RELATIONSHIP BETWEEN GROUND PENETRATING RADAR (GPR) AND DYNAMIC CONE PENETROMETER (DCP) FOR SINKHOLE DETECTION

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ABSTRACT

Sinkholes are a common occurrence that frequently occurs around the world. A sinkhole is an event where water flows into a low area and will cause sedimentation of the soil. Several methods effectively detect and resolve the problem, such as using Ground Penetrating Radar (GPR) and Dynamic Cone Penetrometer (DCP). The study's aims will show the relationship between GPR and DCP measurement that will be affected the result for the sinkhole detection. The objectives are to detect a sinkhole's existence and investigate the relationship between GPR and DCP in sinkhole detection. The study area proposed for this study is the University of Technology MARA (UiTM) Arau, located in Perlis. In this study, a GPR measurement will be conducted using one wavelength which is 800MHz. The methodology includes site selection and reconnaissance, data collecting, data processing, data interpretation, and result; fifth processes or phases are involved. The GPR radargram will be processed using Reflexw software, and the analysis process, which is statistical analysis, was performed on the test result collected from GPR and DCP. As the expected outcome, the strong relationship between GPR and DCP will be achieved due to the sinkhole presence.

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CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter discuss about research details including research background, problem statement, aim and objectives, and significance of study.

1.1 Research Background

Sinkholes are a rare occurrence, but the tragedy can be disastrous when they do occur. The depth of the sinkhole can reach up to several meters, resulting in accidents. According to the US Geological Survey, sinkholes are pits in the ground when water collects in regions with no external drainage (Pappas, 2017). A sinkhole can be formed in many ways, such as through the effect of groundwater. When the groundwater gradient changes due to the removal or addition of water to the system, loose material might flow out more quickly than usual, creating voids that result in surface collapse (Conserve Energy Future, 2022). In simple words, it forms when the ground underneath the land surface cannot support it. There are various types of indentations in the earth's surface that are labelled or described as sinkholes.

Sinkholes are classified into three categories, and the formation is determined by the stratigraphy, which is the varied layers of soil and rock beneath the surface of a given region, as cited by Randazzo (2015). The first category, cover-collapse sinkholes can form suddenly where surface drainage, erosion, and deposition of sinkhole over time result in a shallower bowl-shaped depression. In the second category, where the covering sediments are permeable and contain sand, cover-subsidence sinkholes gradually form. The last type, solution sinkholes form where limestone is exposed at the earth's surface or is covered by thin layers of soil and permeable sand. Sinkhole detection was introduced as a result of this incidence.

The importance of sinkhole detection is to prevent sudden accidents because natural sinkholes cannot be prevented; they will inevitably happen and can be dangerous to the foundation of buildings and roads. A sinkhole's impact varies depending on where and how it forms. Natural sinkholes can form both on land and in the sea. When included on the ground, it can change the overall topography of the area and divert groundwater flow. If it forms unexpectedly in a densely populated place, it can cause a lot of damage to human life and property. Leaks in the underground storm drain and sewer systems caused several holes to form.