EVALUATION OF THE PERFORMANCE OF PERMEABLE AND POROUS PAVEMENTS IN THE URBAN LANDSCAPE

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Abstract

Excess stormwater runoff and the pollution of natural water recourses from the stormwater runoff have become severe global problems nowadays. With the high urbanization, the area of impervious surfaces significantly increases. Consequently, the quantity of stormwater runoff is increasing and therefore the higher loads of pollutants carried by the stormwater runoff to receiving water resources leading to severe degradation of their water quality. The use of pervious pavements in car parks and lightweight driveways in place of traditional impervious surfaces have become one of the innovative, environmental friendly and widely used structural measures globally for past decade. It has a potential to significantly reduce the runoff volume and improve the water quality by trapping the sediments in the infiltrated water. Pervious interlocking concrete pavements can be used as an alternative option rather than go for an expensive build-up of new drainage systems. It is one of the popular pervious pavement types in developed countries compared with porous asphalt and porous concrete pavements. The main problem possible to occur in pervious interlocking concrete pavements is the clogging of the voids. But researches have proved that with proper maintenance clogging can be reduced.

The paper has focused on to investigating the performance of pervious surfaces and compares their performance against a conventional impervious surface. Three interlocking concrete pavement lab models of permeable (I shaped block), porous (Grass paving block) and impervious (Cobble type block) were designed and used for data collection. Each experimental setup consisted with 3 aggregates layers (Open-graded bedding course, base course and sub-base course). Data collection was done in two phases; Using stormwater runoff collected from a street (Spread over the lab models using sprinkles) and rainwater directly from the sky (Lab models kept outside for rainfall events). Quality analyses were done for both rainwater and stormwater runoff for parameters such as pH, Electrical Conductivity (EC), Nitrite, Nitrate, Total Phosphorus (TP) and Total Suspended Solids (TSS). Quantity analysis was only done for rainwater directly from the sky. Considerable

reduction in runoff volumes, pollutant concentrations and loads were obtained from the relevant experiments.

Percentage reduction in runoff volume from pervious pavements varied between 50%-75% when compared to conventional impermeable pavement model. The Grass paving pavement model was infiltrated more water than the I-shaped pavement model. Referring to results gained from this study, it is verified that both pervious pavements can reduce the stresses on drainage systems by effectively managing the stormwater runoff. The water retained within the pavement structure will evaporate back to the atmosphere. Therefore, the results obtained from the experiments verified that the filtration ability of the pervious pavements is much higher compared to impermeable pavement. Consistent water quality improvements were observed from these pervious paver experiments, with reductions in TSS, TP, Nitrite and Nitrate of around 90% to 95%, 50% to 70%, 60% to 75% and 60% to 75% respectively and confirming the findings by previous researchers.

Keywords: Pervious pavements; Stormwater runoff; Stormwater management; Water quality