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Energy efficient design strategies in the hot dry area of Turkey

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Abstract

Climate has a major effect on the performance of the building and its energy consumption. This study is based on a student workshop, which has been carried out for a hot dry area of Turkey. The study first aims to show the similarities and the differences of the traditional housing principles from the climate responsive design point of view. Secondly, it aims to put forward the basic principles and their meaningful changes in usage that can be used in the sustainable housing designs of the future. In this study, design strategies in mardin, a town situated in the hot-dry area of the south-eastern part of Turkey, were examined and modern and traditional houses were evaluated in terms of design criteria such as, selection of the area, distance between buildings, orientation, building envelope and building form. In this paper, a simplified thermal evaluation and comparison of a traditional house with a contemporary house have been given by using only data derived from the measurements and this evaluation has been done via both measurements and questionnaires which are carried out for 100 buildings.
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1. Introduction

Climate has a major effect on the performance of the building and its energy consumption. Reducing energy consumption, using natural resources and providing comfortable, healthier and sustainable living spaces are the aims of a climatically responsive sustainable building design [1].

Sustainable design and construction strategies are of great importance nowadays. Anyhow, one may say that sustainability was already a driving force in the past, showing its validity in those days in different forms and techniques. Therefore, from Vitruvius till today, problems and precautions in design and construction did not change fundamentally, although a lot of development has been seen in materials and technology. Of course, these developments may have had some negative effects. That is the reason why the building process should be discussed in a holistic way. In other words, climatically responsive design, selection of materials and building techniques must be evaluated together and the final product should perform well during its whole service life.

Sustainability, which is presented as a 21st century concept, has been in fact applied since Vitruvius wrote his books and was realized spontaneously in traditional architecture [2]. When "sustainable design and construction strategies for Turkey" are under scrutiny, then it is possible to observe how traditional buildings and settlements in Anatolia were designed in harmony with the local cultural, topographical and climatic conditions and how their design and construction could be integrated in today's design practices.

This study is based on a student workshop, which has been carried out for the hot-dry area of Turkey. The study first aims to show the similarities and the differences of the traditional housing principles in climate responsive design point of view. Secondly, it aims to put forward the basic principles and their meaningful changes in usage that can be used in the sustainable housing designs of the future.

In this study, design strategies in hot and dry climate were examined and modern and traditional houses were evaluated in terms of design criteria such as, selection of the area, distance between buildings, orientation, building envelope and building form. In this paper, a simplified

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thermal evaluation and comparison of a traditional house with a contemporary house have been given by using only data derived from the measurements and this evaluation has been done via both measurements and questionnaires which are carried out for 100 buildings.

2. Climate responsive design strategies in hot and dry climate

The most important design parameters affecting indoor thermal comfort and energy conservation in building scale are site and orientation of the building, distance between buildings, building form and optical and thermophysical properties of the building envelope. Among these parameters building envelope, as it separates the outdoor and indoor environment, is the most important parameter. All of these parameters are related to each other and the optimum values of each parameter should be determined depending on the values of the others and their optimum combination should be determined according to the climatic characteristic of the region.

The climate of the Eastern Anatolian Plateau is relatively similar to desert climate. This region represents the hot and dry area with a high temperature difference between day and night. When evaluating traditional architectural examples, it can be seen that designers were more sensitive and they presented the most suitable design and settlement examples for each climatic region.

2.1. Layout orientation

In the hot and dry area in Turkey, the topography is a basic parameter which determines the architecture of the region. In Mardin, houses are situated according to the slope of a hill of the city and they are all oriented to the south-east. In the city, terraced and row houses do not ever let their shadows fall over the next or on the one facing or behind them (Figs. 1 and 2).
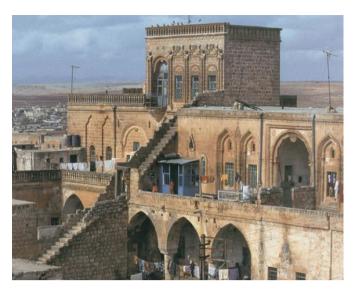

Fig. 2. Terraced house in Mardin.

Fig. 3. Streets from Mardin.

Fig. 1. Mardin city.

Fig. 4. Courtyard house in Mardin.