CHAPTER 1

INTRODUCTION

1. Background

From the beginning of mankind, transportation, especially land transportation has been a main aspect in human lives. Communication and trade would not have been possible without it. For this purpose, thousands kilometers of road have been built over the world. Indonesia , the country with total land area of 1,904,569 square kilometers and population of 263,846,946 peoples (2016 estimate), has 508,620 km length of road consisting of 415,800 km, district/city roads, 58,600km, provincial roads and 38,600 km State roads [1].

Started from the pavements built on Crete during the Minoian period (2600 – 1150 B.C.) mankind continuously develop the construction of road. The famous ancient road construction was built by the Romans. It should be noted that these pavements were remarkably well designed. From those early days of the Roman Empire to the interstate highway system in the United States, roadway networks as well as roadway construction have been developed. The materials used for roadway construction have progressed with time.

In its development, pavements can be broadly classified into two types, flexible and rigid pavement. From the two types of roadway pavement, flexible pavement is the most used in the world at the moment. In Indonesia, for instance, from 91,620 kms length of road,

508,620 km or 95.64% are flexible pavement roads, and roads constructed with rigid pavement are only 0.37%, while the rest of 3.99% are earth/gravel roads [2]. In the United States as of 2001 there were about 2.5 million miles of paved roads of which 94% were bituminous surfaced [2]. Figure 1.1 shows basic flexible pavement structure

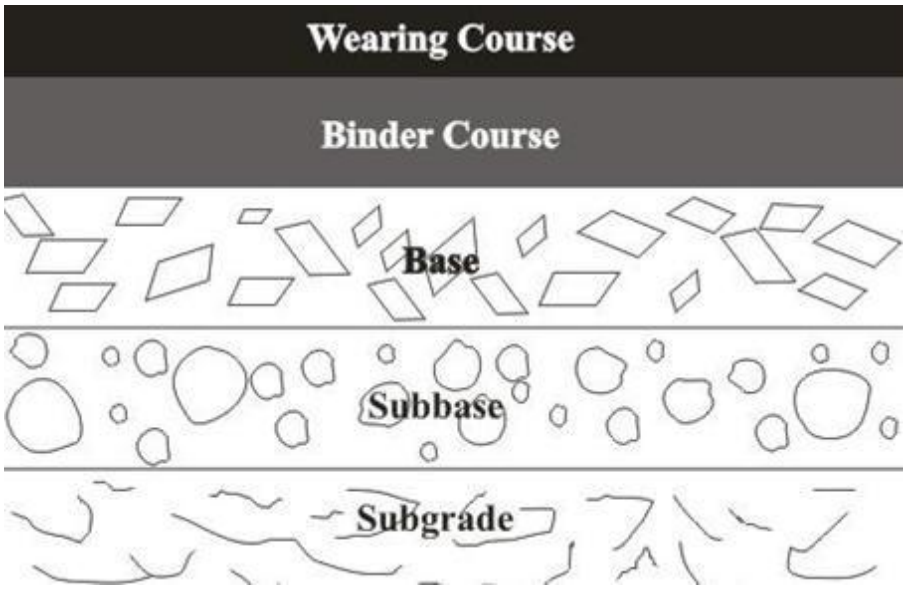

Figure 1.1: Basic flexible pavement structure

In most asphalt pavements, the stiffness in each layer or lift is greater than that in the layer below and less than that in the layer above. This could be understood from the load distribution (Figure 1.2) where the stress at the surface layer is higher than that of the layer below.

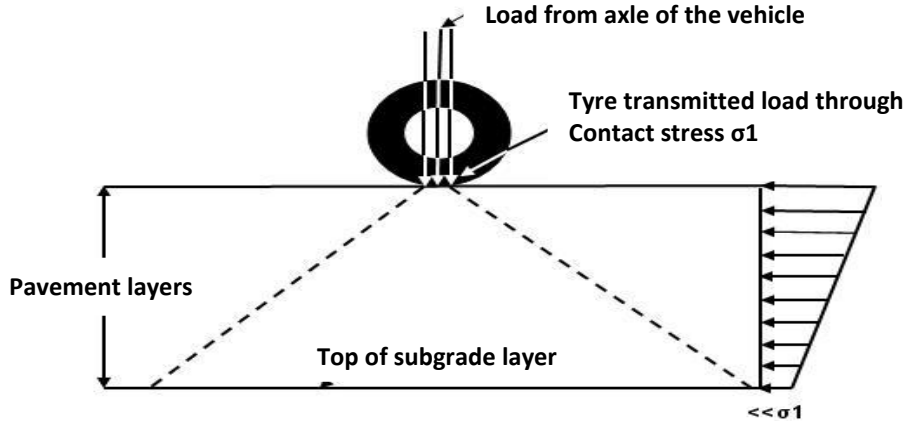

Figure 1.2: Load distributions on flexible pavement

Surface layer has to withstand the maximum stress and bear the changing conditions of the environment. Therefore, this surface layer usually consists of the 'best' and most costly materials. Also, this layer is always 'bound', that is, mixed with a 'binder', in this case asphalt cement or bitumen binder, to prevent raveling materials under traffic, as well as to provide a dense surface to prevent ingress of water, unless it is an open graded friction course. Therefore, the surface layer has two major components, bitumen binder and aggregates.

The performance of asphalt pavements is depend on by the properties of the aggregate, because more than 90% asphalt material is aggregate [2]. Since the aggregate in a bituminous mixture supplies most of the mechanical stability, it must have a certain amount of strength and toughnes to prevent breakdown under traffic and subsequent loss of stability open-graded mixes, for a given load, are probably subject to greater forces of breakdown than aggregate in graded mixes, as explained for base courses. Thus, when working with a material with minimal strength or crushing resistance a denser gradation be more desirable than one which is open graded [3], which can be improved by its replacement.

1.2 Problem Statement

Aggregate is exposed to a wide range of load and weather conditions. However, it does not have good engineering properties, because it is soft in a hot environment and brittle in a cold weather. To prevent the occurrence of pavement distress, it is important to reinforced bitumen to improve its mechanical properties. Replacement aggregate with buton asphalt to strengthen the mechanical properties into renewed interest . This resurgence in interest can primarily be attributed to the following factors.

1. The utilisation BNRA as aggregate replacement in hotmix asphalt concrete.
2. Improvement of aggregate quality by using BNRA as aggregate replacement in perspective stiffness.

1.3 The Objective of the Research

From the above descriptions it is obvious that bitumen should be modified in order to improve its rheological properties or in order to withstand to use in the several of different temperatures. For that purpose, this research has the following objective:

1. To investigate BNRA as aggregate replacement,
2. To study the performance of DG (Dense Grade) and SMA (Stone Mastic Asphalt) using BNRA as aggregate replacement.

1.4 Scope of the Study

To achieve this goal, this research begins by preparing all the needs that are needed. BNRA is an aggregate substitute used for this research, BNRA is used as a substitute for aggregates and for as binder is used asphalt starbit and asphalt penetration. Aggregate cleavage with BNRA is required to produce stronger HMA against pressure and resistance to water immersion. Test assays to evaluate their performance were performed using the Marshall Stability test. Data obtained from test results are analyzed and conclusions and recommendations are made.