



## Comparative Analysis of Sustainability in Mass Housing: Yol-İş Site and Kuzu Effect

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### Abstract

Humanity's most basic needs arise from its relationship with nature. The residence, which is the most basic architectural reflection of the effect of nature on people, creates the greatest impact of human on nature as the architectural element that constitutes the majority of the city today. This puts it at a crucial point in terms of the city's sustainability and sustainable development. The aim of this study is to compare the sustainability of mass housing projects over two mass housing projects. In the first part of the study, a literature review has been made on the concepts of sustainability in housing and public housing. In the second part, in order to eliminate the impact of urban infrastructure, which is a factor that the project design cannot affect, on sustainability, two mass housing projects in Ankara, Ankara Yol-İş Site and Kuzu Effect Closed Site, were selected and a comparative and systematic data analysis was made in order to evaluate environmental sustainability. The results obtained were evaluated.

**Keywords:** Ankara, Yol-İş Site, sustainability in housing, Kuzu Effect, Closed Site, Housing, Public housing, Sustainable

### 1. Introduction

Man is born as a part of nature and continues his life as a part of nature all his life. Human beings who come to life with the presence of nature also shape their life with the effect of the conditions and conditions in nature (Gül, 2013). The rapid urbanization that emerged with the Industrial Revolution triggered the separation of human from nature, and consumption culture triggered the nature to become the object of consumption.

The scenario in which this perspective of human beings continues on a global scale, predicts that humanity will need 2 planets in 2030 and 2.8 in 2050 in order to meet the demand based on resource and land use. In the world where energy consumption increased 40% between 1990 and 2008, 80% of the energy used is from fossil sources (Öztok & Tapan, 2012).

One of the sectors that has a significant impact on the use of fossil fuels is the construction sector. Even though fossil fuels and technology have the ability to make any place in the world livable today, they can achieve this by stealing from the habitability of nature. For this reason, it is necessary to examine sustainability as soon as possible in the construction sector and especially in the houses that make up the majority of our cities, as sustainability is the key to a life with nature, not against nature.

## Sustainability

With the oil crisis in the 1970s and the concept of global warming, which it met immediately afterwards, humanity has embarked on a new quest to review its relations with nature (cited in Sev, Bulhaz, 2010). Sustainability is one of the foremost of these pursuits. The concept of sustainability was first brought to the agenda in the book titled 'Sustainable Society' written by Pirages in 1977 (cited in Tekeli, 2001). Subsequently, Sustainable Development has become a globally discussed concept under the influence of the 'Our Common Future' report by using the definition of 'meeting today's needs without damaging the ability of future generations to meet their own needs' by the Brundtland Commission of the United Nations (Brundtland Commission, 1987). Sustainability is defined by Yilmaz and Keleş (2004: 48) as "the standard of living of people is proportional to the carrying capacity of nature". Although the concept and environmentalist movements received negative reactions in the Heidelberg Meeting in 1992 by 60 scientists from various countries (cited in Keleş, İncedayı, 2004), it was accepted all over the world with the Agenda 21 approach developed at the Rio Summit in the same year. With the Kyoto Protocol in 1997, the idea that sustainability can only be achieved with global cooperation was formed and the 'United Nations Sustainable Development Commission' was established in the same years to manage this cooperation (Tekeli, 2001). However, after the Johannesburg Summit, the issue was mainly addressed in terms of commercial relations, the inadequacy of the United Nations Sustainable Development Commission studies, the limitation of the framework of the United Nations Environment Program (UNEP), the United Nations Millennium Development Goals, which did not attempt to be realized, mostly It has caused it to remain on paper. Today, one of the areas where the concept of sustainability is mostly discussed is architecture. Although sustainable architecture is not a new concept, it has gained importance as the environmental problems caused by human beings have become undeniable. (Cited from Sev. Bulhaz, 2010). From an environmental point of view, today the building sector and buildings are among the leading factors causing environmental pollution. (Ding, GKC, 2008) In this case, the residences, which are the most basic of Maslow's hierarchy of needs system (Figure 1), meet the most basic need of people, and constitute the majority of cities, especially collective dwellings, make it worth examining. In order to examine this issue, it is necessary to know the house first.

