Sharmeen Khan
MSc Dissertation 2015

Strategies to Improve the Thermal & Visual Comfort of the Informal Settlements in India

A Retrofit Project in Mumbai (19.04°N, 72.85°E)

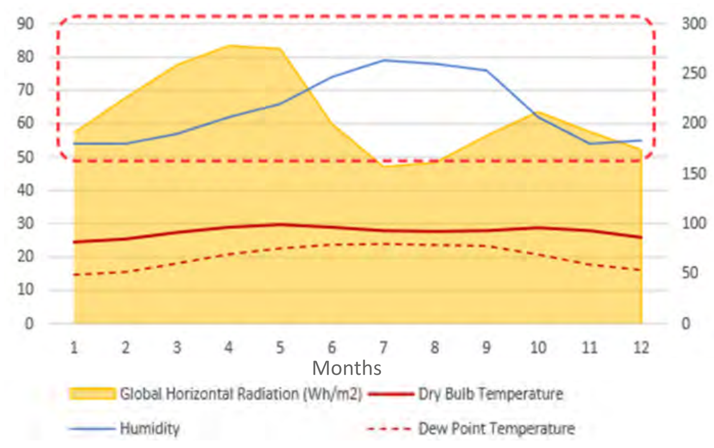
One third of the world's population currently concentrates in the urban areas of the middle income nations. Cities are growing and so is the number of cities, especially in developing countries. Hence, the need to provide basic requirements for shelters is increasing. The lack of provision of affordable homes in urban areas leads to encroachment and unplanned development. One such city, currently experiencing massive haphazard development over a vast area of land, is Mumbai, India. Most of these developments are considered 'informal' and include not just housing typologies but also workspaces, which contribute substantially to the nation's economy. More than 50% of India's population live in such developments, where a room with a roof is considered habitable. It is of utmost importance to understand the shelter requirements of such unplanned developments where, while the land values are soaring, the quality of life of the urban population cannot be neglected. The thermal and visual comfort of these spaces is never taken into consideration since they seem unaffordable to its users.

Thus, the aim of this thesis is to study the current spaces and to suggest affordable strategies in order to improve the living conditions. This was attained by testing various natural ventilation strategies and calibrating several aperture percentages in order to achieve optimum ventilation rates required for human comfort. This exercise led to the design and proportioning of windows in order to achieve the desired amount of daylight and minimize the solar gains simultaneously. The fieldwork and the analytical work aided in concluding that a slum rehabilitation scheme of providing pigeon-hole apartments in tall towers was indeed not a solution. On the contrary the retrofitting of the 'informal' developments demonstrated a high scope for implementation, hence adopting careful strategies would considerably improve the habitation condition of its users along with sustaining its socio-cultural importance.

