IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 1, January 2025

Parametric Investigation on Partial Replacement of Sand by Iron Ore Tailing and Cement by Ground Granulated Blast Furnace Slag in Concrete

Prof. Goutamee Ganesh Meshram
Dr. Rajendra Gode Institute of Technology & Research, Amravati, Maharashtra, India
gautameemeshramce@gmail.com

Abstract: *India is a developing country, requirements of structure is need of our nation, Structure requires huge amount of concrete and depletion of river sand and increasing price of sand is causing a severe effect. Even the disposal of waste materials causes environmental and health problems. Therefore, partial or full replacement of fine aggregates by other compatible materials is required in concrete. In this present project work, utilizing the waste materials and industrial by products in concrete such as Ground Granulated Blast Furnace Slag and iron ore tailing to enhance the mechanical strength of concrete in construction field. In this project work we bought IOT & GGBFS from Gogga Minerals, Karnataka and IVS Industries, Nagpur respectively. Present project work carried out for partial replacement of sand by iron ore tailings and cement by ground Granulated Blast Furnace Slag In this present project work for M25 grade of concrete is used and total 30 no. of cubes of size (150×150×150mm) and total 15 no. of beam of size (150×150×750 mm) were casted and several test such as compression, flexural and water absorption have been performed for various combination of iron ore tailing and ground granulated blast furnace slag respectively from (0%+0%), (15%+5%), (30%+10%), (45%+15%) & (60%+20%) for the curing period of 7 days and 28 days. When the test results were compared with conventional concrete the age of 7 days of curing compressive strength greater than traditional mix by 5.39% and conventional concrete the age of 28 days of curing compressive strength greater than traditional mix by 5.29% Replacing fine aggregate by 30% IOT and 10% GGBFS is effective at age of 7 &28 days of curing compressive and flexural strength increase Therefore, effective utilization of waste materials in different construction materials increases the compressive strength.*

Keywords: waste materials

I. INTRODUCTION

Iron Ore Tailing (IOT) and Ground Granulated Blast Furnace Slag (GGBFS) are two essential materials in construction and metallurgical industries. Both materials have unique properties and applications making them valuable resource in various sectors. These materials are utilized as supplementary cementitious materials in concrete their impact on strength, durability and environmental sustainability and growing importance of incorporating them into modern concrete mixes. In recent decades, extensive research efforts have been dedicated to exploring the myriad possibilities for reusing IOT and GGBFS waste materials. They are no longer merely waste but valuable resources that can be harnessed to improve construction materials and practices. Waste materials like construction debris, blast furnace slag, steel slag, copper slag, iron tailing, coal fly ash, and bottom ash have gained acceptance in many regions as alternative aggregates in various construction applications, such as embankments, roads, pavements, foundations, and building construction.

In the construction industry, the demand for iron and steel is increasing day by day. There are many iron ore mining companies being established due to the presence of ample reserve of iron ore in India. After mining process, the waste generated in the form of IOT is about 10 to 12 million tonnes per annum in India. Another waste produced from Iron

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 1, January 2025

industry is GGBFS is about 15 million tonnes. With the standard of living continually improving, construction industries have consumed more natural aggregate than before the violent use of river sand for construction project has caused a serious environmental problems. In the long term, to extend the practice of partially replacing cement with waste by products and processed materials possessing pozzolanic properties. Lately some attention has been given to the use of natural pozzolans like GGBS as a possible partial replacement for cement. Amongst the various methods used to improve the durability of concrete, and to achieve high performance concrete, the use of GGBS is a relatively new approach, the chief problem is with its extreme finesse and high water requirement when mixed with Ordinary Portland cement.

Aim and Objectives

The objectives of this seminar work entitled "partial replacement of sand with iron ore tailing and ground granulated blast furnace slag" are as given below

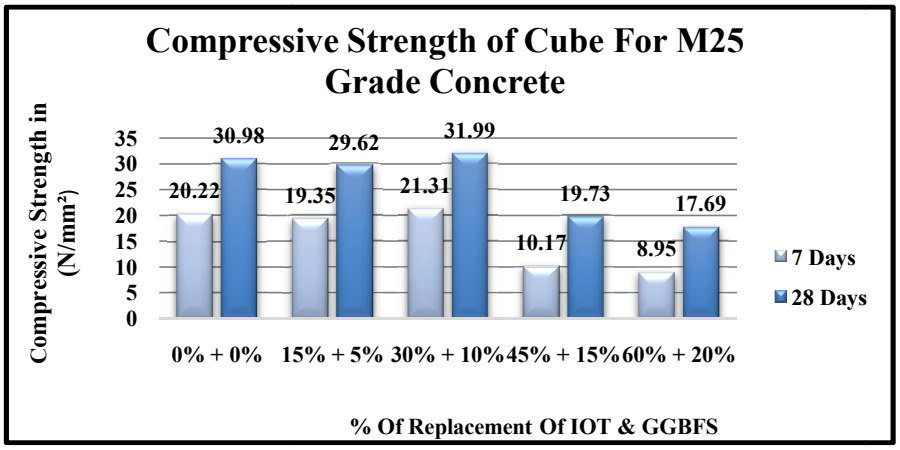
- To study the properties of Iron Ore Tailing and Ground granulated blast furnace slag
- To determine the compressive strength of concrete using iron ore tailings as fine aggregate and ground granulated blast furnace slag as cement at curing of 7 days & 28 days.
- To determine the flexural strength of concrete using iron ore tailings as fine aggregate and ground granulated blast furnace slag as cement at a curing of 28 days.
- To optimize the percentage of IOT & GGBFS.
- To study the percentage of water absorption 7 days & 28 days curing
- To study the Disposal Method of iron ore tailing & GGBFs in concrete.