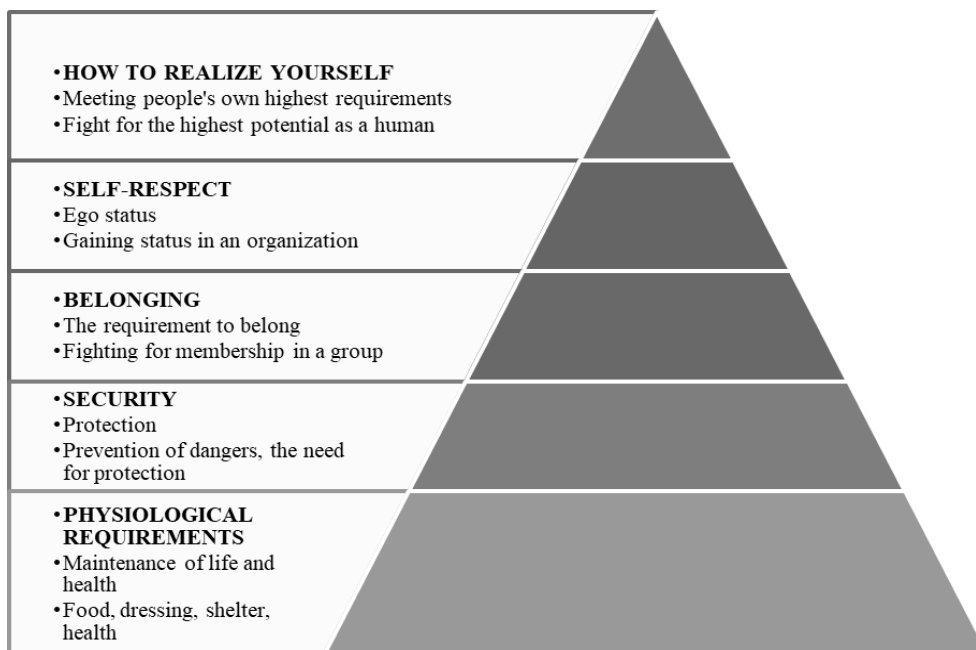


Figure 1 – Maslow's requirement hierarchy system pyramid (interpreted by the authors from Özdemir, 2010 source)

## Mass Housing

As a concept as old as human history, housing, in the dictionary of the Turkish Language Institution, is "the house, apartment etc. people live in; place, residence". (URL-1) The concept of Mass Housing is expressed in the Encyclopedic Architecture Dictionary (2020) of Doğan Kuban as "describing a large number of housing units built with social and physical infrastructure"; Ruşen Keleş (2008: 438) defined it as "major enterprises that can provide technical, social and economic benefits when they are built not as individual buildings but as large housing sites".

From the first shelters to the skyscrapers that define today's city skyline, housing has been the most important architectural reflection of human history and the development of technology. The sudden need for labor that emerged with the Industrial Revolution brought along a rapid migration from the countryside to the city, and this created an urgent need for housing. Depending on this situation, the housing production style has been directed towards mass housing. However, the fast meeting of housing needs is not the only thing that accelerates mass housing production. As Karagül stated, another reason for the preference of mass housing production is to increase the efficiency in the use of existing resources. (cited in Girginer, 2006). In other words, mass housing is both a social result and an architectural reflection of the industrial revolution's mode of production (Tekeli, Gülöksüz & Okyay, 2020). Public housing is not only a great place to keep in the use of economic and natural resources, but also Rapoport's (1969) is one of the smallest unit of social life, as indicated. This brings the house to an important point in raising awareness in terms of resource use and sustainability. It is believed that improving the performance of residential buildings in terms of social, economic and environmental sustainability will foster a greater sense of responsibility and place a greater value on the well-being of future generations. (Mateus and Bragança, 2011).

