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The Revitalization of Urban Fabric in Contemporary Public Spaces; A Case of Shopping Spaces

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Abstract: *Public spaces such as shopping areas are indispensable places for humans. The buying and selling of goods plays a very important role in the development of towns and cities [1]. Shopping places have changed with modern movement. At the same time, these spaces embrace particular events that have collective social, historical and cultural associations; projections of these events influence the physical transformations, which can each be re-identified through time. One of the basic features of traditional shopping areas is the association between urban fabric and social structure [2]. However, contemporary shopping places have emerged as a closed box, independent from the texture of its city losing their spatial values. Therefore, especially in historical cities, the unity of 'urban fabric-shopping place' is impaired. The "space- time" relation in modernity shifts due to societies breaking ties with their traditions, which is leading to the loss of identity [3]. This study discusses the space design of contemporary shopping areas as important public city places and the interpretation of traditional impression in today's modern architecture to refer to values of place. With this aim, "Mediacite" shopping center in Belgium designed by Ron Arad and the eastern covered bazaar will be examined as a case study. The "Mediacite" was created in the context of modern design criteria however the architect has revived the sense of traditional design principles in the place. This project ties together all the disparate elements of its site to create a new axis through the city of Liege [4].*

Keywords: *Urban fabric, public space, shopping place, contemporary, traditional*

Kentsel Dokunun Çağdaş Kamusal Alanlarla Canlandırılması; Alışveriş Mekanlarının Konusu Üzerine

Öz: *Alışveriş alanları gibi kamusal alanlar insan için vazgeçilmez yerlerdir. Kasaba ve şehirlerin gelişiminde alım ve satım, çok önemli bir rol oynamıştır [1]. Moden hareki ile beraber alışveriş mekanları da değişmiştir. Aynı zamanda, bu alanlar, toplumsal, tarihi ve kültürel olayları kucaklamaktadır; Bu olaylar, fiziksel dönüşümleri etkileyerek zaman içersinde yeniden tanımlanabilmektedir. Geleneksel alışveriş alanlarının temel özelliklerinden biri, kentin sosyal yapısı ve dokusunu ilişkilendirmektir [2]. Ancak çağdaş alışveriş alanları, mekânsal değerlerini yitirerek kent dokusundan bağımsız olan kapalı kutu gibi ortaya çıkmıştır. Bu nedenle, özellikle tarihi şehirlerde "kentsel doku-alışveriş makan" nın birliği ve ilişkisi bozulmuştur. Modernite ile beraber "zaman-mekan" ilişkisi toplumların geleneklerle olan bağlarının kopması ve kimliğin kaybolmasıyla, değişmiştir [3]. Bu çalışmada, çağdaş alışveriş alanlarının mekansal tasarımı, önemli kentsel kamusal alanlar olarak ve günümüz çağdaş mimarisindeki geleneksel izlenimlerin nasıl yer aldığı sorgulanarak, değerlendirilecektir. Bu amaçla, Mimar Ron Arad tarafından tasarlanan Belçika'daki "Mediacite" çağdaş alışveriş merkezi ve geleneksel doğu alışveriş yerleri olan kaplı çarşı örnekleri incelenecektir. "Mediacite", modern tasarım kriterleri bağlamında tasarlamış olsa da, geleneksel tasarım ilkeleri ve izlenimlerini taşımaktadır. Bu proje, Liege kentinde yeni bir eksen yaratarak, şehrin farklı elemanlarını birbiri ile ilişkilendirmiştir[4].*

Anahtar kelimeler: *Kentsel doku, kamusal alan, alışveriş mekanı, çağdaş, geleneksel*

1.INTRODUCTION

As Vitruvious mentioned in 15 century B.C. “the discovery of fire is the main reason why people come together and live with each other”. The light and heat of fire have been the main reason and the first step of social exchange and living together. According to the statements of Vitruvius, since the beginning of the Ancient Greek and Roman Architecture up to present, the key role of fire forms the concept and design of public places such as commercial areas where people come together [5].

In the traditional definition the city is defined as the center of social life; significant both for the number of the inhabitants and for the ability to deliver multiple economic, political and cultural functions. Today, the city means the urban space where most of the population lives following the ongoing rhythms and dynamics: the city is the culture that must be constantly nourished and renewed and with it our civilization, it is a place of communication [6].

Urban public spaces have been the critical sites of cultural, social, political, and economic life since the early civilizations until the present day. The form and function of these spaces have varied dramatically, based on particular cultural, social and technological arrangements and requirements, yet retaining a host of similar features [7]. This study aims to analyze traditional architecture impression on contemporary design in the manner of shopping places. The changes and transformations of these places as public spaces will be discussed in terms of form and function.

The introduction of new spatial structures into the historical urban complexes and their skillful integration with the historical context as well as the adaptation of existing buildings that have historical significance are important issues in today’s urban planning and modern architecture [8]. Detecting the various expressive components as clear representations of a unique cultural orientation that capture a historical moment, is what makes up the culture of a city [6].

This study evaluates the architecture of contemporary shopping areas and the ways of integrating them with historical environments. From this point of view, “Mediacite” shopping center, as an example of contemporary design, is untied with the historic fabric of Liege city. As Gambassi [6] mentioned in the sense that everything flows and changes, preservation is transformation and mutation: storage is also mutation, launching a project phase that is responsible and aware of cultural identity. So there is no conservation without innovation. The study is going to analyze the different approaches of modern architecture when it faces the historical cities. Commercial buildings have been constructed in different types, scale and application form for their purposes throughout the history. With today’s vital physical changing and development, the differences of architectural identity should be discussed.

2. SHOPPING PLACES AS PUBLIC SPACES

The definition of public space is closely related with the meaning of its “public” component and the space’s relation with the public realm, the domain of social life. As these descriptions differ, so do the meaning, role and form of public spaces due to different socio-cultural structures of societies., Despite the differences across societies, it can be said that throughout history in all societies the public spaces have enabled some basic activities such as exchanging information, demanding personal and political rights, and carrying out social conduct; i.e., the formation and continuation of social groups [9]. Due to the required balance between the public and private activities that present the values of societies to some extent, each culture places different emphasis on public life. This diversity of public life appear in different kinds of public spaces among societies based on their historical, cultural and social identities. Since the balance between public and private activities is a shifting one, the value that is put on public space also evolves and changes throughout the history and is determined through physical, social, political and economic factors [9, 10].

Smithsimon (2000) defines public spaces as the centers of social life where people are provided with the possibility of interacting with each other, learning and identifying the society they live in through their daily conventions. This conception also incorporates privately owned spaces like shopping centers and retails besides publicly owned spaces like public parks and streets. As Carr et al. [9] define, shopping places are not only retail environments; they are also a type of public space that mostly aims to satisfy "needs in public space".

The history of public spaces begins with Greek agora and continues with Roman forum. Greek's agora, usually located in the center of the polis and the focal point of the town, both functioned as a market place and the gathering place for political assembly. In other words, it had both an economic and political importance [9, 11]. It also served as the meeting place of citizens for daily communication and formal and informal assembly. Historical narratives often abruptly jump from these classical settings to the medieval Europe where plazas and public squares were the main places for public life with the important buildings in which people gathered, made public celebrations and performed plays during the Middle Ages and Renaissance [9]. The shopping streets and marketplaces with their central location, which remarkably grew since the 11th century, were the crucial public spaces of the medieval times. In medieval cities, a great part of the business life was also taking place in the narrow, open streets of the city. The street was the work place, the place of buying and selling, meeting and negotiating and the place where religious and civic ceremonies were held [12].

By the 18th century, as a result of the rise of bourgeoisie, the shopping streets developed in Europe [13]. Just before the Industrial Revolution, the market places in cities were no longer spatially sufficient for the evolving trade. As a result, starting from Italy in 16th century, and in northern Europe in 17th century, the central streets of cities were lined with shops, pubs and coffee shops, where the shops were organized according to their types [14]. Besides the growth of new public spaces for leisure and public entertainment in 18th century, 19th century was marked with the emergence of new consumption places that also serve as important public spaces like the shopping arcade, passages, shopping street, bazaar and department store [15].

Since the end of 20th century, due to the globalization with the increasing use of technology in the design of several spaces forms, usages, characteristics and definitions of shopping places have been changed dramatically. The blurry boundary between public and private, especially in the economic sphere, has led to the popular emergence of semi-public spaces such as shopping malls as public spaces which are well-maintained, attractive and secure for most [16]. The activities that were once taking place in public spaces such as streets and squares, now are shifting towards to take place in closed spaces like shopping centers. The increasing use of closed shopping areas as gathering places and social life centers which are isolated from the rest of the urban fabric can be seen in the developed communities [17, 18]. The integration of urban fabric and the modern shopping centers as enclosed public spaces is crucial for the quality of the city urbanity. The characteristics of the contemporary public spaces affect the identity of historical cities and urban fabrics.

3. HISTORIC URBAN FABRIC AND PUBLIC SPACES

The city is never finished: it is actually a continuous spatial activity. The "culture of the city" is the identification of the various units of expression as obvious and sensible representations of a specific cultural orientation that characterizes a historic moment [6]. According to Topçu [19], the identity of a city depends on the identity elements resulting from different factors such as the city's history, cultural values, architecture, social and economic structure, topography, climate, region i.e. being an easterner or a westerner city and openness to other cultures and so on.

According to Kostof (1999), the urban fabric consists of an urban society, the inhabitants of the area, individual/civil housing units, street patterns or street networks, monumental buildings and public spaces, such as squares, parks commercial areas or open spaces. The components of any city exude a definite sense of place and identity that form the urban fabric.

As Özaslan [21] defines, there is a need for understanding the true architectural values, background and inherent qualities of a historic urban fabric in order to avoid both possible imitations of past forms and further destruction and to achieve a functional, meaningful and identifiable contemporary design.

During the last century, the unprecedented development of the urban environment has strongly influenced the urban transformation. Rapid urban expansion, densification, inappropriate modern interventions, gentrification, and changes in uses are occurring worldwide, directly affecting the historic urban environments [22].

Auge's [23] definition of "absent-space or non-space" gives a clear account of the following facts; first, the transformation of urban space, and the loss of social, cultural and historic characteristics of urban fabric that is re-constructed within buildings. According to Auge, a contemporary shopping center is a building within which non- place or non-space is defined just as the other building types of modern city. The senses of place and space, which contributes to the formation of collective memory, seem to disappear in shopping spaces that are designed to replace public spaces in the new cities of modernity.

4. THE MODERN ARCHITECTURAL PROJECT "MEDIACITE" IN THE OLD CITY OF LIEGE

In the modern era, the functional integration of the ancient city has almost completely disappeared. The technological innovation and the use of new transport and communication technologies that followed the Industrial Revolution have caused a fragmentation of the city, undermining its public spaces [24]. Urban areas and public places evolve and change according to the needs of their inhabitants. Therefore, it is of the utmost importance to determine the role of contemporary architecture in contributing to this change in ways that preserve the special character and quality of the historic environment and combine the two [25].

As it was mentioned previously, shopping malls are accepted as urban public spaces because of their urban public space qualities. Although they are private properties, as Gruen and Smith [26] claim modern shopping places become the centers for urban regeneration projects in the world and "multi-purpose town centers". The integration between urban fabric and traditional shopping areas (such as bazaars, arcades, passages and etc.), in both east and west architecture, could be seen clearly as one of the crucial criteria of design. As architect Ekinci [27] criticizes, contemporary shopping centers are settled as mono block boxes independent of their environment and disintegrate the urban fabric. This situation could cause loss of identity and cultural values in the city particularly in the historic urban fabrics.

