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OPTIMISING THE SLUMP IN CONCRETE BY ADDING CALCIUM OXIDE AND CEMENT

Botla Satyanarayana [1], Eede Lakshmi Lavanya [2], Kamma Manikanta [3], Kolli Navya Sri [4], Nara Narasimha Rama Rao [5], Achanta Sudheer [6].

[1, 2, 3,4,5,] UG Student, Department of Civil Engineering, Ramachandra College Of Engineering, Eluru, Andhra Pradesh, India.

[6] Assistant Professors, Department of Civil Engineering, Ramachandra College Of Engineering, Eluru, Andhra Pradesh, India.

Abstract - Concrete is versatile engineering composite material made with cement, aggregates and admixtures in some cases. Due to the day by day innovations and developments in construction fields, the usage of concrete is increase in construction. If the sometimes site has high slump problem due to that the concrete is not used because of strength problems In this study the slump content is optimised with the following materials i.e., calcium oxide and cement and combination of the CaO and cement at different proportions to increase the strength properties of concrete. Using it provides several advantages, such as improves slump and compression strength and workability properties and increase of long-term strength. The material added to concrete to reduce slump from high level to low level without loss the nominal strength of concrete for that 80 mm slump is reduced to 60mm slump value and 100mm slump is reduced to 60 mm without any change in strength of concrete.

Keywords: calcium oxide, cement, slump test and compression test, slump reduce.

I. INTRODUCTION

Various types of cements are used for concrete works which have different properties and applications. Some of the types of cement are portland pozzolana cement (ppc), rapid hardening cement, sulphate resistant cement etc. Materials are mixed in specific proportions to obtain the required strength. Strength of mix is specified as m5, m10, m15, m20, m25, m30 etc, where m signifies mix and 5, 10, 15 etc. As their strength in KN/m^2. In United States, concrete strength is specific water cement ratio plays an important role which influences various properties such as workability, strength and durability. Adequate water cement ratio is required for production of workable concrete.

When water is mixed with materials, cement reacts with water and hydration reaction starts. This reaction helps ingredients to form a hard matrix that binds the materials together into a durable stone-like material. Concrete can be casted in any shape. Since it is a plastic material in fresh state, various shapes and sizes of forms or formworks are used to provide different shapes such as rectangular, circular etc. Various structural members such as beams, slabs, footings, columns, lintels etc., are constructed with concrete.

The factors affecting the performance of concrete are shown in the below flow chart. the concept of treating concrete is its entity as a building material rather than its ingredients is gaining popularity. The user is now interested in the concrete having the described properties without bothering about the ingredients. This concept is symbolized with the progress of ready mixed concrete industry where the consumer can specify the concrete of his needs and further in the precast concrete industry where the consumer obtains finished structural components satisfying the performance requirements.

The various aspects covered in the following chapters are materials, mix proportioning, elements of workmanship, example, compaction and curing, methods and testing and relevant statistical approach to quality control. The discussion on these aspects are based on the appropriate provisions in the Indian standard codes.

II. MATERIALS USED

Cement:

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry. Cement is the most widely used material in existence and is only behind water as the planet's most-consumed resource. Slump value is of great importance when concrete is in its fresh state. Slump value represents the workability property of concrete.

Table -1
Oxide State Chemical Composition of Cement

Oxide	Per cent content
CaO	60–67
SiO2	17–25
Al2O3	3.0–8.0
Fe2O3	0.5–6.0
MgO	0.1–4.0
Alkalies (K2O, Na2O)	0.4–1.3
SO3	1.3–3.0

Calcium oxide:
Calcium oxide (CaO), commonly known as quicklime or burnt lime, is a widely used chemical compound. It is a white, caustic, alkaline, crystalline solid at room temperature. The broadly used term lime connotes calcium-containing inorganic materials, in which carbonates, oxides and hydroxides of calcium, silicon, magnesium, aluminium, and iron predominate. By contrast, quicklime specifically applies to the single chemical compound calcium oxide. Calcium oxide that survives processing without reacting in building products such as cement is called free lime by using the manufacturing process of cement.

Table-2
Chemical properties of Calcium oxide:

Molecular formula	Cao
Molecular weight	56.08
Colour and form	White powder
Specific surface area	>90m^2/9
Crystallite size	<20mm
Average pore diameter	110A
Total pore volume	>0.2cc/g
Bulk density	0.6g/cc
True density	3.1g/cc
Mean aggregate size	4m
Calcium content	>99.4%

Calcium oxide (quicklime) White solid (CaO) made by heating calcium carbonate ($CaCO_3$) at high temperatures. It is used industrially to treat acidic soil and to make porcelain and glass, bleaching powder, caustic soda, mortar and cement. Calcium oxide reacts with water to form calcium hydroxide ($Ca(OH)_2$).

