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Outdoor thermal comfort study in the underneath-elevated-building (UEB) area:

On-site measurements and surveys in Hong Kong

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Abstract:

The growth of cities intensifies the urban heat island effect by obstructing and weakening the incoming wind and thus deteriorates thermal comfort in the pedestrian level. The elevated building design is believed to be able to create some localized comfort spots at precinct scale, but no researches on pedestrians’ thermal perceptions in the area underneath an elevated building (UEB) have been reported. In this study, simultaneous on-site meteorological measurements and questionnaire surveys of 1,107 human subjects were conducted in a university campus in Hong Kong. Three outdoor thermal comfort assessing models, PET, UTCI and UC-Berkeley model were compared. The survey results indicate that the UEB area is significantly (\(\alpha=0.05\)) more comfortable in hot weather without extra discomfort in cold weather. All three models outputs correlate well with the subjects’ mean thermal sensation votes in linear regression (R\(^2\)≈ 0.9). Yet, shifts in neutral indices (6.2K, 5.8K and 1.1 respectively for PET, UTCI and UC-Berkeley model) appeared when comparing the correlation results separately for the UEB areas and open areas, indicating that the impacts of solar radiation and wind or the lack of them on pedestrian’s thermal comfort perceptions have not been well predicted by the three models. These investigations, on the one hand, characterize the benefits that elevated building designs have on the pedestrian-level microclimate and provide references and inspirations for urban planners to enhance pedestrian thermal comfort by altering building designs; on the other hand, indicate the need to refine the thermal comfort models for better outdoor thermal comfort assessment.

Keywords:

Outdoor thermal comfort, thermal comfort assessing model, underneath-elevated-building area, on-site measurement, questionnaire survey

Nomenclature

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