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## **Energy Efficient *Home*: Landscape Design and Architectural Design as One**

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### **Abstract**

Increasing demand for energy efficient buildings demonstrate that design approaches that are preoccupied by form and style only are not able to lead for creation of sustainable, healthy and livable places that are appropriate for human habitation. Energy efficient architectural design necessitates a contextual approach to the nature and design of built work that relates it to its setting and landscape. Moreover, such a design requires a more holistic design approach that combines the architectural and landscape design into one. Housing environments, especially the courtyard houses, offer a unique area for case studies on renewable energy utilization through architectural and landscape design combination. Focusing on an Eastern Mediterranean urban context, this paper is an investigation on courtyard houses -as archetypal patterns in the built environment- for their special formation in respect to climatic conditions, landscape and true ecologic considerations where architecture and landscape are inseparable and together create the *home* environment.

### **Introduction**

Could present living contexts of traditional environments, which were utilizing the use of renewable energy sources and have achieved ecological balance in the past, be knowledge bases of progressive design for energy efficiency? This study initiates to reveal some of the foundational bases of ecological design of place with focusing on the traditional courtyard houses in an Eastern Mediterranean context. The purpose is to understand the existential relations between architecture, landscape, domestic environments and the local climate. It is expected that this investigation may lead to a future study for a better understanding of how to manage energy consumption in the residential environments and even may give ideas on to

make adjustments and alterations or choosing alternatives for improving renewable energy use in existing built context.

In the Mediterranean context, the special intertwined use of outdoor and indoor spaces of traditional courtyard houses create living relations between people and the surrounding landscape. The surrounding landscape becomes a part of everyday experience in the life-cycle of the inhabitants utilized through their basic habitation –their *home*. *Home*, taken as the central place of our being on this world, not as an isolated object but within its larger setting and the ways it utilize the use of renewable energy sources is the argument in this study.

With characteristic urban residential context of courtyard houses of more than 2000 years, the city of Antakya, in south Turkey, has been selected as the examination area and the investigation has been made with on-site observations for understanding the holistic and dynamic natural processes in the built context. This paper presents the preliminary findings from urban history and the observations in the context of historical city center and its courtyard houses.

### **The location and the climate**

Antakya is located in the Mediterranean region, southern Turkey. It is the center of the Hatay province. With total 5403 km<sup>2</sup> area the province is located between 35° 52′ and 37° 04′ northern latitudes, 35° 40′ and 36° 35′ eastern altitudes. Asi (Orontes) river runs for 94km of its total length 380km within the province boundaries. The city, named Antioch-on-the-Orontes, was founded by Seleucus I Nicator, one of Alexander the Great's general's, in the 4th century B.C. on the naturally protected site where the historical core of the city still lies between the Orontes (Asi) river on the west and Silpius (Habib-i Neccar) mountain on the east.



Fig.1. The urban area, Antakya, view from the castle towards west, 2008.

According to the Köppen classification, Antakya is in the warm Mediterranean climate zone (Csa). It is warm and rainy during winter, with a short period of cold, and rainless and hot during summer. The average temperature is 16°C-21°C. Average rain is 570-1160mm. dominant wind direction is south west (SW, 30m/sec.). With a %68 summer humidity and %74 winter humidity, the average humidity is %69.

### **The historic urban context**

Founded by Seleucids in 300 B.C., the city of Antakya was also a vital metropolis of the Roman Empire during Roman time, the third in the rank after Rome and Alexandria. After that period, the city went under the control of Byzantine, Arab, Seljuk, Mamluk and Ottoman civilizations which caused overlapping of different urban layouts and formed a meeting place of diverse cultures.

The original city of Seleucus was laid out in imitation of the grid plan of Alexandria by the architect Xenarius. The citadel was on Mt. Silpius and the city lay mainly on the low ground to the north, fringing the river. The maps of the Roman Antioch show that the main street layout did not change during the Roman period also. Several sources indicate that the city had a great colonnaded street crossing the heart of the city along north-east and south-west direction. Today, although there have been catastrophic changes in the topography of the river bed and the nearby land, because of the big earthquakes in the 2<sup>nd</sup> and 6<sup>th</sup> centuries, the main axis along north-west and south-east is still preserved as one of the main traffic arteries in the historic city center. Some of the streets lying on north-west and south-east direction, between

the river and the mountain, are also still functioning. These streets are narrower, compared to the main one, and constitute the back-bone of the pedestrian circulation among the courtyard houses in the historic context.



