**Applications and Challenges of an Innovative Load-Bearing Permeable Pavement Developed in Taiwan**

Ying-Haur Lee, Professor, Tamkang University, Taiwan

Nelson N.S. Chou, Adjunct Professor, National Taiwan University, Taiwan

Jui-Wen Chen, Inventor, JW Eco-Technology Pavement, Taiwan

ABSTRACT

Pervious pavements are generally not structurally sound, weak in material strength, and can be easily clogged. Thus, they might only be used in sidewalks, squares, and parking lots, but not for vehicular loads. An innovative eco-technology recently developed in Taiwan uses air-circulated aqueduct frames and impervious Portland cement concrete on top of an aggregate (crushed stone or gravel) base layer to form a structured permeable concrete pavement (called JW eco-technology pavement) can alleviate such problems. The main functions and special features include: (1) The aggregate layer may serve as a detention reservoir to increase flood control capabilities; (2) The stored water may lower pavement surface temperature in summer and help to reduce heat island effects; (3) This eco-technology can prevent water accumulation on pavement surface to improve pedestrian and driving safety; and (4) Exhausts from vehicles may be absorbed by the pavement system and become the nutrients of an underground ecological system.

Through proper designs, the structured JW pavement can possess adequate load bearing capacities as conventional concrete pavements do. Traditional concrete pavement thickness design approaches are proposed to be used as the basic guidelines for determining the required slab thickness. Since the aggregate base course serves as structural bearing layer and reservoir layer, its thickness can be determined as the thicker of the two results based on these design controls. The surface conditions of several JW pavements remain fairly good even after 10 years of service in Taiwan. Evidences indicated that the JW pavement can be successfully used in roadways subject to light traffic under normal geological conditions. However, the subgrade soil underneath the aggregate (or crushed stone) layer warrants further investigations, especially when the soils are suspicious to settlement or may lose shear strength due to wetting. There are still challenges ahead such as to better understand its failure mechanisms, structural capabilities in terms of allowable load repetitions, and other long term performance indices if the structured JW pavement should be used for normal or heavier traffic loading conditions.

**創新式結構透水鋪面的應用與挑戰**

李英豪 淡江大學土木系教授

周南山 台灣大學土木系兼任教授

陳瑞文 JW生態工法發明人

摘要

一般而言，透水性鋪面之結構能力較弱、材料強度不足、且容易堵塞。因此，透水性鋪面通常僅適用於人行道、廣場、停車場，但並非以承載車輛荷重為主要目的。近年來，在台灣發展出一種創新的生態工法，該技術採用不透水的波特蘭水泥混凝土面層、其內並嵌入高通氣的導水管架構與導水溝槽、其下鋪設碎石(或礫石)粒料底層，以形成一種結構性透水鋪面(或管式透水鋪面)，或許可以減輕這些問題。此種透水性鋪面之主要功能和特性包括：(1)粒料層可儲水或蓄水，以增加防洪控制的能力；(2)在夏天儲存的水可降低鋪面溫度，並有助於降低都市熱島效應；(3)此種生態技術可以防止鋪面表面積水，且可改善行人和駕駛安全；和(4)此鋪面系統可吸收車輛廢氣，並成為一個地下生態系統的營養源。

透過適當的設計，結構性透水鋪面可以如同傳統的混凝土鋪面一樣，擁有足夠的結構承載能力。初步建議可先利用傳統混凝土鋪面厚度設計法為基礎，以決定混凝土版所需的厚度。因粒料底層係被用來做為結構承載層和儲水層，建議可以選擇依此二個設計控制的分析結果中較大的值，來做為粒料底層所需之厚度。在國內有數個結構性透水鋪面雖歷經十餘年的現地服務，其鋪面表面狀況至今仍然相當良好。證據顯示，此種透水性鋪面可以被成功地使用在一般地質條件與輕交通量下。然而，仍應進一步調查在粒料底層下方路基土壤，尤其是當土壤可能因為含水量過多而沉陷或失去抗剪強度時之行為。結構性透水鋪面若是要應用在一般或較重交通荷載條件時，目前仍有許多挑戰亟待克服，例如：應更深入瞭解其破壞機制、結構承載能力或可容許的重覆載重次數、和其他長期績效指標。