

EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT WITH DOLOMITE POWDER AND BRICK KILN DUST**Ms. Jagruti B. Pagar¹, Mr. S. S. Kasliwal², Dr. R.K. Pote³ and Dr. U.S. Ansari⁴**¹PG student, Department of Civil Engineering, SND College of Engineering & Research center, Babhulgaon, Yeola²Assistant. Professor, Department of Civil Engineering, SND College of Engineering & Research center, Babhulgaon, Yeola³Assistant. Professor, Department of Civil Engineering, SND College of Engineering & Research center, Babhulgaon, Yeola⁴Professor, Department of Civil Engineering, SND College of Engineering & Research center, Babhulgaon, Yeola¹jagrutipagar1@gmail.com, ²saarabh.kasliwal@sndcoe.ac.in, ³rohit.pote@sndcoe.ac.in and ⁴hodcivil@sndcoe.ac.in**ABSTRACT**

The viability of using dolomite powder and brick kiln dust in concrete in place of some of the cement is examined in this experimental investigation. The result of an experimental study evaluating a concrete mix that substitutes up to 20% dolomite powder and brick kiln dust for cement on an M25 mix are presented in this paper. According to the findings, concrete's compressive strength, split tensile strength, flexural strength, and workability can all be enhanced while the environmental impact of cement manufacturing is decreased by partially substituting dolomite powder and brick kiln dust for cement. The best replacement percentages are established, and the consequences for environmentally friendly building methods are examined. The outcomes of this study leads to the development of more sustainable and ecologically friendly concrete compositions.

Keywords: Dolomite Powder, Brick kiln Dust.

I. INTRODUCTION

Concrete is a crucial construction material, made from a mixture of cement, sand, coarse aggregate, and water. Portland cement is considered the best building material due to its huge mechanical strength. The cement industry consumes most energy and emits greenhouse gases, contributing to 7% of global CO₂ emission. The main constituent of concrete is cement, which binds aggregates and resists atmospheric action. Portland cement concrete is widely used due to its good physical and mechanical properties, economy, durability, ease of creation, ability to frame into various shapes and sizes, and high compressive quality.

The global demand for concrete has increased due to advancements in the construction industry. To meet this demand, some locally and cheaply available wastes can be used to partially replace cement. These wastes not only replace cement but also reduce solid waste in landfills. Civil engineering aims to achieve high strength and durability with cost efficiency, while also preserving the environment from harmful gases. Partial replacement of cement with dolomite powder and brick kiln dust aims to address these issues and meet the growing global demand for concrete.

II. OBJECTIVES OF STUDY

The main objectives of this study are:

1. The study aims to examine the impact of partial cement replacement with dolomite powder and brick kiln dust on concrete's mechanical properties.
2. To determine the optimal replacement percentages of cement with dolomite powder and brick kiln dust.

III. LITERATURE REVIEW

Tugci Busra et. al (2023) The study of expansive soil using brick dust as a stabilizer led to a notable decrease in the soil's behaviour related to swelling and shrinking. The soil's plastic limit and shrinkage limit increased when marble dust was added as a stabilizing agent, but its liquid limit, plasticity index, and shrinkage index fell. The engineering characteristics and behaviour of the expansive soil were enhanced by the addition of brick dust at a rate of 50% of the soil's dry weight. The soil's swelling and shrinking decreased when compared between 100% black cotton soil and a mixture of 50% black cotton soil and 50% brick dust. [1] (Tugce Busra, 2023)

Prithvi Pati et. Al (2022) The study focuses on replacing some of the fine aggregate in concrete with crushed brick detritus. It draws attention to the expanding concern regarding environmental sustainability in the construction industry as a result of the depletion of natural resources and the rising amount of waste produced by construction and demolition operations. [2] (Prithvi Patil, 2022)

Saif Saad Mansoor et. al (2020) This study includes the use of waste resources like silica fume and waste glass powder as pozzolanic materials in concrete as partial cement substitutes. The article explores the effects of different replacement levels on mortar properties and emphasises the potential of waste clay brick as a pozzolanic material for partially replacing cement. [3] (Saif Saad Mansoor a, 2022)

