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The Effect of Lime Stone Powder as an alternative Cement Replacement Material in Concrete after 28 Days - A Review

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***Abstract:** This experimental study presents the variation in the strength of concrete when replacing cement by lime powder in the ratio 30%-35%. M-15 and M-20 grade concrete was used for which lime powder is replaced and an experimental program will be carried out and the effect on characteristics compressive strength will be analysed and the economic parameters are analysed with the optimum % of lime powder so that the overall cost of concrete can be minimized.. The cubes are to be tested after 7 days, 21 days and 28 days and the highest optimum percentage of Lime stone powder which can be preferably needed for highest strength after 28 days is to be examined. The basic aim of this project is to calculate the optimum percentage of lime powder in concrete.*
***Keywords:** Lime powder, concrete, strength.*

I. INTRODUCTION

Lime is a calcium containing inorganic mineral composed primarily of oxides and hydroxides usually calcium oxide or calcium hydroxide. These materials are still used in large quantities as building and engineering materials (including limestone products, cement,concrete and mortar) used in many purpose. A concrete made from a mixture of lime, sand, and gravel is said to be as lime concrete. It was widely used before the lime was replaced by Portland cement.

Since long, Lime has been used to make things like plaster and mortar. Lime is usually made by burning of limestone. Chemically; lime itself is calcium oxide (CaO) and is made by roasting calcite (CaCO3) to remove carbon dioxide (CO2). Lime is also called calx or quicklime. Quick Lime is very caustic and can even dissolve human bodies.

When lime is mixed with water, lime slowly turns into the mineral portlandite (dense) in the reaction CaO + H2O = Ca (OH)2. Lime is mixed with an excess of water so it stays fluid, this is called slaking and the lime resulting is called slaked lime. Slaked lime continues to harden over a period of weeks. Lime has to be mixed with sand and other ingredients to take form of slaked lime cement, that can be used as mortar between stones or bricks in a wall or spread over the surface of a wall There, over the next several weeks or longer, it reacts with CO2 in the air to form calcite again(artificial limestone)

II. MANUFACTURING OF LIME

Lime is usually manufactured by burning limestone, in the process driving off carbon dioxide leaving the clinker of calcium oxide and quick lime. When quick lime is slaked with water, it disintegrates into fine grained powder depending on the volume of water added. The pure slaked lime formed in this way is said to be as fat lime. It can be used for construction of masonry but it hardens quickly in air. Masonry buildings that were built in the past by with fat lime are now demolished as there strength is very less than the strength when lime concrete was placed.

Hydraulic lime is one of the advanced form of fat lime. It is manufactured by addition of fat lime with surkhi (clay rich in silicates).Hydraulic lime can be made into satisfactorily mortar that achieves strength similar to that of cement mortar

III. PROPERTIES OF LIME CONCRETE

Lime concrete provides good bases to bear the sufficient loads and also provide certain degree of flexibility. It adjusts very well when it is in contact with surface. Lime concrete also exhibits certain degree of water proofing property and thus prevents subsoil dampness in floors and walls. Lime concrete also exhibits volumetric stability. It can be made easily and can be available at much cheaper rates. It also resists weathering effects and is very durable

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Chemical Propertiesof Lime

Sl.No	Compound	Content
1	SiO2	59.0
2	Al2O3	21.0
3	Fe2O3	3.70
4	CaO	6.90
5	MgO	1.40
6	SO3	1.0
7	K2O	0.9

IV. DRAWBACKS OF LIME CONCRETE

A. Hydraulic lime usually gains strength in time greater than the time in which cement concrete gains same value of strength.
B. Lime cement takes a long time to cure, and while the ancient world had lots of time, today time is money.
C. Lime cement does not harden in water but stays soft. So there are situations where it cannot be used.

V. USES AND PRECAUTIONS

A. Lime concrete is very widely used for foundation bases of load bearing walls, columns, and under layers of floors.
B. Due to its flexibility it adjusts very well with the underneath base ground and upper construction of cement base.
C. For better quality of lime concrete it is important to compact & cure concrete properly. Lime causes rashes on human skin so the persons which are dealing lime concrete should be provided with suitable rubber gloves.
D. Persons should use oil on their skin to avoid rashes and cracking of their skin due to reaction of lime.

VI. LITERATURE REVIEW

(N.Suneel kumar 2017) This experimental study presents the variation in the strength of concrete when replacing cement by lime powder also replacement by from 0% to 30% in steps of 10%. The compressive strength of concrete cubes at age of 7 and 28 days is obtained at room temperature. From test results it is found that the maximum compressive strength , tensile strength are obtained only at 30% replacement.

(P Meenakshi 2017) This study represents the behavior of concrete, having partial replacement of cement with barites and lime powder. M30 grade of concrete was used for which the barites and lime powder is replaced and an experimental study was carried out and the effect on compressive strength characteristics (0%,10%,20%,30%) was studied. It was found that there is a increase in strength in early 7th day and it remain almost same in 14^{th} day but did not showed any positive result for 28^{th} day.

(P.Anusha,K. Sai Ramya2018) The basic aim of this project is to investigate the compressive strength, flexural strength and split tensile strength of M40 grade of concrete. The limestone powder and copper slag are used as replacing material for cement and fine aggregate to improve its mechanical properties. For 10%,15%,20% of lime stone powder with 0%,20%,40%,60%,80% and 100% with interval of 20% of copper slag are consider for concrete mix and compared with conventional concrete.

