Analyzing transit-based heat exposure and behaviors to enhance urban climate adaptation and mitigation strategies in the southwest USA

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Abstract

Current, low-income and marginalized communities use public transit and engage in non-motorized transit activities more often than other users (Karner et al., 2015). For instance, in South Mountain Village, more than half of residents do not own a car and use public transit as their primary transit mode. Such neighborhoods are also the most vulnerable to heat related morbidity and mortality (Karner et al., 2015). For vulnerable populations that do not have access to AC, exposure to heat due to transit related activities can be a critical component that adds to total exposure (Karner et al., 2015).

Riders’ heat exposure is characterized by two factors: a walk time to the stop and the wait time at the stop. Estimated walking time in the area serviced by the Regional Public Transportation Authority ranges from 1.9 to 5.5 minutes and increases with lower density. The waiting time at the neighborhood stops averages 7-14 minutes in the Valley Metro Service Area. The highest frequency routes are connecting major activity centers and longest wait times are along non-arterial roads and at the fringe developments (Frase & Chester, 2016).

Average public transit rider exposure in Phoenix Metro Area

2-10 minutes
Walking + Waiting
13 to 21 minutes
11 minutes

Empirical evidence suggests that adaptation plays a significant role in how comfortable people feel outdoors. That is why scientists have developed adaptive model of thermal comfort that is based on the assumption that people adapt to the environment to minimize discomfort. It includes three aspects: physiological acclimatization to the climate, psychological (expectations in relation to particular environment and thermal history) and behavioral/physical (adjusting clothing, changing posture, using umbrella etc.) (Nikolopoulou & Steemers, 2003; Rupp, Vasquez, & Lamberts, 2015).

Conclusion and Discussion

In conclusion, current bus stop infrastructure in Phoenix does not provide thermally comfortable conditions for bus riders. Majority feels hot. However, design matters for reducing actual temperatures and influencing psychological thermal comfort. Stops with artistic features provided higher temperature range and were more effective for cooling. Moreover, people who felt that stop is beautiful or pleasant felt more thermally comfortable. Investing in improving psychological thermal comfort can be a cost effective strategy to make people feel more comfortable.

Climate change models suggest that more cities will face climate challenges similar to Phoenix. Thus, we need to rethink how to integrate cooling functions into infrastructure systems in addition to their primary purpose.

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