Discussion of 'Are current concrete strength tests suitable for high strength concrete?'

by M. Imam, L. Vandewalle and F. Mortelmans (*Materials and Structures*, 28 (181) (1995) 384-391).

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In the above mentioned paper, the authors present an interesting investigation of the testing of high-strength concrete, supported by a substantial amount of experimental data. Their main aim was to determine conversion coefficients between strengths obtained by various methods. However, the discussant would like to make three points.

1) There is no universal coefficient for deducing a cubic value from a cylindrical one. He has recently shown that the cylinder/cube strength ratio, in the HSC domain, may range from 0.71 to 1.02 [1]. This fact has been recognized by the authors. What made the discussant react is the classical recommendation that "further research is needed". Actually, as this ratio may display such a large variation, the only thing to do, in the discussant's opinion, is to *measure* it for each particular concrete being dealt with.

2) Another very important point, in assessing the quality of a particular test, is the *standard deviation* obtained. In the referenced tests [1], the discussant found a value as high as 6.7 MPa for 100-mm cubes, which led him to recommend grinding the test faces of the HSC cubes prior to testing. The authors did not address this point in their paper. Could they give the mean estimate of the coefficient of variation for each particular *type* of tests? While a series of 3/4 specimens does not allow obtaining a reliable assessment of the standard deviation of a couple (specimen, concrete), the mean value of the coefficient of variation, as obtained for a given specimen shape with each concrete, has more statistical significance.

3) A final comment deals with the explanation concerning the differences observed between plastic and steel molds. In addition to the two causes mentioned by the authors, a third one may play a role, that is, the temperature rise during hardening. In a 160 x 320-mm cylindrical steel mold filled with HSC, an increase of temperature of up to 10°C may be encountered during hardening [2]. A plastic mold has a lower thermal conductivity, so that the temperature rise may be even higher. On the other hand, it is well known that the higher the curing temperature, the lower the final strength of a concrete [3].

REFERENCES

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- [3] Laplante, P., 'Propriétés mécaniques des bétons durcissants: analyse comparée des bétons classiques et à très hautes performances', *Études et recherches des Laboratoires des Ponts et Chaussées*, OA 13, 299 p. (LCPC, December, 1993).

REPLY TO THE DISCUSSION OF F. DE LARRARD

The authors would like to express their thanks to F. de Larrard for his interest in the paper and for his comments, and would like to offer the following response:

1) It is generally accepted that experiments mainly yield the closest results to reality. However, it is not usually easy to measure each concrete property experimentally. It should also be pointed out that the compressive strength is not only used for quality control purposes. Sometimes, for instance, two or more particular expressions that depend on compressive strength results need to be compared and examined with different test results worldwide. In one expression, the cylinder strength is used, while the cube strength is accepted in another one. What can we do? We should have a conversion factor linking, even approximately, both the cylinder strength and the cube strength. For high strength concrete (HSC), however, the quantity of investigations and test data is still relatively small compared to normal strength concrete (NSC). This may be a reason, among others, for the large variation appearing in the cylinder/cube strength ratio in the case of HSC. In the authors' opinion, if we had much more test data on the cylinder/cube strength ratio, it would be possible to obtain greater accuracy and lessen the variation.

2) In the second comment, the discussant suggested grinding the test faces of HSC cubes prior to testing,