

Application of StormPav Green Pavement System in a Government Buildings Redevelopment Scheme

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Abstract: StormPav Green Pavement System is a non-commercialized permeable road with a function of stormwater detention. This paper demonstrates the application of the R&D product in part of a 14,000 m² government building complex as a new feature of sustainable drainage system. To assess its stormwater impacts to the project site, two software are utilized to analyze the stormwater flow processes when merely 10% of the project area is incorporated with StormPav. Firstly, Storm Water Management Model (SWMM) is used to simulate the project-wide stormwater flow, in which reductions between 22% - 6% in terms of peak flow rates are predicted compared to conventional drains when subjected to 5 - 180 minutes of 10-year Average Recurrent Interval (ARI) design rainfall. Secondly, SolidWorks Flow Simulation (SWFS) simulates the detailed flow processes within the StormPav system, in which it is found 0.5 - 1.3 m/s of velocities are predicted around the inlets and outlet that conform to the local stormwater management standard. Besides, SWFS allows visualization of velocity and streamline profiles across the StormPav system that conventional SWMM could not provide.

Index Terms: On-site detention, Post-development, Pre-development, SolidWorks, Stormwater.

I. INTRODUCTION

This paper describes a case study of a redevelopment scheme involving a government building complex. The compound is about 14,000 m² (1.4 hectares/less than 80 hectares) and it falls under the category of small urban catchment. The complex is packed with buildings and paved walkways that constitute 90% of the area; while green areas for the remaining 10%. The existing drainage plan is presented in Figure 1a. The conventional drainage plan involves only concrete drains. The red lines indicate 450mm wide drains, while the green lines indicate 300mm wide drains. The complex was officiated in 1912. Over the 107 years of usage, it went through several upgrading. The scope here limited to its stormwater drainage facility. The existing drainage was the rapid discharge system, in which stormwater was meant to be collected in the drains to be disposed of the compound as soon as possible [1]. However, the recent development since the 90s had called for a different approach to urban stormwater management. The century-old complex was deprived of sustainable drainage features [2,3]. The

intended redevelopment scheme has allowed the opportunity to retrofit one or few new stormwater features.

There are three drainage outlets designated for the complex. Tracing the drainage network, three sub-catchments could be delineated in Figure 1b. Sub-catchment 3 has the largest catchment area and a large car park of 1420m²; therefore, having an On-Site Detention (OSD) in Sub-catchment 3 is justifiable. OSD is a method of providing manmade stormwater storage structure [4] to temporary detain some portion of potential stormwater generated from any project site. The main purpose of OSD is to alleviate the peak flow rate and abrupt high volume of stormwater being flushed to downstream waterways [5,6] that may cause environmental problems like flash flooding and erosion.

In the case of the studied government building complex, the large surface area provided by the car park could be exploited to have subsurface storage underneath the parking lots [7]. Some modifications to the existing drains are needed. The drains are directed to the subsurface storage via two inlets and one outlet. The subsurface storage could be designed in several ways. The authors are introducing StormPav Green Pavement System, or in short, StormPav, in this paper. StormPav is a R&D product, in which the authors are part of the research team.

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