Shivangi Pandey, Anisha Mire. (2019) This paper deals with the effective use of dolomite powder in cement. It is focused on M20 grades of concrete by nominal design. The percentage of Dolomite powder which replaces cement are 5%, 10%, 15% and 20% by the weight of cement to form concrete. The compressive strength of concrete with dolomite powder is compared with those of the standard specimens. The results indicate that replacement of cement with dolomite powder increases the compressive strength of concrete in optimum mix. [4] (Shivangi Pandey, 2019)

L. Ranjith Kumar, J. Kiran, P. Rangarajan (2017) The purpose of this work is to describe the effect of fine ground dolomite on important physical and mechanical properties of concrete. Dolomite powder has some similar characteristics of cement. The replacement percentages tried were 0%, 5%, 10%, 15% and 20% by weight of cement. The compressive, split tensile and flexural strengths of concrete with dolomite powder were compared with those of the reference specimens. The results indicate that replacement of cement with dolomite powder increases the compressive, split tensile and flexural strengths of concrete. [5] (L. Ranjith Kumar, 2017)

J Sateesh Kumar (2016) have done on their research on “Physical and Chemical characteristics of dolomite for partial replacement of cement in M20 Concrete” The investigation of this paper to study the fresh & hardened concrete when cement is partially replaced by dolomite powder. The percentage of dolomite powder are replaced cement in this investigation are 0%, 5%, 10%, 15%& 20%.The fresh property is workability and hardened properties are compressive strength, flexural strength, split tensile strength . 5%wt and more than 20%wt dolomite limestone into cement always reduces compressive strengths after 7 and 28 days. Specimens containing 10% dolomite limestone powder by weight have the maximal compressive strengths. [6] (J. Satheesh Kumar, 2016)

Hemraj R. Kumavat (2013) Investigated brick waste for its use as a replacement of cement and sand in cement mortar as it behaves as a pozzolana. It may make an important contribution towards decreasing the adverse effect of the production, disposal and the dumping of brick waste on the environment. His findings show that richer mixes gives lower value of bulk density and higher values of compressive strength for sand replacement with brick waste up to 40%. [7] (Hemraj Ramdas Kumavat, 2013)

Ms. Monica C. Dhoka (2013) Carried out experimental study on green concrete and described the properties of concrete and its strength with the use of waste materials. She described about green concrete in which we can reduce the pollution in environment by adopting suitable proportion of materials like cement and can improve the durability of concrete under the serve condition. [8] (Dhoka, 2013)

IV. MATERIALS

A. Cement: The Ordinary Portland Cement of 53 grade conforming to IS: 12269-1987 is used.

B. Fine Aggregate: The fine aggregate type used in the study was Natural sand.

C. Coarse Aggregate: Coarse aggregate are the crushed stone is used for making concrete.

D. Dolomite Powder: Dolomite is a calcium magnesium carbonate-based substance. Dolostone, a sedimentary carbonate rock, is also referred to by this word. The main component of dolostone is the mineral dolomite, which frequently results from metamorphism, and contains a stoichiometric ratio of 50% or more magnesium substitution calcium. The rock-forming mineral dolomite is renowned for its remarkable wettability and dispensability, as well as its moderate absorption of plasticizers and oils. Dolomite resists weathering well.



Figure 1: Dolomite Powder

E. Brick kiln Dust: Sand is one of the two main components used to make construction bricks, along with clay. One byproduct of several brick kilns and tile industries is brick dust. Numerous brick kiln have unplannedly expanded throughout the decades in various parts of nation. These kilns and manufacturers produce tones of waste materials, such as brick dust, shattered brick fragments, or brickbat (brick flakes). These materials are currently only used to fill low-laying areas or are disposed of as rubbish.



Figure 2: Brick kiln dust

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F. Water: In this research potable water free from organic substance was used for mixing as well as curing of concrete.

V. CASTING

Casting programme consists of Preparation of moulds as per IS 10086:1982, preparation of materials, weighing of materials and casting of cubes. Mixing, compacting and curing of concrete done according to IS 516:1959.

Concrete mix is were prepared as per design mix and for each mix following specimens of both conventional and partial cement replaced concretes were casted.

