Adaptive Comfort Models: What Indian Climate Data Actually Shows

Indian researchers built better models. Indian buildings still use the old ones.

At a Glance

Indian researchers built comfort models using 9-month heat data. Buildings still use the 3-month American standard. The science diverged 20 years ago. The buildings have not caught up. [1]

Summary

Adaptive comfort models are derived from long-term field studies in real buildings where occupants live through continuous heat for months at a time. Unlike laboratory studies, field research captures physiological acclimation: the body's ability to recalibrate comfort temperature setpoints when exposed to sustained thermal conditions. [1]

IIT Bombay and IIT Kharagpur conducted the foundational adaptive comfort field study for India. Over 3 years, researchers measured thermal comfort votes from office occupants in Mumbai and Pune through full annual cycles: March heat, monsoon cooling relief, and the return to heat in post-monsoon seasons. The resulting adaptive comfort model, published in Building and Environment (2015), specified comfort temperatures 1.5 to 2.5 degrees Celsius higher than ASHRAE Standard 55 for the same indoor conditions. [2]

The mechanism is physiological acclimation. After 2 to 3 weeks of sustained heat exposure, a person's thermoregulatory setpoint shifts upward. The metabolic rate baseline increases. Sudomotor activity (sweat gland sensitivity) adjusts. By 9 weeks of continuous heat, the adaptation is substantial. An Indian office worker in August, acclimated to 3 months of March-to-May heat, has a fundamentally different thermal comfort expectation than a July office worker in Boston, acclimated to a 1-month heat ramp. [3]

Buildings designed using ASHRAE 55 lock in non-adaptive setpoints: 21.5°C year-round comfort. This conflicts with occupant biology. Worse, it consumes extra energy to maintain a comfort standard that occupants will eventually find uncomfortably cold. A retrofit that shifts from mechanical HVAC-only to Biothermal Microconditioning lets the system adapt as occupants acclimate. Person-level evapotranspiration from areca palm clusters, combined with adaptive thermal mass in Terrapods, creates a system that cools in response to occupant thermal comfort, not just air temperature setpoint. [4]