International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 13
October 2017

Influence of Super plasticizer on The Properties of High Strength Concrete.

Mr.Rayavaram Girish & Mr. Shaik. Fazul
1 PG Student, Dept. Of Structural Engineering , SKR College Of Engineering & Technology, AP
2 Asst. Professor, Dept. Of Structural Engineering, SKR College Of Engineering & Technology, AP

Abstract— *This paper outlines an experimental study that measures the effects of superplasticizer admixture on proprieties of concrete. However, Superplasticizers are the most important admixtures enhancing concrete performance. The development of new superplasticizers during the last decades has determined the most important progress in the field of concrete structures. Hence, an experimental investigation was conducted to determine the optimum dosage for the admixtures and to study the effect of over dosage of the mentioned admixtures. Concrete mixes with SP dosages of 600, 800, 1000 and 1200 ml/100kg of cement were prepared, together with one control mixes. After casting, normal curing was carried out on the concrete samples. Properties such as compressive strength were determined, besides determining the workability of the fresh concrete. However, compressive strength is improved by dosage 1.0 Of SP after 28 days curing is 55 N/mm^2, which is higher than that of control concrete, the optimum amount of admixture must be 1 %. Over dosage of SP found to deteriorate the properties of concrete with indication of lower compressive strength. However, if the dosage levels are lower than the optimum dosage, increase in admixture dosage might help to enhance the concrete characteristics.*

Keywords— Superplasticizer, Admixture, Compressive Strength, Concrete.

1.INTRODUCTION

HIGH performance concrete (HPC) has recently become very attractive to civil engineers and material scientists. As it exhibits higher workability, greater mechanical Properties and better durability, HPC has been increasingly applied in the constructions such as tall building, bridges and off-shore structures [1]. One important chemical admixture in preparing HPC is superplasticizer. The most important improvement in concrete technology during the 30 last years has been the use of superplasticizers. However, the reason that superplasticizers are much more important than any other chemical admixture is the number of improvements, which can be achieve by its use. However, the reason for widespread usage of admixtures is that admixtures are able to impart considerable physical and economic benefits with respect to concrete. However, usage of admixture is not remedy for poor quality of concrete due to the use of incorrect mix proportion, poor workmanship in concrete mixing and the problems caused by low quality raw materials selection. According to [2,3], advances in superplasticizers,

containing alternative water soluble synthetic products, have been proposed in the Been proposed in the last decade to reduce the slump-loss drawback which can partly or completely cancel the initial technical advantage associated with the use of superplasticizers (low *w/c* ratio or high slump level). An admixture, according to the ASTM C-125- 97a standards, is a material other than water, aggregates or hydraulic cement that is used as an ingredient of concrete or mortar, and is added to the batch immediately before or during mixing. A material such as a grinding aid added to cement during its manufacture is termed an additive [4]. Superplasticizer is a type of water reducers; however, the difference between superplasticizer and water reducer is that superplasticizer will significantly reduce the water required for concrete mixing [5]. Superplasticizer is a type of water reducers; however, the difference between superplasticizer and water reducer is that superplasticizer will significantly reduce the water required for concrete mixing [5]. Generally, there are four main categories of superplasticizer: sulfonated melamine-formaldehyde condensates, sulfonated naphthalene-formaldehyde condensaes, modified lignosulfonates and others such as sulfonic- acid esters and carbohydrate esters. Effects of superplasticizer are obvious, i.e. To produce concrete with a very high workability or concrete with a very high strength. Mechanism of superplasticizer is through giving the cement particles highly negative charge so that they repel each other due to the same electrostatic charge. By deflocculating the cement particles, more water is provided for concrete mixing [5]. For general usage, dosage of superplasticizer is between 1- 3 l/m^3. However, the dosage can be increased to as high as 5- 20 l/m^3. Since concentration of superplasticizer is different, any comparison of performance should be made on the basis of the amount of solids, and not on the total mass. Effectiveness of a given dosage of superplasticizer depends on the water/cement ratio. Effectiveness increases when w/c decreases. Compatibility with actual cement is one of the most important parameters that needed to be considered, and it is not recommended that the cement and superplasticizer conform the standard separately [5].

