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Self-Compacting Concrete: A Review

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Abstract: ***Self-compacting Concrete is one of the new innovative types of concrete, and it is used widely in the construction of several industries. This type of concrete can be made by using different admixtures and their combinations. The main aim of the SCC is to improve the durability of the concrete structure and also improves the workability of the concrete structure. Nowadays construction of large structures, it isn't easy to compact the reinforced concrete without voids. This can be overcome by using self-compacting concrete. This type of concrete does not require compaction. So, it is one of the significant advantages of the concrete structure and saves time and energy. This Review paper explains self-compacting concrete and its advantages and uses, and applications of SCC. This paper helps to an understanding about self-compacting concrete.***

Keywords: Self-compacting Concrete, Workability, Excellent Durability, Admixtures, Mix design, Manufacturing, Mechanical Properties.

I. INTRODUCTION

Self-Compacting Concrete is a special type of concrete used in all civil engineering and structural engineering works. It is one of the important types of innovative concrete, and it has excellent properties. It was first used at the end of the 19th century. Okamura introduces this type of concrete. This type of concrete is also known as self-consolidating concrete. One of the most important properties of this type of concrete does not require vibration or compaction. This type of concrete is flowing very easily. This type of concrete has not required more Water than compared with conventional concrete. This type of concrete is similar to the normal conventional concrete in setting and curing and mechanical properties. Normal conventional concrete is dense and viscous, but SCC is not like moderate viscosity compared to conventional concrete. This type of concrete is first used in Japan and North America, and later it is used worldwide. SCC is a fresh concrete, and it flows under its weight, and it does not require compaction.

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II. LITERATURE REVIEW

Arulsivanatham 2017 et al.

This research paper author explained the history of the self-compacting concrete and mechanical properties of SCC and materials used for SCC and explained mix design for SCC. The author also explained factors affecting self-compacting concrete and properties of fresh SC concrete. The author also explained fresh workability criteria for SC concrete, and the author explained the hardened properties of the SC concrete.

Parvin 2013 et al.

This Research Paper Author explains the physical requirements of self-compacting concrete and SC concrete making materials for construction. This author also explained the mixed design approach for self-compacting concrete and test methods on SC concrete. The author also explained on different properties are used in the self-compacting concrete and their mix design.

III. METHODOLOGY

Self-compacting concrete can be compacted into every corner of the formwork easily. Hence it is also called highly engineered concrete. This type of concrete has higher fluidity. The main problem of concrete is durability issues, which can be overcome by using self-compacting concrete. This is the main reason for the development of self-compacting concrete by Okamura in Japan.

OBJECTIVES & USES

- Economical
- Constructability is good
- Construction is faster
- Homogeneity
- Improve durability
- Structural integrity improved
- Segregation resistance is good
- Yield stress is low
- The cost of compaction is less
- Easy to place
- Reduce wear
- Do not require vibrators
- The surface finish is good
- Minimize voids
- Easier pumping
- Deformability is high
- Viscosity is moderate

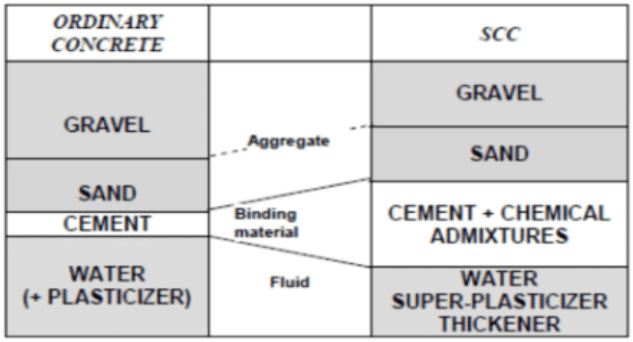
- Fewer labours required
- Low Water required
- Low cost
- Less require human resources

DIS ADVANTAGES

- Problem with creep
- Shrinkage
- Difficult to mix design & complicated
- Requires more trials
- Costlier

