

ABSTRACT

Effect of Aggregate Content on the Non-Destructive Testing of Concrete

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The non-destructive testing (NDT) of concrete is being increasingly used in the evaluation of reinforced concrete structures for the purpose of determining the quality and the strength of concrete in structural members. In the majority of cases the data obtained from performing these tests is used in the acceptance or rejection of structures or parts thereof in first-time construction or in relation to subsequent recommendations for rehabilitation work.

Because of the importance of the resulting decisions, the reliability of the NDT instruments, the competence of the technicians who operate these instruments and the ability of the evaluator to interpret the data accurately are key factors in performing a proper non-destructive evaluation.

Two methods commonly used in non-destructive evaluations locally employ the Rebound Hammer and the Ultrasonic Pulse Velocity (UPV) Tester.

A limited amount of work however has been performed to assess the effect of variations in concrete mix proportions on the final NDT result obtained from these instruments.

Some of the research conducted includes that done by Osborne [1-2], Davis [3], Tomsett [4] and Kaplan [5]. The only local data available is that submitted by Osborne [1-2].

This Project Report presents data obtained from twelve concrete mixes of different aggregate/cement (A/C) and water/cement (W/C) ratios using local quartzitic Guanapo aggregate. The cube specimens produced were tested non-destructively with both the Rebound Hammer and the UPV Tester for determination of rebound number and ultrasonic pulse velocity respectively. They were then tested destructively for determination of compressive strength.

The data indicate that the relationship between compressive strength and rebound number followed a linear trend. Variations in the aggregate/cement ratio did not indicate any significant or characteristic effect on the rebound number.

Comparison of compressive strength (f_{cu}) and ultrasonic pulse velocity (UPV) indicated:

- (i) a linear relationship between the common logarithm of compressive strength and UPV, and
- (ii) an exponential relationship between compressive strength and UPV.

(The relationship in (i) exhibited a higher correlation between the two variables).

For a specific value of compressive strength, the pulse velocity was found to be lower at a lower aggregate/cement ratio.