According to Yamakawa, the utilization of superplasticizer will have positive effects on properties of concrete, both in the fresh and hardened states. In the fresh state, utilization of superplasticizer will normally reduce tendency to bleeding due to the reduction in water/ cement ratio or water content of concrete. However, if water/ cement ratio is maintained, there is tendency that superplasticizer will prolong the time of set of concrete as more water is available To lubricate the mix. In the case of hardened concrete, [6] highlighted that the use of superplasticizer will increase compressive strength by enhancing the effectiveness of compaction to produce denser concrete. Risk of drying shrinkage will be reduced by retaining the concrete in liquid state for longer period of time. In addition, rate of carbonation become slower when water/

cement ratio is decreased with the presence of superplasticizer.

II.OBJECTIVES OF THE STUDY

The objectives must be clearly defined; the followings are the objectives of the study, which include:

- To determine the optimum dosage of concrete superplasticizer for normal concrete.

- To investigate the effects of superplasticizer on properties of concrete.

- been proposed in the last decade to reduce the slump-loss drawback which can partly or completely cancel the initial technical advantage associated with the use of superplasticizers (low *w/c* ratio or high slump level).

- An admixture, according to the ASTM C-125- 97a standards, is a material other than water, aggregates or hydraulic cement that is used as an ingredient of concrete or mortar, and is added to the batch immediately before or during mixing. A material such as a grinding aid added to cement during its manufacture is termed an additive [4]. Superplasticizer is a type of water reducers; however, the difference between superplasticizer and water reducer is that superplasticizer will significantly reduce the water required for concrete mixing [5].

-

Superplasticizer is a type of water reducers; however, the difference between superplasticizer and water reducer is that superplasticizer will significantly reduce the water required for concrete mixing [5]. Generally, there are four main categories of superplasticizer: sulfonated melamine- very high workability or concrete with a very high strength. Mechanism of superplasticizer is through giving the cement particles highly negative charge so that they repel each other due to the same electrostatic charge. By deflocculating the cement particles, more water is provided for concrete mixing [5]. For general usage, dosage of superplasticizer is between 1- 3 l/m^3. However, the dosage can be increased to as high as 5- 20 l/m^3. Since concentration of superplasticizer is different, any comparison of performance should be made on the basis of the amount of solids, and not on the total mass. Effectiveness of a given dosage of superplasticizer depends on the water/cement ratio. Effectiveness increases when w/c decreases. Compatibility with actual cement is one of the most important parameters that needed to be considered, and it is not recommended that the cement and superplasticizer conform the standard separately [5].

According to Yamakawa, the utilization of superplasticizer will have positive effects on properties of concrete, both in the fresh and hardened states. In the fresh state, utilization of superplasticizer will normally reduce tendency to bleeding due to the reduction in water/ cement ratio or water content of concrete. However, if water/ cement ratio is maintained, there is tendency that superplasticizer will prolong the time of set of concrete as more water is available

formaldehyde condensates, sulfonated naphthalene-formaldehyde condensaes, modified lignosulfonates and others such as sulfonic- acid esters and carbohydrate esters. Effects of superplasticizer are obvious, i.e. to produce concrete with a

III. EXPERIMENTAL*2B* PROGRAM

This study will focus on normal strength concrete with characteristic strength of 30 N/mm^2*PP* at 28 days, which used Ordinary Portland Cement (OPC) as binder, 20 mm granite coarse aggregate and sea sand. Sikament® R2002 as superplasticizer. One control mix will be prepared without the use of any admixture. To investigate the effects of superplasticizer, four additional mixes was prepared using admixture dosage of 600, 800, 1000, and 1200 ml/ 100 kg of cement. Slump test used to assess the workability of the concrete mixes. Compressive strength used to determine on concrete cube at 28 days. All samples for hardened concrete test cured in water maintain at temperature of 27 $\pm$ 2ºC (BS 1881: Part 111: 1983). However, five specimens with the dimension of 150 mm x 150 mm x 150 mm fabricated in the Structural Engineering Laboratory of Azzaytuna University, Libya.

IV. RESULTS AND DISCUSSION

A. Effect Of Superplasticizer On Slump Test

The results for slump loss of superplasticized concrete summarize in Table I.