In this context, the eastern bazaar does not present itself as an enclosed, box- like building object but rather as a land–like, topographical and fabric articulation. Bazaar persists through time and retains its historical and cultural values in the contemporary world as it is not only "formed" but also "formative" [28]. In order to clarify our argument, "Mediacite", an example of modern shopping center in Belgium and an "eastern covered bazaar" as an example of the traditional shopping places will be compared in what follows in terms of design features and integration with the urban environment (Figure 1). Mediacite exemplifies a model for how the qualities of a traditional bazaar become a reference for the formation of an alternative modernity in a historic city.

Linguistically, the term used for Bazaar, originates from the Persian word, *chihar/char*, which means *four*. This word, as it is used in the original Persian form, *Char-Su*, does not signify any trading place; it simply means *four sides*. In eastern culture *four* suggests the intersection of four directions, which can be (socially) interpreted as meeting or coming together around a meeting point. The architectural embodiment of this concept gave the shopping place its overall shape. In fact, the bazaar can be considered as a complex which is constructed by the interconnection of meeting venues through a street-like pathway (or in some cases it can be an alley or a passage). The organic structure of bazaar causes the topographic extension and integrates with the urban fabric [29].

Figure 1. Schematic plan of Tabriz Bazaar in the left and Mediacite shopping center in the right. The circulation and connective axes in the middle are descriptive common elements [30] (www.archdaily.com).

Mediacite Shopping Center was constructed at one of the oldest districts of Liege, named Longdoz (Figure 2). The construction of *Gare de Longdoz*, Longdoz Train Station, in 1851 converted this agricultural place to an industrial one. Due to the train station, several factories settled around the area and this accelerated the development of the region. The train station improved the area not only on an industrial level, but also on a social level leading to the opening of shops, cafes, hotels and transportation companies, which all made the region a popular place. However, in the late 60's the region lost its popularity and vivid life as factories and other industrial centers closed, which also led to the closure of Longdoz Train Station as a natural consequence. Liege, one of the world's foremost centers of steel production was since in an economic decline and the contemporary design of Israeli architect Ron Arad, the Mediacite Shopping Center stands as a symbol of the city's revitalization in 2009 today [29].

Figure 2. The topographic extension of Mediacite shopping center in Liege, Belgium (http://www.ronarad.co.uk)

Mediacite is an outstanding contemporary shopping design because of its most obvious features. This building is the first BREEAM certified retail center in Europe. The Building Research Establishment Environmental Assessment Method, or BREEAM for short, sets the standard for best practice in sustainable building design, construction and operation and has become one of the most comprehensive and widely recognized measures of a building's environmental performance. Médiacité meets all of the BREEAM criteria for sustainable development. This ecological building, accommodates economic, retail, cultural and leisure activities in the same place [29].

According to Leatherbarrow [28], fluidity is the fundamental element that leads to a topographic formation. The feature of connectivity encourages the interaction of inside and outside spaces as well as inside and outside communities. As in the case of the bazaar, connectivity and fluidity are the key elements for Mediacite, which has caused it to be developed in a land-like form. Arad describes the building in various ways such as a "river", "snake", "souk" – even a "commercial favela", but just as Calatrava has built a 21st-century railway shed, Arad's structure is a 21st-century descendant of the roofs that bridged old Europe's shopping arcades and eastern bazaars [31]. The mall snakes through the fabric of the refurbished old market at one end extending a total of 350 meters long to connect to the new Belgian national television center at the other.

A new urban axis has been taking shape in the Southern Belgian city of Liège, starting at the Santiago Calatrava designed train station, via a pedestrian bridge, and up until a shopping and audio-visual center designed by Ron Arad. Two entrances of Mediacite Shopping Mall are the starting and ending points of the main axis of the transparent tunnel construction (Fig. 3). The different forms and lighting of these two entrances are the indication of specific binding of two culturally different points of the city together. The first entry in the intersection point of the structure and at the heart of the city in an outdoor form while the other entrance reaches the sea side as if the city was designed to be covered.

Figure 3. Two entrances of Mediacite shopping center from city center and river Muse side (http://www.ronarad.co.uk)

The crucial point in the design of the entire structure could be called a transparent tunnel construction located as a street bazaar in the middle axis. This tunnel is 350 meters long, starting from the center of the old market town lying along the urban while the other end is connected to the new building of the Belgium national television. The enlarged spots along this tunnel, which undertakes the role of a main axis, has created gathering and meeting areas like four sides of traditional bazaar (Figure 4).

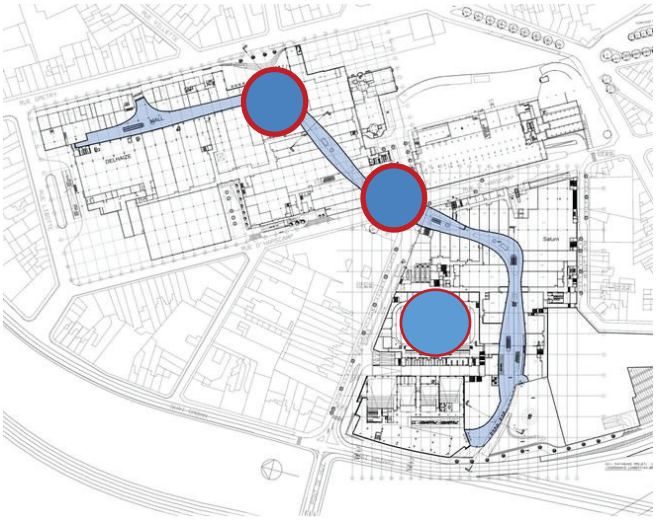

Figure 4. Meeting points along the main axis of Mediacite (http://www.archdaily.com).

The building form and shape of the structure has managed to become a part of the city fabric and has nested inside urban development. This feature quite clearly shows itself in the interior spaces. Transparent materials and natural lighting has provided indoor-outdoor connection enabling the visitor to feel the urban fabric of the city and watch the views inside at the same time (Figure 5).

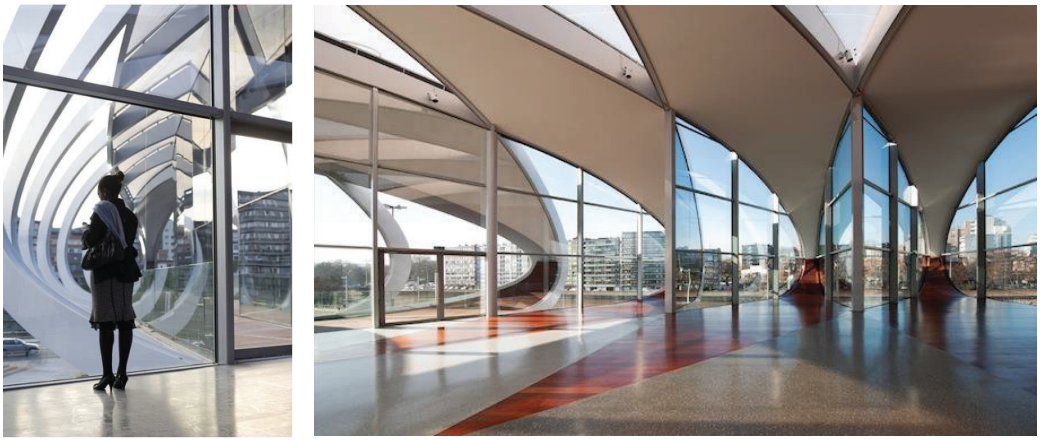

Figure 5. The relation between inside and outdoor in Mediacite Shopping Mall (http://www.archdaily.com)

The atrium of Mediacite Shopping Center that connects two different spatial points of the city is a long thin axis. This axis, which is designed in the form of a "tunnel", is roofed with a material of which the color and transparency has been successful in reviving the central areas of the social space. Ron Arad, preferred red material, to create a sense of movement and vivacity on the users of the space. The artificial red material used in the structure and texture has also caused movement and vitality in the city. This material composed a sense of contradict with the calm texture of the city while being a part of it. The design of the roof bonds with these elements through a network of steel ribs which undulate over the cores of the mall's length, sculpts the volume of the commercial space below. Mirrored into the floor pattern, it draws a curved pathway which pulls one through each of the zones, revealing diverse vistas along the way (Figure 6). As it exits the volume of the main building – at two piazzas linking the old market and the new mall – this overhead ribbed structure wraps downward, merging into the facade to close the envelope [29].

Figure 6. Interior space of Mediacite atrium (Personal Archive).

5. CONCLUSION

This study attempts to reveal some principles which could help us deal with the question of creating a more responsive alternative modernity and at the same time a more negotiable ground between tradition and modernity in a historic city. Mediacite could be considered as a model which demonstrates an alternative approach to contemporary shopping architecture in a historic urban fabric.

Cities which have lost their old populace, could regain the former prestige of urban fabric with contemporary designs. However, instead of producing *timeless* and *non-place* designs like today's box-shaped enclosed shopping centers, these places should be a part of the urban fabric and unity as an enduring negotiation between historical background and present. Within this framework, the eastern traditional bazaar has kept its existence for centuries as a connective and continuous ground between past and future. Arad's attribution to the bazaar with respect to his modern design Mediacite can be interpreted from this aspect. Likewise, the concern of Arad in the topographical approach is to construct a more flexible ground for the negotiation of what is existing and what is new.

Mediacite, along with the new *Gare des Guillemins* (train station) by Santiago Calatrava and the opening of Grand Curtis – a mega museum housing gems from the heritage collections of liege – in 2009, are all drivers for economic redeployment and cultural-social regeneration within the Liege city.

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An Examination of the Characteristics of 19th Century Traditional Turkish House Gardens in Gürün (Sivas) District

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Abstract: *In Turkish culture, garden is a shared area with functional parts, which is shaped as a result of the reflections of culture to space. This formation has become more important with transition to social life and has led to the formation of different spatial arrangements in garden areas. The most important determining characteristic of a traditional Turkish house is that it is usually located in a courtyard or a garden. However, due to developing technology and increasing population, houses with these features have gradually decreased and they have begun to lose their original characteristics. In terms of transferring the national consciousness to the future generations, it is very important to ensure preservation and sustainability of traditional Turkish house gardens, which will enable access to historical and cultural accumulation and to create gardens with these qualities today. For this purpose; within the scope of the study, the concept of garden, its history, plan features and structural elements were specified and features of traditional Turkish house gardens of 19th century in Sivas-Gürün district were examined. The research emphasizes the change these characteristics experienced over time. As a result, the necessity of transferring the original qualities of the gardens to future generations and preserving traditional qualities were explained.*

Keywords: *Traditional Turkish house, Turkish garden, Plan features, Accessory elements, Gürün.*

Gürün (Sivas) ilçesinin 19. yy geleneksel Türk evi bahçe özelliklerinin incelenmesi

Öz: *Türk kültüründe bahçe; insanlar tarafından paylaşılan ve fonksiyonel alanlar içeren kültürün mekâna yansımasının bir sonucu olarak biçimlenmiştir. Bu biçimleniş toplumsal yaşama geçiş ile birlikte daha da önem kazanmış ve bahçe alanlarında farklı mekansal kurguların oluşmasına neden olmuştur. Geleneksel Türk evinin en önemli belirleyici özelliği genellikle avlu veya bahçe içinde konumlanmış olmasıdır. Ancak gelişen teknoloji ve artan nüfus nedeniyle bu özellikteki konutlar günümüzde giderek azalmış ve özgün karakterlerini yitirmeye başlamışlardır. Tarih ve kültür birikiminin günümüze ulaşmasını sağlayan geleneksel Türk evi bahçelerinin korunması, sürdürülebilirliğinin sağlanması ve günümüzde bu niteliklere sahip bahçelerin oluşturulması, millet bilincinin gelecek kuşaklara aktarılması için büyük önem arzetmektedir. Bu amaçla; çalışma kapsamında bahçe kavramı, tarihçesi, plan özellikleri ve yapısal elemanları belirtilerek, Sivas'ın Gürün ilçesi örneğinde 19. yy a ait geleneksel Türk evi bahçe özellikleri incelenmiş ve zamanla bu özelliklerin ne ölçüde değiştiği vurgulanmıştır. Bu çalışmalar sonucunda geleneksel niteliklere sahip bahçelerin özgün niteliklerinin korunup gelecek nesillere aktarılmasının gerekliliği ortaya konulmuştur.*

Anahtar kelimeler: *Geleneksel Türk evi, Türk bahçesi, Plan özellikleri, Donatı elemanları, Gürün.*

1.INTRODUCTION

As a social being, man has formed settlements in order to protect himself against the unfavourable climactic effects, secure his safety against the probable outer dangers such as wild animals and/or other people, and meet his basic needs such as sleep and rest. As the center of life, settlements have had a lot of different characteristics depending on the natural factors and particularly on the economic activities that are closely related to one's life style [1]. The traditional Turkish house has developed this way. All of them have a stone water basman with wooden beams and walls covered with straw and mortar. The main part of the building is located on the ground floor consisting of barn and warehouse. This floor has rooms and a kind of patio [2]. The Turkish house is like a functional machine. It answers all the daily needs of its users. The extended family within such houses included various grouping therefore each room was allocated to a sub-family. Elements like *cumba* or *çıkma* were also functional parts of the house. In this respect, all the materials and individual elements of the Turkish house had to be functional and simple rather than decorative or impressive [3]. These houses, which are closely related to the external environment, are generally located in a garden.