The combined addition of a Shrinkage-Reducing Admixture (SRA) with a CaO based expansive agent (CaO) has been found to have a synergistic effect to improve the dimensional stability of cement-based materials. Their performance was compared in terms of compressive strength and free shrinkage measurements. Results showed that the synergistic effect in reducing shrinkage is confirmed in the specimens manufactured with SRA and CaO. In order to clarify this phenomenon, the effect of SRA on the hydration of CaO as well as cement was evaluated through different techniques. A more deformable mortar or concrete, due to the delay in microstructure development by SRA, coupled with a finer microstructure of CaO hydration products could allow higher early expansion, which might contribute in contrasting better the successive drying shrinkage.

Coarse Aggregates:
Locally available graded aggregate of maximum size of 12.4 mm is used for our present investigations. Testing of coarse aggregate was done as per IS: 383-1970.The 12.4 mm aggregates used were first sieved through 12.4 mm sieve and the retained on 4.74mm sieve. They were then washed to remove impurities such as dust, clay particles and organic matters thereby dried to surface at dry condition. The coarse aggregate is also tested for its various properties by using IS:2386-1963.

Table 3
Physical Properties of Coarse Aggregates

Property	Result
Specific gravity	2.76
Fineness modulus	2.25

Fine Aggregate:

The sand used for experimental program me was locally procured and conformed to grading zone III as per IS:383-1970.the sand first sieved through 4.74 mm sieve to remove any particles greater than 4.74 mm and was washed to remove dust. The sand is tested in accordance with IS 2386-1963.

Table 4
Physical Properties of Fine Aggregate

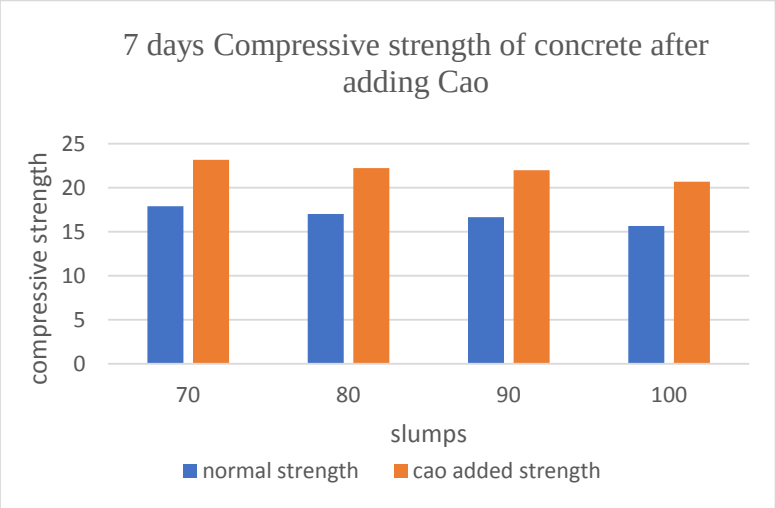
Property	Result
Specific gravity	2.60
Fineness modulus	3.20

III. LABORATORY INVESTIGATION

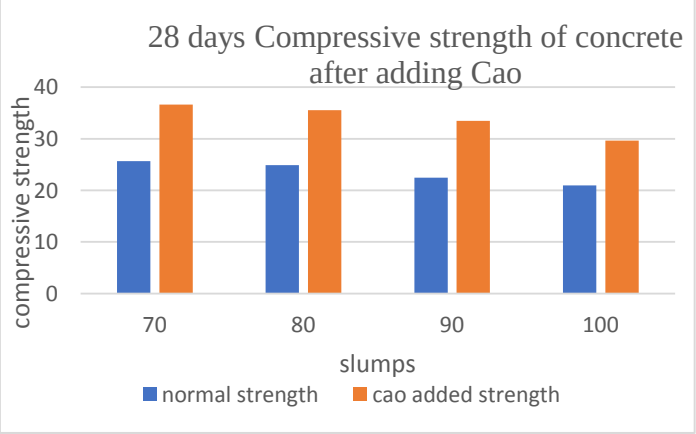
A. Compressive strength of concrete after adding Calcium oxide (CaO)

Table 5
Compressive Strength Of Concrete After Adding Calcium Oxide (Cao)

