CHAPTER 1

INTRODUCTION

1.1 Introduction and Background

In Malaysia, there is around 3 million hectares or approximately 8% of the land is covered with peats. In state of Sarawak, 1.66 million of the land is covered with peat soil (Huat, Prasad, Asadi, & Kazemian, 2014). Peat is an organic soil where the organic content is higher than 75%. The formation of peat soil layer is due the rate of accumulation of plant’s remaining is higher and faster the rate of decomposition. Peat represents an accumulation of disintegrated plant remains which have been preserved under conditions of incomplete aeration and high water content. The formation of peats is more favourable when the area is waterlogged, with excess rainfall and low permeability ground, irrespective of latitude or altitude (Huat et al., 2014). The peat soil is classified as problematic soil due to its natural properties of high compressibility, low shear strength, high initial water content. The high compressibility of peat soil will poses problem of secondary settlement and even tertiary settlement in long term due to the further decomposition of peats. It is found that peat has the potential to be decomposed further and its decomposition rate could be accelerated by controlling the influencing factors like oxygen supply, C:N ratio, pH value and temperature for optimum condition (Pichan & O’Kelly, 2012). The high water content rendering the soil unsuitable for construction. The water content of peat normally varies from 500% to 2000% while for those peat where the water content of less than 500% are usually indicates that there are high mineral fractions within the peat sample (Huat et al., 2014). According to Hwang, Humphrey, Bobet, & Santagata (2005), when dealing with organic and peat soil, few options are available to improve or strengthen the soil, the engineer or owner can choose to strengthen the foundation, eliminate the problem soil (cut & replace), soil treatment or relocate the project. The second and last option are always selected by owner or engineer.
This is because the peat soil is hard to deal with and further consolidation and stability problem may occur in future due to high compressibility and further decomposition of peat. Problem arise when the country facing limitation or shortage of land for development. Hence, solution in strengthening or improving the peat soil plays an important in future development of the country like Malaysia. Several methods such as surface reinforcement, preloading, vertical drain, deep stabilization, piling and chemical stabilization had been introduced by previous researcher in order to improve organic soil and peat soil. Dry Deep Soil Mixing (DSM) also referred to Cement Column is a common method for soft soil stabilization. This in-situ stabilization method involves the mechanical mixing of cementitious compound such as Ordinary Portland cement (OPC) and lime with weak/soft soil.

1.2 Problem Statement

Peat soil is considered as problematic soil due to its natural properties of low shear strength, high compressibility and high initial water content. It is suitable for plantation and agricultural purpose but when comes to construction field, it becomes unsuitable and unfavourable for the engineer to construct the structure like road, building and foundation on it. This is because construction problems like secondary settlement and stability problem may occur when the structure is built on the peat soil. Construction on peat soil is always the last option for engineer and developer as it is very costly and the effectiveness of existing treatment is questionable. However, due to the rapid development in country, lack of land for construction becomes another issue. Thus, solution for the strengthening and improving the peat soil is essential and important in future country development. It is important to understand the properties of peat soil in order to overcome and improve the properties of peat.

Many methods and approaches have been introduced in order to improve the peat soil. However, some of them require huge amount of budget and yet the effectiveness of the ground improvement method is questionable. Hence, elements like environment friendliness, cost, effectiveness, reliability and durability should be considered in selecting the best method of ground improvement.
Cement column stabilization is a common method for soft soil stabilization. In construction industry, OPC is always the first choice cementitious materials for the cement column stabilization because it economically-friendly and high accessibility. However, OPC is highly not environmental friendly and it will contributes to climate changes and global warming. The huge amount of carbon dioxide due to the production of Cement contributes to global warming.

1.3 Research Objectives

The main purpose of this research is to study the effectiveness of cement column in increasing the shear strength and ultimate vertical bearing capacity of homogenous stabilized tropical peat of East Coast of Peninsular Malaysia (Pekan Peat). Three specific objectives have been listed below in order to achieve the aim of this research.

Objective 1: To determine the properties of Tropical Peat.
Objective 2: To measure the shear strength of soil cement column after the stabilization.
Objective 3: To measure the ultimate vertical bearing capacity of footing on stabilized tropical peat.

1.4 Research Questions

This study aimed to address the following research questions

1. What is the effect of cement column which consisting of different proportion of OPC and Fly Ash towards the shear strength of peat soil?
2. What is the effect of cement column which consisting of different proportion of OPC and Fly Ash towards the shear strength of peat soil?