FIELD EVALUATION OF THIN ASPHALT APPLICATION IN LOW VOLUME ROADS IN SRI LANKA

M. Dishan

208096M

Degree of Master of Science

Department of Civil Engineering

University of Moratuwa
Sri Lanka

November 2022

FIELD EVALUATION OF THIN ASPHALT APPLICATION IN LOW VOLUME ROADS IN SRI LANKA

MARKANDU DISHAN

208096 M

Thesis submitted in partial fulfillment of the requirements for the Master of Science in Civil Engineering

Department of Civil Engineering

University of Moratuwa
Sri Lanka

November 2022

DECLARATION OFTHE CANDIDATE AND SUPERVISOR

I declare that this is my own work and the thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and believe it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant University of Moratuwa the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: *UOM Verified Signature* Date: 21.03.2023

The above candidate has carried out research for the Master/MPhil/PhD thesis/ Dissertation under my supervision.

Signature of the supervisor: *UOM Verified Signature* Date: 23/03/2023

ABSTRACT

Field evaluation of thin asphalt application in rural roads

Thin Asphalt surfacing (TAS) is an innovative idea that has the potential to lower construction and maintenance costs of road construction in Sri Lanka. Laboratory based studies conducted in Sri Lanka have shown that the local materials can be used to produce TAS, and this study focuses on the usability of TAS in the field. Few concerns were found when applying this new technology in the field was taken into consideration before field trial. Such as: (1) The possibility that variations in the gradation of aggregates within the specification limit could negatively affect the characteristics of asphalt mix. Investigations were conducted to look at the impact of coarser and finer gradations on Marshall Properties: these grades represent the upper and lower limits of the proposed specification range, where both mixtures fulfilled the requirements. (2) The impact of the top level of longitudinal profile tolerance on the actual thickness of the asphalt mat. Increase in the proposed layer thickness from 25 mm to 30 mm, and adding additional surface top level correction of the base layer to meet the top level of longitudinal profile tolerance of ±10 mm are the options that have been suggested to meet the specified thickness conditions for TAS, where it was found that both approaches can be advantageous. (3) The rate at which heat is released by an asphalt layer that is thinner than traditional asphalt layer. The results of the laboratory-based testing show that paving around 8 a.m. leaves the least amount of time for compaction. This occurred because the temperature of the ground and the surrounding air was low . Findings on the time for compaction in the morning and evening are quite comparable. This similarity shows that base temperature is more significantly impacted by solar flux than the mix temperature. After the conclusion of surveys and laboratory experiments, it was decided to trial TAS in a road in the Gampaha district with low volume traffic. Construction was done in two sections. Section 1 was constructed with a 30 mm thickness and Section 2 with a 25 mm thickness. Under the test section's field conditions, the results for 30 mm layer thickness were significantly better. The temperature reduction of the asphalt layer surface over time was observed during the trial and the time available for compaction was less than 20 minutes. Through this study it was verified that TAS mixtures within the proposed aggregate gradation limit, satisfy specification requirement, top level surface tolerance of the base layer should be adjusted to ±10 mm, it is advantageous to have 30 mm thick TAS layer rather than 25 mm TAS layer considering the fluctuations of surface level of base layer and sunny noon time is more favourable to lay TAS considering the time available for compaction. It was identified that 30 mm thick TAS sections is more attainable than 25 mm thick TAS section during field applications.

Key words: Thin Asphalt surfacing, low volume road, gradation variation, topographical survey, heat reduction rate

ACKNOWLEDGEMENTS

It gives me great pleasure to take use of this opportunity to complete my responsibilities and express my appreciation to all the important individuals who helped to complete the research. As a postgraduate, the importance of this research project is immeasurable to me.

For most all, I express my sincere thanks to Prof. W. K. Mampearachchi, my research supervisor in Department of Civil Engineering for providing necessary guidance to success this research. He always provided his guidance during the difficult times and spend his valuable time discuss the problems encountered during data collection and analysis.

In addition, I would not hesitate to thank all the academic staff and non-academic staff Transportation Engineering Division of Civil Engineering Department of University of Moratuwa and thanks to the staffs of Advanced bitumen testing & Accelerated pavement testing laboratory for supporting my research experiments. It was very helpful me to continue the research works effectively.

It is essential to thank all the staffs of Research and Development Division of Road Development Authority, Ratmalana with supporting with materials and guidance and staffs of Access Construction Company, Rural Road project of Gampaha who made arrangement to provide the relevant data without any hesitation for my study.

Finally, I offer my thanks to my colleagues Nivojan, Dilakshan, Nalaka, Hirushi, Thushanthan, Pabetha, Havishant and Sajinthan for wonderful corporation, and the technical staff of the Department of Civil Engineering for helping in many ways.

Thank You.

M. Dishan

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

TAS - Thin asphalt surfacing

LVR - Low Volume Road

CNESA - Cumulative Number of Standard Axle

HMA - Hot Mix Asphalt

NMSA – Nominal Maximum Size of Aggregates

ICTAD - Institute for Training and Development

SSCM - Standard specifications for construction and maintenance

TA – Traditional Asphalt

VMA - Voids in Mineral Aggregates

VIM - Air Voids in Total Mix

DGAB – Dense graded aggregate base