S. No	Slump (mm)	7 Days Strength (N/mm^2		28 Days Strength (N/mm^2)	
		Normal	Added	Normal	Added
1	70	17.89	23.16	25.66	36.64
2	80	17.02	22.22	24.88	35.56
3	90	16.64	21.98	22.45	33.48
4	100	15.66	20.66	20.96	29.65



Graph 1: 7 Days Compressive Strength Of Concrete After Adding Cao

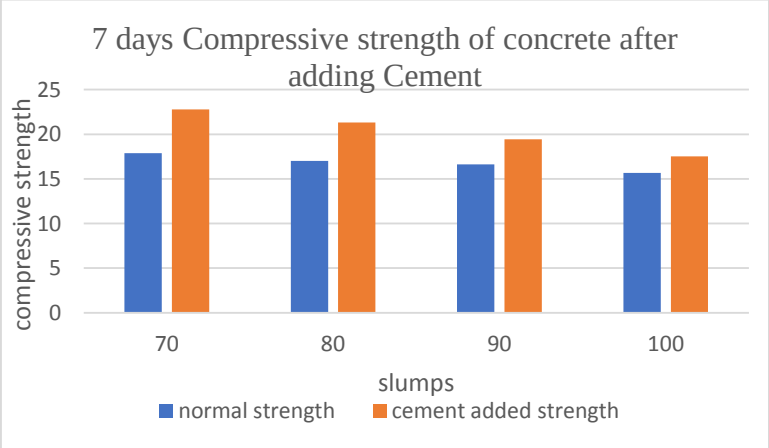


Graph 2: 28 Days Compressive Strength Of Concrete After Adding Cao

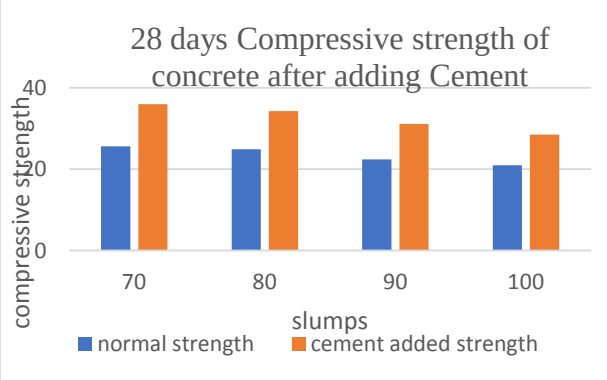
B. Compressive strength of concrete after adding Cement

Table 6
Compressive Strength Of Concrete After Adding Cement

S. No	Slump (mm)	7 Days Strength (N/mm^2)		28 Days Strength (N/mm^2)	
		Normal	Added	Normal	Added
1	70	17.89	22.78	25.66	36.02
2	80	17.02	21.33	24.88	34.32
3	90	16.64	19.43	22.45	31.13
4	100	15.66	17.53	20.96	28.53



Graph 3: 7days Compressive Strength Of Concrete After Adding Cement

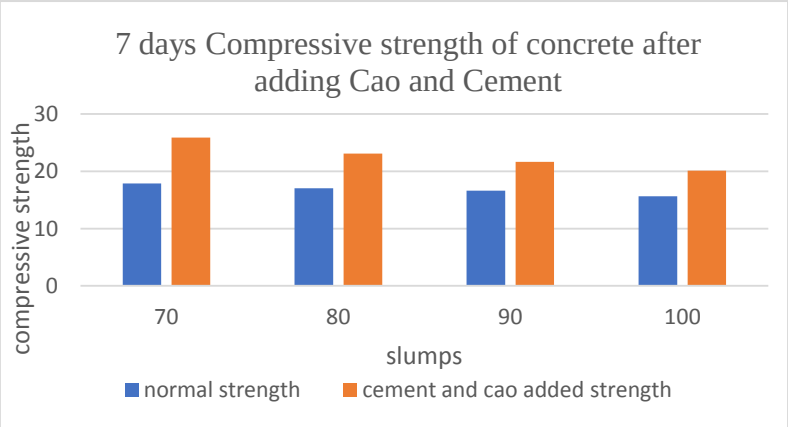


Graph 4: 28 Days Compressive Strength Of Concrete After Adding Cement

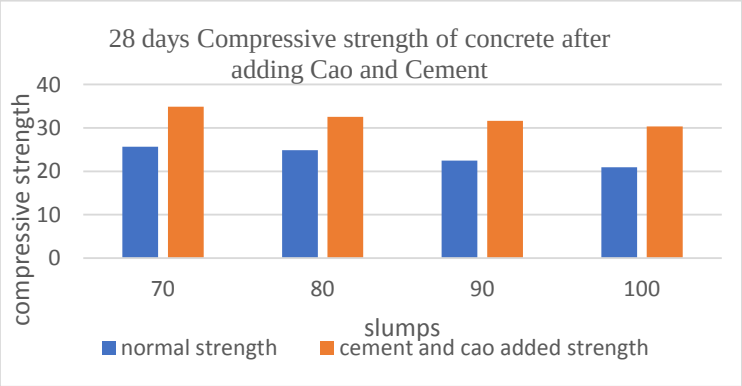
C. Compressive strength of concrete after adding Cement and CaO

