# UNIVERSITI TEKNOLOGI MARA

# AN ELECTRICAL RESISTIVITY MODEL FOR PREDICTING N-VALUES AND SOIL PROPERTIES

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# ABSTRACT

The geotechnical challenges of building on soft soil mostly concern the soil's strength and density. Due to the challenging soil at these locations, SI works are more challenging, and structural stability is more difficult to achieve without careful structural design.Standard Penetration Test (SPT) and soil properties data are crucial factors in the design of piles and foundation strcutures. This data play a fundamental role in assessing the soil's strength and behavior. This data are essential for ensuring the stability and performance of structures, paricularly in situation where the soil conditions vary across a contruction.A structural design can be held up by the difficulties of conducting site investigations and the absence of adequate site research procedures. Parameters of $w$, $\rho_{dry}$ and N-values are the most important parameters required in many geotechnical and structural design solutions. Making boreholes and collecting soil samples during a site inquiry is hampered by the uneven surface of the soil. Instability in the supported structure may result from this critical condition. In addition to being more cost-effective, particularly for bigger areas, the structural design may be produced immediately without waiting for laboratory results. Regarding the characterisation of subsurface profiles across broad regions, the Electrical Resistivity Method (ERM) is a particularly intriguing geophysical technique. Due to its reasonable cost and quicker time, ERM is a geophysical method employed for several years. However, this method's output data cannot be used to determine the soil's physical and engineering characteristics. This research is to improve the current situation with create the modelling which is soil characteristics and other SI data were compared to resistivity readings to determine if there is a correlation between the two. Section 23 of Shah Alam, Selangor; Block F of Taman Keramat Permai; Menara Matrade; and the Institute for Comparative Research and Integrated Care for Animals and Use (ICRACU) are the four locations under investigation. The investigation was conducted to establish a connection between the resistive behaviour of soil and the soil's physical attributes measured in the same location. Using MINITAB, the analysis results show that water content, $w$, dry density, $\rho_{\text{dry}}$ and N-value for strength properties have a good correlation with resistivity, $\Omega$. Three (3) models have been successfully formed to determine the $w$, $\rho_{dry}$ and N-values based on the resistivity values obtained. With the formation of this model, the value of $w$, $\rho_{\text{dry}}$ and N-values are faster and easier to gather only when knowing the value of $\Omega$. This study may offer a guideline for filling in some gaps in previous research where the capabilities of soft computing techniques can be highlighted in numerous engineering disciplines, particularly civil engineering and geotechnical engineering.

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# CHAPTER ONE
# INTRODUCTION

## 1.1 Research Background

At an early stage in development, the foundation for the supporting buildings was improperly designed due to a lack of information and data obtained during the site study. The problem has persisted as a major obstacle in construction engineering. This study uses a geophysical approach (Akhtar et al., 2018), favoured by geophysicists and has recently emerged as one of the most widely applied techniques in civil engineering.

The Electrical Resistivity Method (ERM) is a powerful geophysical instrument for characterising subsurface profiles across extensive areas. Soil strength, an important engineering property, is a constantly evolving and complex study field. According to Qian et al. (2019), shear strength failure is the primary cause of shallow foundation collapse. This is because many shallow foundations are built in the soil layer above the groundwater table, where the soil remains unsaturated. Das (2011) states that the subsidence of a structure resting on a soil foundation may be the outcome of two separate actions occurring within the foundation soil. These processes include the development of shear stresses within the soil mass, which are resisted by the material's shear strength, the effect of compressive stress and the corresponding strain in the soil mass due to the same imposed load. Soil qualities are an essential assessment tool for geotechnical design (Qian et al., 2019). In most cases, a designer or engineer found that performing a soil test is the most practical way to gather soil data that can be obtained by performing a standard penetration test (SPT).

## 1.2 Problem Statement

Previous research by Gui (2003) found that the construction process frequently involves various geotechnical challenges, with the durability issue posing the greatest concern. Engineers responsible for constructing projects on unstable soil often encounter many complicated geotechnical difficulties. Soil that is soft, like clay, can be easily compressed by applying pressure (Chunlin Li, 2014). Generally, it is