



## Adaptive thermal comfort model based on field studies in five climate zones across India

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### ABSTRACT

Indian residences are vulnerable to heat-driven discomfort amid the mounting prevalence of weather extremes, residential design and construction practices, and densifying urbanscapes. Therefore, it is vital to understand the thermal comfort characteristics of nationwide residences. This study proposes an adaptive thermal comfort model based on yearlong field surveys in eight cities located across five climate zones of India – the India Model for Adaptive Comfort - Residential (IMAC-R). The model prescribes the operative temperature bands for 80% and 90% thermal acceptability in correlation with the outdoor reference temperature, applicable to mixed-mode (MM) and naturally ventilated (NV) residences.

More than 80% of the Indian residential occupants experienced a neutral thermal sensation in the indoor operative range of 16.3–35 °C in response to a 5.5–33 °C variation in the 30-day outdoor running mean temperature. Comparing the proposed model with the PMV model revealed that the latter underpredicts the thermal adaptivity of Indian occupants. The model was also compared against its predecessor – India Model for Adaptive Comfort for Commercial Buildings (IMAC MM and NV), along with relevant global and regional thermal comfort models. On average, the neutral temperature prescribed by IMAC-R was warmer than the temperatures prescribed by IMAC MM and NV by 2.9 °C and 2.1 °C, respectively; it was also warmer than the temperature prescribed by the recent ASHRAE-55 and EN 16798-1 models by 2 °C and 0.3 °C, respectively. IMAC-R reserves the prospect of addressing the thermal comfort needs of the national population while paving the way for long-term energy savings and climate action.

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