DEVELOPMENT OF A GUIDELINE FOR IMPLEMENTATION OF POLYMER MODIFIED BIUTMEN FOR HMA BASED ON EMPIRICAL TEST METHODS

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Degree of Master of Science

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DECLARATION OF THE CANDIDATE AND SUPERVISOR

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Abstract

Development of a Guideline for Implementation of Polymer Modified bitumen for HMA Based in Empirical Test Methods

Polymer modification of bitumen has increasingly become the norm in designing optimally performing pavements. Pavements with polymer modification exhibits greater resistance to permanent deformation and thermal cracking, and decreased fatigue damage and temperature susceptibility. Polymer Modified bitumen (PMB) are effectively used in many countries over last three decades to construct pavements with superior performance and extended service life. This research was aimed at identifying the need to implement PMB in Sri Lanka, and also developing a testing procedure for PMB based on currently available empirical test methods.

Five unmodified binders used in Sri Lanka was subjected to a series of laboratory testing in order to study their temperature susceptibility, high and low temperature behavior and moisture damage. The results were compared with the existing pavement conditions and it was understood that their performance is limited in above mentioned aspects. To understand the performance of PMB, a case study was done using two PE modified bitumen samples and two SBS modified bitumen samples. They were subjected to a series of laboratory tests which confirmed that the both types of PMB are suitable to overcome the limitations exhibited by unmodified binders.

The necessity of having a proper testing procedure for PMB is discussed and a specification was proposed considering the available testing facilities in Sri Lankan Laboratories. The test methods were selected considering the adequate control of binder properties during application and usage. Penetration test is included to control the intermediate temperature properties and for the identification of binder grades. Softening point test controls the high temperature properties while viscosity test controls the mixing and compaction temperatures. Elastic recovery test and solubility test were employed in order to identify the amount of polymer in PMB. Storage stability test determines the separation tendency of polymer from bitumen. Flash point limits are set for the application safety. Thus all the essential parameters of bitumen are controlled by the proposed specification. The requirement limits are set considering different PMB specifications of several other countries, past research outcomes and laboratory test results.

The proposed specification which is based on empirical test methods facilitates an adequate quality control of Polymer Modified Bitumen and it would be a useful guideline for implementation of PMB for HMA in Sri Lanka.

Keywords: Bitumen – Polymer Modified - Specification

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LIST OF ABBRIVIATIONS

Abbreviation	Description
ABS	Acrylonite Butadiene Styrene
BDTC	Bitumen Test Data Chart
BBR	Bending Beam Rheometer
COC	Cleaveland Open Cup
DSR	Dynamic Shear Rehometer
DTT	Direct Tension Tester
EA	Ethylene Acrylate
EVA	Ethylene Vinyl Acetate
HMA	Hot Mix Asphalt
IDT	Indirect Tensile Strength
MSCR	Multiple Stress Creep Recovery
PAV	Pressure Aging Vessel
PE	Polyethylene
PG	Performance Grading
PP	Polypropylene
PMB	Polymer Modified Bitumen
RTFO	Rotating This Film Oven
RV	Rotational Viscometer
SB	Styrene Butadiene
SBR	Styrene Butadiene Styrene
SBS	Styrene Butadiene Styrene
SHRP	Superpave Highway Research Program
SI	Styrene Isoprene
TFO	Thin Film Oven
UK	United Kingdom
USA	United States of America

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