iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 Issue: XII Month of publication: December 2022

DOI: https://doi.org/10.22214/ijraset.2022.48431

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

A Review: The Effect and Behaviour of Concrete Using Lime Stone Powder

Dr. E. K. Mohanraj[1], R. Vasanth[2]
[1]Professor, Department of Civil Engineering, Nandha Engineering college Erode.
[2]PG Student Department of Civil Engineering, Nandha Engineering college Erode.

Abstract: Concrete is a major worldwide building material, in which Portland cement is the usual binder. Taking into account environmental factors in cement production, especially concerning CO2 emissions and energy consumption, this works aims at the development of concrete with lime powder. M30 grade of concrete is taken for investigation. The cement is replaced by lime of 5%, 10% and 15%.The concrete mix design will be done as per IS10262-2009. The properties are yet to be study including the workability and characteristics of fresh concrete such as slump, compaction factor and strength properties of hardened concrete including Compression strength, Split tensile strength and Flexural strength for various percentage replacement of cement by lime stone powder.
Keyword: Lime Stone Powder, Calcite Polymorph, Carbonisation.

I. INTRODUCTION

In ancient days lime was used as a binding material for construction in all over the world. Concrete is a composite material composed of fine aggregate and coarse aggregate bonded together with a fluid cement that hardens over times. The word concrete comes from the Latin word “Concretus” (meaning compact or condensed). Concrete is one of the widely used construction material all over the world and it is behind only water as the planet most consumed resource.

Also concrete structures has became a huge concern on this 21st century due to its wide spread use and emission of huge amount of CO2 gas everyday and causes Global Warming. To minimize the green house effect let us see about the ancient limecrete as a replacement of conventional concrete. It plays a vital role in the field of construction industries. Hence it emits a huge amount of Carbondioxide every year. This emission of CO2 gas is the major reason for the increase in green house effect. To minimize this effects many scientists spent numerous years in this research.

Lime concrete, produced by this mix, makes a good base for load bearing walls, columns, or laying under floors because it has a degree of flexibility that regular concrete does not. It also has a certain waterproof property to it that prevent subsoil dampness in floors and walls. Additionally, limecrete can be made easily and cheaply while still providing a durable material that resists weathering and wear and tear.

Keyword: Concretus, Limecrete, Global Warming, Weathering.

II. LITERATURE REVIEW

Bonavetti,V etal This paper describes the effect of duration of initial curing on the mechanical properties (compressive strength, tensile strength, and modulus of elasticity) and the chloride penetration of concretes containing limestone blended cements. Three concrete mixtures (water/cementitious=0.5) containing a portland and two limestone blended cements were subjected to three different initial curing regimens (full, wet, and air curing).

Results show that mechanical properties of concrete containing limestone blended cement are less affected by the cessation of moist curing at early ages. This is attributed to the hydration acceleration owing to limestone presence and the increase of fineness in the clinker fraction of the blended cement. A prolonged initial moist curing reduces this advantage of limestone blended cements and the dilution effect produced by limestone addition impairs the potential mechanical properties. For concretes cured for an initial 7 days, there was no substantial difference in mechanical properties and chloride penetration resistance of cements with and without limestone filler.

M.Heikal etal. Fillers are specially selected, natural or artificial inorganic materials, which improve the physico-chemical and mechanical properties of the cement such as workability or water retention. They can be inert or have slightly hydraulic, latent hydraulic or pozzolanic properties. They cause no appreciable increase of the water demand of the cement, in addition to not impairing the resistance of the concrete or mortar to deterioration in any way or reducing the corrosion protection of reinforcement.

Fillers are normallyeither limestone or any inert material such as sand. The aim of this investigation is to study the effect of substitution of limestone for Homra in pozzolanic cement. The effect of limestone replacement was studied by the determination of the combined water, free lime contents, bulk density, total porosity and compressive strength. The results show that the addition of limestone reduces the initial and final setting time, as well as total porosity, whereas the free lime and combined water increase with limestone content. It can be concluded that limestone fills the pores between cement particles due to formation of carboaluminate, which may accelerate the setting of cement pastes.

