Sustainable Urban Development Minimizing Urban Heat Island Effect and Imperviousness Factor

Executive summary

Control of Urban Heat Island (UHI) and increasing permeability shall help address issues of increasing energy consumption and incremental storm water flows in the context of sustainable urban development. Extensive field studies have been carried out to quantify UHI in the context of Bangalore city. About 0.8 oC – 2 oC higher mean air temperature was observed during the measured period. The impacts of vegetation and water bodies on the urban micro climates have also been studied. Various mitigation measures were tested experimentally which helped to derive at significant conclusions. It was understood that amount of heat flux in case of high reflective RCC roof would be almost 77% less compared to uncoated RCC roof during the peak time. Thus the heat flux reduction is maximum in case of Reinforced Cement Concrete (RCC) mass roof compared with the uncoated RCC roof. The application of maintenance-free reflective white coatings which have insulation property due to presence of nano particles has been highlighted in this study. The measured data has been validated using a software model. A good correlation (R^2= 0.96 for Kodathi, R^2= 0.89 for commercial street, and R^2= 0. 94 for Palace Road) is found in this regard. It is observed that there is 1.5 ^{0}C and 1.9 ^{0}C reduction in peak air temperatures is possible with reflective roof and green roof respectively when compared to the existing case. Reduction in energy consumption for commercial buildings across Bangalore in case of reflective roof and with improved micro climate would be 1642 MWh/yr; this would result in saving of Rs. 10,348 million/yr. Infiltration increases and thus potential increase in ground water table may be realized by use of grid pavers. The measures shall assist towards the process of sustainable urban development.