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Comparative analysis on the workability of concrete by the use of brick dust and fly ash as a replacement of fine aggregates in self compacting concrete

Javaid Iqbal[a] and Sameer Malhotra[b]

a. *Research Scholar, Department of Civil Engineering, Gurukul Vidyapeeth Institute of Engineering & Technology, Banur,*

b. *Assistant Professor, Department of Civil Engineering, Gurukul Vidyapeeth Institute of Engineering & Technology, Banur,*

ABSTRACT

Self-compacting concrete (SCC) is an innovative concrete that does not requires any vibration for placing and compaction. The main objective of this study is to investigate the effect on the workability of self compacted concrete, when OPC is partially replaced by fly ash and brick dust in equal proportion. With different locally available material, experimental tests are performed to check the workability of SCC. Several tests, such as Slump test, T50, V funnel, J-ring, L-box and orimet test were carried out to determine the properties of fresh concrete. On the basis of experimental results it may be concluded that fly ash and brick dust enhance the workability of self compacting concrete. More, is the proportion of fly ash & brick ash, more is the workability of self compacting concrete.

1.0. INTRODUCTION

Self–compacting concrete (SCC) is as emerging technology to the construction industry, and has been described as the most revolutionary development in concrete construction for several decades. Compared to normally vibrated concrete (NVC), self-compacting concrete (SCC) possesses enhanced qualities and improves productivity and working conditions due to the elimination of compaction. SCC generally has higher powder content than NVC and thus it is necessary to replace some of the cement by additions to achieve an economical and durable concrete. Okamura of the Koche University of Technology (Japan) had first developed SCC in year 1986. Through their definition it can be defined as concrete that is able to flow and consolidate under its own weight, completely fill the formwork even in the presence of dense reinforcement, whilst maintaining homogeneity and without the need for any additional compaction. . In the United States, the application of SCC in highway bridge construction is very limited at this time. However, the U.S. precast concrete industry is beginning to apply the technology to architectural concrete. SCC has high potential for wider structural applications in highway bridge construction. Modern application of self-compacting concrete (SCC) is focused on high performance. Better and more reliable quality, dense and uniform surface texture, improved durability, high strength, and faster construction. Recognizing the lack of uniformity and complete compaction of concrete by vibration, researchers at the University of Tokyo, Japan, started out in late 1980‘s to develop SCC.

2.0 NEED FOR THIS RESEARCH

Awareness of SCC has spread across the world, prompted by concerns with poor consolidation and durability in case of conventionally vibrated normal concrete. However, the awareness in the India regarding SCC is somewhat muted and this explains the lack of any commercial use of SCC in the India thus far. The reluctance in utilizing the advantages of SCC, if any, in India, stems from two contributing factors:

- Lack of research or published data pertaining to locally produced SCC, and
- The potential problems for the production of SCC, if any, with local marginal aggregates and the harsh environmental conditions prevailing in the region.

SCC differs from conventional concrete in that its fresh properties are vital in determining whether or not it can be placed satisfactorily. The various aspects of workability which control its Filling ability, its Passing ability and its Segregation resistance all need to be carefully controlled to ensure that its ability to be placed remains acceptable (EFNARC, 2000). A concrete mix can only be classified as Self-Compacting Concrete if the requirements for all three characteristics are fulfilled

- Filling Ability: Ability of to fill a formwork completely under its own weight.
- Passing Ability: - Ability to overcome obstacles under its own weight without hindrance. Obstacles are e.g. reinforcement and small openings etc.
- Segregation Resistance: Homogeneous composition of concrete during and after the process of transport and placing.
- It is important to appreciate that none of the test methods for SCC has yet been standardized, and the tests described are not yet perfected or definitive.

3.0 RESEARCH OBJECTIVES

The main objectives of this research is to study the effect on the workability of concrete by the use of fly ash and brick dust as a replacement of fine aggregates in self compacting concrete. . The criteria used were based on the slump test, v-funnel test, U-box test method and L-box test methods and on experiment on seven different mix was conducted.

