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## Design Characteristics and Adaptive Role of the Traditional Courtyard Houses in the Moderate Climate of Iran

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### Abstract

The building sector consumes a high percentage of total energy worldwide and in turn, a primary contributor to the global environmental degradation. Today with the limited energy resources, vernacular architecture presents an essential source of architectural knowledge in respond to climate and culture without reliance on energy-guzzling active systems. This paper presents a case study of thirty-four courtyard houses in the moderate climate of Babul in terms of its adaptive potential to suit the users' comfort requirements. Most houses are a 2-sided type with the north-south orientation. It reveals adaptation behavior of the occupants who frequently use the spaces throughout the year.

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*Keywords:* Traditional architecture; courtyard houses; adaptive role

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### 1. Introduction

Shelter is a basic necessity for human beings to protect themselves from the extremes of climate. Climate influences the building forms. It partly explains why built forms vary according to the region (Moradchelleh & Rashid, 2011). Other important influencing factors are the culture of people, their religion, the availability of materials and construction technology. One factor may be more dominant relatively to another, depending on the context and people's preferences (Rapoport, 1969). Making an effort to understand how built environment is shaped

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due to the interaction between people and their surroundings has been a fascination for many researchers. People usually react to the alterations and changes caused by the environmental elements through behavioral adaptation, physiological and psychological adaptation to meet comfort requirements (De Dear & Brager, 1998). To gain desirable environment, people have a tendency to adjust their clothing change and relocate their activities to gain the desired comfort level (Roaf, Crichton, & Nicol, 2009). Environmental controlling features such as a mechanism to open and close doors, windows, and blinds increase the range of acceptable temperature of comfort in buildings (Darby&White, 2005). Therefore, thermal comfort in a building is gained through the physical elements as well as through the adaptive behaviors of the occupants (Roaf et al., 2009). This paper aims to contribute further to this area of investigation, focusing on the context of an unexplored richness of courtyard houses in a moderate climate region of Babul, Iran.

Iran experiences four types of climate conditions namely, moderate and humid, cold, hot-dry and hot-humid climates in various regions of the country. As a result, there is a diversity of vernacular architecture that could be found in different parts of the country. In general, Iranian traditional houses are classified into two recognizable types: the introverted type (with internal courtyard) and the extroverted type (without central courtyard) (Mokhtarshahi Sani, 2013). The courtyard type is widely used in the central part of Iran with hot and dry climatic condition (Heidari, 2010). However, this unique architectural feature can be found in other regions with modifications in terms of form and configuration (Amadouni, 1995). Likewise, courtyards are found in many buildings in the southern part of the Caspian Sea. In cities such as Babul, Amol, and Sari, there are many introverted buildings with design features that seem to have been inspired by the architecture of the central region of the country.

It is believed that Safavid period was the golden age of art and architecture in Iran. The Persian culture and architecture of this period was spread to other cities (Cleveland, 2009). During the Safavid and Ghajar period, Mazandaran province, located in the southern part of the Caspian Sea, started to gain recognition by the government. Many palaces, gardens, bridges, inns or caravanserais were established in Mazandaran. There is a strong probability that the traditional houses of this area was influenced by that of the central part of Iran and was also inspired by various forms of the governmental construction (Dashti, 2013). Babul is one of the major cities in Mazandaran province that was an important business center in the region. In Ghajar era, there were commercial ties between Iran and Russia, which elevated the city's economic status. In the nineteenth century, this rapid economic growth developed the city and caused it to be the main commercial center in the province (Kazembeyki & Ireland, 2003). The name of the city during that period was Barfurush, meaning a place for selling products. As the name implies, it was the center for storing and selling goods that were unloaded in the harbor in the coastal city of Babulsar (Dashti, 2013). In Pahlavi period, the name of the city was changed to Babul. Most people engaged in trades and businesses, even the governors of the city were a merchant (Kazembeyki & Ireland, 2003).

The design characteristics of the vernacular architecture in the southern part of the Caspian Sea have been investigated by many researchers (Falakian, 2013; Ghobadian, 1995; Kasmaei, 2012; Khoshshima, 2009). However, most of these studies have focused on the western parts, especially, Gilan province. Thus, this study was an attempt to investigate the design principles of traditional architecture in the eastern areas of the Caspian Sea region, focusing on courtyard houses. One of the oldest cities in this region is Babul, a city that is rich with traditional architecture. This paper attempts to investigate the traditional courtyard houses in Babul with the specific aim of clarifying their design characteristics and their adaptive role to accommodate the comfort needs of its occupants.

### *1.1. Methods*

A field survey was conducted to collect data on existing courtyard houses in Babul. An initial field study was conducted to identify potential houses to be analyzed. The author spent a month walking through the old residential area of Babul, seeking for the available courtyard houses and getting consent from the owners to access their houses and interviews the building occupants. The study is limited by the lack of information about the houses because many of them were not registered under cultural and heritage center of Iran. The difficulty of obtaining permission from the owners narrowed down the study to thirty-four cases built between 1850 to 1960 from late Ghajar to Pahlavi period. Arrangements of access into each house for interviews were made door to door. It made the process rather laborious and time-consuming. In total research spent three months to collect data. The length of time spent in

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