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Pavement thermal behavior with reference to the physical attributes: An experimental and field comparison

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Pavements represent a high fraction of the urban land use and contribute to the Urban-Heat-Island (UHI) in cities by absorbing radiation and converting it to heat, which is released back to the surroundings. This contributes to the microclimatic variations in urban areas, which exhibit higher ambient temperatures in comparison with their outskirts. Different types of pavers are available for pavement construction with vast variations of colour, material, surface smoothness, and mixed designs. These variations may account for varied absorption of radiation and heating and contribute to the UHI in different intensities. Several studies have been carried out to identify how various physical attributes of pavements effect towards urban microclimates using experimental setups. However, these results may vary from the actual thermal performance, and limited studies have been conducted comparing between them. Therefore, the objective of this study is to compare and contrast the trends and quantities of thermal performance between the outside actual pavers and the experimental set ups. Experimental pavers placed at the University of Sri Jayewardenepura, Sri Lanka were classified using their surface textures and colours as Grey-Rough (GR), Grey-Jagged (GJ), Grey-Smooth (GS), Red-Rough (RR), and Black-Rough (BR). The study of actual pavement setups was conducted at two outdoor locations at Jaltara and Kahathuduwa. The experimental paver comparisons with the outdoor pavers in the real-world scenario show that even though the quantifications for the surface temperatures vary based on the size, location and local climate condition of the location, the proportionate variations of the temperature between the experimental pavers and the real-world pavers are similar. The results showed that, at the peak hour the surface temperature of outside actual pavers was higher than that of experimental paver setups by 7.62, 10.32, 9.25, 13.28, 14.94 °C for GS, GJ, GR, RR, BR, respectively. However, both experimental and outdoor pavers showed similar trends in their temperature profiles. Therefore, it can be concluded that the heat absorption depends on the physical attributes of the pavement in similar trends disregarding the scale, although actual pavers show higher surface temperature. Thus, the outdoor data collection performed in this study validates the experimental results.

Keywords: Urban heat island, pavements, thermal performance, experimental study

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