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# FLEXURAL STRENGTH OF SELF COMPACTING CONCRETE

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## Abstract:

Concrete is often considered to be the ultimate construction material. Normal concrete is a vibrated concrete and it is dense aggregate mix that requires mechanical vibrations or poking to remove air pockets that become trapped during the pouring and mixing process. Hence to overcome these defects the self-compacting concrete is used. Although SCC was originally used in specialized situations, over time it became a superior alternative to conventional vibrated concretes. The self-compacting concrete flows easily at suitable speed into formwork without blocking through the reinforcement without being heavily vibrated. The major steps in the production of Self Compacting Concrete are proper design of mixes, the selection of admixtures that has the ability to maintain fluidity of mix and evaluating the properties of the concrete obtained. This project deals with the flexural strength of self- compacting concrete where the cement is partially replaced with fly-ash as10%, 20%, and 40% by weight of cement. . The optimized dosage of super plasticizer of 0.5% of powder content is used in each mix. The flexural strength characteristics are studied.

*Keywords* –– **Self compacting concrete, fly ash, superplastisizers, flexural strength.**

## Introduction:

Building materials are the backbone of civil engineering construction. Among all the modern building materials, concrete is one of the oldest, but most versatile materials, with an annual worldwide production of over 4.5 billion metric tones. It is a manufactured material that can, with appropriate knowledge, be tailored for optimum performance when compared with other construction materials. It posses many advantages including relatively good compressive strength, low cost, general availability of raw materials, adaptability, low energy requirement and utilization under different environmental conditions.

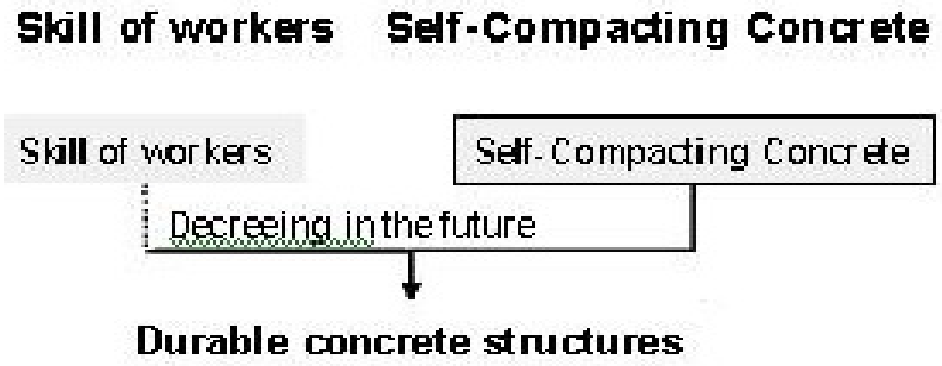
Concrete has its limitation – it can't on its own, flow past obstructions and into nooks and crannies. Through compaction, often using variation is essential is essential for achieving strength and durability of concrete. Rock pockets, sand streaks and a host of workmanship – related problems will come on behalf of concreting.

**Self Compacting Concrete (SCC)** is a form of concrete that is capable to flow into the congested interior of the formwork, passing through the reinforcement and filling it in a natural manner, consolidating under the action of its own weight without having defects due to segregation and bleeding. Partial replacement of cement with industrial by-products such as fly ash further economized the production and use of SCC.

Self Compacting Concrete (SCC) has been described as **"the most revolutionary development in concrete construction for several decades."**

The motive for development of self-compacting concrete was the social problem on durability of concrete structures that arose around 1983 in Japan. Due to a gradual reduction in

the number of skilled workers in Japan's construction industry, a similar reduction in the quality of construction work took place.




Self compacting concrete is just a type of concrete. It is not a mixture of different substances but is formed by combining mixes having the same flow characteristics.

There are three main aspects of designing a SCC mix

- A high range water reducing substance or super plasticizer is added for high flowing characteristics.
- A type of aggregate mixture is added to gain the desired compactness. It is to note that the aggregate content is of round shape and proportional in size in order to increase the locking tendency.

