Reflection of Construction Technology on the Built Environment: Housing Fabric in the Turkish Cities

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ABSTRACT: History of architecture, in one respect, is the history of construction technology and its influence on the built environment. Physical environment houses examples that reveal the relationship of materials and construction techniques with architecture in the past and today. Mid-twentieth century marks a period of change in architecture where modern replaces the traditional, especially in the case of residential architecture in Turkey. With increasing urbanization starting from 1950s, transformation in the housing fabric of Turkish cities is recognized. Anatolian residential architecture that may earlier be grouped according to regional differences bound to the use of local materials and construction techniques gradually lost their characteristics. New material and technology seem to have overruled the principles of design, concept of space, function, form, and aesthetics. This paper discusses the dilemma of the loss of local traditional housing types, and the creation of a wide-scale local type, in the context of building technology and material.

INTRODUCTION

Housing with its quantitative and qualitative aspects is dominantly influential in forming the urban fabric. In 'The Architecture of the City', Aldo Rossi (1982) while making a thorough analysis of the urban forms and components, values the city as a construction realized over time, beyond civilizations and describes the permanent elements of the city as monuments and housing. He forms an analogy between the house and the city. Housing form and typology reflect the values and life styles of a society. House form is a medium where social, cultural and local values are reflected. Materials and construction technology used in housing may provide us insight about its formation.
The aim of this study is to discuss the built environment in the context of housing in the Turkish urban settlements and explore the relation between the construction technology and housing fabric and how technology is influential in shaping housing. This subject is going to be discussed in the setting of housing examples ranging from small towns to major cities in Turkey.

CONSTRUCTION TECHNOLOGY AND THE BUILT ENVIRONMENT

History of architecture in a way may be defined as the history of construction technology. People have constructed physical environment using readily available materials and the relevant technologies and shaped their settlements throughout history. There are many examples of architecture where there is a close relationship between the material and method of construction and the physical form. Analysis of the ancient Greek monumental architecture gives us clues about the earlier wooden construction technology they had used. Specific architectural elements had been translated into stone from the earlier wooden elements. Triglyphe, for example that used to be a structural element in wooden roof construction, was converted to a decorative element in the entablature of later temples constructed in stone. In Greek architecture, structure is the dominating element of form, whereas in Roman architecture, space is the most dominant feature. Space created by the arched and domed structures owes much to opus caementitium, a concrete-like material developed by the Romans. Gothic architecture also finds expression by its elegant structure.

New materials or construction techniques generate breaking points in the course of architectural history. New materials such as iron, steel, glass and reinforced concrete started to become commonly used in construction, due to increase in production following the Industrial Revolution. The Eiffel Tower, the steel bridges or the wide span exhibition spaces such as Crystal Palace may easily be associated to iron and steel as the structural material. The skyscrapers of Chicago School besides the economical, social and cultural reasons may be explained by the capabilities of steel construction, and its availability. Steel, a relatively light and strong material, made it possible for buildings to grow vertically. Today, high-rise buildings continue to appear in cities all over the world as the appropriate technology and economical conditions are provided. Concrete, reinforced concrete and possibilities associated with this material –plasticity, strength and durability- had a lot of influence on the architecture of the twentieth century worldwide. August Perret's delicate details, Le Corbusier's artistic forms and Saarinen's buildings are mediums to understand concrete as a material of plasticity. Concrete in the built form reached its climax in the work of some architects. Today, computerized design and production methods initiate change in the conventional Euclidian geometry of form in architecture. Utilization of aircraft technology in design and construction has been influential on the dramatic forms of Gehry's architecture. Development in timber construction such as glue laminated technology made timber, capable of spanning wide dimensions. Fairly a new material, plastics and their use in the construction industry is in a rise creating opportunities for architects. From primitive to traditional and contemporary, materials and the related technologies together influence the architectural form and the built environment.

