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A Review on Self-Compacting Concrete Using Industrial Waste

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Abstract - *One of the major issues in present time is disposal of hazardous environmental waste .Use of contaminated industrial waste as a replacement of aggregate or cement in concrete is best way to reuse industrial waste and which also helps in economy and environment. Various research works has been conducted on self-compacting concrete using industrial waste material which results in increase in strength and durability whether it is conventional concrete or self-compacting concrete. This paper aims at highlighting the improvement in the quality of self-compacting concrete while using various permutations and combination with different waste material. The research also describes the effects of admixtures and super plasticizers on self-compacting concrete. It also discusses about the effect of various waste material on fresh and hardened properties of self-compacting concrete. The primary objective of this review paper is to set guidelines to carry out further research work*

Key Words: **Self-compacting concrete, admixtures, super plasticizers, micro silica, fly ash**

1. INTRODUCTION

Self-compacting concrete (SCC) is a front runner concrete that does not require any vibratory machine for concrete to settle down. This type of concrete settles down under its own weight, because of this quality of concrete it is extensively used in construction field. It is good alternative of conventional concrete especially in congested formwork where compaction is not fissile and in this situation, work with self-compacting concrete is preferred.

With the rising demand for productivity and comfort at site as well as performance of the hardened concrete, use of SCC can reduce the labor cost, vibratory machine cost and also faster completion of construction schedule. The use of SCC provides greater flaccidity while placing and compaction than the normal concrete as well as acquiring required resources which results in time and resource saving.

Pollution free environment during the construction process is need hour. In last 20 years several research works have been done making use of different industrial waste material like fly ash, rubber waste, tar coal etc.

The present review paper is a research on various progress/innovative method which have been developed over a recent period of time in field of using of waste material in construction.

Some research works have shown that the performance of concrete can be significantly increased by using mineral admixtures and also by using some industrial bi-products

2. OBJECTIVE

Basic idea behind carrying out the research work is to find out the most economical, durable, eco-friendly, resource saving and easily available waste material which can be used in self-compacting concrete as a partial replacement of aggregate which can enhance its performance.

3. LITERATURE REVIEW

Ozawa[12] et al.(1989) did his research on use of mineral admixture like fly ash and blast furnace slag. He found that on partial replacement of ordinary Portland cement by fly ash and blast furnace, flowing properties of SCC improved notably. He concluded that on replacement of 10% to 20% fly ash and 25% to 40% of blast furnace slag cement by mass, best flowing ability and strength of SCC was seen.

Domone[3][4] and His-Wen(1997) conducted a slump test so as to find the workability of concrete. He found satisfying result of workability of concrete.

Bui[1] et al.(2002) invented a new method to find out the segregation of SCC in vertical and horizontal direction . In his experiment, he used different water binder ratio, paste volume, coarse and fine aggregate with various types and quantities of mineral admixtures. This test was helpful in inventing a new method with apparatus to find segregation of SCC in both directions.

Xie[14] et al. (2002) used ultrapulverised fly ash and superplastizer so as to find workability, mechanical properties and durability of SCC. In his test slump flow was 600-750 mm and flow velocity of L box test was 35 to 80 mm/sec.

Lachemi and Hossain[10] (2004) studied fresh and hardened properties of concrete by using different viscosity modifying agent (VMA) to SCC. Flow time should be less than 6 sec for the concrete to be considered as SCC. In his studied no segregation was occurred and jamming of aggregate was seen.

Cengiz[2] (2005) carried out his experiment by taking different proportion of fly ash as a replacement of Portland

cement with SCC and investigated the strength of concrete. The observation revealed appropriate result.

Ferrara[5] et al. (2006) studied high strength self-compacting concrete (HSSCC) for all the basic properties like flow ability, passing ability and segregation resistance of concrete and result was satisfactory.

Kumar[9] (2006) used orimet combination test to evaluate the basic properties of SCC namely flowing ability, passing ability and resistance to segregation. The result was satisfactory.

Sahmaran[13] et al. (2007) presented a research paper on study of fresh and mechanical properties of fibre reinforced self-compacting concrete and found slump value in range of 560-700 mm which was acceptable with recorded time less than 2.9 sec.

Khatib[8] (2008) studied the properties of SCC by replacing portland cement 0 to 80% by fly ash. In his research work he concluded that 40% replacement of fly ash result in high strength of concrete up to 65 N/mm^2 at 56 days. On further increasing the amount of fly ash high absorption values were obtained (should not be less than 2%)

Grdic[6] et al (2008) presented his research paper on self-compacting concrete using different types of additives like silica fume and fly ash. He used L box test and found passing ability of SCC using following formula : $P_a = h_2/h_1$ Where h_1 and h_2 are the height in mm and P_a is passing ability (range 2-10 mm).

Miao[11](2010) examined the fresh properties of concrete with the replacement of cement up to 80% in all mix. It was concluded that fly ash act as a lubricant material which does not react with superplasticizer. Superplasticizer only reacts on cement that means large proportion of fly ash need lesser percentage of superplasticizer.

Heba[7] (2011) did an experimental study on two types of cement content with three types of mixes, first considered different proportion of fly ash, second mix used different proportion of silica fume and third used combination of fly ash and silica fume. It was found that at 30% replacement of fly ash resulted in high compressive strength and high compressive strength was found from mix at 15%.

Yash Paul Sachdeva[18] et al. (Feb 2013) conducted experiment on two types of SCC one with micro silica and other without micro silica (using viscosity modifying admixtures (VMA)). He observed that VMA SCC provides better surface finish than micro silica SCC. Compressive strength curve shows uniform increase of compressive strength values with VMA SCC as compared to micro silica SCC.

