

**NON-DESTRUCTIVE EVALUATION OF STRENGTH
GAIN OF ORDINARY PORTLAND CEMENT MORTAR
BY ULTRASONIC PULSE VELOCITY METHOD**

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Department of Materials Science and Engineering

University of Moratuwa

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Dissertation submitted in partial fulfillment of the requirements for the degree Master



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Declaration

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Acknowledgement

I take this chance to forward my greatest gratitude to University of Moratuwa, for letting me to do the postgraduate degree in Materials Science & Engineering in the Department of Materials Science and Engineering.

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Abstract

This research is based on the results of the study of ultrasonic pulse velocity and compressive strength of ordinary Portland cement mortar. Objectives of this study are to determine correlations between ultrasonic pulse velocity and compressive strength of cement mortar and to predict strength of cement mortar at 28 days within 02 days using ultrasonic pulse velocity of cement mortar. Ten samples of ordinary Portland cement obtained from ten different sources were used to prepare thirty (30) specimens of cement mortar. Water/cement ratio, sand content, method of specimen preparation, curing conditions were kept constant throughout the experiment. Portable Ultrasonic Nondestructive Digital Indicating Tester with a transducer of 54 kHz frequency was used to measure ultrasonic pulse velocity.

Initially ultrasonic pulse velocity of ten samples of cement mortar was measured and compressive strength of same specimens was determined. Then the behavior of ultrasonic pulse velocity with cement hydration was studied. Graphs between ultrasonic pulse velocity and compressive strength of cement mortar, and graphs between ultrasonic pulse velocity and curing time were plotted for ten samples. Correlations obtained from above experiments were used to predict 28 days compressive strength of cement mortar within 02 days.

In this research it was found that the relationship between ultrasonic pulse velocity and compressive strength was linear and Lime Saturation Factor of cement also has an influence on this relationship. Further it was seen that, with the increase of curing period, ultrasonic pulse velocity of all samples increased. At the end it was possible to obtain an equation that can predict the cement strength and that equation was verified using another five (05) cement mortar samples.



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List of abbreviations

Abbreviation	Description
NDE	Non destructive evaluation
OPC	Ordinary Portland cement
SLSI	Sri Lanka Standards Institution
UPV	Ultrasonic Pulse Velocity
NDT	Non destructive testing
LSF	Lime saturation factor
UPA	Ultrasonic pulse attenuation
PUNDIT	Portable Ultrasonic Nondestructive Digital Indicating Tester



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