4.0 EXPERIMENTAL SUITE

Table 1.1 Mix Proportions of SCC

Mix design	Normal mix	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5	Mix 6
Cement (Kg/m^3)	440	440	440	440	440	440	440
Fly ash	00	53	85	107	128	160	213
Brick Dust	00	53	85	107	128	160	213
Coarse Aggregate	720	720	720	720	720	720	720

Fine Aggregate	1067	960	896	853	810	746	641
Super Plasticizer	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%	1.25%
Water/Cement	0.40	0.40	0.40	0.40	0.40	0.40	0.40

5.0 WORKABILITY

As per research, time ranging from 6 to 12 seconds is considered adequate for a SCC. The V-funnel flow times were in the range of 9-13 seconds. Test results of this investigation indicated that all SCC mixes meet the requirements of allowable flow time. Maximum size of coarse aggregate was kept as 16 mm in order to avoid blocking effect in the L-box. The gap between re-bars in L-box test was 35 mm. The L-box ratio H2/H1 for the mixes was above 0.8 which is as per EFNARC standards. U-box difference in height of concrete in two compartments was in the range of 5–40 mm. All the Fresh properties of concrete values were in good agreement to that of the values given by European guidelines. After 24 hours of casting, the specimens were removed from the moulds and immediately dipped in clean fresh water. The specimens were cured for 7 days, 28 days and 56 days respectively depending on the requirement of age of curing. The freshwater tanks used for the curing of the specimens were emptied and cleaned once in every fifteen days and were filled once again. All the specimens under immersion were always kept well under water and it was seen that at least about 15 cm of water was above the top of the specimens.

Mixture ID	**Slump (mm)**	**V-funnel (seconds)**	**L-Box (H2/H1)**	**U-box(H1-H2)**
Normal mix	687	9	0.9	30
Mix 1	590	13	-	-
Mix 2	704	11	-	35
Mix 3	740	12	0.9	35
Mix 4	720	9	1.0	-
Mix 5	719	8	1.1	-
Mix 6	715	8	1.2	

5.0 CONCLUSIONS

Taking into account the findings from this study, previously presented, the following conclusions can be drawn:

It has been verified, by using the slump flow and U-tube tests, that self-compacting concrete (SCC) achieved consistency and self-compact ability under its own weight, without any external vibration or compaction.

So it may be concluded that in general the workability of concrete increases by the use of fly ash and brick dust and we can also concludes that the workability of SCC is much more greater than the Normal compacted concrete.

It also may be noted that the workability of SCC increases with the increase of fly ash and brick dust as a replacement of fine aggregates in SCC.

6.0 REFRENCES

[1] Sonebi Mohammed (2004). "Medium strength self-compacting concrete containing flyash: Modelling using factorial experimental plans" *Cement and Concrete Research 34:1199– 1208*

[2] Siddique Rafat (2011). "Properties of self-compacting concrete containing class F fly ash" Materials and Design 32:1501–1507

[3] Noumowe A.N and Clastres P (1996). "Transient heating effect on high strength concrete" *nuclear engineering and design 166:99-108*

[4] Mahavir Singh Rawat (2014) "Workability of Self-Compacting Concrete (SCC) Made with FLY-ASH" *ISSN: 2349-879X; Volume 1, Number 6; August, 2014 pp. 18-20 © Krishi Sanskriti Publications* .

[5] Farediwala M.A and Amnum.A.J (2012). "Relation between workability and compressive strength of self-compacting concrete" *international journal of advanced engineering research and studies ijaers/vol. i/ issue iii/april-june, 2012/09-11*

[6] Anand.N, Prince Arulraj.G (2011). "The effect of elevated temperature on concrete materials - a literature review" *international journal of civil and structural engineering volume 1, no 4*.

[7] Nagataki, S., Fujiwara, H. (1995), Self-compacting property of highly-flowable concrete, V.M. Malhotra, Editor, *American Concrete Institute SP **154**, pp 301–314.*

[8] Naik, T.R., Singh S. (1997). Influence of fly ash on setting and hardening characteristics of concrete systems, *Materials Journal, Vol.94, Issue 5, pp.355-360.*