Review on Experimental Analysis of Partially Replacement of Cement with Dolomite Powder in Cement Concrete

Prof. Sagar R. Raut[1] Saurabh N. Umale[2] Pranay P. Rathod[3] Sanandan V. Unhale[4] Vishal R. Chavhan[5]

[1]Assistant Professor [2,3,4,5]Student

[1,2,3,4,5]Department of Civil Engineering

[1,2,3,4,5]Jagadambha College of Engineering & Technology, Yavatmal, India

Abstract— This work is carried out to investigate the effect on the properties of concrete with replacement of cement by dolomite powder. Concrete is a mixture of cement, fine aggregate, coarse aggregate, and water. Present days the costs of those materials are accrued thus, we would like to appear at the simplest way to decrease the value of building material. Cement is manufactured by calcining argillaceous & calcareous materials at a high temperature. During this process, a large amount of carbon dioxide is released into the atmosphere. India is ranked second in the list of the largest producer of cement in the world. Thus, the reduction in the use of cement will not only reduce the cost of construction but also the emission of CO2. Dolomite powder is acquired by processing the sedimentary rock which is a mineral, dolomite can be used as a replacement material for cement in concrete up to a certain part. Dolomite powder has some similar characteristics to cement. Using dolomite powder in concrete can increase the strength to some extent. This paper examines the probability of using dolomite powder as a partial replacement material to cement. The replacement percentages tried were 0%, 5%, 10%, 15%, 20% and 25% by weight of cement. The compressive, split tensile and flexural toughness of concrete with dolomite powder were compared with those of the reference specimens. The results indicate that the substitution of cement with dolomite powder increases the compressive, split tensile and flexural strengths of concrete.

Keywords: Dolomite Powder, Compressive Strength, Split Tensile Strength, Flexural Strength

I. INTRODUCTION

Concrete is the fundamental civil engineering material used in most of the civil engineering structures. Many materials are used to assemble good quality concrete. Cement, fine aggregate, coarse aggregate, mineral commixtures, chemical commixtures and water are the constituents of concrete. Cement is the most major constituent material, since it binds the aggregates and resists the atmospheric action. However, manufacturing of cement emits about 0.8 ton of carbon dioxide in to atmosphere for every ton of cement manufactured. Dolomite is a carbonate material collected of calcium magnesium carbonate CaMg $(CO_3)_2$. Dolomite is a rock forming mineral which is noted for its remarkable wettability and dispensability. It has a good weathering opposition. Dolomite is taken for construction material due to its higher surface hardness and density. Asphalt and concrete applications present dolomite as a filler material due to its higher strength and hardness. By the effective implementation of dolomite powder, the objective of reduction of cost of construction can be met. A try has been made to explore the possibility of using dolomite as a replacement material for cement. M_{20} grade concrete specimens were made by replacing 5, 10, 15, 20 and 25% of cement with dolomite powder. The Compressive, Split tensile and Flexural toughness of the specimens were found on the 7^{th} and 28^{th} days. Optimal replacement % of dolomite was determined.

II. LITERATURE REVIEW

They made high volume fly ash self-compacting concrete with 12.5%, 18.75 %, 25 % and 37.5 % of the cement (by mass) replaced by fly ash and 6.25 %, 12.5 % and 25 % of the cement replaced by dolomite powder. The test results for deference characteristics of self-compacting concrete such as slump flow test, J-ring test, V-funnel test and L-box test were presented. The mixes were then tested for other mechanical prospect like, cube compressive strength at 7th day, 28th day and 90th day, cylinder compressive strength at 28th day, split tensile strength, and flexural strength at 28th days. For all stages of cement replacement, concrete achieved superior performance in the fresh and hardened states when compared with the reference mixture.

Bhavin k, et al (2013) presented the details of the investigation carried out on paver blocks made with Kamal M.M, et al (2012) evaluated the bond workability and uniformity in mixture. The toughness of self-compacting concrete mixes containing dolomite powder. Either silica flume or fly ash was used including dolomite powder to increase the bond strength considerably. 7 mixes were proportioned and push-out test was carried out. The variation of the bond strength for other mixes was evaluated. The steel concrete bond suitableness was evaluated based on normal bond strength. The result showed that the bond strength raise as the replacement of Portland cement with dolomite powder increased. All SCC mixes all-inclusive dolomite powder up to 30% yielded bond strength that is adequate for design purpose. The connection of this type of concrete provided unique merits for faster construction. They reported that the shear strength of RC beams were exceeding than that of the conventional SCC without dolomite powder.

Salim Barbhuiya (2011) carried out an inspection to explore the possibilities of using dolomite powder for the production of SCC. Test results illustrate that it is possible to manufacture SCC using fly ash and dolomite powder. The mix containing fly ash and dolomite powder in the ratio 3:1 was found to elate the requirements suggested by the European Federation of Producers and Contractors of Specialist Products for Structures (EFNARC) guidelines for constitute SCC. Compressive strengths of SCC with 75% fly ash and 25% dolomite powder was found to be satisfactory for structural applications.

