StormPav Green Pavement the environmentally friendly pavement

Elsa Eka Putri[1,*] , Rina Yuliet[1], *Seng* Cheh Hoo[2], *Md Abdul* Mannan[2], *Larry* Silas[2], *Wan Hashim* Wan Ibrahim[2], *Mohamad* Raduan Kabit[2], Ron[2] and *Sadia* Tasnim[3]

[1]Civil Engineering Department, Faculty of Engineering, University of Andalas,
[2]Civil Engineering Department, Faculty of Engineering, Universiti Malaysia Sarawak
[3]Faculty of Engineering and Science, Curtin Universiti Sarawak, Miri Sarawak Malaysia

Abstract. Growth of economy and population density, open space is being converted to roads or other infrastructures such as buildings or parking lots reducing green space. This paper demonstrates a new type of green pavement designed to replace flexible and rigid pavements which are water impermeable and have a short design life. This type of green pavement helps reduce runoff problems in urban areas. StormPav GP is an innovative Industrialised Building System (IBS) Green Pavement which has been shown to have structural, environmental and economic advantages. However, its susceptibility to distress has yet to be analyzed. This study addresses this gap by analyzing the mechanistic properties and evaluating distress of StormPav GP as compared to flexible and rigid pavements. WinJULEA, KenPave and Circly 6.0 were used for this analysis which also investigated the effects of different tire pressures on deflections. StormPav GP was found to have lower deflection due to a tandem axle dual wheel load on any pavement surface and provided a more uniform settlement with higher elastic modulus and shear modulus than flexible and rigid pavement.

1 Introduction

As more of the surface area in urban and rural areas becomes covered by roads and buildings green areas are reduced. This lack of filtering vegetation and absorbent soil surface disrupts absorption and increases runoff rates. This absence of vegetation is a considerable challenge for regions with heavy rainfall, such as in Indonesia. Moreover, impervious pavement surfaces such as rigid pavement and flexible pavement lead to problems associated with increased runoff volumes, river bank erosion and flash flooding. If no actions are taken to mitigate these risks sustainable development of particularly urban areas will be affected. One solution is to develop permeable pavement materials that allow the rainwater to pass through.

The ability of flexible pavement to maintain shape after repeated loading is affected by temperature and will decrease if the surface temperature exceeds 45°C [1] [2]. Bituminous pavements particularly are vulnerable to certain defects under high axle loading and braking force as well as to high temperatures.

StormPav GP is an innovative green pavement which has several structural, environmental and economic advantages over impervious asphalt and concrete pavements. While not designed for high-speed traffic above 80km/h, it is suitable for urban and university areas where traffic is generally slower. The chemically inert properties of the Grade 50 concrete it is made from results in low rates of surface distress.

In this research, software modelling is used to investigate surface distress on StormPav GP in response to different tire pressure and the allowable load repetition. It is assumed that StormPav GP has many of the same characteristics as rigid pavement because both produce monolithic solutions in response to the applied load.

2 Materials and Methodology

The evaluation of the pavement used analysis of technical and mechanistic aspects. Comparison of the contact pressure between a tire and this surface with that on rigid or flexible pavements was made. Tire contact area is dependent on the configuration and pressure of the tires which are both factors the critical tensile strain at the underside of the asphalt layer, the deflections of the surface and also the interface compressive strength [3].

The mechanistic analysis was conducted on the flexible, rigid and StormPav GP Pavement to analyze the response of the structure. Distress fatigue cracking was modelled using computer software.

A technical evaluation was conducted using mechanistic modelling of the StormPav GP compared to rigid and flexible pavements to gauge any technical advantages of StormPav GP. Sensitivity analysis using different parameters influencing the behaviour and response of the pavement structure was used.

To ensure comparison of results were valid some constant criteria were used throughout. Although, in real

* Corresponding author: elsaeka@eng.unand.ac.id