CHAPTER I

INTRODUCTION

1.1. Background

Existence of problematic soil such as clay on construction site will cause various problems and it will be different than problems that have been encountered before. Soil stabilization is one among all method of soil improvement that can overcome those problems. Clay characterized by high compressibility and low shear strength (Rao and Thyagara, 2007; Karatai et al., 2017). Those type of soils are not friendly to any structures that built on top of it. Expansive soil will crack when dry season came and will excessively expand when it has contact with water (Karatai et al., 2017).

Whereas in Indonesia, soil improvement for clay especially expansive clay is a popular topic among Indonesian geotechnical engineers. In Indonesia 50 % of roads were constructed above laterite soil which contain high swelling characteristic and will lead to a problem when a structure such as roads are built on the top of it (Muntohar and Hashim, 2002). Expansive soils such as expansive clay can inhibit country's economic growth due to the expenses on repairing the structures and infrastructures that were damaged due to its characteristics. The losses cause by expansive soils were greater than all the expenses from the natural hazards combined. (Jones and Holtz, 1973).

Many scientific approaches have been done lately in order to overcome expansive clay problem. Usage of Portland cement and lime nowadays are limited due to the scarcity of raw material, those problems encourage researchers to make the most of any waste material that are economic and environmental friendly (Ashango and Patra, 2016). Waste from industrial by-products such as blast furnace slag, fly ash, rice husk ash, foundry sand, foundry slag, bottom ash, and cement kiln dust are in fact promising to stabilize clayey soils and already been investigated by researchers. (Khandaker, 2011).

Soil stabilization can be very useful in many parts of the world, especially if the materials needed are locally available. Rice Husk ash or commonly known in Indonesia as *abu sekam padi*. Rice husk can be easily obtained in Yogyakarta since there are many paddy field in the region and Rice husk ash can be obtained from bricks combustion residue. Rice husk ash considered as a pozzolanic material with high silica content and with the right proportion and counterpart it will improve the mechanical properties of the soil (Ashango and Patra, 2016).

Cement kiln dust (CKD) is an industrial by-products of cement manufacturing industry, the growth of by-product material such as CKD is inevitable and CKD is reported to have a high amount of CaO (Naik et al., 2003). In Yogyakarta region, it is easy to find cement industry. Rice husk ash (RHA) can't be used alone without its counterpart (Muntohar, 2016). Since the combination of CKD and RHA will generate pozzolanic reaction,

CKD is chosen as the combination for the expansive soils and RHA. However, optimum amount of CKD and RHA to obtain the maximum shear strength are yet to be known.

This research attempts to solve two main problem in Indonesia. First, to investigate the development of mechanical properties regarding to expansive soils treated with CKD and RHA. Second, to utilize industrial by-products to cope with the scarcity of raw material in years to come. Since CKD and RHA are considered as waste material, it will lead to low-cost soil stabilization and environmental friendly as a result of their removal. Further investigation will be needed in order to utilize RHA and CKD for an in-situ soil stabilization.

1.2. Research Question

Existence of expansive soils in construction project will need a solution. This research is carried out to investigate further regarding:

1. Do the shear strength of the soil (clay) improve with the addition of CKD and RHA?
2. What is optimum CKD and RHA content in order to achieve the maximum shear strength?

1.3. Problem Scope

Before starting the research, limitations have to be made in order to accomplish the main objectives. These are the limitations for this research:

1. Shear behavior of the treated and untreated soil.
2. Clays are classified by doing physical and mechanical test.
3. The clays will be obtained from Kasongan, D.I. Yogyakarta
4. Rice husk ash will be obtained from brick factory at Godean.
5. Cement kiln dust will be obtained from PT. Semen Padang.
6. Chemical content for both rice husk ash and cement kiln dust will be investigated at BBTKLP D.I.Yogyakarta.

1.4. Originality

Clays are popularly known as low-strength and high plasticity soil. There are so many research regarding soil stabilization techniques. Soil stabilization using RHA and CKD are also has been conducted by other researchers before, however an optimum mix to achieve better shear strength between RHA and CKD content for clay is yet to be known. RHA is a pozzolanic material and it needs to be mixed with cement kiln dust in order to improve clay's properties. According to author's knowledge study regarding to shear behavior of RHA and CKD stabilized clay have not been executed by other researchers.

1.5. Objectives

This research was done in order to:

1. To observe the plasticity behavior of soil treated with CKD and RHA in 7, 28 and 36 days curing time.
2. Investigate the changes in shear behavior of clays by varying the content of CKD and RHA.

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