Review Paper On Analysis Of Assessment Of Rigid Pavement Constructed Using Self-Compacting Concrete With Fly Ash And Brick Dust As Replacement For Fine Aggregates

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ABSTRACT

Assessment of rigid pavement of self compacting concrete is very old. Special type of applications such as underwater or bridge concreting have always required concrete, which can be placed without any need for compaction. In such circumstances vibration is simply difficult. Earlier self compacting concretes depends on very high content of cement paste, once super plasticizers became easily available in market, they were added in the concrete mixers. The mixers required special and well controlled placing methods in order to avoid segregation of concrete, and high content of cement paste made them to shrinkage. The overall costs are very high and application remained so limited. As compared to normally vibrated concrete (NVC), assessment of self compacting concrete (SSC) possesses increase in qualities and improves productivity and work conditions due to elimination of compaction in concrete. Self compacting concrete (SSC) generally has higher powder content then than normal vibrated concrete (NVC) and thus it is important to replace some of its cement by additions to get an economical and durable concrete. Japan is using self compacting concrete in bridge and other construction projects which takes place in water, building and tunnel construction since early 1990. In the last seven years, a number of self compacting concrete bridges have been constructed in Europe. In the united states usage of SSC in highways bridges construction is very finite at this time. However, the USA precast concrete industry is starting to apply the technology to architectural concrete. SSC has high potential for larger structural applications in highway bridge construction. The use of concrete without vibrating the highway bridge construction is old. In these days efforts are made to balance the mechanical properties of self compacting concrete sample. The standard which is used based on the 7 days, 28 days and 56 days respectively for compressive, splitting tensile and flexure strength.

INTRODUCTION

Self compacting concrete is the concrete in which without any effect of extra compaction energy, flow slowly under the effect of gravity, as well as totally fills the reinforcing space and the formwork. It is very important for the properties which are at very high flow ability and good sedimentation stability. These properties can be taken by the use of increasing flour grain (flour corn type) by stabilizing additives or their combination in combining with highly effectively flow agents. Most of the people don't know about it at least do not like it too much but, concrete is in any form everywhere. If you don't live at center of desert or sea, please just turn your head around the desert or sea and you will discover this fact of concrete. There is no doubt that concrete is of special importance in the buildings and constructions and bridges. Among the other building and construction and material i.e. (steel, brick asphalat, timber, bituminous etc.). According to the cement sustainability startup, the use of concrete is expected to be equal to twenty five billions tons every year which means above 3.8 per person per year in the world.

Literature Review

This research carried out in the fields related to the present study is reviewed in this section.

Self-compacting concrete principle is very old process which is used in concrete. special usaage such as underwater concreting has always required concrete, which can place without any need of compaction. In such condition vibration was not possible. before self-compacting concretes depend upon very high contents of cement paste, once super plasticizers became present there, they were added in the concrete mixes. The mixes need specialized and well-controlled placing methods in order to avoid from bleeding , and the high contents of cement paste make this prone to shrinkage. Total costs were very high and usage of this stays very limited.

The introduction of "latest" self-leveling concrete or self-compacting concrete (SCC) is linked with the drive towards best quality of concrete studied in Japan around 1983, where the deficency of uniform and complete compaction has been found as the primary factor responsible for poor performance of concrete structures (Dehnet al., 2000). Due to this fact that there was no practical means by which full compaction of concrete on a site was ever to be fully monitered, the aim of this turns to avoid the focus of compaction, by vibration or any other means. From This it led to the important development of the first practicable SCC by researchers Okamura and Ozawa, in (1986), at the University of Tokyo and the eminent Japanese contractors (e.g. Kajima Co., Maeda Co., Taisei Group Co., etc.) quickly followed this idea. The contractors used this idea and stayed at their house in research and development of their own SSC technologies.Each company developed their own mix designs and trained their own staff to act as technicians for testing on sites their SCC mixes. A very important field is that each of the many contractors also developed their own testing devices so that they can test this kind of methods. In the early 1990's there was very less knowledge to people about SCC, mostly which are in the Japanese language. The fundamental and practical know how was kept secret by the large firms to maintain private limitation. The self compacting concrete SCCs was used under trade names of firms, such as the NVC (Non-vibrated concrete) of Kajima Co., SQC (Super quality concrete) of Maeda Co. or the Bio concrete. Sudenly with the Japanese developments work in the SCC area, research and development continu in mix-design and placing of underwater concrete where new admixtures were producing SCC mixes with performance matching that of the Japanese SCC concrete (e.g. University of Paisley / ireland, University of Sher Brooke / Canada) (Ferraris, 1999).