Also our cities today about 80% constitutes the long part housing construction (Figure 2) done and the natural environment is one of the most polluting production. The residential sector in the European Union uses 40% of the total final energy consumed (around 70% of which is heating and cooling) and accounts for about 36% of total CO2 emissions. (European Commission, 2011). The share of energy consumption in the building sector in our country is 50% up on the exit. As of the end of September-2019, the number of registered residences in the Address Based Population Registration System, reaching 38,4 million, constitutes the majority of all buildings (Koman and Eren, 2006).

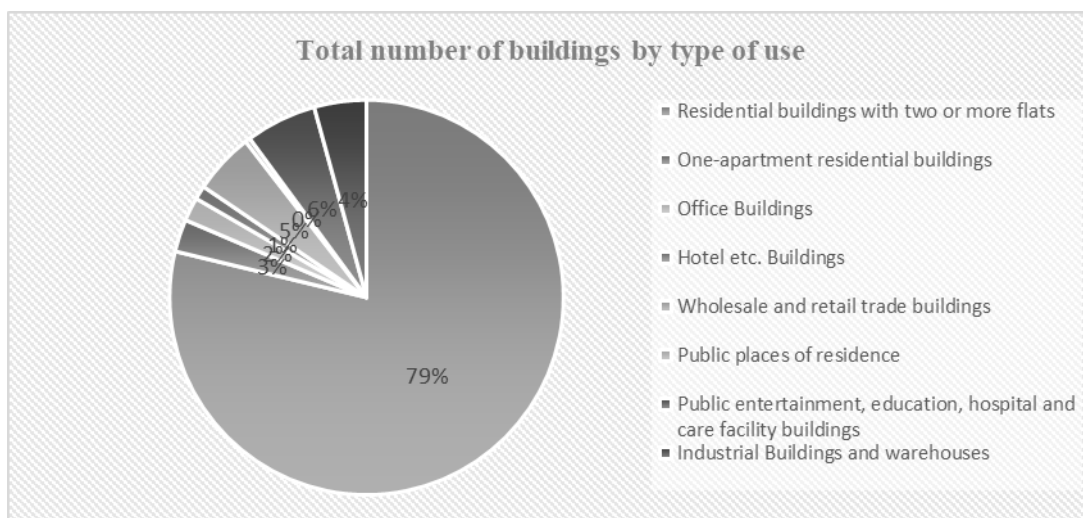


Figure 2 - Distribution of the total number of buildings by type of use (URL-2)

However, we should not ignore the sustainable development developments that have gained momentum in our country as well as in the world in recent years. Sustainable

building certification systems are also developing and diversifying, just like the concept itself. Considering the LEED data, which is one of the most common of these certification systems in our country, a total of 421 buildings were marked as sustainable buildings, excluding those whose application evaluations are ongoing. 42 buildings received LEED certification in 2020. Apart from these Green Building Association of appropriate national certification system, the conditions of Turkey BEST-Residential certified 23 buildings, BREEAM certified 66 buildings were certified a total of 494 projects environmentally friendly, including (Figure 3) (URL-3). For this reason, in this study, mass housing projects were examined in the name of sustainability analysis.



Figure 3 - LEED Certified building in Turkey (URL-4)

## Field Work

### General Information of the Study Area

As a study area for comparative analysis of sustainability through public housing, it has various construction methods in the same city and climate conditions with various similar features to exclude some urban and environmental factors that cannot be affected by the project design (1970-90s and built with today's construction techniques) and two mass housing projects in Yenimahalle and Çankaya districts in Ankara, Yol-İş Sitesi and Kuzu Effect Closed Site were selected. However, in order to examine these two housing estates, it is necessary to reveal some of the characteristics of Ankara that affect the concept of sustainability and some common features that led to the selection of these two projects.



Figure 4 – Location of Çankaya and Yenimahalle districts in Ankara (Created by the authors.)

