The Applicability of Ecological Lessons Learnt from Traditional Houses to Mass Housing Projects: A Case Study of Akçaabat, Trabzon / Turkey

Nilhan Vural

Assistant Prof., Department of Architecture , Karadeniz Technical University, TURKEY
nvural@ktu.edu.tr

Nihan Engin

Associate Prof., Department of Architecture , Karadeniz Technical University, TURKEY
nengin@ktu.edu.tr

Serbülent Vural

Assistant Prof., Department of Architecture , Karadeniz Technical University, TURKEY
svural@ktu.edu.tr

ABSTRACT

The housing needs of Turkey's population are increasing rapidly, especially in major provinces, due to various factors such as natural population increase and migration. Mass housing is considered a solution to the lack of housing. However, mass housing structures are designed and constructed uniformly, without any consideration of the architectural, climatic and topographical features of their location. The care and effort towards ecological values found in examples of traditional architecture, which are in harmony with and respectful to nature, cannot be found in mass housing projects that are built today.

This study emphasizes the importance of adopting ecological design principles in contemporary mass housing projects and demonstrates what kind of ecological lessons can be learned from traditional houses. Therefore, it examines a traditional residential neighborhood in the East Black Sea town of Akçaabat, Ortamahalle, and a recently built mass housing project in the same town in terms of ecological design principles. Following the analysis and comparison, specific suggestions are made for the town of Akçaabat and for the application of ecological lessons learnt from traditional architecture to contemporary mass housing projects.

Keywords: East Black Sea, ecology, traditional housing, mass housing, Ortamahalle, Akçaabat.

INTRODUCTION

Mass housing projects that take ecological design principles into consideration use natural resources in a sustainable manner and offer healthier and higher quality living spaces. Mimicking traditional settlements and buildings in mass housing developments offers important advantages to this design approach (Esin, 2012; Manioğlu, 2008; Okutan, 2001).

In Turkey, housing projects that disregard local climate and topography are built with the same geometrical forms, spatial arrangements, building shell and materials in every province, and they have negative ecological impacts (Yüksel, 2010; Kahvecioğlu, 2011; Toydemir, Gürdal, Tanaçan, 2000). The ecological sensitivity of the locally adapted solutions found in examples of traditional residential structures are not to be found in contemporary mass housing projects. This study aims to show that ecological principles used in traditional houses are applicable to contemporary mass housing projects as well, and it evaluates traditional houses found in Ortamahalle neighborhood of the district of Akçaabat in Trabzon and the TOKI Yıldızlı mass housing project built in the same district. Then it makes suggestions on how to apply the ecological lessons learnt from traditional houses to mass housing projects.

The traditional houses in Akçaabat's Ortamahalle neighborhood and the mass housing project are analyzed in terms of ecological design principles using the numerous studies conducted in this field as well as observation of the sites.

ANALSIS OF TRADITIONAL AND MASS HOUSING IN TERMS OF ECOLOGICAL DESIGN PRINCIPLES

The raditional houses of Akçaabat are mostly located on the southern hills of the seaside town center. Some of these historic houses are still in use. Ortamahalle is the most important neighborhood in Akçaabat in terms of traditional building stock (Öztekin, 1989) (Figure 1a) (Photo 1a). The site has sloped topography and dense flora. Constant humidity and precipitation, strong winds coming from the northwest and therefore carrying humidity from the sea, warm winds from the south-southwest direction, medium levels of sun radiation and a small difference between day and night temperatures are some of the climatic conditions that are reflected in the traditional housing design in this district (Gülalioğlu, 1998; Saka, 1996; Çetingök, 1986; Çakıroğlu, 1996). However,

traditional houses are no longer being built, and the increasing demand for housing is being met by the rapid building of mass housing (Figure 1b).

Figure 1(a-b). Traditional housing and recent mass housing developments in Akçaabat district (URL-1, URL-2)

Contemporary mass housing projects in Akçaabat, as well as all around Turkey, are led by public and private sector partnerships, and the resulting physical structures are very uniform. Public sector involvement in these developments is lead by TOKI. TOKI plays an important role in the transformation of Turkish cities with its piecemeal interventions in almost every province (Yüksel, 2010; Kahvecioğlu, 2011). Therefore, it was considered necessary to choose a TOKI development as an example of current mass housing projects in Turkey to examine and evaluate in terms of ecological design principles (Photo 1b).

Photo 1(a-b). Akçaabat, Ortamahalle traditional houses and TOKI Yıldızlı mass housing

The approach adopted by this study is to examine two different housing types, one traditional and one contemporary, and to evaluate the applicability of the ecological principles of the traditional houses to the contemporary mass housing in order to formulate a solution to the ecological impact of mass housing developments.