VII. CONCLUSION OF LITERATURE REVIEW

Most of the researchers had focused on the optimum % of lime powder for concrete but the area of economy with a proper optimum % of lime powder is missing, So that it can give strength as conventional concrete and also it remains economical. This project completely been focused on the economy with optimum % of lime stone.

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A. Conclusion

1) Replacement of natural cement by 30% artificial lime gives the maximum compressive strength.

2) The concrete mix is more workable when 30% of cement is replaced by lime as the slump values and compacting factor values are high when compared to conventional mix.

3) The concrete mix with 30% of cement replaced by lime powder gives the best mix with high compressive strength with high workability.

4) The replacement of cement by both barite and lime is not successful because initially the strength increases but later it decreses.

5) We observed that the only replacement by barite has shown good results, so the replacement of both barite and lime are not recommended.

6) The cement partially replaced bt limestone powder and the fine aggregate is replaced by copper slag. The percentage of copper slag increases, workability decreases.

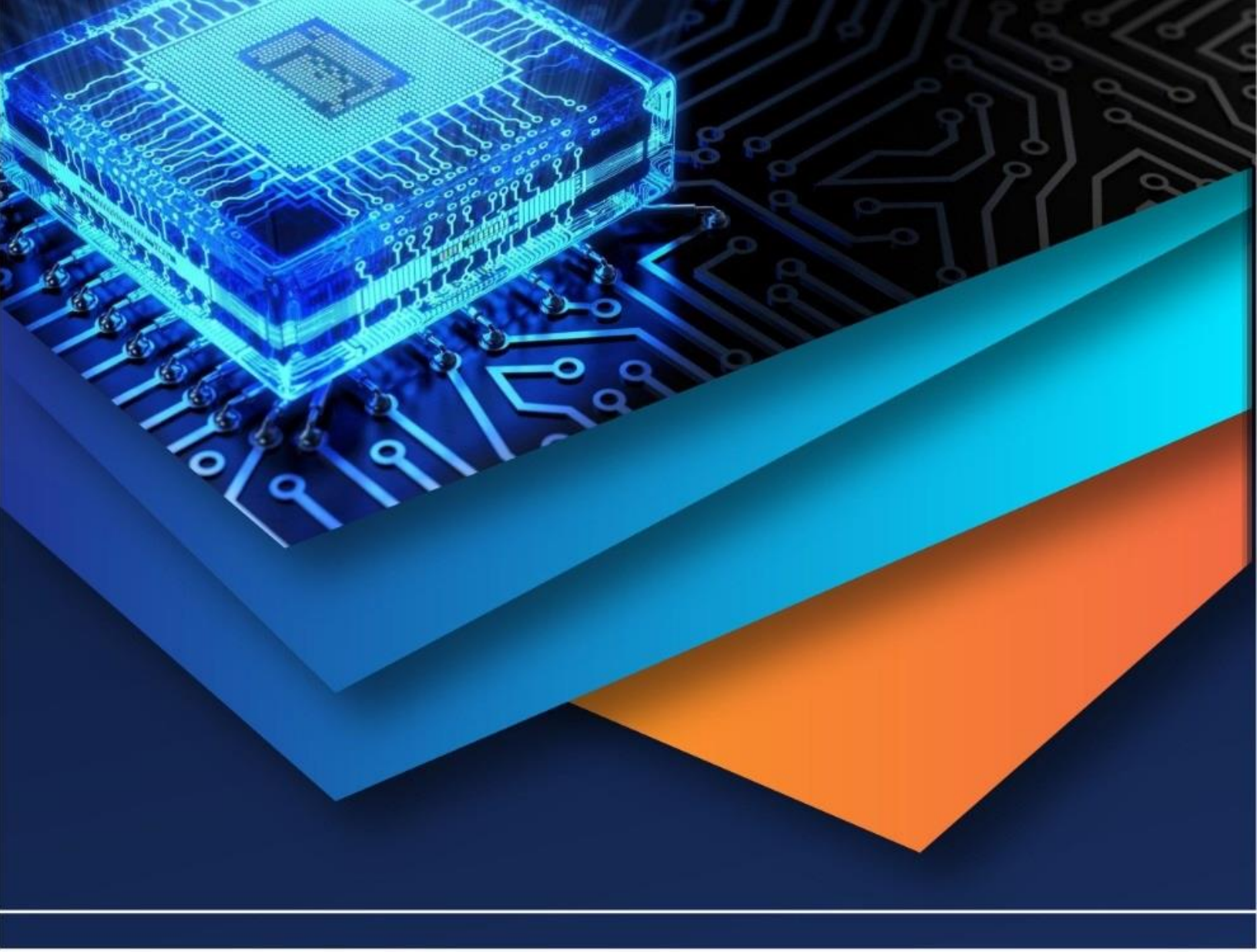
7) The compressive strength of concrete increases as percentage of copper slag increases with 60% and limestone powder increases with 15% and then decreases.

8) 60% of copper slag with 15% of limestone powder shows 25.05% higher compressive strength than nominal concrete for 28 days.

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