engineering proceedings

MDPI

Abstract

Lifecycle assessment of permeable interlocking concrete pavement and comparison with conventional mixes

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Keywords: Pervious interlocking concrete pavement; cement concrete; asphalt concrete; parking lot; lifecycle assessment; pavements; sustainable infrastructure

In recent years, continuous attempts have been made by the pavement industry to explore the opportunities that assist in bringing down the environmental footprint of roadway infrastructure as well as mitigate the harmful impacts of climate change on the quality-of-life. The construction of pervious interlocking concrete pavement (PICP) in parking areas is gaining widespread acceptance attributed to their: (a) ease of installation, (b) high durability and skid resistance, (c) low repair and maintenance requirements, (d) ability to mitigate floods, and (e) potential to purify the stormwater. However, very little research has been conducted to investigate the environmental impacts associated with the installation of such pavement systems. Therefore, the objective of this cradle-to-gate research study was to quantify the environmental footprint of PICP for a 75 m × 16.5 m parking lot that was constructed in the premises of the Indian Institute of Technology Tirupati, India. Further, the quantified impacts were compared to that of traditional asphalt concrete (AC) and cement concrete (CC) parking lots. The scope of the effort encompassed: (a) design of three pavement systems based on site specific requirements as per relevant design codebooks, and (b) quantification of the environmental impacts using systematic lifecycle assessment (LCA) approaches that are in accordance with the international standards. The results indicated that construction of AC parking lot had lower environmental footprint compared to CC pavement and PICP systems. Further, the environmental impacts associated with the construction of CC pavements were the highest. Based on the results, it was understood that though PICP system has intermediate environmental footprint, it provides additional benefits such as infiltration of stormwater into the ground. Further, the PICP blocks have higher design life compared to CC and AC pavements. However, additional research must be conducted in future to ascertain the environmental impacts of the three pavement systems from cradle-to-grave perspective. Such an approach will assist in the integration of LCA toolkits with existing pavement design methods, and further contribute to the development of resilient and sustainable pavement infrastructure.