Table 7
Compressive strength of concrete after adding Cement and Cao

S. No	Slump (mm)	7 Days Strength (N/mm^2)		28 Days Strength (N/mm^2)	
		Normal	Added	Normal	Added
1	70	17.89	25.91	25.66	34.89
2	80	17.02	23.11	24.88	32.55
3	90	16.64	21.66	22.45	31.63
4	100	15.66	20.11	20.96	30.32



Graph 5: 7 Days Compressive Strength Of Concrete After Adding Cement And Cao

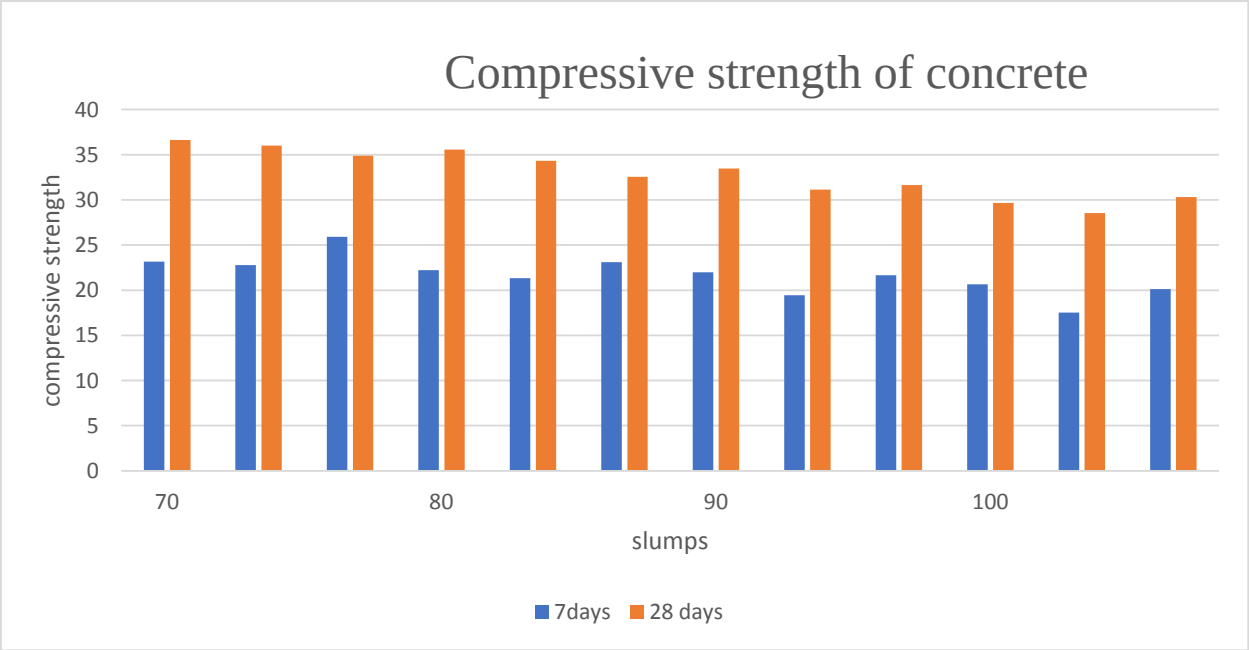


Graph 6: 28 Days Compressive Strength Of Concrete After Adding Cement And Cao

D. COMPRESSIVE STRENGTH VALUES COMPRESSION BEFORE AND AFTER ADDING OF MATERIALS MIX PROPORTIONS

Table 8:
Strength Values Compression Before and After Adding Of Materials Mix Proportions