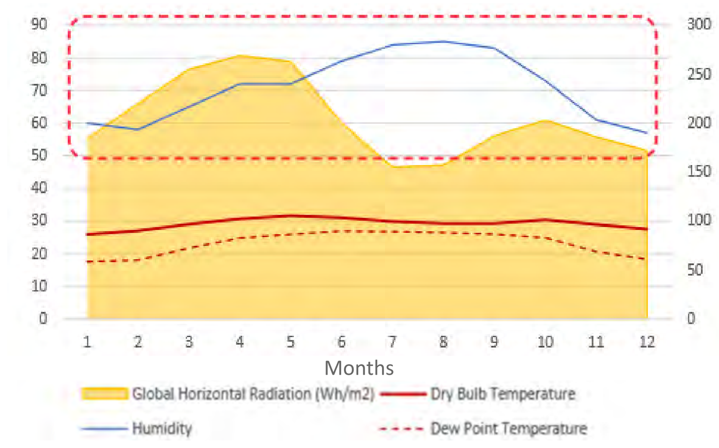
In to the Lanes of Dharavi

Context

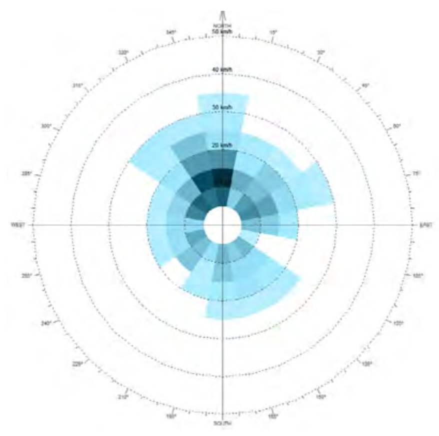
Location - Dharavi Mumbai



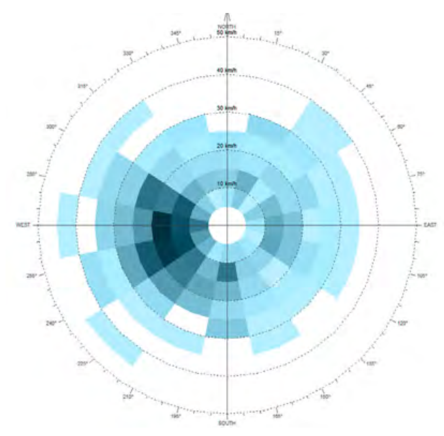
Yearly Average Conditions - Current Scenario



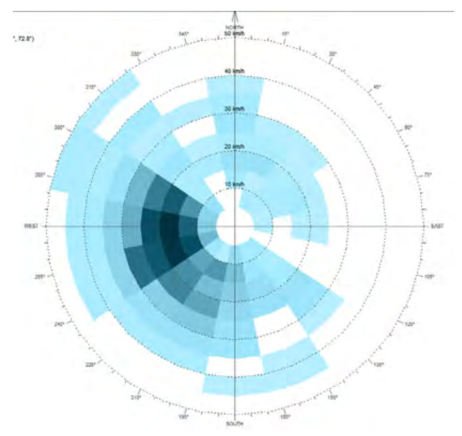
Yearly Average Conditions - Future Scenario



