Modelling of StormPav Green Pavement System with Storm Water Management Model and InfoWorks Collection System

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Abstract: Prior to any construction work related to stormwater, it is preferable to involve a computer-based modelling. This paper outlines two different computer-based modelling tools to model a green technology named StormPav Green Pavement. In determining befitting software for use, two key factors are considered: (i) fast model construction (ii) provision of an affordable design model. To meet these key factors, the Storm Water Management Model (SWMM), and InfoWorks Collection System (CS) are deployed in this study. The predictive results of the two models are compared for different design storm durations under 10-year Average Recurrent Interval (ARI). The predictive results suggest that both models are compatible. Yet, SWMM is preferable to model StormPav Green Pavement as it could provide reasonably fast model construction and the software tool is an open source software used worldwide.

Index Terms: Computer-aided design, flow rate, permeable road, urban drainage, velocity.

I. INTRODUCTION

StormPav Green Pavement is a form of Industrialized Building System (IBS) product patented by [1] that could be a revolution on how the conventional asphalt road is built. It is a new form of permeable road [2] that focuses to overcome the shortcomings of impervious characteristics of conventional asphalt roads. For instance, flash flooding [3-5], and road damages due to water ponding [6] are mostly caused by imperviousness of asphalt roads.

StormPav, in short, is also a multi-purpose structure, which integrates road and drainage structure. This structure is formed by merging multi-units of single modular units as shown in Figure 1 which consists of three precast concrete pieces. Top layer is for supporting of passing vehicles and permeating water atop into hollow cylinder through a service inlet. Middle layer is a collection hollow cylinders to provide spaces for storing and draining purposes. Besides that, the spaces between each unit also provide additional spaces for water flowing. Bottom layer is the raft foundation with service inlets to allow infiltration. Stormwater flows out of

the StormPav system either by evapotranspiration of water, infiltration into native soil beneath it or/ and by outflow through outlet structure. Yet, in this paper, evapotranspiration and infiltration are excluded, so as to concentrate solely on the stormwater storage and conveyance purposes.

Before putting any further commitment on actual construction, computer simulation is a common practice to determine the workability of a system under study [7]. To determine an appropriate software to model StormPav Green Pavement System, two key factors are considered which included (i) fast model construction and (ii) budget for software purchase and maintenance fees. Modelling software being utilized are discussed in the next section.
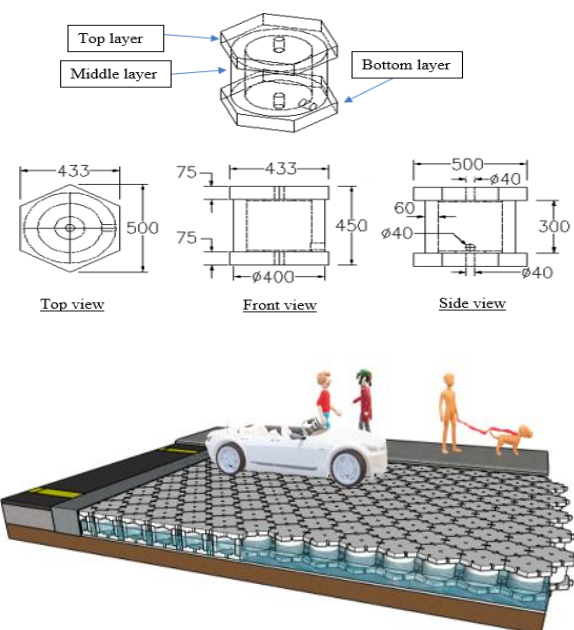

Fig. 1: StormPav Green Pavement

II. MODELLING SOFTWARES

Two stormwater modelling tools, namely SWMM, and InfoWorks CS are chosen to model StormPav.

SWMM is a hydrologic and hydraulic model, provided by the United States Environmental Protection Agency, EPA. SWMM is a dynamic rainfall-runoff model implemented for single event or long-term simulation of runoff quantity and quality from mainly urban study and of backwater effects and reverse flow [8]. The model was introduced in the early 1970's and has continuously been updated since then. The