



Achieving Thermal Comfort in a Naturally Ventilated Hospital in São Paulo, Brazil

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Introduction

There lies great energy savings potential in implementing natural ventilation strategies for indoor environmental conditioning as it allows for a wider thermal comfort band according to the adaptive comfort criteria, as seen in figure 1 (Brager & de Dear, 1998). It has been shown that naturally ventilated buildings spend less than 50% of the equivalent energy used by artificially conditioned buildings (Kolokotroni *et al*, 1996).

It is important however in a subtropical climate like São Paulo to control solar radiation and increase air movement to ensure thermal comfort (Leite & Frota, 2011). Over the last decades, the use of these low-energy strategies has become less common as instead mechanical HVAC systems are being used, resulting in increased energy demand. In this research, a case-study on a hospital building without heating or cooling systems will be performed.

Research Goal

Find to what extent thermal comfort can be achieved by optimizing the interaction with operable windows, blinds and fans in the subtropical climate of São Paulo, Brazil.

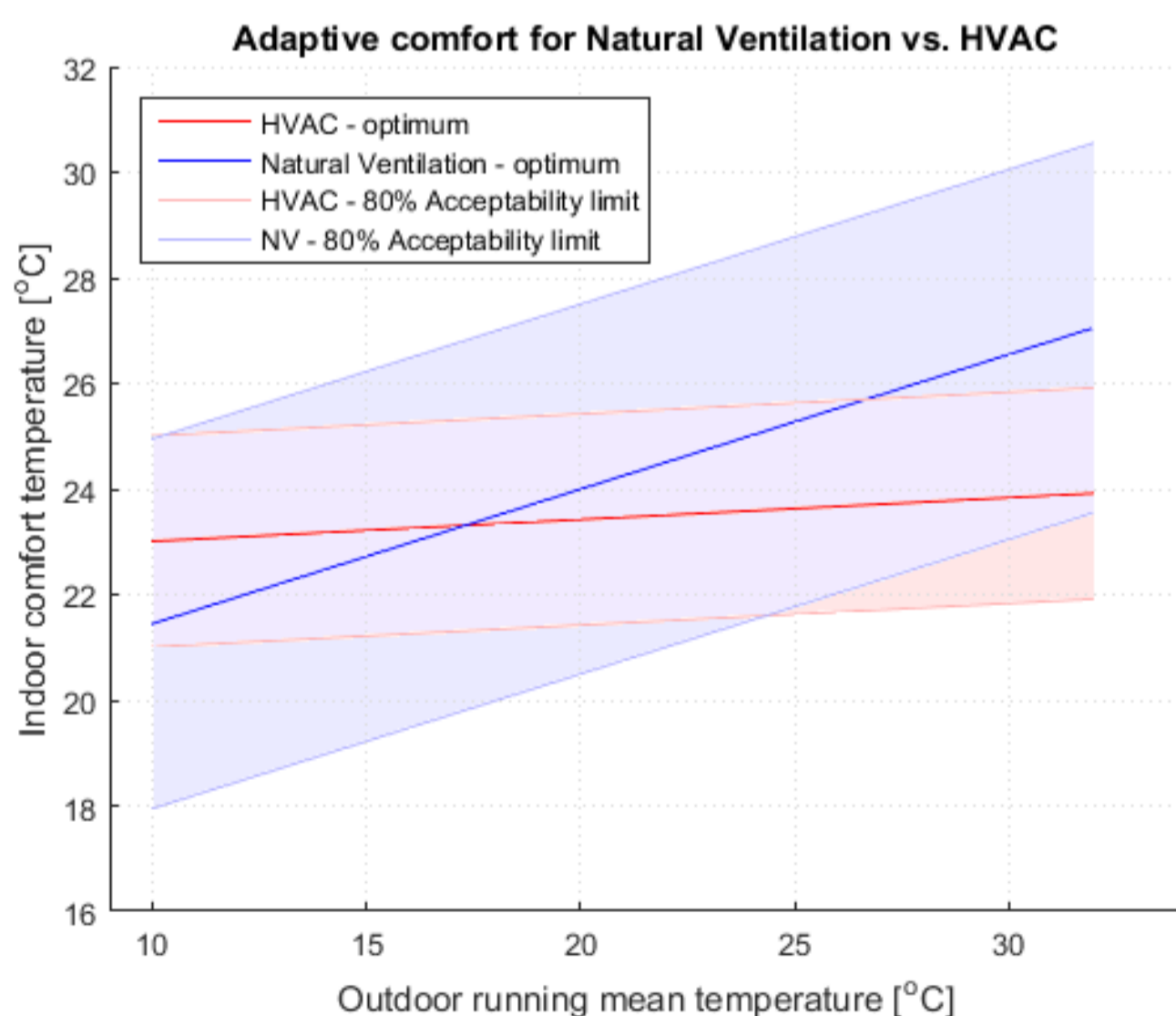


Figure 1: Adaptive comfort criteria, adapted from Brager & de Dear, 1998

Methodology

The case-study building is the Hospital Universitário da USP (figure 2), where measurements will be taken on:

- indoor thermal comfort;
- outdoor conditions;
- occupant behaviour.

This to find the indoor comfort situation and how the occupant influences these conditions.

Simultaneously, a computer model representation of the building is created in EnergyPlus and calibrated with the measurement data. With this model, more strategies for the interaction with building systems can be explored to optimize thermal comfort.

Expected Results

Next to the research goal, this research is expected to give:

- Field data on thermal comfort conditions in a naturally ventilated building in São Paulo, Brazil;
- Suggestions on interactions with operable windows, blinds and fans for achieving thermal comfort;
- Data on local occupant behavior;
- A simulation model to assess thermal comfort in relation to human-building interaction.



Figure 2: Case-study building North façade

- de Dear, R.J., Brager, G.S. (1998), Developing an adaptive model of thermal comfort and preference. ASHRAE Trans 1998;104(1a):145-67.
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 - Leite, R.C.V., Frota, A.B., (2011), City, Wind, Energy: the Limits for Applying Natural Ventilation for Energy Conservation Towards the Urban Densification in Hot Humid Climate, Mecânica Computacional, pp. 2707-2717.