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Effects of changing block dimension and mix design on the performance of Block pavements in Iran

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Abstract

The goal of pavement design is to select a cost-effective and durable pavement for given traffic and weather condition. Traditionally, port pavements have been designed by using the British port association (BPA) method. In this method Conventional 200mm x 100mm plan dimension by 80mm thickness rectangular concrete block paver is recommended. In this study, with applying BPA finite element model, effects of changing the shape (thickness) of concrete block paving on total thickness and cost of the heavy duty pavements in Iran are investigated. A laboratory experiment was conducted to produce samples of different cement contents and water-cement ratios and to study the effects of mix design on concrete pavers. The result showed that for each w/c ratio assumed, increasing the cement content from a certain percentage adversely affects pavers' quality and causes extra cost. The optimum mixture design was obtained when the cement content and w/c were 300 kg/m3 and 0.25 respectively. Numerical results from finite element analysis showed that thicker block pavers in case of heavier loads are more economical than thinner ones.

Keywords: Concrete Block pavements, Mixture design, Finite element

1. Introduction

Concrete Block Pavements (CBPs) have been used for heavy duty pavements in Container Terminals for over 30 years. The main reason of that, is their ability to withstand severe dynamic and static loadings and in many cases, being more economical than asphalt or rigid concrete pavements [1].

With regard to the importance of container terminals and ports in recent years, the need for research and development of heavy duty pavements has been increased. Port and container pavements unlike highway pavements, are subjected to high static loading due to container stacking as well as the wheel loads due to the movement of heavy container handling plants[2-5]. Traffic and axial loads have been increased and these pavements should have a high strength to resist these loads. Therefore, an experimental investigation was carried out to introduce a high quality block paver. Fifteen mixes with five different cement contents and three water-cement ratios were produced. Blocks of size 20 * 10 * 8 cm were produced and tested at the age of 28 days and finally results were analysed. In various codes of practice for pavement design, paver thickness is recommended to be 8 cm, and thicker pavers are not considered because of cost issues. With developing a finite element model similar to British Port Association code of practice (BPA), and defining several layers forming heavy duty pavement, and considering the tensile stress as controlling stress, results of loading on a concrete block pavement with 8 & 10 cm block pavers were compared and a cost comparison conducted between these two pavements.