Alteration of fluid properties to ensure a cohesive mix which will keep the aggregate and paste together. These fluid properties can be achieved by adding high quantity of fine contents such as cement fly ash etc.

**Methodology:**

Based on design mix flexural strength is calculated for self compacting concrete.cement,fine aggregate, coarse aggregate, water ,fly ash,superplasticizer are material for making mix design.

**Cement-** Cement is an extremely ground material having adhesive properties, which provide a binding medium for the discrete ingredients. The product obtained by burning, cooled and ground to the required fineness to produce materials know as cement.

**Aggregates-** The aggregate is used primarily for the purpose of providing bulk to the concrete. The fine aggregates are Natural sand,.Crushed stone sandCrushed gravel sand. Coarse aggregates are Crushed gravel or stone ,Uncrushed gravel or stone ,Partially crushed gravel or stone .

**Water**- Water used for mixing and curing shal be clean and free from injurious amount of oils, acids, alkalis, salts, sugar, organic material the may be deleterious to concrete or steel permissible limits for solids is based on IS 456 – 2000.

**Fly ash**- concretes containing fly ash in order to determine it effect on the air-void stability. 10% to 20% by mass of fly ash was used in the total amount of cementitious material. The tests undertaken indicated that air contents of concrete containing Class C fly ash appeared to be more stable than those of concrete containing Class F fly ash. This occurred primarily because Class C fly ashes have lower organic matter content and carbon content values. The studies revealed that the higher the organic matter content of a fly ash, the higher would be the air-entraining admixture requirement for concrete in which the admixture is used.

Super plasticizer: Super plasticizers (high-range water-reducers) are low molecular-weight, water-soluble polymers designed to achieve high amounts of water reduction (12-30%) in

concrete mixtures in order to attain a desired slump (Gagne et al., 2000). These admixtures are used frequently to produce high-strength concrete (> 50 MPa), since workable mixes with water-cement ratios well below 0.40 are possible.

**Fineness Test -**Correctly 100 grams of cement was weight and taken in a standard IS sieve no 90µ. The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed. % of Residue left on the sieve on 90µ is 1.5.

**Standard consistency test-**Standard consistency of a cement paste is defined as that consistency which will permit a vicat plunger having 10 mm dia and 50 mm length to penetrate to a depth of 33-35 mm from top of the mould. As per the test standard consistency result by water with respect to cement to produce standard consistency is 37%.

**Sieve Analysis -**The sample was brought to air-dried condition before weighing and sieving was achieved after drying at room temperature. The air-dry sample was weighed and sieved successively on the appropriate sieves starting with the largest size sieve.

Fine aggregates fineness modulus is 2.80.

Coarse aggregate fineness modulus is 3.67.

**Experimental study:**

Self-compacting concrete typically has a higher content of fine particles and different flow properties than the conventional concrete. It has to have three essential properties when it is ready for placement: filling ability, resistance to segregation, and passing ability.

**Table 1:Design Mix**

| Water Lit | Cement Kg | Fine aggregate Kg | Coarse aggregate Kg |
|---|---|---|---|
| 178 | 366 | 534 | 1160 |
| 0.48 | 1 | 1.45 | 3.17 |

The beam specimens were of size 100mm x 100mm x 500mm. Then they were left from the mould for a day after the concreting and them put in the curing tank for 7 days and 28 days curing.

**Flexural Strength Test**

The concrete was filled in to the beam moulds of known size. After mould was filled the top surface of the mould was finished with out any undulation. After a day the mould is removed. After taking out from the mould and it was subjected to curing for 7 days and 28 days age. The machine is prepared by providing two rollers on its base. The load is applied through a roller at the center. The rollers are mounted in such a manner that the load is applied axially and without subjecting specimen to any torsion stresses. The load is increased until the specimen fails and the maximum load applied to the specimen during the test is recorded. The different mix proportions are

S000 = MIX (00% FLY ASH + 0.5% S.P)

S00 = MIX (10% FLY ASH + 0.5% S.P)

S001 = MIX (20% FLY ASH + 0.5% S.P)

