MUHAMMAD IMRAN

BACHELOR OF SURVEYING SCIENCE AND GEOMATICS (HONOURS)

FEBRUARY 2024

VERIFICATION OF UTILITIES EQUIPMENT ACCURACY FOR LOCATING ELECTRIC CABLE IN COMPLEX INSTALLATION

MUHAMMAD IMRAN BIN SHARIFFUDIN

2020618376

SCHOOL OF GEOMATICS SCIENCE AND NATURAL RESOURCES

COLLEGE OF BUILT ENVIRONMENT

UNIVERSITI TEKNOLOGI MARA MALAYSIA

JULY 2024

VERIFICATION OF UTILITIES EQUIPMENT ACCURACY FOR LOCATING ELECTRIC CABLE IN COMPLEX INSTALLATION

MUHAMMAD IMRAN BIN SHARIFFUDIN

2020618376

Thesis submitted to the Universiti Teknologi MARA Malaysia
in partial fulfilment for the award of the degree of the
Bachelor of Surveying Science and Geomatics (Honours)

JULY 2024

DECLARATION

I declare that the work on this project/dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA (UiTM). This project/dissertation is original and it is the result of my work, unless otherwise indicated or acknowledged as referenced work.

In the event that my project/dissertation be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree of the Bachelor of Surveying Science and Geomatics (Honours) and agree be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

Name of Student	:	Muhammad Imran Bin Shariffudin
Student's ID No	:	2020618376
Project/Dissertation Title	:	Verification of utilities equipment accuracy for locating electric cable in complex installation
Signature and Date	:	

Approved by:
I certify that I have examined the student's work and found that they are in accordance with the rules and regulations of the School and University and fulfils the requirements for the award of the degree of Bachelor of Surveying Science and Geomatics (Honours).

Name of Supervisor	:	SR DR Mimi Diana Binti Ghazali
Signature and Date	:	

ABSTRACT

Urban areas face significant challenges in maintaining and developing subsurface utility infrastructure due to the increasing complexity and density of underground utilities. The accurate detection and mapping of these utilities are crucial for ensuring efficient and safe urban development. This study aims to evaluate the accuracy and reliability of Ground Penetrating Radar (GPR) and Electromagnetic Locator (EML) technologies in detecting underground electric cables. The objectives include assessing the performance of different EML methods (induction and direct connection) and the effectiveness of GPR in achieving high precision in subsurface utility mapping. The research was conducted at UiTM Arau, Perlis, across two designated sites: a Real site and a Simulation site. The study employed EML methods (both induction and direct connection) to detect electric cables and GPR operating at an 800 Hz frequency to gather subsurface data. Data processing was conducted using Reflexw software, and accuracy was assessed using Root Mean Square Error (RMSE) calculations. The EML methods were evaluated for their RMSE values, with a particular focus on the impact of mutual coupling effects on accuracy. The study found that the direct connection method for EML demonstrated higher accuracy with lower RMSE values compared to the induction method, which was significantly affected by mutual coupling effects. The RMSE values for the induction method (2.56 for 8K Hz and 2.13 for 33K Hz) exceeded the acceptable threshold for Level A measurement accuracy as per JUPEM 2006 KPUP Circular 1. The GPR method showed high accuracy, with RMSE values within the acceptable range, supporting its effectiveness for precise underground utility detection. The results indicate that while GPR and the direct connection method of EML are suitable for achieving high precision in subsurface utility mapping, the induction method's susceptibility to mutual coupling effects limits its reliability. The RMSE value obtained for GPR on real site are 0.03 for cable 1, 0.03 for cable 2, 0.06 for cable 3 and cable 4 while for simulation 0.05 for both cable (cable 1 and cable 2). RMSE value obtain for EML instrument on real site are 4 m for induction method and 0.22 cm for direct connection method while on simulation site are 6 m for induction method and 0.09 cm for direct connection method. This study provides valuable insights for improving detection methods and supports the need for continued innovation in subsurface utility engineering.

TABLE OF CONTENTS