MATERIALS USED

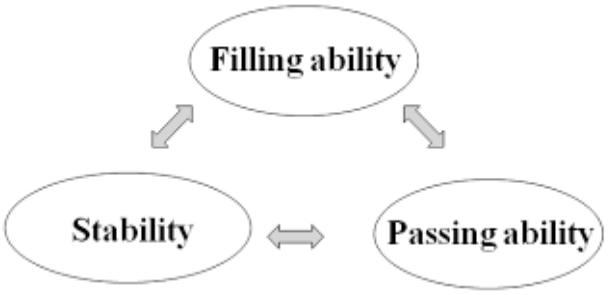
- Fine aggregate: well-graded aggregates such as cubical or rounded aggregates are used in the SCC.
- Cement: OPC 43 or 53 grade of cement is generally used in the SCC.
- Coarse aggregate: it is also similar to the above aggregates.
- Admixtures: In this type of concrete, there are two types of admixtures used. One is mineral admixture (fly ash- it increases the quality and durability of SCC concrete, silica fume- it is used to improve the various mechanical properties of the SCC concrete and GGBS it is used to improves the rheological properties of the SCC concrete). Another one is chemical admixtures (superplasticizers and air-entraining agents etc.).
- Water: normal distilled Water is used similar to conventional concrete.



Properties of SCC

In this, there are three important properties for SCC. The first one is the ability to fill- this is also called the filling ability. The second one is ability of passing- this is also called passing ability, and the last one is resistance to Segregation.

- **Filling Ability:** In this property of the concrete flows easily at a certain speed in the formwork.
- **Passing Ability:** In this property, concrete is passing safely and easily into reinforcement without any troubles. So, the passing of material into the steel or reinforcement is very easy compared to the normal conventional concrete.
- **Segregation Resistance:** In this, aggregates are homogeneously distributed along with horizontal and vertical directions.



Manufacturing and Production

In this, proportions of the concrete are taken utilizing volume rather than the mass of concrete. So, aggregates are all taken from the same source only, i.e., source of aggregates is the same for all. After that, mixing can be done for a longer time than the standard conventional concrete. After the mixing of concrete, placing can be done with the help of types of equipment. In this, after the placing, curing can be done similar to conventional concrete.

Mix Design

In this mix design of concrete, a sequential order can be followed for self-compacting concrete. In this first determine the following properties

- Air content- in this air content used around two percentage.
- The volume of coarse aggregate- should below
- Content of sand- low
- Mixing Composition- good
- Amount of Admixture- more
- Water powder ratio- low

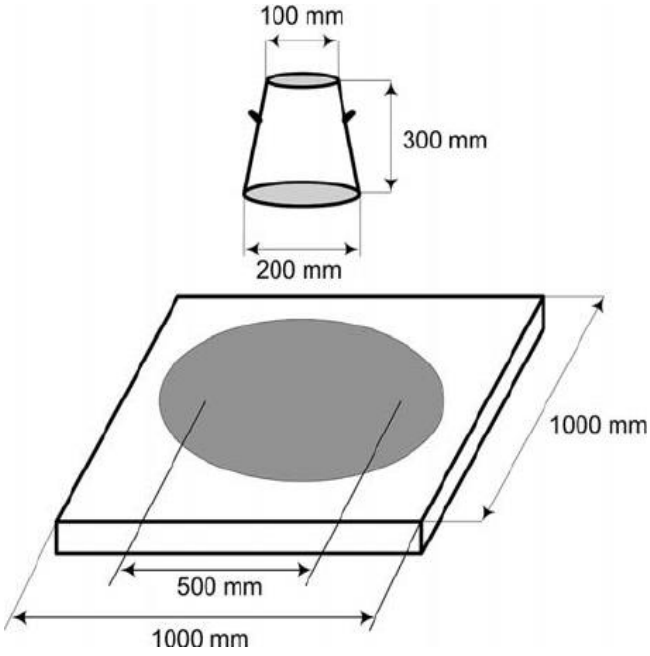
IV. APPLICATIONS

- Used for repair and rehabilitation of structures
- Used for retaining walls for highly durable and stable
- Used for construction pile foundations
- Used in the construction of raft foundation
- Used for complicated structures with steel
- Used in areas of pipes and conduits
- Columns
- Drilled shafts