TABLE I
SLUMP LOSS FOR SUPERPLASTICIZED CONCRETE

Concrete mix	Sikament® R2002 ratio %	Slump (mm)
Control (M)	0.0	95
600 ml/100 kg of cement (M1)	0.6	120
800 ml/100 kg of cement (M2)	0.8	140
1000 ml/100 kg of cement (M3)	1.0	150
1200 ml/100 kg of cement (M4)	1.2	170

The data are recorded and being shown to observe the relation between dosages of SP and slump loss. The value of slump loss for different dosages of SP is then plotted as a graph as shown in Figure 1.

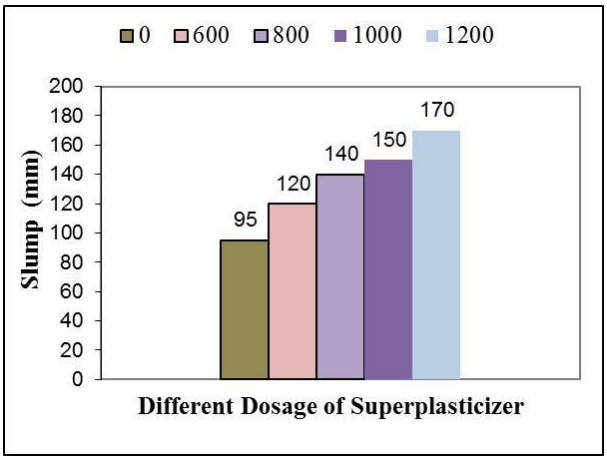

Fig. 1 Effect of SP dosage on slump loss

B. Effect7B Of Superplasticizer On Compressive Strength

Compressive strength of concrete with different dosage of superplasticizer is shown in Table II. This test performed on 28 days. The values of compressive strength for the different dosage of superplasticizer are then shown as a graph in Figure 2.

Graphs above show slump against elapse of different dosages of SP. From the graph, it is clear that slump increase by dosages. However, the SP will help to retain the concrete in liquid state for a longer time, and hence, reduce the slump loss during the transportation of concrete to the site. In addition, over dosage of these admixtures will lead to high slump loss, which will not give true slump that as what we expect and desire.

TABLE II
COMPRESSIVE STRENGTH OF SUPERPLASTICIZED CONCRETE

Concrete mix	Dimension in (mm) L x B x H	Sikament® R2002 ratio %	Compressive
M	150x150x150	0.0	44
M1	150x150x150	0.6	52
M2	150x150x150	0.8	54
M3	150x150x150	1.0	55
M4	150x150x150	1.2	43

After conducting the experiment, graph of compressive strength versus dosage of superplasticizer. From the graph, continuous strength gain for chemical admixture is observed by the increase in compressive strength with increse dosage of superplasticizer, but when we observe the effect of dosage of the admixture, the admixture present different behaviours on
the compressive strength of concrete. Addition of superplasticizer not able to increase the compressive strength of concrete, on the other hand, it reduces the strenght significantly, and become worse when the dosages increase. The superplasticizer (SP), increase in dosage will increase the compressive strength. Since addition of SP will provide more water for concrete mixing, not only the hydration process will not be disturbed, but, it is accelerated by the additional water from deflocculation of cement particles. Hence, increase in dosage will increase the entrapped water and promote hydration of cement. Though increment in dosage of admixture will enhance the compressive strength, there is still an optimum limit for the usage of admixture. When the dosages go beyond this limit, increase in dosage will only reduce the compressive strength. This phenomenon occur since over dosage of SP will cause bleeding and segregation, which will affect the cohessiveness and uniformity of the concrete. As a result, compressive strength will reduce if the used dosage is beyond the optimum dosage. If observation is done on the efficiency in increasing compressive strength, compressive strength of concrete containing SP exceeded 8 N/mm^2, 10 N/mm^2, 11 N/mm^2 respectively for all dosages, and this value is higher than the compressive strength of the control. Optimum dosage of SP is found based on the highest ultimate strength that they present at age 28 days. From the graph, we can observe that optimum dosage for the admixtures is 1000 ml/100kg of cement. Dosage with lower or higher than this optimum value will reduce the compressive strength. For more accurate and precise result, more dosages should be done with smaller interval for a better fit curve.