In ecological design approaches, regional climate and topography should to be considered in determining and applying primary principles. The traditional houses in Akçaabat's Ortamahalle neighborhood and TOKİ Yıldızlı mass housing project were

analyzed at different scales according to these ecological principles: *location*, *flora*, *use of open space*, *building form*, *building shell*, *choice of building materials* and *spatial organization.*

Location

The traditional houses in Ortamahalle are located in the center of an east facing slope. This location protects the houses from the strong northwestern wind and benefits from sun's radiation at the highest level. The positioning and orientation of the houses depends on the terrain and uses it optimally. Each house is located separately or in groups, at different heights and taking advantage of the slope, without shading or blocking each other's views, sun exposure or air circulation (Gülalioğlu, 1998; Çetingök, 1986; Saka, 1996; Çakıroğlu, 1996) (Photo 2).

The TOKI mass housing project in Yıldızlı is located 6 km away from the district center. The development is located almost on the crest of a hill. There are 22 blocks in rows of 4-5 buildings. The high altitude of the buildings exposes them to winds from all directions and especially the northwestern winds that bring humidity and precipitation. Buildings are positioned without any consideration of the effects of the sun and wind, creating a silhouette that is disconnected from and overpowering the topography. The 4-5 store\y blocks are located in close proximity, causing a lot of shade especially in summer months and leading to increased humidity and reduced day light (Figure 2).

Photo 2. Location of Ortamahalle traditional houses

Figure 2. Location of TOKI Yıldızlı mass housing blocks, URL-3

Flora

In Ortamahalle each house is surrounded by dense natural greenery as well as its own garden. Local vegetable and fruit varieties are grown in these gardens. Their trees are located according to the climate. Evergreen trees are planted in the north-northwest direction in order to block cold winter winds, while deciduous trees are located in the

southwest where they can block the summer sun and allow sunlight in winter (Gülalioğlu, 1998; Saka, 1996; Çetingök, 1986; Çakıroğlu, 1996) (Photo 3a). Mass housing projects on the other hand are built by clearing the existing flora and therefore do not have any natural greenery around them. The landscape design consists mainly of lawns. Tree plantations are far from trying to block winds or create shade (Photo 3b).

Photo 3 (a-b). Flora in traditional and mass housing areas

Use of open spaces

The traditional houses are connected to each other with sloped streets. The streets run from the northeast to the southwest, bringing southwestern winds to the gardens and houses and reducing the humidity. The intersections of these streets create small squares with fountains, trees and benches, offering spaces for socialization (Photo 4a). The streets in the mass housing area run both north and south and east and west. They are protected from the strong northwestern winds. Although open areas with seats and playgrounds were designed, it was observed that these do not offer high quality spaces and are not sufficient in number and size. These open areas are not used very often due to the strong wind and constant shade caused by the height and spacing of the buildings (Photo 4b).

Photo 4 (a-b). Use of open spaces in traditional and mass housing

Building forms

The houses in Ortamahalle are mostly rectangular. These are rational forms that are economical in terms of materials, labor and climatic factors and that simplify construction

and connectivity problems (Zorlu, Faiz, 2012). Two or three story houses have oriel type bay windows on their first floors that maximize the amount of sunlight in winter and reduce heat in summer with the shade they cast on the facade. The houses have three or four-sided hipped roofs which are appropriate for the rainy climate of the region. Their eaves are slightly extended due to heavy precipitation (Gülalioğlu,1998; Çetingök, 1986; Saka, 1996; Çakıroğlu, 1996) (Photo 5a).

The Yıldızlı TOKI houses are also rectangular in shape. The building heights range between 8 and 12 stories. Their four-sided hipped roofs end with parapet walls. Parapet walls stick out of the building surface as overhangs. However, these overhangs fail to protect the whole building from the sun due to the height of the buildings. Their sunken balconies do not extend like the oriel windows and are not sufficient in size. They are not used during winter months due to the climate (Photo 5b).

Photo 5 (a-b). Building forms in traditional and mass housing

Building shell and materials

The traditional houses' walls and the floors of the basements are made of stone. This protects especially the back and side facades that are in contact with the ground due to the slope, as well as the other facades and floors, from humidity and run off. The northern entrance facades of the first floors have sea views and these are built with lath and plaster, while side facades can be either stone or lath (Gülalioğlu, 1998; Çetingök, 1986; Saka, 1996; Çakıroğlu, 1996). The lath and plaster technique provides natural climate control due to its breathable structure, with pebbles used in between the laths as filling material (Gülalioğlu, 1998; Çetingök, 1986; Saka, 1996; Çakıroğlu, 1996; Sümerkan, 1990).