The origin of the word "garden" comes from Persian and means "small vineyard". Gardens are generally the places where herbaceous and woody ornamental plants with certain visual qualities, fruits, vegetables and herbs are grown; a garden is also defined as a piece of land where nature's beauty, green features and restfulness are controlled by human hands. Large or small scale, integrated with the environment, inland courts or gardens, are the spaces that are shaped by the characteristics of the region that reflects the living conditions, economic and cultural qualities of the societies during certain periods of history. In this sense, changes that people make and the variety of gardening arrangements have brought many differences to the tradition with respect to the emotional and formal aspects of gardening [4].

Anatolia's unique climate, geographical features, soil fertility and ability to grow many different plants made important contributions to the formation of Turkish garden style. However, due to the lack of a generally accepted, seated garden style over time, designed gardens have constantly changed in history. In addition, due to Western influence gardens that reflect Turkish characteristics gradually began to disappear [5]. This change has been experienced especially in 18th and 19th centuries, thus the original characteristic of Turkish garden art has changed with the influence of Renaissance and Baroque garden art since 18th century. In the middle of the 19th century, the Turkish garden art almost completely disappeared [6].

As the gardens have a dynamic structure, their characteristics are constantly changing. For this reason, Turkish gardens have lost their original features over time with some items being added or removed. However, there are some regions in Anatolia that still have the characteristics of Turkish gardens. One of these regions is the town of Gürün in the city of Sivas in present day Turkey. Its history dates back to ancient times and there are houses from Ottoman period that have been preserved as monuments today. For this reason, within the scope of this research, the garden areas of 8 houses from 19th century, which are considered as monumental gardens in Gürün, were examined. The plan features, structural elements, living and non-living elements of these gardens were investigated and the necessity of transferring these structures to the next generations was emphasized.

1.1. Historical Development of Turkish Garden

Despite nature being always on the agenda of the culture, the tradition of gardens is late in Turkey.
It is a fact that a Turkish garden cannot be transferred to our day with all its features [7]. Traces of the first Turkish garden in 5th and 7th centuries are found in Chu, Talas and Fergana regions, which are considered to be the oldest settlements in Central Asia. In these settlements, nomadic life continued with resident life

for about a century. Despite the existence of adjacent houses during this period, it is found in archaeological excavations that there were gardens and trees around the houses of seigniors [8]. In his study, Evyapan (1972) mentions the 2-3 km wide parks and gardens surrounding Samarkand. These gardens in the east were called "Bağ-ı dil Kuşe" and the gardens in the west were called "Bağ-ı Biheşet". If Central Asia is thought to have developed a common horticultural concept, it is emphasized that it is impossible to research the characteristics of the oldest Turkish gardens in Persian, Chinese and Indian gardens [9].

In 10th century, understanding of nature and garden has gained a new dimension with the acceptance of religion of Islam by a branch of Turks. For example, the idea of "Paradise Garden" which rises to the level of religious belief in the Eastern philosophy, is perhaps the most meaningful and perceptible one among its counterparts. As a matter of fact, the religion of Islam defines "Gardens of Paradise" in Qur'an, and there are encouraging remarks in this regard. Of course, these messages contribute to the creation of gardens resembling paradise in the world. Garden of Paradise is known as the four-parted garden conception, formed by the intersection of four rivers in heaven perpendicular to each other. In the middle of the two main axes, there is usually a garden pavilion which reflects the tendency to establish close contact with water [10].

During the Seljuk and Ottoman periods, main characteristics of Turkish gardens are seen in every garden, from the simplest to the most wealthy ones. After Seljuks became a power in Anatolia, Seljuk sultans built palaces with large gardens and courtyards. Those gardens and courtyards were built in places with plenty of water and designed with dense fruit trees and flowers like a paradise. Ottomans, who became an empire in Anatolia at the end of the 14th century, formed large-scale gardens, promenade sites, meadow areas, public natural parks and more inward mansions and residential gardens [11]. In Ottoman Empire, especially during the period of Suleiman the Magnificent, the garden and flower culture experienced a very bright period. This culture also have influenced Europe and was frequently mentioned by many European observers and artists. Turks were admired very much with respect to their gardens and flowers in Europe. It was frequently emphasized that there is a floral language among Turks and that every flower has a specific meaning [12]. These gardens show similarities and common features as a result of historical, periodical and cultural accumulation.

Ottoman gardens changed over time, depending on the empire's changing process. The Ottoman bourgeoisie discovering the unknown dimensions of urban and private life in the 18th century introduced the culture to new luxuries in many subjects such as reading, entertainment, eating, traveling, changing environment and aesthetics. The Renaissance and Baroque movements, which developed as a result of intercultural interaction and cultural accumulation in Europe, have also influenced Turkish garden culture during this period. Natural forms have been replaced by formal constructions; display and exaggeration were preferred. In these gardens, courtyards, water bowls, pools, fountains, all the architectural elements, the decorative elements and the formal design are remarkable.

In addition, plants have changed in parallel with these developments, and natural species have left their places to imported, exotic species. Until the mids of the 19th century, Ottoman visual taste was changed in the fields of architecture and garden design. It is not possible to find garden samples that remain intact today. The most important data about Turkish gardens are obtained from miniatures and engravings. According to Nurlu et al. (1994), the miniatures of Seljuk and Ottoman periods, garden is usually decorated with a pool, a pergola, a flower bed and a few trees. The characteristics of Ottoman gardens in different periods are briefly summarized below [13];

- From the establishment of Ottoman State until the conquest of Istanbul, there are traces of Seljuk art in gardens. Courtyard gardens stand out in this period. There is no symmetry in the courtyards. For the shade, plane trees, fence trees and nettle trees were used. The floors are covered with stone.

- From the conquest of Istanbul to the Tulip Period, it was possible to see the Ottoman garden concept in Topkapı and Üsküdar Palaces. Simplicity was in the front plan during this period.
- With the commencement of Tulip Period (1703-1730), planned gardens have began to take the place of the simple gardens. Similar to the gardens of the second half of the nineteenth century, the gardens of this period can really be considered as the extensions of nature with flower beds, pools and fountains under the large trees of the classical period and with their gabled and bridged roads that are furnished with pebbles as an imitation of an artificial nature. However, looking at the remnants of the 19th century gardens which have reached our day, the only items we can see are the pools, fountains, "Selsebil"s and roads surrounded by a series of trees [14].
- From Tulip Era to the declaration of the Republic (1730-1923); it appears that symmetrical axes and geometric arrangements start to take place in the gardens due to Baroque effect [15, 16].

In Republican period, importance was given to the construction of cities; urban spaces such as parks, gardens and urban squares were created within the framework of the new social structure. However, in the first years of the Republic, the care given to the preservation, continuity and reflection of the spatial uses of cultural heritage has left its place to the erosion of the culture, and because of rapid settlement and concrete consolidation, these cities have changed rapidly. As a result, nowadays, non-identity buildings and garden areas that ignore the cultural accumulation are formed.

1.2. Characteristics of Turkish Garden

Turks came and settled in Anatolia as nomads from a natural and unprotected life, therefore they have brought a great respect for nature too. This situation is clearly observed in the resident life garden practices in Anatolia. With the acceptance of the Islamic religion by the Turks, "Paradise Garden" has emerged as an ideal (Figure 1) [17, 5]. During this period, Turkish culture based on pure simplicity and tolerance was also reflected on the architectural and outdoor culture. The most important characteristics of this culture are simplicity, formal structure, quaternary system, plant and animal figures, geometric forms and ornaments and embellishments that come up with intersections. In gardens organized according to this understanding, flowing water, fountains and pools, flowering trees and fruit species are used. In Turkish-Ottoman gardens, there are generally alive and inanimate materials like four-cornered marble pools, shade trees and fruitful big trees, bowers with ivy and wisterias, terrace and stairs, water dispensers and jets, founts and lion statues which water floods of their mouths, rose gardens, tulip and fenugreek gardens. In the conception of Turkish – Ottoman gardens, the heaven description of Islam-as it is emphasized that heaven is a kind of garden in which there are flooding waters, big pools and waterfalls with different type of trees just like palms and vineyards-has a great role regarding the use of various kinds of alive materials besides water resistant inanimate materials such as pools, jets, dispensers, founts and statues which poor water out of their mouths. The desire of creating heaven in the world and adorning gardens with various animate and inanimate materials shaped the Ottoman gardens. In these gardens, the ornaments inlude alive elements such as platanus, fraxinus, tilia, ulmus, celtis, laurus and cercis as big trees as well as rose, tulip, hyacinthus and dianthus as plants [18].

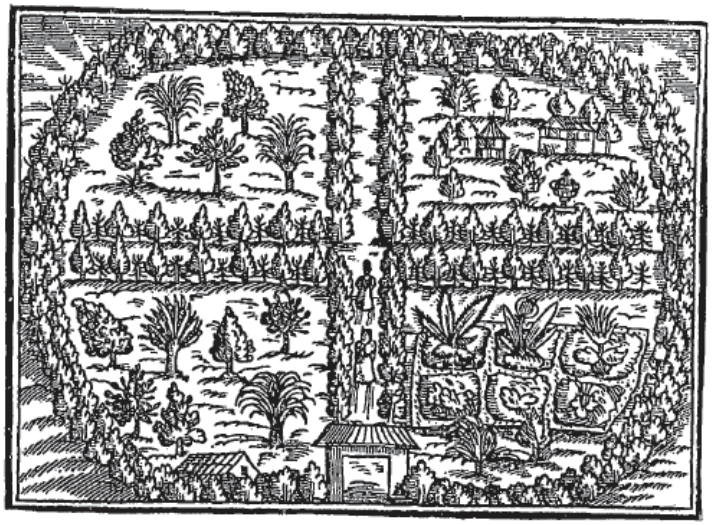


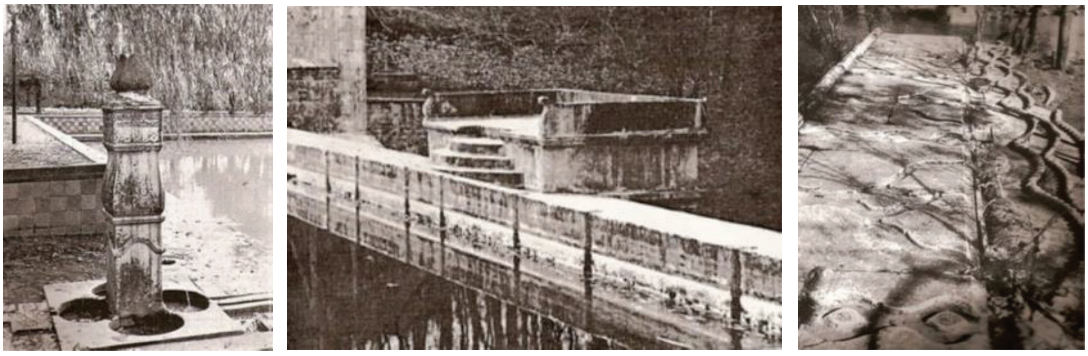
Figure 1. An example of Cihanbağ garden (Garden of Paradise) system [5]

Akdoğan (1995) emphasizes that using water for relaxation and music, using shadows for cooling and using flowers for color and smell are common main principles of Turkish-Islamic gardens. Generally, symmetry is seen in small gardens such as pavilions, palaces and yard gardens belonging to the Ottoman period. This layout was achieved by means of roads, flowers, walls and constructions. The garden is planned according to a main axis and the second axis around it. In the gardens where at least one side is open, at one end of the axis is the element which constitutes the counterpart of the natural element that is predominant in the composition especially in the pavilion. The inner garden is literally a living garden. For this reason, great importance was attached to the house and its surroundings[19].

