EVALUATION OF RESILIENT MODULUS OF UNBOUND MATERIAL TO IMPLEMENT MECHANISTIC-EMPIRICAL PAVEMENT DESIGN(MEPD) IN SRI LANKA

Badugoda Hewa Thiranka Ariyarathne

198325X

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Department of Civil Engineering
Faculty of Engineering

University of Moratuwa
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DECLARATION

I declare that this is my own work and this 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 belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the Masters thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

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ABSTRACT

Road pavement design in Sri Lanka traditionally relies on an Empirical design. This conventional approach, however, is characterized by certain limitations, particularly in its reliance on indirect material properties such as the California Bearing Ratio (CBR) value. The drawbacks of this method may result in the overestimation or underestimation of pavement design, prompting a shift towards the more reliable and accurate Mechanistic-Empirical Pavement Design (MEPD) process.

Despite the advantages of MEPD, its implementation in Sri Lanka encounters challenges, including the absence of laboratory and in-situ testing equipment for modulus testing, the lack of a comprehensive soil database/soil map, and the unavailability of typical modulus values for local materials. This research endeavors to address these challenges by focusing on the development of a relationship for predicting Resilient Modulus (RM) based on other index properties of the soil. Additionally, the study aims to establish a modulus-based soil database and create a soil map for MEPD designs.

To achieve these objectives, soil samples were collected from 28 locations across the country, and their basic properties were determined. Modulus tests were conducted using a Light weight Deflectometer (LWD). The validity of existing relationships for predicting RM was assessed, and subsequently, a new relationship was developed specifically for local subgrade materials.

Furthermore, past soil data collected on a district basis were utilized alongside the newly developed correlation to create a comprehensive Soil Map based on RM values.

In conclusion, this research successfully formulated an RM predicting model tailored to locally available unbound materials in Sri Lanka within the MEPD framework. The established soil database and soil map hold significant potential to enhance the design of road pavements in Sri Lanka, contributing to a more reliable and sustainable road infrastructure.

Keywords: RM, MEPD, LWD, CBR, Unbound Material

DEDICATION

I dedicate this thesis to the remarkable individuals who have played pivotal roles in my life and academic journey.

First and foremost, I extend my deepest gratitude to my parents, Mr. B R Ariyarathne and Mrs. K K De Silva. Their unwavering love, unending support, and constant encouragement have been the driving force behind my achievements. Their enduring faith in my abilities has served as an endless source of motivation, and I am eternally thankful for the sacrifices they made to provide me with the best possible life.

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In addition, I dedicate this work to my sister, Mrs. B H Ariyarathne, whose presence has been a constant source of inspiration. I also extend this dedication to all individuals who tirelessly pursue knowledge and self-improvement. May this thesis, in some small way, contribute to your enriching journey of growth and discovery.

With profound gratitude and appreciation,

B H T Ariyarathne

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This research has been a fulfilling and enlightening experience, and I am confident that the knowledge gained during this endeavour will prove invaluable in my future endeavours.

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LIST OF ABBREVIATIONS

Abbreviation	Description
AASHTO	American Association of State Highway & Transportation Officials
ADB	Asian Development Bank
ASTM	American Society of Testing and Materials
BS	British Standard
CBR	California Bearing Ratio
FHWA	Federal Highway Administration
LWD	Light Weight Deflectometer
MDD	Maximum Dry Density
MEPD	Mechanistic-Empirical Pavement Design
RM	Resilient Modulus
NCHRP	National Cooperative Highway Research Program
OMC	Optimum Moisture Content
QCQA	quality control/quality assurance
RDA	Road Development Authority
RDAPDS	Road Development Authority Pavement Design System
RMSE	Root Mean Square Error
SSCM	Standard Specification of Construction Management
SSE	Sum of Squared Error
TRRL	Transportation and Road Research Laboratory
USCS	Unified Soil Classification System