STUDY ON APPLICABILITY OF ACI AND DOE MIX DESIGN METHODS FOR PAVING BLOCKS

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Degree of Master of Science

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January 2013

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Thesis submitted in partial fulfillment of the requirement for the degree of Master of Science

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JANUARY 2013

DECLARATION

I, Gopinath Kathiravelu, hereby declare that the content of this thesis is an output of the original research work carried out by me under the supervision of **Dr.K.Baskaran**, over a period of 14 months at the Department of Civil Engineering, University of Moratuwa, Sri Lanka. Further, this thesis does not contain any previously published material to the best of my knowledge, except where the acknowledgement is made with due reference.

Signature: ..... Date: .....

The above candidate has carried out research for the Masters thesis under my supervision.

Signature of Supervisor: ..... Date: .....

ABSTRACT

Presently local manufacturers select the initial mix proportions for CPBs in a random basis and improve it through several trials to attain the final mix. Whereas either identification of new mix proportioning method or modification of existing mix design methods yet remains to be researched. In view of the above, applicability of contemporary mix design methods such as American Concrete Institute (ACI) Method and Department of Environment (DoE) Method to mix proportion the concrete paving blocks (CPBs) were studied experimentally in the present study. In line with both mix design methods, constituents of CPBs were estimated for characteristic compressive strengths, from 15 N/mm^2 to 50 N/mm^2, a range that approximately satisfies the requirements of the Sri Lankan Standard for CPBs. Based on the estimated proportions, trial mixes were cast and tested for compression at 7 and 28 days and from the experimental observations, some suggestions are made in this thesis.

Moreover, adoptability of ACI mix design method with local materials is experimentally verified with limited number of test samples and it can be concluded that many sand samples being tested failed to fall within the fineness modulus range specified in ACI method, leaving local sand to be unsuitable in many cases. Hence, a method of combining sand samples is identified in the literatures and presented in the thesis, using which sand samples can be made suitable for ACI Method of mix proportioning.

Further, effect of fine aggregate proportions on compressive strength was studied through set of experiments. Mix proportions were estimated using DoE method for Grade 15 and Grade 50 for finer and coarser sands (94% and 34 % passes through 600 µm sieves respectively) and cubes were cast. They were tested on 7 and 28 days and the test results have shown that the cubes cast with fine sand have attained slightly higher compressive strength to that of coarser sand.

Key words: concrete paving blocks, mix design, ACI Method, DoE Method, target mean strength

DEDICATION

I dedicate this work first to the Almighty who bestow me infinite zeal to work ‘against the tides’ and to my parents who aspire me to achieve greater heights.

ACKNOWLEDGEMENT

Mere words are indeed inadequate to convey my deep sense of gratitude to all those who assisted me in completing this research project, in various sorts, to the best of my ability.

First of all, I'm infinitely gratitude to my research supervisor **Dr. K.Baskaran** as right from pursuing the research grant till the thesis correction, he but none, has been anchoring my efforts. He, not only inspired me towards the achievement of the set objectives, but also enlightened me about the true culture of research.

This research work was supported by University of Moratuwa Senate Research Grant Number SRC/LT/2011/23 and I wish to express my gratitude to them. Further, I'm pleased to offer my humble gratitude to **Prof. S.M.A. Nanayakkara** - Head – Department of Civil Engineering, **Prof. M.T.R. Jayasinghe, Prof. H. S. Thilakasiri** - Research Co-ordinator, **Prof. (Mrs.) Chintha Jayasinghe** - Director, Post Graduate Division and **Prof.Rahula Anura Attalage**, Deputy Vice-Chancellor for their assistance towards successful completion of my research in various sorts. At the mean time, I wish to take this opportunity to thank the non academic staff of the Civil Engineering Department and Post Graduate Division of University of Moratuwa, Sri Lanka.

Finally, I wish to thank everybody who probably do not read this, but assisted me in various sorts towards the successful completion of this project.

K.Gopinath
10/01/2013

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List of Abbreviations

Abbreviation	Description
CPB	Concrete Paving Block
ACI	American Concrete Institute
DoE	Department of Environment
W/C ratio	Water/Cement Ratio
Avg.	Average
Coarse Agg.	Coarse Aggregate
Fine Agg.	Fine Aggregate
Max	Maximum
Min	Minimum
BTC	Before Thickness Correction
ATC	After Thickness Correction
TCF	Thickness Correction Factor