S002 = MIX (40% FLY ASH + 0.5% S.P)

**Table2 : 7 Days Flexural Strength Test**

| S.No | Mix | Fly Ash % | Superplasticizer | 7 Days Strength N/mm$^2$ |
|---|---|---|---|---|
| 1 | S000 | 00 | 0.5 | 5.30 |
| | S00 | 10 | 0.5 | 5.52 |
| 2 | S002 | 20 | 0.5 | 4.78 |
| 3 | S004 | 40 | 0.5 | 3.95 |

**Figure 1:Flexurl strength for -7 days**

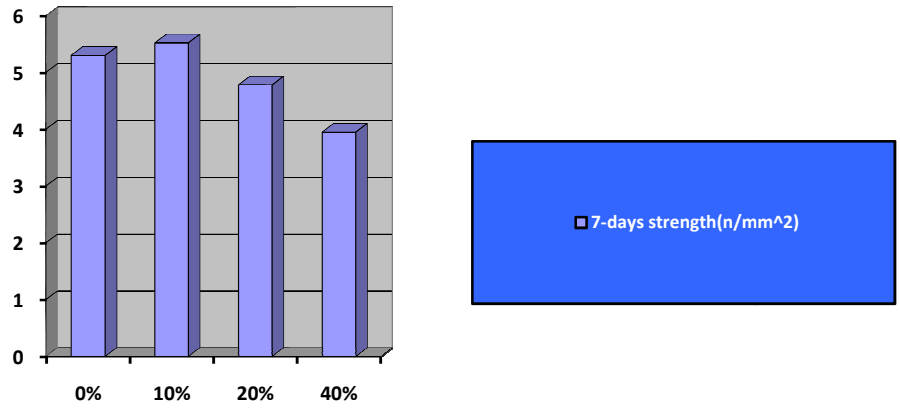
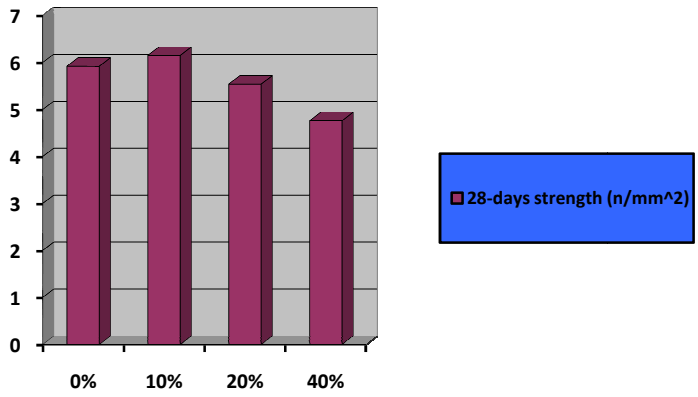



**Table 3 : 28 Days Flexural Strength Test**

| S.No | Mix | Fly Ash % | Superplasticizer | 28 Days Strength N/mm$^2$ |
|---|---|---|---|---|
| 1 | S000 | 00 | 0.5 | 5.92 |
| 2 | S001 | 10 | 0.5 | 6.15 |
| 3 | S001 | 20 | 0.5 | 5.54 |
| | S002 | 40 | 0.5 | 4.76 |

**Figure 2:Flexurl strength for -28 days**




**Result and Discussion:**

Based on laboratory study it was found that workability increased with increase in fly ash content, but it followed different strength charecteristics.The strength of the concrete increased fly ash in 10% replaced with cement. So, use only 10% replaced by the cement. As a scope for future work the research can be carried out by replacing fine aggregate with fly ash in account of meeting the strength requirements. The fresh concrete properties show good filling ability, segregation resistance with replacement of cement with different mineral admixtures. Hardened concrete properties decreases with the addition of mineral admixtures.

**Conclusion:**

Based on above study the self- compacting concrete where the cement is partially replaced with fly-ash as0%,10%, 20%, and 40% by weight of cement. . The optimized dosage of super plasticizer of 0.5% of powder content is used in each mix.Incresing the fly ash content the strength is gradually decreasing.

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