Table 1: Proportion of Dolomite powder and Brick kiln dust

Specimen Designation	%Cement	% Dolomite Powder	% Brick kiln Dust
NM	100	0	0
TR1	80	5	15
TR2	80	10	10
TR3	80	15	5

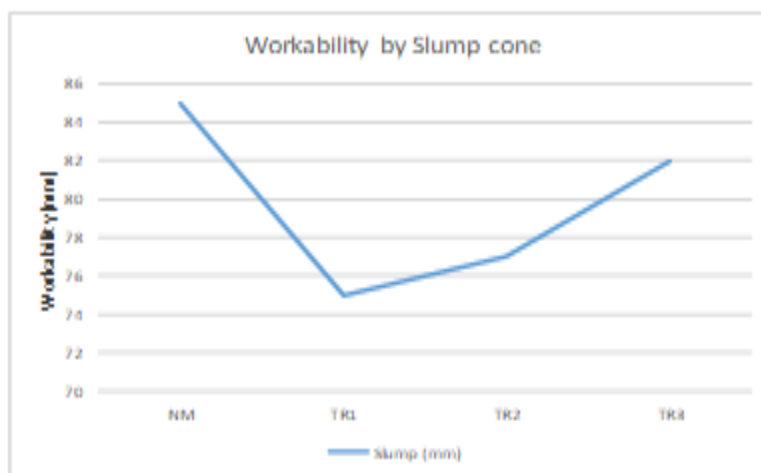
VI. TESTINGS

- 1. Compressive strength test:** Concrete cube specimens (150 mm x 150 mm x 150 mm) for computing compressive strength.
- 2. Split tensile strength:** Concrete Cylinder specimens (150 mm Dia. and 300 mm Height) for computing tensile strength.
- 3. Flexural strength test:** Concrete Beam specimens (150 mm x 150 mm x 700 mm) for computing Flexural strength.

VII. RESULTS AND DISCUSSION

Table 2: Workability by Slump Cone Results

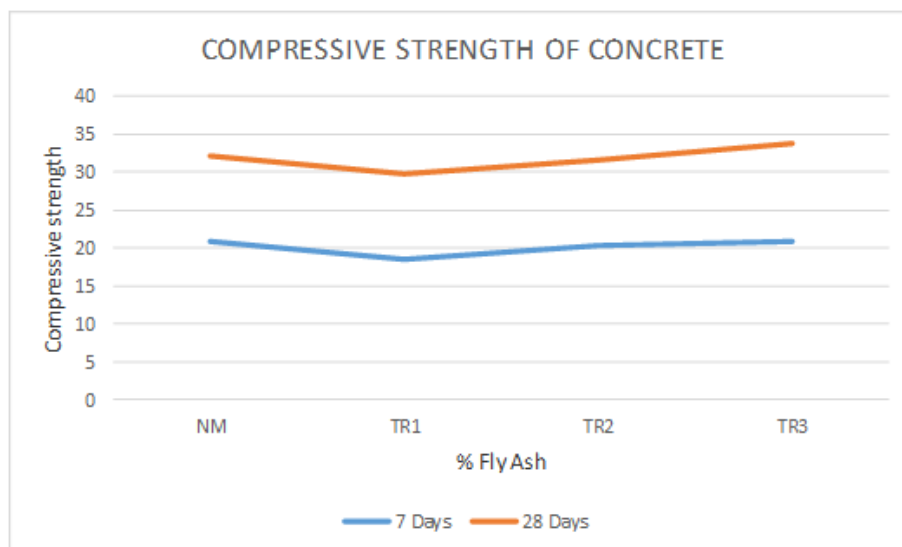
Specimen Designation	% Cement	% Dolomite Powder	% Brick kiln Dust	Workability by slump Cone (mm)
NM	100	0	0	85
TR1	80	5	15	75
TR2	80	10	10	77
TR3	80	15	5	82



