New Horizons in Architecture, Planning and Design

2019

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Prof. Dr. Latif GÜRKAN KAYA

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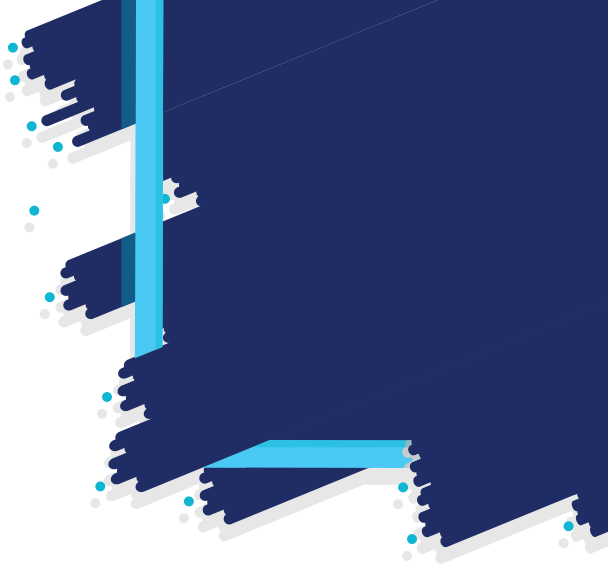

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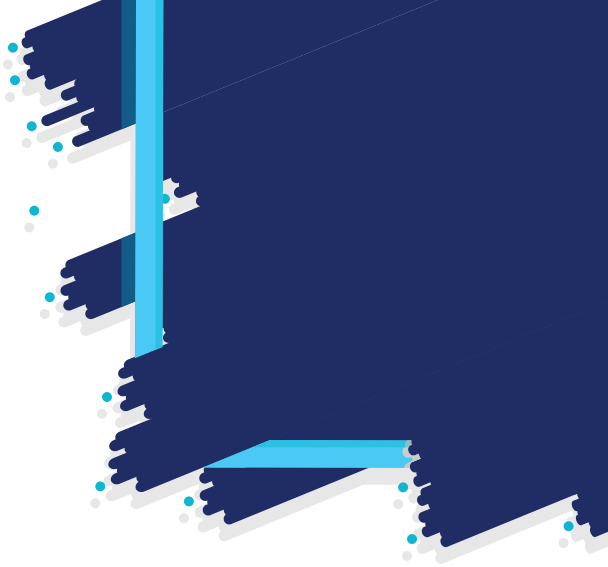

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GECE AKADEMİ

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CHAPTER 7

INVESTIGATION OF STAIR ACCIDENTS FOR TURKEY

Abdurrahman YAĞMUR TOPRAKLI[1]

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INVESTIGATION OF STAIR ACCIDENTS FOR TURKEY

Abdurrahman YAĞMUR TOPRAKLI[1]

INTRODUCTION

Falling down a stair is common and is often associated with severe injury. Epidemiology is a branch of medical science that examines the distribution of accidents and health related conditions in the community. International articles show epidemiological studies of stair fall and its consequences. In the UK, which has statistical data on stairs, more than 4000 deaths in the 2.5 million emergency home accidents each year result in death. Approximately 230,000 of these accidents and 497 of the deaths are due to stairs (Roys, 2001). Although there are no statistical data in Turkey, 11 fatal accidents have been observed in the last 10 years when the accidents reflected in the media are examined. Considering the time spent with stairs, it can be said that one of the most dangerous places for people are stairs.

Stair Terminology, Human Movement on Stairs and Dimensions

Riser is used to express the vertical length between two steps. The nosing is the part formed by extending the step in the horizontal plane. All steps on the stair must have the same riser height to avoid possible accidents. Tread length can be defined as the horizontal distance between two steps.

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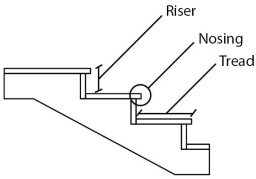


Figure 1: *Stair Components.*

In infancy, the foot shape is similar to a triangle and the fingers are approximately the same length. Foot development is completed by the age of 16 to 18 years. Figure 2 shows the physiological changes of the foot according to age. Body weight is transferred to the floor by means of the feet. Different points of the foot are loaded at different rates. Figure 5 shows load transfers with bare feet and shoes. When the foot is on a flat surface, the greatest load falls on the heels. As the heel lifts up, the load begins to move towards the tiptoe. When a healthy person walks, the feet are at an angle of about 15 ° with the walking line and there is a 5-6 cm gap between the feet (Figure 4).

When designing a stair, the riser should be calculated by adding shoe size to the bare foot size. One of the most important parameters for the tread is the user foot size. There is not a research for the distribution of users based on measurement of foot size and population in Turkey. Instead, French measures of foot size were adopted. Table 1 shows for the foot age-gender relationship of UK citizens.

Table 1: *The Relationship Between Foot Measures and Age in England (Pheasant, 1996; Roys, 2001).*

Age	**Male**			**Female**		
Range	**%5**	**%50**	**%95**	**%5**	**%50**	**%95**
19-25	245	270	290	220	240	260
19-45	245	265	290	215	235	255
45-65	240	260	285	215	235	255
19-65	240	265	285	215	240	255
65-80	235	255	280	210	255	250

To keep in balance, the heel and comb part of the foot must be firmly on the ground. When descending a stair, especially in stairs that have less tread size, the inability of the comb part of the foot to step firmly can cause loss of balance and lead to falls.

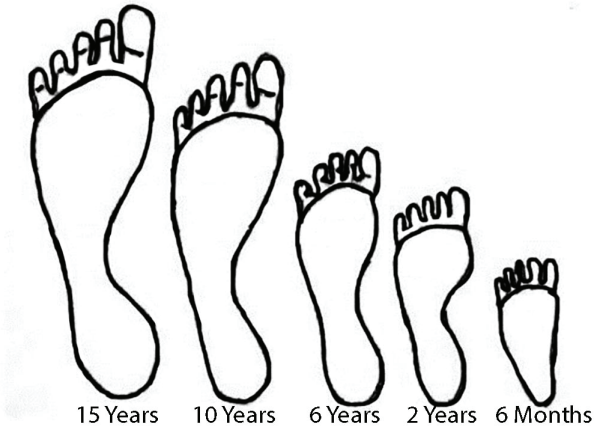
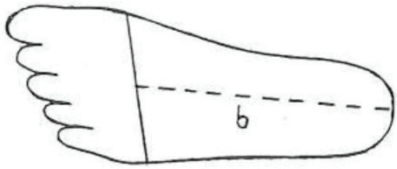


Figure 2: *Physiological Structure of Human Foot According to Age (Ayakkabı ve Saraciye Teknolojisi Ayakkabıda Ölçü Alma, 2013).*



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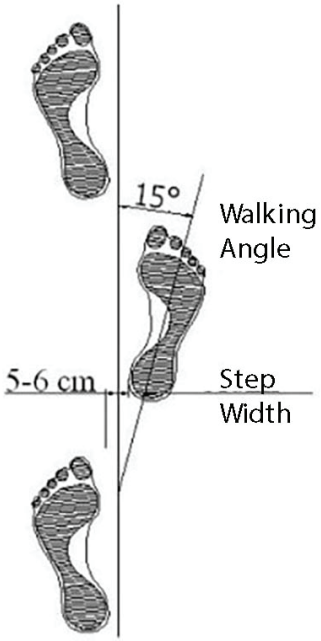


Figure 4: *Normal Walk (Ayakkabı ve Saraciye Teknolojisi Ayakkabıda Ölçü Alma, 2013).*

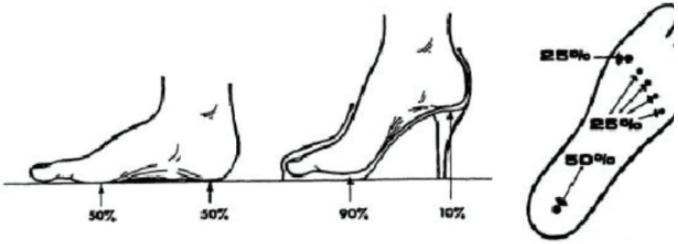


Figure 5: *Load Distribution on Foot (Ayakkabı ve Saraciye Teknolojisi Ayakkabıda Ölçü Alma, 2013).*

When people walk on the stairs, they move much differently than when they walk on a straight path. When descending a staircase - most of the accidents occur at the descent of the staircase - the tiptoe first touches the step. As the center of gravity moves away from the center of

pressure, the balance becomes difficult to achieve, resulting in accidents. When ascending, the front foot moves almost horizontally to the next step. The heel may or may not touch the step. The foot in the back rises from the stair and raises the entire body. In this context, stair descent is more dangerous in terms of user safety. In his pioneering work, Fitch examined the foot motion of a lady wearing heeled shoes through video recording at the descent and ascent of stairs (Fitch, Templer, & Corcoran, 1974). Accordingly, the risk of stair descent is clearly visible (see Figure 6).

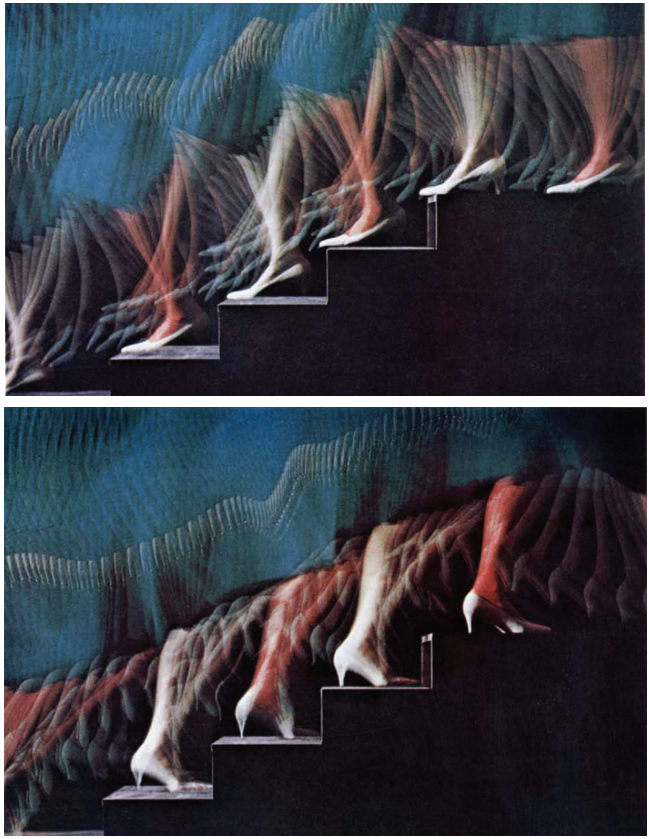


Figure 6: *Foot and Leg Movement at Stair Descent and Ascent (Fitch et al., 1974).*

According to the analysis conducted by Templer et al. with video cassettes focusing on accidents on staircases and the relationship between stair measurements (Cohen, Templer, & Archea, 1985)on vs. off employer's premises, site category, the safest staircase has maximum 15.2 cm (6 ") riser height and at least 27.9 cm (11") tread length. There are also studies that take into account physiological loads, such as human metabolic rate or heart rate, to achieve appropriate tread / riser combinations when walking on stairs (Fitch et al., 1974).

In his pioneering work, Nagata indicated the difference of stumbling rate between the use of flat shoes and high-heeled shoes on stairs (Nagata, 1995)they are likely to experience mis-steps or to trip. In this paper the perceived difficulty while descending stairs with various tread/rise combinations is evaluated using sensory tests. An index to design tread depth and rise height is found from a multiple regression analysis of experimental results. Ten young males (average age 21.0. According to the analysis of stair-related injury data while walking on stairs, people are more likely to have accidents during stair descent (Nagata, 1995)they are likely to experience mis-steps or to trip. In this paper the perceived difficulty while descending stairs with various tread/rise combinations is evaluated using sensory tests. An index to design tread depth and rise height is found from a multiple regression analysis of experimental results. Ten young males (average age 21.0. In order to develop a rational approach to the design of safer stair sizes, people's shoe sizes should be considered. For women wearing high-heeled shoes, step-edge design is a more critical area (Nagata, 1991).

In this study, firstly, he examined the relation between riser height and tread length in terms of ease of use and described the difficulty experienced by the user in stair use in Figure 7. Accordingly, the figures indicated on the rings

on the chart represent the difficulty expressed by the users. It can be seen here; for Japanese users, the easiest handy tread length is around 30 cm and the riser height is around 15-16 cm (Nagata, 1995)they are likely to experience mis-steps or to trip. In this paper the perceived difficulty while descending stairs with various tread/rise combinations is evaluated using sensory tests. An index to design tread depth and rise height is found from a multiple regression analysis of experimental results. Ten young males (average age 21.0.

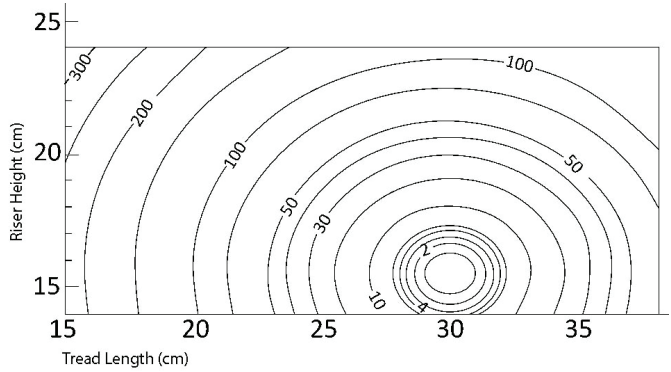


Figure 7: *Riser Height / Tread Length Difficulty Index (Nagata, 1995)they are likely to experience mis-steps or to trip. In this paper the perceived difficulty while descending stairs with various tread/rise combinations is evaluated using sensory tests. An index to design tread depth and rise height is found from a multiple regression analysis of experimental results. Ten young males (average age 21.0.*

Roys, in his study, mentioned public, semi-public and private spaces in relation to stair riser height and tread length and design differences required by different uses (Roys, 2001). His study also showed the requirements in different areas of use with a graph as can be seen in Figure 8. The values given in the graph are defined as very restrictive, since many people are expected to use the

public stairs at the same time. Semi-public spaces are used by a large number of people, but no density is expected at the same time. A limited number of people use private stairs and are expected to become familiar with this stair. For this reason, restrictions are given more freely.

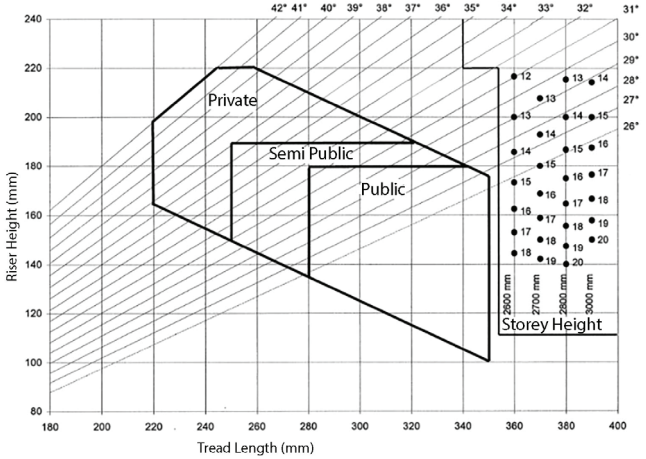


Figure 8: *Acceptable Riser Heights and Tread Lengths (Roys, 2001).*

Causes and Types of Stair Accidents

The three main reasons for stair accidents are; user behavior, lack of maintenance and faulty design. Accidents due to user behavior can be reduced, but because they are user-related, they are closely related to one's characteristics. Although accidents caused by user behavior can be reduced through education, it cannot be very effective unless people change their behavior. Maintenance-related accidents are easy to control and easy to prevent stair accidents. For example, if the step or handrail is not stable, it must be repaired. Similarly, a loose carpet on the staircase can cause a serious accident. Some accidents can be caused by material properties and durability. For example, wood stairs can be damaged by mold over the years. The most accurate and effective

reduction in stair accidents can be achieved by improving design quality. Variable riser height is an example of design faults.

Accidents at the ascent of the stairs are inherently less dangerous (Templer, 1995). This is because the person's center of gravity is slightly ahead. Thus, even if the person falls, he/she is not to suffer much harm. The greater risk occurs during the movement of the rear foot between the two steps. Here, the risk of falling increases as the height of the riser increases. Another risk at the ascent is seen when lifting the body by applying pressure to the floor behind the foot.

Accidents in stair descents are more serious because they can cause the user to fall along the stairs (Templer, 1995). Fractures and head injuries are more common in stair descending accidents (Roys, 2001). If the tread length of the stair is greater than the size of the person's shoes, the risk of falling is reduced. One can scramble the next step, the tip of the toe can slide off the nosing, and these risks increase as the tread length decreases. As tread length decreases, one of two results occurs; Either the person begins to bend his feet outwards, which causes the foot to make a dangerous angle in the direction of walking - or allow his feet to hang at the end of the step. Without one of these, there is a risk that one will not be able to place the foot straight on the step. These situations can cause the person to fall along the stairs. Another risk factor for stair use is the floor friction coefficient. Accordingly, if the relevant coefficient is low, there is a risk of slipping of the foot. If the person allows the foot to hang at the end of the step, there is a high risk that the foot will slide off the lower step. The one falls forward or backward, depending on where the person's center of gravity is and whether or not the one reacts (such as holding onto handrails). Falling back can probably cause serious pain, but not as dangerous

as falling forward. Foster et al. evaluated the importance of emphasizing the edges of the steps. Accordingly, the presence of stripe indicators on the steps, reduce the incidents of heel catch, and tripping for the elderly or visually impaired people. The implementation of this indicator is especially important at the last step. In addition, the position of the indicator appears to be important. It has been observed that the tripping is minimized when the strip is pulled 10-30 mm from the end of the step (Foster, Hotchkiss, Buckley, & Elliott, 2014).

Stairs with low number of steps are more likely to cause stair accidents. According to the investigation made by Jackson and Cohen, %50 percent of the stair accidents seen on stairs with 4 or fewer steps (Jackson & Cohen, 1995). The reason behind this may because people do not pay attention on stairs with low number of risers by comparison with stairs with high number of risers. On first and last three steps of the stairs, a similar result is observed. These steps are the riskiest steps since %60 of the stair accidents seen on these steps (Jackson & Cohen, 1995).

About deficiencies of stairs, Kim and Steinfeld conducted a review by analyzing 578 stairs published on an architectural design magazine and concluded that %61 of these stairs had at least one deficiency (Kim & Steinfeld, 2017)a leading architectural professional journal, over a thirteen-year publication period (2000 to 2012. Considering these stairs seen as “good design” products, stairs on normal use expected to have more deficiencies. This is an important data since it shows the severity of the situation.

One of the most deficiency seen on stairs analyzed in Kim and Steinfeld’s work is missing or unhandy handrails (Kim & Steinfeld, 2017)a leading architectural professional

journal, over a thirteen-year publication period (2000 to 2012. Handrails have a very significant role on preventing stair accidents (Nemire, Johnson, & Vidal, 2016). Size and shape of the handrail is very important to be useful during an accident. The size of the handrail should be 32 to 51 mm (Figure 9).

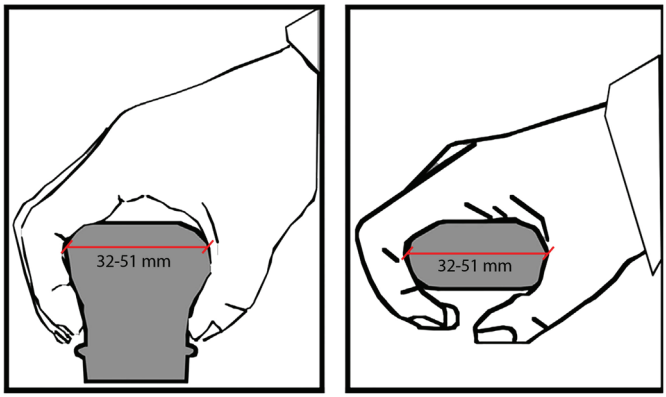


Figure 9: *Optimum Handrail Measurements, adapted from (Nemire et al., 2016)*

The obstacles, objects on the stairs are a common reason of stair accidents. Another cause of accidents is surface of the stair. In some examples, stair surfaces are covered with carpet or similar materials to make stair look more elegant or to make stair slip resistant as can be seen in Figure 10. Nemire et al. put emphasis on slip resistance to lower the accident rates. The risk seen when the cover material or the stabilizer become loose. This situation may lead users to slip, stumble, and trip over the stair.

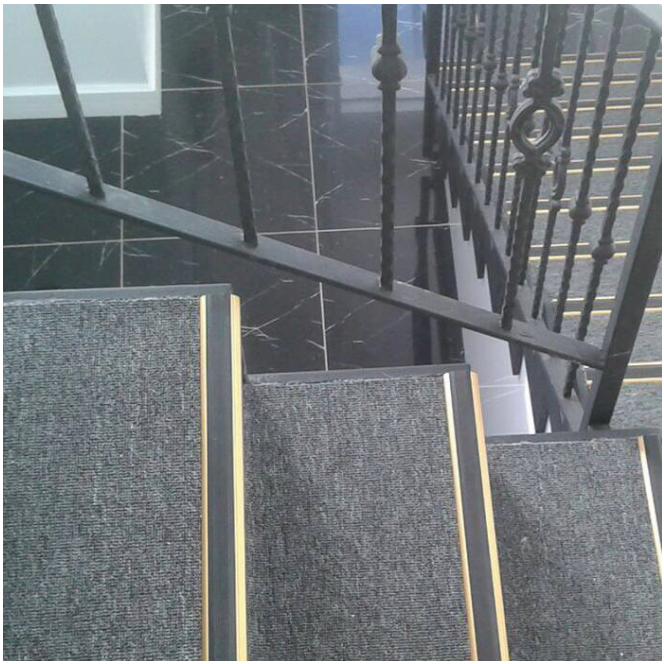


Figure 10: *An Example of Surface Cover and Stabilizer on Stairs That May Cause Accidents ("Stair Covering," 2017).*

Stair Accidents in Turkey and Numerical Analysis

In the United States, approximately 2100 stair accidents occur annually (*Injury Facts*, 2015) and 1,300,000 entries are made to emergency departments of hospitals (Kim & Steinfeld, 2017)a leading architectural professional journal, over a thirteen-year publication period (2000 to 2012. According to a study conducted in America, 984,000 people were injured as a result of stair accidents in 1996 (*Accident Facts*, 1998). Roys stated that most stair accidents can be prevented by making the tread length more than human foot length (Roys, 2001). According to the British Standards Institute, this length should be at least 280 mm (*British Standards Institute*, 1984). According to

Pheasant, most adults in the UK (except for 24% of men and 2% of women) have feet less than 280 mm (Pheasant, 1996). However, the shoe length can be increased up to 30 cm, taking into account the shoe sole in order to address a larger segment of society. Table 2 shows the characteristics of stair-related accidents in the United States according to emergency records between 1990 and 2012. Accordingly, the risk weights of stair accidents are calculated and given in Table 3.