Fig.2 Traces of the grid urban plan, historic city center, Antakya (analysis on aerial photo by the author)

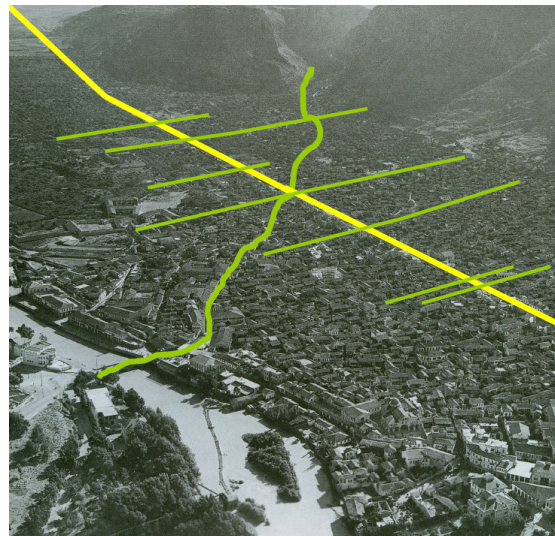


Fig.3. Street axes connecting urban fabric to the surrounding landscape (analysis on urban image by the author)  
(image: Kondoleon, 2000)

From an ecological point of view, the street network of the historical city is connecting the urban ground to the surrounding landscape, providing natural ventilation corridors and allowing view-axes towards natural landmarks –the river and the mountain. The streets lying between the high and low grounds, from mountain side towards the river, also serve as water channels during the rainy season protecting the city from floods.

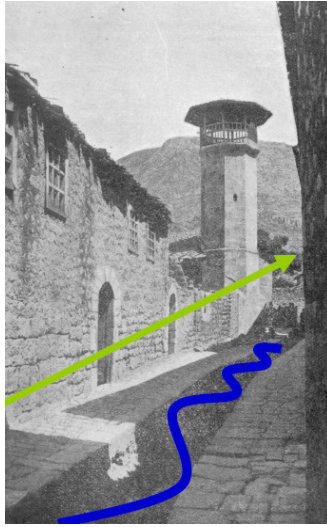


Fig.4. The streets serve as connecting spaces between the city and the surrounding landscape, while also functioning as water collecting channels (analysis on photo by the author) (photo: Demir, 1996)

### **The courtyard houses and energy efficiency**

If one tries to follow a chronological development of planning principles and typological characteristics of courtyard houses of Antakya in time, certainly one can see that the inevitable factors like earthquakes, floods and change of property rights are causing interruptions. Through history the city has been destroyed by several big earthquakes that made changes in topographic conditions and serious damages erasing the traces of the past urban fabric. Ever-changing site conditions created a difficult situation to make a detailed and definite study on development of houses' structural and ornamental details. But the courtyards remained as the constant typological elements in the organization of domestic and also the public buildings for more than 2000 years.

The information about the Hellenistic courtyard houses of Antakya seems to be lost with the traces of the urban fabric of that time. For the same reason, the information about the Roman courtyard houses of the city is more in general. The information about the organization of spaces in the courtyard houses of Roman Antioch is limited to a number of published plans and to the photographs showing the preserved evidences on their sites during the excavations in 1930s. Most of the existing courtyard houses in the city were built during the last years of the Ottoman Empire and in the first decades of the 20<sup>th</sup> century. Today, the survived pattern of these domestic quarters is mostly concentrated around the narrow streets opening to Kurtulus Avenue. This avenue has been superimposed on the famous colonnaded street of the

Roman city during French mandate time of 1930s. It is the main axis crossing the heart of the historic city center in northeast-southwest direction lying in parallel to Habib-i Neccar Mountain on the east and Asi River on the west directions. The narrow streets crossing the main avenue guide one through the historic center while allowing vistas towards the mountain (Deviren 2004). The walls of the courtyard houses, varying in heights between one to two stories, define the geometry of the streetscapes.