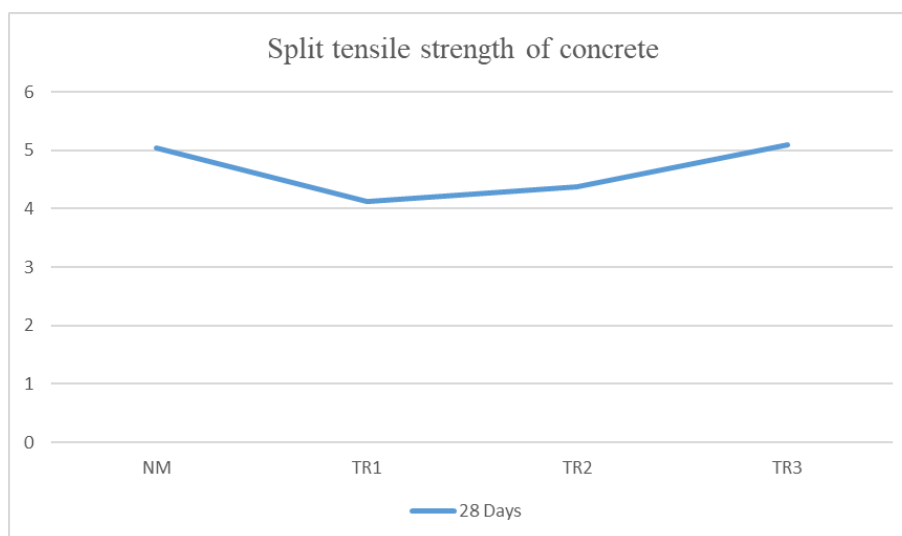
Graph 1: Workability of Concrete

Table 3: Test results of Hard Concrete

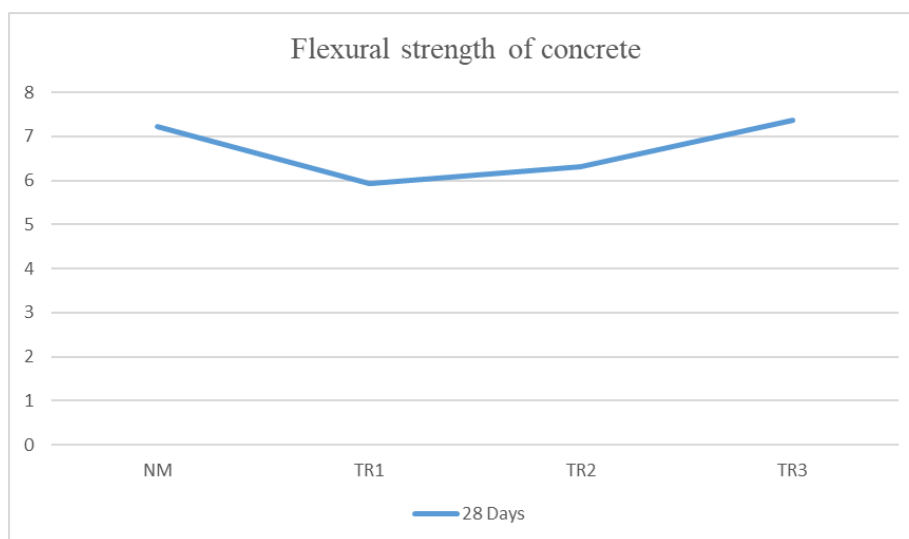
Specimen Designation	% Cement	% Dolomite Powder	% Brick kiln Dust	Compressive strength(Mpa)		Split Tensile strength (Mpa)	Flexural strength (Mpa)
				(7Days)	(28Days)		
NM	100	0	0	20.80	32.15	5.04	7.22
TR1	80	5	15	18.60	29.70	4.12	5.92
TR2	80	10	10	20.40	31.60	4.38	6.32
TR3	80	15	5	20.80	33.70	5.10	7.36



Graph 2: Compressive Strength of Concrete



Graph 3: Split tensile Strength of Concrete

**Graph 4:** Flexural Strength of concrete

According to the experimental analysis there is a lot of experiment work was carried out on addition of brick kiln dust and addition of dolomite powder to study their improved engineering properties in compressive strength, tensile strength, flexural strength etc. As per the results we found 15% of dolomite powder and 5% of brick kiln dust gives the good results in compressive strength, split tensile strength and flexural strength. Also we got good result of workability but as the percentage of brick kiln dust get increased the workability of concrete get reduced.

VIII. CONCLUSION

1. According to the experimental analysis Dolomite and Brick dust were discovered to improve the properties of concrete.
2. Concrete with 5% brick kiln ash and 15% dolomite powder substituted for cement has good mechanical qualities (Compressive Strength).
3. Good slit tensile strength is demonstrated by concrete that has 5% brick kiln ash and 15% dolomite powder substituted for cement.
4. Good flexural strength is demonstrated with concrete that has 5% brick kiln ash and 15% dolomite powder substituted for cement.
5. The workability of concrete continues to decline as the percentage of brick kiln dust increases.

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