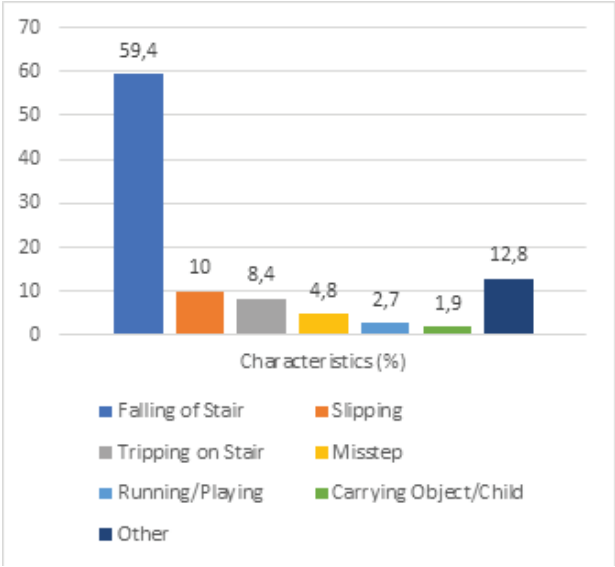
Table 2: *Characteristics of Stair Related Accidents According to Emergency Records in America from 1992 to 2012 (Blazewick, Chounthirath, Hodges, Collins, & Smith, 2018)760,843 patients were treated in emergency departments for a stair-related injury during the 23-year study period, averaging 1,076,558 patients annually, or 37.8 injuries per 10,000 United States residents. The annual rate of stair-related injuries decreased by 12.6% ($p < 0.001$.*

Characteristics	**≤10 Age**	**11-60 Age**	**≥61 Age**	**Total**
Gender	**%**	**%**	**%**	**%**
Male	55,8	35,7	29,4	37,6
Female	44,2	64,3	70,6	62,4
Location				
Interior	63,1	60,3	63,1	61,2
Exterior	7,2	7,3	10,7	7,9
Unknown	29,7	32,5	26,2	30,9
Ruined Body Part				
Head / Neck	64,9	11,6	23,6	21,6
Arms	13,2	16,3	21,9	16,9
Body	4,2	20,1	22,2	18,1
Legs	16,1	50,9	30,6	42,1
Unknown	1,6	1,1	1,7	1,3
Diagnostic				
Twist	8,6	41,8	16,3	32,3
Soft Tissue Injury	30,1	22,9	22,3	23,8

Fracture	11,4	17,0	34,7	19,3
Tear	26,7	5,5	11,3	9,7
Head Trauma	16,0	3,1	7,2	5,8
Other	7,2	9,8	8,2	9,1
Decision				
Discharged	96,9	96,4	81,5	93,8
Inpatient Treatment	2,5	3,0	18,2	5,7
Left Against Medical Advice	0,5	0,6	0,2	0,5
Unknown	0,1	0,1	0,0	0,1
Cause of Accident				
Falling of Stair	67,9	57,5	59,3	59,4
Slipping	4,5	11,3	9,3	10,0
Tripping on Stair	5,8	8,1	12,1	8,4
Misstep	0,8	4,6	9,1	4,8
Running/Playing	10,4	1,7	0,3	2,7
Carrying Object/Child	1,9	2,0	1,3	1,9
Other	8,8	14,7	8,7	12,8

If the results obtained from the research conducted by Blazewick et al. is reviewed, it can be seen that interior accidents are a lot more common. This may be because people spend more time in home as compared to outside. Results in terms of gender can be interpreted as same way since women spending more time in home. As can be seen in Table 3, most common cause of accident is falling of stairs. This result is connected with the ruined body part result since the legs are expected first to touch the ground when falling of stairs.

Table 3: *Weights of Stair Related Injuries.*



When data from the Turkey Statistical Institute examined, it is seen that there is no data of injury or death from falling off the stairs. When examining the news in Turkey in 10 years between 2009-2019, it is seen that the stair related fatal accidents are subject to the news. The news of falling down the stairs appears to be the subject of news only when there is a recognized person or serious injury other than death. The news of death as a result of falling down the stairs is recorded as falling down the stairs for the elderly, while children are recorded as falling down the stairwell as a result of the wrong railing design. This study is the first study in Turkey since statistics are not kept on the subject. Similar studies are expected to increase in the future. In this study, only accidents that occur as a result of the use of stairs are taken into account, fight or work-related stair accidents are excluded. Accordingly, when Table 4 is examined, it is seen that 11 people have died in accidents caused by the use of stairs in the last 10 years. The fact that 6 of these deaths have been seen in the last three years can be thought

to be related to the removal of related news from news sites as time passes. Here, as with stair accidents in Turkey (see. Table 4), age weight of the accidents (see. Table 5) are given. When the relevant news is examined, most of the death news from falling down a stair are indoor (see Table 6) and, unlike in the United States, the deaths from falling down a Stair are usually men (see Table 7).

Table 4: *Stair Related Fatal Accidents in Turkey (Compiled from News from 2009 to 2019).*

Year	**Age**	**Gender**	**Location**	**Result**
2010	66	M	Exterior	Death
Detail	"N.D. (66), on the way to his home in the evening, fell on the stairs in the same street he lived by losing balance. Ambulance called by those who saw the incident. N.D. died at the scene determined."			
Year	**Age**	**Gender**	**Location**	**Result**
2014	20	E	Interior	Death
Detail	A soldier fell down stairs of a building in Sivas 5th Infantry Training Brigade Command on Sunday, April 20 and diagnosed with cerebral hemorrhage in the intensive care unit of Cumhuriyet University Medical Faculty Research and Application Hospital infantry M.Y. (20) could not be saved despite the interventions.			
Year	**Age**	**Gender**	**Location**	**Result**
2014	83	E	Interior	Death
Detail	Father of 2 children, K.P. (83) fell on the stairs near his apartment in İzmir, Mehmet Ali Paşa Neighbourhood, Erdem Street No 7.			
Year	**Age**	**Gender**	**Location**	**Result**
2017	41	E	Interior	Death
Detail	In Safranbolu district of Karabük, the person who fell from the stairs of his house died. According to the information obtained, the man living in İzzetpaşa District, Akseki Street S.Ç. (41) lost his balance on the staircase, which was about 4 meters high inside the house, and fell. 112 teams hospitalized S.Ç. to Safranbolu State Hospital. Despite all the interventions made, the man could not hold on to life. Police launched an investigation into the incident.			
Year	**Age**	**Gender**	**Location**	**Result**
2017	70	E	Interior	Death
Detail	In a 3-storey building in Eskisehir, the old man died of falling from the stairs. The event occurred in the apartment in Deliklitaş Street. The old citizen (70) fell because loss of balance. Rolled down the stairs and the old man was covered in blood at the door of a lower floor in the apartment.			

Year	Age	Gender	Location	Result
2018	66	E	Interior	Death
Detail	According to the information, R.E. (66) lost his balance and fell from a height of about 2 meters. His head hit the ground seriously injured and hospitalized to Ertürk, Salihli State Hospital by medical teams. After the first intervention here, R.E., was referred to Manisa City Hospital. Despite all the interventions he could not be saved and died.			
Year	**Age**	**Gender**	**Location**	**Result**
2018	66	E	Interior	Death
Detail	In Gaziantep, due to the elevator is broken, the man tryed to climb the stairs to the 5th floor. C.Ö. lost his balance and fell. The unfortunate man died at the scene. The incident occurred in the neighborhood Mehmet Dai Street kolejtepe. Because the elevator was broken in the building he was living in, he climbed the stairs. C.Ö. lost his balance and fell down the stairs. Neighbors heard the sound and found the man lying on the ground. Medical teams arrived to scene determined that C.Ö. died.			
Year	**Age**	**Gender**	**Location**	**Result**
2018	2	-	-	Death
Detail	B.Y. fell down the stairs of his home in Gaziantep. After 20 days of struggle to survive in the hospital, B.Y. passed away.			
Year	**Age**	**Gender**	**Location**	**Result**
2019	30	E	-	Death
Detail	Vietnamese national V.D.N. (30), on 3.01.2019, at around 4:30 pm, fell down the stairs in a workplace in Haspolat and was seriously injured. He was receiving treatment in Lefkoşa Dr. Burhan Nalbantoğlu State Hospital, intensive care unit, despite all the interventions on 16.01.2019 could not be saved and died. The autopsy revealed that the cause of death was a skull bone fracture and brain hemorrhage due to falling from a height.			
Year	**Age**	**Gender**	**Location**	**Result**
2019	86	E	Interior	Death
Detail	One of the old tailor tradesmen in Burdur, R.Y. (86) suffered a brain hemorrhage last Tuesday, from falling down a Stair at his house in the Yenice neighborhood. Since Tuesday, Burdur State Hospital has continued treatment in the Surgical Intensive Care series. R.Y.'s brain death took place in the evening today.			
Year	**Age**	**Gender**	**Location**	**Result**
2019	33	K	Exterior	Death
Detail	In Bursa Yildirim District, lost the balance of the stairs falling 33-year-old (A.A.) died in the hospital.			

As can be seen in Table 4 and 5, age is considerably effective on accidents. The age average of stair accident victims is above 50. Novak et al. in their study for evaluating

the age effect on stair accidents, revealed that clear distance between the foot and the nosing is closer for elderly. This leads elderly to have more accidents (Novak, Komisar, Maki, & Fernie, 2016). Other than that elderly more likely to have vision disorders. Brinker et al.'s study revealed that high contrast markings placed on stairs lower the accident ratio for low vision people (den Brinker et al., 2005).

Table 5: *Age Weight of Stair Related Accidents in Turkey (Compiled from News from 2009 to 2019).*

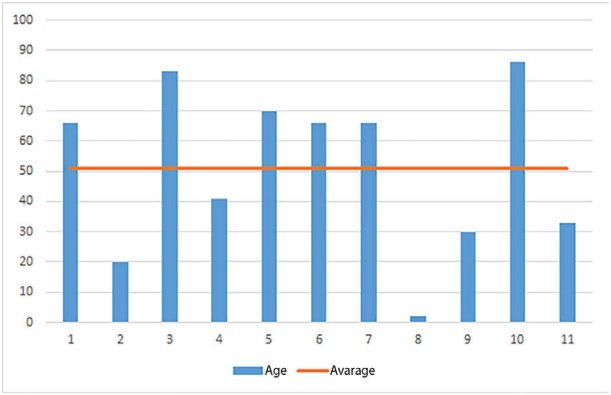


Table 6: *Location Weight of Stair Related Accidents in Turkey (Compiled from News from 2009 to 2019).*

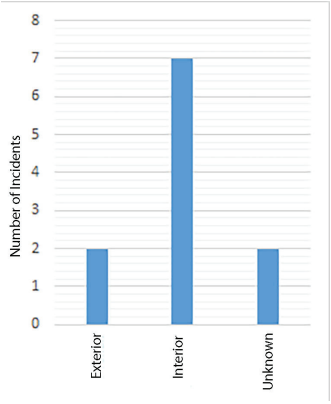
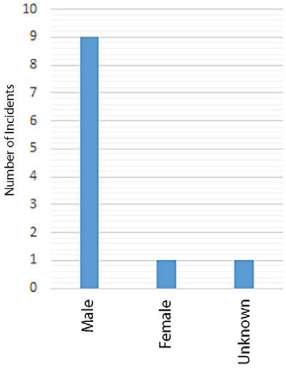


Table 7: *Gender Weight of Stair Related Accidents in Turkey (Compiled from News from 2009 to 2019).*



Stair accident rates in the world are indicated by using the literature. In this study, accident rates are compiled from web news since there is not a statistic on the stair accidents. In order to prevent stair accidents, the most common defects in staircases were revealed and the things to be considered in stair design were determined. Falling down the stairs is high in architectural based accidents. These accidents cause long-term disability and high economic costs, especially for middle-aged or elderly people. Falling down a stair can also lead to a high degree of death or serious injury. In our country, there is no statistical data on injuries and deaths due to falling down stairs. Fatal accidents of falling from a stair in the last 10 years in Turkey shown in Table 4.

Discussion

As a result of the literature study; necessary attention should be given to design of the stairs to prevent accidents caused by faulty design. In the staircase design, user-oriented calculations should be made rather than clichés. The user mass of the Stair should be determined, and the design should be based on the measurements of the human body. When calculating the stair tread, the human foot length should be considered. Calculation methods such as $2a + b = 62$, which do not have test results, may not provide a correct approach to stair design.

Conclusion

The following conclusions can be drawn from the studies seen in the literature.

1. Standard stair heights may not provide an optimal design to ensure safe stair use among individuals with a wide range of capabilities. In the stair design,

the user can use human foot length and so on. The dimensions directly affect the design.

2. Studies on aging and health conditions, cognition, emotion and perception factors also affect the use of stairs.

3. It was found that there are problems in the construction of balustrades, railings on the stairs and problems due to uneven riser heights and lack of visual contrast. (Kim & Steinfeld, 2017)a leading architectural professional journal, over a thirteen-year publication period (2000 to 2012.

4. Depending on whether the staircase will be indoors or outdoors, the coating material should be carefully selected. Accidents can be seen as a result of the wrong choice of coating material, especially in the outdoor and winter months.

Accordingly, it can be estimated that architects' design by considering the above-mentioned issues will be effective in reducing the deaths caused by falls. Statistics about Stairs accidents are not kept in Turkey. With the basic statistical data to be kept, user-based and design-based stair fall risk scale can be developed in future studies and the risk factor of stair designs can be evaluated in this respect. This can contribute to the welfare of the country.

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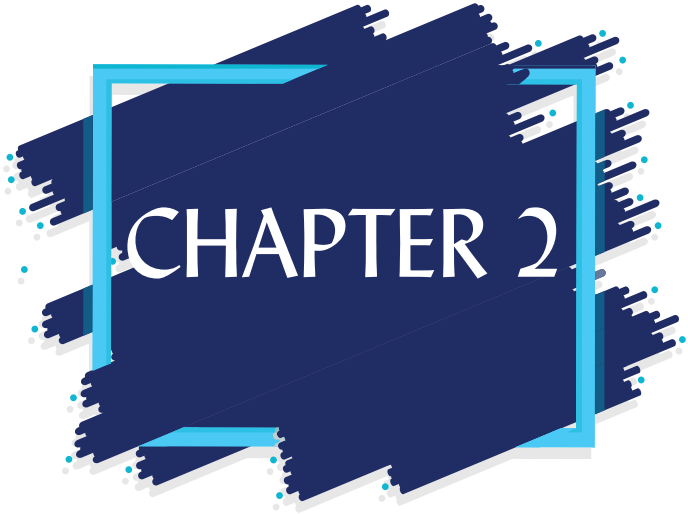
BIOPHILIC SMART CITIES IN ECOLOGICAL SUSTAINABILITY – SMART CITY INTERACTION

Aybüke Özge BOZ[1], Canan CENGİZ[2]



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BIOPHILIC SMART CITIES IN ECOLOGICAL SUSTAINABILITY – SMART CITY INTERACTION

Aybüke Özge BOZ[1], Canan CENGİZ[2]

BIOPHILIC CITY

Humans that are in continuous interaction with their environment play an important role with regard to ensuring sustainability. The increasing environmental issues and deteriorations in our environment are human based and the attitude of humans towards the environment play a significant role in these issues (Boz and Cengiz, 2019).

These issues and deteriorations have resulted in the breakdown of the instinctive bond between humans and other living systems leading to the onset of the alienation from nature. The fact that humans are part of this system cannot be changed even though they have withdrawn from nature due to increasing alienation from the natural world and have rejected that they make up a biological entity in essence (Olgun and Yücel, 2012). In this context, the relationship between humans and nature can be explained by way of the concept of biophilia. According to Kellert (1997), Fromm has defined the concept of biophilia as, "the passionate love of life and of all that is alive". Whereas Edward O. Wilson defined biophilia as, "The innate (hereditary) emotional affinity of mankind to other living organisms" (Çorakçı, 2016).

Biophilic design is based on bringing forth natural elements in the architectural space for the health and

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welfare of people in the built environment thereby ensuring the sustainability of the interaction between people and nature. It is aimed within the scope of this design to increase the quality of life of people in modern built environments by way of applications compatible with nature. Biophilic design encourages integrated architectural solutions with the sense of responsibility that develops due to the emotional commitment to certain spaces and areas as well as the already existing relationship between humans and nature (Boz and Cengiz, 2019).

Biophilic design has two basic dimensions. These are; "Organic or Naturalistic" dimension and "Place-Based or Vernacular" dimension. Both basic dimensions of biophilia are detailed under six main headings with 70 attributes in total (Table 1) (Kellert, 2008).

Table 1. *Elements and attributes af biophilic design (Kellert, 2008)*

Environmental features	**Natural shapes and forms**	**Natural patterns and processes**
Color	Botanical motifs	Sensory variability
Water	Tree and columnar supports	Information richness
Air	Animal (mainly vertebrate) motifs	Age, change, and the patina of time
Sunlight	Shells and spirals	Growth and efflorescence
Plants	Egg, oval, and tubular forms	Central focal point
Animals	Arches, vaults, domes	Patterned wholes
Natural materials	Shapes resisting straight lines and right angles	Bounded spaces

Views and vistas	Simulation of natural features	Transitional spaces
Façade greening	Biomorphy	Linked series and chains
Geology and landscape	Geomorphology	Integration of parts to wholes
Habitats and ecosystems	Biomimicry	Complementary contrasts
Fire		Dynamic balance and tension
		Fractals
		Hierarchically organized ratios and scales
Light and space	**Place-based relationships**	**Evolved human-nature relationships**
Natural light	Geographic connection to place	Prospect and refuge
Filtered and diffused light	Historic connection to place	Order and complexity
Light and shadow	Ecological connection to place	Curiosity and enticement
Reflected light	Cultural connection to place	Change and metamorphosis
Light pools	Indigenous materials	Security and protection
Warm light	Landscape orientation	Mastery and control
Light as shape and form	Landscape features that define building form	Affection and attachment
Spaciousness	Landscape ecology	Attraction and beauty

Spatial variability	Integration of culture and ecology	Exploration and discovery
Space as shape and form	Spirit of place	Information and cognition
Spatial harmony	Avoiding placelessness	Fear and awe
Inside-outside spaces		Reverence and spirituality

The idea of biophilic cities takes its inspiration from the concept of "biophilia" put forth by E.O. Wilson reminding our inherent affinity to affiliate with natural and arguing that integrating with nature in urban areas is beneficial for humans (Russo and Cirella, 2017). According to Beatley (2010), biophilic city corresponds to biophilia at the city scale according to its simplest definition (Kellert, 2016). Cities have been an environmental media that have been subject to maximum transformation and deterioration during the historical process and alienation from nature has been accepted as normal in these environments. However, theoretically there is no need for alienation from nature to take place. Over a century ago, pioneering landscape architect Frederick Law Olmsted has said (Kellert, 2016):

"A man's eyes cannot be as much occupied as they are in large cities by artificial things […] without a harmful effect, first on his mental and nervous system and ultimately on his entire constitutional organization […] The charm of natural scenery is an influence of the highest curative value […] tending, more than any single form of medication we can use, to establish sounds minds in sound bodies".

In essence, biophilic cities are areas with biodiversity intertwined with nature where city dwellers can experience, see and feel the nature - plants, trees, animals - within the daily flow of business and entertainment (Beatley, 2011).

Biophilic city is a concept indicating the formation of areas that reduce stress and increase physical welfare by combining nature, human biology, planning and design in order to put forth stronger and sustainable cities (Beatley, 2011; Browning *et al*., 2014; Cook, 2016). Reaching the level of biophilic city is an important sustainability goal for the following purposes (Cook, 2016):

- It helps to regulate the impact of people on the ecosystem,
- Improves ecosystem services,
- Provides biodiversity contribution to the cities,
- Ensures fair access to nature and resources and
- Passes down a healthy planet to future generations.

Physical environments of cities represent an important criteria for developing biophilic cities. However, the level at which a city and its residents can be accepted as biophilic is related with many factors such as the level at which they benefit from this close environment and the time they actually spend outside. Their level of knowledge on the surrounding natural environment and the importance they give to this subject is another important criteria. Moreover, a biophilic city is one where the city dwellers actively take part in experiencing nature. In addition, those who live in biophilic cities have a wide range of opportunities for spending time in nature and preserving it. It is important to understand that biophilic cities are not only green cities. Nature has to be abundant in biophilic cities, however this is not a sufficient condition and the "philia" part of this concept is as important as the "bio" part. This means that: those who live in biophilic cities take on a direct and active role for acquiring information on their natural surrounding and conserving it and thus they develop strong emotional bonds with this nature (Beatley and Newman, 2013).

SCALES AND BENEFITS OF BIOPHILIC ELEMENTS

Biophilic elements are classified as building, neighborhood and city according to the scale they are applied at. According to this classification (Reeve, 2014) (Table 2):

Building scale elements: Elements that can be integrated into and around the buildings and are generally limited to an individual property parcel.

Neighborhood scale elements: Elements integrated into and alongside streets, roads and sidewalks and parcel-sized blocks (for example, vacant blocks of land within a residential suburb).

***City scale elements*:** City scale biophilic elements are larger in size. These are not integrated into the urban fabric in the way that building or neighborhood scale elements are, and are instead large areas of vegetated space or open water within the city.

