IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

The Experimental Investigation Of Red Mud with different percentage in concrete

1st Shashi Prakash Tiwari
Student, Department of Civil Engineering
Buddha Institute of Technology, Gorakhpur, India

2nd Tejendra Singh
Student ,Department of Civil Engineering Buddha Institute of Technology, Gorakhpur, India

3rd Rohit Singh
Student, Department of Civil Engineering
Buddha Institute of Technology, Gorakhpur, India

4th Vishal Kumar Gautam
Student, Department of Civil Engineering
Buddha Institute of Technology, Gorakhpur, India

5th Ankur Kumar
Assistant prof., Department of Civil Engineering
Buddha Institute of Technology, Gorakhpur, India

Abstract: Red mud's interaction with concrete is the subject of this study's experimental investigation. In this work, different percentages of red mud were used in place of cement in concrete, and various mechanical properties were examined. Red mud is replaced with cement starting at a 1 percent interval and progressing to 24%. This is examined for the three different concrete grades M20, M-25, and M-30. The current study's investigation of mechanical qualities includes tests on durability as well as compressive strength, split tensile strength, and flexural strength.

Red mud, cement, industrial waste, and the mechanical qualities of concrete are some of the keywords.

1. INTRODUCTION

One of the most significant building materials is concrete, and concrete needs to be improved in order to perform better and last longer. In many different types of buildings all around the world, concrete is used extensively as a cost-effective building material. Concrete is desired for its high impact resistance and increased energy absorption capacity. Concrete is a brittle substance that is highly hard, highly impact resistant, and has a large ability to absorb energy. Together, the parts can withstand a variety of loads. Steel reinforcement resists tension stresses, while concrete resists compression forces. The Bayer Process, used to make alumina from bauxite ore, is known for its inefficient use of energy and produces substantial amounts of waste.-liked mud, high alkalinity bauxite residues. Red mud is a waste product of the Bayer Process, which is frequently used to make alumina.

Only about 3% of the world's total production of aluminium comes from India. Red mud is one of the intermediate products of the bauxite, or aluminium oxide, refining process. Currently, more than 120 million tones of red mud are produced annually at a rate estimated to reach 2.7 billion tones . Higher pH is more noticeable than 1.1 because the Red Mud is so close by and is caustic. Conditioning it is risky, and transferring it is difficult. With the intention of reusing it in other industries, such as structural designing, horticulture, and gas medications, such as embankments and bricks, This issue needs to be resolved. They completed a project deal including the use of lime and Red mud mixed down in street development organised bond. The compressive and flexural quality of this type of cement is close to or considerably greater than that of conventional solid, meeting the requirement of bond cement used for asphalt materials at 28-day compressive quality is around 30-40 MPa. Examined slag and Red mud launched by a composite strong soluble activator have a 28-day flexural quality of between 4.5 and 5.5 MPa.

Because the compressive and flexural qualities of this type of cement are close to or considerably greater than that, which is around 30-40 MPa of standard solid, may satisfy the need for bond cement used for asphalt materials at 28-day compressive quality. Flexural quality at 28 days ranges from 4.5 to 5.5 MPa. Analysed red mud and slag produced by a combined strong soluble activator and produced antacid slag. High compressive quality (the 28-day compressive quality may be up to 125 MPa), dazzling erosion resistance, employing 30% of the red mud, and more noticeable early quality (the underlying and last setting are independently 62 min and 95 min) are all characteristics of the red mud bond. According to reports, construction materials include phosphor

gypsum, impact heater slag, red mud, fly ash, waste tea, and others. and the long-term ecological impact of such methods has been taken into account. used red mud's effects on its unconfined compressive quality as a concrete stabiliser, the pace at which compacted earth liners swell as a water-powered barrier, and pressure-driven conductivity research. The test results show that as compared to standard earth testing, compacted mud tests with cement-red mud and red mud additives have higher compressive quality and a lower water driven conductivity.

2. OBEJECTIVE

The purpose of the experimental inquiry was to find solutions to the issues associated with the enormous demand for natural resources for the production of conventional construction materials as well as to lessen environmental risks brought on by industrial waste. Finding alternative, affordable, and environmentally friendly building materials from industrial waste is the finest economic option to get rid of issues and dangers. Due to the importance of using affordable, readily accessible, and ecologically friendly building materials, it is imperative to use and inspect the appropriate waste products while building.

These were the study's main goals.

• To ascertain the procedure for making red mud concrete of the M40 grade.
• To demonstrate the strength gain from combining red mud and hydrated lime.
to further understand and be aware of the compression, tensile, and flexural parametric strength characteristics of red mud concrete.

