Concrete research news

from University College, University of London

Testing concrete at early ages

INTRODUCTION

The ultrasonic-pulse-velocity method of testing concrete has interesting potentialities for monitoring changes in strength with time from a few hours after the concrete has been placed. The application of this facility during construction work could result in an increase in the rate of progress as well as providing a check on quality assurance, but the reliability of the relationship between pulse velocity and strength must be established.

AIM

To examine the reliability of concrete-strength estimation from pulse-velocity measurements made during the first few days after placing for temperature regimes ranging from below 0° to 60°C.

SCOPE OF RESEARCH

The tests have been made mainly on 100 mm cubes but continuous monitoring has also been carried out on a number of 300 × 100 × 165 mm prisms, the 300 mm length being used as the pulse path. For this monitoring, a special add-on unit has been developed to convert the digital output of a Pundit ultrasonic apparatus into an analogue output, to enable the transit time to be recorded continuously against age on a pen recorder.

The variables being studied are mix proportions, type of aggregate, type of cement, curing temperature and humidity. Cycles of freezing and thawing have been included in the curing conditions examined.

PROGRESS TO DATE

Empirical relationships between strength and pulse velocity have been established, particular attention being given to those corresponding to an age from about 3 h up to a cube strength of about 15 N/mm². It appears that these relationships are practically independent of the curing temperature within the range 1° to 60°C.

With the use of the continuous monitoring equipment, the damage caused by freezing and thawing has been clearly indicated by pulse-velocity changes. It has been found that, for an aggregate/cement ratio of 5·0, if freezing is delayed until a pulse velocity of about 3·6 km/s has developed, the long-term strength of concrete which has been subjected to freezing and thawing is not reduced by more than 5% in comparison with normally cured concrete.

STAFF

Supervisor: Mr R. H. Elvery
Investigator: Mr L. A. M. Ibrahim
Address: Department of Civil and Municipal Engineering
University College, London
Gower Street
LONDON
WC1E 6BT

Ultrasonic attenuation in concrete

INTRODUCTION

Although pulse-velocity measurement has become a standard technique for testing concrete, attempts have been made in the past to measure the attenuation of ultrasonic pulses passing through concrete to provide an alternative method of assessing concrete quality. The main difficulty has been that of providing constant coupling conditions between the transducers and the concrete surface. The variation in signal strength due to variations in coupling efficiency has been greater

than the attenuation changes being measured in the concrete.

In the present programme, tests are being made with the transducers and concrete specimens immersed in water to overcome this problem, and measurements of the amplitude of the first half-wave received by the receiving transducers are being made.

AIM

To study ultrasonic-pulse attenuation in concrete specimens in order to evaluate the method as a means of testing concrete.

SCOPE OF RESEARCH

Attenuation of ultrasonic pulses is being measured by a cathode-ray oscilloscope in conjunction with a specially designed unit which can measure attenuation accurately.

The underwater technique has required the use of watertight transducers. Three sets of these have been made with frequencies of 54, 82 and 118 kHz respectively.

Most of the specimens used in this programme have been prisms of 100 × 100 × 250 mm size and a study is being made of the relationship between strength and both pulse velocity and attenuation for a range of mix proportions and ages. Tests are also being made on larger specimens with void-forming inclusions to determine the effectiveness of void location.

PROGRESS TO DATE

Results from the tests carried out so far indicate that pulse-attenuation measurement is not as consistent as pulse-velocity measurement, but it can be of greater value when it is used for the detection and location of zones of substandard concrete

STAFF

Supervisor: Mr R. H. Elvery
Investigator: Mr L. C. F. Lam Tin Cheung
Address: Department of Civil and Municipal Engineering
University College, London
Gower Street
LONDON
WC1E 6BT