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Study the Fresh and Hardened Properties of the Self Compacting Concrete with Partial Replacement of Cement by Bentonite

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ABSTRACT—

Self Compacting Concrete is an innovative development of conventional concept which require high binder content to increase its segregation resistance, To increase the stability of fresh concrete (cohesiveness) using increased amount of fine material in the mix proportion, the develop SCC with reduced segregation potential. Modern application of SCC is focused on high performance more reliable and uniform quality. This paper is the present a comparative study on use of different material as binder content in SCC for its effect of workability and strength properties are verified. The cement is replaced partially by the material bentonite (10%,15%,20%). It's calcium bentonite used. It is to compare the tensile strength, compressive strength, flexural strength parameter were determined and the result has been calculated. Considerable work has been done by adding bentonite to concrete in a view of improving the properties of SCC.

Keywords—Bentonite, Self-compacting concrete, SCC.

I. INTRODUCTION

The development of new technology in the material science is progressing rapidly. In last three decades, a lot of research was carried out throughout globe to improve the performance of concrete in terms of strength and durability qualities. Consequently concrete has no longer remained a construction material consisting of cement, aggregate, and water only, but has becomes an engineered custom tailored material with several new constituents to meet the specific needs of construction industry. The growing use of concrete in special architectural configurations and closely spaced reinforcing bars have made it very important to produce concrete that ensures proper filling ability, good structural performance and adequate durability. In recent years, a lot of research was carried out throughout the world to improve the performance of concrete in terms of its most important properties strength and durability.

Concrete technology has under gone from macroto micro level study in the enhancement of strength and durability properties from 1980's onwards. Till 1980 the research study was focused only to flow ability of concrete, so as to enhance the strength however durability did not draw lot of attention of the concrete technologists. This type of study has resulted in the development of self-compacting concrete (SCC), a much needed revolution in concrete industry. Self- compacting concrete is highly engineered concrete with much higher fluidity without segregation and is capable of filling every corner of form work under its self-weight only (Okamura 1997). Thus SCC eliminates the needs of vibration either external or internal for the compaction of the concrete without compromising its engineering properties.

To establish an appropriate mixture proportion for a Self - Compacting Concrete the performance requirements must be defined taking into account the structural conditions such as shape, dimensions, reinforcement density and construction conditions. The construction conditions include methods of transporting, placing, finishing and curing. The specific requirement of Self Compacting Concrete is its capacity for self-compaction, without vibration, in the fresh state. Other performances such as strength and durability should be established as for normal concrete.

II. MATERIALS AND METHODOLOGY

Cement - Generally Portland cement is used for Self- Compacting Concrete.

Aggregates - The maximum size of aggregate is generally limited to 20mm . Aggregate of size 10 mm is desirable for structures having congested reinforcement. Wherever possible size aggregate higher than 20 mm could also be used. Well cubical or rounded aggregate which are desirable. Aggregates should be of uniform quality with respect to shape and grading. Fine aggregate can be natural or manufactured. The grading must be uniform throughout the work. The moisture content or absorption characteristics must be the closely monitored as quality of SCC will be sensitive to such changes. Particles smaller than 0.125mm i.e. 125 micron size are considered as FINES which contribute to the powder content.

Mixing Water - Ordinary potable water of normally PH7 is used for mixing and curing the concrete specimen.

Bentonite - Bentonite is a mineral admixture. Bentonite is a strong colloidal properties and when in contact with water increase of volume in several fold by swelling. Its partial replacement cement(5%, 10%, 15%, 20%, 25%, 30%, 35%) by bentonite. Two types of bentonite are there, namely, swelling bentonite which is also called sodium bentonite and non swelling bentonite is called calcium bentonite. Bentonite employed by industry to perform a multitude of jobs most industrial application involve the swelling property of bentonite to from viscous water suspension depending upon relative proportion of clay and water these mixture are used as bonding, plasticizing, and suspending agent. Bentonites react chemically with many organic materials to form compounds which are used chiefly as gelling agents in a variety of organic liquids.

