Discussion

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Young's modulus and Poisson's ratio of concrete cured at various humidities*

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Contribution by O. Ishai

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The paper has successfully achieved its objective of providing valuable information on the various moduli of concrete. It is to be regretted, however, that it should be limited to description and analysis of results, without any attempt at explaining the phenomena involved.

The influence of platen friction on lateral deformation during compression tests can be obviated altogether by interposing a layer of wax or any other frictionless material, whereas increase of the height/diameter ratio only reduces this effect but does not eliminate it. The wide scatter in the values of Poisson's ratio (Figures 3 and 5) can be attributed to distortion of lateral readings due to micro-cracks widening perpendicularly to the direction of the axial load. These micro-cracks already appear at low stress levels^(1,2) without specific dependence on concrete strength.

The reduction in Young's modulus with time at low humidities (40–65%) can be attributed to emptying of the cavities in the concrete as they dry out. This process not only arrests hydration at an early age, but also increases the instantaneous deformations by transforming water-filled cavities, behaving like rigid nuclei under instantaneous load, into air voids. This phenomenon was also noted by the contributor and his co-worker⁽³⁾ in the course of a study on the variation of instantaneous torsional deformations of mortar specimens during oven-drying at 105°C.

As shown by curves based on the author's Tables (Figures 4c and d), correlation between Young's modulus and strength is especially weak in concrete with high water/cement ratio at low humidities. The

reason lies in the qualitative physical dissimilarity between these parameters, which are affected differently by the two factors mentioned. At this juncture, a warning is in order against the unverified use of formulae, Tables and curves relating the two parameters, a common practice in the design of prestressed concrete elements and statically indeterminate structures. As shown by the curves in Dr Plowman's paper and other experimental studies, the correlation is only reliable in circumstances identical with the laboratory conditions under which the experiment was carried out (and even then there is wide scatter), while obviously no uniform conditions can be expected in field work.

REFERENCES

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Reply by the author

Increasing the height/diameter ratio has of course not eliminated entirely the effects of platen friction but they have been reduced, it is thought, to a level low enough to be disregarded in this investigation. The experimental work is continuing and it is hoped to publish the results at a later date with comments on the phenomena involved. Delaying publication until these results were available was thought to be depriving other workers for too long a time of information which might be of use to them.

*Pages 77–82 of *Magazine* No. 44.