The plan scheme of the courtyard houses in Antakya is usually a composition of a row of rectangular rooms located on one or two sides of the courtyard - the central open space. Rooms on the ground floor serve for daily functions with a kitchen and a bathroom located on a far corner from living room and guest rooms; bedrooms and halls, which are used as private living rooms for family members, are placed on upper floor. Courtyards form a *transition space* between houses and streets, and serve as main circulation areas between the rooms. (Deviren 2004)

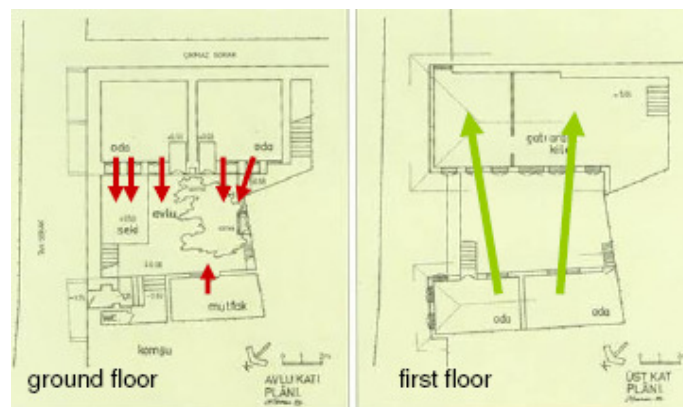


Fig.5. Plan of a courtyard house (analysis on the image by the author) (image: Demir, 1996)

In their research on the transitional spaces' effects on energy efficiency, Pitts and Bin Saleh suggest that such spaces, whilst being important, do not require the fine control of temperature or comfort limits associated with the principal areas of a building; and that they can also be actively designed to modify the experience and expectation of persons moving through them. They further argue that, transition spaces in buildings (including such areas as foyers, lobbies, certain atria and ancillary spaces not directly occupied in relation to the activity of the building) pose an interesting and fruitful area for comfort research. Entrance and transition areas of buildings are often perceived as some of the most important in

architectural design terms since they also impact on a wide range of senses and perceptions of human occupants; have an important role in control of circulation; and are often associated with some of the longer lasting impressions that occupants or visitors have of the building. (Pitts and Bin Saleh 2007) Their research shows that transitional spaces can help to save energy if they can be developed according to their climatic needs. The courtyard houses in Antakya, with their semi-open transition space organizations between the outdoor (courtyards) and indoor (rooms surrounding the courtyards) spaces, are typical examples of climate responsive design, providing comfortable living conditions for their inhabitants, and that are contributing to the energy efficiency of the whole building complex.



Fig.6. Eyvan, the semi-open space, providing protected area (from sun and rain) for sitting and working outdoors. Antakya, 2004. (photo:author)

The semi-open spaces opening to the courtyard on the ground floors are called *eyvan* and they provide shadowed areas for daily use (i.e. dining, play area for children, resting). There are also raised platforms, called *seki*, either open or covered with grape-vine, used for daily activities of the inhabitants during warm seasons.



Fig.7. Raised platforms (*seki*) in the courtyard, providing contact ground with sky above. Antakya, 2004. (photo: author)



Fig.8. Specialized raised platforms (*seki*) in the courtyard, covered with grape-vine, providing outdoor dining and resting places. Antakya, 2004. (photo: author)

On the upper floors there are usually a semi-open corridor providing access to the bedrooms and overlooking to the courtyard area with operable windows. During the cold season the windows are kept closed, increasing the solar gain and keeping the heat inside. During warm seasons the windows are kept open to catch the breeze and used for cooling the upper floor rooms. The corridor is functioning as a shaded transition area. The transitional spaces surrounding the courtyard, neither cooled nor heated artificially, remain in a natural and free-running state during the whole year, contributing to energy savings.



The presence of courtyards as central open spaces and the surrounding transitional spaces provide comfortable and pleasant naturally-conditioned spaces for the inhabitants and increase the time spent at outdoors. The use of natural ventilation is also increased with the careful organization of openings in the outer walls of the rooms. While the eye-level windows and doors are opening directly to the courtyard, the upper row of small-size windows provide natural air-circulation, and mostly, are used for cooling during warm seasons.