III. EXPERIMENTAL INVESTIGATION

A. Material used

1) Cement

Cement is a binder, a substance that sets and hardens independently, and binds other materials together. Many types of cements are accessible in the market. The frequently used cement is Ordinary Portland cement. Ordinary Portland cement of 53 grade was used for the analysis. The specific gravity of Ordinary Portland cement was 3.15 g/cm^3.

2) Coarse aggregate

The coarse aggregate is the huge component of concrete. It is chemically a steady material. Existence of coarse aggregate reduces the drying shrinkage and other dimensional changes occurring on account of movement of moisture. Hard broken granite stones were used as coarse aggregate in concrete. Size of coarse aggregate used in the inspection was 10mm. The specific gravity of the coarse aggregate was found to be 2.68.

3) Fine aggregate

The main function of the aggregate is to assist in producing fine aggregate also help the cement paste to hold the coarse aggregate particle in suspension. This action promotes plasticity in the mixture and prohibit the possible segregation of paste and coarse aggregate. It should be reliable, clean and be free from organic matters. It should not contain any definite amount of clay balls and harmful impurities such as alkalis, salt, coal, decayed vegetation etc. Streams and has been used as fine aggregate. The specific gravity of sand was initiated to be2.56.

4) Water

Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. The water, which is used for making concrete should be clear up and free from harmful impurities like oil, alkalis, acids etc. Water for making concrete should have pH between 6 and 8. Provincially available drinking water was used in this work.

5) Dolomite

Dolomite is a carbonate material serene of calcium magnesium carbonate. The term is also used to relate the sedimentary carbonate rock dolostone. Dolostone is composed primarily of the mineral dolomite with a stoichiometric ratio of 50% or greater content of magnesium substitution calcium, often as a result of metamorphism. Dolomite is a rock forming mineral which is noted for exceptional wettability and dispensability as well as moderate oil and plasticizers absorption. Dolomite has good weathering resistance. The possessions of the dolomite powder are given in Table 1.

Sr. No	Property	Dolomite Powder
1	Formula	$CaMg(CO_3)_2$
2	Specific gravity	2.85
3	Color	white, grey to pink
4	Determination	Brittle
5	Moisture content (%)	Nil
6	Crystal system	Trigonal
7	Sieve analysis	Zone III

Table 1: Properties of dolomite powder

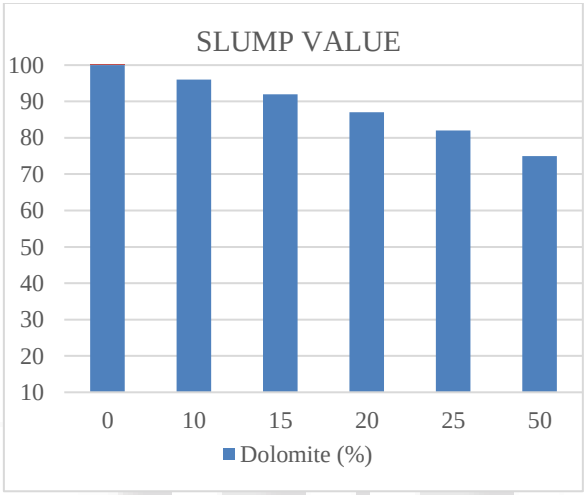
6) Details of concrete mix

In the present investigation, M_{20} mix was designed as per the instruction given in IS 10262:2009. The water cement ratio affect was 0.48. The quantities of cement, fine aggregate and coarse aggregate required for 1m^3 of concrete are 399.13 kg, 526.56 kg, 1221.81 kg respectively.

IV. RESULTS

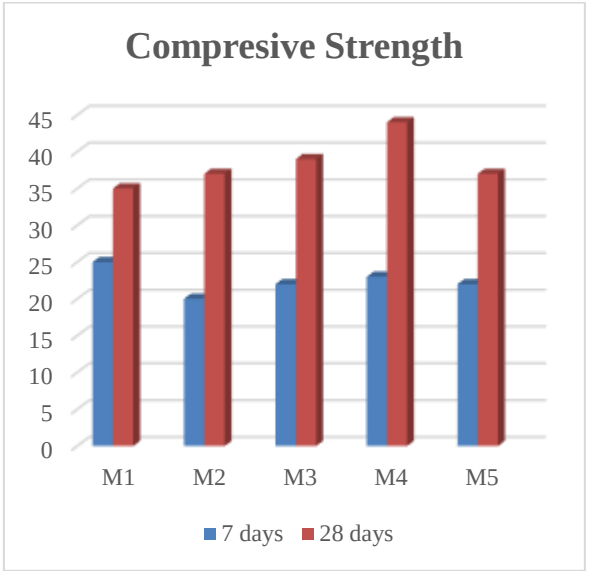
A. Workability Test

To measure the workability of fresh concrete this test is carried out according to IS 7320-197. Properties of fresh concrete are presented in fig.1.Slump value of concrete base to be decrease with increase in dolomite content from 20 to 40 %. So, concrete was base to be less workable due to high grade of concrete, low water content, absence of any plasticizer, addition of dolomite.



