

The impact of tree transpiration on the safety and serviceability of pavement under seasonal variations

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First Author	
Last Author	
Authors	Yuliana; Apriyono, A; Leung, AK; Keawsawasvong, S; Kamchoom, V;
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Abstract	Roadway trees planted as barriers reduce traffic noise and particle pollution in cities. However, tree roots may alter the soil's moisture content, resulting in uneven soil subsidence and maintenance issues for neighbouring structures. This study determined the safe distance between trees and pavement by investigating the effects of transpiration on pore water pressure (PWP) and pavement subsidence under seasonal variations. The root water uptake was simplified in a finite element model using multiple hydraulic head boundaries and validated using field observations. A hypoplastic model was used to model non-linear behaviour and plastic strain accumulation in unsaturated soil. Evergreen trees can reduce PWP by 72% during the dry season and 84% during the wet season, compared to bare soil. The subsidence did not decrease linearly with the distance away from trees under a rigid and impermeable pavement structure. The maximum bending moment was influenced by the distance between trees and pavement with the highest value occurring when trees were located near the pavement (up to five times the bending moments on pavement without trees). Our findings suggest that the pavement is at risk of experiencing structural failure if trees are located within 0.4 times their height away from the pavement.
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Author	Dr.Eng ARWAN APRIYONO, S.T, M.Eng