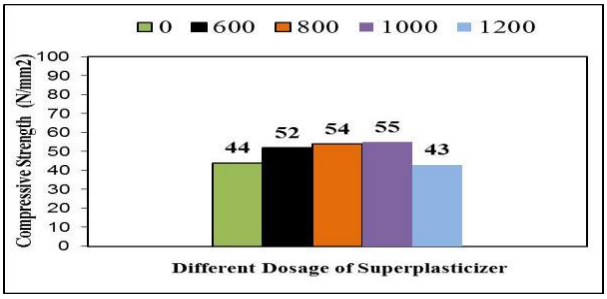

Fig. 2 Compressive strength of concrete with different dosages of superplasticized

SP had been successfully studied. From the results of the study presented earlier, the following conclusions are offered:

➢The workability of concrete can be increased by addition of superplasticizer. However, very high dosages of SP tend to impair the cohesiveness of concrete.

➢Slump loss can be reduced by using the chemical admixtures. However, effectiveness is higher for superplasticizer concrete.

➢Compressive strength is improved by SP compared with control; On the other hand, even its ultimate strength is higher than the desired characteristic strength.

V. CONCLUSION

The general objective is to evaluate the workability, unit weight and compressive strength of concrete mix with 10% replacement of cement content by fly ash in addition to varying doses of superplasticizer. From the test results, following conclusions are

1. Use of supplementary cementious materials that is, fly ash with an aim to achieve better workability with the saving in cementious material.

2. From the slump and compaction factor tests, it is observed that concrete containing fly ash and superplasticizer yields good workable mix in addition to increase in compressive strength marginally.

3. Addition of superplasticizer along with 10% fly ash of cement content accelerates the compressive strength of Self-Compacting.

4. Self-Compacting Concrete not only establishes the uniform and homogenous mix but also gives marginal reduction in weight of hardened mix of concrete.

5. From the present study, one can support to the comments made by previous researchers about saving of time in construction and also environment friendly user because of no compaction and vibrations resulting to no noise creation.

6. The scope of study in future is to assess the workability of mix using L-box test for the requirement of properties like passing, filling and flow ability whereas V-funnel test employed to know the property of viscosity. Further, hardened properties of SCC could be assessed for other test like flexural strength, split tensile strength and water absorption test as per Indian standards.

-

REFERENCES

[1] Aitcin, P. C. and B. Miao, “How to Make High-Performance Concrete”, Proceedings of the 2nd Seminar on High-Performance Concrete, Taipei, Taiwan, ROC, (1992), 91-118.

[2] Fukuda K., Mizunuma T., Izumi T., Iizuka M., Hisaka M.M., *Slump Control and Properties of Concrete with a New Superplasticizer. I: Laboratory studies and tests methods*, Proceedings of the Intern. RILEM Symposium on "Admixtures for Concrete. Improvement of Properties,

Editor: E. Vasquez, Chapman & Hall, London, pp 10-19 (1990).

[3] Tanaka M., Matsuo S., Ohta A. and Veda M., *A New Admixture for High Performance Concrete*, Proceedings of the "Concrete in The Service of Mankind", Editors: R.K. Dhir and M.J. McCarthy, pp. 291-300 (1996).

[4] Ramachandran, C. K., Hignite, C. E., Gray, S. L. & Melnykovych, G. *Concrete Admixtures Handbook - Properties, Science, and Technology*, (1981) Biochem. J. 198, 23-28.
[5] Properties of Concrete – A. M. Neville, 2005

[6] Yamakawa I., Kishtiani K., Fukushi I., Kuroha K., *Slump Control and Properties of Concrete with a New Superplasticizer. II. High strength in situ concrete work at Hicariga-Oka Housing project*, RILEM Symposium on "Admixtures for Concrete. Improvement of Properties", Editor: E. Vasquez, Chapman & Hall, London, pp 94-105 (1990).

Author's Details:

Mr.Rayavaram Girish received Btech in Civil Engineering from Audisankra Institute of Technology(ASIT) affiliated to the Jawaharlal Nehru technological university Anathapur in 2014, and pursing M. Tech in Structural Engineering from SKR College of Engineering affiliated to the Jawaharlal Nehru technological university Anantapur in 2016, respectively.

Mr. SHAIK. FAZUL Working As Assistant Professor Dept of Civil Engineering SKR College of Engineering affiliated to the Jawaharlal Nehru technological university Anantapur in 2016, respectively.