

UNIVERSITI TEKNOLOGI MARA

**THERMAL COMFORT IN
TRADITIONAL COURTYARD
HOUSES IN BABUL, IRAN**

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ABSTRACT

Buildings account approximately 40% of the total annual energy consumption in Iran. It is therefore crucial to seek for means to reduce dependency of modern buildings on energy-consuming mechanical systems. The researchers believe that there is no better way to learn on passive design strategies than examining traditional architecture. This research focuses on a case study of Babul, an old commercial city, located in the Caspian Sea region. While many researchers have examined the potential of courtyard houses in hot-dry region in Iran, empirical data on the performance of courtyard houses in moderate climate region are few. Babul has many undocumented courtyard houses, and several are now under threat of being demolished. The study examined design characteristics of these houses and assessed thermal condition of the indoor and outdoor spaces through environmental measurement and occupants' survey. The study documented several courtyard house configurations, applied with other passive design regimes, namely ivan, veranda, balcony, windows, and patio. During the assessment period the temperature inside the case study houses rose up to 30.2°C. The thermal assessment shows the residents rated their thermal environment as acceptable with acceptability rate of 90.3%. The most frequent actions taken by the residents to overcome thermal discomfort are by opening doors and windows, and making personal adjustment such as wearing light clothing and taking showers. Despite the cultural concerns for security and privacy, the residents of the houses regularly open their doors and windows throughout the day. In overall, 92.8% of the house inhabitants frequently change their living / family space according to the time of the year. When an indoor space was hot, they moved to the outdoor living space such as veranda, ivan and terrace. Houses investigated in this study represent not only the architectural style of those periods, but also the environmental tolerance of its inhabitants. The study reinforce the common knowledge that under the climate condition of moderate climate, passive design approach can result in a thermally comfortable houses, effectively achieved through incorporation of courtyards that encourage ample cross ventilation and shades.

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Relentless quest of human for comfort and happiness has engendered irreversible harm to the environment. These days, hardly a day passes by without hearing or reading concerns for Earth's deteriorating condition. Earth is getting warmer as a result of increasing use of fossil fuels, brutal deforestation, and high emission of greenhouse gas. According to the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), the average temperature of Earth's near-surface air and oceans has continued to increase and will eventually lead to serious consequences that are beyond repair (IPCC, 2007).

This explains why *global warming* is a hotly debated topic and the subject of countless research in recent years. Virtually in all fields of science, scholars have undertaken ongoing efforts to come up with the best practices in mitigating the unpleasant consequences of this hazardous phenomenon. In seeking for ways to leverage natural ventilation systems as an eco-friendly strategy against the reliance on fossil fuels, architects and designers would have to consider the aspects of human thermal comfort.

The human body and mind cannot perform efficiently in an inconvenient situation where the inappropriateness of one or some of the environmental factors—such as temperature or humidity—have provided an uncomfortable situation. Outside of comfort range the productivity level of people highly decreases (Olgyay, 1963). Therefore, achieving human needs and providing a thermally comfortable place to live is a significant aspect that cannot be overlooked.

Traditional societies around the world have built their shelters with adequate comfort, utilizing natural energy in their surrounding environment without the use of mechanical cooling systems (Roaf, Crichton, & Nicol, 2009). The human being from the beginning learns how to deal with the climate circumstances. Instead of fighting