According to Öztan (2004), gardens are grouped as promenade areas, public gardens, vine gardens, set gardens, inner courtyard gardens, waterfront gardens and palace gardens [20]. There are two types of gardens in Turkish culture that are completely different from each other in functional and architectural terms. First type of these gardens that are called the outside gardens, are large-scale recreational places integrated with nature. The second type of gardens are house, mansion and palace gardens which are integrated with the architecture, called inner gardens. Within the scope of this research, since the characteristics of the Turkish house gardens were discussed, features of the interior gardens were also mentioned. These are briefly summarized below:

- In the design of Turkish gardens simplicity stands out. Gardens are designed in harmony with nature.
- Importance of spiritual factors in Turkish culture is a distinctive feature for Turkish garden.
- As a remnant of the nomadic experience, great importance was given to the life outdoors. For this reason, in the selection of location, from the smallest houses to the greatest palaces, firstly the general position, the slope and the view of the land were considered [21].
- Generally, interior gardens have axle-based plans. Other gardens do not have a definite axle, and a design similar to nature is fundamental in these gardens [21].
- Sets and sofas are forms that have risen from the requirement of landscape earthwork. In areas where this obligation does not exist, the natural form of the land is preserved.

- The closeness of the inner gardens with their houses is one of the most noticeable features. This feature shows that the house and the garden are considered as a whole and that the horticulture is supposed to be a part of the house, which is reserved for the time spent outdoors. With a half open space in Turkish gardens called *Taşlık*, ideal connection between the garden and the building was aimed [17].
- In Turkish gardens, the garden floor would be left with natural coating or as soil. Areas close to the house and the prominent spaces such as pool and fountain areas are covered with stone, mosaic and similar materials [21].
- Plants are untouched and their natural forms are preserved. The art of pruning was only applied towards the end of the 18th century and merely to plants such as boxwood and thorn.
- In Turkish culture, the tree alone is holy and possesses personality. With the belief that a tree is sacred and is the symbol of nature in the culture, trees became important elements of the garden.
- Functionality is important in Turkish gardens. Trees used in the garden are selected according to its shade, smell and color characteristics. While dense trees are used at the border of a garden, attention was paid to the use of plants for shadow and visual purposes in the interior areas [22]. Plankwood, ash, linden, elm, nettletree, oak, laurel, julia and wild peer are the most commonly used tree species. In addition to other tree species, gardens also include fruit trees, vineyards and vegetable gardens [11].
- In Turkish gardening, flowers have a special place. No complexity regarding the color or the species is seen in fragrant and beautiful flowers [9].
- Water is a part of the garden that is never missing. Water surely takes place in the garden as sea, creek, pool and even in the most simple form of a fountain. Flowing or moving water is more preferred than still water.
- In Turkish gardens, water, floods, water bowls, stagnant and flowing waters are seen in rich forms [23].
- Lanscape and planting are effective parameters of ecological design and are composed of a pool, a well and a pump as well as the green areas that are located in the courtyards of the houses. These elements meet the requirements of the house as well as providing a space to enjoy the natural environment [24].
- Places in Turkish house gardens that are considered as part of the main garden area are; Courtyard or *Hayat* (i.e. Life), barn, alley, hunting area, vineyard, grassy field, lawn or rose garden, grove (a small wooded area formed by planting of local, big trees), croop, hothouse, "Tulip Garden", fruit garden, worship space, footpath, porch, loggia (place where top is covered and front side is open), vegetable garden, herb garden (flattened with stone), terrace or terraces (a flat area supported by a wall, obtained by soil or other material), landscaped or seperated ground "parterre" (a place to plant flowers in the gardens), pillow (a place prepared by thin soil and fertilizer for planting seedings). Accessories are; border, passenger stone, fountain [17] (Figure 2-a), *seki* (stone and mud set in front of houses for sitting) [17] (Figure 2-b), cascade (A series of small cascades) [17] (Figure 2-c), arbour, rotationally [25] (Figure 3-a), cascade [17] (Figure 3-b), cave, fountain, pool, sculpture, arbor, well-wheel, bird house, barbecue, mosaic, cooker, pergola, swing, fountain and so on [26].



a b c

Figure 2. (a) a fountain, (b) a terrace and (c) a cascade model from İstanbul [17]

a b

Figure 3. (a) a dönerce [25] *and (b) a cascade model [17]*

• Vegetable elements commonly used in Turkish garden designs are *Taxus baccata* (Yew), *Cupressus* sp. (Cypress), *Cedrus* sp. (Cedar), *Juniperus* sp. (Juniper), as leafy tree *Salix* sp. (Willow), *Acer* sp. (Maple), *Pistacia lentiscus* (Gumwood), *Tilia* sp. (Linden), *Laurus nobilis* L. (Daphne), *Magnolia grandiflora* L. (Large Flowering Magnolia), *Populus* sp. (Poplar) and *Washingtonia robusta* and *Phoenix dactilifera* as palm types. For design purposes, color and odor effect, usually shrubs, geophytes and perennial species are used. Intensively used bush, geophyte and seasonal species are *Rosa* sp. (Rose), *Camellia* sp. (Camellia), *Ligustrum* sp. (Privet), *Hydrangea* sp. (Hydrangea), *Narcisus* (Nergis), *İris* (Iris), *Tulipa* (Tulip) *Anemone* sp. (Anemone), *Antirrhinum* sp. (Snapdragon), *Chrysanthemum* sp. (Crysant), *Dianthus* sp. (Clove) and *Dahlia* sp. (Aster). In addition to the plants used for the designs of Turkish gardens, fruit trees were also used for providing privacy with its shade as well as for its smell and color effects and economic advantages for functional purposes. Due to their economic functions, the vegetable species were also included in the gardens, and seasonal differences were created by combining deciduous and evergreen species [4, 26].

2. MATERIAL AND METHOD

During the preparation of this research, firstly, the literature on the historical development of the Turkish garden, the plan features of the garden, the parts and the used living and non-living elements were investigated. Then, in the determined region, field surveys were conducted in May and June 2014-2015 and the garden formations of traditional houses belonging to 19th century were examined and verbal expressions of people were recorded. Photography and documentation are also among the conducted work.

As a result of the evaluations made, the characteristics of the traditional houses in Gürün county, courtyard and garden layout, typology, relation with garden space, garden landscape and change of garden landscape over time are emphasized. The results are of great importance for the fact that they carry a documentary nature in terms of rapidly degrading natural and cultural assets and will be a basis for a sustainable and conservational culture of historical environments. Moreover, the stduy emphasizes the necessity of preserving the garden areas in the traditional houses which are formed as a result of the fusion of the geography of Turkish nation and their own cultural accumulation, to be transmitted to the future generations.

3. FINDINGS AND DISCUSSION

It is stated that the history of the Gürün county, which is the subject of the research, extends to very ancient ages. Some even claim its history to date back to the Neolithic Age, 6000-5000 BC [27]. The district has been an important settlement center for many years with its natural beauties and its rich history.

Within the scope of this research, 8 houses from 19th century, which are considered to be monumental works in Gürün, have been examined. These are; Rüştü Köse House, Doruk Bey Mansion, Çiftçiler Mansion, Fuat Bey Mansion, Halise Saraçoğlu House, Hüsrev Bey Mansion, Talat Kırış Mansion and Şahin Moroğlu House. These houses reflect the characteristics of traditional Turkish houses of the 19th century with their facade features, plan type and positioning in the courtyard. These houses are usually one, two or three-storey, plastered, wooden carcass buildings (Figure 4). Materials used in interior and exterior details are a part of social life. Mostly, rubble stones are used on the ground floor, and mud bricks or various filling materials are used on the upper floors. The exterior facades are straw added mud plastered and the interior is lime plastered. Since attention is paid to family privacy, courtyard garden walls of the houses are built with wood-carved rubble stones almost up to the first floor level. It is not possible to see the interior of the house from the street. The windows are caged or covered on the upper floors, and the main entrance doors are usually double-winged.

Figure 4. Fuat Bey and Çiftçiler Residence (2015); traditional Turkish houses in Gürün

On the upper floors, the rooms open to the sofas and in some houses we can see “eyvan” between two rooms. Many old Gürün houses have wooden balconies or balconies with balustrades running alongside the “eyvan”. Family usually lives on the top floor of the house. The kitchen, bathroom, living room and the bedrooms are located on the upper floor. Due to functional reasons, warehouse, cellar, barn, haystack (alaphy) are always on the lower floor. Oven i.e. “tandır”, “aşgana”, sitting place, fountain, toilet and poultry are in the garden of the house. The gardens are located in the front, in the sides or behind the house in the form of a continuation of the courtyard. So the houses have turned into courtyards. Garden is for sitting, resting, cooling, producing, preparing food and cooking; there are fixed and portable equipments (stove, tandor, cedar, warehouse etc.) that meet these functions in the garden (Figure 5-a, b). For topographical reasons, sets are often found in the garden too.

a b

Figure 5. Examples of (a) ocak and (b) tandır in Gürün (2014); used for cooking and baking in the garden of the traditional houses.

In the traditional old Turkish cities, the neighborhood is the most important accommodation unit. The houses which are a unit of the neighborhood are formed of street, courtyard, garden, stony sofa and room plans respectively. This feature is the same for the houses examined in the field of research. The gardens are in the form of a garden with a courtyard and are generally square or rectangular. When you enter from the garden door, you first see the courtyard. This part is used as a transition area to the house or the garden (Figure 6-a). In the courtyards, stones, commonly known as raft stones, were used as flooring and these stones were arranged in a geometrical harmony. In addition, in a corner of the courtyards there are troughs created by carving stepping stones, or mortar stones (Fig. 6-b, c).

a b c

Figure 6. Examples of (a) a courtyard, (b) sal stones and (c) a basin (2014); seen after entering from the street doors of the traditional houses in Gürün

The gardens were often used as a gathering place for the household and for cooling and shade during the hot summer season. At the same time, gardens were also used for production purposes, and people usually grew vegetables and fruit. The walls of the house facing the courtyard have flower beds and the trees are on the edge of the garden for providing shade. In the gardens Mulberry (*Morus alba*), plum (*Prunus domestica*) and apple (*Malus domestica*) trees were grown as fruit types. Pepper (*Capsicum frutescens*), onions (*Allium cepa*), lettuce (*Lactuva sativa*) and parsley (*Petroselinum hortense*) were grown as vegetables. As flowers; roses (*Rosa* sp.) begonia (*Begonia* ssp.), carnation (*Dianthus* sp.), chrysanthemum (*Chrisanthenum indicum*), geranium (*Pelargonium zonale*), lily (*Lilium* sp.) and ivy (*Ipomoea purpurea*) species were included. In large courtyards, sometimes trees like poplar were found. There were also gazebos created with grape vines for shading purposes. The irrigation of the gardens was made with an arc system.

However, these houses, that are examined within the scope of the research, were also affected from the developing and changing technology. They have lost their original character during this process, especially because they have been taken into legal protection after 2000s. This change is reflected in the garden, which is an inseparable part of the house, as it is in the interior of the house. Understanding of a garden has changed over time, and it has begun to lose its old function. Fixed and portable fittings (stove, tandır, seki, stones etc.) in the gardens have been either removed or left ineffective. In some houses, instead of raft stones used in stony grounds, concrete material which is easy to clean is preferred. Due to the less importance given to agriculture and animal husbandry, planting-gwowing activities in gardens have also decreased. In addition, according to the needs of the households, the architectural patterns incompatible with the architectural texture were also encountered (Figure 7). These practices show the distance from the traditional culture.

Figure 7. In Gürün, the building constructed in an incompatible manner with the architectural texture in the garden area of Hüsrev bey Residence (2014)

4. CONCLUSION

With the 18th century Westernization process, the Turkish garden culture began to have deformation, and in 19th century, it began to lose its own characteristics. Anatolian houses which are still preserved, have been studied and the garden characteristics of these houses have been examined. According to this, in Gürün houses with traditional characteristics;

- The garden is a "courtyard" garden and has a square or quadrangular shape.
- The garden, which has a courtyard and an extension, is an intermediate space which provides transition from general space (street) to the private place.
- The gardens are functional and everything is designed according to human needs. Significant spatial units within the garden have been formed to respond to this functionality in the examined houses (ashgana, cellar etc.).
- The garden is the social interaction area of the family. It is also the area used for gardening, recreation, cooking, eating, storage, agricultural production and defense. The garden is a special place for women because of the status of women in society and privacy.
- The garden is an extension of the courtyard and forms an integration between the house and the open space. The gardens are located at the front / side or back of the house.
- For topographic reasons, there are cascading forms in the gardens.

Reflecting the characteristics of Turkish garden, the gardens of traditional Gürün houses have evolved as a unique space concept as a result of cultural accumulation, religious influences and local environmental conditions. However, rapidly changing and developing living conditions modified garden layout in the traditional houses of Gürün. Especially due to intensive population growth, abandonment of crowded family life and developing technology, gardens have started to lose their functional characteristics. Changing living conditions have modified livelihood type, and since the agricultural production and livestock are almost abandoned, the functional structures in the garden (such as ashgana, cellar, poultry house, barn or farm) have also been removed or used for a different function (warehouse etc.). In the same way, reinforcement elements (cedar, slab, pebble, stone, trough, stove and tandoor, etc.) in the garden are either raised or left useless in a corner of the garden.

However, it should be kept in mind that these structures which are the living witnesses of the past, are a treasure that provides continuity between generations. To protect historical buildings and historical environments, restoration according to the original form must be facilitated and the sustainability must be ensured by taking the balance of protection and use into consideration. It should not be forgotten that regardless of the works reflecting cultural and architectural values in contemporary societies, they should be evaluated together with their surrounding green spaces. For this purpose, it is of great importance to protect and transfer the garden spaces, which are an inseparable part of the traditional Turkish house, to the future generations.

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Parametric Approaches to Innovative Jewelry Design


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Abstract: *This study aims to investigate the general usage of parametric modeling feature of computerized design which is used in innovative jewelry design, to examine the use of parametric design in the jewelry design field and to produce new ideas by comparative analysis.*

Keywords: *Design, jewelry design, 3D modelling, parametric design, parametric jewelry design*

Yenilikçi Takı Tasarımına Parametrik Yaklaşımlar

Öz: *Bu çalışma inovatif takı tasarımında son derece etkin bir biçimde kullanılan bilgisayarlı tasarımın parametrik modelleme özelliğinin genel kullanımını araştırmak, parametrik tasarımın takı tasarım alanında kullanımlarını incelemek ve karşılaştırmalı analizlerle yeni fikirler üretmeyi amaçlamaktadır.*

Anahtar kelimeler: *3 boyutlu modelleme, parametrik tasarım, takı tasarımı, parametrik takı tasarımı*

1. INTRODUCTION

The computerized design has started to be used in all the fields of design in today's world. Due to its ease of use and the reducing effect on the margin of error, it is preferred by many designers and has started to make its own promise in many areas of handmade design. For computerized design, it can be said that the old type handmade craft has turned into a new generation of crafts by adapting to the conditions. Tools such as hammer, anvil, saw were replaced by mouse, keyboard, drawing tablets and computerized design programs. In addition to this, in modern design methods, parametric design started to have a special place in architecture and product design. With parametric modeling, it is very easy to make changes by controlling variables on the final product.

2. COMPUTER AIDED DESIGN

Computers have been in use for more than 40 years in architectural design. However, it has not been a long time since the development of the concept and creative design phases [1]. A wide variety of computer-aided design programs have currently been in use, and these programs differ in terms of both the interface and the followed process steps [2].

Computer-aided designs can be modeled with one of the three-dimensional design programs. Also, they can be scanned by three-dimensional models that are made with any kind of material [3].

Computer-aided design is the first step of copying and duplicating the product by using a computer. With the design that is made in the computer environment, the designer can prevent all the negativities which may occur in the physical environment, thus the designs are completed perfectly in the virtual environment prior to transferring the models to real materials [4].

2.1. History of Computer Aided Design

Until 25 years ago, almost all of the drawing operations were made on paper. Minor changes on the models were mean redrawing. Basically, it was necessary to make a design from scratch for the big changes. Computer-aided drawing tools have completely changed this tradition [5].

With computer-aided design, two-dimensional drawings, plans, sections and views, three-dimensional modeling and models, animations and photorealistic images have become easily prepared expression techniques. Computer-aided design has gone through a difficult process to reach the conditions it has today [6].

The history of computer-aided design is thought to have been based on Vannevar Bush's imagination of a device that can provide information to people in 1945. He named this device as Memex.

In 1956, after computers entered commercial life, Fortune magazine defined the machines which have graphical input and which can display three-dimensional objects with multiple window indicators as Computer Aided Design i.e. CAD. These machines are the basis of today's machinery [7].

2.2. Development of Computer Aided Design

Although CAD applications were described in the 1950s, interactive computer graphics were first discussed in 1963. This system has been called “The Sketchpad System” with illuminated pens that are developed to be used along with the system [8].

In the late 1960s, computers were begun to be used in architecture offices, however, the second generation CAD systems emerged in the 1970s. A graphical user interface was developed with a mouse and window system by Macintosh. In the 1980s, before AutoCAD’s release, applications such as VarseCAD and CADkey were used for meeting market requirements [9].

The impact of the fourth generation of computer-aided design software has been on personal computers. During this period, the computers were still very low-power and simple-equipped but providing a basis for the fifth generation of software. In 1990, the construction sector was hit by computer and electronic communications. Digital design information has started to be sent over the internet in this period.

2.3. Computer Aided Design at the Present Time

Nowadays, the software that is used in the design process varies according to preferences as well as project requirements. Different software can be used during the sketch and the presentation stages. Vector-based, object-based, NURBS (curvilinear forms) and three-dimensional solid modeling software are used during the sketch and presentation stages of the design process.

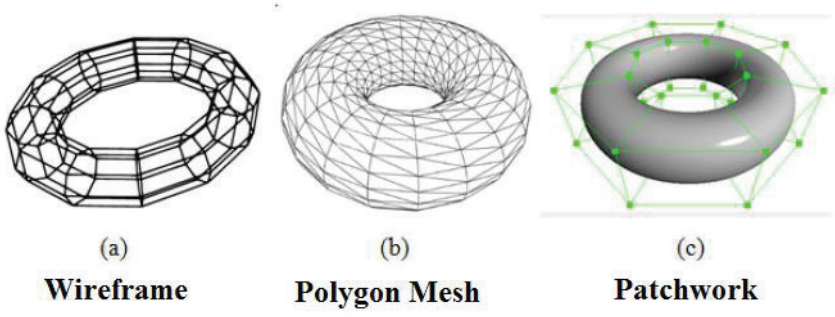

Figure 1. Three-dimensional design impressions

3. PARAMETRIC DESIGN

As a method, parametric design means a situation where the design process can be led depending on some variables. The desired product can be entered in the computer and the form is determined, then it is possible to make endless changes over the specified form. Thus, multiple variations can be produced from a single product.

3.1. History of Parametric Design

In 1978, Hillyard and Braid proposed a system where the geometric shapes between the coordinate components could provide a limited variation between certain tolerances. This proposal did not bring a major change to the current perspective. As Gossard Light refers to this situation as a basis of its own, it gives a reference to a more mature definition of parametric design.

In the late 1980s, there was a growing demand that geometric modeling, free-form surfaces, and solid modeling should be improved with respect to the ability of modeling techniques and the ability to change a model when the main techniques of solid modeling are assimilated.

In 1985, Professor Samuel Geisberg founded the Parametric Technology Foundation. In 1988, the development process of parametric design has been started with the development of the first commercially successful parametric design program Pro/ENGINEER.

3.2. Development of Parametric Design

In computer-aided design, the main problem is that some intuitive information about a machine can be interpreted and applied by the machine automatically [10]. This has created boundaries in parametric design. These limits began to emerge in 1963 in Sutherland's groundbreaking work. Many attempts were made to solve the problem of geometric limitation in an efficient and powerful way, but none have succeeded. Ge and colleagues (1999), Essert-Villard and colleagues (2000), Li and colleagues (2002), Aoudia and colleagues (2010) have tried different methods to improve this issue and tried to expand these limits [10].

During the development of parametric design, especially in the late 1980s, as geometric modeling, free-form surfaces and solid modeling techniques have become more common, it was thought that modeling techniques should be more interactive and changes should be made after a design.

Two topics have been drawn on this subject, one of these is increasingly less used and the other one draws the attention of the researchers. One of these is the programming of variables or the static generation of possible models, and the other is the systems that allow the change of size and constraints after the production of more complex models.

In the development of the parametric design process, new concepts were introduced, such as procedural modeling, history-based restriction modelers, variable geometry modelers, rule-based variable modelers and quality-based modeling, and parametric design continued to evolve [11].

4. APPLICATION AREAS OF PARAMETRIC DESIGN

Parametric design is applied in many areas in today's world. Especially, the use of parametric design in the architectural field is increasing. Apart from home decoration, furniture, accessories, jewelry, and clothing in many areas of the parametric design stand out.

4.1. Architecture

Although the idea of producing ideal cities with established principles and logical steps is based on the invention of the computer, their designs create networks between the sub-systems within the city and allow change. Parametric design techniques have also facilitated this approach [12].

The computerized modeling and design methods developed in the analysis of complex projects enable mathematical and parametric modeling. With the parametric models, the architecture allows architects to quickly and precisely change certain parameters instead of seeking alternative solutions for days.

For example, the correct form of the Swiss-Re building can be achieved in a scaled, complex and interrelated geometry in the context of regular restrictions.

Figure 2. Swiss-Re building

4.2. Urban Transformation

If we go through the Kartal-Pendik urban transformation project designed by Zaha Hadid Architects, it aims to reduce the burden of the old city by creating a city center in a 55-hectare area which is suitable for all kinds of buildings within the city. The importance of parametric design is very significant in the design of the texture and the design of the roads.

