UNIVERSITI PUTRA MALAYSIA

EFFECTIVENESS OF NUTS FOR DETECTION OF CONCRETE DIETERIORATION AND DEFECTS

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EFFECTIVENESS OF NDTs FOR DETECTION OF CONCRETE DETERIORATION OR DEFECTS

By

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This project report attached hereto, entitled **"Effectiveness of NDTs for Detection of Concrete Deterioration of Defects"** prepared and submitted by Norsuzailina Mohamed Sutan in partial fulfillment of the requirement for the degree of Master of Science is hereby accepted.

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ABSTRACT

The deterioration of concrete in structure is a result of several degradation mechanisms and results in a decrease in the integrity of the structure. The state of deterioration is often hidden from view and is only evident at a stage where there is a significant reduction in the load carrying capacity. Ensuring better performance of concrete structures requires early detection of defects. Defects are often introduced during casting and detection during in-service life is often too late to remedy the situation.

Tests were performed to evaluate the feasibility of using Impact-Echo Method and Ultrasonic Pulse Velocity Test in detecting defect and determining its depth during the early age concrete (between day 3 to day 28) or in another word monitoring the quality of concrete on site as early as possible.

Tests were performed on two RC Slabs Grade 30 and 40 at day 3,7,14 and 28 with a fabricated void at a known location. The results obtained from using both tests were compared to the known void location to determine the accuracy of both methods hence the effectiveness of each test. Tests were also performed to examine theoretically the relationship between the porosity of concrete at each stage and different strength with the accuracy of void depth detected.

Both methods could detect defect in specimens during the early age. However, in the determination of depth of defect, Impact-Echo Test gave more accurate results. Porosity has significant effect on the accuracy since the lower the porosity, the more accurate the depth of defect determined. In addition, the stronger the concrete, the better accuracy obtained for both methods.

It is concluded that both methods can be used to assess the in-situ properties of concrete or as means for quality control on site since both tests could detect defects from day 3 and the accuracy ranges 55.75% to 99.05% from day 3 to day 28 (full strength)

TABLE OF CONTENTS:

Permission to make photocopies	ii.
Project approval form	iii.
Acknowledgements	iv.
Abstract	v.
Table of content	vii.
List of tables	ix.
List of graphs	x.
List of figures	xii.
List of plates	xiii.
1.0 INTRODUCTION	**1.**
1.1 Background	1.
1.2 What is NDT?	2.
1.3. Scope of Study	3.
2.0 LITERATURE REVIEW	**4.**
2.1 Ultrasonic Pulse Velocity Test	4.
2.1.1 History and Development	4.
2.1.2 Testing Principle	5.
2.2 Impact-Echo Test	6.
2.2.1 History and Development	6.
2.2.2 Testing Principle	8.
2.3 Derivation from Previous Studies	10.

3.0 METHODOLOGY 11.
3.1 Experimental Set-up 11.
3.2 Approach to Testing 12.
3.2.1 Impact-Echo Test 12.
3.2.2 Ultrasonic Pulse Velocity Test 14.

4.0 RESULTS AND DISCUSSION 16.
4.1 Ultrasonic Pulse Velocity Test Results 16.
4.1.1 Void Depth Determination 16.
4.1.2 Tabulated Results 20.
4.2 Impact-Echo Test Results 21.
4.2.1 Void Depth Determination from Spectra 21.
4.2.2 Tabulated Results 25.
4.3 Assessment of Test Methods 26.
4.4 Discussion 27.
4.4.1 Accuracy 27.
4.4.2 Theoretical Factor Affecting the Results 28.
5.0 CONCLUSION AND RECOMMENDATIONS 31.
5.1 Conclusion 31.
5.2 Recommendation for Further Research 32.

REFERENCES 33.
APPENDIX A: Mix Proportion of Project Specimen 36.
APPENDIX B: Calibration Specimens, Project Specimens and Testing of Specimens 37.
APPENDIX C: Tests Data of UPV 41.
APPENDIX D: Determination of Void Depth and Accuracy for UPV 42.
APPENDIX E: Calculation Prior to Testing for Impact –Echo Test 46.
APPENDIX F: Determination of Void Depth and Accuracy for Impact-Echo Test 49.
APPENDIX G: Changes of Porosity with Specimens Age (Theoretical) 51.