Table 2. *Classification of biophilic elements based on their scale of application and special benefits ((SBEnrc), revised from 2012).*

	Elements	**Forms of biophilic concept**	**Special benefits**
BUILDING	Indoor plants	-Potted plants on desks, at workplaces or outdoor environments -Indoor living walls (Green Walls) -Indoor plants in areas such as atriums	-Reducing diseases -Improving efficiency -Improving air quality
	Green Roofs	-Intensive: Roof gardens that require maintenance with soil deeper than 200mm and larger vegetation -Extensive: Roofs that are covered with soil up to 200mm, with ground cover vegetation	-Improving building energy efficiency -Water management -Field efficiency -Food production -Sound insulation -Increasing roof/wall use life -Vertical urban agriculture
	Green Walls	-Panel System: Pre-planted structured panels are attached to the wall and they also have an embedded irrigation system -Felt System: Structured panels with felt planting sections are placed in the related field and maintained moist -Container/Trellis System: Previously prepared structured panels with pots and drip irrigation system for these pots	

NEIGHBORHOOD	Green Verges	-Street trees and canopies chosen depending on physical properties -Shade planting for buildings placed to remove heat load -Green streets and alleys that create cool pervious greenways -Rain gardens and bio-swales integrated into stormwater management plan and consisting of pervious channels -Green permeable sidewalks	-Reducing traffic / encouraging walking, and cycling -Reducing building cooling/ heating energy use indbreak -Water management -Food production
	Green Islands	-Urban parks and gardens placed close to transportation routes -Community farms close to homes -Residential backyards with space for food production -Lawns and gardens reducing UHI effects -Waterways and streams uncovered and rehabilitated	-Reducing traffic / encouraging walking and cycling -Food production -Reducing reflection -Community sense -Education
CITY	Green Corridors	-Green corridors extending to outside the urban area (biodiversity corridors) -Highway passes and migratory routes -Common backyard areas that can be part of the green corridor -Buffer zones for protection against storms in coastal areas	-Coupling biophilic elements -Reducing traffic/ encouraging walking and riding a bike -Providing connection -Increasing tourism -Cognitive path finding, protection of biodiversity
	Urban Agriculture	-Hobby gardens -Urban farms -Agricultural applications in and around the city	-Food production -Providing employment opportunities -Education
	Water ways	-Wetlands -Artificial (constructed) wetlands -Ponds and lakes -Day-lighted streams -Vegetated swales and drainage corridors -Infiltration basins -Mangroves	-Water management -Water treatment -Water storage -Improving water quality -Protection of water resources

Cities and their environments contain various ecological and green elements ranging from parks to trees, rivers (Cengiz *et al*., 2012) and habitats along the rivers and great efforts are being made to improve the characteristics of these elements. Cities may become greener by various methods such as bringing urban rivers to light (saving them from underground pipes and raising up to the surface once again), creating walkways, planting new trees, establishing hobby gardens, green roofs and vertical gardens (Beatley and Newman, 2013).

The impacts of biophilic elements in cities can be classified under 6 main headings (Table 3).

Table 3. *Environmental impacts of biophilic elements in cities and their observable benefits (Reeve, 2014)*

Impact on environment	Examples of observable benefits
Thermal effects	-Reduced heat transfer through building shell -Reduced energy demand -Reduced urban heat island effect -Reduced greenhouse gas emissions -Potential increase in infrastructure lifespan -Reduced ground level ozone production
Hydrologic effects	-Reduced volume and speed of stormwater runoff -Improved quality of runoff (due to reduced velocity of runoff) -Increased groundwater recharge -In some cases, reduced potable water demand for irrigation (in other cases, irrigation demand may increase) -Improved health of receiving water bodies
Filtering effects	-Improved air quality - Improved water quality (due to filtering of runoff)

Aesthetic effects	-Physical, neurological, and emotional wellbeing benefits -Increased social capital &community connection -Increased property value -Increased likelihood of active transport -Reduced traffic speeds and accidents
Biodiversity effects	-Increased diversity of species -Provision of habitat refuges and corridors -Food production / food security

In addition to the direct benefits from biophilic cities, access to nature has an impact of making individuals, families and communities healthier and happier. In the meantime, it also enables the establishment of new social connections which strengthen the cities further. Healthier, more social individuals, families and communities increase the chances of adapting to the future (Beatley and Newman, 2013).

BIOPHILIC CITY APPLICATION EXAMPLES AND APPROACHES

Many urban areas around the world set examples to us for designing urban environments nested with nature. Singapore recently changed its official motto from "Singapore, a Garden City" to "Singapore, City IN a Garden". New buildings are now obliged in accordance with the The City's Landscape Replacement Policy to have a natural area in the vertical plane as compensation for the natural area lost at the ground level. This policy has paved the way for new buildings that make significant contributions to the green city sense such as Park Royal Hotel (Beatley, 2016; Beatley, 2017) (Figure 1).

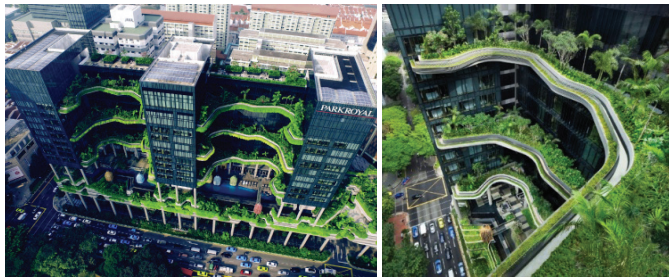

Figure 1. *Park Royal Hotel (URL-1) (URL-2)*

The city of Milwaukee also creates new green pockets by merging empty parcels as part of the "GR/OWN Program". The city of San Francisco started a renowned and pioneering program called "Parklet" (from on-street parking spaces) formed by planting flowers and plants to hard surfaces by way of "Sidewalk Garden Permit" (Beatley, 2016; Beatley, 2017) (Figure 2).

Figure 2. *San Francisco Parklet examples (URL-3)*

The city of Portland has also given importance to building "Green Streets". Green streets are comprised of road-sides and sidewalks that have transformed into rainwater collection partitions, rain gardens-dikes (such rain gardens reduces the adverse impacts of flood water by way of vegetated channels or those with mulch or graveled) (Beatley, 2016; Beatley, 2017) (Figure 3).

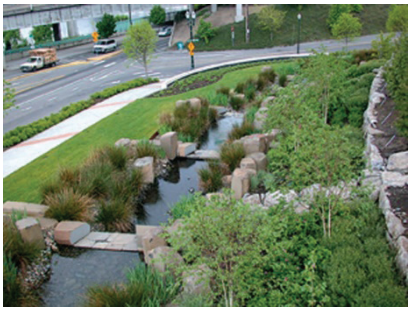

Figure 3. *Portland roadside rain garden example (URL-4).*

The city of Pittsburgh has also tried to make its riverfront area more usable by way of walkway and bike road investments and even a new "Water Trail" with "South Shore Riverfront Park" (Figure 4). While mobility options increase in many different cities including Wellington, New Zealand, Rio de Janeiro and Singapore, other investments are also ongoing for trails that aim to make it easier to interact with nature (Beatley, 2016; Beatley, 2017).

Figure 4. *South Shore Riverfront Park (URL-5)*

BIOPHILIC SMART CITIES

Biophilia is part of the daily life of healthy individuals and it is a concept based on written resources. All urban areas have an option to be enhanced and arranged in compliance to nature by implementing biophilic design. Quality of life is among the primary goals of smart city

approaches. At this point, *Biophilia* also provides facilities that provide quality of life. There are areas in urban environments where nature that is integrated to designs for improving the quality of life of people has to struggle to continue its existence; at such areas biophilia can be put into practice not by way of biological but technological methods. The design of smart cities will especially benefit from the integration of biophilic design principles into the procedure due to their strong tendency for technological advancement and their focus on utilitarian metrics applications (Downton *et al*., 2016**)**.

Social way of life in the world has more than ever brought about the necessity and desire to be closer to nature. In this sense, increasing the amount of urban green areas and the inclusion of natural elements to spatial solutions is of significant importance. Thus, important contributions are made to sustaining urban biodiversity, providing ecosystem services as well as human health (physical and psychological), increasing environmental safety and city and environmental aesthetics and social sustainability.

Smart city approach has generally been defined with regard to resource and energy consumption rather than ecological sustainability, for example, “it makes use of digital technology to reduce costs and optimize resource consumption, thereby not endangering the use of current resources for future generations “. Smart cities aim to improve the quality of life of people while rarely emphasizing the need to preserve the quality of life for other living things in the urban environment. Conversely, healthy sustainment of living systems requires an effective relationship that is integrated with nature independent of people (Downton *et al*., 2016**)**.

Biophilic cities pay regard to ecological sustainability and put forth an understanding that supports smart cities as an approach that enables spatial analyses by way of engineering methods and that makes use of digital technology. In this regard, smart city-biophilic city integration within the theoretical framework of the quality of life, ecology, technology, human-nature interaction and environmental responsibility awareness has brought about the concept of biophilic smart cities.

According to DeJong *et al*. (2015), the concept of smart city has shifted the focus from the environmental façade of the city to infrastructure and the use of information by encouraging engineering system solutions (information and communication technologies (ICT)) for urban issues. As an umbrella term encompassing all kinds of communication devices or applications, ICT does not place a special emphasis on environmental sustainability (Russo and Cirella, 2017). Thus, there is a need for a concept that can combine engineering system solutions with environmental sustainability in cities while reducing environmental deterioration. For this purpose, the concept of smart cities should be combined with biophilic cities to focus on a wider goal such as providing solutions to environmental issues as well (Russo and Cirella, 2017).

CONCLUSION

People are affected from the environment they are in and they also have an impact on the environment in return. There are relationships based on space underlying the approach to sustain human-nature interaction in the built environment. In this context, establishing a historical, geographical, ecological and cultural bond with the space and forming an emotional affinity and commitment with nature is effective in the implementation of biophilic design

and defining an important process that can move from the part to the whole with regard to reaching a holistic result.

Biophilic cities protect the already existing resources in nature while striving to repair the resources that have been deteriorated or that are about to go extinct and they try to integrate nature to the applied projects in different forms. In this scope, biophilic cities are easily settlement areas that are known for their unique nature and biodiversities, that are inspired from nature and that imitate nature. In addition, they encourage people to interact with nature thereby ensuring that they are in continuous relationship with urban biodiversity and climate. They invest in the development of the bond established with nature and accordingly the related educational institutions and infrastructures. People in biophilic cities actively interact with nature and acquire information on biodiversity. Those living in biophilic cities also have a significant awareness on the nature and history of the city (Beatley, 2011).

Early efforts to apply biophilia to urban planning have focused on landscaping on and around buildings, and have prompted investigations on a wider range of application across cities. Further integration of such elements into urban design may help in adapting to many of the impacts and consequences of climate change, such as increased urban temperatures (exacerbating the urban heat island effect), increased energy demand, and intensified storm events, loss of biodiversity and declining agricultural yields (Reeve *et al*., 2011).

Biophilic design; supports low energy buildings to diminish climate change; contributes to human comfort, mental, emotional and social health as well as the diversity and preservation of species in the face of climate change (Africa *et al*., 2019).

Improvement of urban quality of life, adapting to climate change and ensuring sustainability are among the major subjects that both biophilic cities and smart cities emphasize. However, attaining environmental sustainability in smart cities remains in the background with regard to sustainability. The integration of biophilic cities with smart cities will decrease environmental issues by completing in biophilic cities the missing parts of smart cities via green areas and surfaces at the building, neighborhood and city scale.

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URBAN BIODIVERSITY ANALYSIS

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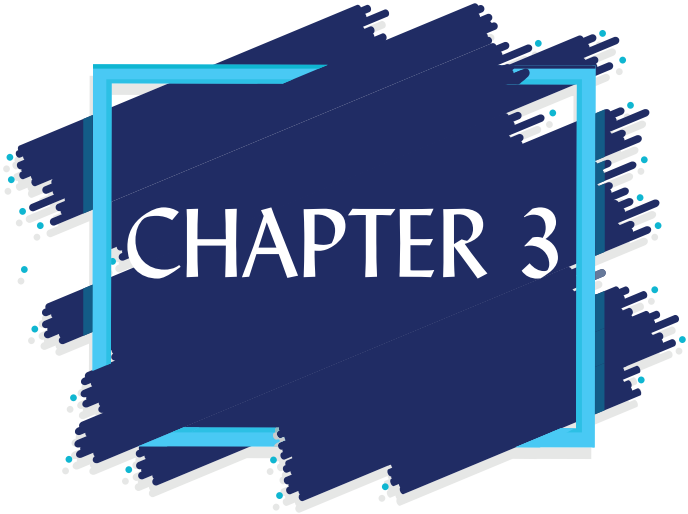

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Bülent CENGİZ[1], Deniz KARAELMAS[2]

1. INTRODUCTION

Industrialization that started in the 19th century in the world brought about with it damages to the environment and natural resources (Dilbirliği, 2007; Demir, 2013). Biological diversity and natural resources have been damaged significantly by the 20th century due to unsustainable use and these damages have now reached irreversible levels (Demirayak, 2002; Demir, 2013). People who ignore environmental issues and think that resources are endless and can be obtained at any time have reached a level of awareness with regard to the necessity of protecting natural resources and the environment and have started taking the necessary actions (Dilbirliği, 2007; Demir, 2013). However, nature conservationists and natural resource administrators have tried to approach the issue with a wider perspective starting from the 80's when majority of such attempts failed due to social and economic difficulties. As a result, the concept of "biodiversity" or "biological diversity" started to be taken into consideration with the 1992 conference in Rio de Janeiro (Momsen, 2007). Accordingly, the objective was to secure the requirements of the current generation as well as those of the future generations by way of the sustainable use of biodiversity (Demir, 2013).

Loss of biological diversity in the world during the 21st century continues to be a source of significant concern for both international policy makers and national authorities.

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Studies indicate that 11 % of the world's natural habitats that the world has in 2010 will be lost by 2050, that 40 % of the current agricultural areas will face significant risks due to overuse and that 60 % of the coral reefs can be lost until 2030. These numbers signify that human-based causes have increased the extinction of species by 50-1000 times (Erik and Tarıkahya, 2004; Tekeli *et al*., 2006). This concern resulted in the World Sustainable Development Summit (Johannesburg 2002) to take on a global goal for reducing the loss of biological diversity until 2010 (Marchetti, 2005).

Biodiversity makes up the foundation for the continuation of the living beings and humans on earth while also taking on a key role thanks to the products and services it provides which are related with species, gene source and ecosystem diversity (Özhatay, *et al*., 2009). It is indicated that the financial aspect of the positive impacts of biodiversity is 3 trillion dollars annually which corresponds to 11 % of all income in the world economy (Momsen, 2007; Demir, 2013).

It can be observed when areas that are richest with regard to biodiversity are examined that tropical areas are in the lead. In the meantime, it is also indicated that 16 out of 25 locations considered as "biodiversity hot spots" in the world are located in tropical regions. Majority of them are located within the border of developing countries (Momsen, 2007). Therefore, Turkey is among the countries that are richest in biological diversity (Demir, 2013).

Turkey is located at the intersection of Euro-Siberian Flora Region (Black Sea and Marmara regions), Mediterranean Flora Region (Mediterranean and Aegean Regions) and Irano-Turanian Flora Region (Central and Eastern Anatolia regions) (Çelik, 2017). It can be observed following an assessment of Turkey with

regard to ecosystem diversity that it is comprised of different ecosystems. These can be listed as inland water biodiversity, forest and mountain biodiversity, agricultural area – steppe biodiversity and coast-marine biodiversity (Mumcu and Korkmaz 2018). Turkey is also among the leading countries in the world with regard to endemic plants that are limited with the regions they grow in. It can be observed when provinces are evaluated with regard to the number of endemic plants that Antalya, Konya and İçel are ranked high with 578, 478 and 366 endemic plants respectively (Çelik, 2017).

Plant diversity in Turkey is richer in comparison with its neighboring countries due to the impact of the temperate climate zone it is located in. The number of plant species in Turkey is almost equivalent to the number of plant species in the European continent. According to studies carried out, there are about 12.000 plant taxa in Turkey, 3000 of which are endemic (Özhatay and Kültür, 2006; Ekim, 2005). Turkey is one of the richest countries in the world with its endemic plant variety and its endemism ratio of 34,4 % (Tekeli *et al*., 2006; Özhatay *et al*., 2009).

It is of great importance to pass down the biodiversity of Turkey to future generations. Indeed, many volunteer and official organizations strive to attain and preserve the biodiversity of our country and they all approach the problem from a different perspective (Çelik, 2017). However, it cannot be said that serious urban planning strategies are developed to reduce the loss of biological diversity in accordance with conservation goals (Lovell and Taylor, 2013; Bennett and Lovell 2014-2019). Therefore, the items indicated below should be given considerable attention in order to preserve the biological biodiversity and to recover the lost ecosystem services (Bennett and Lovell 2014-2019, Burkman and Gardiner, 2014, Egerer *et al*., 2017).

Agricultural biological diversity, urban ecology, landscape design and planning, determining participant perception, ecosystem services and similar themes have been emphasized in national and international studies on urban biodiversity. In this regard, Liang *et al*. (2008) made use of field studies and SPOT remote sensing data for examining the impacts of urbanization in Beijing on plant biodiversity. It was determined as a result of the study that plant diversity in artificial green areas and parks is lower in comparison with the plant diversity in streets and natural green areas. In this context, habitat fragmentation has significant impacts on plant biodiversity and there is a positive and statistically significant relationship between high fragmentation and low plant diversity. Galluzzi and Negri (2010) carried out studies on agricultural biodiversity in homegardens as important social and cultural areas where households may increase their sources of income and living. They put forth the future limitations and opportunities with regard to the roles played by homegardens in the preservation of agricultural biological diversity and cultural heritage. Uslu and Shakouri (2013) emphasized policies and approaches for landscape design and planning in order to enrich the biological diversity and urban ecology in countries. In this scope, tools for strengthening the ecological connection supporting biological diversity were suggested by taking into consideration the current ecological approaches in Turkey, plant design examples, green roads etc. Lindemann and Marty (2013) carried out a study by applying a questionnaire on 249 participants in Switzerland in order to put forth the attractiveness of the gardens and the plant species in the gardens. It was determined as a result of the study that the level of attractiveness is influenced by whether the number of species in the gardens is high or low. Clarke *et al*. (2014) carried out a study in Beijing to put forth the biodiversity in different urbanized regions

and ecosystem services provided by homegardens. It was determined as a result of the study that gardens in three different urbanized regions of suburbs, artificial cities and extra-urban differ with regard to biodiversity of species. Fischer *et al*. (2016) evaluated the pastures and forage layer at different locations with regard to biological diversity and carried out a study on 15 parks in Santiago in order to put forth their relationships with environmental variables. The results have shown that plant compositions in the parks differ with regard to urban-rural characteristics. Surat and Yaman (2017) examined the plant species in private residence gardens, apartment blocks and residence areas in Batumi with regard to their aesthetic, visual, functional, socio-cultural and ecological values. It was determined that the number of exotic plant species in the gardens is quite high and that plant diversity attracts more attention in new residence areas. Moreover, it was also determined in the study that the ornamental plants used in the residence area have been replaced by fruits and other beneficial species in villas and private residences. Sezen *et al*. (2018) carried out a study for determining the areas of use in landscape architecture in and around the city of Erzurum by taking into consideration the characteristics and seasonal color changes of plants. Yang (2019) compared three herbaceous plant covers and grasses at the Xian province of China to obtain information and make suggestions on the design, planning and management of grasses at local public parks. It was determined as a result of the study that there is a positive relationship between the plant species diversity in grasses and the green area ratio around the grasses and a negative relationship with the frequency of the use of chemical fertilizers. While there is a positive relationship between the frequency of use of the local plant species in grass with irrigation frequency and grass size; it was concluded that there is a negative relationship between the

frequency of the use of chemical fertilizers and mowing frequency.

In this study, concepts and definitions related with biodiversity, genetic diversity, species diversity, ecosystem diversity were put forth in addition to carrying out evaluations and analyses on urban biodiversity, urban green areas, urban green infrastructure and urban biodiversity planning.

2. Definition of Biodiversity

The concept of biological diversity or biodiversity is used to indicate the diversity of all living organisms as well as the diversity in and between the organisms (Uslu and Shakouri, 2013). Biological diversity can be defined as a whole comprised of genes, species, ecosystems and ecological events at a certain region (Topçu, 2012; Mumcu and Korkmaz 2018).

The concept of biological diversity has been defined in the Biological Diversity Act as; "*variability among living organisms from all sources and the ecological complexes of which they are part and includes diversity within species or between species and of eco-systems*". The diversity and ecosystem diversity within species and between species has been included (BDA, Item 2; Mumcu and Korkmaz 2018; Dilbirliği, 2007).

Çepel 1997, defines biological diversity as follows; "*diversity between the living things in an ecosystem, richness of an ecosystem with regard to living species, diversity with regard to both species and genetics of the same species"* (Uslu and Shakouri, 2013). According to the most general definition by Alonso *et al*. (2001); biodiversity is the variations of all living things and their intersections.

Biodiversity makes up the foundation of ecosystem functioning (Harrop and Pritchard, 2011). Biodiversity is defined as the diversity between species and ecologic communities - ecosystems (Biological Diversity Act, 2015). Therefore, the concept of biodiversity encompasses the ecosystem while also focusing on the level of species since the gene levels are well-defined, measurable and easily trackable in majority of the studies on both species and urban biological diversity (Nielsen *et al*., 2014; Farinha-Marques *et al*., 2011).

2.1. Biodiversity Types

Biodiversity that forms the primary source of the life support systems required for the sustainment of life on earth has three main types. These are genetic, species and ecosystem diversity (Demir, 2013). However, diversity of ecological functions has also recently been included in this group. It is not possible to consider these four different types separately. Each of these four types is significant and they interact with each other. A change in one leads to changes in others (Alonso *et al*., 2001).

