International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048
Volume 7, Issue 1, pp 8-10, January-2023
https://doi.org/10.47001/IRJIET/2023.701003

Experimental Study on Compressive Strength of M40 Concrete by Replacing Artificial Sand and Steel Fiber against Natural Sand and Cement

[1]Abhishek Kumar Chaudhary, [2]Pushpendra Kumar Kushwaha, [3]Mithun Kumar Rana

[1]M. Tech. Research Scholar, Civil Department, RKDF College of Engineering, Bhopal (M. P.)-402026, India
[2,3]Assistant Professor, Civil Department, RKDF College of Engineering, Bhopal (M. P.)-402026, India

***Abstract* - For use in construction, Natural River sand is highly Natural river sand is highly valued for use in construction. Researchers found that manufactured sand (M-sand) is a good replacement for fine aggregate in concrete because current sand cannot keep up with the increased demand for concrete. In the current experiment, river sand was gradually substituted with M-sand, which was increased incrementally by 10% from 0% to 100%. For the mix classes of M40 with comparable specific gravities, mechanical and durability tests were performed. Workability was enhanced for all concrete grades in the second stage steel fibre mix in concrete that was used to boost the strength of regular concrete. The mechanical parameters of split tensile strength, flexural strength, compressive strength, and elastic modulus performed better during the 7, 21, and 28-day curing periods.**

Keywords: Durability, Impact Resistance, Manufactured Sand, Strength, Workability.

I. INTRODUCTION

The usage of concrete is widespread throughout the world. Every year, more than ten billion tonnes of concrete are used. It ranks second after water in terms of global usage. Cement, sand, aggregate, and water are the main ingredients in traditional concrete, a versatile substance. The amount of aggregate in the mix is a factor that has both immediate and long-lasting influence on the quality of concrete. The aggregate component is infinitely flexible in terms of shape and grading, unlike water and cement, which do not vary any specific attribute other than the quantity utilised. For concrete, both coarse and fine aggregate of the highest calibre are crucial. The fresh and hardened properties of concrete are impacted by the aggregates, which make about 65 to 80% of the total volume of concrete.

The volume of fine aggregate makes up 20% to 30% to the overall volume of concrete. For the sustainable development of the nation, concrete was frequently used as a building material. Demand for fine aggregate has significantly increased as a result of increased concrete use. The majority of Indian states are experiencing a sand and aggregates shortage. Because of the swift industrialization of the nation.

II. LITERATURE SURVEY

Nithyambigai. G (2015) explored the strength of concrete mix at 28-day and 56-day age containing 0%, 25% and 50 % of fine aggregate by M. Sand and 0%, 25% and 50 % of cementitious materials by fly ash.

Chandrasekar R et al (2017) carried out for utilization of waste foundry sand (WFS) in High strength concrete. The waste foundry sand was replaced in the place of normal sand with four different percentages (10%, 20%, 30%, and 40%). The several tests such as compressive strength, split tensile strength, modulus of elasticity, flexural strength, ultrasonic pulse velocity (UPV), rebound hammer test, are performed for 7 days and 28 days to obtain the behavior the concrete due to foundry sand.

Lakshmi (2022) carried out an experimental investigation to find the optimal percentage of a possible substitute for fine aggregate and coarse aggregate. In this investigation, fine aggregate is substituted by using marble powder and coarse aggregate is substituted by using demolished waste as 0%, 10%, 20% and 30% replacement respectively.

III. OBJECTIVE

- To find out workability, compressive strength, split tensile strength and flexural strength of concrete specimens for Mix design for M40 grade concrete with various replacement levels of manufactured sand and steel fiber.
- To compare the strength characteristics using M sand and natural sand in concrete.
- To find out the optimum percentage of artificial sand to get maximum strength of concrete.

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 7, Issue 1, pp 8-10, January-2023

https://doi.org/10.47001/IRJIET/2023.701003

IV. RESULTS AND DISCUSSIONS

4.1 Slump Cone Test Results

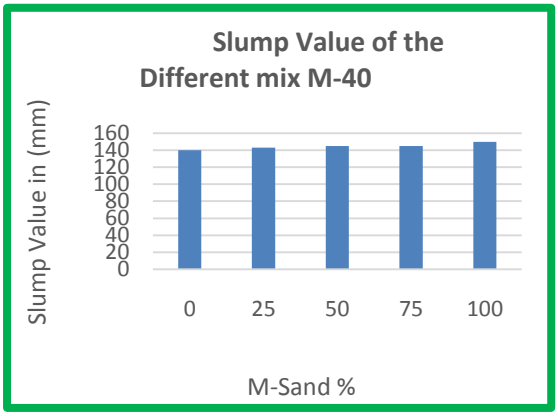

Figure 1: Slump Test Result for M40

4.2 Compressive Strength

Compressive strength is used to measure the strength of hardened concrete. The concrete cube sizes 150 mm are used. The compressive strength of the concrete cube is determined based on IS: 516 –1959.