VERNACULAR HOUSING, MATERIALS AND CONSTRUCTION TECHNOLOGY IN ANATOLIA

House as a shelter is a basic form of dwelling and requirement for survival. Norberg-Schulz (1985) describes dwelling in four modes; natural, urban space, public and private dwelling. Among these, house, the private dwelling has a special place in human life. It is a symbol of survival, a defined territory, a place where personality and individuality are reflected (Norberg-Schulz, 1980). Values, beliefs, aspirations of mankind may be traced in the built environment as morphology of housing reflects differences in identity and culture. House reflects not only the aspirations of the individual it also reflects social, economical, cultural and historical values of its locality. Complex pattern of relations among individuals and groups produce settlement patterns and house typologies (Rapoport, 1989). House as an outcome of these relations bears complex meanings. The relationship between the house and its user is unique however it seems to loosen in the modern age. The role of the user and the architect in the production of housing gradually diminishes and popular culture shapes the architecture of housing as described by Lozano (1990). This kind of development results in popular and commercial *tendencies* being reflected more in the house form, rather than the idiosyncrasies. Considering the vast amount of housing, only a limited number are designed and produced with the cooperation of the user/client which results in the production of similar housing everywhere. Housing production process and standardization are also among the causes.

In contrast to the prototype modern housing, the traditional architecture in Turkey possesses variety with vernacular characteristics. The traditional Turkish house and its development may be described with respect to location, climate, available materials, and construction technology and plan types. Eldem (1954) defines the Turkish house as a type and states that this type had developed within the borders of the Ottoman Empire over five centuries, possessing special features according to location. Eldem also emphasizes that the most important common feature was the similarities in the plans. Kuban (1981) classifies traditional housing in Turkey according to geographic regions and related construction materials. Examples of housing with wooden structure and mud infill, or various uses of the materials mud, wood and stone may be traced in different regions of Anatolia. Examples of 'himis' construction –wood structure with masonry infill- are found in western Anatolia, Marmara, and mid northern Anatolia; Safranbolu, Kula and Bursa regions. In Safranbolu, the typical house construction comprises of stone and wooden parts. In thick ground floor walls built of stone, mud is used as infill. Floors and walls of the upper storey are in wooden construction. In relatively recent examples, enclosure of the upper levels is of wooden construction with stone infill (Gunay, 2003). Traditional architecture in mid Anatolia, uses mud as the basic building material. In the northern Anatolia house, wooden construction is dominant, while stone is the construction material of the east, southeastern Anatolia; Kayseri and Niğde regions. Among these, Mardin houses are considered to be the significant examples of stone masonry construction. In a typical Mardin house, pillars and arches or walls as load bearing elements form the structural system. Stone is used in different ways in the Mardin house; cut stone is used on facades facing the courtyard and the terrace especially in the courtyard walls of the ground floor as well as in the interior partition walls. Fieldstone as secondary material is used for relevant purposes. Stone is also used for interior and exterior ornamentation. Due to the available stone quarries nearby, limestone is preferred in Mardin houses. There are two techniques of stone walling; fieldstone wall is generally used in foundation and in ground level which is not open to the exterior. 'Sandik' wall laying technique is used for all the other walls where the walls are laid with honed or rough surfaced stone with fieldstone infill. All interior and exterior flooring are made of stone. In the courtyards, mud and stone are used together as the floor covering. The vaults are constructed using fieldstone and mortar (Alioglu, 2005). Various materials; wooden, wood and stone infill, mud and stone and related construction techniques had created the traditional vernacular architecture of Anatolia, whereas architecture of housing *in Istanbul may be characterized by the wooden townhouses beginning with the twentieth century (Kuban, 1981)*.

Variety in housing in Turkey developed over the years, formed types with regard to technology and materials used, while preserving and expressing the identity of each city/region depending on location, climate, land-

scape and social culture. Traditional housing exhibited a medium where social and cultural variety of Anatolia and Istanbul could be explored until the transformations in the built environment accelerated by the industrialization in Turkey.

