INFLUENCE OF THE AVERAGE PARTICLE SIZE ON THE PHYSICOCHEMICAL PROPERTIES OF CONCRETE

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ABSTRACT

This work deals with a comparison of results obtained from a numerical simulation of the physical and mechanical properties of different concretes tested. The study of different granular skeleton of each concrete has allowed us to study the influence of an average particle size required on the properties of concrete (fresh and hardened). The results have been sorting to select the most relevant mixtures.

A panel of granular classes 4 / 22.4 was prepared, from the different granular classes obtained 97 concrete mixes were tested by a simulation using concrete mix design software BetonlabPro, what allowed us to obtain results, this results had a an analysis to sort and select the best values in order to achieve it experimentally and establish a comparative study to validate the simulation with an experimentation. A witness concrete (Bt) was prepared using the Dreux-Gorisse method to compare it with those obtained by simulation and experimentation , while keeping a constant value for $\frac{E}{C}$ ratio, $\frac{G}{S}$ ratio and the minimum compressive strength.

According to a ratio $\frac{G_f}{G_g}$ (Gf is 4/8 fine aggregate, Gg coarse aggregate 16/22.4) the different cases studied were divided into 5 sub-classes to be able to describe aggregate and concrete properties.

The granular distribution is important to describe aggregate properties and consequently those concrete properties. The good choice of aggregate is very important factor mixes concrete.

Keywords: Physico-mechanical, concrete, granular class, middle granularity Bétonlabpro.

INTRODUCTION

The quality of concrete is measured in the values of the compressive strength obtained [1]. To obtain a concrete with a good compressive strength we must consider the $\frac{w}{C}$ ratio, because according to Abrams, the compressive strength depends on this parameter [2] while, Feret, provided the strength (Tensile and compressive strength) in terms of the volume concentration
for cement paste. [2] However, although the $\frac{W}{C}$ ratio is a basic concept in concrete technology, it is not sufficient for a complete control of the compressive strength; other parameters are required [2].

Aggregates represent 80% of the compressive strength [1], that's why we have to make a big care about granular properties to prepare concrete mixes in order to get a good resistance. For this, we have focused our research on obtaining the best granular skeleton based on the determination of the granular characteristics for different granular classes studied. To do this, we studied 97 classes 4/22.4mm, prepared in the laboratory from three types of gravel (4/8, 8/16, 16 / 22.4 mm). Mixing by different percentage where the average fraction 8/16 mm varying from 10% to 80% in steps of 5%, gave us 15 granular classes. Each class has its own subclasses granular, obtained from varying the other two fractions (4/8 and 16/22.4) with a pitch of 7.5%.

The characterization of aggregates is an important step in the formulation of concrete. [3] A total of tests are performed. Mechanical, tests are performed on standard cylinder specimens for compressive strength [4], and on prismatic specimens for flexural tensile strength [5]. The tests are performed according to the requirements of the European standard.

RESULTS AND CONCLUSIONS

The ratio $\frac{G_f}{G_g}$ helps us to describe the influence of the average particle size in presence of fine or coarse particles, or both with a predefined percentage.

The influence of the average particle size is clear when $\frac{G_f}{G_g} > 5$

The compressive strength at 7 days and 28 days decrease with increasing percentage of the average granularity when $\frac{G_f}{G_g} > 5$

Improvement is recorded for compressive strength at 7 days and 28 days. Varying the granular distribution for an aggregate will change the flakiness index then change the slump value.

The slump test result change in the same direction as the average particle size 8/16mm, but not in the same direction with the ratio $\frac{G_f}{G_g}$.
This study has shown that the influence of the average particle size on the properties of aggregates as well as the properties of the concrete is considerable. The percentage obtained for the different studied granular classes invited us to review the quantities of aggregates chosen by Dreux-Gorisse method as optimal.

REFERENCES


[4]-NF EN 12390-3 Compressive strength 17 (2003).