B. Compressive Strength Test

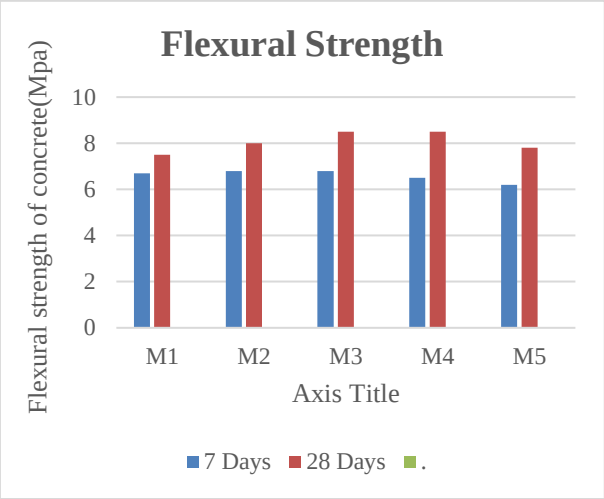
The test is carried out according to IS: 516-1959 & IS: 10086-1982. For this concrete cube of size 150 mm x 150 mm x 150 mm is used.Fig.2 shows compressive strengths test results. It is observed that M4 mix which is having 30% dolomite gives the maximum compressive strength of 43.78 MPa, comparative study shows the gain of strength is slow due to addition of dolomite.



C. Flexural Strength Test

According to IS: 516-1959 the standard beam specimen of size 150mm x 150mm x 900mm were tested under Universal

testing machine (UTM). The test results for flexure are shown in fig.3. Flexural Strength for M3 mix concrete found to have higher value than other mix concrete.



V. Conclusion

From literature review and present study it is concluded that Dolomite is an economical substitute for cement in construction industry

Use of Dolomite enlarge mechanical as well Elastic Properties of Concrete when replaced in optimum percentage Environmental burden can be reduced efficiently using dolomite

From the experimental analysis Properties of concrete found enhanced with incorporation of dolomite

Acknowledgement

It is good opportunity for me to publish this paper on "Experimental analysis of partially replacement of cement with dolomite powder in cement concrete." We are thankful to my project guide Prof. S. R. Raut, Jagadambha College of Engineering, Yavatmal, for their constant encouragement, inspiration and able guidance. I take this contingency to express my deep sense of gratitude towards those, who have helped me in various ways for this work. At the last but not the least, I am thankful to my parents, who had encouraged & inspired me with their blessings.

References

[1] Athulya Sugathan, "Original exploration on partial Replacement of Cement with dolomite powder" International Journal of Innovative Research in Science, Engineering and Technology. DOI: 10.15680 / IJIRSET. 2017.060704112748

[2] Deepa Balakrishnan S., Paulose K.C. "utility and strength characteristics of self-compacting concrete containing fly ash and dolomite powder" Cochin University of Science and Technology, Kochi, Kerala, India, Volume-2 pp-43-47

[3] G.J.Thilak, A.Nisha Devi, A.Thangadurai "Original work on the effect of limestone (dolomite) as fine aggregate with steel fibre on the features of concrete" International Journal of Innovative Research in Technology © March 2017 | IJIRT | Volume 3 Issue 10 | ISSN: 2349-6002.

[4] J.Aswani, M. Indira, T.M. Jeyashree. "A Study on Effect of Crystalline Dolomite Silica as a Partial Replacement of Cement" International Journal on Engineering Technology and Sciences – IJETS™. ISSN(P): 2349-3968, ISSN (O): 2349-3976 Volume III, Issue III, March- 2016

[5] K. Sathishkumar, K.Anitha "Experimental investigation on partial replacement of cement by dolomite and fine aggregate by copper slag" International Journal of Pure and Applied Mathematics. Volume 116 No. 14 2017, 25-30

[6] Effective Use of Dolomite in Concrete Compositions" Institute of Structural Macro-kinetics and Materials Science RAS Vladimir State University, Riga Technical University, Dec 2016, vol. 19, 27–32.

[7] Aravinthan K, Sivasankara Pillai C "Increasing the Efficiency of High Volume Dolomite Self-Compacting Concrete" EASA College of Engineering and Technology, Coimbatore, India. International Journal of Engineering Science and Computing, June 2016, ISSN 2321 3361 20161 IJESC.

