Durability of Concrete using High Volume Fly ash, GGBS and M-Sand" international Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887 Volume 7 Issue III, Mar 2019- Available at www.ijraset.com ©IJRASET:

[4] 4. R.Anusuya, D.Chandraleka, S.Sarumathi, G.Karthikeyan (2018) "Experimental Study on Concrete by Replacement of Fine Aggregate with Copper Slag, GGBS and M- Sand" Volume 3, Issue 3, March– 2018 International Journal of Innovative Science and Research Technology ISSN No:-2456-2165IJISRT18MA345 www.ijisrt.com 418

[5] R. SubashiniT. ,Dr. M. Shahul Hameed (2016) "Study on behavior of M-Sand Concrete using GGBS as Filler"IJSTE - International Journal of Science Technology & Engineering | Volume 3 | Issue 05 |

November 2016 ISSN (online): 2349-784X All rights reserved by www.ijste.org 236

[6] P.K. Prasanna (2020) "Compressive Strength Assessment using GGBS and Randomly Distributed Fibers in Concrete" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-2, December 2020

[7] S.k.Sirajuddin (2019) "Experimental Investigation on Properties of Concrete by Partial Replacement of Cement with GGBS and Fine Aggregate with Quarry Dust" International Conference on Advances in Civil Engineering (ICACE-2019) | 21-23 March 2019

[8] Pratap Singh (2019) "An Experimental Study on Effect of Concrete Performance in Addition of GGBS and Partial Replacement of Cement by Glass Fiber" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 7 Issue: 5

[9] Anas (2018) "A Review on Ground Granulated Blast-Furnace Slag as a Cement replacing material" International Research Journal of Engineering and Technology (IRJET) ISSN: 2395-0056 Volume: 05 Issue: 04 | Apr-2018

[10] Shanmugaratnam (2018) "Ground Granulated Blast Furnace Slag (Ggbs or Ggbfs) and Fly Ash (Fa) in Concrete – A Study Report" SSRG International Journal of Civil Engineering (SSRG - IJCE) - Volume 5 Issue 3 – March 2018

[11] Vaishak K (2018) "Study on Strength and Durability Properties of GGBS-Fly Ash based Concrete" IOSR Journal of Engineering (IOSRJEN) ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 08, Issue 6 (June. 2018)

[12] Sunil Bhagwan Yamgar (2018) "Study and Analysis of Strength of GGBS Concrete" International Journal of Engineering and Management Research ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962 Volume-8, Issue-6, December 2018

[13] B K Varun (2018) "EFFECT OF ADDITION OF FLYASH AND GGBS ON CEMENT CONCRETE IN FRESH AND HARDENED STATE" International Journal of Advance Engineering and Research Development Volume 5, Issue 02, February -2018

[14] Chalamcharla Venu Gopal (2017) "Partial Replacement of Cement with GGBS in Concrete" International Journal of Advance Research, Ideas and Innovations in Technology