EFFECT OF FINE PERCENTAGE ON PROPERTIES OF SUBBASE MATERIAL

I.I.I. Inan

(118855 X)

Master of Engineering in Highway and Traffic Engineering

Department of Civil Engineering

University of Moratuwa

Sri Lanka

September 2015

EFFECT OF FINE PERCENTAGE ON PROPERTIES OF SUBBASE MATERIAL

I.I.I.Inan

(118855 X)

Thesis submitted in partial fulfillment of the requirements for the Master of Engineering in Highway and Traffic Engineering

Department of Civil Engineering

University of Moratuwa

Sri Lanka

September 2015

Declaration of the Candidate and Supervisor

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.

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: Date:

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

Signature of the supervisor: Date:

Effect of Fine Percentage on Properties of Subbase Material

Abstract

With the huge infrastructure development in Sri Lanka, road construction plays a vital role. Massive quantities of construction materials are required for these highway and expressway constructions. Finding Subbase material as per specification is a major issue in most part of the country. Therefore, in some road construction projects, crushed stone is used as an alternative material to replace Subbase material. Due to the scarcity of good quality material, there is a need of research to use marginal materials for sustainable development in the highway industry.

Standard Specification for Construction and Maintenance of Roads and Bridges(SCA/5) (SSCM) (ICTAD,2009) is used as a road construction specification in Sri Lanka. Liquid limit(LL), plastic limit(PL), maximum dry density(MDD), California Bearing Ratio (CBR), and sieve analysis are specified in selection of gravel Subbase material. According to sieve analysis requirements in SSCM, percentage of passing 75µm sieve should be 5-25% by weight. This grading limit for Subbase material was adapted to the specification in second edition of SSCM in 2009.Questionnaire survey conducted among senior engineers has expressed that one of the least important parameters in material selections was grading (84% of the participants) and 16% of the engineers have expressed grading as the most difficult parameter to meet. This study was conducted to evaluate the possibility of relaxing the passing percentage of fine fraction.

Experimental study was conducted by altering the fine fraction of soils, varying from 0-40%. Properties of these samples were tested and it revealed a linear relationship with high correlation factor between fine fraction of the material and its properties (CBR, MDD, OMC). Only three samples out of ten samples were within the grading band requirement and nine samples out of ten samples satisfied CBR requirements. By scrutinizing the findings and available literature, it can be recommended that grading band of No.200 sieve passing can be relaxed up to 35% if soil sample satisfy the specified CBR requirement (30), PI value is less than or equal to 10, and swell percentage is less than 2%. Further, linear regression models were fitted to assess the CBR of material with reference to fine fraction(Percentage passing of 425µm, 300µm, 75µm sieves). Statistical analysis explained that material passing 425µm and retained on 300µm, and 75µm passing percentage are the significant parameters when predicting CBR of the selected soil in this study.

Key words: Subbase Material, Grading Band, Fine Fraction

ACKNOWLEDGEMENT

First and foremost, I would like to thank the Department of Civil Engineering, University of Moratuwa, Sri Lanka, for selecting me to follow the post graduate programme MEng in Highway & Traffic Engineering.

I convey my respectful gratitude to my supervisor, Professor W.K.Mampearachchi, for his guidance, supervision, stimulating motivation, and valuable ideas throughout this research. Without his help this thesis would not been possible.

I extend my thanks to the lectures and staff of Transportation Engineering Division, with special appreciation to Professor J.M.S.J. Bandara, for their thoughts and guidance for completion of this research and thesis.

I am grateful to my employer, Road Development Authority, for the awarded sponsorship to follow the master of engineering programme and granting official leave for studies.

A special thank is due to my friend Nadeesha Abeysinghe and his staff, for not only providing support to do the experimental laboratory work, but also for valuable comments and suggestions.

Finally, I wish to express my eternal appreciation towards my family, who were always there for me no matter where I am, with unconditional support and patience.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AASTHO	American Association of State Highway and Transportation Officials
CBR	California Bearing Ratio
CEA	Central Environmental Authority
EPL	Environmental Protection License
GI	Group Index
GSMB	Geological Survey and Mines Bureau
ICTAD	Institute for Construction Training and Development
IML	Industrial Mining License
LL	Liquid Limit
MDD	Maximum Dry Density
NP	Non-Plastic
OMC	Optimum Moisture Content
PI	Plasticity Index
PL	Plastic Limit
RDA	Road Development Authority
SSCM	Standard Specification for Construction and Maintains of Highways and Bridges
TRL	Transport Research Laboratory
USCS	Unified Soil Classification System

LIST OF APPENDICES