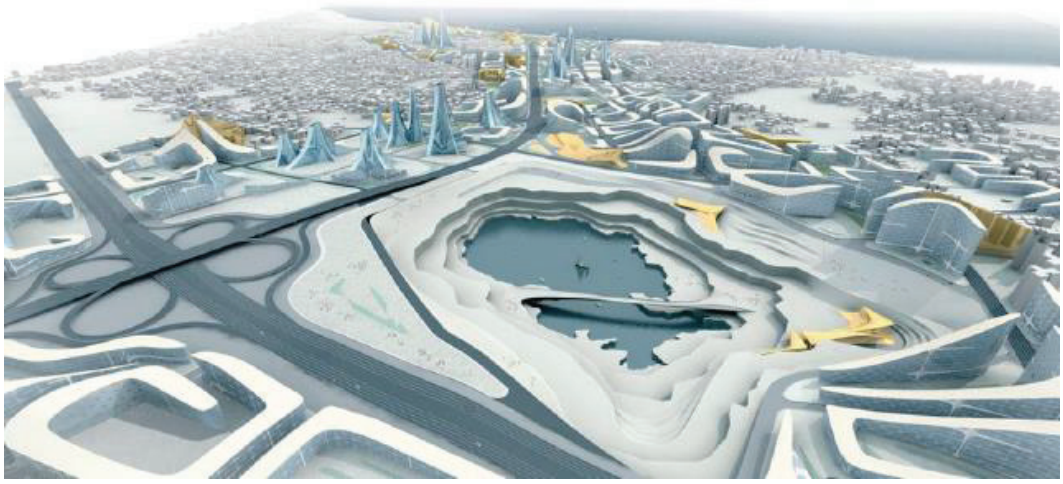

Figure 3. Kartal-Pendik Urban Transformation Project, Final Image, 2009

4.3. Home Decoration

In the home decoration industry, which goes to modernization in line with changing supply and demand, the place of parametric design continue to growing.

Figure 4. Parametric Seating Unit

Almost every part of the home decoration, especially the seating units, can be seen with the products prepared with parametric design. It is also possible that parametric design will be used more in the future with changing dynamics.

4.4. Accessories and Jewelry

With the increase in computer-aided design and developments in jewelry design and manufacturing sector, the use of parametric models and modeling is becoming increasingly widespread.

Designers can use new parametric design tools to achieve more modern and different looks, develop new ideas or bring new perspectives to traditional design ideas.

5. APPLICATION OF PARAMETRIC DESIGN IN JEWELRY DESIGN

Parametric design methods which have been used in many design applications can also be used effectively in jewelry design. This can be by introducing new design ideas or adapting existing designs into new and different designs by using parametric design tools.

5.1. Examples of Parametric Jewelry Design

The most used type of parametric design in jewelry is the texture studies in ring and necklace modeling.

Figure 5. Parametric design ring

By using parametric design, designers can prepare a specific model and then create changes and differences in parameters that can produce many different models effortlessly.

This also helps the designers to try all the new ideas in their mind and see them in the computer before they finish their model completely.

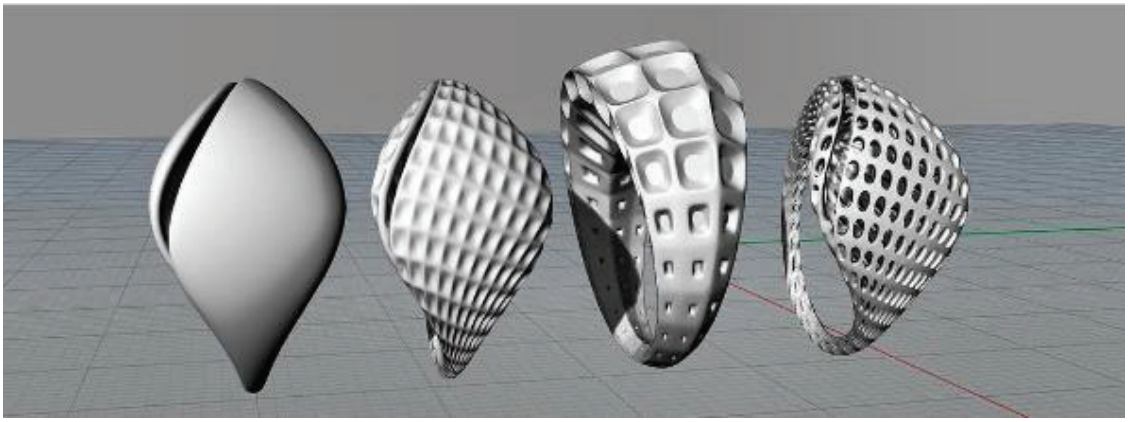

Figure 6. Differentiating the model by using different parameters

With parametric design methods, the designer can add different parameters while preparing a model. Then the designer can change the location and direction of these parameters and work on getting the desired result.

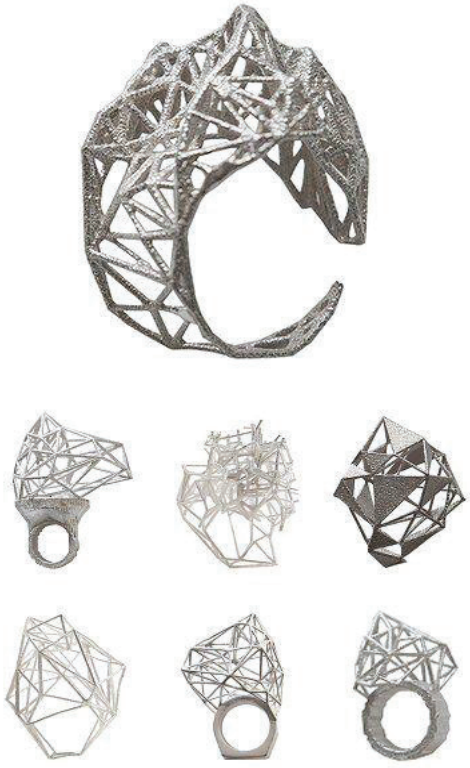

Figure 7. Types of parametric jewelry using different parameters

5.2. Parametric Jewelry Design Ideas for Future Application

It has not been ignored by many companies that the parametric design has become increasingly widespread and has a different impact on the jewelry sector with its modern appearance.

Many companies have been using the different variations of the old models from their catalog for the new season models and utilize different types of products that they sell.

With the parametric design, even the most sold and most popular classic models can be modified to be brand new. Even models such as Snowflake, Heart, Eternity, Angel Wings, Dragonfly can be reshaped with parametric design.

Figure 8. Best seller necklace models

Also, some companies use the hollow structure of the parametric design to produce larger parts and bigger products using less material. The most prominent example of this is the bracelets produced by Nusret Jewelry , which are specially preferred by Arabic countries.

Figure 9. Nusret Jewelry Fusion Bracelet

Other companies have also seen this change in the jewelry as well as jewelry sector, and they have begun evaluating the materials they have in order not to remain alien to their market and try not to fall behind these innovations by carrying out R&D studies.

6. CONCLUSION

After the development in the use of computerized design, the designers first started to move the models they designed in their heads to the computer environment. After that, they continued to develop themselves by using the variable parameters with the development of the parametric design concept.

Thanks to the parametric design, the changes that are made on a model enable different designs to be easily prepared by only entering the variables differently without the need to make the whole model from scratch. In this way, the amount of consumed time and energy is reduced whereas the productivity i.e. the number of products is increased.

The world of infinite possibilities and differences of parametric design can be the salvation of the jewelry and jewelry sector which happens to be in a difficult situation now. First of all, thanks to the parametric design, the designs using hollow structures provide less product weight and require less material, thus the designs can be sold at cheaper prices.

Another reason is that the products sold in the world of jewelry design are generally certain and people do not stop choosing these models. Using parametric design methods, it is possible to add another look to the products that sell well and always sell, such as the sign of infinity, angel wing, snowflake, four-leaf clover, dragonfly and heart. These products can be prepared with new textures that are prepared using parametric design and modeling. This can increase the chances of selling different and new forms of these models.

It can be predicted that the use of parametric design will increase in time in the jewelry design sector. One reason for this is the increasing modernization in jewelry design. Another reason is that people prefer personalized products. Personalized jewelry design with parametric jewelry design allows consumers to choose their own preferences.

In any case, it can be said that parametric jewelry design products will be seen more on shelves in the future and people will pay more attention to parametric design.

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Design and Analysis of Reinforced Concrete Buildings with Base Isolator


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Abstract: *In this study, the behavior of the base isolation system and the classical fixed based building system were investigated. The rules taken into consideration during the design phase are taken from the 2018 Turkish Building Earthquake Code. The results of the building model which was designed in two different ways with base insulators and built-in supports, were compared. In the first model, 7-storey hospital building is designed and modeled as fixed base support. The same building is then designed with Lead Rubber Isolator. In the time-history analysis, the acceleration records of the earthquakes were performed. The results obtained from the analysis of time-history were compared in tables and graphs.*

Keywords: *Base Isolation System, earthquake regulations, forces, earthquake resistant design*

Taban İzolatörlü Betonarme Binaların Tasarımı ve Analizi

Öz: *Bu çalışmada, taban izolatör sistemi ve klasik ankastre mesnetli bina sisteminin davranışı incelenmiştir. Çalışmamızdaki bina tasarımında dikkate alınan kurallar 2018 Türk Deprem Yapı Yönetmeliğinden alınmıştır. Çalışmada, taban izolatörlü ve ankastre mesnetli olmak üzere iki farklı şekilde tasarlanan bina modeline ait sonuçlar karşılaştırılmıştır. İlk modelde, örnek olarak tasarlanan 7 katlı hastane binası ankastre mesnetli olarak modellenmiştir. Aynı model daha sonra kurşun kauçuk izolatör ile tasarlanmıştır. Daha önce meydana gelmiş depremlere ait deprem ivme kayıtları kullanılarak zaman tanım alanında analizler yapılmıştır. Zaman tanım alanında analizden elde edilen sonuçlar tablo ve grafiklerle karşılaştırılmıştır.*

Anahtar kelimeler: *Deprem izolasyonu, deprem yönetmeliği, depreme dayanıklı tasarım*

1. INTRODUCTION

In the earthquake prone areas, base isolation technique is one of the alternative methods for reducing losses. Base isolation involves decoupling the structure from the ground by use of a material, which has very high vertical stiffness but relatively low horizontal stiffness thus allowing the building to move easily in horizontal direction. This concept has become reality within the last 30 years.

A civil engineer's main goal in seismic design of buildings is to limit inter-story drift and floor acceleration. While a large floor acceleration may damage nonstructural components in the building, a large interstory drift during an earthquake causes damages in the structural components of the building. The interstory drift can be reduced by designing a more rigid structural system. However, this will lead to a high floor acceleration. Base isolation technique may reduce both interstory drift and floor acceleration at the same time. In this system, all the deformation is concentrated in the isolation system with the first dynamic mode of the structure. By this way, fundamental period of the building is shifted longer than the fixed base counterpart and that of the ground motion. At the same time, the direction of the earthquake forces are deflected through the dynamics of the system and their effects are reduced.

In the present paper, the seismic response of a base isolated and fixed base reinforced concrete building is investigated.

2. SEISMIC ISOLATION

Seismic isolation application is one of the important and new technological design methods developed by the structural engineers, aiming to reduce the earthquake forces that will affect the superstructure and thus protect the important structures such as hospitals, bridges, viaducts and energy structures that are required to be used immediately after an earthquake.

Base isolation method involves the principle of allowing the transfer of some part of the motion energy reaching the foundation of the structure with the ground shaking during the earthquake to the superstructure system. In general, this is done by means of advanced technology devices placed between the basic system of the structure and the superstructure. Although the theoretical knowledge of the method is quite old, the techniques related to its implementation are still in development stage. However, especially in recent years, applications for this type of construction method have gained momentum in the developed countries of the world. Though very few, some theoretical research and practical applications are also available in Turkey [1,2,3,4,5].

