CHAPTER 1

INTRODUCTION

1.1 Background Study

Asphalt pavement is a mix of coarse and fine aggregate stone, sand, and asphalt cement, which is petroleum based.

Hot Mix Asphalt, HMA is asphalt mixtures that are heated and poured at temperatures between 150-180℃. This type of asphalt is commonly used for highways, interstates, and roads due to its flexibility, water resistance, and ability to repel water. HMA is used when the outside air temperature is above 40℃, due to its propensity for rapid cooling.

Warm Mix Asphalt, WMA is asphalt mixture that is manufactured at temperatures between 90-120℃. the mixtures use less fossil fuels and resources in its manufacturing process and includes additional binding materials and additives, such as wax, emulsions, and zeolites for easier pouring and spreading at low temperature.

WMA is less costly to produce than HMA. Since WMA is manufactured and shipped at lower temperatures, it does not cool as fast as HMA. Thus, it can be shipped over longer distances, and used outside of the normal paving and road construction periods. WMA can be used to pave roads, highways, interstates, car paths, driveways, walking paths during the day or at night.

WMA is also better for the environment and worker health. Since it is poured and laid at lower temperatures, there is less dust, smoke and fumes. Therefore, it can be safely used in tunnels, and on days when air quality is low.

1.2 Statement of The Problem

Hot mix asphalt (HMA) is produced in a very high temperature. By this, there is high energy consumption (fuel) which increases the global warming effects and also the

emissions of greenhouse gasses. This pollution will not only affect the earth, but will also affect the safety and health of the workers.

1.3 Objective of Study

- To develop a Warm Mix Asphalt, WMA with addition of crude palm oil.
- To study the effects of different values (percentage, %) of CPO when added to the mix asphalt, based on the Marshall test, Specific Gravity test, and Indirect Tensile test.
- To determine the optimum percentage of CPO to be used as the additive to the mix asphalt.

1.4 Scope of Study

The study is focused on the effect of moisture level of aggregate on the energy consumption in the mix asphalt production. Variables used are the addition of crude palm oil into the mix design. This study will also cover the characteristics of the asphalt pavement mix design using the Marshall Test that were conducted at the laboratory.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Other than high energy consumption (fuel), the increasing global warming effects and emissions of greenhouse gases is one of the contributions of the production of hot mix asphalt (HMA). To overcome this situation, researches have been done in the very recent years in finding solution for energy reduction during the hot mix asphalt production. One of the reasonable solutions is usage of warm mix asphalt (WMA) technologies.

WMA is modified hot mix asphalt (HMA) that is produced, placed and compacted at a 10-40 ‘C lower temperature than the conventional HMA but at a higher temperature than the water boiling temperature, which is range from 120 ‘C to 140’C. (Kim, Lee, & Amirkhanian, 2012)

The first category, water based processes is the non-additive processes based on foaming. Spraying water into the heated bitumen will cause bitumen foam. The foaming formed when the bitumen is heated at 175-180 ‘C. The foaming can also be formed by adding moist sand into the asphalt mixture. What makes the asphalt mix workable is the foam that ensures sufficient coating of the asphalt binder and aggregate.

The second category is water bearing additives are natural and synthetic zeolites which also based on foaming. Just like the first category, the foam is caused by adding natural or synthetic zeolite into the asphalt mixture during the asphalt production.

The third category is using organic additives which are wax additives such as Fischer Tropsch, Montan waxes, and fatty acid amides. With their longer chemical chain, their melting point is at about 100’C. The function of the longer chain is to help keeping the wax in solution and reduce binder viscosity at typical asphalt production and compaction temperatures.