Rigid-compacting concrete has been already used in different countries. In Japan, most of construction projects include the application of SCC in the late '90s. In these days, people in Japan, taking efforts by being made to free SCC of the "special concrete" label and integrate it into day-to-day concrete industry production (Okamura, 1997).

Currently, the percentage of self-compacting concrete in the yearly product of ready-mixed concrete (RMC), as well as precast concrete (PC), in Japan is around 1.3% and 0.6% of concrete products are used. In the USA, the construction industry is also leading SCC technology in various project through the Precast/Pre-stressed Concrete Institute (PCI) which has done some very important research on the use of SCC in precast/ pre stressed concretes starting with 1999. It is roughly estimated that the daily producing of SCC in the precast/ pre stressed industries in the United States will be 18000 m^3 in the first quarter of 2015 (and almost 5% of the annual ready-mix concrete). Moreover, some other state departments of transportation and engineering in the United States of America (23 according to a latest survey) are using this type of technology. This high level of interests from the construction industries, as well as manufacturing of this new concrete, the use of SCC should grow at a very high rate in the next some years in the United States. However, even if this is made from the similar material the industry has used for many years, the whole process, from mix design to placing of different practices, including quality control method, needs to be change so that new method can be adapted in order for this latest technology to be applied well mannerd. Research similar to the rigid and the self-compacting concrete was also takes place out in Canada, few years when the concept was familar in Japan. Institute for Research in Construction, Canadian Precast/ Pre stressed Concrete Institute, CONMET-ICON are some of the important bodies which studied various features of this latest technology. The introduction of this type of SCC in Europe is largely interconnected with these activities of the international association Fresh Special Concrete Mixes". The TC145-WSM was founded in 1992 and it immediately in no time attracted expert memberships from all over the world.

Conclusions:

It has been verified, by using the slump flow and U-tube tests, that rigid compacting concrete (SCC) achieved consistency and self compactability under its own weights, without any external vibration or compaction. Also because of the special admixtures used, self compacting concrete SCC has achieved a density between 2400 and 2500 kg/m^3, which was greater than that of normal concrete 2370-2321 kg/m^3.Rigid compacting concrete can be determined in such a way, by adding chemical and mineral admixtures, so that it's splitting tensile, flexural strength and compressive strengths are higher than those of normal vibrated concretes.

- The properties such as slump flow, V funnel flow times, L box, U box. In terms of slump flow, all SCCs exhibited satisfactory slump flows in the range of 590–745 mm, which is an indication of a good deformability in this concrete.
- The compressive strength increases with an Increase in the percentage of the Fly ash & Brick dust in it. An increase of about 37% strength at 7 days 15% strength at 28 days and 8% at 56 days was observed with the increase of Fly ash & Brick dust specimens from 5% (SCC MIX1) to 12% (SCC MIX4).
- It was observed that the percentage increase in compressive strength was more predominant at very early ages.

- The strength which was later increased at later ages also but not so quickly because the pozzolanic reactions of the fly ash is faster at early ages and the brick dust acts as a filler also along with pozzolanic activity against the fine aggregates which acts as a filler product only.
- The split tensile strengths of self and rigid compacting concrete SCC after 7 days are comparable to those determined after 28 days for NC. This was possible because of the use of Fly ash & Brick dust as a fine aggregate replacement, which usually tend to increase the early strength of concrete.

REFERENCES

Dehn, F., K. Holschemacher, and D. Weisse, “Self-Compacting Concrete – Time Development of the Material Properties and the Bond Behavior”, LACER No. 5, pp.115-123 (2000).

