PERFORMANCE OF COLD IN PLACE RECYCLE METHOD FOR DIFFERENT STABILIZATION AGENTS

ABDUL RAHIM BIN ABDUL HAMID

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> Faculty of Civil Engineering Universiti Teknologi Malaysia

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ABSTRACT

Cold in Place Recycling (CIPR) is a treatment process of road that had a structural defect. The process consists of recycling asphalt from the pavement layer to a certain layer in order to improve the pavement structure. The process involves breaking up and pulverizing the existing pavement. This material will be named Recycle Asphalt Pavement (RAP). Even though the CIPR method is proved successfully implemented but due to lack of knowledge and understanding about this method, it's only applied in about 10% of total Malaysian roads length. The aim of this study is to encourage interested parties to have more understanding in the CIPR treatment by broaden its spectrum. By providing the results of the performances for various types of the stabilization agents, it can be used as an optional for any user to use any of these stabilization agents type. For this study four (4) types of stabilizing agents will be used such as cement, lime, foamed bitumen and bitumen emulsion. From this study it is shown that cement and lime can be effective stabilizing agents but foamed bitumen and bitumen emulsion had score the lowest.

ABSTRAK

'Cold in Place Recycling (CIPR)' adalah proses rawatan yang dijalankan pada jalan yang mengalami kerosakan struktur. Proses ini adalah termasuk kerja kerja mengitar semula aspalt dari lapisan permukaan jalan ke bahagian bawahnya didalam memperbaiki struktur pavemen. Proses ini termasuk kerja – kerja memecah dan mengaul pavemen sedia ada ini. Material ini akan dinamakan 'Recycle Asphalt Pavement (RAP)'. Walaupun kaedah CIPR ini berkesan tetapi kurangnya pengetahuan tentang kaedah ini maka ianya kurang digunakan. Penggunaannya di Malaysia adalah kira – kira 10 % sahaja dari panjang jalan keseluruhan. Tujuan kajian ini adalah untuk menggalakkan mana – mana pihak yang berminat untuk mempunyai lebih kefahaman tentang CIPR dengan meluaskan spektrumnya. Dengan menyediakan keputusan dari performance untuk beberapa jenis agen penstabil; ianya boleh dijadikan seleksi pada mana – mana pengguna untuk menggunakan agen – agen penstabil ini. Untuk kajian ini (4) jenis agen penstabil digunakan iaitu simen, kapur, bitumen berbusa dan bitumen emulsi. Dari kajian ini menunjukan bahawa simen dan kapur boleh menjadi agen penstabil yang baik tetapi bagi bitumen berbusa dan bitumen emulsi menunjukan skor yang terendah.

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LIST OF SYMBOLS

| A | - | Corrected area |
|-----------------------|---|------------------------------------|
| A_0 | - | Initial surface area of the sample |
| d | - | Diameter |
| З | - | Axial strain |
| γ_b | - | Bulk density |
| γ _{dry} | - | Dry density |
| h | - | Height of the specimen |
| Р | - | Reading of axial load at failure |
| π | - | 3.142 |
| q_u | - | Unconfined compressive strength |
| S_t | - | Tensile strength |
| v | - | Volume |
| <i>W</i> ₁ | - | Weight after compaction |
| <i>W</i> ₂ | - | Weight of nearest 1 gram |

CHAPTER 1

INTRODUCTION

1.1 Background

This study is about the treatment process of a road which had experienced in structural defect. The selected road is FT 64 lies in between the Benta Town to the Jetty Terminal in Kuala Tahan River. The selected area is 1 KM length and divided to (5) five section. Each section consists of 200 meters for the cement, foamed bitumen, bitumen emulsion, lime and control.

A series of test had been conducted in the pre - construction stage, construction stage and post construction stage. Test such as Surface Condition Survey, International Roughness Index, Falling Weight Deflectometer and Dynamic Cone Penetration Test were conducted at site. (5) Five trial pits had been dug in order to obtain the sample and a direct thickness of each road layer had been measured.

Sample that had obtained at site will be tested such as sieved analysis test, optimum moisture content, optimum bitumen content, unconfined compressive test and the indirect tensile test. The Recycled Asphalt Pavement (RAP), the new aggregate and stabilizing agent were mixed in the design mix stage.

In order to have an optimum result, the stabilizing agents are added in increasing percentage of content. For cement and lime it is predetermine to use 2%, 3%, 4% and 5% of their content. Meanwhile for emulsion and foamed bitumen the content is increasing from 1% to 7%. And at the post construction the test that had conducted before will be conducted again with the new constructed road. This is to validate the data that had obtained before the treatment.

1.2 Problem Statement

Road base is an unbound layer. It is designed to be a layer that will carry and absorb loading from the vehicle and transmit it into the lower layer. So road base layer are often defect due to a higher and frequent loading imposed to it.

CIPR is a treatment process that recycled the original road base and adds with a new mixture and stabilization agent in order to withstand the imposed loading from the vehicle. The type of stabilization agent plays a significant role to boost the performance of the mixture. Thus in this study is conducted to obtained knowledge of the performance of each stabilizing agents used.

1.3 Objective of the Study

The aim of this study is to determine the performance of CIPR by using different type of stabilization agents. To achieve the above aim, the following objectives were set out at the beginning of the study as follows:

- 1) To determine the parameter and original properties of the road base.
- 2) To determine the new design mixture for the new road base layer.

1.4 Scope of the Study

The scope of study will be focused on the testing of existing pavement (pavement evaluation) and obtaining samples on trial pits. Sample that had been obtained on site are tested in order to determine the proportion of the RAP and the new aggregate. Then the pavement rehabilitation mix design with various type of stabilizing agents. The final tests are conducted at the post construction stage in order to validate the design. However this study is limited for the Partial Depth Recycled (PDR) which is to depth of the road base.

1.5 Significance of the Study

This study is conducted to have more understanding on the CIPR method itself. Many industrialists prefer the reconstruction method because the method is simple. It was done by scrapping unwanted layer and reconstructed again with totally new material. In terms of time of construction and the ease of construct the reconstruction method is the first choice, but in terms of sustainability and cost, the CIPR are the brilliant choice. CIPR method use up to 40% of recycled RAP which indirectly had saved the 40% of the material cost. And by recycled the RAP we can reduce the wastage of the construction.

This study also is conducted to have more data on the CIPR method by using various types of stabilization agents. This is to give the industrialists the options to propose and use the stabilization agents that had been tested. It is hope that industrialists will be educated for understanding and using this CIPR method with any of the stabilization agents.

1.6 Organization of the Thesis

There are five chapters covered in this thesis. Description for each chapter is shown as follow:

Chapter One of this report introduces the background of the project, problem statement and described the specific objectives addressed in the study as well as design components limitation.

Chapter Two presents a review of literature and relevant research associated with the problem addressed in this study such as the types of road defect, types of road treatment, the CIPR Method and the types of stabilization agents and explanation on method adopted in methodology.

Chapter Three presents the methodology of the project and procedures used for data collection that had obtained from the tests conducted.

Chapter Four contains an analysis of the data by graphing method. The results then will be discussed.

Chapter Five offers a summary of the findings and recommendations for future research.

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