Different climates are also observed in places in Ankara, where generally continental climate prevails. In the south, the steppe-steppe specific to Central Anatolia, and the mild and rainy climate of the Black Sea in the north is observed. The winters in Ankara are very cold and the summers are very hot. Annual temperature change is between 40 ° C and -24.9 ° C. Although the average precipitation varies in districts, it is between 300-540 mm and the humidity in the air is between 40-79%. In the provincial scale, the average temperature is 11.7 ° C, and the annual average rainfall is 389.1 mm. The temperature difference between day and night is also high. Average number of snowy days does not exceed one month. Steppe plants throughout the province; Looking at the surface area, up to 10% of the forest is seen. The land, which is green in spring, is covered with yellowed and dried grass in summer. The effect of the sea climate is observed in the north and northwest of the province and this region is covered with large forests, most of which are in the form of woods and coppice forests. 15 percent of the land is meadow and pasture. Grain is also a vegetation covering the land. (URL-5)

When the climatic characteristics of Çankaya and Yenimahalle districts located in the central region of Ankara, which are selected as the districts of the study areas due to their similarities, it is seen that the climatic conditions and air quality are similar with the effect of their geographical proximity. It has been observed that these districts continental climate is dominant in, the winters are cold and snowy, the summers are hot and dry, and the winters are dry and cold, and in the spring season it receives the uphill rains called forty. In addition, it was observed that the air quality of both districts was the same (Figure 5).



Figure 5 – Ankara Province Air Quality Values (URL-6)

In addition, when the neighborhoods of Batıkent where Yol-iş Sitesi are located and Or-An neighborhoods where Kuzu Effect is located; Two neighborhoods in Ankara, which are almost equidistant from the center (Figure 6), started to develop as sub-centers in the 70s in order to prevent slums, but while Batıkent was designed as cooperative sites by the Cooperatives Upper Union, Or-An was designed by the Private Sector. It has been seen that it was designed as a satellite city project. Both neighborhoods are designed with environmental and social facilities. More detailed information about these two districts and the project will be given below.



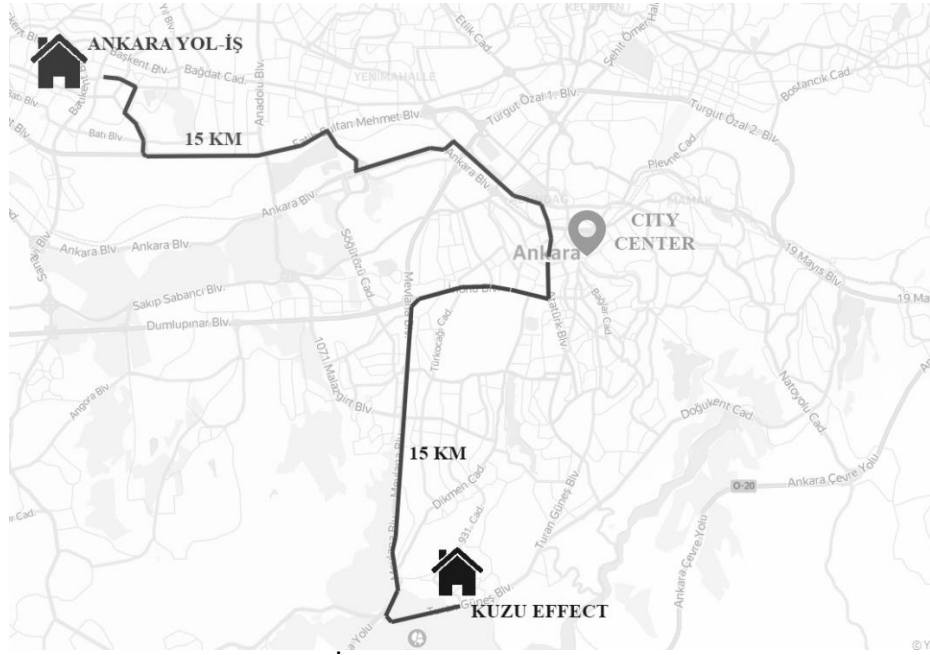


Figure 6 – Distance of Ankara Yol-İş and Kuzu Effect Sites to the City Center (Created by the authors)

