

## Effect of Steel Fiber on Self-compacting Concrete: A Review

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**Abstract** – This review paper represents the collection of data and conclusion of the various studies done on the strength properties of steel fibered self-compacting concrete. Addition of Steel fiber at certain limit improves compressive strength and not only suppress the formation of cracks, but provides more strength. Steel Fibers have been added to hardened state. Fiber reinforced concrete becomes necessary whenever durability that is limited crack widths or safety considerations are design criteria.

**Key Words:** Self compacting concrete, Steel fiber, Superplasticizer, Compressive strength, Durability.



Fig -1: Slump flow test

### 1. INTRODUCTION

The Self compacting concrete (SCC) is a flowable concrete which flow by its own weight and achieve good compaction without use of vibrator. SCC has good cohesive properties which resist segregation. The raw material an important part of the mix design process for SCC, because it effects on stability as well as the cost of the mix. SCC or any plain concrete is known to be brittle and can easily crack under tensile force.

The Self compacting concrete (SCC) was first developed in Japan in 1988 to achieve durable concrete structures. SCC is described as the most revolutionary development in concrete construction for several decades. Originally developed due to shortage of skilled labour, it is economically because of a number of factors, such as: faster construction, reduction in site manpower, better surface finishes, easier placing, improved durability, greater freedom in design, thinner concrete sections, reduced noise levels, absence of vibration and safer working environment [1]. The successful development of Self compacting Concrete must ensure a good balance between stability and deformability. Researchers have set some guidelines and tests such as Slump flow shown in Fig.-1, V-Funnel test shown in Fig.-2 and L-Box test shown in Fig.-3 for mixture proportioning of SCC, which include reducing the volume ratio of aggregate to cementitious material, increasing the paste volume, water-powder ratio (w/p), carefully controlling maximum coarse aggregate particle size, total volume and using various viscosity modifying agent (VMA).



Fig -2: V-Funnel Test



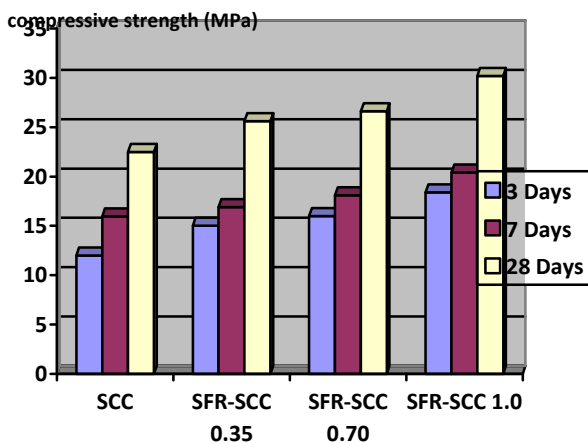
Fig -3: L- Box test

## 2. Literature Review

**Abhishek Sachdeva and Pankaj Singhal [2]** studied the effect of steel fiber in self-compacting concrete (SCC) with variation from 0.35%, 0.70% and 1% by weight of cement and also varied viscosity modifying agent (VMA) from 0.1 to 0.2% by weight of cement. The ability of flow was measured with slump-flow test, V-funnel test and L-Box test. They used flyash in steel fiber self-compacting concrete (SF-SCC). It was observed that compressive strength in case of 0.35% steel fiber mix was more than that of SCC and 0.70% steel fiber mix at any day was more than that of 0.35% mix and compressive strength of 1% steel fiber is more than that of 0.35% and 0.70% mix. So it is found that with the increase in steel fiber, compressive strength also increased.