Livesy,P etal Limestone-filled cements have been developed in Europe during the last twenty years. They are now being standardised in Europe (CEN) and the UK (BSI). A working party jointly set up by the British Cement Industry and the Building Research Establishment has investigated the composition and performance of these cements. This paper summarises some of the points from the report of that working party. It observes that limestone-filled cements can be produced to strength classes 32.5, 32.5R, 42.5 and 42.5R and that such cements can be used to produce a full range of strengths of concrete. It concludes that a relationship exists between the strength class of the cement, the cement content and the strength of the concrete. It demonstrates that the strength of the concrete is a better guide to the resistance to carbonation than the type of cement used; that the degree of air entrainment governs the performance in freeze/thaw conditions and that the chemical composition of the base Portland cement controls the resistance to sulphates and chlorides. Whilst the quality of the limestone filler was found to influence the performance of the cement in concrete, the most significant effect was observed to be with fillers which affected the water demand of the cement.

Lothenbach,B etalThe influence of the presence of limestone on the hydration of Portland cement was investigated. Blending of Portland cement with limestone was found to influence the hydrate assemblage of the hydrated cement. Thermodynamic calculations as well as experimental observations indicated that in the presence of limestone, monocarbonate instead of monosulfate was stable.

Thermodynamic modelling showed that the stabilisation of monocarbonate in the presence of limestone indirectly stabilised ettringite leading to a corresponding increase of the total volume of the hydrate phase and a decrease of porosity. The measured difference in porosity between the “limestone-free” cement, which contained less than 0.3% CO_2, and a cement containing 4% limestone, however, was much smaller than calculated.

S.Tsivilis etal. In this paper, the properties and the behavior of limestone cement concrete and mortar are studied. Portland limestone cements of different fineness and limestone content have been produced by intergrinding clinker, gypsum and limestone. In order to have compatible results, the produced cements were selected to have the same level of strength. Portland limestone cement, containing up to 20% limestone, presents satisfactory concrete strength and workability, while the sorptivity and the chloride permeability seems to be similar to the pure cement concrete. Limestone cement concretes indicate lower resistance to freezing and thawing compared with the pure cement concrete. Portland limestone cement, containing 20% limestone, shows the optimum protection against rebar corrosion. Furthermore, the limestone additions decrease the carbonation depth and the total porosity of the mortar.

Wendimu Gudissa etal. (2010) The investigation has revealed that, Replacement of ordinary Portland cement by fine limestone powder from 5% to 10% with Blain fineness value of 4000 to 4500 cm2 /gm satisfies the standard compressive strength requirement of high early strength cement as per the standard requirements. The results of grinding shows that, as the replacement of limestone increases by weight, increases in cement fineness and decrease in grinding time were observed compared to pure ordinary Portland cement. Since limestone is softer to grind than pure clinkers the energy required is also relatively less than required to grind pure clinker for Portland cement production. The test results indicated that, the compressive and flexural strengths of cement mortar decrease with the increase in the percentage addition of limestone content for same blain fineness and also increase with the increase of fineness.

III. MATERIALS USED

A. Cement

Cement is a binder and a chemical substance used for construction that sets, hardens and adheres to other materials to bind them together.

It is a mixture of Calcium oxide, Silica, Alumina, Iron Oxide, Gypsum and Flyash. The word cement derived from Ancient Roman term Opus Caementicium. Based on its purposes there are several types of cements available in market. Cement used in our project ordinary Portland cement of 53 grade.

Table 1 Properties of Cement

Property	*Value*
Fineness Test	*10%*
Consistency Test	*29%*
Intial and final setting time	*34 min and 430min*
Soundness Test	*5.1mm*

B. Fine Aggregate

Sand is a basic engineering material. It generally consists of natural sand or crushed stone. The aggregate equal and lesser than 4.75mm in size are called fine aggregate. In this project work, M-Sand has been used as a fine aggregate.

Table 2 Properties of Fine Aggregate

`Property	Value
Specific Gravity	2.65
Fineness modulus	2.64

C. Coarse Aggregate

The aggregates which are greater than 4.75mm in size is called coarse aggregate and their maximum size can be upto 63mm. Aggregate for load bearing concrete must be hard, strong, non-porous and elongated particles. The maximum size of aggregate depends upon the type of concrete here the aggregate is being obtained from the crushers in Government approved granite quarry.