TABLE I. PHYSICAL PROPERTIES OF BENTONITE

Colour	Light yellow
Size	Pass from sieve # 200
Free swell	60% by volume
Nature	Pozzolani

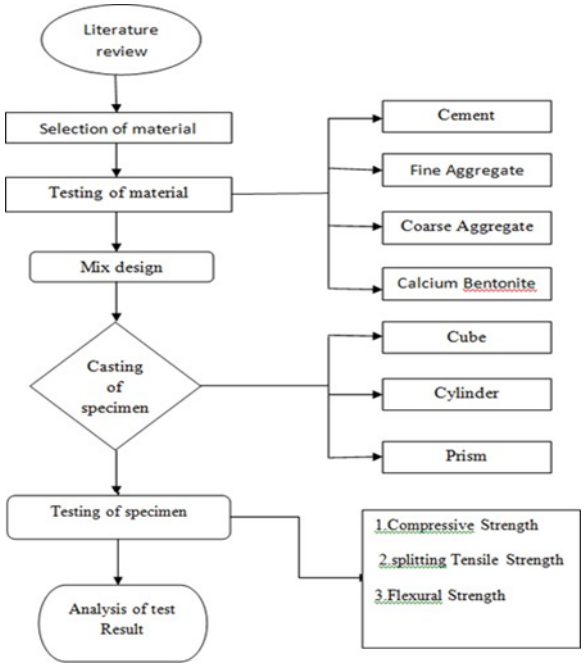

FIG I. METHODOLOGY

III. EXPERIMENTAL INVESTIGATION

Initially, basic tests were conducted for fine aggregate, coarse aggregate and cement to check their suitability for concrete making. The concrete mix design is also prepared.

TABLE II. MIX PROPORTION

Cement (kg/m^3)	**F.A (kg/m^3)**	**C.A (kg/m^3)**	**Wate r(kg/m^3)**
479	577.22	1133.64	191.61
1	1.21	2.37	0.40

A. Concrete Casting

TABLE III. CUBE CALCULATION OF % REPLACEMENT OF CEMENT BY BENTONITE

10%	**15%**	**20%**
Cement - 4.32kg	Cement - 4.10kg	Cement - 3.84kg
FA - 5.88kg	FA - 5.88kg	FA - 5.88kg
CA - 11.64kg	CA - 11.64kg	CA - 11.64kg
Water - 1.92kg	Water - 1.92kg	Water - 1.92kg
Bentonite - 0.48kg	Bentonite - 0.72kg	Bentonite - 1kg

Compressive Strength of Concrete is defined as the load, which causes the failure of a standard specimen. The test of compressive strength should be made on 150mm size cubes.

Concrete cylinder of size 150mm dia×300mm height is subjected to the action of the compressive force along two opposite edges, by applying the forcein this manner.

TABLE IV. CYLINDER CALCULATION OF % REPLACEMENT OF CEMENT BY BENTONITE

10%	**15%**	**20%**
Cement - 6.86kg	Cement - 6.31kg	Cement - 6.05kg
FA - 9.15kg	FA - 9.15kg	FA - 9.15kg
CA - 24kg	CA - 24kg	CA - 24kg
Water - 3.16kg	Water - 3.16kg	Water - 3.16kg

TABLE V.PRISM CALCULATION OF % REPLACEMENT OF CEMENT BY BENTONITE

10%	**15%**	**20%**
Cement - 6.452kg	Cement - 6.05kg	Cement - 5.62kg
FA -8.64kg	FA - 8.64kg	FA - 8.64kg
CA - 13.47kg	CA - 13.47kg	CA - 13.47kg
Water - 3kg	Water - 3kg	Water - 3kg
Bentonite - 0.717kg	Bentonite - 1kg	Bentonite - 1.478kg

Compressive, split tensile and flexural strength test are done at 7 days, 14 days and 28 days for comparing bentonite replacement with cement.

