CHAPTER 1 INTRODUCTION

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1.1 BACKGROUND

As there is the uncertainty of subsoil and the orientation of the boundaries between the individual soil strata is always incomplete, it is a major concern to assist engineers with better design and developments in future (Zhang et al., 2020; Shen et al., 2021). This book was focused on investigating the behaviour of soil and rock in solving various geotechnical issues. Numerous studies related to soil and rock properties have been discussed and the application of the respective techniques have been applied in civil engineering construction (El-Naqa et al., 2019). The number of construction developments increases due to the increase in demand for houses and major structures. Consequently, stable soil formation as a foundation of the sub and superstructure is needed and the choice of suitable soil material is inevitable (Jiang et al., 2023).

This book is divided into two main topics which are Part I: Ground improvement and Part II: Advanced geotechnical method and applied design technologies. The first part is "Ground improvement" consists of four subchapters: Stabilisation of laterite soil using canlite soil stabiliser, Stabilisation of marine clay using biomass silica rubber chips mixture, microstructure analysis of electronically Malaysia stabilised peat and tree-induced suction on two-layered slope under rainfall patterns. This is followed by the second part which emphasised the "Advanced

geotechnical method and applied technologies" and consists of subchapter such as particle image velocimetry in geotechnical engineering, 2D resistivity method in locating near-surface fracture zones, geotechnical properties of tokai clay for double track construction, design of engineered sanitary landfill liner using laterite soil, art of tunnel lining design in soft ground and effects of permeability disparity on seepage pattern of earth fill dam.

1.2 GROUND IMPROVEMENT

Most of the soil's problems are encountered on site where the properties of materials cannot reach the required specification. Variation in soils' properties and their compositions with time and loading gives a challenge to the geotechnical engineer (Hussin et al., 2021). Some of the properties in soils also do not meet the required standard for successful construction. Therefore, various ground improvement methods are used to provide a viable solution to such a challenge.

The chapters covered in "Ground improvement" discussed the solution of stabilising different types of soil associated with unsuitable material. It covers the solution for problematic soil including the laterite soil, marine clay and peat. Those materials are treated by stabiliser either chemical or waste material, using mechanical improvement techniques. In addition, the application of ground improvement on the slope surface by means of tree-induced suction has also been discussed.

Common chemical stabilisers used are either lime or cement. These two types of stabilisers are popular due to their promising in sustaining the prolonged pozzolanic reaction. However, nowadays a similar function of reaction is also provided by another nontraditional stabiliser. In this book, canlite which is also dominated by sufficient calcium oxide (CaO) was used to stabilise the laterite soil (Chapter 2). Different from lime and cement, canlite is mixed with soil material in the form of liquid. The findings proved that canlite also provided a similar long-term pozzolanic reaction as the strength of laterite soil not only improved

immediately with the addition of canlite content but also showed progression in strength with the curing period.

Using chemicals to treat unsuitable material normally prolong with time. This is one of the unique attributes of such a stabiliser with the presence of sufficient cations (Ca^{2+}) and clay minerals, influencing pozzolanic reaction. However, in such cases where the pozzolanic materials are absent or insufficient, modification is still taking place to treat the unsuitable material. Hence, this results in a short-term solution. In such cases, the utilisation of waste material is the solution to not only modify the unsuitable material but also provide the solution of abundant waste material. For instance, by utilising the rubber chips material produced by the rubber industry as one of the stabiliser materials in enhancing the engineering properties of marine clay. Slightly different from canlite which has similar properties to lime or cement, addition of rubber chips on marine clay is aimed to provide a short-term solution. This is because it has no pozzolanic materials to provide long-term strength gained. Nonetheless, it contributes to the reduction in a void, hence increasing the stability and the serviceability of the soil structure. In this book, the utilisation of rubber chips on marine clay shows a promising result of up to seven days of curing (Chapter 3). Not only that, but the findings also proved the basis in terms of cost reduction while protecting the environment.

Peat is considered the worst type of unsuitable material. Even some study and application of chemical Stabilisation has been carried out, but the success rate is still an argument. The main issue with peat is its permeability characteristics. In this book, peat soil is improved by using electrokinetic Stabilisation to induce a consolidation process as an advantage over traditional methods (Chapter 4). As a result, the strength of peat increased due to flocculation which enhanced the consolidation process.

As we know, the factor triggering soil instability is water. This is more serious when it comes to slope stability. Rainfall contributes to the triggering of landslides by infiltrating the slope cover, which causes a rise in the groundwater-surface and an increase in the hydrostatic pore water