

# An Experimental Study On Improvisation Of Cement Concrete By Using Chalcedony

Vennila.R<sup>1</sup>, Sountharya.G<sup>2</sup>

<sup>1</sup>Dept of Structural Engineering

<sup>2</sup>HOD, Dept of Civil engineering

<sup>1,2</sup>Sembodai Rukmani Varatharajan Engineering College

**Abstract-** Concrete is one of the widely used construction materials for structures. Cement concrete is an artificial stone produced by hardening mixture of cement, sand, stone chips and water. Since cement concrete is very good in compression but weak in tension, steel reinforcement are to be provided in tension zone. The low tensile strength and brittle character of concrete have been bypassed. The chalcedony is a rock which is obtained from the sedimentary type of rocks. The chalcedony is available in plenty in all the mountains. The chalcedony is made to a powder form and it is replaced to cement and experimental investigation is carried out. The replacement of cement by chalcedony has more strength than the ordinary conventional concrete.

## I. INTRODUCTION

Chalcedony is a cryptocrystalline form of silica, composed of very fine intergrowths of quartz and magnate. These are both silica minerals, but they differ in that quartz has a trigon crystal structure, while magnate is monoclinic. Chalcedony's standard chemical structure (based on the chemical structure of quartz) is SiO<sub>2</sub> (silicon dioxide). Chalcedony has a waxy luster, and may be semitransparent or translucent. It can assume a wide range of colors, but those most commonly seen are white to gray, grayish-blue or a shade of brown ranging from pale to nearly black. The color of chalcedony sold commercially is often enhanced by dyeing or heating.

## II. LITERATURE REVIEW

George S. Austin and James M. Barker studied the compressive strength of concrete under static load. The percentages of replacement were about 5% and 10% for cement by chalcedony and carried out the performance of ordinary concrete. It was concluded that the replacement of chalcedony for cement improved the performance of concrete under static loading.

Gopalakrishnarao Parthasarathy, Ajit Chand Kunwarand Ramaswamiah Srinivasan carried out, in some geological formations, a fibrous form of microcrystalline silica

with characteristic length-slow vibration has been noted, closely associated with length-fast fibers of chalcedony. Chalcedony with or without agate banding occurs as amygdaloidal and vein fillings besides zeolites in the old Deccan flood basalts.

R.Hesse, earth science Reviews, 1989 – Elsevier, studied about the solidifications of originally non-siliceous sediments affects a wide variety of rock – types from minor to pervasive.

J.E Gillott Prof Emeritus, dept. of civil engineering, univ.of Calgary, Canada, studied the expansive alkali aggregate reactions are a frequent and worldwide cause of poor durability in PCC.

Rafat Siddique and Juvas Klaus have studied about the Influence of metakaolin on the properties of mortar and concrete: These may be naturally occurring materials, industrial wastes, or byproducts or the ones requiring less energy to manufacture. Some of the commonly used supplementary cementing materials are fly ash, silica fume (SF), granulated blast furnace slag (GGBS), rice husk ash (RHA) and metakaolin (MK).

A.Oner, S. Akyuz, and R. Yildiz analyzed the An experimental study on strength development of concrete containing fly ash and optimum usage of fly ash in concrete. This paper presents a laboratory study on the strength development of concrete containing fly ash and optimum use of fly ash in concrete. Fly ash was added according to the partial replacement method in mixtures.

with different mix designs were prepared. 4 of them were prepared as control mixtures with 250, 300, 350, and 400 kg/m<sup>3</sup> cement content in order to calculate the Bolomey and Feret coefficients (KB, KF).

A. Oner.S and Akyuz An experimental study on optimum usage of GGBS for the compressive strength of concrete. This paper presents a laboratory investigation on optimum level of ground granulated blast-furnace slag

(GGBS) on the compressive strength of concrete. GGBS was added according to the partial replacement method in all mixtures. A total of 32 mixtures were prepared in four groups according to their binder content.

Quartz cement in sandstones: a review by Earle F. McBride studied about the Quartz cement as a syntaxial overgrowth is one of the two most abundant cements in sandstones. The main factors that control the amount of quartz cement in sandstones are: framework composition; residence time in the “silica mobility window”; and fluid composition, flow volume and pathways. Thus, the type of sedimentary basin in which sand was deposited strongly controls the cementation process. Sandstones of rift basins (arkoses) and collision-margin basins (litharenites) generally have only a few percent quartz cement. Silica diagenesis: origin of inorganic and replacement cherts by Reinhard Hesse have studied about the Silcretes originate from weathering and soil-forming processes under climatic and environmental conditions conducive to the formation of duricrusts and laterites. In more humid climates, however, non-weathering-profile silcretes occur which have been distinguished from weathering-profile silcretes.