Designation	M-Sand %	Fibre (%)	Compressive Strength in N/mm^2		
			7 Days	21 Days	28 Days
Control Mix	0	0	26.3	38.2	45.3
MS25	25	0.5	28	40.23	46.12
MS50	50	0.75	29	43	48
MS75	75	1	29.5	43.1	51.23
MS100	100	1.25	31	44	52.56

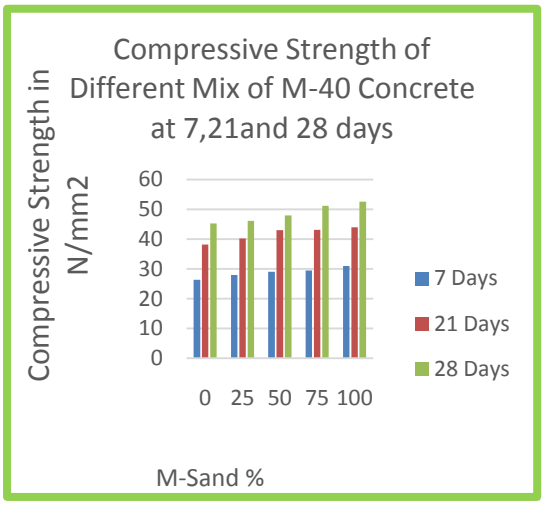

Figure 2: Compressive Strength of Different Mix of M-40 Concrete at 7, 21 and 28 days

From the results, it is found that the strength of concrete increases with the increase in the addition of fibre in concrete. This increase in strength is due to the capability of steel fibres to absorb the load applied, reduce the stress at the crack area and delay of crack development in concrete. The compressive strength of concrete increases by 5% to 12% with the addition of steel fibres.

V. CONCLUSION

- The workability of concrete decreases, as the percentage of artificial Sand increases in the concrete mix.
- The mix proportioning designed to achieve the compressive strength of 40 MPa. However, compressive strength obtained was 43.3 Mpa respectively, for conventional plain concrete specimens For plain concrete specimens, the maximum strength was obtained for 100% Msand, which is about 12.58%, % higher than conventional specimens of M40, grade concrete with R Sand respectively. 100% M- sand with 1.25% steel fiber, it was found that the mix with 100% M-sand and 1.25% steel fiber has maximum strength, which is 16.01%.

REFERENCES

[1] A K Sahu, S Kumar and A K Sachin., 2003 Crushed Stone Waste as Fine Aggregate for Concrete. The Indian Concrete Journal, vol 77, no 1, p 845.

[2] H.Donza,O. Cabrera, E.F. Irassar (2002), " High-strength concrete with different fine aggregate" , Cement and Concrete Research, Vol.32, Issue 11, PP: 1755-1761.

[3] Bhatty, J., Gajda, J., Botha, F., and Bryant, M. (2006), "Utilization of Discarded Fly Ash as a Raw Material in the Production of Portland Cement," Journal of ASTM International, Vol. 3, No. 10, PP: 1-14.

[4] Reddy, M.V. and Reddy, C.N.V.S. (2007), "An experimental study of rock flour and insulator ceramic scrap in concrete', Journal of Institute of Engineer, Vol 8, Issue 8, PP: 47-50.

[5] T. Kaosol, "Reuse concrete waste as crushed stone for hollow concrete masonry units," in Proc. The 3rd Technology and Innovation for sustainable development international conference (TISD2010), Faculty of engineering, Khon Kaen University, Thailand, 2010, pp. 176.

[6] Nimitha Vijayaraghavan and A S Wayal (2013), "Effects of Manufactured Sand on Compressive Strength and Workability of Concrete", International journal of Structural & Civil Engineering Research, Vol. 2, No. 4, PP: 228-232.

[7] Sheetal A. Sahare, Mugdha N. Priyadarshini, Shweta S (2015), "Effect of Artificial Sand on Compressive

ISSN (online): 2581-3048
Volume 7, Issue 1, pp 8-10, January-2023
https://doi.org/10.47001/IRJIET/2023.701003

Strength and Workability of Concrete", International Journal for Science and Advance Research in Technology, Volume 1 Issue 4, 183-188, April 2015.

[8] Nithyambigai. G (2015), "Partial Replacement of Manufactured Sand and Fly Ash in Concrete", International Journal of Emerging Technology and Advanced Engineering, Vol. 5, Issue 6, PP: 166-170.

[9] Chandrasekar R, Chilabarasan T, Roshan Thariq Shah A, Visuvasam J (2017), "Development of high strength concrete using waste foundry sand", Journal of Chemical and Pharmaceutical Sciences, Vol. 10, Issue 1, PP: 348- 351.

[10] M. Manoj Pravarly, S. Mahesh (2017), "Characteristic of High Performance Concrete by using ROBO Sand and Fly ash", International Journal of Scientific Engineering and Technology Research, Volume 6, Issue 6, PP: 1015–1022.

[11] Prasanna K, Anandh K S, kiruthiga K (2017), "Study on High Performance Concrete with Replacement of Fine Aggregate by Manufactured Sand", International Journal of Civil Engineering and Technology, Volume 8, Issue 8, PP: 1502–1514.

Citation of this Article:

Abhishek Kumar Chaudhary, Pushpendra Kumar Kushwaha, Mithun Kumar Rana, "Experimental Study on Compressive Strength of M40 Concrete by Replacing Artificial Sand and Steel Fiber against Natural Sand and Cement" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 7, Issue 1, pp 8-10, January 2023. Article DOI https://doi.org/10.47001/IRJIET/2023.701003

****