### Yol-İş Sitesi

The Yol-İş Sitesi Blocks, located in the Batıkent district of Ankara province, were built in 1990 as one of the first implementations carried out by the Türkkonut Cooperatives Supreme Union, including the Yol-İş Union (Figure 7). The Batıkent Project, which includes the Yol-İş site, was initially called the "Akkondu Project" as a place where people with low income can live in order to prevent slums. As it reminds the shanty house, the name "Akkondu" was abandoned during the project phase, and the project was put into practice under the name of "Batıkent Project" (Keskinok, 2002). Following the expropriation of 10.5 million square meters by the Ankara Municipality between 1974 and 1978, the Batıkent Project was put into practice in 1979; the first supreme union established in the same year for the implementation of the project is Batıkent Housing Production Building Cooperatives Union (Kent-Koop., 1995). "Türkkonut", which was established with the membership of Ankara Metropolitan Municipality in 1985, followed Kent-Koop. And the construction of many residential living environments in Batıkent was transferred to Türkkonut. The concept of residential living environments corresponds to housing sites and their social environments within the scope of the Batıkent Project (Keskinok, Ç., 2002). There are residential living environments consisting of 50-200 residences in Batıkent and children's playgrounds, gathering places, common areas and daily shopping areas are located within an average of 100 m walking distance to the living environment. In this sense, living environments are similar to today's closed sites. One of the living environments in Batıkent that has the feature of staging and being carried out by different cooperative supreme unions is the Batı Sitesi Mahallesi within the scope of Türkkonut practices. Batı Sitesi Neighborhood residential living environments, 1., 2., 3. Stage 1-2 is the stage 1-2 of residential living environments (Kent-Koop, 1980). One of the projects built within these stages is the multi-storey structure of 06 Yol-İş Sitesi.



Figure 7 – Ankara Yol-İş Sitesi (URL-7)

Housing layout is a regular site within the living environment. Housing gross area of 100sqm. It consists of 28 blocks and 560 flats (Figure 8). There are two flats on each floor of the 10-storey buildings, on the ground and 9 floors. (Bayraktar ve Girgin, 2010) All flats have a bathroom, a guest toilet, a kitchen, a living room, and a large balcony on both sides in a 3 + 1 plan. 62.2% of it is reserved as green areas, other parts are planned as parking lots (Figure 9). A health center and a mother and child health center in the neighborhood; kindergarten, primary education and high school; bazaars and open bazaars; religious buildings; Services such as social facilities and sports fields are within walking distance. In the site plan, there is an outdoor basketball court, children's playground and sitting areas. 06 Yol-İş Site is also qualified in terms of its planned layout and transportation facilities. The site plan is designed in such a way that none of the blocks will reduce the daylight efficiency of the other, the block fronts are approximately 20 meters and the layout is surprising. There is approximately 75 m<sup>2</sup> green area and approximately 110 m<sup>2</sup> open area per flat.



Figure 8 – Ankara Yol-İş Site Layout Plan (Created by the authors.)

