

**UNIVERSITI TEKNOLOGI MARA**

**DEPTH DETERMINATION OF  
UNDERGROUND PIPE IN DIFFERENT  
TYPE OF SOIL BY USING HIGH AND  
LOW FREQUENCY OF GROUND  
PENETRATING RADAR (GPR)**

**SUHaida BINTI SUAMKAH**

Thesis submitted in fulfillment  
of the requirements for the degree of  
**Bachelor of Surveying Science and Geomatic  
(Hons)**

**Faculty of Architecture, Planning and Surveying**

**January 2018**

## **AUTHOR'S DECLARATION**

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Undergraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Suhaida binti Suamkah

Student I.D. No. : 2014846632

Programme : Bachelor of Surveying Science and Geomatic (Hons)-  
AP220

Faculty : Architecture, Planning and Surveying

Thesis : Depth Determination of Underground Pipe in Different  
Type of Soil by Using High and Low Frequency of  
GPR

Signature of Student : .....

Date : January 2018

## **ABSTRACT**

Pipe detection is most crucial aspect that had to be taken in order to carry any activities on the ground. It is an important role to choose the best, correct type of instrument used in detecting the location, position and depth of the underground pipe for further work based on the type of the soil where the pipe was buried. Other than that, in order to investigate the pipes, a destructive technique is often used (Jones, 1982). So, the surveyed area was being damaged and destroyed. By using the GPR observation method, any destruction on the site can be prevented. In order to avoid from destroying the surrounding area, a precise digging planning can be obtained by using GPR device (Sepp, E. M., & Colonel, L., 2000). This study is done by comparison method where the depth of the underground pipe obtained from GPR observation for both frequencies will be compared with the depth obtained from leveling method. The depth comparison is applied for each of the type of the soil.

# TABLE OF CONTENT

	<b>Page</b>
<b>CONFIRMATION BY PANEL OF EXAMINERS</b>	<b>ii</b>
<b>AUTHOR'S DECLARATION</b>	<b>iii</b>
<b>ABSTRACT</b>	<b>iv</b>
<b>ACKNOWLEDGEMENT</b>	<b>v</b>
<b>TABLE OF CONTENT</b>	<b>vi</b>
<b>LIST OF TABLES</b>	<b>ix</b>
<b>LIST OF FIGURES</b>	<b>x</b>
<b>LIST OF PLATES</b>	<b>xi</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xii</b>
<b>CHAPTER ONE INTRODUCTION</b>	<b>1</b>
1.1 Research Background	1
1.2 Research Gap	2
1.3 Problem Statement	2
1.4 Research Aim	3
1.5 Research Objectives	3
1.6 Research Question	3
1.7 Methodology	4
1.8 Expected Outcome	7
1.9 Significance of Study	7
1.10 Structure of Thesis	7
1.11 Summary	8
<b>CHAPTER TWO LITERATURE REVIEW</b>	<b>9</b>
2.1 Introduction	9
2.2 Ground Penetrating Radar	9
2.3 Electromagnetic Wave of GPR	11
2.4 Reflection and Transmission of Wave	12
2.5 Dielectric Permittivity	12

2.6	Electric Conductivity	13
2.7	Magnetic Permeability	14
2.8	Frequency of GPR	14
2.9	Resolution of the GPR	15
2.10	Levelling	15
2.11	Temporary Bench Mark	16
2.12	Summary	17
<b>CHAPTER THREE RESEARCH METHODOLOGY</b>		<b>18</b>
3.1	Introduction	18
3.2	Methodology	18
3.3	Project Planning	20
	3.3.1 Study Area	20
	3.3.2 Research Tools and Instruments	21
3.4	Data Collection	21
	3.4.1 Depth of Underground Pipe using Levelling Method	22
	3.4.2 Depth of Underground Pipe using GPR Observation	22
3.5	Data Processing	23
	3.5.1 Calculation in Obtaining Depth using Levelling Method	23
	3.5.2 2D Analysis using ReflexW Software	23
3.6	Summary	24
<b>CHAPTER FOUR RESULTS AND DISCUSSION</b>		<b>25</b>
4.1	Introduction	25
4.2	Depth of The Underground Pipe using Leveling Method	25
4.3	Depth of The Underground Pipe using GPR Observation	25
4.4	Depth Comparison	26
4.5	Summary	28
<b>CHAPTER FIVE CONCLUSION</b>		<b>29</b>
5.1	Introduction	29
5.2	Limitation of Study	29
5.3	Recommendation	29