FINITE ELEMENT MODEL APPROACH TO DETERMINE THE OPTIMUM DIMENSIONS FOR INTERLOCKING CONCRETE BLOCKS USED FOR ROAD PAVING

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Declaration

I hereby declare that this is my own work and this thesis does not incorporate without acknowledgement to 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.

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

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Abstract

Concrete Block Paving (CBP), which is a predominant construction method used nowadays, is based on the ancient road construction technology "Stone Paving". The use of CBP is a common sight in most of the developing countries due to its economic adaptability. Although it has emerged as a cost-effective paving material, it is yet being developed as a full-fledged construction technique. The aim of this research was to determine optimum dimensions for concrete blocks using a finite element model, evaluating the deflections and stresses in pavement with the application of loads.

A three-dimensional finite element model was built to measure the elastic deflection basin with ANSYS finite element modelling software. The reason for developing a finite element model is, as the construction of concrete block pavements for experimenting is costly and challenging, a finite element model simulating the field conditions could be used to overcome these issues and perform further research. Previously developed finite element models and laboratory models were studied. The results obtained from the developed finite element model were verified with the deflection values obtained in a laboratory scaled model. Similar deflection basins could be observed for different load cases.

Several block types were considered initially and block dimensions with best performance were identified. Based on those results a new block type which optimizes the performance was proposed carrying out finite element analysis. An alternate block type to the proposed block type was also analysed and it could only be recommended for non-traffic areas.

In addition, the effects of wheel path on concrete block pavement in both longitudinal and transverse directions were considered to have an idea about the variation of stress and deflection at different locations of the pavement. Although no significant values were observed with the block orientation, closer the wheel path to the edges higher the stresses obtained.

Key words: Concrete Block Paving, Block shapes, Block dimensions, Loading position

Dedication

To my dear father, mother and my husband

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M. M. D. V. Gunatilake

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