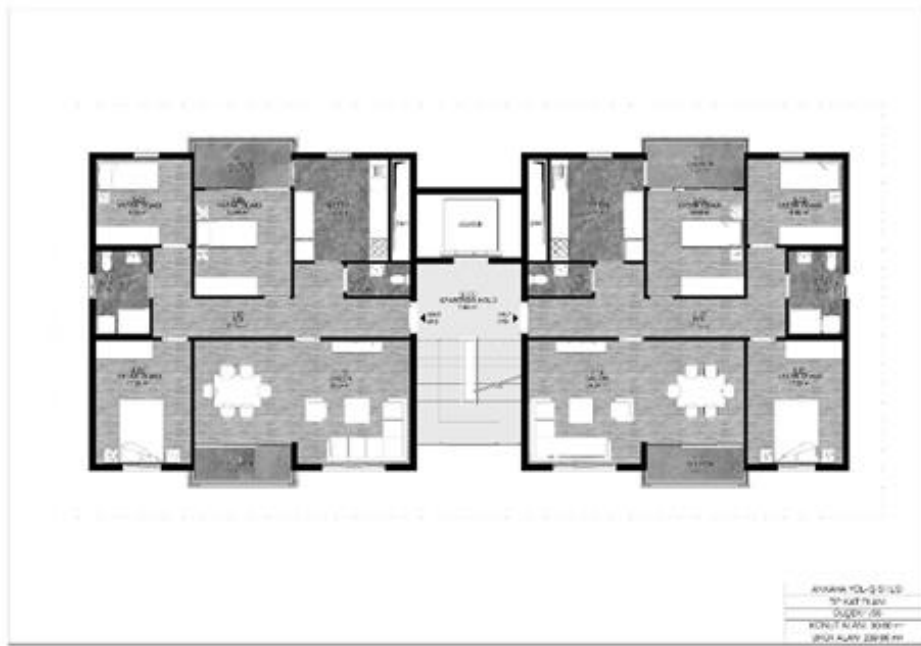


Figure 9 – Ankara Yol-İş Site Floor Plans (Created by the authors)

### Kuzu Effect

Kuzu Effect is a closed housing site located in Or-an district of Ankara and in a way it represents the state of the development of Or-an district today after a long period. In the 1970s, social developments brought the housing problem in the country to the agenda more intensely. Housing is an important problem for low and middle income people in the '70s. Housing acquisition was not supported, except for a state bank and limited funds from the SSK. On the one hand, housing production through cooperatives such as the Batikent cooperative model is becoming widespread; The absence of a housing market regulated and regulated in the field of housing production created different searches in the society; It has also revealed a model called "flat for land, for land". As a result of the zoning changes realized, cities have become more concentrated with new multi-storey houses. This situation did not meet the requirements and negatively affected the building quality and building costs. (Kazancı, N. 2014) The residential fabric to be created in the Or-an area of Çankaya district emerged as a result of the search for a solution to this increasing housing demand in the 1970s. The foundation date of Or-an Sitesi started as a private sector initiative, until then, there was no satellite city project that was examined and realized by private entrepreneurs. In this sense, Or-an Site is considered among the original projects for the 1970s. It is also known that almost all of the area considered for Or-an residential area, whose target is 30 thousand people and 7 thousand residences and social facilities, is surrounded by slums. (Kazancı, N. 2014)

"OR-AN", which is a joint stock company with approximately 350 partners, mostly composed of architects and engineers, namely "Orta Anadolu İnşaat A.Ş." has been established. (Ultav and Sahil, 2004). The project started with the acquisition of 1.1 million square meters of land on the southern slopes of Çal Mountain. The constructions in Or-an Sitesi started in 1970 and firstly with the building groups known as 'first parcel' and 'second parcel'; then the residences were opened for sale and settlement. In the process dating back to 1978, there was the construction of the building group known as "Primary Insurance Blocks" and "Second Insurance Blocks", made with the loan of the Social Insurance Institution. As of 1979, there are building groups planned as multi-storey buildings, two-storey bazaar and eight-storey residences on top and in adjacent blocks.



Between 1982 and 1984, Turan Güneş Boulevard was opened in parallel with the construction of the deputy lodgings, which were built in the east direction of Or-an Site and opened to residence, thus ensuring the integration of Or-an Site with the city. (Kazancı, N. 2014)

After 20 years of development, deputy lodgings were demolished, parcelization arrangement and zoning plan change was made in existing and surrounding lands. With the latest regulations, housing projects with new period construction methods, including the Kuzu Effect Project, have been placed in this area (Figure 10).



Figure 10 - Kuzu Effect Project (URL-8)

Kuzu Effect, in Çankaya district of Ankara province; It is a multi-functional building group that includes two types of residential blocks, namely "Residence" and "Loft", office-studio and office floors called "Studio", and a shopping center. The project with a land area of 30.730 m<sup>2</sup> has city, forest and lake views; There are 8,200 m<sup>2</sup> of green space, including green roofs and green terraces. In addition, the building has the feature of being the first project of Architect Emre Arolat in Ankara. It received Leed Gold certificate on 10.02.2019 (URL-9). In addition to this, when the project is examined, it is seen that it has 6.100 m<sup>2</sup> green roof and green terrace area, 62230 m<sup>2</sup> residential area, 16000 m<sup>2</sup> office area and 35.000 m<sup>2</sup> shopping area.