II. RESULT AND CONCLUSION

In this project, result are obtained by various tests for concrete casted using various proportions of IOT & GGBFS.

Compressive strength

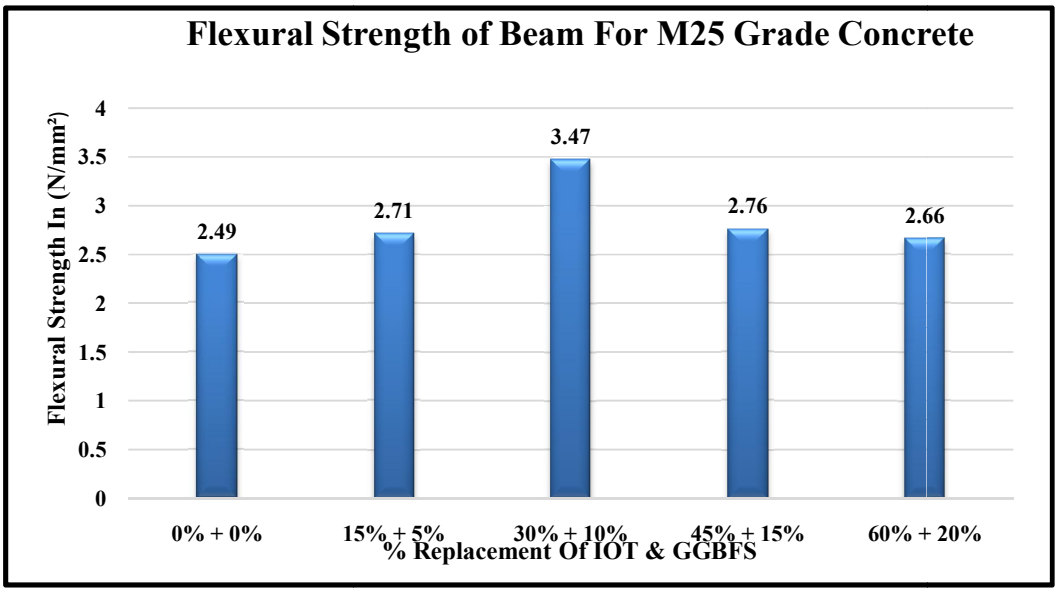
Average Compressive Strength Of M25 Grade Of Cube At 7 Days Of Curing