Table 3 Properties of Coarse Aggregate

Property	Value
Specific gravity	2.62
Water Absorption Test	2.68%
Crushing strength test	24.5%
Abrasion and Attrition test	3.3%

D. Water

Water is an important ingredient of concrete as it actively participates in chemical reactions with cement to form the hydration product, calcium-silicate-hydrate (C-S-H) gel. The strength of the cement concretedepends mainly from thebinding action of the hydrate cementpaste gel. A higher water binder (w/b) ratio will increase the strength, durability, water toughnessand other related properties of concrete. The water used for making concrete should be free from desirable salts that may react with cement. Algae in mixing water may cause marked reduction in strength of concrete either by combining with cement to reduce the bond or by causing large amount of air entrainment in concrete.

E. Lime

Lime is great binding material used in olden days. Calcium carbonate ($CaCo_3$) when heated to a temperature of 1100^{o}C gives quicklime (CaO) and carbon dioxide (CO_2). Quick lime is a very pure form of lime and highly reactive in nature. Thus, it cannot be stored for more than a week. Hence, slacking of lime is done by adding a small quantity of water to quick lime. This gives hydrated lime which is stable in nature and can be easily stored. Slacking of lime is an exothermic chemical reaction and causes a significant volume increase.

Table 4 Chemical Properties of Lime Stone

Component	Lime stone powder%
SiO_2	11.25
Al_2O_3	2.76
Fe_2O_3	1.15
CaO	43.77
SO_3	0.27
MgO	2.15
Na_2O	0.35

IV. PROPERTIES OF LIMECRETE

1) Lime concrete provides good workability and has desired plasticity.
2) It prevents subsoil dampness due to certain level of waterproofing property.
3) It resists weathering effects.
4) Bases constructed with lime concrete bears sufficient loads.
5) It needs more time for setting.
6) It attains very less compressive strength at the initial stage of setting.
7) Lime is cheaper and available easily.
8) Lime concrete is environment-friendly as it requires less energy for production of lime and emits less carbon dioxide through carbonation process compared to conventional Portland cement.