NEW MATERIAL AND TECHNOLOGY: CONCRETE TAKES COMMAND

Westernization in the Turkish-Ottoman world is considered to have started in the period of the Ottoman reformations 'Tanzimat'. Influence of transformation in various fields such as politics, education, military, economics, social life and the phenomenon of modernization starting from 1840s, gradually found its expression in architecture and construction. The preliminary changes in the physical environment started in Istanbul and were accelerated by the fires that often broke out and swept the wooden houses in the neighborhoods. The fires of Istanbul had been influential in changing the housing fabric both in pattern and in constructional means. In the fire raided neighborhoods, the urban pattern changed from organic into grid and the building technique from wooden to masonry (Celik, 1993).

Due to the western influence in social life, a new type of housing emerged especially in the Pera region as a new alternative for the bourgeoisie; apartments with masonry and steel construction fulfilled the requirements of the new emerging section of the society and caused additional changes in the urban fabric. Use of adopted contemporary construction techniques along with the European architectural styles may be related to the reorganization in the architectural education in Turkey as well as the imported know-how. New modes and styles transferred from Europe necessitated new building materials and techniques among which were cement, concrete, reinforced concrete and the relevant construction methods (Sey, 2003).

Utilization of reinforced concrete was developed in France and England within the same period. In France, it was first used for building boats, then flowerpots and water tanks, eventually, followed the bridges and various building types with column and beam construction. In England, it was used for the production of fireproof housing, warehouses and other buildings. The first reinforced concrete apartment building in New York was constructed in 1875. By the nineteenth century, concrete was being used in the construction of major buildings. In 1920s, the scientific basis for pre-stressed concrete construction had been established and concrete began to be used in large scale constructions (Bell, 2006). Use of concrete construction i.e. reinforced, cast in place, pre-cast, autoclaved cellular concrete, brought new dimensions to architecture and its production.

Use of concrete construction technology in Turkey is considered to have started with the Republican period, although early individual examples date back to 1910s. A composition of cement with gypsum was being used in the Ottoman period, during the mid nineteenth century. The first reinforced concrete building was constructed in Istanbul, in between 1919-22. Harikzedegan apartments also reserve being the earliest social housing blocks in Turkey. Another example, an office building for sea transportation, Seyri Sefain Acenta Building (1915), is also considered an early example of reinforced concrete construction with mat foundation (Sey, 2003).

The welcoming of the concrete technology in Turkey coincides with the ideology of the Republican period. Rebuilding of the nation with new ideals, constructing new cities, requirement for a new architecture and availability of the new construction material concrete, overlapped in the Republican period. A novelist and theorist of the early 1900s, Peyami Safa (1899-1961) stated that new Republic had taken roots from mainly two obligations; fighting the war of independence and "building the nation's ground and mentality with concrete" (Safa, 1981: 289). According to Safa, wood symbolized the Ottoman past that had to be gotten rid of, whereas concrete symbolized novelty, modernity, the West and the new Republican regime. In parallel with numerous others, the fields of construction and architecture were subjects of interest where reform was required. Especially during the World War years, foreign architects preferred to accept the invitations of the young Republic and took commissions in Turkey. Among them, Bruno Taut (1880-1938) had a special influence over young architects and on the development of the modernist trend, with his teaching at the academy in Istanbul and through his book "Ein Wohn Haus" radiating his futuristic view of technology and the house, also expressing the enthusiasm felt about technology and the miraculous performance expected from technology and chemistry in that period (Inceoglu, 2004). A productive and well-known leading figure of modern Turkish architecture, Eldem (1908-1988) who had led studies on the traditional Turkish house as an academician, tried to implement a special sensitivity for them. He had also been the first Turkish architect who transferred certain local and historical features of these houses into modern architecture by his buildings; he had somehow translated the wood, mud and stone tradition into the language of concrete construction.

The building activity during the Republican period, increased following the long lasted war years, in the context of destruction and reconstruction of the physical environment, formation of the new borders, shifts in population and building the new capitol. Concrete technology seemed to fulfill all requirements; it could *easi*ly be adopted from the West.

The tendency to use concrete may also be explained by understanding the specific advantages of this type of construction. Concrete construction especially when it is produced in-situ is labor intensive. The construction industry preferred labor intensive methods because wages were low, unemployment rate was high and qualified personnel were rare. Cast-in-place concrete system is less costly in terms of initial investment because production takes place on the site. Besides, Turkey is located on an earthquake zone and in that respect concrete was a better solution than the existent traditional masonry or mud construction. Political decisions may also have been influential on the preference of concrete, as the material for the construction sector in Turkey. Eventually governments initiated the development of this industry by installing numerous cement factories. The

following figures indicate the abundant and accelerating use of concrete in time. The production of cement, one of the basic ingredients of concrete increased from 12 500 tons to 104 110 tons between the years 1923-1930. By 1979, it had reached 13 812 000 tons (Sey, 2003).
Modern architecture in the western world was created as an outcome of industrialization together with the new constructional means and it reflected its implications onto the periphery countries. In 1950s, as an outcome of industrialization in Turkey, migration from suburbia to urban area caused a drastic rise of population in major cities. People in search for a job and better living conditions migrated in large numbers to cities. Requirement for mass housing grew to a large extent. However the government and the municipalities were caught unequipped and in spite of the efforts, the requirement of housing could not be met. The new comers tried to resolve their housing problem themselves. The result was the creation of a new type: squatter settlements, 'gecekondu'. As the name denotes, the form of production is rapid, nonstandard; construction is made overnight using any material at hand, therefore the building produced is temporary and illegal. This kind of process for building production, started as an individual effort to own a shelter however became institutionalized in a short while. Building squatters for sale and rent became a source of income and finally got legalized since the authorities preferred gaining the goodwill and votes of the squatter household majority rather than opposing them, especially in pre-election periods.
On the other hand, governmental efforts in response to the housing shortage were implemented. Development of cooperative housing and formation of the state owned banks for low cost mass housing were initiated. In 1965, the government passed legislation on individual ownership that made it possible for people to own a flat in an apartment building. Rise in population, the ownership legislation, increase in land prices, speculation, availability of the new construction technology and material i.e. concrete, altogether produced a new house type i.e. the apartment house. Concrete structures, housing of various types, started to dominate the cityscape in Turkey by the mid twentieth century. These types included social housing for people with low income, mass housing for all income groups, and apartment houses by individual developers. The common concern in all may be highlighted as the production of healthy and 'modern' housing. Concurrently, the housing from the Ottoman and early Republican periods started to be replaced by the reinforced concrete constructions, the multistory apartment blocks. Appropriate and available construction technology for the new type would be concrete, since alternatives like prefabricated systems of wood, concrete or steel were not available. The transformation started in the major cities such as Istanbul, Ankara; Izmir and Adana and then followed other Anatolian cities.
In 1970s, new trends in social life led the development of summer housing as the second homes in and around the shore towns and cities. Although these were single family, twin or row houses of two to three stories, developers preferred using the available cast-in-place concrete construction technology. The new material concrete was introduced to these towns that used to possess traditional houses, accelerating the loss of vernacular architecture. Eventually the new material replaced the traditional. While rebuilding the environment using concrete construction technology, the intention was to produce healthy and modern housing. The new urban fabric gradually spread around the country with an extended use. Even in the restoration of traditional houses, the main structure started to be constructed with concrete, the enclosure with brick walls and wood veneer. Today it is getting harder to preserve the few remaining examples of vernacular housing due to the land speculation and diminishing vernacular construction techniques and materials. Vernacular building techniques and crafts are time-consuming and expensive therefore are not preferred.
The transformation of urban settlements in the last two decades in Turkey follows a similar trend with the world. High-rise offices of information technology and banks move in to the central area, forming areas of prestige as the production sector moves out. Shift in distribution of sectors within the urban space, influences the distribution of housing districts. A new understanding of time/distance is formed. Housing / dwelling communities for mid and high income groups, passing beyond the squatter neighborhoods encircling the centers, moved far away, to the outskirts and formed sub-cities. The area in between that used to be squatter settlements, transformed into multistory, low quality apartment houses (Tekeli, 1998). Along with these developments, boundaries between squatter settlements and state and private initiated housing started to diminish. Various types got interwoven in the housing fabric. The distinction became undefined in terms of mass and quality. Settlements at the outskirts of the city possess housing of better quality than the central area.

CONCLUSION

Housing in Turkey today, reflects an expression of sameness in the urban fabric ranging from small towns with low population to highly populated major cities. The architectural setting exhibits an image dominated by the concrete construction material and technology. This image defines the cityscape. Quantity and density of housing strengthens this image. Even in cases where local requirements indicate other forms of construction, typical concrete blocks are preferred. Concrete construction in a way, created a house type and form.
On the other hand, concrete construction may be considered among the causes of loss of vernacular architecture, techniques and identity in the built environment developed over the years. The extent of change in the built environment in Turkey projects a loss of identity. The urban fabric in small towns, on the plateaus of eastern Anatolia, the shore of Black Sea, Mediterranean or in Istanbul looks similar. Environmental issues no longer seem to be a matter of concern. Variety in housing that used to exist in Anatolia seems to be reduced to the same type with the use of the same material and method.

The invasion of so-called modern housing in the urban fabric is a subject of criticism among architects, urban planners and politicians. A widely accepted point of view interprets the existing housing as 'concrete masses' charged with a negative connotation. In a way concrete technology is held responsible for the outcome. The outcome can not be reduced to one cause; reasons behind are more complex. The explanation of this phenomenon requires a wider perspective; social, historical, political, economical dimensions altogether prepare the ground for this outcome. These dynamics coincided with the new material and technology -concrete- in the construction world in that specific time and place. The cause can not be the material and technology itself, it may be related to how it is handled. Criticism concentrating on concrete as a construction material needs to be drawn to the discussion of unifying construction material, technology and architecture. The existent urban fabric in Turkey provides a medium to explore the issues of identity, memory, space and place making, for parties related with the design and development of the built environment.

REFERENCES

Alioglu,F., 2005: Tarihsel surecte sehir dokusu ve geleneksel Mardin evleri. In F. Ozdem (Ed.), *Tasin bellegi Mardin,* pp.177-2, Istanbul: Yapi Kredi Yayincilik.

Bell, B.V.and Rand, P., 2006: *Materials for architectural design*. London: Laurence King Publishing Ltd.

Celik Z., 1993: *The Remaking of Istanbul: Portrait of an Ottoman city in the nineteenth century*. Berkeley: University of California Press.

Eldem,S.H., 1954: *Turk evi plan tipleri.* Istanbul: ITU Yayinlari.

Gunay,R., 2003: *Safranbolu evleri*. Istanbul: Yapi Yayin.

Inceoglu,M.N., 2004: *Mimarlikta soylem kuram ve uygulama*. Istanbul: Tasarim Yayin.

Kuban,D., 1981: *Yuz soruda Turkiye sanati tarihi.* Istanbul: Gercek Yayinevi.

Lozano, E.E., 1990: *Community design and the culture of cities: The crossroad and the wall*. New York NY: Cambridge University Press.

Norberg-Schulz, C.,1980: *Genious loci: Towards a phenomenology of architecture.* London: Studio Vista.

Norberg-Schulz, C., 1985: *The concept of dwelling: On the way to figurative architecture*. New York NY: Rizzoli.

Oymen Gur, S., 2005: The eastern Black sea traditional house. In A. Batur (Ed.), *Rural architecture in the Black sea region*, pp162-211, Istanbul: Mas Matbaacilik.

Rapoport,A., 1989: On the attributes of tradition. In J.P. Bourdier, N.Alyasad (Ed.), *Dwellings, settlements and tradition: Cross-cultural perspectives*, pp.77-105, Landham MD: University Press of America.

Rossi,A., 1982: *The Architecture of the city.* Cambridge, MA: MIT Press.

Safa, P., 1981: *Ataturk devri fikir hayati*. Ankara: Kultur Bakanligi Yayinlari.

Sey,Y., 2003: *Turkiye cimento tarihi*. Istanbul: Cali Grafik Matbaacilik.

Tekeli,I., 1998: Turkiye'de Cumhuriyet doneminde kentsel gelisme ve kent planlamasi In Y. Sey (Ed.) *Yetmisbes yilda degisen kent ve mimarlik,* pp. 22-23, Istanbul: Tarih Vakfi Yayinlari.