Dhiyaneshwaran[16] et al.(March 2013) studied workability and durability characteristics of self- compacting concrete using VMA and class F fly ash. In this sounding, SCC was prepared by its customary constituents such as cement; fine aggregate, coarse aggregate, water and mineral admixtures. He used Glenium Stream2 as viscosity modifying admixture (VMA) and Glenium B233 as super plasticizer. He carried out his experimental study by taking water-powder ratio of 0.45. He did test for workability and durability, from his findings he concluded that as dosage of super plasticizers was increased workability also increased. It also found that as amount of fly ash is increased, compressive strength of concrete was decreased. it also explained that with increase in fly ash, water absorption percentage decreases.

A small change in dosage of VMA would lead to significant change in SCC quality such as flowing ability, passing ability and segregation resistance. If it is increased than desired then flow ability may fall below 500 mm slump.

Zekong Chen[17] et al. (August 2015) focused on the construction quality of SCC and surveyed performance of SCC concrete with conventional concrete structure under same condition. He concluded that it will be beneficial to explore the engineering properties of SCC.

Zeeshan Adib Ahmed[19](August 2016) presented research paper on high lean self-compacting concrete (HLSCC) using Fly ash. He observed that SCC with the addition of 30% fly ash gives favourable strength for M70 grade. HLSCC does not give satisfactory result in workability due to small particle size and large surface area and hardened properties of concrete shown higher strength.

Dinesh et al[15] (April 2017) investigated through his research work and experimental studies it was found that when cement is partial replaced with silica fume, there was increased in fresh(workability) and hardened properties(split-tensile strength and compressive) of concrete remarkably.it was also find that workability of concrete was increased by using fly ash but hardened properties was decreased.

4. CONCLUSIONS:

As discussed in paper there can be various methods, materials and quantities in which different admixture or/and superplasticizer can be used as SCC depending upon its availability, workability, need and economic viability. Various techniques and methodologies which have been discussed can be implemented in practical manner to dispose of hazardous waste in environmental friendly way. In most of the cases as discussed the industrial waste increases the strength, workability and durability.

REFERENCES:

[1] Bui, V.K., Montgomery, D. Hinczak, I and Turner, K.,"Rapid testing method for segregation resistance of self- compacting concrete," Cement and Concrete Research. 32: 1489-1496, 2002.

[2] Cengiz, Duran Aity,"Strength properties of high- volume fly ash roller compacted and workable concrete and influence of curing condition," Cement and Concrete Research. 35: 1112-1121 year 2005.

[3] Domone, P. and His- Wen, C (1997),"Testing of binders for high performance concrete research," Cement and Concrete Research.27: 1141- 1147, 1997.

[4] Domone, P.,"A review of the hardened mechanical properties of self- compacting concrete," Cement and Concrete Composites. 29: 1-12, 2007

[5] Ferrara, Liberato; Park, Yong- Dong and Shah, Surendra P.,"A method for mix design of fibre reinforced self-compacting concrete," Cement and Concrete Research. 37: 957-971,2006.

[6] Grdić, Zoran; Despotović, Iva and TopličićĆurčić, Gordana ,"Properties of self- compacting concrete with different types of additives," Architecture and Civil Engineering. Volume 6, No. 2: 173-174, 2008.

[7] Heba, A. Mohamed ,"Effect of fly ash and silica fume on compressive strength of self- compacting concrete under different curing conditions," Ain Shams Engineering Journal. 2: 79-86,2011.

[8] Khatib, J.M.,"Performance of self- compacting concrete containing fly ash," Construction and Building Materials. 22: 1963-1971, 2008.

[9] Kumar, P.,"Methods of testing and design," IE (I) Journal-CV, Volume 86: 145-150,2006.

[10] Lachemi, M and Hossain, K.M.A.," Self- consolidating concrete incorpating new viscosity modifying admixtures ,"Cement and Concrete Research. 34: 917-926, 2004.

[11] Miao, Liu ,"Self- compacting concrete with different levels of pulverized fuel ash," Construction and Building Materials. 24: 1245-1252, 2010.

[12] Ouchi, M.and Okamura, Hajme,"Self- Compacting High-Performance Concrete," Concrete International.50-54,1997.

[13] Sahmaran, Mustafa and Yaman, Ismail Ozgur,"Transport and mechanical properties of self- consolidating concrete with high volume fly ash," Cement and Concrete Composites. 31: 99-106,2007.

[14] Xie, Youjun; Liu, Baoju; Yin, Jian and Zhou, Shiqiong,"Optimum mix parameters of high strength self-compacting concrete with ultrapulverized fly ash,"Cement and Concrete Research. 32: 477-480, 2002.

[15] Dinesh.A, Harini.S, Jasmine Jeba.P, Jincy.J and Shagufta Javed,"Experimental Study on Self-Compacting Concrete," ISSN: 2277-9655, March 2017.

[16] Dhiyaneshwaran, S., Ramanathan, P.,Baskar, I. and Venkatasubramani, R.,"Study on Durability Characteristics of Self-Compacting Concrete with Fly Ash," Jordan Journal of Civil Engineering, Volume 7,No.3, 2013.

[17] Zekong Chen and Mao yang,"The Research on Process and Application of Self-Compacting Concrete,"Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 5, Issue 8, (Part 3), August 2015, pp. 12-18.

[18] Yash Paul Sachdeva, Prof. Sanjeev Naval and Dr. Manjeet Bansal," Self-Compacting Concrete using Industrial Waste Materials," IOSR Journal of Engineering e-ISSN:2250-3021, p-ISSN: 2278-8719, Vol.3, Issue 2 (Feb 2013) V1, PP 24-30.

[19] Zeeshan Adib Ahmed and Dr. S.H. Mahure,"High Strength Self-Compacting Concrete using Fly Ash," IJRASET Volume VIII, August 2016, ISSN: 2321-9653.