2.1.1. Genetic Diversity

Genetic diversity is evaluated as a factor that plays a key role in providing continuity to biodiversity (Çepel, 1997). Genetic diversity determines the biochemical and physical characteristics of existence as genetically transferred biochemical packages (Dilbirliği, 2007). In other words, genetic diversity is defined as populations isolated from each other as well as the diversity of the species in the same population (Dervişoğlu, 2007; Demir, 2013).

Genetic diversity is measured by way of the gene difference in a certain species, population, variety, sub-species or race. Species may be classified as those that are

closely related, distant related and non-related (Mumcu and Korkmaz 2018). Genetic diversity responsible from different characteristics enables the populations to remain alive against new diseases and adapt to environmental conditions subject to local conditions (Alonso *et al*., 2001).

2.1.2. Species Diversity

It is defined as the reproduction of a group of organisms with similarities and the formation of productive living things named as species (Demirayak, 2002). Species diversity is generally evaluated as the total number of species inside a certain geographical boundary (Dilbirliği, 2007).

It can be indicated that taxonomic diversity has also been taken into consideration when examining species diversity (Mumcu and Korkmaz, 2018). Species emerge in all shapes and sizes. Small organisms that can only be viewed by a microscope, flowering plants, ants, bugs, butterflies, birds and elephants, whales and bears can be indicated as examples of species. Each of these species is comprised of a group of organisms with characteristic features (Alonso *et al*., 2001; Dilbirliği, 2007).

2.1.3. Ecosystem Diversity

Ecosystem diversity is used to define all non-living things such as air, soil, water and minerals in addition to animals and plants. These have complex relationships among each other as well as with their environment and communities. These relationships make up the foundations of sustainable life. The entities that make up ecosystem diversity are not equally scattered in the world but share an equal level of importance. For example; it is known that some ecosystems such as coral reefs and tropical forests

have too many complex forms. The level of biodiversity is lower in other ecosystems such as polar and desert regions (Alonso *et al*.. 2001, Dilbirliği, 2007).

2.1.4. Diversity of Ecological Functions

All ecosystems are in relation and interaction with each other. Therefore, the sophistication of their relationships results in diverse ecosystem functions (Dilbirliği, 2007). This diversity is due to the diversity of gene, species and ecosystem. Thus, the diversity level of these three elements has an impact on the diversity level of ecological processes (feeding, competition, development, movement, local distribution, energy flow, circulation of matter). For this purpose, the diversity of ecological functions which is the fourth type of biodiversity is evaluated as a result of the diversities for the first three fundamental types (Uzun, 2004).

2.2. Ways of Conserving Biodiversity

Many steps have been and are continued to be taken to conserve biodiversity since it is a very important economic issue for humans in addition to being related to ecology and culture (Demirayak, 2002). Conservation of biodiversity is generally carried out under two main titles as In Situ and Ex Situ conservation methods.

2.2.1. Ex Situ Conservation

The Ex Situ conservation method is one that aims to conserve biological diversity (plants, animals) or the genetic diversity it is comprised of outside of their natural habitats. Botanical gardens and zoos, aquariums, gene and seed banks are evaluated within the scope of the ex situ conservation method (Ministry of Environment and Forestry Ministry of Environment and Forestry, 2008).

2.2.2. In Situ Conservation

The In Situ conservation method is the conservation of species inside their natural habitats. In situ conservation prevents the loss of genetic sources. This is the best method for conserving biodiversity. National parks and natural reserves are evaluated within the scope of this method (Ministry of Environment and Forestry, 2008).

3. Urban Biodiversity Analysis and Its Assessment

Biodiversity has been passed down as the heritage of millions of years of evolution. However, the adverse impacts of humans on this ecological heritage have been significant throughout history (Hahs *et al*., 2009; Alberti, 2010). Indeed, the fact that the number of species that have gone extinct during the last 200 years is greater than that 65 million years ago sums up this situation (Uslu and Shakouri, 2013). Global loss in biodiversity is equivalent to the destruction of natural habitats and increasing urbanization with the increase of human population (Mcdonald *et al*., 2008; Grimm *et al*., 2008; Dirzo *et al*., 2014; Newbold, 2015).

Urbanization has taken the place of agricultural and semi-natural landscapes (McDonald *et al*., 2008). The most significant adverse impact of this change has been on the habitats of living things (Uslu and Shakouri, 2013). Habitat loss and fragmentation, changes in resource availability, climate changes, increasing chemical pollution are among adversities that have a negative impact on biological diversity (Grimm *et al*., 2008; McKinney, 2002). These impacts lead to decreases in species and genetic diversity as well as losses in ecological functions and ecosystem services (Radford and James, 2013; McKinney, 2006).

Even though urbanization has been related with decreases in the richness, diversity and abundance of terrestrial species (Faeth *et al*., 2011) the loss and fragmentation of urban habitats, parks and other green areas have been considered as insignificant (Atchison and Rodewald, 2006). However, cities are now accepted as places of greater significance and it is emphasized that cities may accommodate plant and animal species diversity including those that are under threat (Savard *et al*., 2000; Ives *et al*., 2016; Garrard, 2017). In this regard, it is now thought that urbanization may display a unique biological diversity including evolutionary processes and that it may contribute to the quality of life in an ever globalizing world (Ahern, 2013; Müller and Werner, 2010).

Biological diversity in cities is affected significantly from green areas, green roofs and walls as well as the presence of streets covered with trees. It is essential that there are sceneries with variety and distribution sufficient for sustaining different ecosystem services including wildlife and human population. Green infrastructure in urban landscape is comprised of recreational parks and gardens, unadministered natural open areas, wetlands and urban areas (Cengiz, 2013).

Ensuring biodiversity in cities means that urban dwellers will have nature by their side and that the ecological qualities of cities will be improved (Uslu and Shakouri, 2013). Areas that are suitable for providing urban biodiversity can be listed as below (Uslu and Shakouri, 2013);

- ✓ Parks and public gardens,
- ✓ Natural and semi-natural areas (wetlands and isolated empty areas),
- ✓ Green corridors,

- ✓ Outdoor recreational areas,
- ✓ Game, entertainment areas,
- ✓ Hobby gardens, public gardens and urban farms,
- ✓ Surrounding areas of graveyards and religious structures,
- ✓ Accessible natural areas in the immediate surroundings of the city,
- ✓ Structural and hard tiled floors such as squares, marketplaces, pedestrian walkways etc.

Biodiversity in urban areas provides social and biological functions to the dwellers such as ecological balance, ecosystem services, environmental protection, outdoor recreation, aesthetic entertainment, nature education and shelters, sanctuaries and distribution centers for wildlife species. Roads are manmade urban corridors that are among the most important elements of urban green infrastructure. Roadside trees which are indispensable for urban green areas are valuable for biological diversity, recreation and aesthetics. They provide shelter and care for many different plant and faunal species (Mutlu *et al*., 2017).

Including the conservation of urban biodiversity as a goal has significant impacts for ecosystem function (Vandermeer and Lin, 2008, Swift *et al*., 2004; Tscharntke *et al*., 2005). Increase of urban biodiversity may have positive effects on the quality of life (Chivian and Bernstein, 2004; Cengiz and Boz, 2019; Fuller *et al*., 2007; Hanski *et al*., 2012). Educating the city dwellers will in turn make it easier to conserve biological diversity in natural ecosystems as well (Savard *et al*., 2000). Factors such as socio-economic state, cultural characteristics and user habits influence plant selection and hence urban

biological diversity (Bekçi *et al*., 2012; Cengiz vd. 2014; Swan *et al*. 2011).

Various models have been developed during the last decade for estimating the impact of climate change on biodiversity. The results obtained from these models indicated that climate change has some disquieting results for biological diversity; for example, the results indicate that many plant and animal species may go extinct in the coming century (Willis and Bhagwat, 2009). Human welfare, ecosystem function and even the climate itself is affected from the changing geography as global climate changes (Pecl *et al*., 2017).

Scientists of our day experience difficulties in estimating how climate change will affect the distribution of species and communities of species. Phenomenological species distribution models are used which neglect the potential and biotic interactions of species. The potential role played by evolutionary community ecology in improving our understanding with regard to how climate change will impact biodiversity distribution in the future is studied (Lavergne *et al*., 2010). Habitat destruction is indicated as the greatest global threat of climate change against biological diversity in the coming years (Leadley *et al*. 2010).

3.1. Urban Biodiversity Planning

Biodiversity plays a key role in the ecosystem hierarchy (Mace *et al*., 2012). In this framework, it is observed that many countries have increased their efforts to reduce the loss of biological diversity. As one of these countries, Turkey has increased support for efforts to preserve biological diversity at the global scale (T.C. Ministry of Environment and Forestry, 2008). These efforts traditionally encompass

large natural habitats and ecosystems that are relatively untouched (Lovell and Johnston, 2009).

3.2. Urban Green Infrastructure

Green infrastructure provides opportunities for the conservation of urban biodiversity and eliminates some of the negative ecological impacts of urbanization in urban areas (Norton *et al*., 2016). Therefore, even though the improvement of green infrastructure has positive impacts on urban biological diversity, it is very important to determine which species and characteristics are the most effective (Snäll *et al*., 2016).

Parks as a part of the urban green infrastructure may function as points of biological diversity subject to their histories and characteristics (Nielsen *et al*., 2014). Parks as a type of urban open area play a significant role in the conservation of biodiversity and the provision of recreational services to the local public (Jim and Chen, 2006; Li *et al*., 2006). These areas provide both social and psychological services to city dwellers such as reducing stress, recovery support and social connections thereby improving one's quality of life (Chiesura 2004).

Urban green areas are among the important areas that play a significant role in providing and conserving urban biodiversity (Goddard *et al*., 2010). Urban green areas are used for representing the private and public areas of a city and generally containg various habitats that support multiple uses (Bennett and Lovell, 2019). Many different land types such as natural areas, neighborhood parks, boulevards, green infrastructure, green roofs and residential gardens with potential to support urban biological diversity contribute to the urban green area (Davies *et al*. 2009, Bennett and Lovell 2019). Urban green areas provide perfect design opportunities thanks to

their already existing and potential functions. Planners and designers should take into consideration the opportunities to conserve the current public green areas. They should preserve these areas with neighboring special lands or other green areas and even expand them while combining these characteristics with green public corridors (Hellmund and Smith 2006).

Rear garden or home gardens characterized by structural complexity and multi-functionality contain many plant species that support biological diversity (Bennett and Lovell 2019). Floristic richness of home gardens contribute to the cultural identity as well as household economy, nutrition and health (Agbogidi and Adolor, 2013). There is a greater need for studies on the biological and social benefits of home gardens and more importance should be given to introduce them further as solutions for the conservation and sustainability of biological diversity in man-made environments (Galluzzi and Negri, 2010).

Green roofs emerge more and more as ecosystems that are becoming popular in cities (Williams *et al*., 2014). Retaining rain water, increased building energy efficiency and colder microclimates are among the benefits of green roofs but they can also provide a habitat for many different species (Oberndorfer *et al*., 2007). In this regard, policies should be developed for the use of green roofs in order to ensure biological diversity in the cities (Williams *et al*., 2014).

In addition to the aforementioned items, roadside trees have many environmental benefits such as eliminating air pollution (Kiran *et al*., 2011), improving urban aesthetics (McPherson *et al*., 1999) and supporting wildlife environments (Mutlu *et al*., 2017).

Urban biodiversity is determined by way of planning, designing and managing the built environment which in turn is affected by the economic, social and cultural values and dynamics of the human population (Müller and Kamada, 2011).

CONCLUSION

Diversity of ecosystems provide various services that are required for the development and growth of economy which is essential for people. In this scope, it is important to develop policies with regard to the actions that will be carried out for increasing the evaluation capacity as well as the environmental applications suited to biological diversity.

Effective protection of the rich biodiversity of Turkey through a mixture of in situ and ex situ programs as well as the strengthening of policy framework are among important issues regarding the preparation of the related laws and regulations.

Issues such as plant diversity, agricultural biological diversity, urban ecology, landscape design and planning, determining participant perception, ecosystem services and similar topics have been emphasized with an aim to develop urban biodiversity.

Development of an awareness to improve and preserve urban ecosystems within the context of sustainable future makes it necessary to determine urban biodiversity, planning, design and preservation.

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EVALUATION OF NEIGHBORHOOD DESIGN QUALITY BY ANALYTIC HIERARCHY PROCESS

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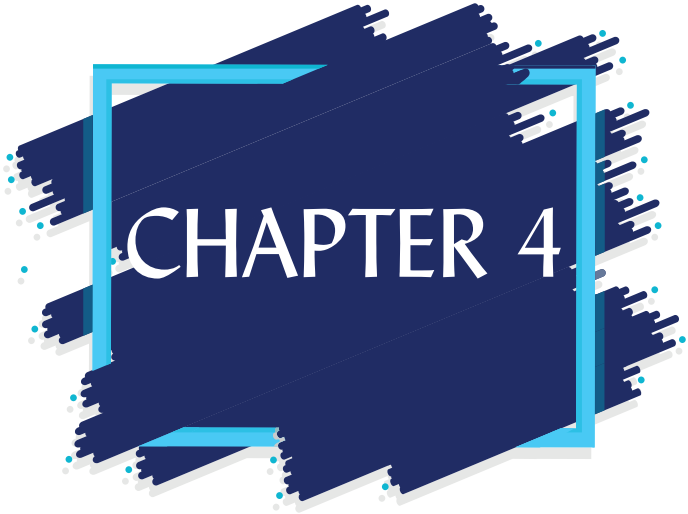

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1. INTRODUCTION

Design quality of living environment has been studied during the past few years by several researchers (Ewing & Handy, 2009; Clemente et al., 2005). Urban design, architecture, landscape architecture, environmental psychology, and other related literature focused on mostly perceptual qualities. Nowadays, concerns about urban aesthetics and design quality are increasing depend on traditional neighborhoods are replaced by social housing projects. The aim of this study is to determine which urban design quality criteria step forward in neighborhoods from mass housing and traditional urban settlements. In this study, the analytic hierarchy process (AHP) was applied to eight subjective urban design qualities (imageability, enclosure, human scale, transparency, complexity, legibility, linkage and coherence) for Duzce city in Turkey.

2.URBAN DESIGN QUALITY CRITERIA

There are too many perceptual qualities are described in theliterature. Ewing et al (2005) focused on eight urban design qualities since they claim that these qualities are distinct and important from both the qualitative

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literature and quantitative measure by users of urban space: imageability, legibility, enclosure, human scale, transparency, linkage, complexity, and coherence. Therefore, these eight criteria have been evaluated within the scope of this study (Table 1).

Table 1. *Definitions of Urban Design Qualities (Ewing et al., 2005).*

Imageability	Imageability is defined as the quality of a place that contributes to its distinctive, recognizable, and memorable.
Legibility	Legibility facilitates any spatial structure of a place to understand and navigate as a whole with a sense of orientation.
Enclosure	Enclosure as having a room-like quality refers to the degree to which horizontal spaces are visually defined by vertical elements.
Human scale	Human scale refers to a size of physical elements and proportions of humans correspond to the speed of humans walk.
Transparency	Transparency refers to the degree to which people can see or perceive human activity beyond the street or other public space
Linkage	Linkage refers to visual and physical connections from building to the street, building to building, space to space, or one side of the street to the other which tend to connect distinct elements.
Complexity	Complexity is about to the visual richness of a place. The complexity of a place depends on the variety of the physical environment such as the numbers and types of buildings, architectural diversity and facade ornamentation, landscape elements, street furniture, signage, and human activity.
Coherence	Coherence is defined as a sense of visual order. The degree of coherence is affected by consistency and complementarity in the scale, character, and arrangement of buildings, landscaping, street furniture, paving materials, and various physical elements.

3.STUDY AREA AND METHODS

3.1.Study Area

Duzce city, located in the middle of Istanbul and Ankara metropolitan cities, has gained provincial status after the devastating earthquakes in 1999. After being a province, it has rapidly migrated due to its strategic location and economic investments, depending on the establishment of Duzce University and industrial investments. This situation led to insufficient housing stock and the formation of new residential areas and mass housing projects outside the city center.

Four neighborhoods were selected from Duzce city as our study area (Table 2). While two of them are called as traditional neighborhoods, other two neighborhoods were built as mass housing projects after 1999 earthquakes.

Table 2. *Study Areas.*

Traditional Neighborhoods	**Mass Housing Projects**
Kultur	Metek-TOKI
Uzunmustafa	Guzelbahce

3.2.Method

AHP was developed by Saaty (1980) to make choice and prioritization for multi-criteria decision making problems. This is achieved by evaluation of a set of criteria and sub-criteria through a series of pairwise comparisons. Numerous applications of the AHP have been made since its development and it has been applied to several types of decision problems especially for social sciences (Byun, 2001). In this study, 4 neighborhoods were defined as alternatives and 8 urban design quality were defined as criteria (Figure 1).

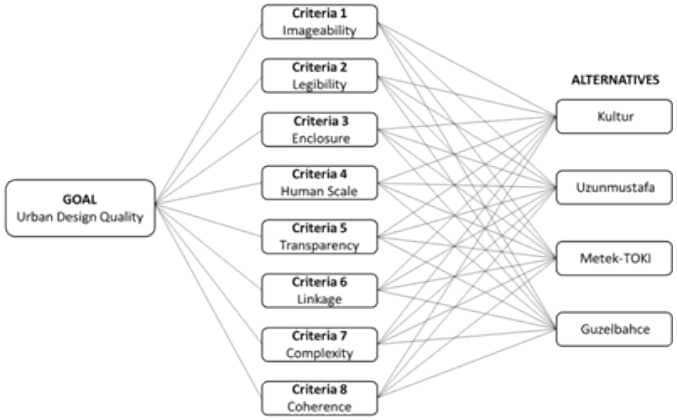

Fig 1. *AHP Model for Duzce City Neighborhoods Urban Design Quality*

Each alternative was compared with each other by expert panel in terms of importance based on these 8 criteria. The scale (Table 3) which was formed at this importance level was taken from Saaty (1980). Expert Choice 11 software was used to analyze the data sets.

Table 3. *The scale of importance (Saaty, 1980).*

Intensity of Importance	Definition	Description
1	Equal importance	Both factors are equal in importance
3	Moderate importance	A factor is somewhat more important than the other according to experiences and estimations
5	Strong importance	A factor is much more important than the other
7	Very Strong or demonstrated importance	A factor is preferred significantly much more than the other
9	Extreme Importance	One of the factors is absolutely more important than the others
2,4,6,8	Intermediate values	These are the intermediate values for the values mentioned above and used when compromise is needed

4.RESULTS AND DISCUSSION

Sensitivity analysis contributes to verify the results of the decision. The Expert Choice implementation of AHP produces four graphical sensitivity analysis modes: dynamic, gradient, performance and two-dimensional analysis. Dynamic and performance sensitivity analysis are employed in this study (Byun, 2001). As indicated in Figure 2, according to the evaluation of urban design quality, the degree of priority of the main criteria are shown as follows: Complexity (%18,7) Coherence (%15,8), Linkage (%15,4), Human Scale (%14,1), Legibility (%10,7), Imageability (%10,4), Transparency (%9,3), Enclosure (%5,5). The most important main criterion is the Complexity, while the Enclosure is considered the least important. The total consistency rate was recorded as 0,01 and the results were deemed to be consistent since they were below 0,1. The fact that complexity is the most important main criterion gains importance in terms of evaluating the mass housing. Especially, one of the biggest criticisms made to mass housing in Turkey is dominated by the monotony and being inadequate in terms of complexity.

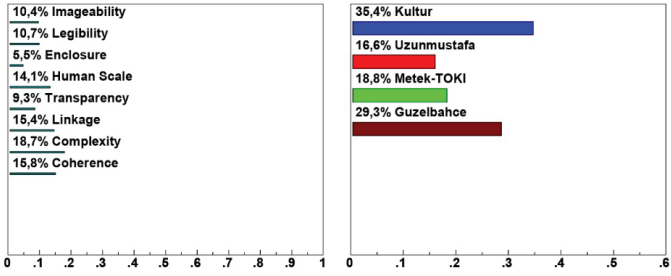

Fig 2. *Dynamic Sensitivity Analysis of Duzce City Neighborhoods.*

In terms of imageability, legibility, enclosure, linkage and complexity, Kultur neighborhood scored the highest in result. However, coherence, transparency and

human scale were found as the highest for Guzelbahce neighborhood(Figure 3). Kultur as a traditional neighborhood has a special character and variety in texture, color and structure type. Thus, the imageability and complexity of this neighborhood were found as high. On the other hand, Guzelbahce as a mass housing project offers a uniform layout in terms of the building type. This may have led to a high-quality perception of the neighborhood in terms of coherence.

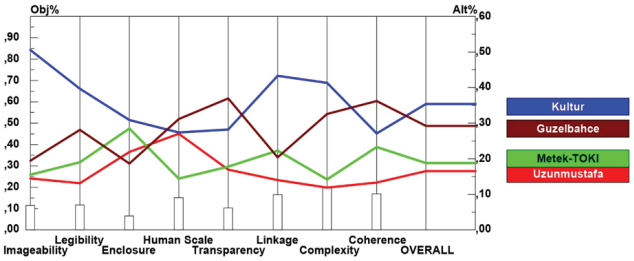

Fig 3. *Performance Sensitivity Analysis of neighborhoods from Düzce City*

Kultur neighborhood scored the highest design quality in the result, followed by Guzelbahce and Metek – TOKI neighborhoods (Figure 4). Kultur is also the oldest neighborhood that forms the core of the city and stands out in terms of many quality criteria. Although Uzunmustafa is a traditional neighborhood, it has the lowest design quality.

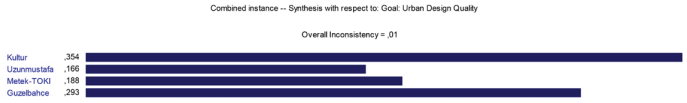

Fig 4. *Synthesis for overall Urban Design Quality of neighborhoods.*

As a design quality criterion complexity scored the highest for all study area in the result, followed by coherence and linkage (Figure 5). In this study, the

preference of experts for the complexity criterion may be due to the condition of the study area. Unlike many other cities in Turkey, Duzce city does not have a very rich cultural heritage, hence architecture and diversity in the urban context. The desire by experts to increase the diversity in Duzce city may have contributed to these findings.