LIST OF TABLES:

TABLE		PAGE
Table 4.1	Impact Echo Test Results	20
Table 4.2	Ultrasonic Pulse Velocity Test Results	25
Table C.1	UPV Test Data	41

LIST OF GRAPHS:

TABLE		PAGE
Graph 4.1	Void Depth Determination by the Indirect Method (Grade 30 RC Slab at day 3)	16
Graph 4.2	Void Depth Determination by the Indirect Method (Grade 30 RC Slab at day 7)	17
Graph 4.3	Void Depth Determination by the Indirect Method (Grade 30 RC Slab at day 14)	17
Graph 4.4	Void Depth Determination by the Indirect Method (Grade 30 RC Slab at day 28)	18
Graph 4.5	Void Depth Determination by the Indirect Method (Grade 40 RC Slab at day 3)	18
Graph 4.6	Void Depth Determination by the Indirect Method (Grade 40 RC Slab at day 7)	19
Graph 4.7	Void Depth Determination by the Indirect Method (Grade 40 RC Slab at day 14)	19
Graph 4.8	Void Depth Determination by the Indirect Method (Grade 40 RC Slab at day 28)	20
Graph 4.9	Accuracy of Void Depth (GD30)	26
Graph 4.10	Accuracy of Void Depth (GD40)	27
Graph 4.11	Correlation Between Accuracy of UPV Test and Porosity (GD30)	29
Graph 4.12	Correlation Between Accuracy of Impact-Echo Test and Porosity (GD30)	29
Graph 4.13	Correlation Between Accuracy of UPV Test and Porosity (GD40)	30

Graph 4.14 Correlation Between Accuracy of Impact-Echo Test and Porosity (GD40) 30

Graph G.1 Porosity Vs Slab Age (GD30) 51

Graph G.2 Porosity Vs Slab Age (GD40) 51

LIST OF FIGURES:

FIGURE		PAGE
Figure 3.1	Determination of Depth of Flaw by Indirect Method	15

LIST OF PLATES:

PLATE		PAGE
Plate B.1	Calibration RC Beam Specimen	37
Plate B.2	Calibration RC Slab Specimen	37
Plate B.3	RC Slab Grade 30 Project Specimen	38
Plate B.4	RC Slab Grade 40 Project Specimen	38
Plate B.5	Fabricated Defect/Void made of Polystyrene in one of the Specimens	39
Plate B.6	Testing with Ultrasonic Pulse Velocity Test	39
Plate B.7	Testing with Impact-Echo Test	40

CHAPTER 1

INTRODUCTION

1.0 Background

In the past years great progress has been made in the field of non-destructive testing in civil engineering (NDT-CE) and this trend will certainly continue and even accelerate. Although many novel ideas and approaches have been advanced and improved, instruments are being developed, new techniques are constantly being researched. Keywords like "maintenance or replacement "," quality control, monitoring "," building inspection and the like highlight this development.

Non-destructive testing in civil engineering will doubtless help outline future tasks and identify objects to be tested. Available solutions must be optimized. Testing strategies will have to be developed for special applications, e. g. how to use the different techniques, how to combine them with numerical calculations, how to check the accuracy of test results and how to interpret them. Potential users of NDT methods should be able to judge the benefits of the different techniques and test instruments. Non destructive testing can be applied to each stage of an item's construction. The materials and welds can be examined using NDT and either accepted, rejected or repaired. NDT techniques can then be used to monitor the integrity of the item or structure throughout its design life.

1.2 What is NDT?

Non-destructive testing is an interpretive nomenclature used for the inspection of materials and components in such a way that allows materials to be examined without changing or destroying their usefulness as oppose to destructive method. Non-destructive testing and evaluation techniques, which is less time consuming and possibly and relatively inexpensive provides relevant means for periodic inspections in order to maintain the quality of, constructed facilities. NDTs are useful for the following purposes:

1. Tests on actual structures.
2. Tests at several locations.
3. Tests at various ages.
4. Quality control of actual structures.
5. Assessment of uniformity of concrete.
6. Assessing whether forms can be safely removed, curing discontinued, prestressed applied, loads imposed etc.
7. Location and assessment of the extent of cracks, voids and honeycombs.
8. Monitoring progressive changes in the condition of reinforcement in concrete.
9. Confirmation of location of suspected distress or deterioration due to overloading, fatigue and chemical attack.

1.3 Scope of study

The project scope of study is to evaluate the feasibility of using **Impact-Echo Method** and **Ultrasonic Pulse Velocity Test** in detecting defect and determining its depth during the early age concrete (between day 3 to day 28).

The main interest is also to find out how changes in porosity of concrete with age affects the accuracy of defect detection of UPV and Impact-Echo tests and if there exist any correlation between them by monitoring the accuracy of defect detection in relation to the theoretical porosity changes of early age reinforced concrete.

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