S. No	Slump	Compressive strength		Material added	Quantity	Slump	Compressive strength	
		7days	28days				7days	28days
1	70	18.22	29.18	Cao	100	60	23.16	36.64
				Cement	300		22.78	36.02
				Cao+Cement	200		25.91	34.89
2	80	16.88	26.65	Cao	200	60	22.22	35.56
				Cement	400		21.33	34.32
				Cao+Cement	300		23.11	32.55
3	90	15.22	23.52	Cao	300	60	21.98	33.48
				Cement	600		19.43	31.13
				Cao+Cement	450		21.66	31.63
4	100	15.08	21.65	Cao	400	60	20.66	29.65
				Cement	750		17.53	28.53
				Cao+Cement	550		20.11	30.32



Graph 7: Compression Strength After Adding Material

IV.CONCLUSION

The purpose of this research is to finding and comparing out the compressive strength of M25 grade calcium oxide and cement and combination of cao and cement is added with concrete with the conventional concrete at the water cement ratio of 0.50 for better fruitful adding to optimise the slump value and good compression strength.

1. Based on experimental investigations concerning the compressive strength of concrete.
2. After the completion of all experimental tests, this study is concluded that the calcium oxide and cement and combination of cao and cement is used as a concrete mix.
3. The compression strength of M 25 grade concrete increases when the calcium oxide and cement and combination of cao and cement and later on increasing the proportions in the mix leads to the increase the strength of the concrete increasing the proportion of calcium oxide and cement leads to the increase in the workability of concrete.
4. Calcium oxide behaving like a admixture and acts as a binding material as same as cement because of having both the materials 95% same chemical composition.

IV. REFERENCES

[1]. Bye, G. C.; Sruble, L.; Livesey, P.; Del Strother, P. Portland Cement Composition, Production and Properties. London: ICE Publishing, 2011, 240p
[2]. Hewlett, P. C. Lea's Chemistry of Cement and Concrete. London: Elsevier Science & Technology Books, 2004, 1066p.
[3]. Sobhani, J.; Najimi, M.; Pourkhorshidi. Effects of retempering methods on the compressive strength and water permeability of Concrete, Scientia Iranica 2012, 19(2): 211-217.
[4]. Erdogdu, S. Arslantürk, C. and Kurbetci, S. Influence of Fly Ash and Silica Fume on the Consistency Retention and Compressive Strength of Concrete Subjected to Prolonged Agitating, Construction and Building Materials 2011, 25: 1277-1281
[5]. Neville, A. M.; Brooks, J. J. Concrete Technology. Porto London: Pearson, 2010. 460p.
[6]. Ravina, D. Slump Retention of Fly Ash Concrete with and Without Chemical Admixtures, ACI Concrete International 1975, 17: 25-29.
[7]. Baskoca, A. Ozkul, M. H.; Artirma, S. Effect of Chemical Admixtures on Workability and Strength Properties of Prolonged Agited Concrete, Cement and Concrete Research 1998, 28(5): 737-747.
[8]. Hawkins, M. J. Concrete Retempering Studies, Journal Proceedings 1962, 59(1): 63-72.
[9]. Alhozaimy, A. M. Effect of Retempering on the Compressive Srength of Ready Mixed Concrete in Hot-Dry Environments, Cement and Concrete Composites 2007, 29(2): 124-127.
[10]. Kim, Y. Y; Lee, K. M.; Bang, J. W.; Kwon, S. J. Effect of W/C Rartio on Durability and Porosity in Cement Mortar with Constant Cement Amount, Advances in Materials Science and Engineering 2014, 11p.

Biography

Author1:



BOTLA SATYANARAYANA
B. Tech Student,
Department of Civil Engineering,
Ramachandra College of Engineering, Eluru
West Godavari District- 534007, Andhra Pradesh, India.

Author2:



EEDE LAXMI LAVANYA
B. Tech Student,
Department of Civil Engineering,
Ramachandra College of Engineering, Eluru
West Godavari District- 534007, Andhra Pradesh, India.

Author3:



KAMMA MANIKANTA
B. Tech Student,
Department of Civil Engineering,
Ramachandra College of Engineering, Eluru
West Godavari District- 534007, Andhra Pradesh, India.

Author4:



KOLLI NAVYA SRI
B. Tech Student,
Department of Civil Engineering,
Ramachandra College of Engineering, Eluru
West Godavari District- 534007, Andhra Pradesh, India

Author5:



NARA NARASIMHA RAMARAO
B. Tech Student,
Department of Civil Engineering,
Ramachandra College of Engineering, Eluru
West Godavari District- 534007, Andhra Pradesh, India.

Author6:



ACHANTA SUDHEER
Assistant professor,
Department of Civil Engineering,
Ramachandra College of Engineering, Eluru
West Godavari District- 534007, Andhra Pradesh, India