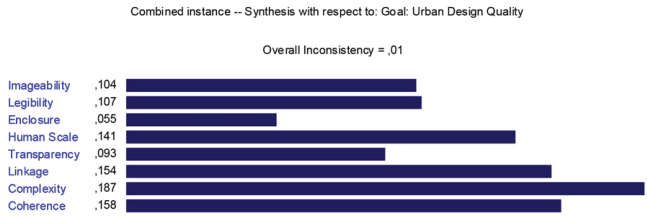

Fig 5. *Synthesis of each urban design quality for all neighborhood.*

5.CONCLUSION

Similar to previous studies, our results showed that imageability was also high in neighborhoods with high overall quality perception. In addition, it was concluded that the design quality of the neighborhoods is independent of their types such as being a traditional or mass housing project. In terms of social sustainability, it is very important that a neighborhood is either a mass housing or a traditional one. However, this study revealed that the perception of the design quality cannot be directly related to the neighborhood being traditional or mass housing.

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A CASE STUDY FOR TRADITIONAL OTTOMAN-TURKISH HOUSES IN THE CENTER OF KIRKLARELI

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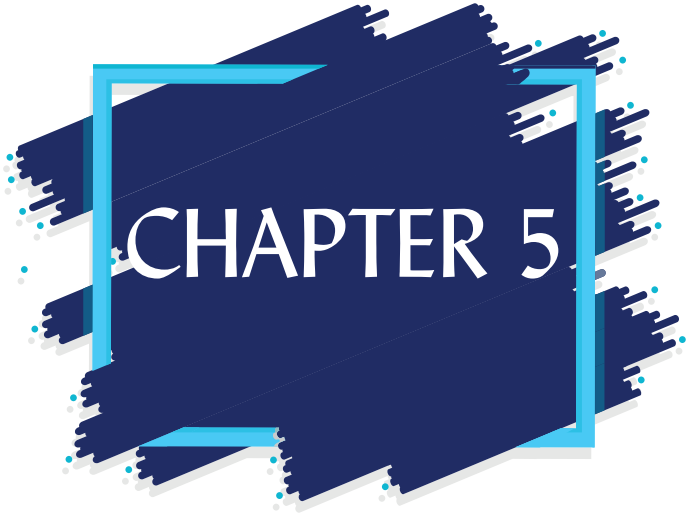

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A CASE STUDY FOR TRADITIONAL OTTOMAN-TURKISH HOUSES IN THE CENTER OF KIRKLARELI

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1. INTRODUCTION

The province of Kırklareli is located in the Thrace part of the Marmara Region. It is located between the northern latitudes of 41 degrees, 13 minutes, 34 seconds and 42 degrees, 05 minutes, 03 seconds and eastern longitudes of 26 degrees, 54 minutes, 14 seconds and 28 degrees, 06 minutes, 15 seconds according to its position in the world (Kırklareli Provincial Yearly, 2000). It is surrounded by Bulgaria in the north, Black Sea in the east, Istanbul in the south east, Tekirdağ in the south and Edirne in the west (Yurt Ansiklopedisi, 1983). Trakya region is commercial and strategically important region because it has passed over one of the two trade routes between Europe and Asia since early history. Therefore, throughout the history, many nations have sustain war to capture this region and have established dominance over certain periods of time. (Dağgülü,1995).

The history of Kırklareli has parallels with the history of Thrace. In ancient times, after the rule of the Scythians , Persians, Thracian tribes, the Odrysian kingdom, Philippos of Macedonia and Galatians, the city joined the Roman territories and was located within the borders of Thrace province of Rome. After the Roman Empire was divided into two parts, the city fell to Byzantium (East Rome) (Dursunkaya, 1948). During the Byzantine period, the name of the city was Saranta Ekklesies. At this time, the Bulgarians were attacked the city occasionally. The

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Bulgarians used the name Lozengrad for the city. There is no definite information in the first Ottoman sources about the date on which Saranta Ekklesies entered under the Ottoman's rule. It is generally accepted that this place was captured after the conquest of Edirne. The date of the conquest is known as the date of 768-770 (1366-1368) with regard to Islamic Calendar. After entering under the Ottoman's rule, the name of the city was changed as the Kırkkilise, which was the translation of the previous name, This name was used until the Republic period (Demiraco, 2007).

Kırkkilise was a township affiliated to Vize district in the province of Rumelia in the rule of Ottoman. In the wake of Tanzimat reforms, the Kırkkilise became a district center affiliated to the province of Edirne owing to the fact that the Ottoman change over the administration from states system to provincial system. The city was conquered by the Russians during the Russo-Turkish war and according to one of the articles of the Treaty of Ayastefanos signed after this war, the Kırkkilise was left to the newly founded Bulgarian Principality. But according to the Berlin Agreement, which was signed the same year, the city was returned to the Turks and continued to be a district center. During the second half of the 19th century, there were eleven mosques, three prayer rooms, six churches, a synagogue, twenty-one inns, two Turkish baths, forty-four stores, and 721 shops in 1874 with a population ranging from 7500-14.000. Kırkkilise was occupied by the Bulgarian forces at the beginning of the Balkan War. The city was saved on July 21, 1913 from this occupation, which lasted for nine months. During the Turkish War of Independence, Kırkkilise, which had been in the Greek occupation, was taken back on November 10, 1922. At the beginning of the Republic period, it became a province in 1924. Towards the end of the same year, the name of the Kırkkilise was changed to Kırklareli (Demiraco, 2007).

2. METHOD

"Case study" was used as a method in the study. The scope of this study involves the traditional houses of the Yayla Quarter which is located in the historical settlement of the city of Kırklareli and dated back to the Roman and Byzantine period, became an important settlement area since the Ottoman period and is now declared as an urban protected area (1996) by the Regional Council for the Conservation of Cultural Property (EKVKBK, 2018).

This study tries to reveal the similarities and differences determining the evaluations of physical and spatial conditions, sequences-fractal constructions of the houses within the settlement and analyses of the spatial constructions and facade typologies of the houses.

Field research was carried out in the area. In archive research, archive of Edirne Regional Council for the Conservation of Cultural Property (EKVKBK, 2018), Cultural Property Inventory of Kırklareli (KKVE, (2018), Kırklareli Provincial Culture and Tourism Directorate and The Ottoman Archives of the Precidency of Republic of Turkey were searched and literature search was carried out by the way of supporting the subject.

The historical development of Kırklareli is presented of the introduction part of the work. Secondly mentioned of the spatial features of the Ottoman - Turkish city and the traditional Turkish houses. Thirdly, identified of urban fabric and traditioal houses during the Ottoman period in Kırklareli. Were made defination of the physical and spatial conditions and the constructs about fractal arrangements of the settlement. Were mentioned of he characteristics of the traditional houses in Kirklareli. İn the fourth chapter, there were presented analysis of plan and facade typologies of traditional houses was made in the field. The houses are named with parcel numbers and they are examined

in terms of plan, facade features, construction technique and materials. There were compared and tabulated facade and plan typologies of all the houses surveyed. Findings are demonstraded in the results section. As a result of this study, similarities and differences were determined as the results of the analysis for determining the spatial constructions and façade typologies of the houses.

4. TURKISH-OTTOMAN CITIES AND TRADITIONAL TURKISH HOUSE

The formation of the Turkish Ottoman cities is not formal, it can not be defined geometrically. In this city structure, it can be easily adding and removing. They do not damage the feature of the formation. The texture of the cities has usually been the result of a functional building act and lead to not worry about aspect of the homes. Formations usually carry the same characteristics and sets of houses in the same character cause to form narrow, uneven streets. Despite not being a geometrically defined square, it is consciously left around the mosque, fountain and the bazaar and there are openings that appears like self-created (Şahin, 1992). In the cities, the road network is similar and there is no distinction between street and avenue. There are quarters with organic texture. The roads in this texture suddenly change direction without following any rule. There are differences in path lengths. Generally, there are dead-end streets towards into city block (Aliağaoğlu & Uğur, 2016). Historical and cultural identity shaping the urban space and dwellings in the city (Osmanoğlu, 2018a).

4.1. Spatial Characteristics of the Traditional Turkish House

The Turkish House is a type of house formed in the Rumelia and Anatolian regions within the borders of the

former Ottoman State, which has continued for about 500 years and is characterized by its own characteristics (Eldem, 1954). The Turkish House is based on a modular system. The smallest unit of this module is a room with service areas which are before and next to it. (Alsaç, 1993). According to Sedad Hakkı Eldem, while the rooms in the Turkish house are reproduced continually, anteroom comes out in front of the rooms as a common area. The form of anteroom determines the type of house. The anteroom can be in front of, or in the middle of or between the rooms. In terms of plan types, Turkish houses are gathered in four categories as without anteroom, exterior anteroom, interior anteroom and central anteroom

4.2. Plan Type without Anteroom

Plan type without anteroom is formed by lining up of rooms side-by-side. (Figure 1). The rooms have no connection with each other. Every room is entered from the outside. These species are usually used for garden houses protected by a garden gate and garden walls with inner court. Garden and stony ground take the place of anteroom. If the number of rooms is high, an iwan can be included among them. (Bektaş, 2014). There are also two-storey plan types without anteroom. It can be climbed up the upper storey with stairs in court.

Figure 1. *Plan Type without Anteroom (Küçükerman, 1973)*

4.3. Plan Type with Exterior Anteroom

This plan type is the first phase of the history of wooden houses of the Ottoman period. Connections between the rooms of the plan type with exterior anteroom are provided

by a common space called anteroom. In the rural part of Anatolia, it can be found many practices of this plan type especially in houses with garden and court. First form of this plan was formed by lining up of the rooms to the only one side of the anteroom, afterwards, L and U shaped plan types came to the fore with the addition of the pavilion to one side of the anteroom and the fact that pavilion takes the form of room and these additions are on one or both ends of the anteroom (Eldem, 1954). Bektaş also classifies the exterior anteroom as side anteroom, anteroom with L-shaped plan type and anteroom with U-shaped plan type. If the rooms are on the one side of the anteroom, it is called side anteroom; if the rooms are arranged on the one side of the anteroom adjacent to each other, the sofa is at a corner or is L shape, it is called L-shaped plan type with exterior anteroom; if the rooms are on the three sides of the anteroom and this is called U-shaped plan type with exterior anteroom (Figure 2) (Bektaş, 2014).

Figure 2. *Plan Type with Exterior Anteroom (Küçükerman, 1973)*

4.4. Plan Type with Interior Anteroom

Plan type with interior anteroom is the most common type of plan implemented in Turkish house. A type of plan called colloquially "karnıyarık" has emerged putting anteroom between the rooms(Figure 3). According to the condition of the ladder, special places such as pavilion or terrace on the one or both ends of the anteroom takes place. There is either a cedar or a large housing space that which is slightly elevated and even separated by railings from anteroom (Burkut, 2014). In the oldest types, the stairs are outside the anteroom. Later on it is taken into

the anteroom, but it is randomly positioned. The interior anteroom is enlarged by adding a side anteroom, an iwan or a anteroom with staircase (Eldem, 1954). In the interior anterooms, it is usually preferred two faced anteroom with namely anteroom with open two facades and windows. Later on, along with opening the doors of the rooms bevelled that are brought to the corners of the rooms and expansion of the middle part of the anteroom, this type starts to bear a resemblance to central anteroom (Hacıhafızoğlu, 2003).

Figure 3. *Plan Type with İnterior Anteroom (Küçükerman , 1973)*

4.5. Plan Type with Central Anteroom

Using of the plan type with central anteroom is started to be implemented later than the others. During the 18th and 19th centuries, buildings such as palace, small palace and pavilion in Istanbul had very different and interesting forms, thus adding richness to house designs (Figure 4) (Burkut, 2014). Together with the central anteroom, the house plans have become more square or square-like rectangles. Four rooms are located on four sides of the building, and service spaces such as stairs, iwan, pantry, and kitchen are put to use between the rooms. Even as the anteroom has four corners at first, in time, that corners are bevelled and formed as octagonal, polygonal, oval or elliptical shapes (Eldem,1954).

Figure 4. *Plan Type with Central Anteroom (Küçükerman, 1973)*

5. URBAN TISSUE AND TRADITIONAL HOUSES IN KIRKLARELI IN OTTOMAN PERIOD

Kırklareli, which was included in the Ottoman's territory in the mid-14th century, came into prominence due to its proximity to Istanbul and the ways of campaign to the west. Under the rule of Ottoman, in Kırklareli, minorities were settled in Yayla, and on the sides of Kırklar Hill, the Muslim Turks were generally settled. In 1492, in the wake of the Jewish massacre in Spain, Jewish people rescued by the Ottoman fleet brought to the Ottoman lands. A separate district was established in the Karakaş quarter for the Jewish people arrived in Kırklareli.(Saatçi Uluengin, 2016) It is known that during the Byzantine period the city spread out on the axis of Yayla Quarter and Kırklar Hill. Afterwards, the city enlarged in the south direction (Karaçam, 1995).

5.1. Urban Tissue

It is known that the Kırklareli township had 6 districts in the Ottoman period in the title registry dated 1530 according to the Ottoman Archives (CDAB-OA, 1). The second document dated 1642 is "Maliyeden Müdevver Avâriz Defteri" (CDAB-OA, 2). In this document, it is seen that the number of quarters has increased to 10. (Saatçi& Uluengin, 2016). The historical center of the province of Kırklareli is the Cumhuriyet Square, which is also the city center today. Hızırbey Kulliye built by Hızır Bey in 1383 is located in the square. In Kırklareli, the housing zones and the bazaar district developed separately. The commercial activity in the city centered on the Cumhuriyet Square and along the roads separated from it in various directions especially on Edirne Street. (Karaçam 1995).

The Ministry of Culture carried out inventory studies in the city before 1990 and 31 examples of civil architecture were registered (Şahin 2000). However, many historical buildings and houses were destroyed, in the pre-1990 period. The reason is the basic principles of the Urban Conservation Policy not detected before 1990 in Turkey (Şahin, 2004). The Regional Conservation Council declared the district consisting of the Yayla and Demirtaş Quarters as "Urban protected area" on the date of 19.09.1996 started the zoning plan studies for protection (Figure 5). This plan has been in force since 2001. Yayla region, which is the urban protected area today; it is located in the north of Cumhuriyet Square, which is the center of the city.

Residential and residential areas demonstrate very properly of the social, economic and cultural structure of the physical space; according to other urban functions in historic or not historic cities. (Osmanoğlu, 2018b). One of the best examples for this traces of the organic form of the traditional Turkish quarter are visible at the Yayla quarter (Figure 6). The locations of the buildings within the parcel influences the relation of the buildings with each other and with the streets. Tissue of the streets are formed by the positioning of buildings. Some of the buildings have entries only in the street while others have entries also in the garden. Dead-end streets are common. The highest point of the land is Yayla Square, where the Yayla Mosque is located. From this point the area descends to the east and south. The slope is less in areas close to the square, while in regions close to the border of the protected area, it is more. Topography of the region has an effect on positioning of buildings. The basement floor obtained by utilizing the elevation difference is used with functions such as cellar, pantry, warehouse. It should be noted that only the architectural heritage must be protected along with its surroundings. It is important to be aware of the fact that this heritage must be protected along with its surroundings

in order to protect the architectural heritage in Yayla Quarter. Although it is not stated in definitions, historical, urban and street fabrics, squares, traditional construction practices, material, color, fabric and folk architecture; regional, traditional and rural architecture are accepted as going to be protected assets (Şahin, 2004). The most important means of protecting cultural and natural heritage is planning. It is implied that in the site areas defined within laws, by taking interaction-transition field of the area into consideration, the necessity of making reconstruction plan for protect cultural and natural assets in the direction of sustainability principle is stated (Osmanoğlu, 2019a). The "Kırklareli Urban Site Conservation Development Plan" (Fiqure, 5) which includes the Yayla quarter, should have contents that effectively protect the urban texture and pattern (square, street, material, color, technique, etc.).

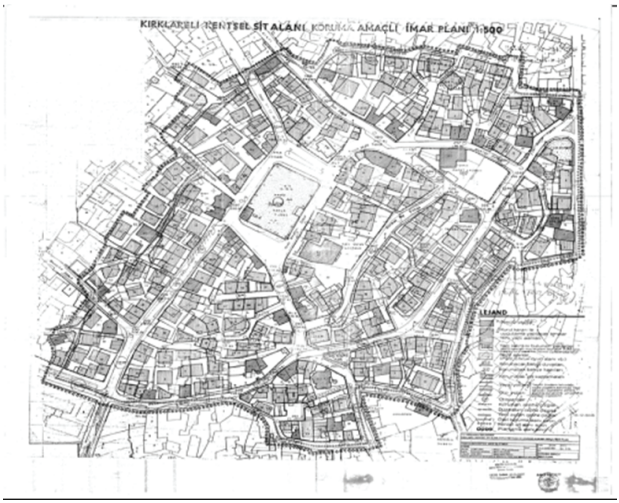


Figure 5. *Plan of Urban Conservation Area in Kırklareli Figure 6. Traditional Urban Tissue in Yayla Quarter*

5.2. Traditional Houses

The houses in Yayla and Demirtaş Quarters are generally two-storey buildings that made of masonry or wooden Masonry buildings are designed especially in the neo-classical style and they are widely prevalent in Kırklareli. As a result, the former Governor's Mansion (Figure 7), the Turkish Ocağı (Figure 8), and the Celepoğlu Mansion (Figure 9), all of which were originally designed as a house, were designed as neo classical styles. But there was build public structure as a Kocahıdır primary school (Figure 10) known as the Hamidiye Elementary School and is now a museum building (Figure 11) was designed the town hall. And all of them designed same style. On the other hand, it is also possible to see that traditional houses that made of mainly wooden also take its place in the texture of the city Orhan Özmadenci (Figure 12) and Aydın Akkul's houses (Figure 13) are some of these.



Figure 7. *Old Governor Hall Figure 8. Türk Ocağı Figure 9. Celepoğlu Mansion*


Figure 10. *Kocahıdır Primary School Figure 11. Kırklareli Museum*


Figure 12.*Orhan Özmadenci's House Figure 13.Aydın Akkul's House*

Outside of the Yayla Quarter, the Muslim Turkish people, who settled down on plain,the lower part of the city, usually built adobe houses with frame walls in the garden surrounded by walls. The roofs of these houses, which were single-storey and sometimes two-storey, were covered with tiles (Saatçi & Uluengin, 2016). According to Karaçam, they were the houses with facing garden and had no window on the street. In the houses with garden, large court and high garden walls, there were large doors with two wings where animals and cars entered and there would be a small door next to it. These houses usually had a water well.

In the interior of the houses there were shelves in the rooms, lockers and cells embedded in the walls. In the rooms this would usually be a bedroom, in a corner of it, or in another room, a house bath. The bathhouses were more modest, as the wealthy families had different shape of baths. The houses of these families differed in terms of architecture, decoration, workmanship and materials. There were ornaments motifs in the wooden parts. These houses were called "Ekabir, Bey, Paşa, Ağa Houses"(Karaçam, 1995). It has been observed that the traditional items brought by the Western Thrace immigrants since the 19th century participated in the local architecture. These are the kümbet and the commonly used heating devices called 'maşinga'. In the following years (1930), became widespread the use of sacred cousins called mashing. Lignite has been used for both of cooking and cooking on maşingas. Then cooker was made of plaster of red soil in outside ,the houses is renewed every first summer when entering (Yurt Ansiklopedisi, 1982).

In the traditional houses of Kirklareli, the chimneys of the heating quarries are often overturned. These chimneys located on the exterior are formed on the elbows by forming overhang. These different sizes of chimneys have given interesting plastic effects to the facades (Figure 14) (Saatci & Uluengin, 2016). In order to protect and transfer to the future of the traditional dwellings which are largely destroyed and have been shrouded since 1990, the participation of the people in protection must be ensured as well as the community (Şahin, 1990). For this purpose , it will be natural procedure to protect these dwellings by taking the concept of sustainability into consideration evaluating and functioning them within the concept of Sustainable Tourism (Osmanoğlu, 2019b).

Figure 14. *Suspended chimney examples in Yayla Quarter (106 Block of Buildings and 4 Parcel; 728 Block of Buildings and 23 Parcel; 87 Block of Buildings and 8 Parcel number houses)*

6. ANALYSIS OF THE HOUSES OF YAYLA QUARTER IN KIRKLARELI

Nineteen houses of Yayla Quarter in Kırklareli are renumbered with block of buildings and parcel numbers and examined according to location, plan features, facade features, construction techniques (Figure 15). The study shows that the entrances of the houses are generally in the south. There are five houses with the entrance located in the southwest, four houses with entrance located in the south, two of them in the southeast, three of them in the west, three in the northwest and one of the in the east. The examination of the garden and street connections of the entrances shows that they have both garden and street entrances. On the other hand, six houses are entered only through the street and their gardens are in the back. The houses numbered 2, 4, 5, 12, 13, 19 are entered from the garden. The houses numbered 1, 7, 8, 9, 14, 16 are

entered only from the street. The houses numbered 3, 6, 10, 11, 15, 17, 18 have street and garden entrances.

According to the plan features, it is determined that most of them are of plan type with interior anteroom. The front-facing rooms have living spaces while back-side has mostly service spaces. There are two houses (houses numbered 3 and 13) with exterior anteroom plan type, and four houses with central anteroom plan type (houses numbered 2, 4, 10, 12). The houses are generally two-storey above the basement. In places where there is no slope, the ground floor is elevated and formed basement or the houses are made up of ground floor and first floor. The houses also have large rectangular windows, double-leaf wooden doors. Entrances are elevated in all structures with at least a few steps and are withdrawn to create entrances. The edges of the windows have jambs and there are mouldings between storeys and eaves-cornices. These houses usually have balconies instead of oriel. Only three houses have oriel.

Filled wooden carcass and masonry system are applied as a construction technique. The fillings between the wooden carcass are brick and stone. These are applied on the inner surface as plaster or as a timber cover on the outer surface. It is discovered three houses with timber cover.