Wind Velocity - January

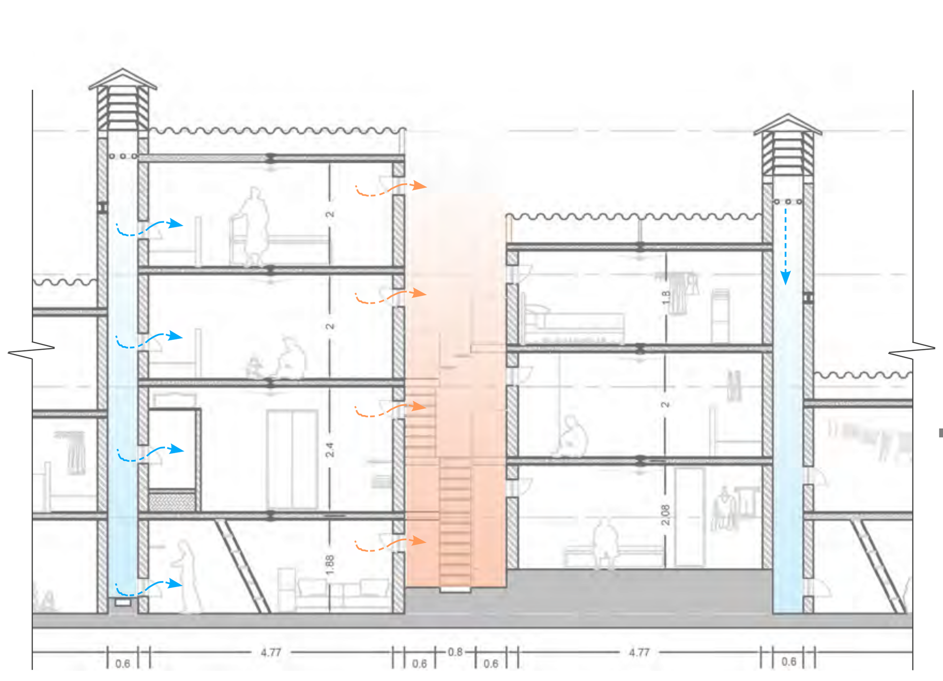


Wind Velocity - May

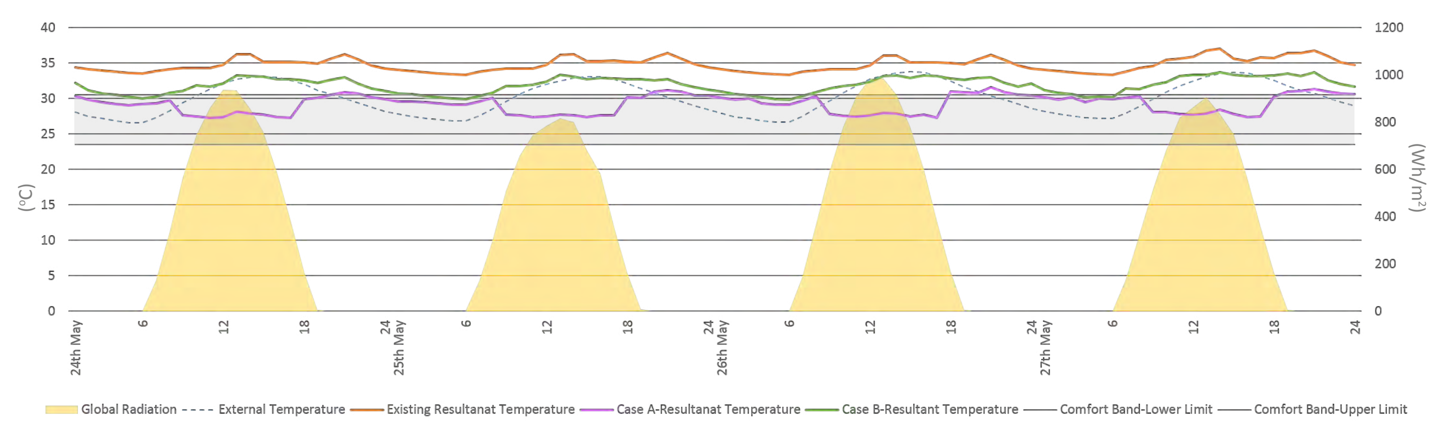


Wind Velocity - July

Design studies

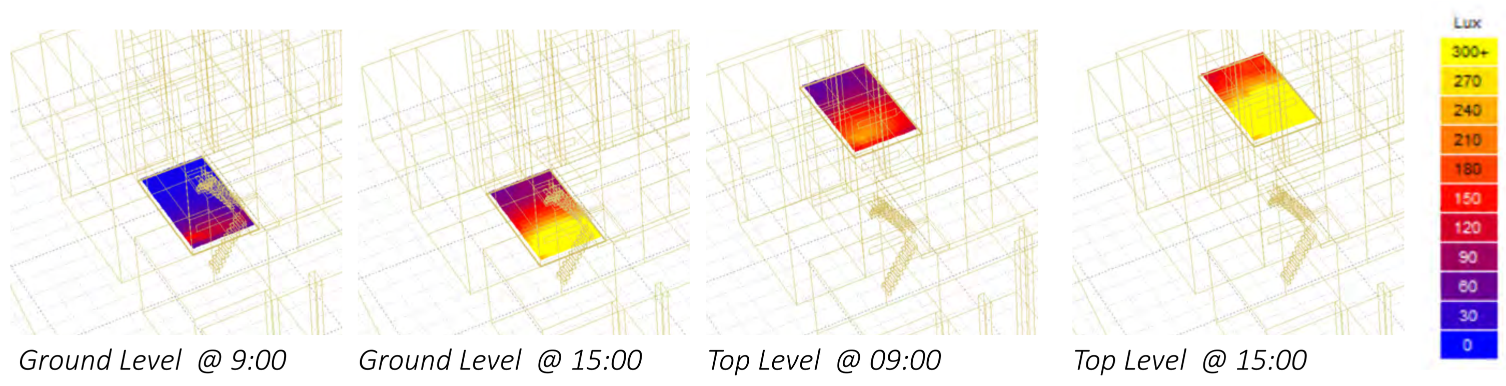


Design Proposal - Case A



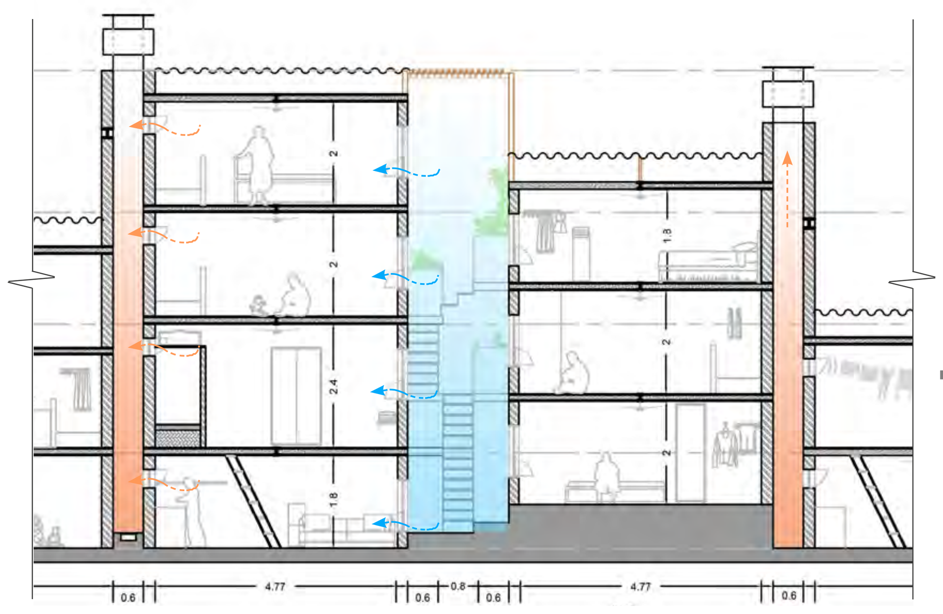
Typical Summer Days - 24th May to 27th May - Thermal Analysis Simulation for Ground Level