V. USES OF LIMECRETE

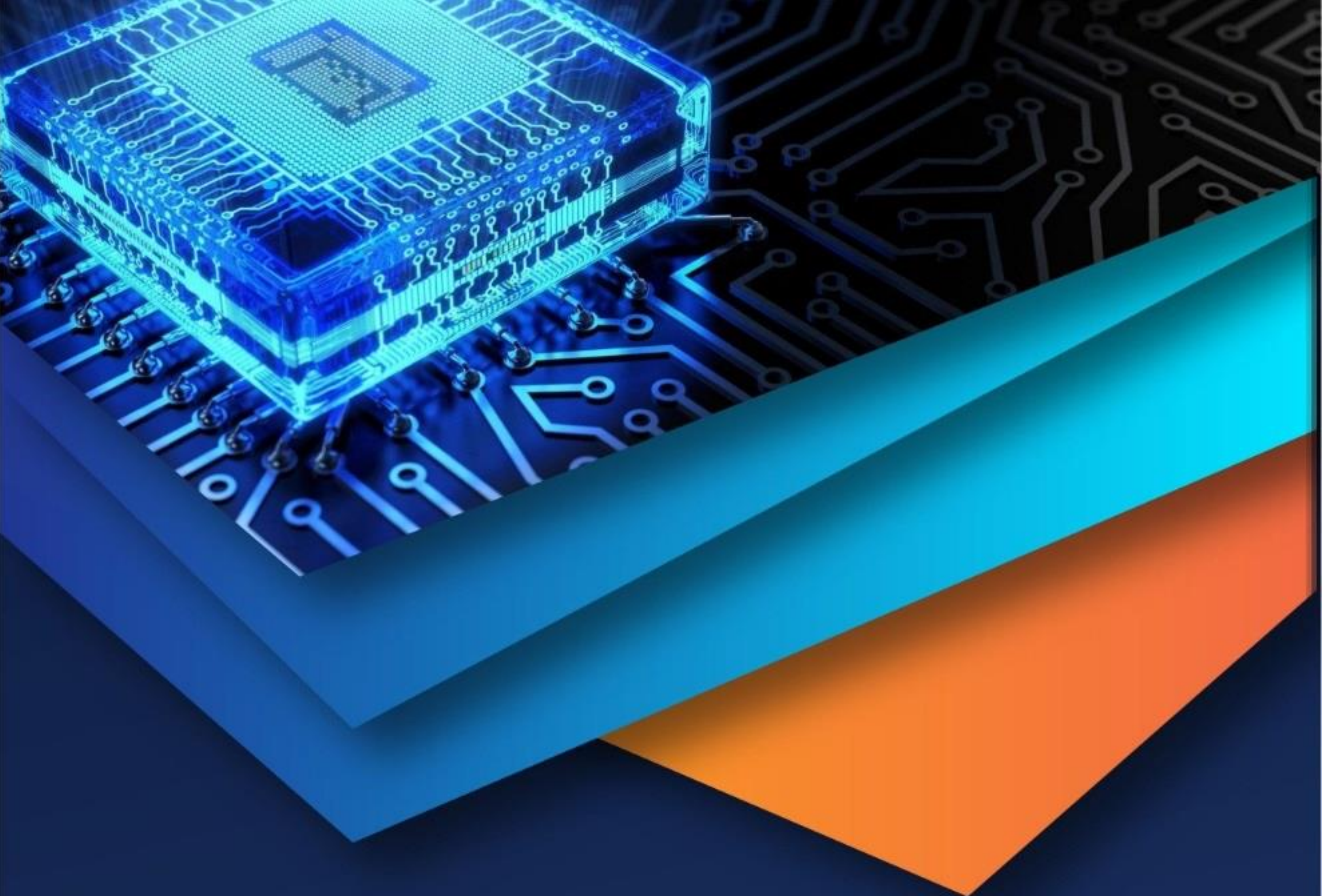
1) Lime concrete can be used for the construction of temporary structures or unimportant structures which are built for the ease of construction of permanent structures like tunnels, bridges, retaining walls, dams etc.
2) It has low thermal conductivity used for flooring at the ground level of old buildings.
3) Lime concrete mixed with an insulating material like lightweight clay or pumice is used for flooring purpose.
4) It adjusts well when coming into the contact of any surface due to its flexibility and hence forms a good bottom base and upper base construction for cement base.
5) Foundation base of load-bearing walls can be constructed using Lime concrete.
6) It is very widely used for foundation bases of load bearing walls, columns and under layered floors.
7) Due to its flexibility it adjust very well with the underneath base ground and upper construction of cement base.

VI. CONCULSION

1) The basic properties cement, fine aggregate, coarse aggregate and lime were found.
2) Further the results of mechanical properties of concrete should be done and compared with conventional concrete in future.

REFERENCES

[1] Bonavetti, V., Donza, H., Rahhall, V., and Irrassar, E., "Influence of initial curing on properties of concrete containing limestone blended cement," Cement and Concrete Research. Vol.30, No. 5, pp. 703-708., 2000.
[2] M. Heikal, H. El-Didamony and M.S. Morsy, Limestone-filled pozzolanic cement, Cement and Concrete Research 30 (2000) 1827-1834 .
[3] Howard, I.L., Shannon, J., Cost, V.T., and Stovall, M., "Davis Wade Stadium Expansion and Renovation: Performance of Concrete with Portland-Limestone Cement, Fly Ash, and Slag Cement," Journal of Materials in Civil Engineering, 27 (12), 2015.
[4] Livesy, P., "Performance of limestone-filled cements," Blended Cements, Ed.: Swamy, R. N., Elseiver Science, Essex, UK, pp. 1-15, 1991.
[5] Lothenbach, B., Saout, G., Gallucci, E., Scrivener, K.," Influence of limestone on the hydration of Portland cements", Cement and Concrete Research, vol. 38, pp: 848-860, 2008.
[6] G. Menendez, V. Bonavetti and E.F. Irassar, Strength development of ternary blended cement with limestone filler and blast-furnace slag, Cement& Concrete Composites 25, 61-67, 2003.
[7] S. Tsivilis, G. Batis, E. Chaniotakis, Gr. Grigoriadis and D. Theodossis, Properties and behavior of limestone cement concrete and mortar, Cement and Concrete Research 30 (2000) 1679-1683.
[8] Wendimu Gudissa etal., "The use of Lime stone powder as an alternative cement replacement material: An experimental study," Journal of EEA vol.27, 2010.



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY