Criterion for the Design of the Building Envelope Related to Ecological Sensitivity in Tourism Buildings in the Mediterranean Region, Turkey

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ABSTRACT: Since the Tourism Encouragement Law issued in 1982, the tourism sector in Turkey continues to grow rapidly. Today, in Mediterranean Region, throughout the building and operation processes of the facilities with a capacity of nearly 130 thousand, law regulations of the usage of the climate-related and topographical sensitivities and energies cannot be established. Now, starting with the heating, cooling, ventilation and lighting, the handling of the high energy needs of the accommodation buildings in Mediterranean Region comes out to be a problem. On the contrary, a research conducted by the Akdeniz University Environmental Problems Research and Application Center, suggests that, in this region 171 million kWh of electrical energy can be conserved [1].
The aim of this paper is the articulation of the design criterion of the most fit building envelope to ensure the ecological sensitivity, the reduction of the energy usage to a minimum and the user comfort is stated of tourism buildings in the Mediterranean Region, where the summer months are very hot and winters are moderate. The case area is selected to be the Kemer and Belek tourism sites, remembering the number of examples and the study opportunities.

Keywords: building envelope, design principles, Mediterranean Region

1. INTRODUCTION

Since the implementation of the Law for the Encouragement of Tourism in the 1980s, facilities related to tourism increased in Turkey. In conjunction with this act, through the government promotions, many tourism facilities were build especially in the Mediterranean Riviera. For instance, the number of certificated bedstead has increased six times from 60 thousand to 355 thousand in eighteen years from 1980 to 1998.

A similar acceleration was experienced in the number of tourists and tourist receipts. The number of transient foreigners was 5.3 million in 1990; this number almost doubled and became 9.7 million in 1997. Also the tourist receipts reached from 3 million dollars to 7 million dollars. These numbers certify the beginning of tourism investments, the speed of tourism development, and environmental activities in our country [1].

The underpinning idea of the law and the promotions was, of course, to support the tourism growth; unfortunately, tourism buildings were built on wrong places which damaged coastlines and forest lands. Besides, the climatic, topographical, and natural environment inputs were disregarded. Briefly, in the last two decades Mediterranean Riviera has been covered with concrete constructions and the coastline became nearly dead.

Neglecting the climatic and local conditions of the sites chosen for the hotels and other touristic facilities caused the problem of high energy demand. According to data gained from TEDAS District Office (Turkish Electricity Distribution Corporation), the highest usage of electric energy is in the commercial sector. In this sector, especially the high energy expenses of tourism facilities can not be omitted. The used energy in Kemer and Belek districts of Antalya is 30 million kWh in August. The cost of this energy is 6.5 million New Turkish Liras.

As a result of high usage of energy sources, construction of new dams on water resources with exceptional natural beauty and historical value becomes the agenda. However, this is a temporary solution on the account of the construction of new tourism buildings. Conversely, alternative energy resources can be used or some measurements can be taken to decrease the energy consumption in existing facilities and in future buildings.

On the other hand, day by day, a tourism movement that is environmentally conscious and that demands naturally preserved environments is becoming the major inclination among the tourists. In a list published in 1992 by The American Society of Travel Agents (ASTA), 236 tourist activities were defined in total. Nearly 90% of the highly environment-conscious German tourists remove the countries from their holiday lists if they are insensitive about environmental values. [2]

In this context, the aim of this paper is forming a criterion for design of an optimal building envelope of tourism buildings in Mediterranean Region to ensure ecological sensitivity, to reduce energy usage to minimum, and consequently to provide user comfort.

2. IMPORTANCE OF BUILDING ENVELOPE IN DESİGN

Building envelope is a fundamental component which is made up of roof, foundation, and out wall. While protecting the building from rain, snow and hail, per contra, it contributes to derive benefit from the thermal and light source of the sun-energy by taking the advantage of angular position of building according to sun.

Today, on account of the technological development, 'local condition and specialities' are ignored and a global architectural understanding appeared. This trend, empowered by technology and material, exhibits the same form all over the world that has no vernacular/local speciality; and instead of solving the atmospheric and geographical circumstances by natural forms, it uses the technological and material means. Under the influence of this trend, building envelope is handled as curtain wall and interior arrangements are solved by artificial air-conditioning and lightening [3].

Building envelope is the face of the building, which protects the structure from climatic conditions. In the frame of 'design understanding' of an architect, the image that he/she wants to create reflects on the building envelope. The envelope is examined in the context of climatic data, economic situation, construction technology, and material usage.

3. THE BACKGROUND

The studies on optimum building envelope mostly analyse the effects of heat, sound, and light on a building envelope, propose methods to calculate these conditions, and suggest appropriate materials with a view to provide minimum energy usage. A study done by Lollini et al proves the global benefits of an insulated building envelope. They also display the economic advantages of 'quality-performance' building envelope. Furthermore, they emphasize that some environmental benefits can be gained by usage of insulation materials [4].

Another research done by Oral, Yener, and Bayazıt studied on providing thermal, visual and acoustic comfort conditions in the rooms by minimum energy usage which is important for energy preservation and user health. In order to provide these conditions, the effects of physical environmental factors on building envelope are explored. In this context, the calculation methods of heat, light and sound factors in the rooms are determined [5].

In a study done from 1979 to 2001, which stem from the 334% increase in electrical energy usage in the domiciles of Hong Kong, the heat dissipation in building envelope is analysed and precautions against dissipation are enhanced. The evaluation in the research is done out of 144 housing that were constructed from 1992 to 2001. The energy consumption is determined by evaluating the orientation, wall construction, window space, window selection, shading tools and colours of outwalls [6].

Manioglu and Yılmaz propose the most appropriate 'building envelope design' depending on the climatic comfort and building life periods. Firstly, the internal and external design conditions are handled in the study. Secondly, total thermal looses through the shell of a building are calculated. Finally, under the shed of these inputs the most fit building envelope alternatives are offered [7].

The mentioned studies include the technical calculations in the field of environment and technology, which are made in order to provide inner comfort conditions within a building envelope design.

The aim of this presentation is, both providing a design guide for the designer related to the conditions of a site, such as topography and orientation, and use the environmental building experience by means of local architectural data rather then calculating heat light comfort levels. Furthermore, another effective role of a building envelope is to create a "building image". Although this subject is important for all building types of architecture, today in an atmosphere that requires rapid image change and pretentious designs, an emphasis seems to be more urgent.

4. THE IMAGE OF A BUILDING

The qualities related to image are such assets that are pervasive from building scale to settlement scale, in which formal, logical, and aesthetically sensible features are predominant [8].

The efforts on creating image in tourism residences have been handled in architectural literature. In our country, continuance and permanence of some local images have been 'normative' in practice. For instance, according to the Planning Regulations in Bodrum, using repeating certain features of local buildings in new designs, such as the ratio of windows to facades, terrace roof, white wash and woodwork is obligatory.

There are studies in Turkey, which especially focus on the residential places of Mediterranean Region that use local, historical, and traditional architectural features. In one of these studies, it is emphasized that in such applications, the aim is not reconstructing an Ottoman settlement or a Seljuk Caravanserai.

Furthermore, not only that it is common to see reapplication of Roman, Seljuk and Ottoman architectural elements in new tourism buildings but they are mixed in the same complex. In another determination, writers emphasise that, historical, local features are not only used outside their context but also handled in a different approach within historical process (e.g. constructing a Seljuk tomb 20 m above the ground which has to be built on deaf- filled ground). Abali and Onder emphasize that another problem is using vernacular residential forms. They state that using local or traditional residential texture may fit within design principles of holiday villages, however constructing lots of identical residential place

at the same time will cause monotony in these complexes [9].

In recent years, mostly used approach in tourism sector is “thematic hotel” concept. As an example, “Hotel Topkapı Palace” is identical with Topkapı Palace, which is in Istanbul, and “Hotel Kremlin Palace” is combination of St. Basil Cathedral, Kremlin Palace and other historical places that are situated in Red Square Moscow can be found in Antalya as an accommodation structure.

Although it is not the only criterion in determination of ‘building image’, the above mentioned applications show that traditional-local and historical architectural features (some times on demand of tourists), are important data for cultivating image in tourism architecture. It is a fact that these applications are just used for “visual” purposes. Architectural product maybe repulsive, boring and misleading with the unconsciously use of traditional and historical architectural features in modern architecture.

For this reason, it is stated that in the tourism sector eating up building image, the architectural features needs rapidly and easily changing (flexible) applications rather then permanent ones [10].

Furthermore, as per this annunciation, in addition to the “visual” usage of values in the local architecture, the need to criticise the traditional building envelope formation, structuring and production shall be stated. In this context mentioning the climate, natural environmental features and local building envelope of Antalya will be useful.

5. NATURAL AND PHYSICAL PROPERTIES OF ANTALYA

5.1 Environmental- climatic characteristics of City Antalya and tourism

Antalya Plain and the West Tourus Mountains that rise in the east and west sides of midlands of this plain, forms the morphologic structure of City Antalya. Mountains are covered by maki at the outskirts and covered by forests at the inwards. When it is looked from the sea to the Antalya Plain -one of the biggest campaigns of Mediterranean Region out of two- it is surrounded by the Bey Mountains from the east and south-eastward, Tourus Mountains from the west. There is Mediterranean flora nearly 800 m long from the seaside to the midlands named maki which are ever green for four seasons. The district is really attractive for the tourists because it can provide sea bathing at the shore and skiing at the mountain on the same day.

It is necessary to mention the water resources in the district because the water surface has great importance on daily life, architectural conformation, and ecological planning. Rivers of the district brings in value to the region by having effect on both the architectural conformation and water sports.

Mediterranean climate is dominant in Antalya. Summers are long, muggy; winters are soft (warm) and rainy. The yearly average temperature is 18.7 C° whereas in summer average temperature is between 21-30 C°.

Furthermore, local architectural heritage, materials used, and precautions against climate are important inputs for the proposed criterion of building envelope. On this account, in this part of the paper, it is necessary to mention the feature of traditional settlement.

5.2 The building envelope of traditional building pattern in Antalya and its districts

In Antalya, in construction of buildings, it is needed to avoid sun and provide coolness because of the hot summertime and warm winter. Hereafter, the orientation of traditional residential places, residence organisation, residence dimensions and features of building envelope will be handled to shed a light on the criterion on design of building envelope.

5.2.1 Settlement pattern and orientation

In settlements buildings are arranged to protect people from muggy weather in summertime and to draw maximum benefit from the sun during winter. In order to provide this comfort some solutions are sought both for town texture and building orientation. The refreshing air currents blowing from the sea have been destined towards the town centre and via to residential promises. Especially, to avoid the north-westerly winds the buildings are placed in attached parcels. The building envelope of the houses attached in direction of northwest has two sides. Thus the reduction of surface area of building envelope provides internal climatic comfort. Buildings are oriented toward the scenery created by the mountains and the sea. This factor establishes grounds of bay windows and hall-like rooms on the two open sides. The traditional houses of Antalya are usually composed of ground floor, entresol and first floor.

One first enters the garden or the courtyard within a house. The ground-floor is allocated for service areas such as kitchen, larder, bathroom, WC and depot. In summertime all the daily activities are performed in the first floor which is usually on the northeast of the house. This place is sunny in the mornings and in shade and cool in the afternoons. The south-westerly places become hot in the afternoon so that people spend most of their time in the courtyard, hall or garden.

5.2.2 Space organisation

Courtyard on which the building is placed, is directly tied-up to the first floor. Integrity is sought between the sofa on the first floor and the other places. The design organisation is flexible in the houses. In some houses the hall opens to outside (street) and the other places are seated around the hall. In such houses the hall also opens to the garden directly.

5.2.3 Dimension and form of spaces

The houses are measured depending on the activities in the house and the dimensions of wooden beams (joist). It should be mentioned that function is prioritized over form during the measurements.

5.2.4 Recess and jut in building envelope

In the building texture, 50-60 cm long valances are built. These valances not only shade the streets but also provide protection for the building against the harmful sunbeam. The bay windows located in the southwest are used to ventilate the home and used for the scene.

5.2.5 Solidness and Voidness in the building envelope

The window ratio of width to height is ½. The minimisation of window surface area reduces the benefits of radiation.

5.2.6 Determining Material in the Building Envelope

The materials used in the traditional architectural texture are sought to be vernacular, recyclable and resistant. In all the residences the natural materials such as stone, brick, wood and tile are used. Rendered stone is used on construction of the ground floor of housings and timber frame and filler are used on the construction of upper floor. The plaster is made of natural materials, namely, straw, sand and lime. The glass surfaces used on the windows are selected to provide appropriate sunlight and daylight inside the house. When the sunlight is not wanted inside the house the sunlight is hindered by timber lids on the windows.

Using natural materials in construction of housings provided harmony with the changing climatic conditions. Usage of stone on the ground floor obtains air circulation in summertime and stores warm air in the house during winter. The timber used on the first floor of building envelope insulates the sound and heat.

5.2.7 Surface colours

In traditional housing of Antalya, which is located in a hot and humid climatic region, light colours are selected in order to reflect the sunlight.