The traditional houses have more windows on the wide entrance facades that have the sea view and these receive sunlight from the south and/or the east. The wide rear facades of the traditional houses and one of the side facades are positioned to receive the northwestern winds. Therefore, there are no windows on the rear facades, but only

small openings for toilets, bathrooms or storage rooms. The side facades that might receive northwestern winds either have no windows or only one window (Photo 6 a).
Materials and window opening proportions in mass housing do not take orientation and its climatic effects into consideration. Due to the tunnel form construction system, the walls are made of reinforced concrete and brickwork. The size, proportions and characteristics of the windows are same on all facades (Photo 6 b-c).

Photo 6 (a-b-c). Building shell and materials in traditional and mass housing

Spatial organization

The layout of the houses in Ortamahalle generally have an inner *sofa*, except for one or two examples with outer or middle *sofa*s. In the inner *sofa* layout, all the other rooms surround the *sofa* that is located in the middle of the floor plan. This creates a room that can be protected from extreme cold and extreme heat and is comfortable in any climatic condition, the *sofa*. Rooms on both sides of the *sofa* have opposite doors and windows provide natural air conditioning using summer winds to disperse humidity. Stair wells also contribute to the air conditioning by directing the wind with open windows and doors in the summer (Manioğlu, 2008; Gülalioğlu, 1998; Çetingök, 1986; Saka, 1996; Çakıroğlu, 1996; Boduroğlu, 2009) (Figure 3).

The mass housing examples have three layout types: B, C and D. The B and C layouts have four apartments on each floor, while the D layout has two (URL-4). All of them have two facades and one balcony. Benefiting or protection from climatic elements (wind, rain, sun and humidity) is not taken into consideration in the spatial organization and orientation of the mass housing layouts (Figure 4).

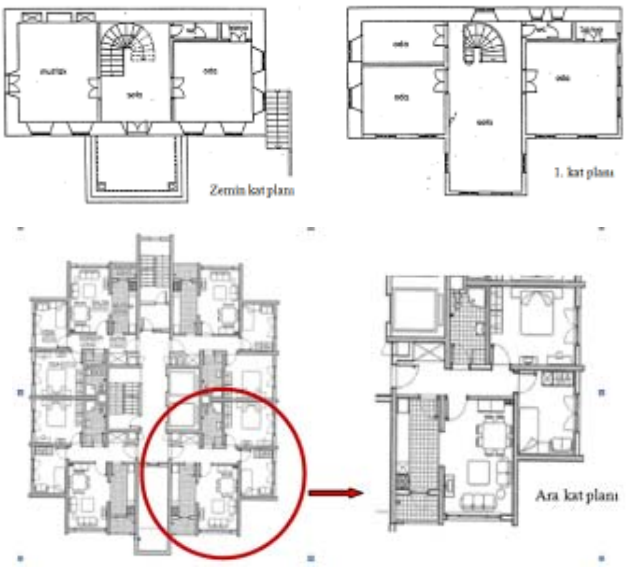

Figure 3-4. Spatial organization examples from traditional houses (Saka, 1996) and mass housing (B type) (URL-4)

SUGGESTIONS

In light of the ecological lessons learnt from the traditional houses in Ortamahalle, here are some design principles that can be applied to future mass housing projects in Akçaabat:

1. In mass housing projects, building positions and street directions should be designed to block strong and salty and humid northwestern winds and to benefit from warm southwestern winds.
2. Buildings should be positioned and sized so that they do not cast shade on each other or block each other's air circulation, sunlight and views.
3. Especially on sloped terrains, excavation should be avoided and vertical and horizontal structures should take advantage of the topography.
4. Building heights should be in harmony with the silhouette of the topography and should be perceived as part of it.
5. Housing developments should be designed for minimum disturbance of the natural flora and fauna.
6. Evergreen trees should be planted on the north-northwestern sides of the buildings in order to block cold and humid winds in winter, while deciduous trees should be planted on the south sides to block the sun in summer and allow it in winter. Each housing unit should have a private garden of sufficient size.
7. Open areas and recreational facilities should be designed for the social activities for every age group.

