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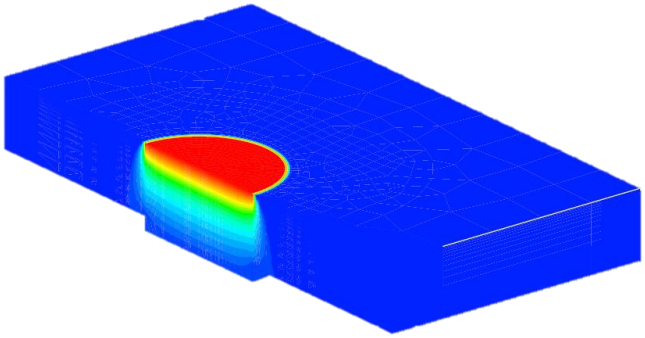
Design Of Cool Concrete Pavement Using Capillary Wicking For Decreasing Urban Heat Island Effects.

Abstract:

The Urban Heat Island(UHI) is an effect that appears in many urban areas worldwide. It is observed both higher surface and near-surface air temperatures in cities compared to countryside. Reducing the UHI allows for lowering energy consumption during summer and for improving human wellbeing. The UHI is due to increased use of manmade materials and urbanization development. Concrete pavement which is the most common material in urban horizontal surfaces is a major contributor to the UHI. Due to solar irradiation, high volumetric heat capacity and low albedo, surface temperature reaching upwards to 60°C is observed. Decreasing the top temperature of pavement is an efficient solution when combined with green areas. Cool concrete principles are based on solar reflection or water evaporation. The objective of this program is to develop a water-retentive pavement having capability to cool top surface temperature through the water evaporation. For such systems, water is retained at bottom level and lifted to top surface by capillary wicking. The porous network distribution will be designed to ensure a sufficient quantity of evaporated water. Numerical simulations and experimental tests will be undertaken to study the influence of meteorological and environmental conditions on cooling efficiency and to investigate the quantity of lifted water under the thermal gradient and the phase change.



Simulation of the heat transfer in the concrete pavement