



Effects of Specimen Type and Dimensions on Compressive Strength of Self Compacting Concrete

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Abstract

Inadequate homogeneity of the cast concrete due to poor compaction or segregation may dramatically lower the performance of mature concrete in situ. To insure adequate compaction and facilitate placement of concrete in structures self compacting concrete (SCC) has been developed. On the other hand, the compressive strength of concrete is used as the most basic and important material property when reinforced concrete structures are designed. In the application of uniaxial compressive strength test, standard cylindrical and cubic specimens are usually employed in the quality control of concrete. In addition to the standard specimens different types and sizes of specimens can be preferred for research and development or comparison purposes. The specimens composed of the same material proportions, and the same strength grade at different geometry and shape may give variable strength values despite they were prepared from the same concrete batch, which makes the test results hard to compare. In this study, the compressive strength values of cubic and cylindrical specimens at two strength levels with different sizes were investigated and transformation coefficients were proposed.

Keywords: Self compacting concrete, Compressive strength, Size effect, Standard Cylindrical and Cubic

1. INTRODUCTION

Self compacting concrete (SCC), requiring no consolidation work at site or concrete plants, has been developed in Japan to improve the reliability and uniformity of concrete 1988[1]. The use of SCC offers many benefits to the construction practice, the elimination of the compaction work results in reduced costs of placement, a shortening of the construction time, improving working environment and in sustainability the advantages of SCC are an improving homogeneity of concrete production and the excellent surface quality without blowholes or other surface defects [2]. On the other hand the compressive strength, as one of the most important properties of hardened concrete, in general is the characteristic material value for the classification of concrete in national and international codes. In the application of uniaxial compressive strength test, which is usually employed for the quality control process of concrete, the type and dimensions of the specimens considerably affect the test results. Due to the size effect, the relative strength of specimens varies at different dimensions. In order to explain these phenomena, statistical models and approaches of fracture mechanics are being used [3]. Many studies are conducted for the comparison of the test results derived from specimens with different sizes [3], and in the vicinity of these results, some transition coefficients or formulations are proposed. However, these transition coefficients and formulations do not take the compressive strength grade into consideration or valid only in between pre-determined strength values [3].

The standards related with sampling define the standard cylinder as 150 mm diameter and 300 mm height, and the standard cube with edges of 150 mm [3]. The employment of small specimens such as cylinder with 100 mm diameter and 200 mm height or cube with edges of 100 mm is limited due to some disadvantages of these specimens. These disadvantages are:

- The increase in size of specimens may cause a relative strength enhancement and may increase the variability of test results.
- The maximum aggregate size of the concrete mixture should be limited in order to reduce the wall effect.

On the other hand, there are some advantages of using small specimens which can be listed below:

- Small specimens can easily be transported and there is less probability of damage caused by any accident.