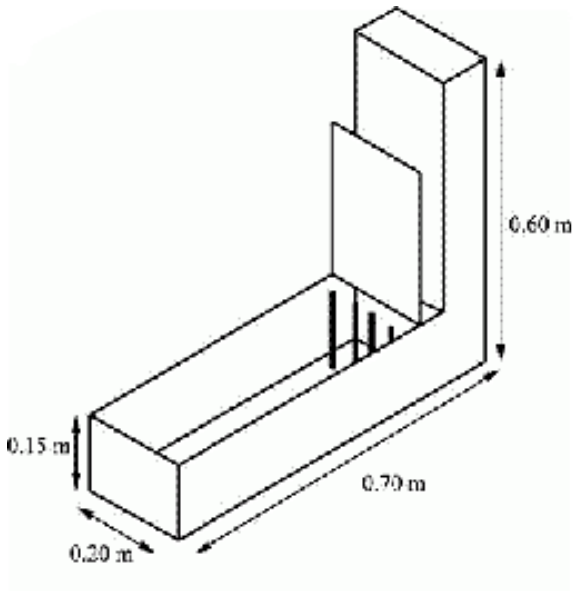
V. TESTS & RESULTS

There are different types of tests used on self-compacting concrete to test its durability and performance. In this one of an important type of tests are as follows;

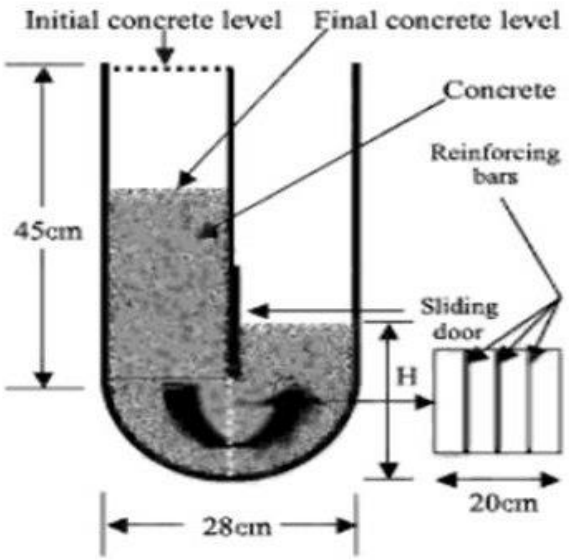
Slump flow test: it is the one of important test on self-compacting concrete. This test is used to know the horizontal flow of the concrete. It is used to know the filling capacity or ability of the concrete. This type of test can be performed in the field.



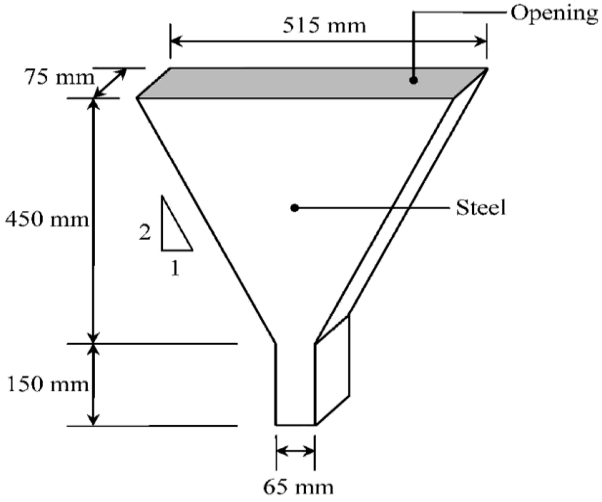
L box test: this type of test is used to determine the passing ability of the concrete. Around 14-15 litres of concrete can be filled into the vertical section of the L Box. This test can be completed within five minutes for better results. Calculate the blocking ratio H2/H1.



U box test: this type of test is also used to calculate the concrete's passing ability. In this test, around twenty litres of concrete are taken into the U Box. In this, there are two compartments in the U Box. The first compartment height is measured (H1), and the second compartment of the U Box measured height is (H2). The complete process of this test can be complete within five minutes only. The filling height of this test is H1-H2. If the value of H1-H2 equals zero, then the concrete passing ability is good and which is flows like Water and the filling height is not more than 30 mm.



V funnel test: this type of test is conducted to know the filling ability of the concrete. This size of aggregates is used around 20 mm. this test is also used to determine the segregation resistance.



GTM screen stability test: this type of test is used for segregation resistance of concrete.

Orimet test: this is also one of the filling abilities tests of concrete.

VI. CONCLUSION

Self-compacting concrete is an excellent material for the construction of any structures. There are many advantages and applications are there for using SCC rather than conventional concrete. It is also one of the finest good building materials for the construction of structures. The compaction amount depends on type of concrete; by using this no, there is no need for Some are disadvantages are also but develop a good SCC according to IS Codes to improve the concrete's workability. The main conclusion of using the self-compacting concrete is as follows;

- Save time
- Save cost
- Increase durability
- Safe working environment
- The cost of SCC is higher than conventional concrete, about 10-15%.

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