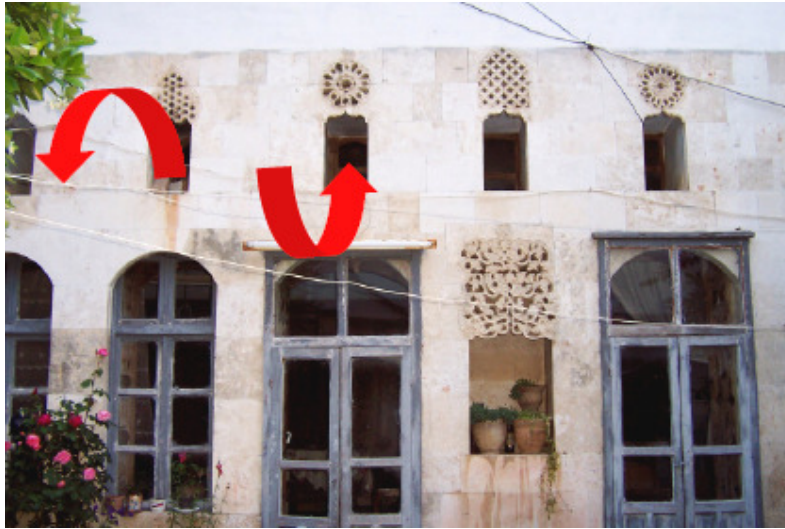


Fig.9. Upper windows on the facades, providing natural ventilation and cooling effect for warm season. Antakya, 2004. (photo: author)

In most courtyards, there are soil *pools*, covering a large portion of the open courtyard area. Typically the citrus trees are grown in these pools. The citrus trees, leafless during winter and green from spring to fall periods, improve solar and daylight access during colder periods and ensure sufficient shading during hot periods. The existence of citrus trees in the courtyards complete an important task while maximizing the solar potential on houses during cold season and creating sunless and gloomy adjacent open space for the use of inhabitants.



Fig.10. Deciduous trees (mostly citrus trees) allow solar access to the houses during cold winter periods and provide shaded areas while allowing breeze during hot summer periods. Antakya, 2004. (photo: author)

The existence of water wells and, also sometimes the small water pools, complete the ecological task of courtyards. The rain water collected by the water channels in the courtyards are stored in the wells and are used in households.

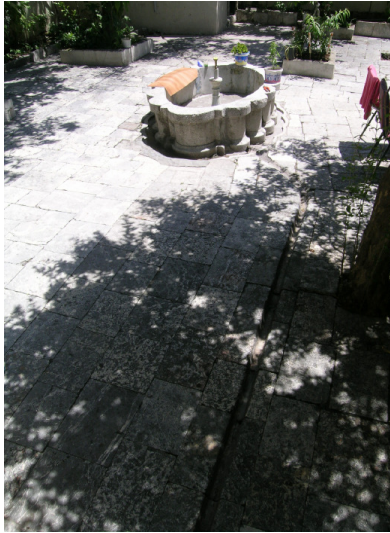


Fig.11. A water pool and water collecting channels in a courtyard house in Antakya, 2008. (photo: author)



Fig.12. A water well in a courtyard house in Antakya, 2008. (photo: author)

Some recent research (Znouda, Ghrab-Morcous and Hadj-Alouane 2007) held on the energy performance of buildings has shown that the energy performance of a building is determined by its response as a *complete system* to the outdoor environment and the indoor conditions. Courtyard houses, consisting of intelligent and well-balanced mix of indoor and outdoor spaces, are self-proved that they have potential to create their own complete system and can further serve as pleasant microclimate bases within the urban fabric. Therefore the climate responsive context of courtyard houses, within the urban fabric, can be used as archetypal patterns in informing energy and climate conscious residential design which would help to improve the quality of urban design.

### **Concluding remarks**

The existence of courtyards with their place-bound identity is important in contemporary Mediterranean cities which are in need of contextual consolidation and transformative processes for new developments that could be done without losing the memory of place and its ecological bases. As the core of the house, the courtyard is a sophisticated spatial entity, connecting the urban context and the surrounding landscape. The courtyard can be seen as the primary unit of the city, the larger context, which is physically, ecologically and socially produced and functioning.

Further detailed analyses are certainly still required to obtain more definite results on the impacts of the courtyards' role on the energy efficiency in the urban context of Antakya. However, from an architectural point of view, the on-site observations makes one to think that it may be more important to balance the single frame of energy efficiency aim with that of the a more holistic design approach that may lead one to investigate the complementary potentials between ecology, energy efficiency and design in a *living* place. Courtyard houses in Antakya are not only climate responsive and are contributing to energy efficiency in the urban context, but further, they are places for networks of events, actions and views through spaces; they are narrative of dynamics, itineraries marked by social, historical and geographical specificity that intertwines architecture and landscape into a whole multifunctional web called *home*.



Fig.13. Courtyards as social gathering places, courtyard of the House of the Chamber of Architects, Antakya , October 2005 (photo: author)

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