

# **Self-Compacting High-Performance Concrete from Chemical & Mineral Admixtures**

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## **Abstract**

The research covered the background and study of mechanical and rheological properties of self-compacting concrete, when incorporated with different chemical and mineral admixtures at micro scale. Although, with secondary raw materials (SRM's) along with chemical admixtures, an improvement in rheological as well as increased mechanical properties in self-compacting concrete are observed, but it can alter different fresh and hardened state properties. We developed a methodology to understand chemistry of self-compacting concrete and its improvement as a high performance self-compacting concrete using SRM's. With the addition of these SRM's, the behavior of self-compacting concrete was observed at fresh and hardened state with singular material addition (Binary) and then in combination of two materials (Tertiary). The replacing mineral admixtures were Silica fume, Fly Ash, Marble powder and Limestone powder. Cement was replaced initially at the ratio of 5%, 10%, and 15% by weight of cement and then a combination of 5%, 10 % and 15% of each SRM's with cement. Along with mineral admixtures, chemical admixture was also incorporated name Gellinium 51 which is a Type F, HRWR (high range water reducer), manufactured under BASF Germany® tag. Throughout the experimental process, the consideration was given by the both ASTM & European Standard EN206-1, for self-compacting concrete which was kept under eye. Target flow for the preparation of high performance self-compacting concrete was kept at 750 mm for all the formulations. To prepare a high performance self-compacting concrete, fixed water cement ratio of 0.3 was used. To achieve target flow for self-compacting concrete, adjustment is done in chemical admixture. We observed a good response when replaced cement with these materials, and the best results was observed by replacing cement with 10% Silica Fume and 10% Fly Ash replaced by 20% of cement. Improvement of 24% in compressive strength along with improved workability in fresh state was observed. European standards provided us a wide range of guidance to make concrete better and reliable in performance and durability. In this study, every experiment was according to the guidelines recommended by European as well as ASTM Standards. Tertiary formulation with Silica Fume and Fly Ash at 10 percent of replacement individual with cement shows higher strength among all of them. Silica Fume and Fly Ash seems to be better SRM's than Marble Powder and Limestone Powder.

**Keywords:** Secondary Raw Materials, Silica Fume, Fly Ash, Marble/Limestone and Self-compacting concrete.

## **Biographies**

**Dr. Saman Shahid** earned her Ph.D. in Environmental Sciences from University of the Punjab, Lahore Pakistan. She has done M.Phil. & M.Sc. (Physics) from Government College University, Lahore. She works as an Associate Professor and deals with the teaching and research of Physics, Electronics and Environmental Sciences in the NUCES-FAST, Lahore Campus. She has 47 international/local/conference publications with impact factor greater than 39. Her areas of interest are: Materials Science, Semi-Conductor Physics, Environmental Physics and Bioinformatics.

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