CASE A
DAYLIGHTING - SUMMER

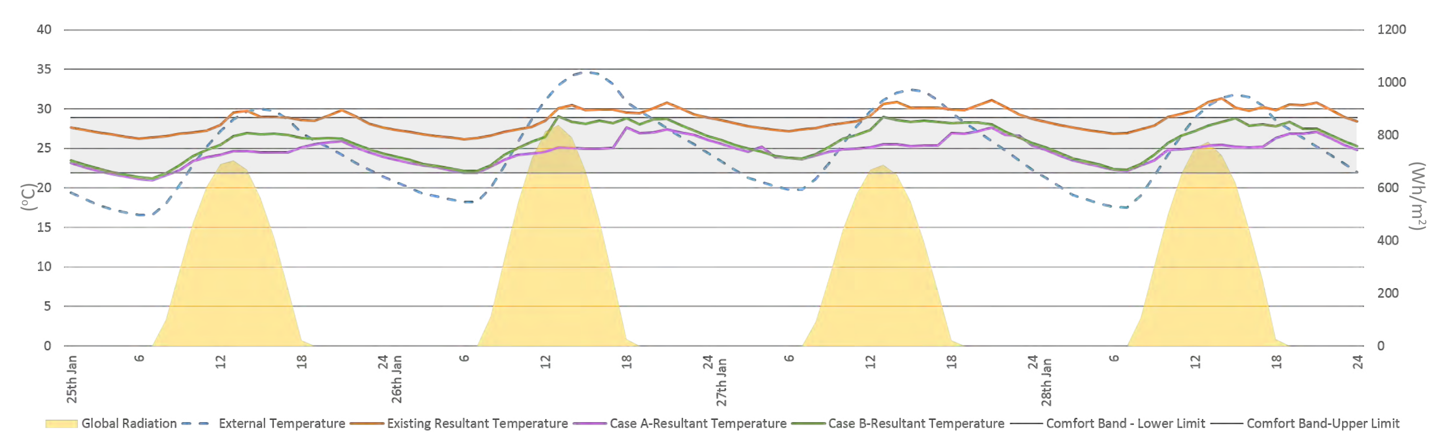


Ground Level @ 9:00 *Ground Level @ 15:00* *Top Level @ 09:00* *Top Level @ 15:00*