6.1. Comparison by Type of Anteroom

When the houses are examined according to the plan features, it is seen that the twelve of them are in the plan type with interior anteroom, in the six of them stairs are located on the entrance axis of the stairs, and in the five houses stairs are located behind one of the rooms next to the entrance. There are no stairs in the house numbered seven. There are two houses with the exterior anteroom plan type. In the one of them, the stairs is located on the

edge facing the outside where there are no rooms, and in the other, located between the two rooms in the part where the rooms are located. There are four houses with the central anteroom plan type, in the one of them, stairs are located on the entrance axis and in the other, stairs are between the rooms, on the other hand, two houses have no stairs.

6.2. Comparison by Entrance Type

All of the houses have an entrance with iwan and all of them are reached by ascending at least one or two steps. In four houses the stairs are located on the entrance axis overflowed from facade, four houses are in the niche on the entrance axis. In two houses the stairs are in the niche on the one side, in the one house it is on the one side again but overflowed and it is entered from a small niche following the landing, while in one house the stairs are located in the niche and on the two sides. Unlike these, in the house numbered 19, a few steps of the wide stairs built by overflowing from the entrance are in the niche, then a landing is built and the steps are widened and extended to the street.

6.3. Evaluation of Oriel, Balcony and Pinnacle

Most of the houses have an balcony above the entrance in the view of facade features. In the six houses there are balconies above the entrance, pinnacle in the two houses, and oriels in the three houses. Except for these, four houses do not have any of these features.

6.4. Comparison by Window Types

The windows are mostly wooden windows with 1/2 ratio. In one house, the ratio is 1/1. Eight houses have arched jambs. Six windows are rectangular windows with 1/2 ratio. One of them is flat jamb, and the other is wooden sill.

6.5. Comparison by Door Types

Considering doors, it is seen that all of them are wooden and double-leaf doors. Eleven of these have upper windows, two of them have both upper and side windows; in the two house, on the other hand, there are no windows.

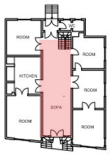
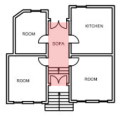
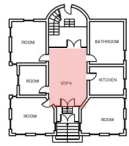
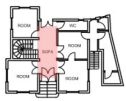
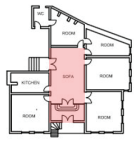
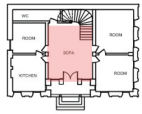
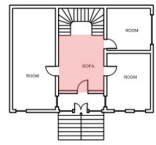
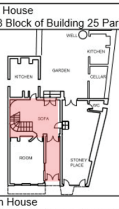
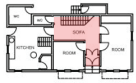
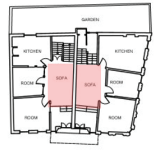
Figure 15. *The location of the houses in the parcel*

Table 1. *Photographic list of houses was analyzing*

Pictures of Houses			
			
1th House 87 Block of Building 8 Parcel	2th House 87 Block of Building 1 Parcel	3th House 88 Block of Building 21 Parcel	4th House 88 Block of Building 16 Parcel
			
5th House 100 Block of Building 5 Parcel	6th House 87 Block of Building 41 Parcel	7th House 728 Block of Building 23 Parcel	8th House 728 Block of Building 25 Parcel
			
9th House 87 Block of Building 23 Parcel	10th House 113 Block of Building 35Parce	11th House 110 Block of Building 43Parcel	12th House 110 Block of Building 3Parcel

Pictures of Houses			
			
13th House 728 Block of Building 29 Parcel	14th House 128 Block of Building 23 Parcel	15th House 128 Block of Building 95 Parcel	16th-17th House 128 Block of Building 7-8 Parcel
			
18th House 108 Block of Building 20 Parcel	19th House 152 Block of Building 7 Parcel		

Table 2. *Classification of Yayla Quarter Houses According to Interior, Central and Exterior Anteroom Plan Typologies.*

PLAN TYPE WITH INTERIOR ANTEROOM			
			
9th House 87 Block of Building 23 Parcel	1th House 87 Block of Building 8 Parcel	15th House 128 Block of Building 95 Parcel	6th House 87 Block of Building 41 Parcel
			
8th House 728 Block of Building 25 Parcel	7th House 728 Block of Building 23 Parcel	18th House 108 Block of Building 20 Parcel	5th House 100 Block of Building 5 Parcel
			
14th House 128 Block of Building 23 Parcel	11th House 110 Block of Building 43 Parcel	19th House 152 Block of Building 7 Parcel	16th -17th House 128 Block of Building 7-8 Parcel

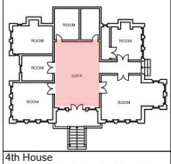
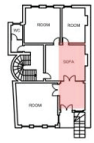
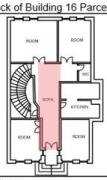
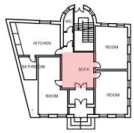
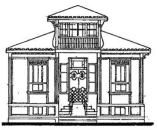
PLAN TYPE WITH CENTRAL ANTEROOM		PLAN TYPE WITH EXTERİOR ANTEROOM	
			
4th House 88 Block of Building 16 Parcel	2.th House 87 Block of Building 1 Parcel	13th House 728 Block of Building 29 Parcel	3th House 88 Block of Building 21 Parcel
			
12th House 110 Block of Building 3 Parcel	10th House 113 Block of Building 35 Parcel		

Table 3. *Façade Typology of the Houses in the Yayla Quarter*

Houses with balcony above the entrance			Houses with Pinnacle
			
12th House 110 Block of Building 3 Parcel	6th House 87 Block of Building 41 Parcel	10th House 113 Block of Building 35 Parcel	15th House 128 Block of Building 95 Parcel
			
16th – 17th House 128 Block of Building 7-8 Parcel	19th House 152 Block of Building 7 Parcel	8th House 728 Block of Building 25 Parcel	9th House 87 Block of Building 23 Parcel

Houses with oriel on both side	Houses with oriel on one side	Houses without Balcony and oriel	
			
14th House 128 Block of Building 23 Parcel	13th House 728 Block of Building 29 Parcel	7th House 728 Block of Building 23 Parcel	1th House 87 Block of Building 8 Parcel
			
11th House 110 Block of Building 43 Parcel		2th House 87 Block of Building 1 Parcel	3th House 88 Block of Building 21 Parcel

7. CONCLUSION

The houses examined in Kırklareli Yayla Quarter are all of the plan type with anteroom. The most common type is the plan type with interior anteroom. Most of the houses have basement floors. Anyone can get through to the ground floor with a few steps. While basement floor is mostly accessed from inside the house, there are also entrances from the garden without connection with the house. The stairs are usually located either directly opposite the entrance axis or behind one of the rooms situated symmetrically to the facade. It is known that, in the two houses, the stairs are overflowed from the facade and protruded cylindrically. The kitchens and wet areas are generally located on the rear facade, not towards the facade facing street, but towards the garden. In all of the houses, there is usually an elevated entrance. This entrance is inside of the facade. The entrance doors of the houses are double-leaf and wooden. In general, they all have an upper window, there are a few houses with upper side window or without window. The houses have central entrance. In general, there is balcony above the entrance. The windows are placed symmetrically on both sides of the entrance. The windows are of long rectangular shape, and most of them are inside of the arched jamb. A small number of buildings have wooden sills and ornaments. The most prominent features on the facades are the wide fronts, the mouldings between the storeys, the window jambs and the stone facings ranging from the roof of the building to the floor. Filled wooden carcass and masonry system are applied as a construction technique. The fillings in between the wooden carcass are brick and stone. These are applied on the inner surface as plaster or as a timber cover on the outer surface. The foundation walls are usually rubble stone walls. Brick and stone are used in the masonry system. The brick is applied as both bearing and backfill material in the masonry system.

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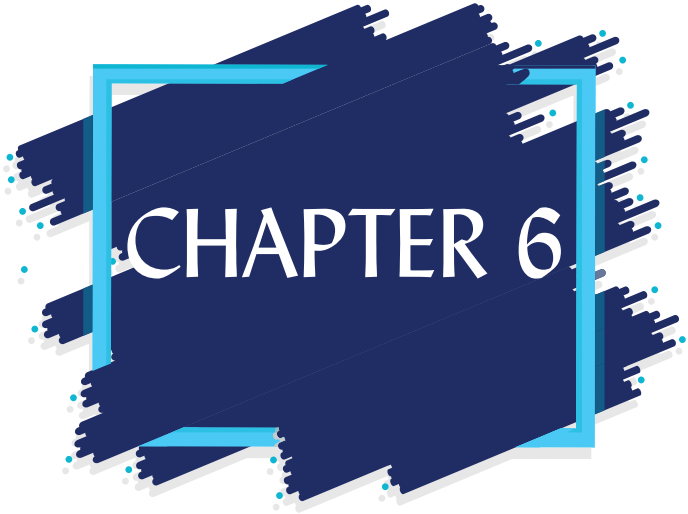
A CASE STUDY IN THE CONTEXT OF THE LIFE-SPACE RELATIONSHIP: TOWN OF KAYACIK, MANİSA

Eti AKYÜZ LEVİ[1] , Göze BAYRAM[2]



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1. INTRODUCTION

In today's life, people living in the rural areas which their roots are connected to, have been forced to move to cities due to challenges that they are facing in the rural areas with the rapid growth of city life's economical, social, cultural as well as educational improvements. It is unfortunate that, abandoned rural areas with the architectural characteristics that have been formed by the life style are facing loss and disappearance as they are unable to resist the time. On the other hand, occupied rural areas are losing its characteristics due to unplanned construction activities that are not taking into account surrounding aspects, material and correct construction techniques. Manisa-Kayacik countryside which has important richness of history, nature and cultural assests with the traditional Turkish housings has been chosen as an example to study the life-space relationship.

In this paper, the reflection of life to the space is being analyzed through Manisa Kayacık Town Houses. Within the scope of the study, the past and the present of traditional structures within Manisa-Kayacık rural which has significant richness in history, nature and cultural assets, is being examined with area study. The structures in question are being classified in terms of plan typology and the life-space relation is being dealt with architectural components.

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Thus, in the direction of today's living condition needs, the change of traditional spaces is observed.

2. GENERAL INFORMATION ABOUT KAYACIK

The town of Kayacık in the district of Gördes, affiliated to Manisa province in the Aegean Region, takes its name from the structure of its topography, which leans its back against the rocky areas.

Figure 1. *View from Kayacık*

Kayacık, which used to be located on the routes of important trade roads and through which camel caravans used to pass in the past, later lost its former importance and remained aside as a result of the fact that the road network was changed.

Although it is not exactly known when the settlement was established, it is thought – on the basis of the archaeological research – that its past dates back to circa 6000 B.C. Besides, the town reflects a multilayered quality which offers cultural diversity with its 750-year-old mosque, the church constructed in the 19th century, and its traditional houses.

The first registration study in the area was carried out for the minaret of the Yukarı Cami (Upper Mosque) building (with Decision No. 6531 dated 26/01/2011) (the archive files of İzmir Regional Council for the Conservation of Cultural and Natural Properties No. II.). İzmir Regional Council for the Conservation of Cultural Properties No. II registered 18 immovables in the settlement with Decision No. 984 dated 08/06/2012. One of them is a cemetery.

The masjid and the village room, the church, the coffee house and the traditional houses can be indicated in the context of important historical spaces in the settlement of Kayacık, which includes four neighborhoods (İstiklal, Cumhuriyet, Hürriyet, and Atatürk).

There are various archaeological remains in the close vicinity of the area (Şahankaya and Yedi Kule) (Roosevelt, 2009).

Figure 2. *Kayacık Hill and "Queen's Tomb"*
(Kayacık Municipality photograph archive, 2009)

For such reasons as the limited transportation possibilities, the bad straits, and the failure of buildings to meet current living conditions in the settlement of

Kayacık, the houses are abandoned and the people either migrate to Manisa and İzmir or go to Antalya in order to work as seasonal workers in greenhouse cultivation. That's why the population of the town, which was 2,670 people in 2000, fell to 1,041 people in 2012 (URL-1).

A school where education at the elementary and secondary school levels is provided is available in the settlement, and the high school is accessed through transportation. Agriculture and animal husbandry constitute the sources of living for the people, and there is a milk collection center in the vicinity of the settlement.

3. HOUSES OF KAYACIK

Located in a sloping area, the settlement of Kayacık is striking with its organic street fabric, which offers spaces with surprises, and with its roofs, which are covered with Turkish-style tiles and which cover the settlement like a veil when viewed from the top. The houses are generally two-story, and their downstairs is intended for such service spaces as depots and stables. The upstairs, the actual living floor, is approached by means of an outer flat stone staircase. One gains access to the rooms through the sofa (hall) space.

Figure 3. *View from Kayacık*

Sedad Hakkı Eldem (1968), a researcher on Turkish houses, took the element of sofa as the basis and classified the Turkish house as having no sofa, an outer sofa, an inner sofa, and a central sofa (1953). The houses of Kayacık are of the type of plans with an outer sofa and an inner sofa. The sofa is either open or closed in the examples with an outer sofa. The houses with an open outer sofa in the settlement can be classified as having a room, two rooms, and three rooms. There are examples with two and three rooms in those with a closed outer sofa. On the other hand, the houses reflecting an order of plan with an inner sofa have three or four rooms.

Such elements as an abdestlik, a tabaklık, and a fireplace can be seen in the examples with an open sofa. In some examples concerned, the element of wooden latticework was used for the purposes of privacy and solar control at the periphery of the sofa space. The rooms contain the elements of a fireplace, a yüklük, and a gusülhane (a bathing cubicle).

It is perceived that in some houses, one of the rooms was converted into a kitchen and a toilet was added to the sofa space.

The houses are in the composite system, and the main stone walls preserve their continuity on two or three façades of the first floors in the majority of the buildings. The construction system is timber frame on the other façades and the partition walls of interior spaces. The houses mostly have a hip roof. The roof material is particularly Spanish tiles and Turkish-style tiles.

Figure 4. *Composite system examples from Kayacık houses*

4. SOCIAL LIFE

In Kayacık, the people support each other in various important events and delight and sadness are shared. This is observed in such events as festivals, weddings, and deaths or at various disasters.

Figure 5. *Festival Day in Kayacık from May 2012*
(Reference: *Kayacık Municipality photograph archive, 2012***)**

Whilst the settlement intensively lives in winter, it partially becomes unoccupied in summer as people go to the tablelands. In winter, housewives finish the work of their houses and gather, whereas men meet at the coffee house. It is observed that women support each other and that those with no oven bake their breads and cook their dishes in the oven of those possessing it.

In line with the changing way of life and conditions, various alterations were made to some houses so as to meet the current comfort conditions. Examples in which wet spaces were included in the building are seen. Such things as a refrigerator and a washing machine were placed and a kitchen counter was included in the sofa space. A television is available in the houses so people know about the global world.

5. REFLECTION OF LIFE ON SPACE

Example 1

A hall (çardak) and a room – Plot No. 1939 – with an open outer sofa

One enters the house from the space called a courtyard (saya), from where one gains access to the toilet on the one hand and the animal shed on the other hand and, by means of vertical circulation, to the upstairs – the çardak space. One gains access to the room from the çardak, which qualifies as an open outer sofa.

While the downstairs qualifies as the service floor, the upstairs is the actual living floor. At the çardak is the element of fireplace, where dishes are cooked and water is heated; next to it is the section which is called an "ışıklık" and where kerosene lamps used to be placed in the past; and on the other wall is a fountain.

Figure 6. *View from Plot No.1939*

Figure 7. *Fireplace and fountain in the hall (çardak) (Plot No:1939)*

The room includes a fireplace opposite the entrance and a yüklük next to the entrance. A yüklük is a fixed cupboard where the comforters and mattresses laid at night and collected during the day depending on the flexible use of space are placed. In the houses of Kayacık, the lower section of yüklüks qualifies as a cupboard which is called "yüklükaltı" and where clothes are placed. At the corner of a yüklük is the bathing section generally prevalent in Turkish houses and called a "gusülhane". The loom, a reflection of the occupation of carpet making – a traditional handicraft – that had contributed to the livelihood of the people by the 1980s, partially maintains its existence in the room (Figure 9).

Now that the actual sources of living for the people are agriculture and animal husbandry this has been reflected on the space where they live through the animal shed located in the downstairs of the house.

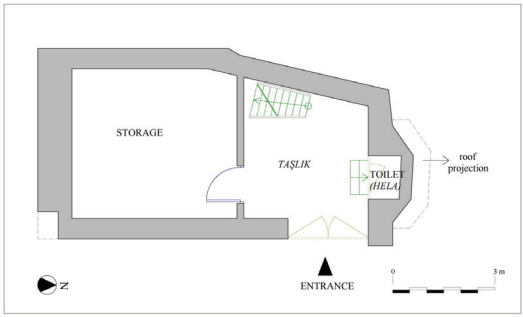

Figure 8. *Ground floor plan of Plot No.1939*

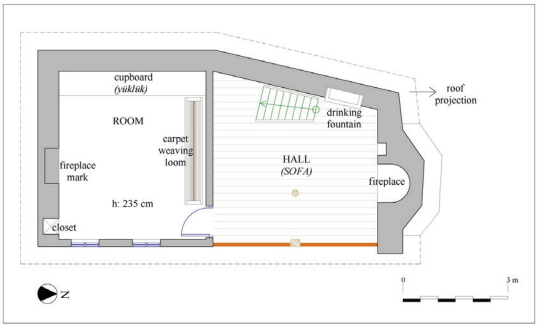

Figure 9. *First floor plan of Plot No.1939*

Figure 10. *Carpet weaving loom in the room (Plot No.1939)*

Example 2

A çardak and two rooms – Plot No. 1851 – with an open outer sofa

One enters the house through the taşlık space, and the downstairs contains a space with a feed trough on the side of it and two adjacent spaces, each accessed through a door from here, with them being spaces where the occupations of agriculture and animal husbandry are reflected on the house. Based on the presence of a feed trough section in one of them, it is considered that it was used as a stable, whereas the other one was a crop depot – a granary.

Figure 11. *View from Plot No.1851*

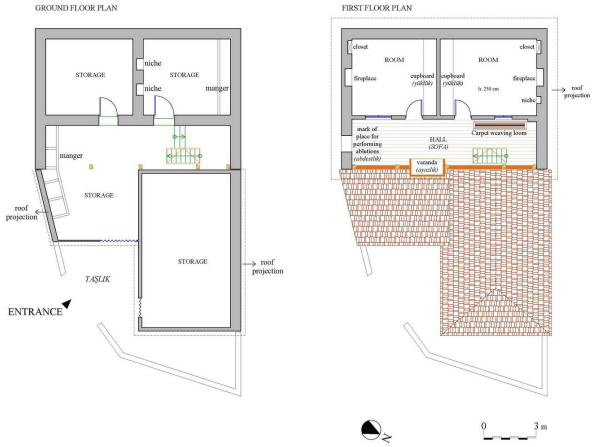

Figure 12. *Floor plans of Plot No.1851*

The upstairs is accessed by means of a staircase the first two steps of which were built with stones and the rest of which was made of the wooden material. Over the staircase is a lid which qualifies as a horizontal door so the floors are separated.

One gains access to the two rooms from the çardak space, one of whose faces is open. The rooms have a window and a door which face the çardak. The rooms contain a yüklük that continues along the wall on the wall next to the entrance as well as a fireplace and a small cupboard on the wall opposite the yüklük.

Figure 13. *Fireplace, shelf (cilve) and closet in the room (Plot No.1851)*

In the room is a fixed shelf (cilve) which is at an easily reachable height when standing and which rotates along the walls, as a characteristic of a Turkish house. The ayazlık, qualifying as a specialized sitting corner to watch the environment, and the hand loom, which reflects the occupation of carpet making, are seen in the çardak space. The çardak space is bordered by wooden latticework up to a specific height as the reflection of privacy.

Figure 14. *Ayazlık and carpet weaving loom in çardak (Plot No.1851)*

Example 3

A sofa and two rooms – Plot No. 1869 – with a closed outer sofa

One enters the house from the street through the taşlık space. There is a depot opposite the entrance, a coop next to it, and a toilet on the other side. One enters the upstairs by means of a door from the L-shaped outer staircase made of stone materials.

Figure 15. *View from Plot No.1869*

The sofa space contains an abdestlik and a cupboard, and one gains access to the two rooms from here. The rooms include a yüklük and a fireplace that continue along the wall, with one of them located next to the entrance but the other one located opposite the entrance.

There is a niche on both sides of the fireplace in one of the rooms. The room in the south-east reflects the quality of being a winter room since it is closed to the outside and with its stone walls, whereas it only has a window which opens to the sofa space.

A visual connection with the street is made by means of the window of the other room, which opens to the outside. The downstairs spaces reveal the source of living and the way of life.

Figure 16. *View from cupboard (yüklük) in Plot No.1869*

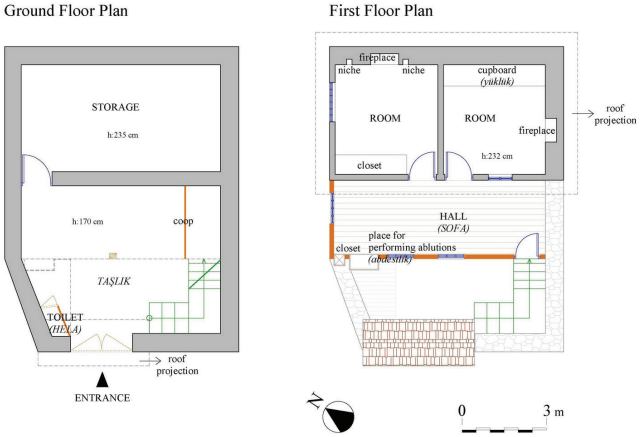

Figure 17. *Floor plans of Plot No.1869*

Example 4

A sofa and three rooms – Plot No. 1948 – with a closed inner sofa

One enters the house from the street by means of the courtyard, and a toilet and a fountain are present at the corner of the courtyard. Of the four closed units located downstairs, two are stable spaces that contain feed trough sections and the other two are depots.

Figure 18. *View from Plot No.1948*

One gains access to the stair landing by means of the single flight staircase located at the courtyard and leaning against the depot and to the sofa through the door. There is a fountain in the sofa space. Distribution to the three rooms from the sofa is possible. The rooms contain a yüklük; furthermore, one of them has a fireplace besides it.

