

**CORRELATION STUDY OF DIELECTRIC CONSTANT  
COMPARED TO THE STRENGTH OF CONCRETE BLOCK USING  
MICROWAVE NON DESTRUCTIVE TESTING (MNDT)**

**Thesis presented in partial fulfillment for the award of the  
Bachelor in Electrical Engineering (Hons)  
UNIVERSITI TEKNOLOGI MARA**



**KAMAL SHAHRIL BIN KAMARWAHIDDIN  
FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA  
40450 SHAH ALAM SELANGOR  
MALAYSIA**

## **ACKNOWLEDGMENT**

Assalamualaikum. Praise to ALLAH, the most Merciful and the most Gracious for given me a healthy to finish my project and this thesis. Without His Grace and Compassion, none of this works would have been finished.

First I would like to express my deepest gratitude and appreciation to my supervisor of this project Puan Hasnida Bt Saad for the valuable guidance and advice. Without her encouragement and critics, this project maybe would not materialize on time. I also would like to thank her for given me a few references and example that is related to this project.

Secondly, I would like to extend my gratitude to Encik Zakaria who work at HTC Concrete Company and provided me some of block concrete samples. Appreciation also goes to Prof. Dr. Zaiki Awang for giving me the opportunity to use the MNDT equipment and also to Encik Khairil Adzhar research assistant at Microwave Laboratory for his guidance and my senior Mohd Hafiz Bin Abu Bakar.

I would also like to appreciate my thanks to technician at Civil Engineering for helping me and allow me using the equipment at the laboratory. Very special thanks to my family who always support me from behind until I finish this project successfully.

Last but not least I would to offer my regard and blessing to all of those involved either directly or indirectly towards the success of this project and thesis.

## ABSTRACT

The main objective of this paper to presents a method in determining the correlation between dielectric constant and the strength of concrete block using Microwave Non Destructive Testing (MNDT) at frequency X band with range of 8 GHz to 12 GHz. In order to complete this research, 30 samples from the 3 types of concrete cube had been collected from HTC concrete company and test it using MNDT technique. In order to know the electric properties such as dielectric constant loss factor and loss tangent, MNDT technique used free-space microwave measurement (FSMM) in order to get the data by reflection and transmission measurements in free space from the samples. Different grade of concrete block give different value of dielectric constant, factor loss, and tangent loss. Concrete block has an ideal characteristic of dielectric constant which is in between 2.1 – 2.3. All the results from experimental work were observed and analysed using FOTRAN software based on  $S_{11}$  and  $S_{21}$  parameters that measured by Microwave Non Destructive Testing (MNDT). From the results, obtained the average value of dielectric constant for concrete block grade 20 is 2.4, grade 30 is 2.6 and grade 35 is 3.0. Higher dielectric constant reflects higher strength of concrete block.

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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

Nowadays concrete is one of the materials that use widely in construction field after steels. Concrete also known as an artificial stone or rock. Its primary properties are that is workable before hardening, strong in compression and stays strong for extremely long timescales. Concrete is a strong hard building material composed of sand, gravel, cement and water. It is used for making buildings, roads, bridges, vessels pipes etc. These types of construction use different grade of concrete. Actually, concrete is a mixture of a binding agent which is generally cement to bond the other materials together such as fine aggregate (sand), coarse aggregate ( gravel/stones ), and water. Different grade of concrete give different strength. The strength of concrete is affected by the fluctuations in quality and type of aggregates, the batching accuracy of components and the accuracy of concrete mix preparation, and other factors.

#### 1.1.1 Non Destructive Testing (NDT)

Non Destructive Testing (NDT) is a technique that testing of materials to detect internal and surface defects which do not damage or destroy the material under test. There are five major NDT methods which are Radiography, Ultrasonic, Magnetic Particles, Liquid Penetrant and Eddy Current. Non Destructive Testing (NDT) has been used widely in industrial sectors such as petroleum, petrochemical, ship construction, aircraft, railway, power station, gas pipeline etc. The use of NDT in inspecting concrete is not as common as in the metallic construction. This may be due to lack of demand or no specific requirement by code or standard from the related sectors as compared to metallic construction. However, research and development