2. THE MATERIALS USED

Ordinary Portland cement (OPC) grade 43 was utilised, and it complies with the composition and property requirements set forth by the Indian Standard Organisation.

Water: Because it sparks the interaction between cement, pozzolan, and aggregates, water is essential for the production of concrete. With its help, the mixture is hydrated. In this investigation, distilled water was used as the water source.

Fine Aggregates: Sand, crushed stone, or a combination of the two make up most fine aggregates, which are granular materials used in construction. By supplying stability, filling the gaps between coarse particles, and adding to the overall strength and durability of the concrete mixture, it performs a critical role in concrete

Coarse Aggregates: Coarse aggregates are granular building materials that often include crushed stone, gravel, or a combination of the two. In comparison to fine aggregate, coarse aggregate is larger in size and is largely responsible for giving the concrete mixture strength and stability. The fine aggregate fills the spaces between the coarse aggregate, which accounts for the majority of the concrete's volume and creates the skeleton of the construction.

Red Mud: Produced using Bayer's technology to produce alumina from bauxite ore, red mud is obtained from Hindalco Steel Industry in Belgaum and used to substitute cement. The utilisation of the bauxite ore affects the features of the red mud.

Figure 1. Red Mud

2. METHODLOGY

The following steps can be used to summarise the approach for designing a precast concrete pavement panel using mechanically strong waste:
The goal is to identify the red mud concrete's strength parameters, which are formed by substituting red mud and hydrated lime for cement. Numerous experiments are conducted. The work study that was done is lab-focused. This project uses materials including red mud, lime, cement, fine aggregate, coarse aggregate, and superplasticizers.

Material selection: Decide what kind of mechanically strong waste will be included in the mix design for precast concrete.

Mounding: Using a mix design that includes mechanically robust waste, cast the precast concrete pavement panel.

Curing: To guarantee the precast concrete pavement panel achieves the desired strength and durability, cure it under regulated circumstances.

Testing: To ensure that the design satisfies the specified performance requirements, test the precast concrete pavement panel for strength, durability, and other desired attributes.

Installation: Employ the proper procedures and techniques to install the precast concrete pavement panel at the desired position.

2. RESULT AND TESTING

Table:1 Preliminary test

S. No	Properties of Materials	Standard Value	Experimental Value
1	Fineness of cement	0 -10%	8%
2	Standard consistency value	32%	32%
3	Soundness Test	Less than 10%	8.55mm = 9mm

4	Initial and Final setting time	30 min & 10 hrs.	35 min and 10 hrs.

➡ **CONCRETE CUBES COMPRESSIVE STRENGTH WITH PERCENTAGE OF REPLACED AGGREGATE**

Figure 2 . Compressive Strength Test

Table: 2 Compressive Strength After 7 Days

S .No.	Mix	Different Percentage (%) of replacement	Compressive Strength (in N/mm²)	Average Compressive Strength (in N/mm²)
1.	M25	0	15.55 16.00	15.77
2.	M25	3	21.77 22.44	21.12
3.	M25	5	27.12 29.85	26.24
4.	M25	7	24.15 26.28	25.21

Table: 3 Compressive Strength After 14 Days

S. No.	Mix	Different Percentage (%) of replacement	Compressive Strength (in N/mm²)	Average Compressive Strength (in N/mm²)
1.	M25	0	18.61 19.01	18.81
2.	M25	3	27.36 26.81	27.08
3.	M25	5	34.39 35.06	34.72
4.	M25	7	33.48 33.14	33.31

Table: 4 Compressive Strength After 28 Days

S .No.	Mix	Different Percentage (%) of replacement	Compressive Strength (in N/mm²)	Average Compressive Strength (in N/mm²)
1.	M25	0	25.33 25.11	25.22
2.	M25	3	28.40 29.77	30.08
3.	M25	5	37.10 38.96	38.03
4.	M25	7	36.09 36.83	36.46

a) Flexural Strength: Concrete's flexural strength is used to gauge its tensile strength. He at least has three times the depth span he measured with a concrete load of 6 x 6 inches (150 x 150 mm).