### III. METHODOLOGY AND MATERIALS

The methodology for this thesis work is followed below:

- Selection of appropriate title
- Literatures regarding the study
- Identification of replacement material
- Mix design as per Indian standards
- Results and discussions
- Conclusion

#### 1. Materials

##### A. Cement:

Cement one of the most important constituent, because it is used to bind sand and aggregate and it resists atmospheric action. The main raw material for the production of cement is clinker. Clinker is an artificial rock made by heating limestone and other raw materials in specific quantities to a very high temperature in a specially made kiln. Cement undergoes a chemical reaction with water and sets, hardens when in contact with air or underwater. The natural cement is brown in color and its best variety is known as Roman cement. The natural cement resembles very closely eminent hydraulic lime. It sets very quickly after addition of water.

##### B. Fine Aggregates

River sand has been used for the experiments to get the results of this study. Aggregates with grain sizes below 4.75mm are termed as fine aggregates. The fine aggregates complying with the requirements of any grading zone I, II, I is suitable for concrete but the quality of concrete produced will depend upon a number of factors including the proportions. The bonding of cement paste takes place at the surface of the aggregates. Hence the fine aggregates should be clean and free from debris, silt. The gradation of fine aggregates affects the workability and finish ability of concrete. The fine aggregates used falls under the Zone III.

##### C. Coarse Aggregate

Coarse aggregates of size 20mm has been used for the study and it is obtained from the local quarry of perambalur district. The coarse aggregate used has good strength, stiffness, toughness and hardness.

##### D. Admixture

An admixture used is common sugar for improving the strength and retards setting time.

##### E. Water

Water is the most important ingredient after cement for making concrete. It is also the least expensive. Careless use of water can lead to poor quality concrete. Water is used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, sugar, and organic materials of other substances that may be deleterious to concrete.

##### F. Chalcedony

Chalcedony a cryptocrystalline silica material is found to be good binding material as cement. Chalcedony is a dense, translucent material of white grey or brownish color. Chalcedony is obtained from weathering volcanic rock and also in sedimentary rocks.

Chalcedony, a fibrous form of microcrystalline silica with characteristic length-slow vibration has been noted, closely associated with length-fast fibers of chalcedony. The chalcedony material is available in plenty and it has a good binding property and it can be replaced by cement and to reduce the consumption of cement. Chalcedony has a waxy luster, and may be semitransparent or translucent. It can assume a wide range of colors, but those most commonly seen are white to gray, grayish-blue or a shade of brown

ranging from pale to nearly black. The namechalcedony comes from the L

Chalcedony is a dense, more or less translucent, but never transparent and never opaque material. Pure chalcedony appears homogeneous and is white, gray or blue. When illuminated from the back, it may look slightly red. The blue and red tones found in pure chalcedony are caused by Rayleigh scattering of light on tiny particles, the mechanism that is also mostly responsible for the blue color of the sky. More often, chalcedony contains inclusions of various minerals, which, if colorful, will taint the chalcedony.

#### IV. RESULTS AND DISCUSSIONS

Testing of hardened concrete plays important role in controlling and confirming the quality of cement concrete works. Compression test is the most common test conducts on hardened concrete. It is easy to perform the test. For this generally concrete cubes of size 150 X 150 X 150 mm confirming to I.S. 10086:1992 – specification for moulds for use in tests of cement and concrete are preferred.



Figure 2. Cement Concrete Cubes

In assembling the mould for use, the joints between the sections of the mould shall be thinly coated with mould oil and similar coating of mould oil shall be applied between the contact surfaces of the bottom of the mould and the base plate in order to ensure that no water escapes during the filling.

The concrete mix design selected is M30 grade of concrete. 30 represents characteristic compressive strength of concrete at 28 days of curing in N/mm<sup>2</sup>.

