Outturn of Steel Fibres on Self Compacting Concrete: A Review

Priyadharshini V[1], Dr. K. Sudha[2]
[1]Dept of Civil Engineering
[2]Associate Professor, Dept of Civil Engineering
[1, 2] Government College of Engineering, Salem, Tamilnadu, India.

Abstract- *This article interprets the results of various studies done on the self-compacting concrete by incorporating steel fibres at different proportions. By incorporating steel fibres, the resistance to the formation of flexural cracks is increased. Also, the flexural cracking stress increases due to the addition of fibres. But adding fibres to the fresh concrete has some negative effect on its fresh properties (workability). Yet a good flowability may be achieved if some modifications are done in the mix proportions.*

Keywords- Self compacting concrete, steel fibre, workability, Complete compaction.

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 the 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 lack of uniformity and complete compaction of concrete by vibration researches at the University of Tokyo, Japan started in late 1980's to develop SCC. By early 1990's Japan has developed and used SCC that does not require vibration to achieve full compaction. In India, during the last few years, attempts were made in the laboratories and in the fields to develop and use SCC. However, large scale uses have been rare. The Self Compacting Concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. Generally, fibers are added in concrete to suppress the formation of cracks which occurs due to plastic and drying shrinkage. Use of steel fibre makes significant improvements in flexural, impact and fatigue strength of concrete. The steel fibre is likely to get rusted and lose some of its strength. But investigations have shown that the rusting of the fibres take place only at the surface. Incorporating steel fibre in self compacting concrete has dual advantage i.e., it makes the concrete to flow easily even in congested reinforced areas.

II. LITERATURE REVIEW

[1] Thomas Paul, Habung Bida, Bini Kiron, Shuhad A K, martin Varghese – For this study they used OPC 53 grade, coarse aggregate of size 20mm and hooked-end steel fibre with aspect ratio of 75. For different percentage of fibres (0%, 0.4%, 0.8%, 1.5%) beams, cubes and cylinders were casted. It was observed that the slump value decreases as the percentage of fiber increases, which means workability decreases with increase in fibre content. When compared to other fibre content proportion 0.8% of steel fibre possessed good compressive strength, flexural strength and split tensile strength. It was also observed that the ductility of SCC was found to be increased with increase in fibre content.

[2] Bhalchandra, Pawase Amit Bajirao - For this study, a cube specimen of size 100mm × 100mm × 100mm and beam specimen of size 500mm x 100mm × 100mm for different proportions of steel fibre (0% to 3%) were casted in order to determine its compressive and flexural strength. It was observed that the compressive and flexural strength increase with increase in the percentage of fibre content.

[3] Venkateswaran, Nandhini, Ponmalar – For this experimental work, they conducted several tests on fresh and hardened concrete. They concluded that the workability and compressive strength reduced when the percentage of steel fibre (0%, 0.5%, 1%) was increased. It also observed that the flexural strength was increased on increasing the percentage of steel fiber.

[4] Ipsita Bose Roy Choudhury, Naveen Kumar, Raghunandhan – Experimental investigation were carried out to determine the compressive, split tensile and flexural strength of steel fiber reinforced Self compacting concrete with steel fibre of proportion 0%, 0.25%, 0.5%, 0.75%, 1%, 1.25% and 1.5%. When compared to other fibre proportion, 1.25% possessed good compressive strength, split tensile

strength and flexural strength. But, the workability reduced on increasing the percentage of fibre content.

[5] Abhishek Sachdeva, Pankaj Singhal – studied the effect of steel fibre in self compacting concrete with from 0.35%, 0.75% and 1% by weight of cement. The flowability was measured with slump-flow test, V-funnel test and L-box test. They used fly ash in steel fiber SCC. It was observed that the compressive strength and flexural strength of 1% steel fiber SCC was more than that of 0.35% and 0.75%. It was also observed that the workability of the concrete decreased with increase in steel fibre percentage.