Figure 19. *Cupboard and fireplace in the room (Plot No.1948)*

The exterior walls on the three sides of the house except for the southern side are stone upstairs. Of the rooms, two lead to a garden and one of them leads to the sofa by means of the windows. Two rooms have been connected to the outer environment.

When the examples under examination are evaluated in general, it is understood from the granary space seen in the houses that people were engaged in agriculture, from the animal shed that one of the sources of living was animal husbandry, and from the carpet loom in one of the rooms or at the çardak that carpet making was carried out.

Figure 20. *View from hall (sofa) (Plot No.1948)*

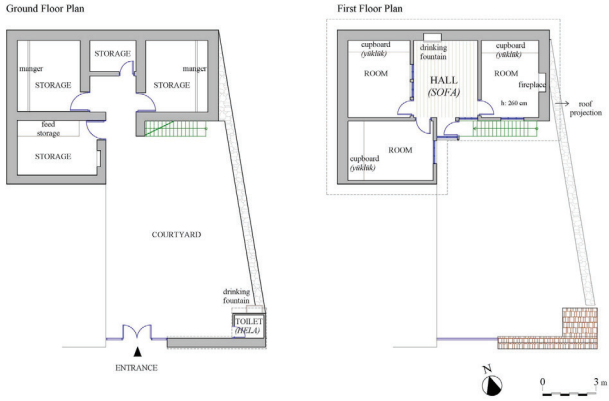

Figure 21. *Floor plans of Plot No.1948*

6. EVALUATION

When the life of the people of Kayacık and the houses of Kayacık are examined in the context of the life-space relationship, it is seen that they grow the agricultural crop they need, make use of the milk, eggs, and meat of the

animals they keep, and procure their other needs by selling the remaining products in the market in a self-sufficient production economy order. The reflection of the way of life and the source of living on space takes place through the carpet looms in the upstairs rooms and sofas, along with such spaces as stables, granaries, and coops located downstairs.

Even though the houses partially have physical sustainability today, the partial disappearance of the sustainability of life affects physical sustainability too; the houses are abandoned to their fate; and they rapidly disappear when they remain unoccupied and unused.

In this context, the buildings should be adapted to current living conditions without damaging their original identities, thereby enabling the houses, and gradually the town, to live. When realizing this, the reviving of the potential of the settlement will contribute to conservation by maintaining.

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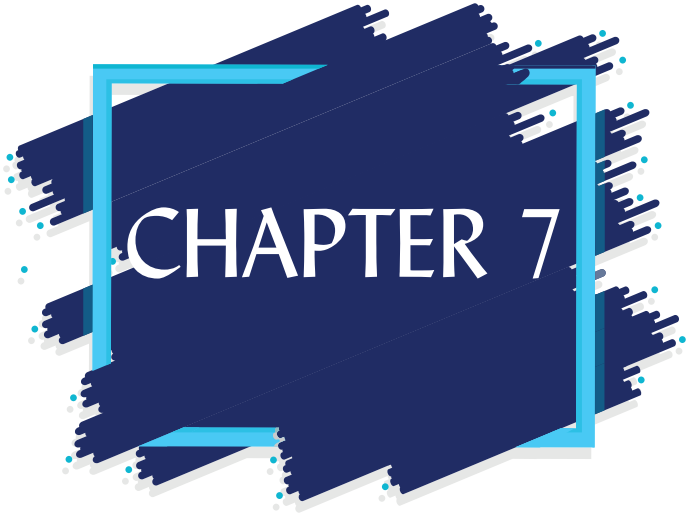
SUSTAINABILITY PERCEPTION OF USERS FOR THE VERNACULAR HOUSES REFUNCTIONED FOR PUBLIC USE: A STUDY ON THREE PARTICULAR BUILDINGS AT THE HISTORIC CITY CENTRE OF AFYONKARAHİSAR[1]

Gamze ÇOBAN [2], Pınar DİNÇ KALAYCI[3]



1 This article was adapted from my master thesis entitled "Sustainability in Refunctioned Buildings: Evaluation of Three Buildings Located in Historical City Center of Afyonkarahisar" under the supervisor of Prof. Dr. Pınar Dinç Kalaycı in the Department of Architecture within the Institute of Natural and Applied Sciences at Gazi University.

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1. INTRODUCTION

The increase in the population and thus in the consumption following the Industrial Revolution has caused the energy resources to diminish and the damage to the environment to deteriorate, of which recognition has caused government to develop new policies and the concept of sustainability to emerge. Sustainable architecture is based on minimizing the damage to the environment, efficient use of resources, and meeting the conditions needed for human health and comfort. Within the conception of sustainability, making use of the present building stocks instead of constructing new buildings gives an advantage in terms of the energy and the use of natural resources required for demolition and construction, and causes the re use studies to be discussed within the scope of sustainable architecture [1].

The historic city centre of Afyonkarahisar has hosted many civilizations in the course of history, and as a result,

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has had cultural properties created through a cultural accumulation of almost 800 years since the 12th century. The historic city centre of the city, where immovable cultural properties are collectively found, was designated as an "Urban Protected Area" in 1988 [2]. The buildings in this area have been quitted over time since a railway has come to the city and the buildings have failed to meet the needs of modern life, and the settlement area has moved to the north-east of the city [3]. Upon the replacement of the city centre, residences, being the most common immovable cultural properties, also began to be abandoned, it has gained importance to protect the buildings having the characteristics of a bridge between the past and the present. The conception of protection, by integrating into modern functions, has reached today an understanding with the purpose of protecting, protection by freezing has been abandoned, and the idea of conserving by meeting the needs of the age has come into prominence [4].

Based on the idea that the sustainability of the re used buildings is correlated with the high potential of use of the buildings, in this study, the sustainability of the re used buildings at the historic city centre of Afyonkarahisar was investigated through the users' satisfaction. It was aimed to provide feedback for future studies by determining the criteria for the satisfaction of the users with the re used version of the buildings and for the sustainability of the re used buildings [5].

2. CONCEPTUAL FRAMEWORK

2.1. Sustainability of Historic Buildings

Historic environments, which means the ruins and settlements that have come from the past civilizations to the present, provide information about the local architectural identity through the buildings within them in

addition to causing the local arts to be examined on site and recognized. This gained information helps to recognize and understand the lifestyles that have not reached today and about which there is no written information [6]. Being the documents that best reflect the characteristics of their period, the immovable cultural properties are of great importance in that they reflect the social, cultural and economic structure, lifestyle and philosophy of past ages [7]. Therefore, it comes to be necessary to protect the historic buildings, which are an important part of the urban identity and culture. Factors such as stopping to need the functions of buildings and the functions going out of date due to the changing circumstances and value judgements cause the building to be abandoned [8]. For buildings that have completed their life, the whole building and all of its construction materials become waste as a result of demolition [9]. In addition to the damage to the nature by the wastes caused by the demolition of unqualified buildings, buildings with cultural value are also exposed to destruction. The characteristics of being a historic cultural property that adds value to a building requires the building to be sustained, and the approach of protection gains importance along with the idea of sustaining the historic buildings [10]. The conception of protection involves the protection of the human-made physical environment as well as the cultural values, and buildings present themselves as integrated into the society and the environment they exist within. Therefore, the conception of protection is not seen as independent from society and environment. Leaving buildings empty for protection causes them to be destructed and disappear after a while, and it becomes a necessity to continue to use the buildings by giving them new functions and to protect them. The objective for groups of buildings that cannot meet functional needs, but have completed their structural life is to transform the existing building stock and save it

for the city, and to ensure continuity of the togetherness of the buildings with the users [11].

2.2. Conception of Refunctionalization

International Council on Monuments and Sites (ICOMOS), at which it is stated that protection of monuments is always possible by using them for a beneficial social purpose, explains that the best way to protect buildings is to use them for a beneficial purpose, so at this point, the importance of re use studies become apparent [12]. While use of the existing building stocks instead of constructing new buildings ensures environmental sustainability through the decrease in the consumption of energy and resources, it also support social sustainability through the protection of cultural values and transfer of them to the next generations [1]. The most found examples are the traditional residences in the re use studies, which are seen as an alternative process of building production. The need for residences, which is the basic element of this study, never comes to an end, and despite this, the residences designed for a different lifestyle and family structure become unable to meet some needs of the modern life. This situation requires the residences to be re used and to continue to be used [13]. Success of the re used building depends on the continuity of the function, and functional sustainability is ensured when the requirements for the new function and the existing building perfectly adapt to this function [14]. A new function unsuitable for the re used version accelerates the building's destruction increases the risk of losing the building. Analysis of functional sustainability requires a number of research studies, and the physical (the building's spatial composition, the building's volume and dimensions, the building's functional relationships setup, and the building's location) [15] and technical characteristics (lighting, heating, etc.) of the buildings, and the satisfaction of the users with the new function become important [16, 17].

In re use study, it is expected that the existing building's original functional setup and its new functional setup be the same as or similar to each other. Giving an existing historic building functions with a different inter-spatial connection setup causes undesired situations in the functional setup, choosing a function unsuitable for the economic state of the people living in the region causes the building to be abandoned, and lack of analysis of the socio-cultural state of the region causes a decrease in use of the building [13]. Based on these ideas, in the study, the "Post-Occupancy Evaluation" survey was conducted taking as a basis the idea that paying attention to the opinions of the users supports the positive development of the process of designing and causes the planning to be done to progress more properly. The POE study was used as a means of (i) assessing the satisfaction with the re used versions of each building, and (ii) determining the performance criteria that positively affected the buildings' sustainability.

The POE studies, described as the studies aiming to increase the liveability in a physical environment, is defined as a discipline that investigates to what extent and how the objectives determined within the programme of existing buildings have been accomplished and how the users use the building. The POE studies are stated to provide feedback for existing buildings and at the same time to provide feedforward by obtaining information to be used for the buildings to be designed in the future. Building performance elements of the POE consist of three branches, being the technical performance criteria involving lighting, heating, ventilation, and acoustics; the functional performance criteria involving conformity of the building's spaces' size, height and form to the new function, and accessibility; and the behavioural performance criteria involving the perception of the users about the space [5, 18].

Table 1. *Post Occupancy Evaluation Performance Criteria*

Technical Performance	Functional Performance	Behavioural Performance
Lighting, Heating, Ventilation, Acoustics	Involving conformity of the building's spaces' size, height, form to the new function, accessibility	The perception of the users about the space spacious, peaceful, beautiful, comfortable, useful, harmonious, well groomed.

2.3. Methodology

Place: Within the scope of the study, the buildings at the historic city centre of the province of Afyonkarahisar having gone out of use due to the changing lifestyle, being a potential for re use studies caused the study to be carried out in this area. First of all, the re used buildings were detected at the historic city centre, and the buildings were seen to have consisted of monumental buildings and examples of civil architecture. Among these buildings, Afyon Agency of the Chamber of Architects, Mihrioğlu Mansion Restaurant, and the House of Culture and Art, all of which were transformed for public use after having been used as a residence, were selected as the buildings to be examined.

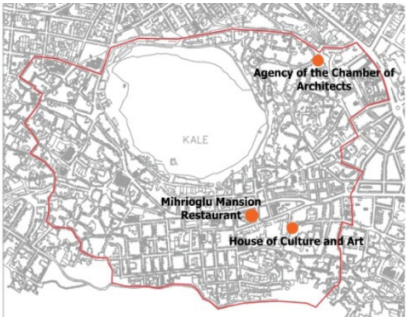


Figure 1. *Location of the selected buildings in the Urban Protected Area*

In literature studies, it is stated in studies focused on sustainability of re used buildings that the sustainability of the new function is correlated with the success of the adaptation of the function to the existing building, and that it is decisive in this correlation to what extent the spaces of the existing building meet the needs of the new function. Behavioural performance is suggested as sustainability, and it is explained that behavioural performance is correlated with technical and functional performance, and that the perception of the users about the space depends on these performances. In addition to this, in the studies, an evaluation was made over single function, and no conclusion was reached about how results varied by different functions. Accordingly, in the study, differently from the literature studies, it was aimed to determine, for the ref buildings, which of the criteria of technical, functional and behavioural performance the sustainability of the new function was correlated with, and which performance subtitles affected the sustainability of the new function. Therefore, some hypotheses were put forward in the study, which are as follows:

H1: Technical, Functional and Behavioural performances are significantly correlated with sustainability.

H2: Technical, Functional and Behavioural performances equally affect sustainability.

H3: Choice of function differentiates the performances that affect the sustainability. Answers were sought to these hypotheses in terms of users' satisfaction.

Method: The method of the research study on the re used building was applied in two stages as follows:

(1) Preparation of the spatial program of the new function, determination of the new function's requirements for each spatial level, physical analyses of spaces

(qualitative evaluation) for an understanding of adequacy of the spatial dimensions and

(2) A survey (quantitative evaluation) applied to the users for determination of the performance scores of the spaces. Unlike the other POE studies, sustainability was discussed under a separate title in order to the correlation with and effect on sustainability of the technical, functional and behavioural performances. Under the title of sustainability, the criteria were investigated of the use of green spaces, the variety of the means of transportation, the use of natural construction materials, the conservation of the original elements of the building for the new function, the visual integration with the buildings around.

The data obtained as a result of the qualitative and quantitative evaluations was collectively interpreted, it was discussed along with reasons which performance scores that indicated the users' satisfaction were found to have been high and which were found to have been low, and then implications were provided for future re use studies.

Survey: In the survey of the study, which aimed to determine the users' satisfaction with the re used buildings, four of the questions were prepared on a five-point likert type scale, and six were prepared as multiple-choice ones. In the survey, status of the technical, functional, behavioural and sustainability performance criteria for the buildings were investigated respectively. Performances correlated with sustainability were determined by a correlation analysis, and performance criteria that were found to have affected sustainability were determined by regression analyses over the performance that were found to have been correlated. Correlation analysis was conducted to determine whether the components were normally distributed, and if both components were normally distributed, Pearson correlation coefficients were

considered otherwise, Spearman corelation coefficients were taken into consideration. For the three selected buildings, 50 randomly selected users for each were applied the survey after their experience with the buildings, and a total of 150 users were surveyed.

Analysis: Within the course of the study, SPSS (Statistical Packages for the Social Sciences) programme was used for all statistical analyses. A reliability analysis was conducted for all questions before the analysis of the data from the survey, and the values were stipulated to be bigger than 0,07. In the reliability analysis conducted to determine the consistency between the questions, the Chamber of Architects was found to be Cronbach's Alpha: 0,824; Mihrioğlu Mansion Restaurant to be Cronbach's Alpha: 0,878; and the House of Culture and Art to be Cronbach's Alpha: 0,887. For the questions placed under the titles of technical performance, functional performance, and sustainability, the points of "I strongly disagree", "I disagree", "I slightly agree", "I agree", and "I strongly agree" were used, and for the questions placed under the title of behavioural performance, the points of "Extremely Poor", "Poor", "Fair", "Good", and "Very Good" were used in a 5-point Likert type scale [19], and the average values under 2.60 indicated that the elements were good.

3. RESULTS AND DISCUSSION

Qualitative Evaluations

Table 2. *Image of the selected buildings*

Mimarlar Odası	Mihrioğlu Konak Restoran	Kültür ve Sanat Evi
		

Upon an evaluation of the re used building of Afyonkarahisar Agency of the Chamber of Architects, it was found that the building had the necessary units of a secretary's office, a chairman's room, a room for the board of directors, a project control office, an accountancy office, a library, a kitchen, wet areas, a storeroom, and a heating room. But the building, used with its new function, had no units such as an exhibition room, a meeting room, or a training room. Upon an analysis of the spatial organization, it was seen as the positive aspect of the new function that the chairman's room and the room for the board of directors were upstairs since spaces that served both temporary and permanent users and served a big number of users must be located near the building entry in order to avoid unnecessary circulation within the building, and it was found that the location of the project control and the accountancy offices, which were the most used spaces, on the first floor caused unnecessary circulation within the building. The building's state before its re use and its present state were compared within the scope of the idea that the building's original state must be protected and the interferences with the building must be minimized, and as a result of this comparison, it was determined that the wet area in the kitchen had been removed and the wet area near the entry on the first floor had been removed. It was observed that such a change had been made because the transformation of the building from its function in private use into public use had required separate wet areas for men and women to be designed, and it was concluded that this change had resulted from spatial necessities. The building's original spatial and mass integrity had not been interfered with, and its inter-spatial connection setup had not been changed (Table 3).

Discussing according to the Time Saver Standards the sufficiency of the size of the building's spaces for the actions within the new functions, it was seen that the 16,11

m² secretary's room on the ground floor had a sufficient size, the 12,95 m² library had no sufficient size considering its 10-person settlement layout, the 22,50 m² chairman's room and the 15,60 m² accountancy room had a sufficient size for use. It was found that the 12,10 m² project control room had a sufficient size for 1 person's study, but could not provide the users with a comfortable elbow room and a waiting space mostly used by architects who came to the chamber of architects for project control and approval. It was observed that the 14,60 m² room for the board of directors was insufficient in terms of the equipment used and the size for the meetings of the 10-person board of directors [20].

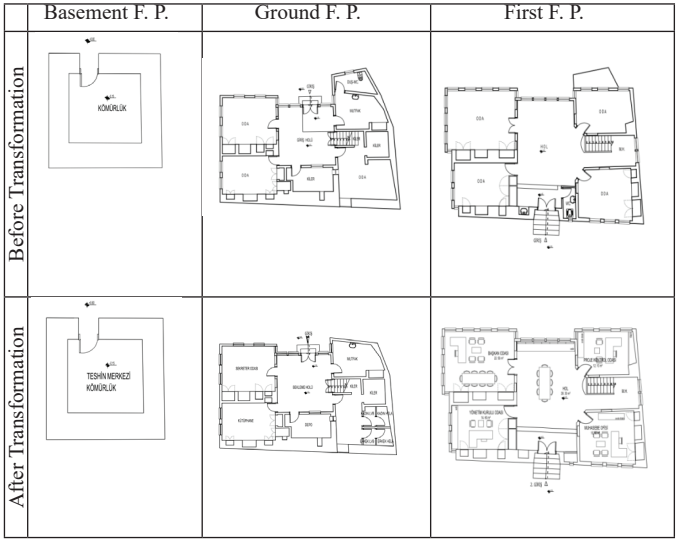


Table 3. *Floor Plans of Afyonkarahisar Agency of the Chamber of Architects before and after the transformation (The architectural project of the building was obtained from the Chamber of Architects.)*

Upon an evaluation of the program of the re used building of Mihrioğlu Mansion Restaurant, it was seen that the building as a restaurant had the necessary spaces of a lobby, a dining hall, a kitchen and associated sub-units, wet areas, administrative offices, storerooms, and a heating room.

Upon an analysis of its spatial organization, it was seen that Mihrioğlu Mansion Restaurant had the units of a kitchen, an administrative office, a reception – a cash point, and a storeroom on the ground floor, but no space was observed where users could eat on the ground floor. Considering the disabled and the old users, it was concluded that there must be a dining hall on the ground floor, and the lack of such an area on the ground floor was seen as a weakness of the new function. Location of the kitchen on the ground floor had been a right decision in terms of receiving products, and it was found that the new function's positive aspects were that the cash point and the reception were located at the center of the building to face the entry, and that the administrative office saw that area. The original state and the present state of the building were compared within the scope of the consideration that the original state of the building must be protected and the interferences must be kept to a minimum, and it was seen as a result of that comparison that the wall in the kitchen area and the staircase in the basement had been removed. It was observed that those interferences had been contrary to the protective approach, but had been applied for the spaces' requirements, and the spatial and mass integrity of the building was not impaired, and the inter-spatial connection setup was not impaired despite the removal of one of the staircases (Table 4).

Discussing according to the Time Saver Standards the sufficiency of the size of the building's spaces for the actions within the new functions, it was observed within the new function that the 22,41 m² kitchen had a sufficient size, and that the space used as an administrative office had no sufficient size for one person's study and for receiving guests. It was determined that the number 2 (dining hall 1)16,01 m² space designed for 16 people's dining and the number 5 (dining hall 4) 17,13 m² space designed for 18 people's dining on the first floor were insufficient considering the actions of sitting and dining along with

the action of serving by waiters, and that the number 3 (dining hall 2) and the number 4 (dining hall 3) rooms had a sufficient size for those actions [20].

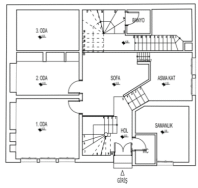
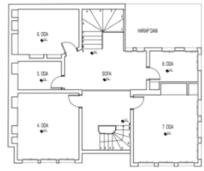
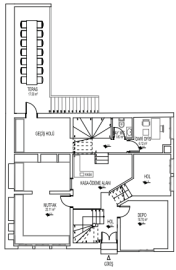
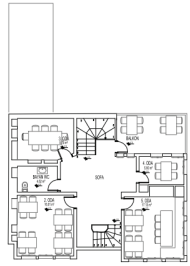
	Basement F. P.	Ground F. P.	Fisrt F. P.
Before Transforma-tion			
After Transformation			

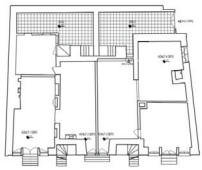
Table 4. *Floor Plans of Mihrioğlu Mansion Restaurant before and after the transformation (The architectural project of the building was obtained from the Mihrioğlu Konak Restaurant.)*

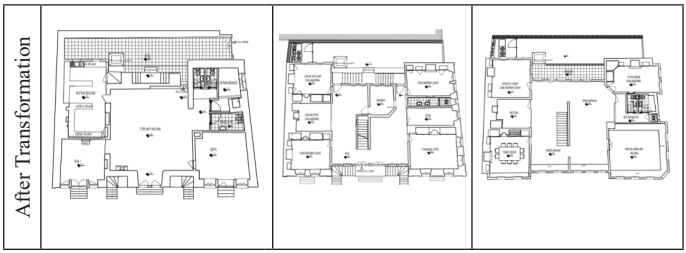
Upon an evaluation of the re used program of the building of Afyon House of Culture and Art, it was determined that the building must have exhibition units since it was intended to reflect the local culture and lifestyle, and in addition to this, it was determined that the building must have units such as a meeting hall, administrative units, wet areas, and a storeroom, and that the building had these spaces. It was seen that the kitchen located on the ground floor of the building was planned as a space where meals were cooked and served, and the kitchen on the second floor was planned as a space that would serve beverages, and it was seen that the connection of the dining room located on the second floor with the kitchen on the ground floor was poor, but the elevator found within the building could be

used to serve meals. The pre-re use state and the present state of the building were compared within the scope of the consideration that the original state of the building must be protected and the interferences must be kept to a minimum, and it was seen as a result of that comparison that some of the walls had been removed in order to transform the residence, once used by 4 families, into single building, and walls had been added in some spaces in order to divide them. It was determined that those changes within the building had not impair the building's original spatial setup, and the building's spatial integrity had been left the same in general (Table 5).