- Mix design for M30 (NORMAL CONCRETE)
- RATIO IS : 1:1.54:2.86:0.50

Table 1. Proportions of Ingredients

Water	Cement	Fine aggregate	Coarse aggregate
197	368 kg	570 kg	1051 kg
0.50 (W/C)	1	1.54	2.86

#### 1. Replacement of Chalcedony by Cement:

The percentage of chalcedony replaced with cement therefore reduces the cement content. The table explains this process:

Table 2. Percentage Replacement of Chalcedony to Cement

Sl NO	PROPERTIES	PERCENTAGE OF CHALCEDONY USED						
		NORMAL	2.5%	5%	7.5%	10%	12.5%	15%
1	Cement, (kg)	1.53	1.49	1.45	1.42	1.37	1.34	1.30
2	Natural sand(kg)	2.31	2.31	2.31	2.31	2.31	2.31	2.31
3	Chalcedony(gms)	-	38	76	114	153	191	229
4	coarse aggregate (kg)	4.30	4.30	4.30	4.30	4.30	4.30	4.30
5	Water,(ML)	750	750	750	750	750	750	750

#### 2. COMPRESSIVE STRENGTH AFTER 7 DAYS: (Ordinary Concrete): GRADE OF CONCRETE: M30:

The compressive strength of ordinary concrete occurred while testing the samples after 7 days is given below:

Table 3. Compressive Strength at 7 Days (Ordinary Concrete)

Sp. No	Area of loading mm <sup>2</sup>	of Load at failure stage N	Compressive strength N/mm <sup>2</sup>
1	22.5 X 10 <sup>3</sup>	449 X 10 <sup>3</sup>	19.95
2	22.5 X 10 <sup>3</sup>	462 X 10 <sup>3</sup>	20.53
	Average		20.24

#### CUBE IN 28 DAYS (Ordinary Concrete):

The compressive strength of ordinary concrete occurred while testing the samples after 7 days is given below:

Table 4. Compressive Strength at 28 Days (Ordinary Concrete)

Specimen No	Area of loading face mm <sup>2</sup>	Load at failure stage N	Compressive strength N/mm <sup>2</sup>
3	22.5 X 10 <sup>3</sup>	680X 10 <sup>3</sup>	30.22
4	22.5 X 10 <sup>3</sup>	663X 10 <sup>3</sup>	29.65
Average			29.94

**4. COMPRESSIVE STRENGTH OF CONCRETE CUBE IN 7 DAYS (Chalcedony replaced by cement):**

The consolidated failure load and compressive strength after 7 days is given below:

Table 5. Consolidated Failure Load and Compressive Strength at 7 Days (Chalcedony Replaced)

Specimen No	% Replacement of Chalcedony	Area of Loading mm <sup>2</sup>	Load at Failure N	Compressive Strength N/mm <sup>2</sup>
5	2.5%	22.5 X 10 <sup>3</sup>	456X 10 <sup>3</sup>	20.26
7	5%	22.5 X 10 <sup>3</sup>	500X 10 <sup>3</sup>	24.89
9	7.5%	22.5 X 10 <sup>3</sup>	620X 10 <sup>3</sup>	27.56
11	10%	22.5 X 10 <sup>3</sup>	643X 10 <sup>3</sup>	28.57
13	12.5%	22.5 X 10 <sup>3</sup>	629X 10 <sup>3</sup>	27.95
15	15%	22.5 X 10 <sup>3</sup>	580X 10 <sup>3</sup>	25.78

