World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:10, No:03, 2016

Distribution of Micro Silica Powder at a Ready Mixed Concrete

Authors : Kyong-Ku Yun, Dae-Ae Kim, Kyeo-Re Lee, Kyong Namkung, Seung-Yeon Han

Abstract : Micro silica is collected as a by-product of the silicon and ferrosilicon alloy production in electric arc furnace using highly pure quartz, wood chips, coke and the like. It consists of about 85% of silicon which has spherical particles with an average particle size of 150 μm. The bulk density of micro silica varies from 150 to 700kg/m^3 and the fineness ranges from 150,000 to 300,000cm^2/g. An amorphous structure with a high silicon oxide content of micro silica induces an active reaction with calcium hydroxide ($Ca(OH)_2$) generated by the cement hydrate of a large surface area (about 20 m^2 / g), and they are also known to form calcium, silicate, hydrate conjugate (C-S-H). Micro silica tends to act as a filler because of the fine particles and the spherical shape. These particles do not get covered by water and they fit well in the space between the relatively rough cement grains which does not freely fluidize concrete. On the contrary, water demand increases since micro silica particles have a tendency to absorb water because of the large surface area. The overall effect of micro silica depends on the amount of micro silica added with other parameters in the water-(cement + micro silica) ratio, and the availability of superplasticizer. In this research, it was studied on cellular sprayed concrete. This method involves a direct re-production of ready mixed concrete into a high performance at a job site. It could reduce the cost of construction by an adding a cellular and a micro silica into a ready mixed concrete truck in a field. Also, micro silica which is difficult with mixing due to high fineness in the field can be added and dispersed in concrete by increasing the fluidity of ready mixed concrete through the surface activity of cellular. Increased air content is converged to a certain level of air content by spraying and it also produces high-performance concrete by remixing of powders in the process of spraying. As it does not use a field mixing equipment the cost of construction decrease and it can be constructed after installing special spray machine in a commercial pump car. Therefore, use of special equipment is minimized, providing economic feasibility through the utilization of existing equipment. This study was carried out to evaluate a highly reliable method of confirming dispersion through a high performance cellular sprayed concrete. A mixture of 25mm coarse aggregate and river sand was applied to the concrete. In addition, by applying silica fume and foam, silica fume dispersion is confirmed in accordance with foam mixing, and the mean and standard deviation is obtained. Then variation coefficient is calculated to finally evaluate the dispersion. Comparison and analysis of before and after spraying were conducted on the experiment variables of 21L, 35L foam for each 7%, 14% silica fume respectively. Taking foam and silica fume as variables, the experiment proceed. Casting a specimen for each variable, a five-day sample is taken from each specimen for EDS test. In this study, it was examined by an experiment materials, plan and mix design, test methods, and equipment, for the evaluation of dispersion in accordance with micro silica and foam.

Keywords : micro silica, distribution, ready mixed concrete, foam
Conference Title : ICCET 2016 : International Conference on Concrete Engineering and Technology
Conference Location : London, United Kingdom
Conference Dates : March 17-18, 2016