In summary, seismic isolation application technique and working principles are as follows: the structure is separated from the horizontal components of the earthquakes movement by placing an insulated high lateral rigidity isolator between the foundation and the superstructure. The base isolator unit having low horizontal stiffness, makes a large displacement in the horizontal direction and the earthquake energy is largely damped here. The superstructure moves in block form, however the displacement that occurs therein remains in the permissible limits.

Base isolation systems are divided into two main groups: rubber bearing and sliding bearing systems. The multilayer rubber-based base isolation systems are used all around the world. This system consists of steel plates as well as rubber elements and is generally in the form of layers. These systems are manufactured to provide the horizontal direction damping and vertical direction stiffness at the same time. Rubber materials have flexible behavior and great damping properties. Typical section of rubber bearing is shown in Figure 1.

The friction pendulum system is an improved friction seismic isolation technology to improve the seismic isolation resistance of structures. The friction pendulum isolator has a sliding material on the spherical surface made of non-corrosive steel. The part of the jointed slide contacting the spherical surface is covered by a low friction composite material. When the slide moves on the spherical surface, it increases the load being transported and provides a return force to the system. In this system, energy consumption is caused by the friction between the articulated sliding and the spherical surface. Typical view of sliding bearing is shown in Figure 2.

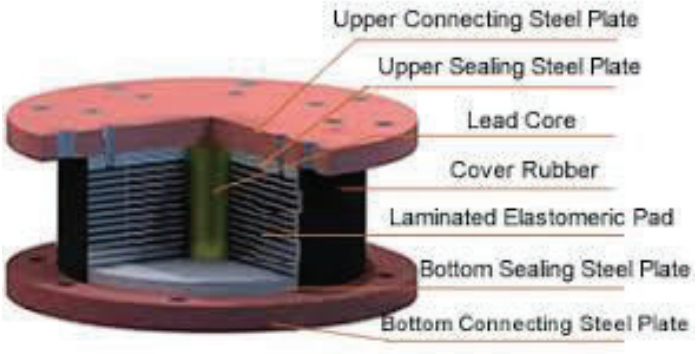


Figure 1. Rubber bearing [6]

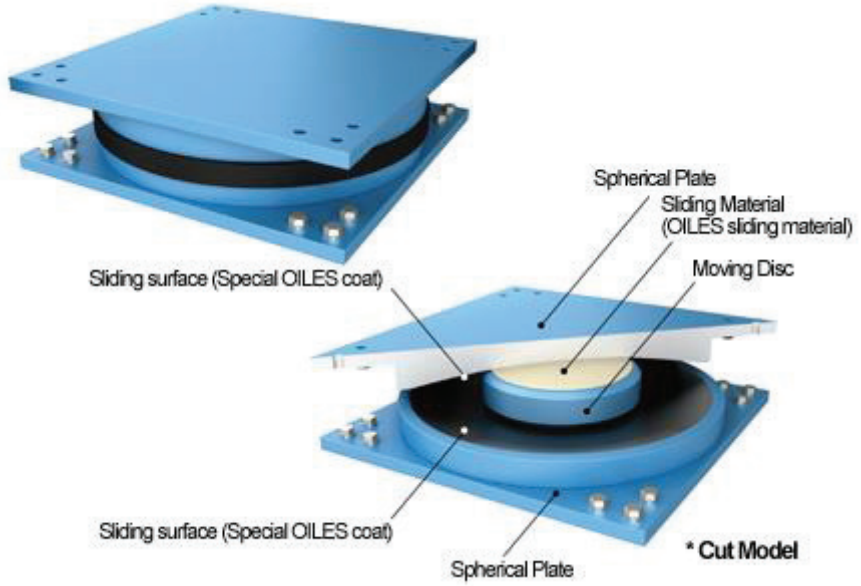


Figure 2. Sliding bearing [7]

Current study investigates the effect of buildings on earthquake behavior by using a rubber base isolator system.

3. CHARACTERISTICS OF THE BUILDING

In this study, the effects of base isolators on the behavior of a building were investigated. A reinforced concrete building with seven floors with a total height of 21 meters was first designed without isolators (fixed base) and time-history analysis was carried out. The same model was designed again with rubber isolators between the foundation and the ground (base isolation), where each floor was 3 meters high. The architectural floor plan and 3D view of the model is given in figures 3 and 4 respectively. The building model stands on an area of 40 m x 19 m. The general properties of the model are as follows:

- The type of used concrete is C35, steel is S420.
- The column dimensions are 80x80 cm, beams 30x60 and the slab is 15 cm thick.
- The model is assumed to be located in first degree seismic zone of Turkey.
- It is assumed that the local soil class is ZD.

- In the base isolation system, 24 lead rubber isolators were placed under the columns between the foundation and ground floor.

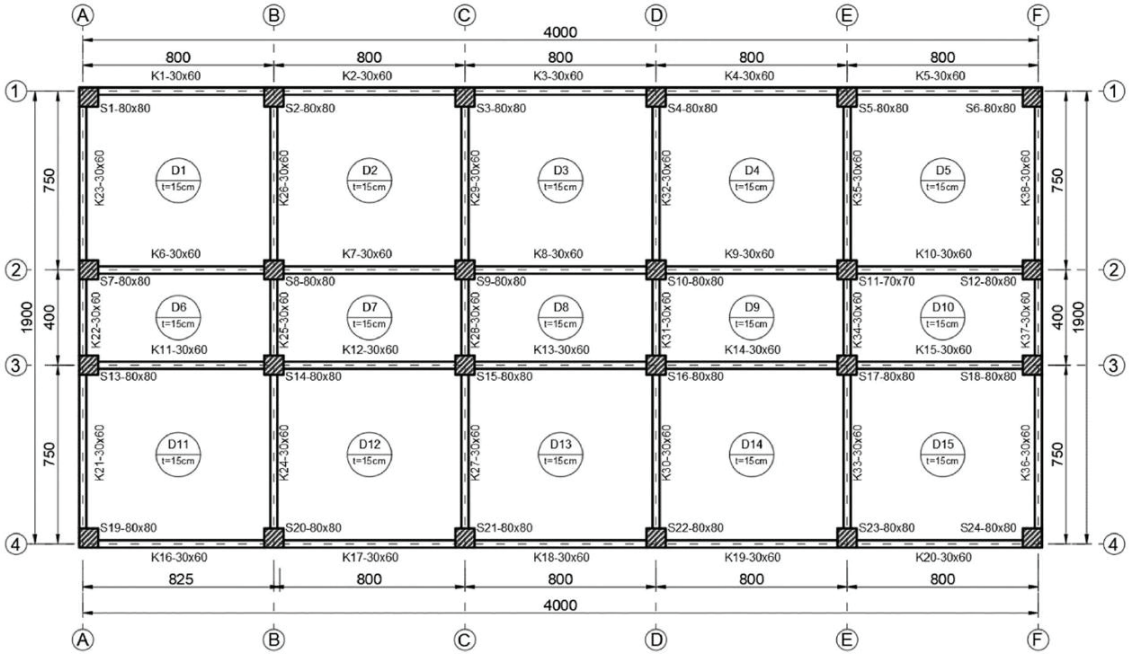


Figure 3. Floor plan of the building

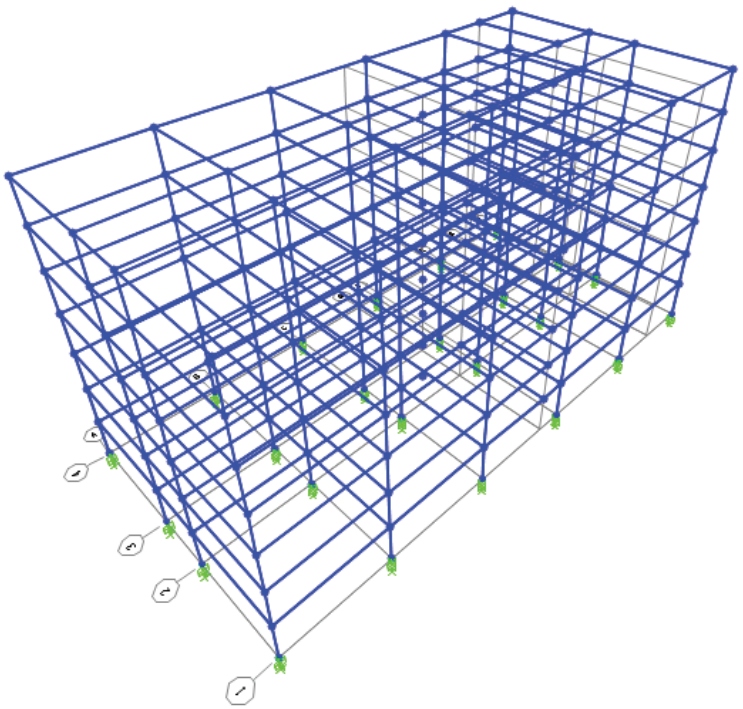


Figure 4. 3D Analysis model of the building

2. EARTHQUAKE ACCELERATION RECORDS

The earthquake acceleration records used in time-history analysis are shown in Table 1 and Figure 5. Table 1 shows the names of the earthquakes, epicentral distance, shear velocities of soil, the years of the earthquakes and their magnitudes. Figure 3 shows spectra of the recorded accelerations.

Table 1. Selected earthquake records

No	Station	Year	Magnitude (M)	Distance (R)	V_{s30} (m/sn)
1	Imperial Valley	1979	6.53	10.45	231.23
2	Manjil	1990	7.37	63.96	348.69
3	Morgan Hill	1984	6.19	11.53	221.78
4	Landers	1992	7.28	68.66	328.09
5	Big Bear	1992	6.46	34.98	296.97
6	Hector Mine	1999	7.13	73.55	339.02
7	Chi-Chi	1999	6.20	21.62	258.89
8	Denali Alaska	1998	6.5	15.45	224.35
9	Ferndale City Hall	1982	7.5	10.55	242.65
10	Lenah Valley-6	1989	7.1	18.45	340.35
11	Amp chi	1998	6.5	25.56	300.45

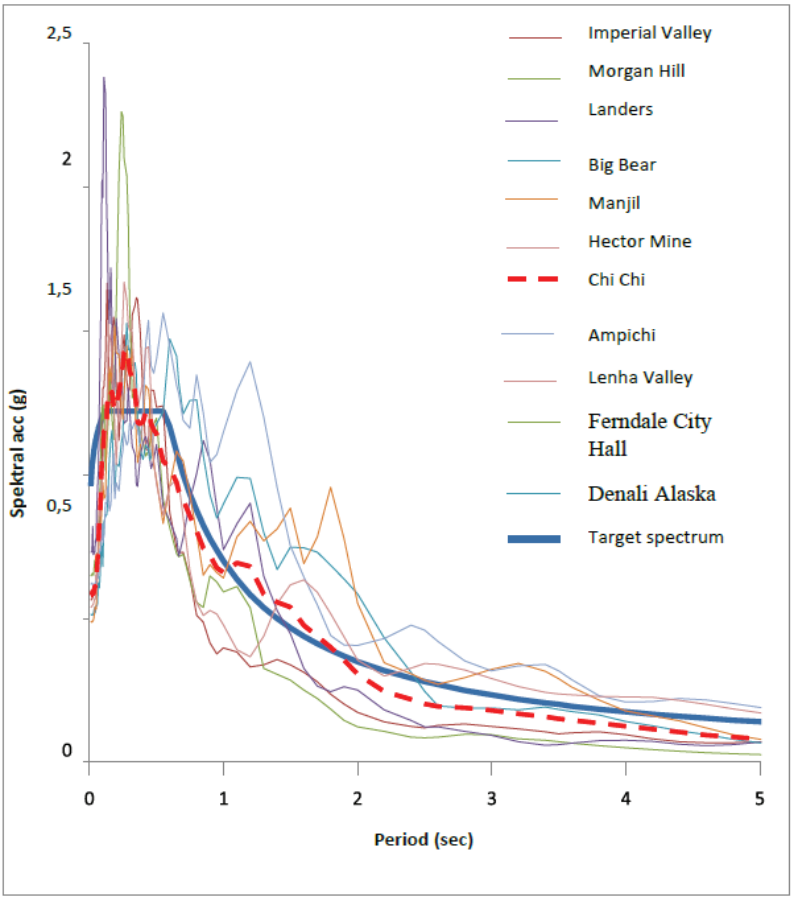


Figure 5. Earthquake spectrum and target spectra of the earthquakes

3. LEAD RUBBER ISOLATOR PROPERTIES

The type of the isolator used in this paper was obtained from the manufacturer Dynamic Isolation System [8]. The properties of the isolators are shown in Table 2. Several iterations were carried before determining the maximum displacement. They are capable of making 215 mm displacement in the horizontal direction.