FIG II. COMPRESSIVE STRENGTH TEST

FIG III. SPLIT TENSILE TEST

FIG IV. FLEXURAL STRENGTH TEST

IV. RESULTS AND DISCUSSION

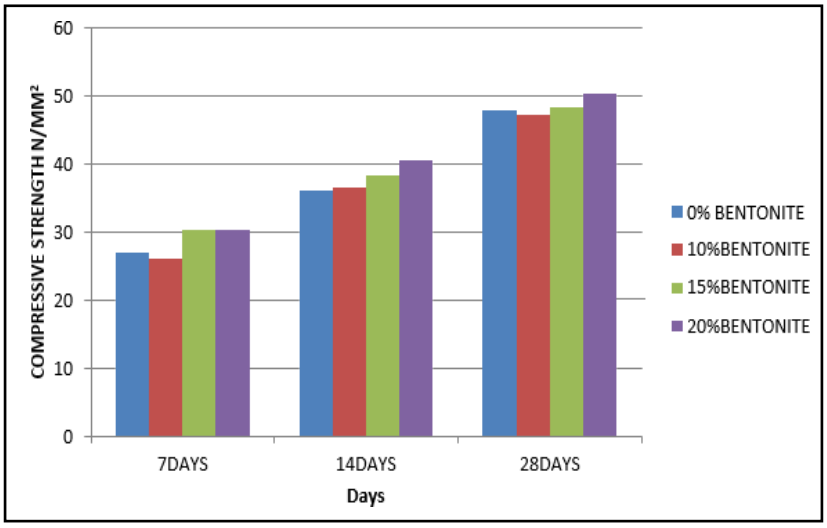

FIG V. COMBINATION OF THE 0%,10%,15%,20% COMPRESSIVE STRENGTH

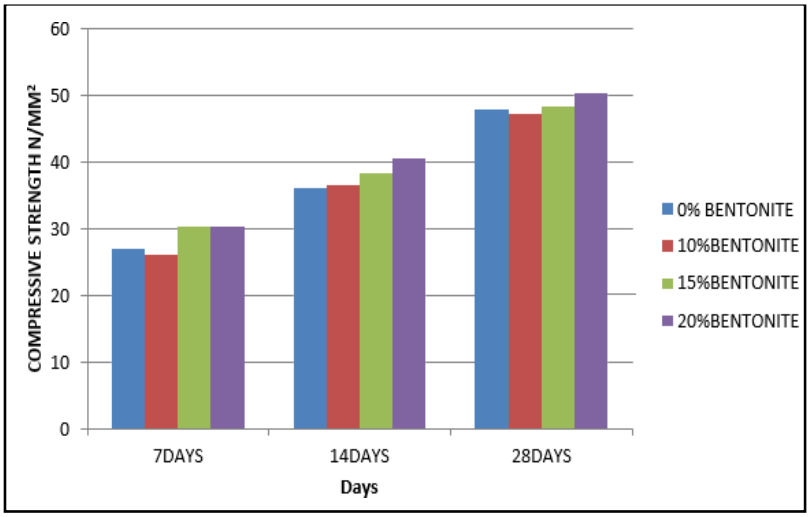

FIG VI. COMBINATION OF THE 0%,10%,15%,20% OF TENSILE STRENGTH

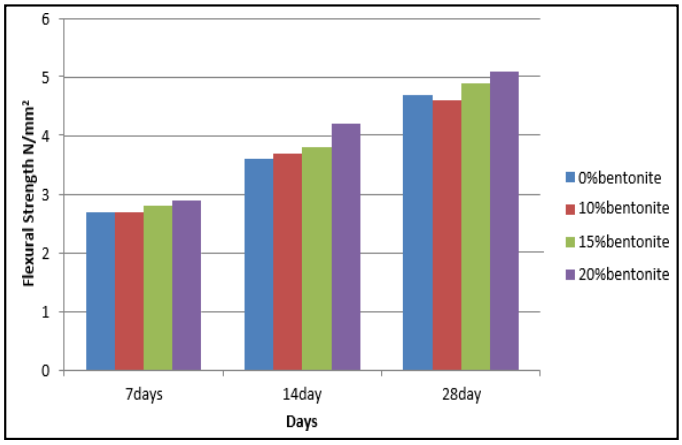

FIG VII. COMBINTION OF THE 0%,10%,15%,20% OF FLEXURAL STRENGTH

V. CONCLUSION

From the results obtained it can be concluded that Bentonite can be used in structural concrete as a partial replacement, by weight of cement, to produce durable and reliable concrete. Bentonite can be used in concretes where latter stages strength is required because Bentonite results in poor early stage compressive strength but gives good results in later stage.

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