Briefly the physical properties of region can be summarised as follows: transferring air current to the inside regions of the city, constructing of 2.5-3 m wide narrow roads for shady open areas, flowing waters in the arches on the streets, storing and using the rain water by roof gutters, painting houses in white colour hindering the sunlight, planning patio houses, using elements such as eaves, lattice and lid takes attention.

6. CRITERION

According to above mentioned concepts, and considering environmental inputs a relation scheme is obtained (Fig.1).

The functions of building envelope are handled in one group: providing image, balancing worm and humidity, control of solar radiation and daylight, balancing noise, visual comfort, providing security.

The architectural criterion and elements effective in the construction of building envelope are handled in another group: building mass and form, spatial organisation, space dimensions, physical properties and materials, solidness and voidness, elements of façade.

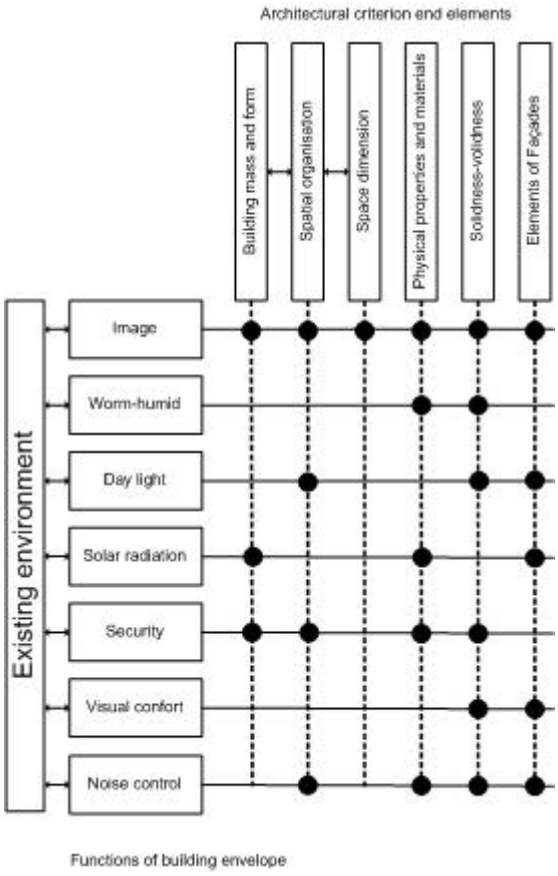

Figure1: Relation scheme: Functions of buildings envelope and architectural criterion and elements.

The criteria mentioned above, which are a pre-study of the model that will provide data for the design of the building envelope, are evaluated in the 6 hotels of the area (Fig.2- and Fig 3).

As a result of the meetings and the observations in the hotels;

- On the image of the hotels around Kemer and Belek areas, together with the building mass and form, spatial organization and the solidness and voidness ratio are found to be the most effective criteria.
- In the establishments, warm-humid balances are ensured by the solidness-voidness ratios in the masses.
- The most effective factors involved in having daylight inside the building are the spatial organization solutions and the solidness-voidness ratio of the building envelope.
- The effective usage of the daylight is tried to be obtained by the physical properties and the façade elements of the structures.
- A high level of security is ensured by the building mass and form, physical properties and material, and the solidness-voidness balance.