Table 2. Lead rubber isolator properties

Lead Rubber Isolator	Value	
Isolator diameter, B	550	mm
Diameter of lead core, BL	150	mm
Stiffness modulus, Gv	0.7	N/mm^2
Thickness of each layer,rubber,t	10	mm
Strength, FQ=	126000	N
Total height of rubber layers,Tr	150	mm
Vertical stiffness, kv	629774.7	N/mm
İnelastic stiffness, k2	1026.254	N/mm
Elastic stiffness,k1	10262.54	N/mm
Strength ,FQ	126000	N
Effective stiffness,ke	1553.695	N/mm

4. COMPARISON OF ANALYSIS RESULTS

In the first phase, the building was designed as fixed supports and then as base isolator. The results of the analysis are given in tables and figures. Period, floor displacement, inter-story drift, floor acceleration values obtained from both analyzes were compared.

4.1 COMPARISON OF PERIODS

As a result of the analyses, it was seen that the periods of the base isolated building were longer than the fixed bearing building periods. In particular, the first period of the building was determined to be about 2 times higher (Fig. 6).

4.3 COMPARISON OF FLOOR DISPLACEMETS

In the examined building, it was observed that the building with fixed bearing made less relative displacement than the isolated building in general. It is understood that the biggest displacements in the two buildings occur on the top floors, and the earthquake effect on these floors is great. It was determined that the biggest displacement in the isolated building was at the base level where the base isolator was placed (Fig. 7).

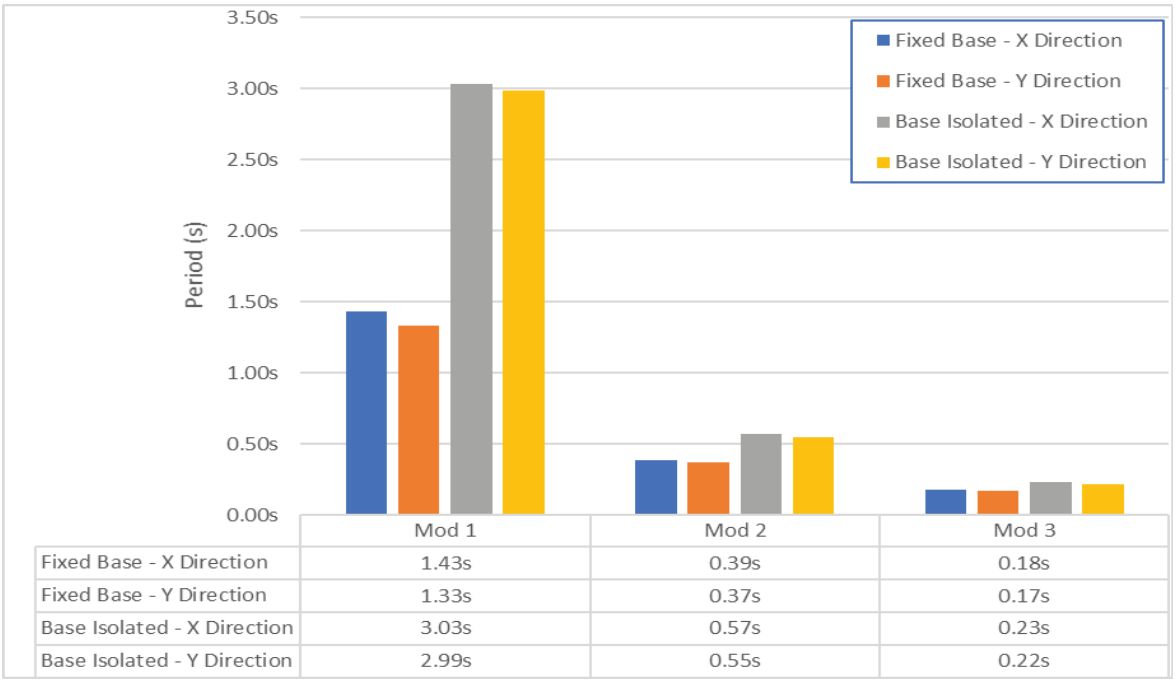
4.4 COMPARISON OF INTER-STORY DRIFT RATIO

When inter-story drift ratios are examined, these values are very low in the top floors of the base isolated building compared to the fixed base building. Therefore, the earthquake damage to the structural elements of the building with base isolation is expected to be minimal. Due to the inter-story drift ratios in the fixed base building, great damage may occur in the structural elements. The base isolation system has allowed the building to be rigid. As a result, inter-story drift ratios are very low in this building (Fig. 8).

4.5 COMPARISON OF FLOOR ACCELERATIONS

Reducing floor accelerations is important to prevent damage to items and valuable equipment inside the building. As seen from the results, the floor accelerations of the base isolated building are very low compared to the fixed supported building. In the building with base isolator, the acceleration value of the

top floor was 4 times lower in the x and y direction than the fixed supported. Since the effects of earthquakes are accelerated in the building with base isolator, the damages in the equipment in the building can be prevented (Fig. 9).



	Mod 1	Mod 2	Mod 3
Fixed Base - X Direction	1.43s	0.39s	0.18s
Fixed Base - Y Direction	1.33s	0.37s	0.17s
Base Isolated - X Direction	3.03s	0.57s	0.23s
Base Isolated - Y Direction	2.99s	0.55s	0.22s

Figure 6. Comparison of periods of building

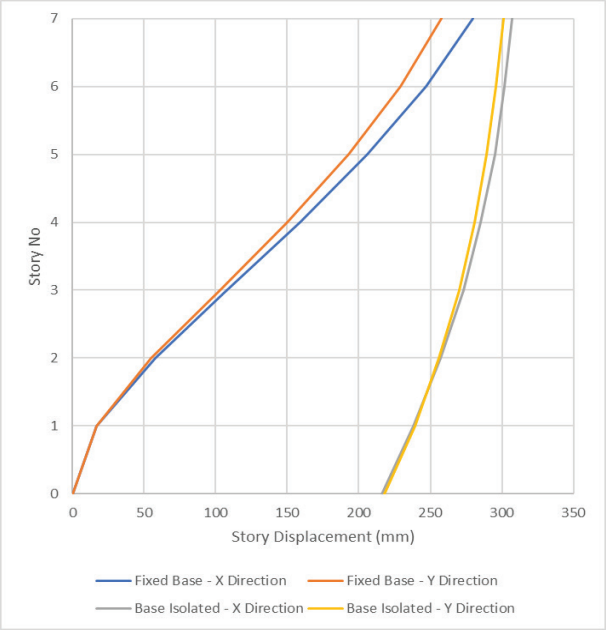


Figure 7. Comparison of floor displacements

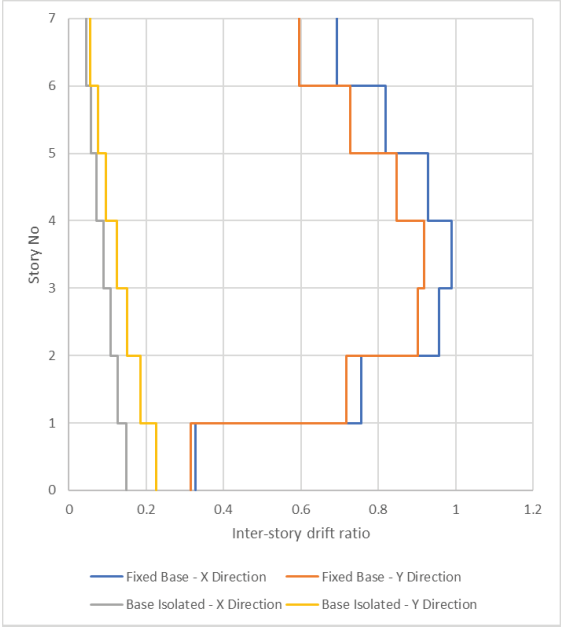


Figure 8. Comparison of inter-story drift ratio

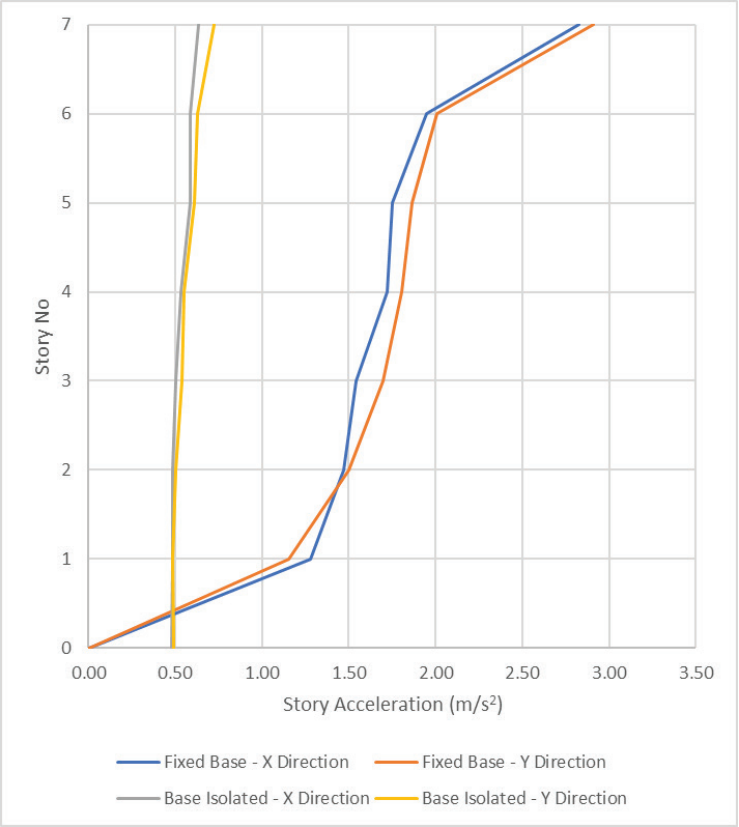


Figure 9. Comparison of story acceleration

4. CONCLUSION

In light of the analyses carried out in the paper, it is observed that Base Isolated building behaves independently from its foundation. The building moves together as one rigid body different from the fixed based building.

The periods of isolated buildings are long and therefore frequency of the vibration of the floors are reduced. The fixed base buildings are subjected to higher floor vibration because of their short periods.

The floor displacements of the base isolated building are generally more than the displacements of the fixed base building, however, the inter-story drifts are small compared to the fixed base building. Therefore, the structural elements of the base isolated building are not harmed by seismic forces.

The floor accelerations of the base isolated building are low because the effect of seismic force is reduced by isolators' movements changing the direction of seismic forces. This is important since the sensitive materials in the building are not going to be harmed as long as the floor acceleration is low.

Based on these results, it is concluded that the isolators should be used in the construction of important buildings such as fire fighter stations, communication buildings, airports, bridges, police headquarters, historical buildings, hospitals and buildings that contain important material and machines, which are located in earthquake prone regions.

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