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Concrete strength evaluation through the use of small diameter cores

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The Authors have highlighted the two principal causes of uncertainty relating to core testing which appear to be aggravated as the diameter of test specimens reduces. First, the influence of length/diameter ratio has been examined by many workers as the Authors indicate, but the work of Munday and Dhir²⁶ indicates that the influence of strength level on corrections may be relevant to their findings. The second factor is moisture content. Drying rates are notoriously variable, hence the standard use of specimens soaked for 48 h in the UK. The procedures used by the Authors may well produce moisture conditions more closely approximating those existing in the in-place concrete, but their statement that the procedures maintain uniformity of moisture condition between specimens at the time of testing is questionable.

Recent results obtained at the University of Liverpool suggest that dry testing not only increases variability but also has a major effect on the influence of specimen proportions on measured strength. Dry testing may thus potentially provide an explanation for the discrepancies relating to length/diameter effects reported by the Authors as well as the high variability of vertically drilled 100 mm cores that they encountered. In this latter respect it would be interesting to know how their air-cured specimens were stacked, and if they were turned during storage. It is noted that 28 day tests were made on specimens cut one or two

weeks before that time. Although the specimens were returned to their original curing regime it is surely possible that the effect of the environment on a core will differ from that on concrete within a larger specimen during the strength development phase.

Reply by the authors

Kesler¹⁰ has indicated that concrete strength is important in determining the correction factors for cores having low L/D ratios; in particular, lower strength concretes require greater correction than do higher strength concretes. Munday and Dhir²⁶ also reach the same conclusion that the effect of L/D on measured core strength varies with its strength and that this effect increases at an increasing rate as both L/D and concrete strength decrease. In our investigation, for vertically drilled cores, only six mixes were tested. The limited results (Fig. 2) show a fairly consistent trend in respect of this effect for L/D ratios of 1.0 and an inconsistent trend for L/D ratios of 1.5. Nonetheless, the results generally concur with Kesler's¹⁰ conclusion.

We agree with Dr Bungey that drying rates are variable, even in the very humid tropical climate of Singapore. The testing procedures reported in the investigation were adopted to maintain a general moisture condition under laboratory conditions at the time of testing. Its departure from the moisture

Fig. 2. Strength correction factors for L/D ratios

condition required in BS 1881⁹ could well support conclusion 2.

In our investigation, air-cured specimens were kept in an open air environment with one of their flat ends, on level ground. They were left untouched until the day before testing when they were brought into the laboratory for trimming, capping and load testing.

The number of specimens tested at any one age, as well as the time required for their preparation, necessitated the need to cut the 28 day specimens 1–2 weeks before testing. We agree that the effect of the environment on a core will be different from that on concrete within a larger specimen during the strength development phase. This observation could well explain the observation reported in conclusion 5.

Reference

26. MUNDAY J. G. L. and DHIR R. K. Assessment of in situ concrete quality by core testing. *In situ/Nondestructive Testing of Concrete*. pp. 393–410. American Concrete Institute, Detroit, 1984, SP 82-20.