Ain Shams University
Faculty of Engineering
Structural Engineering Department

Utilization of Limestone Quarries Powder In Production of Self-Compacting Concrete

A Thesis

Submitted in Partial Fulfillment for Requirements of the Degree of
Master of Science in Structural Engineering

By

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Thesis : Master of Science in Civil Engineering (Structural)

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STATEMENT

This thesis is submitted to Ain Shams University, Cairo, Egypt, in partial fulfillment of the requirements for the degree of Master of Science in Civil Engineering (Structural).

The work included in this thesis was carried out by the author at Properties and Testing of Materials laboratory of the faculty of engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or qualification at any other university or institute.

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ABSTRACT

Since the introduction of Self Consolidated Concrete **SCC** in Japan during the late 1980's, acceptance and usage of this concrete in the construction industry has been steadily gaining momentum. In United States, the use of SCC has been spearheaded by the precast concrete industry. SCC must possess the following key fresh properties: filling ability, passing ability, while being cohesive, i.e. capable to resist segregation. In order to increase segregation resistance, SCC mixes are typically designed with high powder content, and/or contain chemical admixtures such as super plasticizers and viscosity modifying admixtures, which in turn, tend to significantly increase the overall cost of SCC.

In limestone quarries, considerable amounts of limestone powder **LP** are being produced as byproducts from stone crushers. High amounts of powder are being collected; utilization of this byproduct is of big benefit from disposal and environmental pollution aspects. Incorporation of limestone quarry powder in SCC as a filler can reduce the common cost of SCC, beside the improvement of concrete sustainability.

The main objective of this research was to study the effectiveness of using locally available limestone quarries powder, in the production of enhanced SCC mixtures.The influence of carefully chosen powder types resulting from diverse local sources was investigated. An experimental/comparative study of both its fresh and mechanical properties was conducted to decide the best powder source. Then, a profound investigation for the effect of powder content was followed in deep to decide the best performance of the produced SCC, with regard to each of its accomplished properties respectively; fresh, mechanical, and durability. Finally, an examination for the improvementfrom incorporating a specific content of silica fume with lime powder was followed.

The experimental program was divided into two phases, namely:
Phase one; which designed to evaluate the three different sources of investigated LP, through chemical and physical experimental tests. In addition, the fresh and mechanical properties of three SCC mixes from these powders were conducted.

Phase two; was designed to assess the influence of a variable contents of the best powder source determined from phase one on the fresh, mechanical and durability properties of the developed SCC mixes. A final SCC mix was performed to study the improvement of incorporating the best LP content with silica fumes on the fresh and hardened properties of the concrete.

Experimental test results revealed that Al-Menia quarry powder is the best among other sources, and that 30 to 40% LP replacement of fine aggregate produced a significant improvement for the mechanical and durability properties. Beside LP, employing silica fume was found to have a little improvement on the mechanical and durability properties of concrete.

Keywords: Self-Compacting Concrete, Limestone Powder, Silica Fumes, Fresh Properties, Hardened Properties, Durability.

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