Figure 3. Flexural strength Test

Calculation

The modulus of rupture (fb) or flexural strength is given by

For a > 20.0 cm, Fb = pl/bd2, and for a 20.0 cm, Fb = 3pa/bd2.

were, where a = the distance along the specimen's tensile side's midline from the break line to the near beam.
sample width (cm) = b
d = (cm) depth of break
(cm) is the supported length.
maximum load (kg) = p

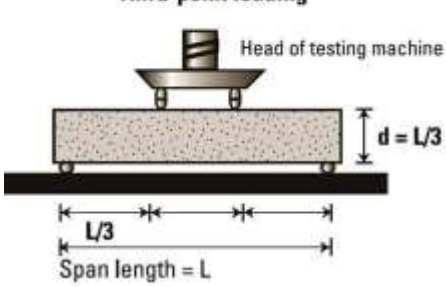
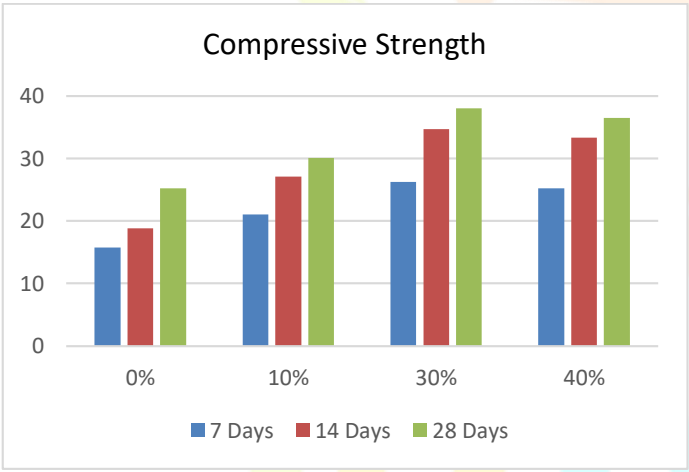


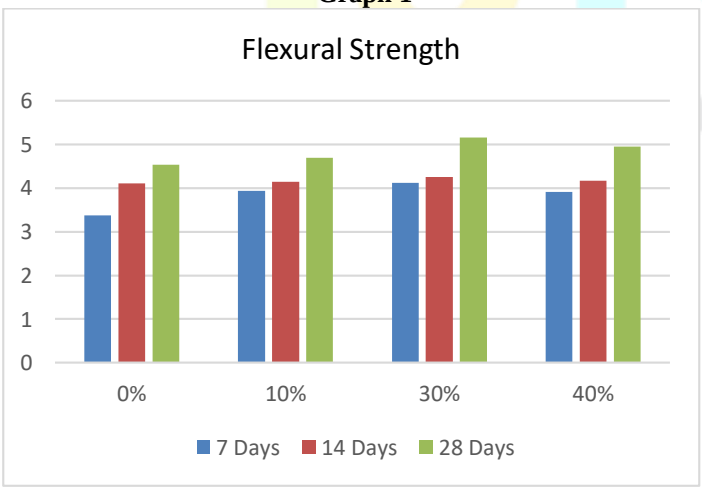
Figure 4 - Flexural Strength

Table:5 Flexural Strength

S.No.	Different Percentag(%) of replacement	Flexural Strength (N/mm^2) After 7 days	Flexural Strength (N/mm^2) After 14 days	Flexural Strength (N/mm^2) After 28 days
1.	0%	3.38	4.11	4.54
2.	3%	3.94	4.14	4.69
3.	5%	4.12	4.259	5.16
4.	7%	3.91	4.17	4.95



Graph 1



Graph 2

3. CONCLUSION

In conclusion, adding varying amounts of red mud to concrete has the potential to improve strength, increase durability, and provide sustainable waste management, among other advantages.

• **Strengthening:** The addition of red mud to concrete can increase its compressive and flexural strengths.
• Increased Resistance to Sulphate Attack, Carbonation, and Chloride Ion Penetration: Red mud-modified concrete demonstrates better resistance to sulphate attack, carbonation, and chloride ion penetration.
• **Workability Considerations:** Red mud's fine particle size and pozzolanic activity may make it more difficult for concrete mixtures to be worked.

A future study on red mud in concrete at various percentages will focus on the following areas:
A more thorough investigation should be made to ascertain the ideal proportion of red mud in concrete for various applications and performance criteria. This may entail a thorough examination of the strength, toughness, and workability characteristics of different red mud replacement levels.
• **Long-Term Performance Evaluation:** Conduct field research and long-term monitoring to evaluate how red mud-modified concrete performs under real-world circumstances. This will support the verification of the material's sustainability and durability during a long service life.
• **Environmental Impact Assessment:** Perform a thorough analysis of the effects of adding red mud to concrete on the environment. To determine the entire impact, consider variables like carbon footprint, energy use, and trash reduction
.• **Economic Viability :** look into whether employing red mud in concrete is economically viable and cost-effective. Analyse red mud's availability, cost, and potential market worth as an additional cementing material..

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