

Modelling of Surface Permeation in Multiple-Orifice Permeable Road

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Abstract

A patent-pending StormPav green pavement is introduced here as a form of permeable road, in which the system employed precast concrete pieces as modular units. The pavement layer consists of hexagonal plates with each a service inlet to drain water. This study is exploring the water draining capability or technically surface permeation of these service inlets. Virtual and physical modelling are performed to investigate the service inlets as multiple orifices to permeate surface water of the said permeable road. Both modelling efforts have deduced that the permeable road has 18,000 – 24,000 mm/hr of permeation rate when subjected to a 5-minute red-alert storm (>60mm/hr of intensity). It implies that StormPav green pavement has superior surface permeation against the forming of water ponding and flash flood on roads.

Keywords: CFD; Infiltration; Pavement; Rainfall; Runoff.

1. Introduction

The idea of changing the conventional roads to permeable one had been initiated since 1960s. Different permeable road models are introduced since then. For one, this paper introduces a new form of permeable road - a patent-pending Industrialized Building System (IBS) product named StormPav [1] (see Figure 1).

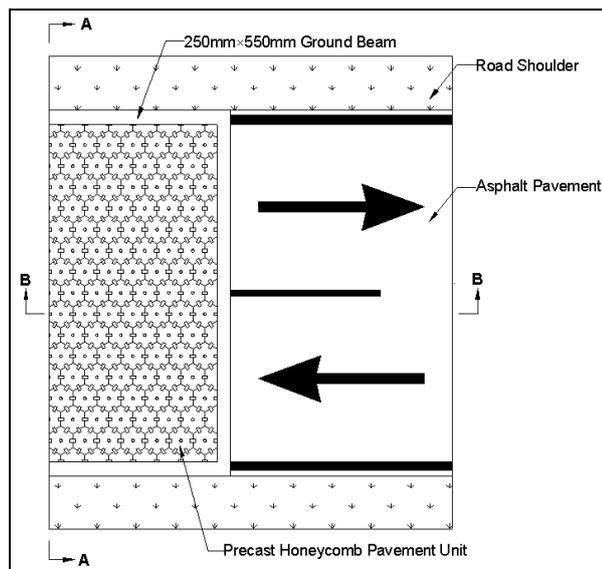


Fig. 1: StormPav Permeable Road

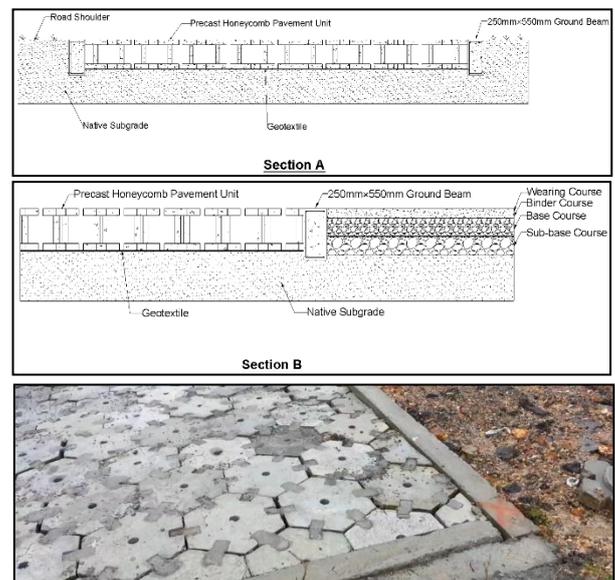


Fig. 1: Continued

StormPav consists of three precast concrete pieces to form a single modular unit, namely a top cover, a cylinder and a bottom plate (see Figure 2). Specially designed Grade 50 concrete mix is used to cast these pieces that could withstand crushing load up to 100 kN/unit. Utilization of the specialist concrete with high loading capacity has enable the fabrication of such a IBS modular unit. It has been designed to have hollow cylinders as the middle layer that function as temporary stormwater storage; and even with the intentional cavity, a single modular unit is proven strong enough in the laboratory to withstand heavy vehicle on top of it [2-3].