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ENVIRONMENTAL ASSESSMENT OF STORMPAV GREEN PAVEMENT FOR STORMWATER MANAGEMENT

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Abstract: This study evaluates the stormwater management potential of a green pavement technology for permeable road pavement with subsurface micro-detention storage (StormPav) from a water quality perspective. The system provides integration of permeable pavement with hollow spaces to attenuate peak discharge with design installation using precast products. The environmental assessment was gathered from field experiments to assess the water quality, mosquito breeding capability and infiltration rate in the StormPav. The water quality parameters were determined to assess environmental benefits, which are one of the components of sustainable development. The parameters consist of total suspended solids, pH and alkalinity and they showed identical results to other permeable pavement types. Larvae development was found as early as eight days in stagnant water in the cylindrical hollow section of StormPav. However, the StormPav showed a high permeability rate within 122.45 mm/hr to 168.12 mm/hr at subgrade soil of HSG A soils group with no stagnant water retained in the void section in less than two hours, which nullified the required retention time for larvae development. Hence, StormPav displayed a significant benefit in terms of environmental concern for a sustainable design invention in stormwater management with the presence of subsurface detention storage.

Keywords: Sustainability, permeable pavement, detention pond, stormwater management, environmental.

Introduction

Rapid growth through urban development introduced more impermeable areas as well as a notable reduction of infiltration, groundwater depletion and increment of peak runoff. Therefore, urban growth leads to an increase in sediment and nutrients in water bodies (Osman *et al.,* 2020). Urban runoff is considered to be a significant source of water pollution (Shen *et al.,* 2020) with waste in water resources coming from domestic, commercial, industrial and transportation sources (Czemiel Berndtsson, 2010). It can affect the environment chemically, physically and biologically; hence, contributing to environmental degradation and health risks (Park *et al.,* 2013). Reducing the transport of nutrients to watersheds is important for water pollution control (Osman *et al.,* 2020) towards sustainable urban development. Contaminants in water can affect water quality and consequently, human health. Polluted water is related to disease outbreaks such as diarrhoea, dysentery, cholera, typhoid and guinea worm infection (World Health Organisation [WHO], 2012).

Stormwater management is important in balancing economic growth, social element and environmental protection. One of the major control-at-source measures in stormwater management is the application of green infrastructure. Permeable pavement has been a major consideration in the practice of stormwater management (Scholz, 2013). It is a green approach to the collection, storage, treatment and reuse of stormwater runoff (Imran *et al.,* 2013). Permeable pavement showed a significant achievement in control stormwater pollutions. Studies found a reduction of the pollution build-up consisting of total suspended solids (TSS) of between 28% and 73%, total nitrogen of between 32% and 60%, total