CHAPTER I

INTRODUCTION

1.1 Background

In the last few years, the government has been intensifying improving the country's infrastructure development. One of the projects that is being intensified is road construction. Roads are important facilities that the country needs to connect between cities. From Choirul (2019), the target of road construction in 2020 reaches 837 km. The target jumped dramatically when compared to the achievements of the construction of the 2019 road along 406 km. To fulfill this target, the government need a lot of material to create a high quality and long lasting pavements.

Deputy for Facilities and Infrastructure of Bappenas Kennedy Simanjuntak (Hamdani, 2019) in a meeting at the Indonesian Parliament Building explained that 500 km of new roads and a new 600 km of toll roads would be built. Construction of new roads in the country needs a large amount of natural aggregate. The need of natural aggregate for road construction will impact on imbalance environmental. Civil engineering need to think the environmental balance, so they have to find alternatives as a substitution to the natural aggregate.

At the same time, the manufacturing process of iron in Indonesia also results in production of ground granulated blast furnace slag as a byproduct. Ground granulated blast furnace slag is one of the two type of ferrous slag, with the other one being steel slag. Ground granulated blast furnace slag is recovered by melting

separation from blast furnaces that produce molten pig iron. It consists of non-ferrous elements contained within the iron ore along with limestone as an auxiliary materials and ash from coke. On average, the production of one metric ton of crude iron will also produce 0.25 to 0.3 metric ton of ground granulated blast furnace slag. As on 2017, Indonesia produced more than 2 million tons of ground granulated blast furnace slag annually. Ground granulated blast furnace slag is rarely utilized that it can be bought for small amount of money, or even for free. If ground granulated blast furnace slag is not utilized, then the deposit of ground blast furnace slag might cause problem for the environment.

In this study, ground granulated blast furnace slag (GGBFS) is used as partial replacement of natural fine aggregate in subbase layer in different percentages. To find out the strength of the ground granulated blast furnace slag (GGBFS) mixture in the pavement, a California Bearing Ratio (CBR) test was performed. As an alternative to the CBR test is the Dynamic Cone Penetrometer (DCP) test, which is a tool designed to test the strength of the subbase of a pavement. The correlation between DCP and CBR values of will be conducted to evaluate the relationship between them are strong or weak due to alternative test of subbase strength.

1.2 Problem Statement

Subbase is a layer of construction that continues the load from the base to the sub grade in the form of compacted grained material. The government's new roads needs of a large amount of natural aggregate to fulfill the target. The used of natural aggregate for construction which is done massively and continuously will make it

scarce. The replacement of fine aggregate with waste material such as ground granulated blast furnace slag (GGBFS) will prevent the environmental imbalance. When replacement is conducted, the strength of the new subbase need to test using California bearing ratio (CBR). Civil engineering always encounter difficulties in obtaining representative CBR values for pavement layers because the CBR test is time consuming and it cannot be easily determined in the field. While using DCP test just takes a very short time for analysis and interpretation. Therefore, predicting CBR value from DCP test make better solution to evaluate performance of pavement layers than using costly and time intensive procedures.

1.3 Objective

The objective of this research is to know about the correlation between California Bearing Ratio (CBR) and Dynamic Cone Penetrometer (DCP) values from the replacement of fine aggregate on the subbase using ground granulated blast furnace slag (GGBFS).

1.4 Limitation

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

1. The soil that will be used is obtained from Berbah, Yogyakarta.
2. The coarse aggregate used is obtained from Clereng.
3. The natural fine aggregate used is obtained from Merapi.
4. The ground granulated blast furnace slag is obtained from PT. Krakatau Semen.

5. The base mixture of 10 : 50 : 40 (Soil : Coarse aggregate : Fine aggregate) will be used.
6. The variation of fine aggregate substitution with ground granulated blast furnace slag will be 0%, 15%, 30%, and 45%.
7. The correlation test between CBR and DCP value on subbase course is only carried out on unsoaked condition.

1.5 Research Benefit

The result of this final project is expected to help evaluate the correlation between CBR and DCP from the utilization of ground granulated blast furnace slag (GGBFS) as fine aggregate replacement in the subbase course. Then, the results could be applied in the construction project to predicting CBR value from DCP test.

1.6 Originality of Final Project

Positive results from various studies were obtained when using ground granulated blast furnace slag (GGBFS) as a subbase layer material. A study from Neeraja (2018), about the utilization of ground granulated blast furnace slag (GGBFS) and fly ash in granular subbase layer. The study evaluated the compaction and California Bearing Ratio (CBR) tests of conventional material for strength parameters, and a comparative study is made to know the variation of strength by replacing a known percentage of conventional material with granulated blast furnace slag and fly ash under different proportions.

Various studies of relationship between California Bearing Ratio (CBR) and Dynamic Cone Penetrometer (DCP) show the strong correlation between them. A study was carried out by Sahoo and Sudhakar in 2009 about the relationship between DCP and CBR values for fine grained soils. From five different type of soils that tested, this study was investigated the correlation between DCP and CBR in the laboratory and the field.

From all the researches and studies that have been done, none of them discussed about the relationship between DCP and CBR using ground granulated blast furnace slag (GGBFS) on subbase layer as fine aggregate replacement.