**Table -1:** Compressive Strength result

Compressive Strength Result			
Mix	3 Days	7 Days	28 Days
SSC	12	15.9	22.5
SFR-SCC .35%	15	16.9	25.6
SFR-SCC .70%	16	18.1	26.6
SFR-SCC 1.0%	18.4	20.4	30.2



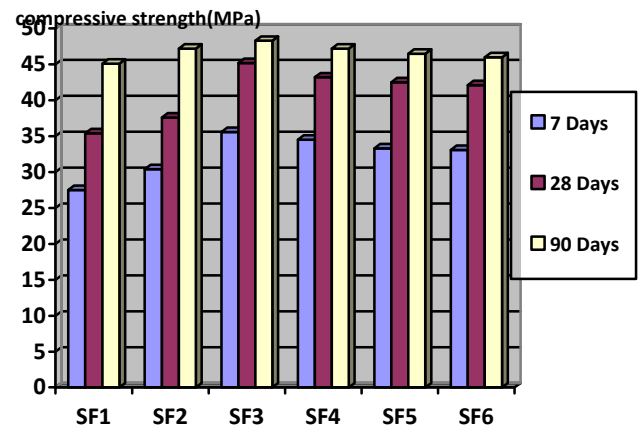
**Chart -1:** Compressive strength result test

**Abbas AL-Ameeri [3]** considered that Steel fibers had effect on compressive, tensile strength, flexural strength, and modulus of elasticity and ultrasonic pulse velocity of steel fiber self-compacting concrete. The content was (0 – 1.5 %) steel fiber by volume of mix. All fiber mixes performed for tensile strength, and flexural strength relative to plain mix at all curing ages. The strength increased as the fiber content increased. The results indicated that the workability reduced

with the increase of steel fiber content. The steel fiber content of 1.5% by Vol. of mix had better effect on hardened properties but worst on fresh properties of SCC. As well as 0.75% and 1% steel fiber content were sufficient for achieving satisfying performance in fresh and hardened properties of SCC.

**Table- 2:** Compressive strength

MIX	Compressive Strength		
	7 Days	28 Days	90 Days
SF1 (0%)	27.5	35.4	45.1
SF2 (0.50%)	30.4	37.6	47.2
SF3 (0.75%)	35.6	45.2	48.3
SF4 (1.0%)	34.5	43.2	47.2
SF5 (1.25%)	33.3	42.5	46.5
SF6 (1.50%)	33.1	42.1	46.0



**Chart-2:** Compressive Strength Test

**Krishna Murthy.N et. al. [4]** observed that Self-compacting concrete possesses improved qualities and productivity and working conditions due to elimination of voids. A simple tool has been designed for self-compacting concrete mix design with 29% of coarse aggregate, replacement of cement with Metakaolin and class-F flyash, combinations of both and controlled SCC mix with 0.36 water/powder ratio (by weight) and 388 liter/m<sup>3</sup> of cement paste volume. After that they found, this tool is simple and user friendly for SCC design mix, and considered to be the most promising building material for the revolutionary changes in construction.

**H Okamura and M Ouchi [5]** discussed about development of Self compacting concrete, also named it "High Performance Concrete" and defined the three stages of concrete namely Fresh (self-compactable), Early age (avoidance of initial defects) and After hardening (protection against external factors). He told about mechanism for achieving self-compatibility, influence of coarse aggregate depending on spacing size, role of mortar as fluid in flowability of fresh concrete, role of mortar as solid particles, influence of coarse aggregate -content, shape & grading after that he concluded self-compacting concrete becomes so widely used that it will be seen as the "standard concrete" rather than as a "special concrete," we will have succeeded in creating durable and reliable concrete structures requiring very little maintenance work.

**Nan Su et. al. [6]** proposed a new mix design method for self-compacting concrete (SCC) called NAN SU Method. The amount of aggregates, binders and mixing water, as well as type and dosage of superplasticizer (SP) to be used are the major factors influencing the properties of SCC. Slump flow, V-funnel, L-box, U-box and compressive strength tests were carried out to examine the performance of SCC, and the results indicate that the proposed method could produce successful SCC of high quality. They introduced the Packing Factor (PF) of aggregate which is defined as the ratio of mass of aggregate of tightly packed state in SCC to that of loosely packed state.

### 3. CONCLUSIONS

1. Compressive strength increases with increment of steel fiber in SFR-SCC
2. Workability slightly decrease with increase of steel fiber in SFR-SCC
3. Flexural strength increases with increment of steel fiber in SFR-SCC
4. Tensile strength increase with increment of steel fiber in SFR-SCC
5. Self-compacting concrete is simple and user friendly.

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