8. Rectangular forms should be used to disperse humidity with wide surfaces facing the wind and benefiting from sunlight by facing south and east.
9. The materials and elements used on the facades should protect the building from strong and wet winds from the northwest.
10. Window openings on south and/or east facades should be increased in order to benefit from daylight and sun's heat. Materials used in the building shells should be breathable and preventing condensation.
10. The main living space should be protected from extreme cold and heat, designed in the form of the inner *sofa* located in the center of the layout. Openings or spaces in front, back and sides of the *sofa* should be designed according to protection or benefiting from various factors.
11. The two story solutions found in traditional houses and the climatic and spatial benefits of this design should be reflected in mass housing with multistory flats.
12. Window and door positions and sizes should allow natural air conditioning.
13. The number of apartments on each floor should be determined according to equal protection or benefit from wind, heat and light from different directions. The spatial arrangement inside every apartment should also take this into consideration.
14. Closed and/or open balconies should be rendered usable with appropriate sizes, orientation to the wind and sun and relationships with indoor spaces.
15. Using natural and locally sourced materials such as stone and wood increases the ecological value of traditional houses. Therefore, future housing developments should involve more extensive use of wood in the structural, overlay and joinery elements and tree plantations should be created to produce structural wood products.

AFTERWORD

The analyses and evaluations of this study reveal that mass housing developments are focusing on rapidly meeting housing needs and neglecting ecological values. Traditional houses that are designed according to cultural, topographical and climatic conditions and that reflect a great deal of ecological knowledge are an important source of lessons for current and future developments with ecological design approaches. The suggestions given above should eliminate environmental and energy problems and provide environmentally friendly ecological mass housing developments that use resources sustainably and offer higher quality living conditions.

REFERENCES

Boduroğlu, Şenay, F. S. Kariptaş, and Esin Sarıman. 2009. "Geleneksel Türk Evi'nin Sürdürülebilir Tasarım Kriterleri Bağlamında Değerlendirilmesi". Uluslararası Ekolojik Planlama ve Mimarlık Sempozyumu, Antalya, October 22-25 .

Çakıroğlu, Birgül. 1996. "Geleneksel Konut Mimarisinde Cephe Düzeyinde Malzeme ve Biçim İncelemesi", Masters Thesis, Karadeniz Technical University.

Çetingök, Naci. 1986. "Yapının İklime Uyum Düzeyinin Saptanması İçin Bir Yöntem ve Geleneksel Mimari Üzerinde Örneklenmesi", Masters Thesis, Karadeniz Technical University.

Esin,Tülay. 2012. "Toplu Konut Tasarımında Ekolojik Yaklaşımlar". İzolasyon Dergisi 93: 16-21.

Gülalioğlu, Asuman. 1998. "Karadeniz Konutlarının İklim ve Çevre Açısından Araştırılması". Masters Thesis, Mimar Sinan University.

Kahvecioğlu, Hüseyin. 2011. "Türkiye'de Son Dönem Kitlesel Konut Üretimi: Başarı İçin Nicelik Yeterli mi?". Arredemento Mimarlık Dergisi 240: 102-105.

Manioğlu,Gülten. 2008. "Geleneksel Konutlarda Sürdürülebilir Yaklaşımlar". Tasarım Dergisi, 181:121-125.

Okutan, Mehmet. 2001. "Tarihte Anadolu Yapılarının İklimle Kurdukları ilişkiler". XXI Dergisi 7: 98-103, İstanbul.

Öztekin, Kamuran. 1989. "Geçmişten Günümüze, Günümüzden Geleceğe Akçaabat "Ortamahalle". Mimarlık Dergisi 89: 68-70.

Saka, Emine. 1996. "Akçaabat Geleneksel Konutları Örneğinde Yöresel Kimlik Arayışı". Masters Thesis, Karadeniz Technical University.

Sümerkan, Mustafa, Reşat. 1990. "Biçimlendiren Etkenler Açısından Doğu Karadeniz Kırsal Kesiminde Geleneksel Konutların Yapı Özellikleri", PhD diss., Karadeniz Technical University

Toydemir,Nihat, Gürdal Erol,and Leyla Tanaçan. 2007. "Yapı Elemanı Tasarımında Malzeme", Literatür Yayıncılık.

Yüksel, Ü. D.,and G. S. Atanur. 2010. "Sürdürülebilir Yaşam Çevreleri İçin Planlama ve Tasarım İlkelerinin İrdelenmesi: Bursa Toplu Konut Projeleri". Yapı-Yaşam Kongresi, Bursa, 2009, Mart

Zorlu, Tülay,and Serap Faiz. 2012. "Ekolojik Mimarlık: Doğu Karadeniz Kırsal Konutu", Mimarlık Dergisi 367:56-60.

URL-1 http://tr.worldmapz.com/photo/170336_ar.htm

URL-2 http://www.trabzonhaberajansi.com/upload/resimler/29Z_akcaabat-fotograf-1.jpg

URL-3 http://www.akcaabathaber.com/yurutmeyi-durdurma-karari-1033h.htm

URL-4 http://www.toki.gov.tr

Photos Engin,Nihan and Nilhan Vural. 2014, Akçaabat, Trabzon.