Design Proposal - Case A

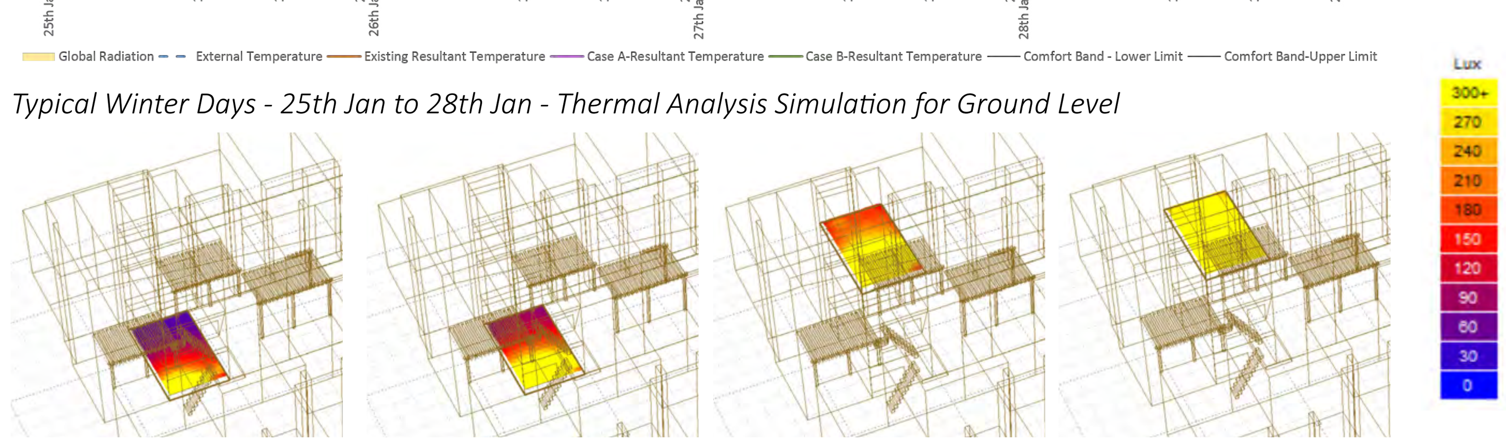


Design Proposal - Case B



Typical Winter Days - 25th Jan to 28th Jan - Thermal Analysis Simulation for Ground Level

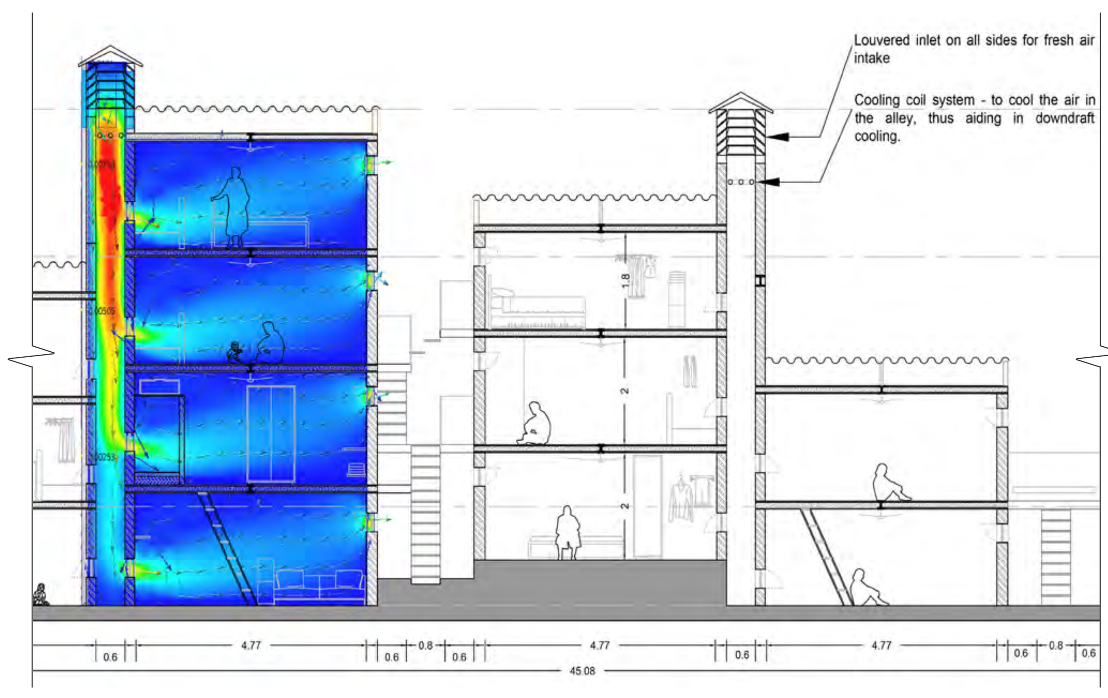
CASE B
DAYLIGHTING - SUMMER



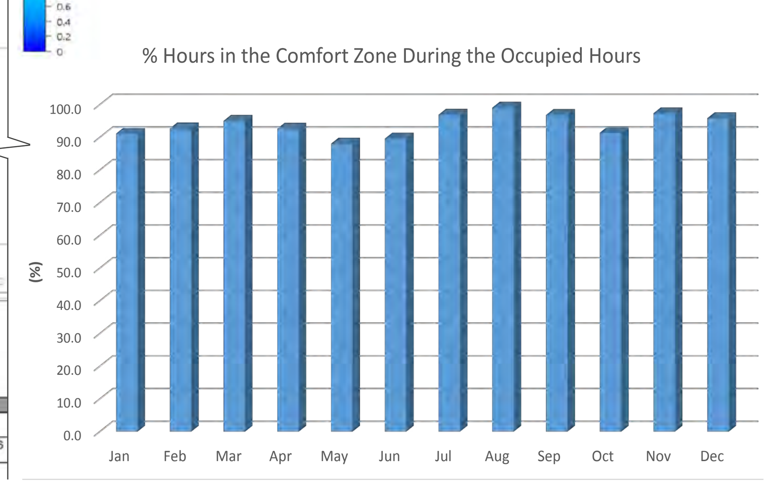
Ground Level @ 9:00 *Ground Level @ 15:00* *Top Level @ 09:00* *Top Level @ 15:00*