[6] B. Krishna Rao, Professor V. Ravindra (2010)- In this Study the steel fibre of diameter 0.92mm, tensile strength of 331Mpa and a specific gravity 7.850 were taken. The main variables used in the study were three different values of aspect ratios (15, 25 and 35) and the corresponding lengths were 13.8mm, 23 mm and 32.2mm respectively. Three different values of percentage of volume fraction of steel fibers (0.5%, 1.0% and 1.5%) and the corresponding weights were 39.25, 78.50, and 117.75 kg/m3 respectively. The two control mixtures did not contain any steel fibers. Out of these two, one was normal compacting concrete (NCC) of M30 grade and the other one had fly ash replacing 35%, by weight of cement (A0V0). All of the remaining mixtures had the same amount of fly ash replacing 35% by weight of cement. These were named as A1V1, A1V2, A1V3, A2V1, A2V2, A2V3, A3V1, A3V2 andA3V3 indicating the three different values of aspect ratios (i.e. A1=15, A2=25 andA3=35), and three different values of percentage of volume fraction (i.eV1=0.5%, V2=1% and V3=1.5%) of steel fiber incorporated in the mixture. The most significant changes were observed on the compressive strength, split tensile strength and later on flexural strength. The substitution of fly ash without steel fibers resulted in lower compressive, split tensile and flexural strengths at 7d, 28d, and 56d even though the w/p of the mixture was kept constant. The reduction in compressive strength was 8.35% at 7d, 2.37% at 28d, and 2.16% at 56d. The reduction in split tensile strength was 2.79% at 7d, and 5.79% at 28d. The reduction in flexural strength was 5.03% at 7d, and 2.99% at 28d. This reduction could be attributed to the low pozzolanic activity of the fly ash. But the increase in compressive, split tensile and flexural strength was 2.19%, 2.25% and 1.69% at 90d. The fiber content increased from 0.5 to 1.0%, and from 1 to 1.5% decreases. However, only marginal increase was noticed in the ultimate strength. On the other hand, maximum compressive, split tensile and flexural strength was found to be increased markedly and maximum increase was about 7.20%, 11.07% and 8.77% at 90d in the case of specimen with aspect ratio 25 and volume fraction 1%. SFRSCC mix showed higher compressive, split tensile and flexural strength rather than normal compacting concrete.

[7] Chithambar ganesh, Muthukannan – For this study, the steel fiber added in proportions such as 0.25%, 0.5%, 0.75% and 1%. The compressive, split tensile strength were analyzed. The test results were observed for both fresh and hardened concrete. On increasing the percentage of fibre content, the workability reduced and its compressive strength and split tensile strength about 0.75% of fibre possessed good strength followed by gradual reduction of strength.

[8] Shalini mohan, Rajalingam - A study was performed for M30 grade with fiber content of various proportion (0.5%, 0.1% and 1.5%). Both fresh and hardened properties were studied. It was observed that the fresh properties of SCC decreased with increase the percentage of steel fiber where its compressive and flexural strength increased with increase in fiber content.

III. CONCLUSION AND DISCUSSION

- From the existing literatures, the most desirable quantity of steel fibers is in the range of 0.5% to 1.5%.
- Addition of Steel Fibers to the SCC, significantly increases the flexural strength.
- Addition of Steel Fibers to the SCC, significantly increases the Compressive strength and Split tensile strength up to certain extent and then decreases.
- On increasing the fiber content, the mode of failure changes from brittle to ductile when subjected to compression and bending. i.e., ductility property is good.
- Fresh Properties of SCC with steel fibres decreases on increasing the percentage of steel fiber.Howeverit can be corrected by increasing the dosage of Superplasticizer or by modifying the mix proportion.

REFERENCES

[1] *"Experimental study on Self Compacting Concrete with Steel fibre reinforcement"* by Thomas Paul, Habung Bida, Bini Kiron, Shuhad A K, martin Varghese – International Journal of Science, Engineering and Technology Research (IJSETR) Volume 5, Issue 4, April 2016.

[2] *"Performance of Steel fibre Reinforced Self Compacting Concrete"* by Dr.Mrs. S.A. Bhalchandra, Pawase Amit Bajirao – International journal of Computational Engineering Research (ijceronline.com) Vol.2 Issue.4

[3] *"Study on Steel Fibre Reinforced Self Compacting Concrete"* by A. Venkateshwaran, K.Nandhini ,V.Ponmalar –Asian Journal of Engineering and Applied

Technology ISSN:2249-068X Vol.7 No. S1, 2018, pp. 11-15

[4] *"Study on structural performance of steel fibre reinforced self -Compacting concrete"* by Ipsita Bose Roy Choudhury, Naveen Kumar B, Raghunandan MH – International Journal of Advance Engineering and Research development Volume 4, Issue 6, june-2017.

[5] *"Strength evaluation of steel fibre reinforced- Self compacting concrete"* by Abhishek Sachdeva, Pankaj Singla – International Journal of Engineering Research and Technology (IJERT) ISSN:2278-0181, Vol.4, Issue 09, September 2015.

[6] *"Steel Fibre Reinforced Self-Compacting Concrete Incorporating Class F Flyash"* by B. Krishna Rao, Professor V. Ravindra – International Journal of Engineering Science and Technology Vol.2(9), 2010, 4936-4943.

[7] *"Effect of steel fibers over the self-Compacting concrete"* by A.Chithambar Ganesh, M. Muthukannan – International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN:2278-3075, Volume -9 Issue- 2S2, December 2019.

[8] *"Steel fiber Incorporated Self compacting concrete"* by shalini Mohan, Prof.M. Rajalingam - International Journal of Innovative Science, Engineering and Technology, vol.3 Issue 4, april 2016. ISSN 2348-7968.