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 1, January 2025

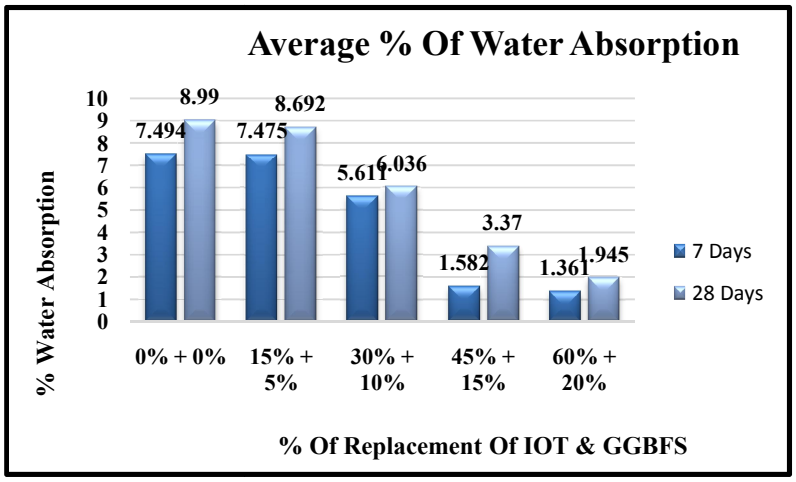
Flexural strength

Average Flexural Strength Of M25 Grade Of Beam At 28 Days Of Curing



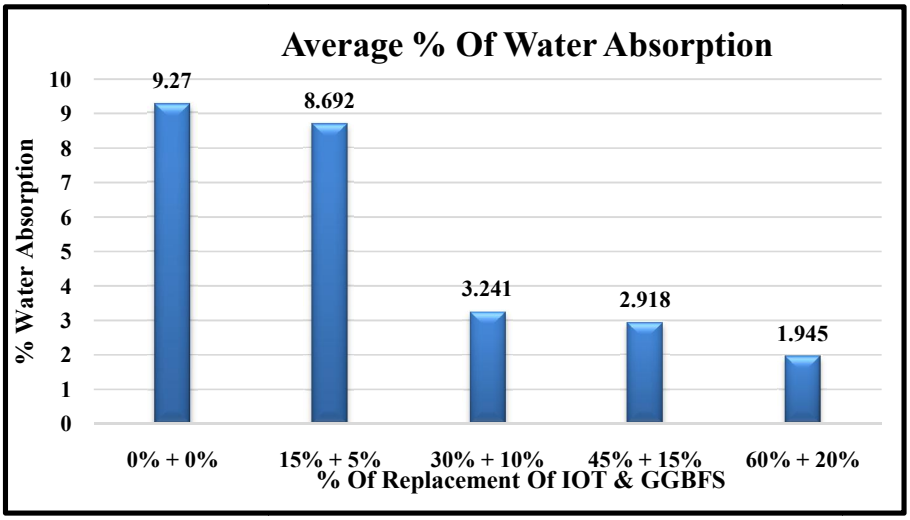
Water absorption

Average % Of Water Absorption Of M25 Grade Of Cube At 7 Days And 28 Days Of Curing



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 1, January 2025

Average % Of Water Absorption Of M25 Grade Of Beam At 28 Days Of Curing



REFERENCES

[1]. Ananthayya M. B., Prema Kumar W. P., Vijay K., "Effect of partial replacement of sand by iron ore tailing (IOT) and cement by ground granulated blast furnace slag (GGBFS) on the compressive strength of concrete", International Journal of Engineering Research Technology, ISSN:2278-0181, Volume-3, Issue-8, August-2014.

[2]. Abdul Qadeer, Brijbhushan S, Sharanamma, " An experiment on the properties of concrete replacing fine aggregate partially by iron ore tailing (IOT) and cement partially by ground granulated blast furnace slag (GGBS)", International Journal Issue-2, December 2019.

[3]. Akshay Jain, Anubhav Rai, Y.K. Bajpai, "Effect of iron ore mine tailing and ground granulated blast furnace slag on compressive and flexural strength of concrete", International Journal of Emerging Technology in Engineering Research, ISSN:2454-6410, Volume-6, Issue-5, May-2018.

[4]. Shwetha R A , "Study of utilization of iron ore tailings as fine aggregate and GGBS as partial substitute in concrete", International Journal of Engineering Research and Technology, ISSN:2278-0181, Volume-6, Issue-6, June-2017.

[5]. Ravikiran Kattoli, Brijbhushan.S, Maneeth.P.D, ShreenivasReddy.S, Siddharth.B, "Effect of partial replacement of cement by ground granulated blast furnace slag and sand by iron ore tailing on properties of concrete", International Journal of Advance Technology and Engineering Exploration, ISSN(print):2394-5443, ISSN(online):2394-7454, Volume-5(45)

[6]. Ruiying Bai, Jiwei Cai, and Xiaoxin Feng, "Study on reducing ASR expansion in concrete prepared with iron ore tailing sand", Advance Material Research Vols 295-297 (2011) pp 594-597.

[7]. Yannian Zhang, Zhijun Li, Xiaowei Gu, Moncef L. Nehdi, Afshin Marani, Lei Zhang, "Utilization of iron ore tailing with high volume in green concrete", Journal of Building Engineering 72 (2023) 106585, 17 April 2023.

[8]. Yogendra O. Patil, Prof. P. N. Patil, Dr. Arun Kumar Dwivedi, "GGBS as partial replacement of OPC in cement concrete-an experimental study", International Journal of Scientific Research, ISSN:2277-8179, Volume-2, Issue-11, Nov-2013.

[9]. S. Revathy, M.E., Poovarasan A, Prabhaharan.P.G., Prabhakaran.K.B, Shivraj.O.R, "A study on partial replacement of cement with GGBS in concrete", Technical Research Organization India, ISSN(print):2393-8374, ISSN(online):2394-0697, Volume-6, Issue-3, 2019.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 1, January 2025

[10]. P Lakshmaiah Chowdary, S Khaja Khutubuddin, B Vinayaka, D Saikiran, Y indija, Y Narasappa, "An experimental study on cement replacement by GGBS in concrete", ISSN(online):2319-8753, ISSN(print):2347-6710, Volume-6, Issue-4, April-2017.

[11]. M.Rajaram, A.Ravichandran, A.Muthadhi, "Studies on optimum usage of GGBS in concrete", International Journal of Innovative Science and Research Technology, ISSN:2456-2165, Volume-2, Issue-5, May-2017.

[12]. B N Skanda Kumar, Suhas R, Santosh Uttam Shet, J M Srishaila, "Utilization of iron ore tailings as replacement to fine aggregate in cement concrete pavement", International Journal of Research in Engineering and Technology, ISSN(e):2319-1163, ISSN(p):2321-7308, Volume-03, Issue-07, Jun-2014.