Design Proposal - Case B

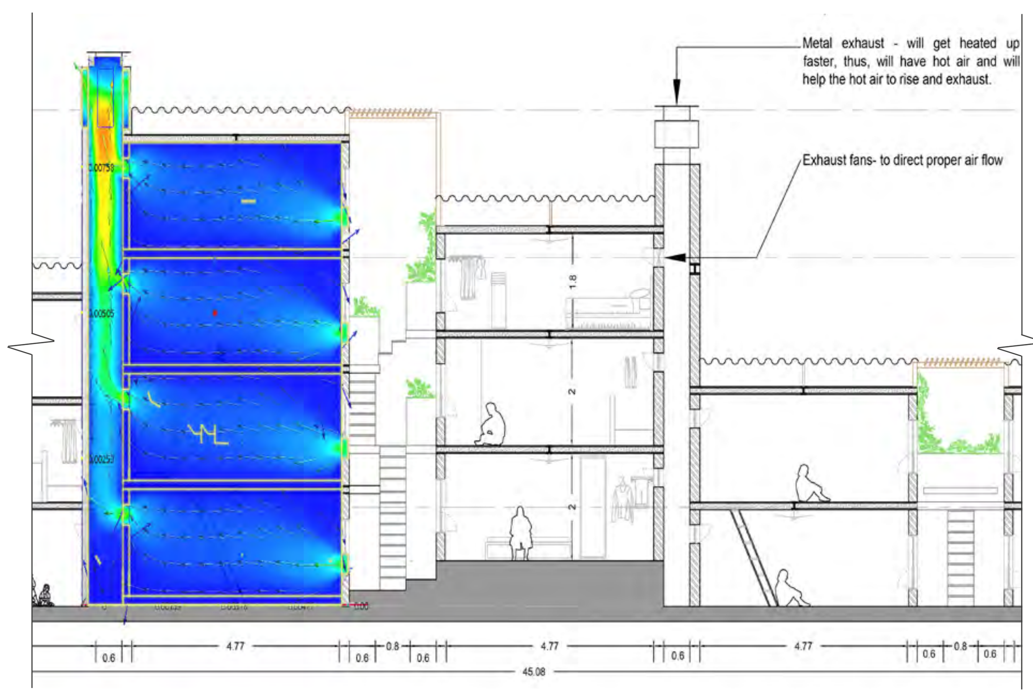
Outcomes



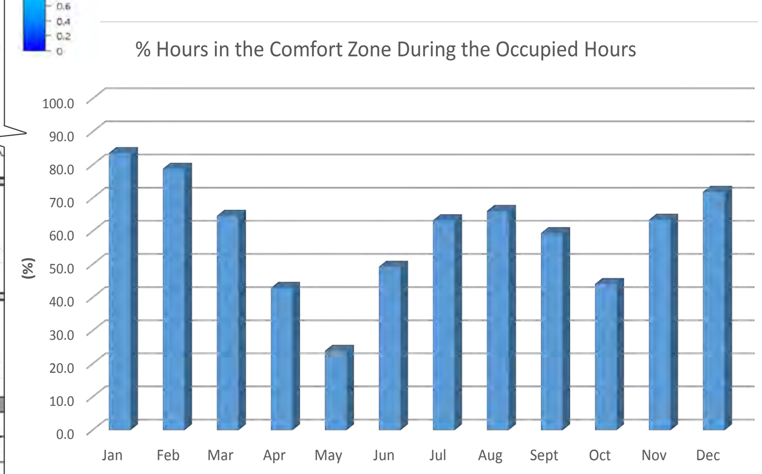
Computational Fluid Dynamics Simulation for Case A



Case A - % of Occupied Hours in Comfort Band



Computational Fluid Dynamics Simulation for Case B



Case B - % of Occupied Hours in Comfort Band