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Assessment of porous pavement effectiveness on runoff reduction under climate change scenarios

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ABSTRACT

Climate change has affected both water quantity and quality by increased rainfall, runoff, and associated pollutant loading in urban areas. Stormwater Best Management Practices (BMPs) are now being popularly considered for the reduction of increased runoff due to urbanization. Most research has been conducted on the analysis of BMP effectiveness under current conditions. However, there is no extensive literature on BMP effectiveness studies considering climate change. In this study, the effectiveness of BMP, porous pavement in particular, has been assessed under climate change scenarios. Climate change scenarios were generated by trend analysis of the historical rainfall data. The 2-year and 100-year design storms having 24-h durations were determined for three scenarios: current conditions, 2020, and 2050 using frequency analysis. Storm Water Management Model was then calibrated and used to evaluate the impact of climate change and the effect of incorporating porous pavement on runoff. Geographic information system analysis showed that 33.4% of the basin was suitable for the installation of porous pavement. Hydrologic modeling demonstrated that climate change can increase peak flows by as much as 26.9% relative to current condition. Further analysis showed that porous pavement can be effective in reducing the runoff volume and peak flow below current conditions for all scenarios, offsetting negative impact of climate change.

Keywords: Climate change; Porous pavement; Runoff; Stormwater modeling; SWMM

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