Discussing the sufficiency of the size of the building's spaces for the actions within the new functions, it was seen that the kitchen with an area of 27,54 m² was sufficient in size for the new function, and the space allocated to the 54 person meeting hall was sufficient in size with 63,08 m². It was seen that the administrative office located on the ground floor was sufficient in size with its area of 18,97 m² for one person's study and for four guests. It was determined that the 10-person dining hall located on the first floor was sufficient in size with its area of 18,48 m², and the 33,67 m² space where sitting areas had been organized in three walls was sufficient in size for receiving guests [20].

Table 5. *Floor Plans of House of Culture and Art before and after the transformation (The architectural project of the building was obtained from the Afyonkarahisar Municipality.)*

	Basement F. P.	Ground F. P.	First F. P.
Before Transformation			



Quantitative Evaluations

According to survey results, the building with the highest value of technical performance was the House of Culture and Art, and the building with the lowest was Mihrioğlu Mansion Restaurant (Mihrioğlu Mansion Restaurant<the Chamber of Architects< the House of Culture and Art). The House of Culture and Art had been planned to become a building that would reflect the lifestyle and culture of a particular period in the region and for this purpose, the materials and the interior space equipment used for the new function had been selected in accordance both with the building and the local culture. In addition to this, the building's lighting, heating, ventilation and acoustic performances were found to be at a level that would meet the users' expectations, and the optimum organization of lighting, heating, ventilation and acoustics due to the limitation to the interferences with the technical requirements within a registered building was found to be sufficient by the users. The values given by the users for the criteria of selecting materials within the new function in accordance with the local culture and structure increased its average of technical performance, and caused the building's average technical performance to be 2.42, which meant a good value (Table 6).

Tablo 6. *The average of the technical performance of the selected buildings*

		Agency of the C. A.		Mihrioğlu M. R.		House of C. A.	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Lighting	Space 1 Lighting	1,86	,658	2,31	,900	2,77	,808
	Space 2 Lighting	3,42	,786	2,36	,981	2,10	,790
	Space 3 Lighting	2,00	,789	2,20	,869	2,31	1,024
Heating	Space 1 Heating	2,61	,771	2,42	,941	2,19	,707
	Space 2 Heating	2,35	,855	2,51	,869	2,14	,872
	Space 3 Heating	2,63	,830	2,18	,777	2,31	,869
Ventilation	Space 1 Ventilation	2,36	,764	2,67	,953	2,64	,906
	Space 2 Ventilation	2,80	,675	2,76	1,026	2,52	,917
	Space 3 Ventilation	2,15	,691	2,47	,894	2,55	1,041
Acoustic	Space 1 Acoustic	2,11	,931	2,80	,919	2,52	1,042
	Space 2 Acoustic	2,43	,927	2,84	,903	2,48	,773
	Space 3 Acoustic	2,08	,826	2,67	1,108	2,51	,891
Fire Notices		3,26	1,206	3,51	,895	3,02	1,115
Harmony of the building materials with the each other		2,62	1,190	2,09	,925	2,00	,958
Harmony of the building materials with the original building		2,21	,858	2,00	,853	2,10	,937
1,00-1,80:very good, 1,81-2,60:good, 2,61-3,40:fair, 3,41-4,20:poor, 4,21-5,00 very poor							

According to survey results, the building with the highest value of functional performance was the House of Culture and Art, and the building with the lowest was Mihrioğlu Mansion Restaurant (Mihrioğlu Mansion Restaurant<the Chamber of Architects< the House of Culture and Art). The reason why one building's functional performance value was found to be higher than the other buildings was that the actions within the new function could be met in suitable spaces, and that the building had the spaces required by the new function. The registered status of the building, and the limited interferences with the building's size, height, and form had caused the new function to be shaped based on the present spaces' physical properties, and the exhibition halls requiring a large area had been

designed within the hallways connecting the rooms to each other, and the exhibitions reflecting the daily life had been designed within the building's rooms, and the existing spaces had been adapted to the new function. In addition to this, it caused the users to assess its functional performance value better than the other buildings that the building was closer than the other two buildings both to the public transportation and the city centre, and that, unlike the other two buildings, it had had the planning of a disabled lift for the disabled users though it was not applied on site (Table 7).

Table 7. *The average of the functional performance of the selected buildings*

	Agency of the C. A.		Mihrioğlu M. R.		House of C. A.	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Equipment appropriateness	2,34	,891	2,38	1,029	1,98	,680
Form appropriateness	2,40	,798	2,47	1,057	2,20	,765
Height appropriateness	2,32	,859	2,36	,957	2,15	,731
Size appropriateness	2,72	,949	2,80	1,198	2,32	,906
Spatial relationship	2,15	1,024	2,20	1,036	2,36	1,055
Avaliability of necessary spaces	2,79	1,041	2,76	1,090	2,93	,973
State of disabled users	4,11	1,005	4,22	1,042	3,16	1,185
Accessibility	2,68	1,086	2,31	,874	2,12	,832
Public transportation	2,74	1,113	2,89	,959	2,62	1,209
Access on foot	2,40	,901	2,02	,690	2,00	,796
Access of disabled	3,91	,929	3,71	1,100	3,64	1,144
Parking area	3,74	1,113	4,02	,892	3,50	1,254
Relation with parkin area	3,77	1,108	4,07	,837	3,69	1,239
1,00-1,80:very good, 1,81-2,60:good, 2,61-3,40:fair, 3,41-4,20:poor, 4,21-5,00 very poor						

The building with the highest value of behavioural performance was the House of Culture and Art, and the building with the lowest was the Chamber of Architects (the Chamber of Architects<Mihrioğlu Mansion Restaurant<the House of Culture and Art). It was seen that especially the hosting hall ensured a higher user satisfaction than the other spaces at the House of Culture and Art. It was thought that the reason why the space had a high average compared to the other spaces in the criteria of beauty, comfort, usefulness, care, and organization was that the hosting hall had different functions, the interior space equipment had been selected according to the size of the space and the cultural features of the region, and it was a hall to serve a big number of people at a time (Table 8).

Table 8. *The average of the behavioural performance of the selected buildings*

	Agency of the C. A.						Mihrioğlu M. R.					
	Space 1		Space 2		Space 3		Space 1		Space 2		Space 3	
	Mean	Std D.	Mean	Std D.	Mean	Std D.	Mean	Std D.	Mean	Std D.	Mean	Std D.
Spacious	2,02	,675	3,74	,966	1,96	,779	2,82	,960	3,22	2,82	,960	3,22
Peaceful	1,79	,623	3,55	1,08	1,83	,789	2,31	,949	2,82	2,31	,949	2,82
Beautiful	2,11	,699	3,45	1,03	1,89	,729	2,29	1,10	2,78	2,29	1,10	2,78
Comfortable	2,17	,892	3,34	1,04	2,09	,880	2,49	,991	3,00	2,49	,991	3,00
Useful,	2,34	,815	3,21	1,14	2,30	,805	2,84	,852	3,11	2,84	,852	3,11
Harmonious	2,06	,704	2,60	,970	2,06	,704	2,53	,944	2,80	2,53	,944	2,80
Well groomed.	2,02	,847	2,85	,978	2,00	,659	2,36	,883	2,56	2,36	,883	2,56
Av.	2,07		3,24		2,01		2,52		2,89		2,28	
1,00-1,80:very good, 1,81-2,60:good, 2,61-3,40:fair, 3,41-4,20:poor, 4,21-5,00 very poor												

	House of C. A.					
	Space 1		Space 2		Space 3	
	Mean	Std D.	Mean	Std D.	Mean	Std D.
Spacious	3,33	,687	2,62	1,024	2,38	,962
Peaceful	3,26	1,32	2,55	1,109	2,31	1,047
Beautiful	3,14	1,26	2,22	1,188	1,97	1,063
Comfortable	2,81	1,11	2,07	1,045	1,92	,833
Useful,	2,95	1,12	2,93	,973	1,83	,935
Harmonious	2,86	,926	2,71	1,066	2,43	1,107
Well groomed.	2,57	1,03	2,33	,928	2,36	1,078
Av.	3,14		2,74		2,48	
1,00-1,80:very good, 1,81-2,60:good, 2,61-3,40:fair, 3,41-4,20:poor, 4,21-5,00 very poor						

The building with the highest value of sustainability performance was the House of Culture and Art, and the building with the lowest was the Chamber of Architects (the Chamber of Architects<Mihrioğlu Mansion Restaurant<the House of Culture and Art). Re use of the building having been used as a residence by purchasing by the local government in order for it to reflect the lifestyle of the city and to give information about the city had enabled the building to support the promotion of the city, and had caused the original elements within the building to be protected consciously and the materials to be used to be selected as natural and conforming to the local culture. The building had become a means of identification with its new function in the region, and a building known by the local people. The promotional function and the location of the building close to the city centre had caused it to have a better value than the other two buildings within the sustainability assessment (Table 9).

Table 9. *The average of the sustainability of the selected buildings*

	Agency of the C. A.		Mihrioğlu M. R.		House of C. A.	
	Mean	Std. D.	Mean	Std. D.	Mean	Std. D.
Function harmony with the neighboring	2,60	,837	2,60	,837	2,71	1,349
Being a description point	2,99	1,229	2,99	1,229	1,93	,745
Visual harmony	1,80	,726	1,80	,726	2,45	1,131
Reflecting the local culture	2,18	1,011	2,18	1,011	1,98	,897
Green spaces	2,98	1,118	2,98	1,118	3,43	1,085
Protection of the elements in the previous function	2,49	,925	2,49	,925	2,40	1,014
Harmony of the elements with building character	2,38	1,007	2,38	1,007	2,50	1,110
The building that we want to show our guests	1,73	,720	1,73	,720	1,76	,821
Contribution to the promotion of the city	2,36	,826	2,36	,826	2,14	1,138
Ecological perception	2,95	,919	2,95	,919	2,71	1,066
Access by biycle	3,20	1,173	3,20	1,173	2,95	1,306
Walking path	2,83	1,195	2,83	1,195	2,79	1,159
1,00-1,80:very good, 1,81-2,60:good, 2,61-3,40:fair, 3,41-4,20:poor, 4,21-5,00 very poor						

Results for the hypotheses:

H1: The results of the correlation analysis done for the hypothesis that technical, functional and behavioural performances are significantly correlated with sustainability are found to be as follows:

(i): The sustainability performance of the Afyonkarahisar Agency of the Chamber of Architects was normally distributed (sig.≤0,05) (Table 10) and Spearman Correlation coefficients were used. The only performance criterion determined to have significant correlation with sustainability within the reuse of Afyonkarahisar Agency of the Chamber of Architects was the functional performance. Considering the power of these correlations, a moderate correlation of 59,9 % was detected (Table 11).

(ii): The sustainability performance of the Mihrioğlu Mansion Restaurant was not normally distributed (sig.≥0,05) (Table 10) and Pearson Correlation coefficients were used. The only performance criterion determined to have significant correlation with sustainability within the reuse of Mihrioğlu Mansion Restaurant was the functional performance. Considering the power of these correlations, a moderate correlation of 45,5 % was detected (Table 11).

(iii): The sustainability performance of the House of Culture and Art was not normally distributed (sig.≥0,05) (Table 10) and Pearson Correlation coefficients were used. The only performance criterion determined to have significant correlation with sustainability within the reuse of House of Culture and Art was the functional performance. Considering the power of these correlations, a moderate correlation of 44,1% was detected (Table 11).

Table 10. *Normality test results*

	Agency of the C. A.			Mihrioğlu M. R.			House of C. A.		
Performance Criteria	Shapiro-Wilk			Shapiro-Wilk			Shapiro-Wilk		
	St.	df	Sig.	St.	df	Sig.	St.	df	Sig.
Technical P.	,971	47	,300	,897	45	,001	,933	42	,016
Functional P.	,938	47	,015	,977	45	,508	,967	42	,254
Behavioural P.	,956	47	,073	,979	45	,581	,957	42	,113
Sustainability	,945	47	,027	,960	45	,120	,968	42	,293

Table 11. *Results of correlation analysis of sustainability and technical, functional, behavioural performances according to buildings.*

Sustainability x Performance Criteria			Pearson Correlation Coefficient			Spearman Correlation Coefficient		
			Technical P.	Functional P.	Behavioural P.	Technical P.	Functional P.	Behavioural P.
Agency of the C. A.	Sustainabilty	Cor. C.	,242	,548**	,369	,265**	,599**	,339
		Sig.	,101	,000	,011	,072	,000	,120
		N	47	47	47	47	47	47
Mihrioğlu M. R.		Cor. C.	,163	,455**	,273	,184	,232	,245
		Sig.	,285	,031	,069	,227	,125	,104
		N	45	45	45	45	45	45
House of C. A.		Cor. C.	,312*	,441**	,118	,283	,070	,420**
		Sig.	,044	,003	,457	,069	,658	,006
		N	42	42	42	42	42	42
1,00-1,80:very good, 1,81-2,60:good, 2,61-3,40:fair, 3,41-4,20:poor, 4,21-5,00 very poor								

H2: The results of the regression analysis done for the hypothesis that technical, functional and behavioural performances are equally effective on sustainability are found to be as follows:

(i): For the results of the regression analysis done in order to assess the effect of the functional performance criteria for the Agency of the Chamber of Architects on sustainability, the criterion with the biggest coefficient and greatest effect on sustainability was determined to be *accessibility* by 28,5 %, which was followed by the criterion of *public transportation* by 9,0 % (Table 12).

(ii): For the results of the regression analysis done in order to assess the effect of the functional performance criteria for Mihrioğlu Mansion Restaurant on sustainability, the criterion with the biggest coefficient and greatest effect on sustainability was determined to be *public transportation* by 28 %, which was followed by the criterion of *accessibility* by 11,4 % and *avaliability of necessary spaces* by 8,5 % (Table 12).

(iii): For the results of the regression analysis done in order to assess the effect of the functional performance criteria for House of Culture and Art on sustainability, the criterion with the biggest coefficient and greatest effect on sustainability was determined to be *conformity of the form of the spaces in the present building to the new function* by 40,4 %, which was followed by the criterion of *equipment appropriateness* by 4,6 % and *public transportation* by 1,1% (Table 12).

Table 12. *Effect of performance criteria on sustainability*

Functional Performance x Sustainability	New Function					
	Agency of the C. A.		Mihrioğlu M. R.		House of C. A.	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
Equipment appropriateness	,096	,635	,235	,245	,404	,032
Form appropriateness	,230	,269	-,191	,525	,094	,722

Height appropriateness	-,144	,460	,017	,916	,078	,794
Size appropriateness	,360	,070	-,011	,964	-,241	,258
Spatial relationship	-,414	,094	,047	,745	,046	,040
Avaliability of necessary spaces	,402	,144	,085	,042	,363	,123
State of disabled users	,053	,340	-,030	,823	,220	,245
Accessibility	,285	,027	,114	,032	,220	,245
Public transportation	,090	,007	,280	,028	-,011	,043
Access on foot	,119	,459	,236	,179	,173	,356
Access of disabled	,096	,783	,074	,801	,413	,313
Parking area	-,230	,679	,310	,299	,707	,087

H3: The below results were obtained for the hypothesis that the choice of function differentiated the performances that affected sustainability:

(i): Through the regression analyses done separately for each of the three buildings, it was revealed that the criterion of accessibility for the office function, the criterion of public transportation under the title of the variety of transportation for the restaurant functions, and the criterion of the conformity of the forms of the spaces of the building to the new function for the house of art function affected sustainability. According to this, it was concluded that the functions differentiated the performances that affected sustainability, and different results were obtained for each function (Figure 5).

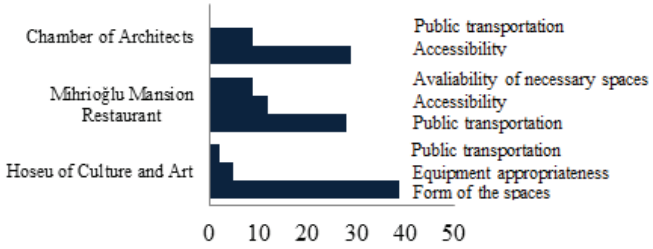


Figure 2. *Performance criteria that affect sustainability*

It was determined for all of the three buildings that the functional performance was significantly correlated with sustainability (the Chamber of Architects: 59,9 %; Mihrioğlu Mansion Restaurant: 45,5 %; the House of Culture and Art: 44,1 %), and no significant correlation was found between the technical and behavioural performances and sustainability. Considering the sustainability of the building re used independently from the functions, it was found that it was not possible to make a generalization, sustainability varied by the building types and functions, and no average result was able to be obtained (Table 13).

Table 13. *Relationship between performance criteria*

	Building	Performance is associated with sustainability and performance is affect of sustainability
Agency of the Chamber of Architects		Functional Performance ,599 Accessiblity ,285 Public Transportation ,090 Sustainability

It was concluded that the reason why the sustainability of a building used as an office was mostly affected by the criterion of accessibility was that the building was used for a short time and for business. Considering the purpose of use and frequency of use of the building, it was determined that the building used as an office was mostly used for business and for a short time. The users, who came to the building for procedure such as project approvals and permits, expected to access the building in the easiest way. According to the results of the survey, the accessibility value of the building was found to be moderate, and based on the physical analyses, it was revealed that, although the users found the building accessible due to its location, the parking problem around the building along with the difficulties in accessing the building by the disabled users negatively affected the users' criterion of accessibility for the building. It was thought that the reason why the sustainability of a building used as a restaurant was mostly affected by the criterion of public transportation under the title of advantage of transportation to the building was that its users were mostly domestic and foreign tourists since the building was located on the cultural axis at the historic city centre and they used tour buses or public transportation in

order to access the building. According to the results of the survey, the public transportation value of the building was found to be moderate. It was seen in the physical analyses that the building was at the city centre and close to the public transportation routes, and it was thought that the reason why its public transportation value was found to be moderate could be that the number of public transportation vehicles accessing the region was small and they could be taken at long intervals. It was thought that the reason why the properties of the spaces within the function of the House of Culture and Art where exhibition halls were predominant mostly affected sustainability was that the new function of the building contained spaces requiring a large area such as exhibition halls and meeting halls and different spatial features were needed depending on the properties of the products to be exhibited. According to the results of the survey, the value of the conformity of the building's spaces' forms to the new function was found to be good. It was found to be positive by the users that the exhibition halls divided by theme required by the new function had been planned within the rooms of the building and the exhibition units requiring a large area were located at the hall at the centre of the building, and the state of the spatial setup required by the new function within the building satisfied the users.

4. CONCLUSION

In the present study, focused on sustainability of re used buildings, adaptation of the buildings used for a purpose different from its intended one to a new function was assessed with a focus on spatial performance through the approach of post-occupancy evaluation. It was seen that the users' expectations and satisfaction differentiated by the functions. For all of the three functions, the functional performance was found to be correlated with sustainability, and it was concluded that an increase in the

functional performance would increase the sustainability of the new function. Through the regression analyses done separately for each of the three buildings, it was discovered that different criteria affected sustainability within different functions. It was determined that the qualitative and the quantitative evaluations were found to support each other, and the criteria of accessibility within the function of an office, public transportation within the function of a restaurant, and conformity of the present building's spaces' form to the new function within the function of a house of art affected the sustainability of the new function, and it was concluded that the new function differentiated the criteria of functional performance that affected the sustainability and no result was mentioned which was common for all of the buildings.

This study has become an alternative to the studies, reviewed within the scope of a literature study, in which behavioural performance was suggested as sustainability, and unlike those studies, it has revealed that the building's functional performance is important for the sustainability of a new function. It has been determined, in parallel with the studies that have stated that the sustainability of a new function is correlated with the success of the function and the present building's adaptation and the criteria of the fulfilment of the new function's requirements by the present building's spaces and the location of the building within the city are decisive in that correlation, that the criteria of the presence of the spaces required for the new function and the fulfilment of the function within suitable spaces are important for sustainability [4, 7, 14]. In this study, unlike the literature studies, no common result has been obtained and no generalization has been made for three re used buildings for the sustainability of the buildings through testing the sustainability of these re used buildings within different functions such as an office, a restaurant, and a house of art. It is concluded that buildings described

as cultural properties have unique limits of interferences, any function must be evaluated within its context, and it is not right to make a generalization [11].

The registered nature of the re used buildings has caused the interferences with the building to be limited, which has affected the values given to the performance criteria. It is concluded that it is necessary to keep the interference with the building limited, to select functions according to the building's spaces' properties such as size, form, and height before re use, to determine the necessary spaces based on the new function's requirement programme, and to discuss their adaptability to the present building with the least interference in order to ensure the necessities of the technical requirements such as natural lighting, heating, ventilation, and acoustics and the criteria of the conformity of the spaces' size, form, and height to the new function. In addition, it is concluded that new extensions could be made in accordance with protective principles in order to be able to meet the needs of the new function within the building.

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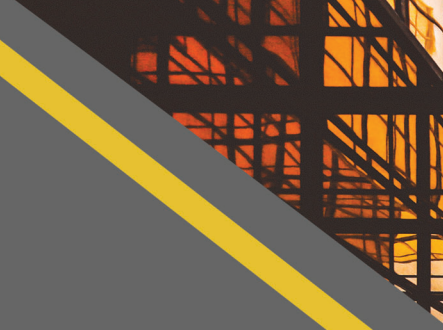

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