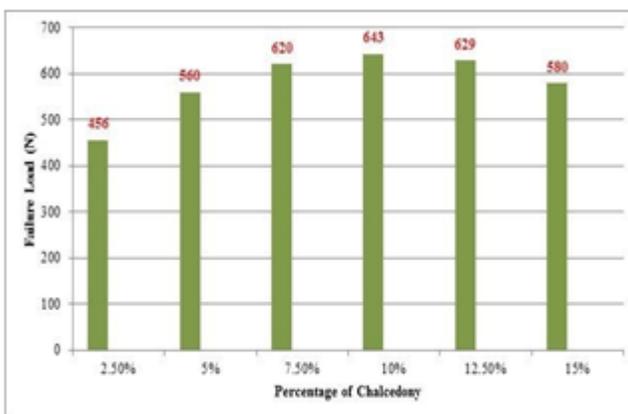


Figure 3. Failure Load of Chalcedony at 7 days

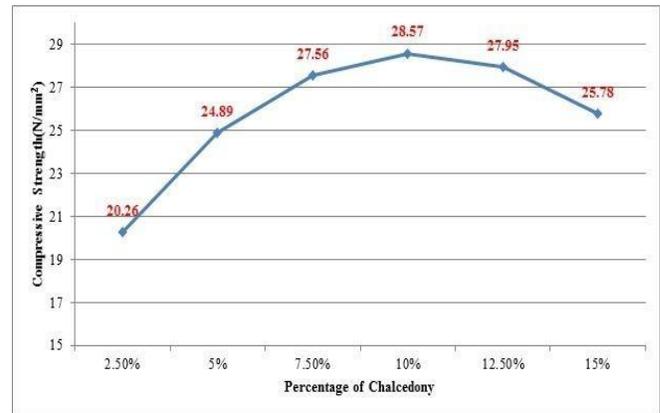


Figure 4. Compressive Strength of Chalcedony at 7 days

**5. COMPRESSIVE STRENGTH OF CONCRETE CUBE IN 28 DAYS (Chalcedony replaced by cement):**

The consolidated failure load and compressive strength after 28 days is given below:

Table 6. Consolidated Failure Load and Compressive Strength at 28 Days (Chalcedony Replaced)

Specimen No	Percentage of replacement of chalcedony	Area of loading face mm <sup>2</sup>	Load at failure stage N	Compressive strength N/mm <sup>2</sup>
16	2.5%	22.5 X 10 <sup>3</sup>	656X 10 <sup>3</sup>	29.12
18	5%	22.5 X 10 <sup>3</sup>	728X 10 <sup>3</sup>	32.35
20	7.5%	22.5 X 10 <sup>3</sup>	736X 10 <sup>3</sup>	34.67
22	10%	22.5 X 10 <sup>3</sup>	800X 10 <sup>3</sup>	35.56
24	12.5%	22.5 X 10 <sup>3</sup>	756X 10 <sup>3</sup>	33.60
26	15%	22.5 X 10 <sup>3</sup>	718X 10 <sup>3</sup>	31.91

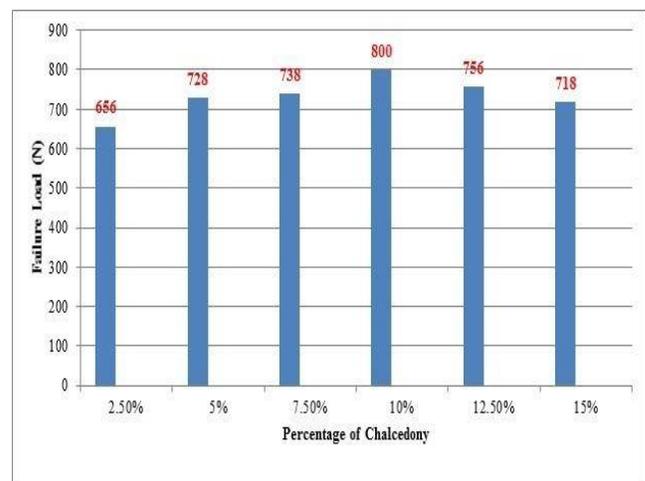


Figure 5. Failure Load of Chalcedony at 28 days

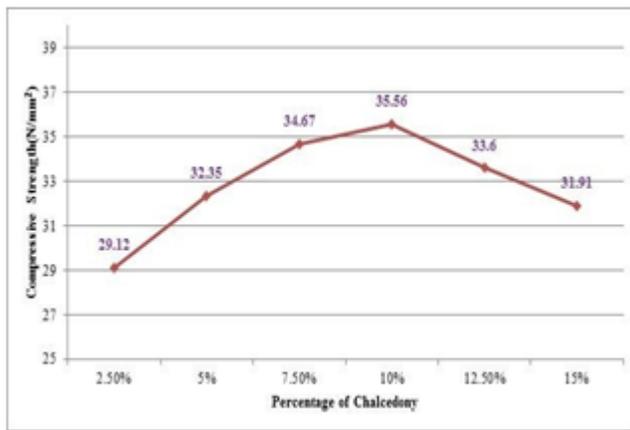


Figure 6. Compressive Strength of Chalcedony at 28 days

## V. CONCLUSIONS

Based on the experimental study on the replacement of cement by Chalcedony with different mixing proportions and on testing, the following conclusions are made:

- The partial replacement of chalcedony for cement to ordinary concrete enhances its load carrying capacity both at first visible crack and at ultimate failure.
- From this experimental program, the compressive strength of the replaced concrete by chalcedony at 10% of cement is found to get the optimum value.
- The partial replacement of chalcedony of 10% by cement to ordinary concrete results in 30% increase in compressive strength when compared to ordinary concrete specimen.

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