Dr. R. Sri Ravindrarajah, D. Siladyi and B. Adamopoulos, “Development of High-Strength Self-Compacting Concrete with reduced Segregation Potential” 1 Vol., 1048 pp., ISBN: 2-912143-42-X.

Felekoglu, B. (2008). A comparative study on the performance of sands rich and poor in fines in self-compacting concrete. Construction and Building Materials vol: 22, pp. 646–654.

Felekoglu, B., Turkel, S., Baradan, B, ” Effect of w/c ratio on the fresh and hardened properties of SCC” Building and Environment Research vol: 35, pp.373–379

Felekoglu, B., Turkel, S., Baradan, B. (2005) Effect of w/c ratio on the fresh and hardened properties of SCC. Science directs- Building and Environment Research vol: 35, pp.373–379.

Ferraris, C.F., Brower, L., Daczko, J., Ozyldirim, C. (1999). Workability of Self-Compacting Concrete, Journal of Research of NIST, Vol: 104, No. 5, pp.461-478.

Gebler, S.H., Klieger, P. (1987). Effect of Fly Ash on Some of the Physical Properties of Concrete, Portland Cement Association, R & D Bulletin 089.01T. International, Vol. 19, No. 8, pp.62-63.

Halstead, W. J. (1986). Use of Fly Ash in Concrete, NCHRP Synthesis 127. High Reactivity Metakaolin (HRM). Advanced Cement Technologies, LLC. Metakaolin. http://metakaolin.com/metakaolin/metakaolin-description. Retrieved May 7, 2010.

Irassar, E.F. (2009). Sulfate attack on cementitious materials containing limestone filler — A review. Cement and Concrete Research vol: 39, pp. 241–254.

Kasami, H., T. Ikeda, and S. Yamana, “Workability and Pumpability of Superplasticized Concrete”, Internl. Symp. on Superplasticizers in Concrete, Ottawa, Canada (1978).

Kazumasa OZAWA, Anura S.M.NANAYAKKARA and Koichi MAEKAWA： Application of Multi-Phase Model to The Pipe Flow of Fresh Concrete Proceedings of JSCE,No.466/V-19,pp.121-131,1993

Khaloo, A. R., Houseinian, M. R. (1999). Evaluation of properties of silica fume for use in concrete, International Conference on Concretes, Dundee, Scotland.

Khatib, J.M. (2008). Performance of self-compacting concrete containing fly ash, Construction and Building Materials vol: 22, pp. 1963–1971.

Khayat, K.H., Aitcin, P.C. (1987). Silica Fume a unique Supplementary Cementitious Material, Mineral Admixture in Cement and Concrete, Vol.4, by Dr. N.S Ghosh (Ed.)

Khayat, K.H., Vachon, M., Lanctot, M.C. (1997). Use of Blended Silica Fume Cement in Commercial Concrete Mixtures, ACI Materials Journal, pp.183-192

Kosmatka, S.H., Kerkhoff, B., Panarese, W.C. (2002). Design and Control of Concrete Mixtures, 14th Edition, Portland Cement Association.

Kraus, R.N., Naik, T.R., Ramme, B.W., Kumar Rakesh. (2009). Use of foundry silica- dust in manufacturing economical self-compacting concrete. Construction and Building Materials vol: 23, pp. 3439-3442.

Krieg, W. (2003). Self-Compacting Concrete: Definition, Development, and Applications, A Technical Paper Presented in the Meeting of the ACI, Saudi Arabia Chapter, Eastern Province, October.

Kuroiwa, S., "High Performance Concrete in Severe Environments", ACI SP-140, pp.147-161 (1993).

Liu, M. (2010). Self-compacting concrete with different levels of pulverized fuel ash, Construction and Building Materials vol: 24, pp.1245–1252

Lothia, R.P., Joshi, R.C. (1996). Mineral Amixture – concrete Admixture handbook by V S ramachandran (Ed.)

Mata, L.A., (2004). Implementation of Self-Consolidating Concrete (SCC) for Prestressed Concrete Girders, MS Thesis, North Carolina State University, November.