

# CHAPTER I

## INTRODUCTION

### 1.1. Background

Indonesia is the fourth most populated country in the world. With this single issue, the number of the populations boosts the people to have an ownership of vehicles, not excluding the big vehicles such as bus and truck. Cited from Badan Pusat Statistik (BPS) in the year of 2018-2020, the number of big vehicles in Indonesia has reached about 10,4 million. With this number of big vehicles, the strength of the road is one of the crucial elements in the transportation sector. However, many roads in Indonesia are not able to provide minimal conditions for preventing destructions such as fatigue and cracking due to failure of the insistence of the road, which we can determine by the materials of the road itself that can't withstand the weight of the vehicles. Not only by the numerous big vehicles, Indonesia owns a hot climate, which can be destructive for the pavement such as rutting at high temperatures. Stated in Hamed (2020) journal, in order to improve the quality of the asphalt mixture, many researchers have tried to add many polymeric materials such as styrene butadiene styrene, styrene-butadiene rubber (SBR), ethylene-vinyl acetate (EVA), and polypropylene (PE). From the studies, it shows that polymeric materials modified asphalt mixture could improve the characteristics of asphalt mixtures. One of the polymeric materials that known as the strongest is Ultra High Molecular Weight Polyethylene (UHMWPE). This material has longer chain to transfer load more effectively to the polymer power by

strengthening intermolecular interactions. This journal will go deeper in to the mixing of asphalt and UHMWPE for bitumen.

There are two basic process for adding the UHMWPE in asphalt mixture, wet and dry process. In wet process, UHMWPE is added to hot asphalt and allows the UHMWPE and asphalt to react. The asphalt mixture with wet process could obtain the desired volumetric parameters as specified. Volumetric parameters are important because stability parameter and Marshall immersion are depending on void in the mixture of asphalt. The purpose of this study is to investigate the effect of adding crumb of UHMWPE to asphalt mixture using wet process.

## **1.2. Problem of Study**

Some researchers already conducted researches on adding polymer material into asphalt mixture. However, there are so little researches that talk about adding UHMWPE. This study makes some existence problems that need to investigate further, such as the Marshall test's properties effect of UHMWPE to mixture on Marshall Stability, Flow, Marshall Quotient, Density, VFWA, and VITM. These problems are required in order to investigate whether the mixture would be sufficient for the standard requirement for bitumen. Hence, this research is carried out to investigate further:

1. Investigate the Marshall Test's properties effect (such as: Marshall Stability, Flow, Marshall Quotient, Density, VFWA, and VITM) of adding crumb of UHMWPE into asphalt mixture.

2. Investigate the best size and the best amount for crumb of UHMWPE when added inside the asphalt mixture among size #50 and size #3/4” and among 1% amount of UHMWPE and 2% amount of UHMWPE.
3. Investigate the best asphalt content percentage among 5,5%; 6%; 6,5%; and 7%.

### **1.3. Scope and Limitation**

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

1. The research about this study in Indonesia is still limited.
2. This research is conducted in Yogyakarta.
3. The research will be conducted in Atma Jaya Yogyakarta Laboratorium
4. Some of the UHMWPE crumbs are not perfectly on the preferred size due to tool limitations.

### **1.4. Outline of the Thesis**

This thesis is breakdown into six chapters that consist of an introduction, literature review, theoretical basis, research methodology, results and discussion, and the last is conclusions and suggestion.

The first chapter of this thesis is an introduction. It is divided into five sub-chapters which are the background of this research, problem of study, scope and limitation, outline of the thesis and the last one is the originality of this thesis. The

second chapter is a literature review that encloses a literature study to uphold the thesis.

The third chapter is the basic theory that focusing on the theoretical knowledge on how to run the research process. Fourth chapter is research methodology. It is about methodology research, preparations, materials that used, etc. The fifth chapter is results and discussion, it will discuss how to analyze the data that have been obtained before and discussion. The last chapter is conclusion and suggestion. It has the conclusion of the thesis and suggestion to reassure the thesis.

#### **1.5. Originality of the Thesis**

Mixing of UHMWPE and asphalt has never been used in any Indonesian thesis previously. Hence, there has never been any endeavor to conduct similar research in the Indonesia construction industry. This final project will be a unique and new in its attempt to identify the effectiveness of adding UHMWPE to asphalt mixture.