CHAPTER 1

INTRODUCTION

1.1 Background of Study

Clayey soils are usually categorized as expansive soils. Other names of these soils are soft soils or fine-grained soils. These types of soils are known lead to critical damage to structures resting on them. Normally in construction industries, the structures that constructed on clay soils are tend to trigger the soil when exposed to additional load as well as external impact. This deformation could potentially cause significant failure to foundation and structures. Besides, the construction of roadway on the soft soils also encountered the same problem. This is because the soils do not have enough physical properties for construction application. It is very risky if the construction is still continuing on these types of soils without any remediation or improvement on the soils. As a general knowledge, the common approach when facing this difficulty is to remove all the soils and replace it with stronger soils or material like crushed rocks. The excessive expenses regarding the soils replacement cause the researcher to explore another method to make the cost become more reasonable.

Nowadays, there are many methods to improve the soils. From time to time, researchers make use of soils stabilization technique to enhance the geotechnical characteristics of clay soil to maintain roadways, control foundation settlement, prevent structures from collapsing, as well as avoid any kind of related failure. Various soil stabilization techniques are suitable for stabilization involving expansive clayey soil. These kinds of methods consist the application of chemicals, soil replacing, rewetting, moisture control, compaction control, surcharge loading and thermal methods (Chen, 1988; Nelson and Miller, 1992; Yong and Ouhadi, 2007). Instead of using chemical product, recycled or reused materials usually are might offer more economical options
for a variety application of soil stabilization. As an example we can use lime and silica fume to improve the soil characteristics and also the performance of the soil. Preservation with the aim of getting rid of all environmental considerations is really a series issue (Edil & Craig, 2007). All these methods may have their advantages and disadvantages of being ineffective and also costly. Therefore, new methods are still being research to improve the strength properties in order to reduce the swell potential of expansive soils.

As an example, cement was initially utilized as a stabilizing agent in the beginning of the 20th century. It had been combined with the soils in order to create road materials and was used in a wide range of applications worldwide. Since then, many other materials such as lime, fly ash, silica fume, organic polymers and other mixtures have been used as stabilizing agent. Among the stabilizing agent that have been identified, lime and silica fume have been selected in this research because these types of materials have good characteristics to improve its stability, increase the bearing capacity and reduce settlement and lateral deformation of the clayey soil. Type of clay use is Kaolin S300. As a general knowledge, kaolin is a clay mineral with the chemical composition $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ (Weaver & Pollard, 1973). Kaolin has a minimal shrink swell capacity and low cation exchange capacity. It is easy to absorb water and will shrink as water is drawn away. This kind of clayey soil contains clay mineral that have the possibility of swelling and shrinkage under transforming water content.

Lime provides an economical as well as powerful way of chemical improvement. The standard utilization of lime stabilization is in the treatment of clay subgrade to create improved road foundation without necessity for large amounts of imported granular aggregates. In United States and Europe, lime stabilization is actually popular regarding improving traffic ability, loading capacity of foundations of road and embankment and also for erosion control (Perry et al., 1977). Contrary to lime modification, lime creates long lasting improvements in soils characteristics offering structural benefits. Other than improving roadways, lime also treat foundations and embankment. Silica fume is very fine dust of silica from a blast furnace produce during silicon metal production and it has historically recently been considered as a waste product. Based on the previous study, it is indicating that silica fume help to improves
geotechnical properties of the fine-grained soils for example hydraulic conductivity, swelling behavior, and unconfined compressive strength (Aiticin et al., 1984). In addition, silica fume also have the ability to reduce the effects regarding freezing and also thawing cycles on the strength as well as permeability within the landfill liner and cover systems. Among the pozzolanic materials, silica fume has becomes the most effective by-product due to its extremely energetic and higher pozzolanic property (Atis et al., 2005).

1.2 Problem Statement

Clay present difficulty to geotechnical engineer due to its complex nature and also contains variable materials. In the preliminary stage, the soils do not have enough physical properties for construction purpose. This is because; marginal soils which include soft clays, loose sand, and organic are not satisfactory materials for construction applications. However, this type of soils are very important in geology, construction, and also for the environmental applications because of their wide consumption as impermeable along with containment barriers inside landfill areas and other environmentally applications (Kayabali et al., 1997). As an example, during the site investigation process, if the soil at any particular locality is unsuitable entirely or partially based on the engineer requirements a fundamental decision must therefore be generated whether to be able to remove the site materials and replace with a superior materials or just accept as it is and design to standard sufficient to meet the constraints by its recent quality or the last choice is to alter the properties of existing soil to become better and meet the engineer requirement.

Nowadays, the construction on soft soil is growing because of insufficient appropriate terrain for infrastructures as well as other developments. In this research, study is carried out by using kaolin S300 clay mixed with lime and silica fume. One of the well known waste industrial materials is silica fume. In western countries, it has recently become environmentally undesirable to produce the fume in to the atmosphere and thus it is collected (Aiticin et al., 1983). Awareness is very important related to the harmful issue of the silica fume. Hence, we need to fully utilize the silica fume wisely