CHAPTER I.
INTRODUCTION

1.1 Background

Since the early of 1970s the threat of a shortage of petroleum and petroleum by products have stimulated the search for alternatives to traditional flexible pavement materials. Recycling of old bitumious binders are but a few of the methods under investigation to make more efficient use of petroleum in road construction and maintenance.

Substitution of sulphur for part of the bituminous binder or more commonly known as Sulphur Extended Asphalt (SEA) in asphaltic concrete pavements was earlier described by Bencowitz and Boe[1] in 1938. They reported that sulphur in the SEA binders lowered the viscosity of the mixing temperature and improved the performance of the paving. Increasing the sulphur content of the binder resulted in increased stability of the compacted mixture. However, renew interest in the use of sulphur in pavement construction and maintenance did not take place until the early 1970s. It was started because of concern over the increasing cost and decreasing availability of bitumen coupled with a forecast of everincreasing supplies of sulphur. Since then, many years of research have been spent utilizing sulphur as an extender or by itself with a catalyst as a pavement binding agent. Pavement projects using sulphur have been constructed in Europe, Canada and the United States. Some of the first projects used a sand-asphalt-sulphur (SAS) blend[2,3] which uses free sulphur for additional road support in areas where aggregates are scarce. Also, pavements have been designed and constructed using sulphur extended asphalt as a binder[4,5,6] to reduce the total asphalt cement content required by blending it with a lower cost binder material. The outcomes of these trial projects are very promising. In Thailand, study on the subject of SEA is in its infancy, sofar only a few experimental works have been published those by Tansiri[7] (1982), Taneerananon and Tansiri (1983)[8] and Younger, Jones and Wang (1983)[9]

Sulphur is one of the most plentiful elements on earth. It exists in abundant quantities in prime sources and in even greater amounts in secondary forms. In 1980 the sulphur stockpile was estimated at 26 million tonnes[10]. Environmental control in many countries, notably the U.S. and middle-east countries will help to increase this stockpile because tremendous quantities of sulphur will be extracted from power plant stack emissions, coal liquification and gasification, processing of shale oil and the de-souring of oil and natural gas. It is estimated that the world reserve of sulphur is of the order of 11,000 million tonnes(11), hence the supply is virtually limitless.

1.2 Scope

The work to be carried out in this research project will comprise the following main activities:

- The determination of optimum content of sulphur in sulphur-bitumen binder used in mix design by the Marshall method.

- the study of the influence of compaction temperature on stability level and unit weight of the mixes.

- A review of the social, economic and environmental consequences of the possible use of sulphur-bitumen binder in road construction in rural areas.

1.3 Metholodogy

The experimental work will be carried out in the highway materials laboratory of the Department of Civil Engineering, Prince of Songkla University.

The Marshall method of mix design will be used for the determination of optimum binder content.

The traffic classification used in the design is of the heavy type.

Six trials of different weight percent of sulphur and asphalt cement in the sulphur-bitumen binder, namely 0-100, 20-80, 30-70, 40-60, 50-50 and 60-40 will be conducted with the 0-100 or straight asphalt used as control percentage.

The aggregate gradings used in the mix design will conform with Thailand Department of Highways specifications.

1.4 Materials

The following materials are used in the project:

Asphalt cement (AC) : 80-100 penetration grade.

Sulphur : commercial grade, in powder form.

Aggregates : local limestone.