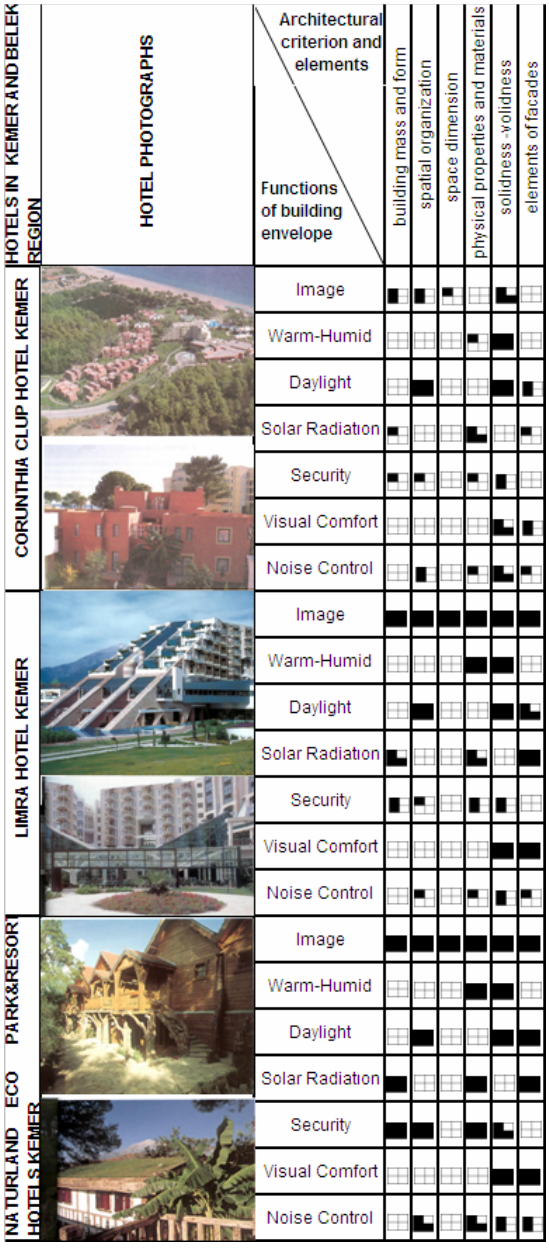

Figure 2: Relation scheme: Example Hotels and Functions of Buildings Envelope

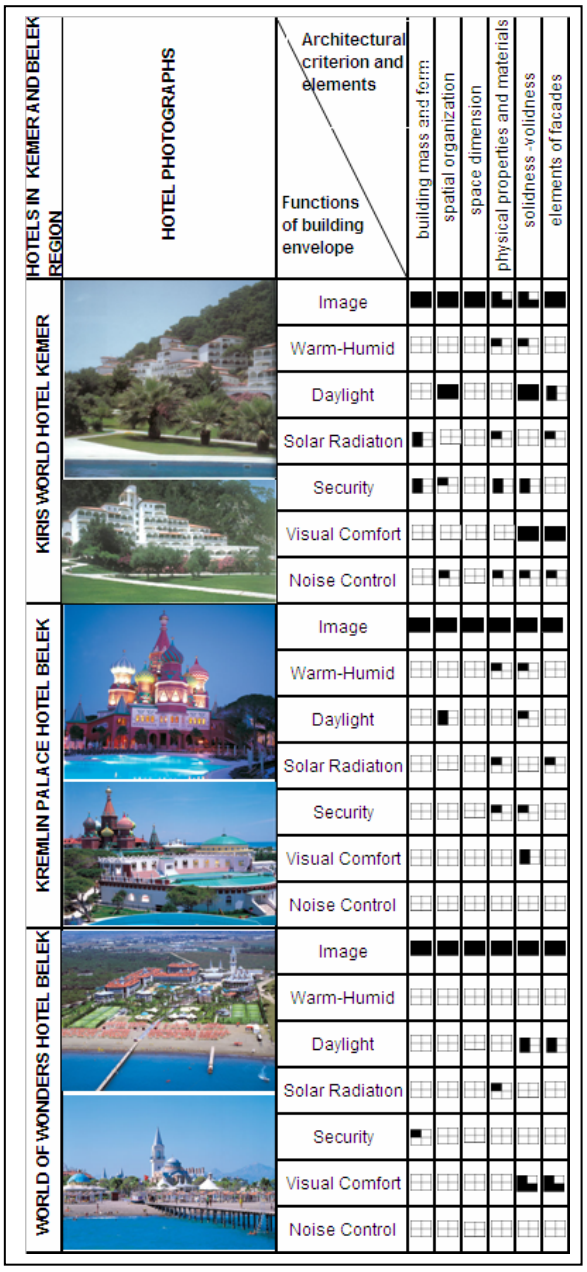

Figure 3: Relation scheme: Example hotels and Architectural Criterion and Elements.

- The solidness-voidness ratio is the most important criterion to obtain visual comfort.
- Noise control is achieved by solidness-voidness and spatial organization.

As a result of all these evaluations, the image criterion is seen to be 38% effective in the formation of the building envelopes of the establishments.

7. CONCLUSION

The insufficient comfort conditions in the accommodation buildings will not meet the holiday needs of tourism guests and will cause unproductive

working personnel. Besides, it will increase the energy consumption used for holding the comfort conditions at the optimum level.

The designer has duties on both providing thermal, visual and audible comfort and determining the peculiarities of building envelope in accordance with the environment, climate and other local inputs. For this reason, criterions are determined in order to form data for works on building envelopes of future accommodation buildings and for renovation of building envelopes of existing buildings in Antalya Region.

In the light of the pre-study the model will be developed and will be tested in a group of selected buildings in the Kemer and Belek districts of Antalya, where the tourism residences are overbuilt. The testing methods and obtained results of the study will be the subject of another presentation.

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