透水性路面上漫地流之水理分析

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摘　要　本研究將路面上因降雨等造成之漫地流視為一流場，並分成兩個區域(水層與透水層)，推求漫地流流經道路時之流況解析，希望藉此瞭解當地表為透水性材質時對水流流動之影響。文中之地表為透水鋪面，如開放級配瀝青混凝土，是為具滲透性之多孔介質，考量其地表流速不為零的真實現象外，透水層中的水流則視為孔隙介質流。

漫地流流況求解過程為先對整體流速分佈進行求解，積分後得流量，以此推得水深之微分式，再以數值方法求得水深之值。具體作法如下：以簡化之那維爾-史托克斯方程式(Navier-Stokes equation) 搭配宋 (1993) 根據 Biot 多孔彈性介質理論所建立之多孔介質層流模式為控制方程式，予以求解。

在求得漫地流流況之解後，再分別探究各參數對水深和流況之影響。結果發現坡度越陡、坡長越短、降雨強度越小、鋪面孔隙率增大、鋪面厚度增加皆能使地表水層水深降低，且各參數越大時水深變化呈非線性成長。本研究的例子中，坡度 0.02、鋪面厚度為 5cm 且孔隙率達 0.4 以上時，將可達到地表完全不積水，即水層之水深降到零。最後，本解可應用於推求設計一道路鋪面之坡度、厚度、孔隙率及路寬等參數值，以符合現地排水之需求。

關鍵詞：孔隙介質流、透水性鋪面、漫地流。

Hydraulic Analysis of Overland Flow on Pervious Pavement

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ABSTRACT　This study divided the flow field into two regions, the water layer and the permeable layer for analyzing overland flow on a road, and investigated the influence of the flow within a permeable medium. In addition, the flow in the permeable layer was considered as the porous media flow. The differential equation of water depth was formulated and solved by numerical methods. The governing equations were the simplified Navier-Stokes equation and Song's (1993) laminar model based on Biot's poroelastic theory. The results indicate that water depth decreases with steeper slope, shorter slope length, smaller rainfall intensity, larger porosity and thickness of the pavement. The depth of water grows up nonlinearly if each parameter is larger. A case of slope 0.02, the thickness of pavement 5cm, and the porosity over 0.4 will not pond on the surface. The results can be applied to pavement designs.

Key Words:　porous media flow, pervious pavement, overland flow.

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