The Kuzu Effect Project, which is planned to have a construction area of 186,393 square meters in total, includes a 17-storey "Loft" block, a 46-storey "Residence" tower, a three-storey shopping mall, three-storey horizontal office, three-storey home office and social facility units. 1 + 1, 2 + 1, 3 + 1, 4 + 1 and 5 + 1 apartments in the "Residence" block, 4 + 1 and 6 + 1 apartments in the "Loft" block, 1 + 1 and 2 + 1 in the office-studio block. There are apartments and offices of different square meters and sizes. There are 124 stores / shops in the commercial area designed in the project. Access to each function is provided from different points. The project has an automation system. In addition to these, floor gardens and green covered terraces were designed considering (Figure 11) (URL-10).

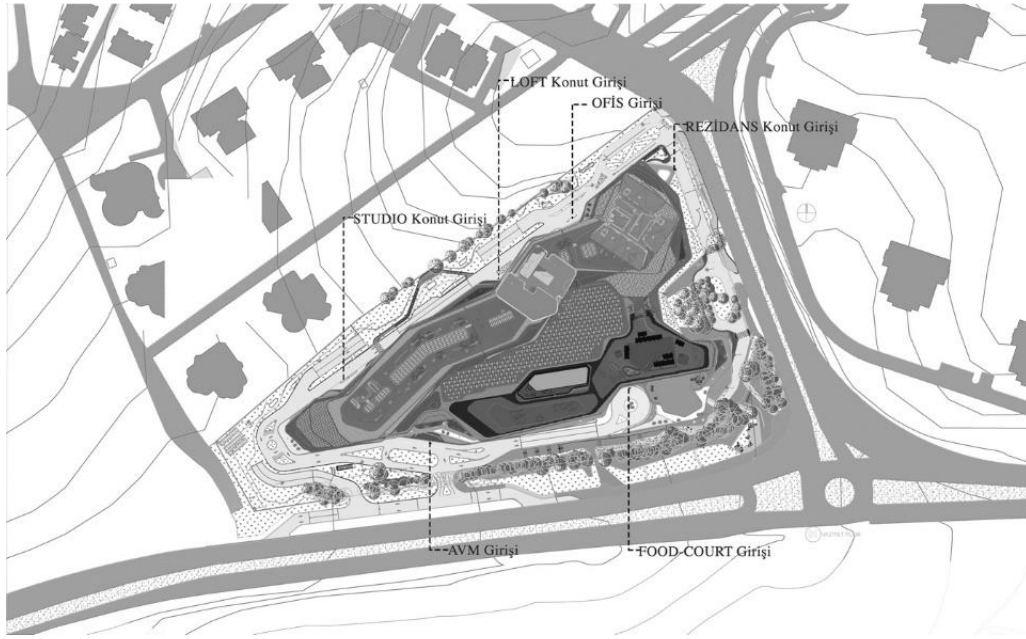


Figure 11 – Kuzu Effect Site Plan (URL-11)

The sizes of the flats in the Kuzu Effect project; 1 + 1 apartments are 103-115 m<sup>2</sup>, 2 + 1 apartments are 92-199 m<sup>2</sup>, 3 + 1 apartments are 218 m<sup>2</sup>, 4 + 1 apartments are 257-367 m<sup>2</sup>, 5 + 1 apartments are 462 m<sup>2</sup> and 6 + 1 apartments are 454 m<sup>2</sup>. 3 + 1 apartments are located on the right arm of the Kuzu Effect Residence housing block of the project. Apartments receiving daylight from the southeast are 149.75 m<sup>2</sup> net. It also receives partial sunlight from the south and northeast directions. There is a living room, a kitchen, two standard rooms, a dressing room and an en-suite bathroom, a public bathroom and a guest toilet. The balcony extending along the southeast direction is 29.30 m<sup>2</sup> (URL-11)

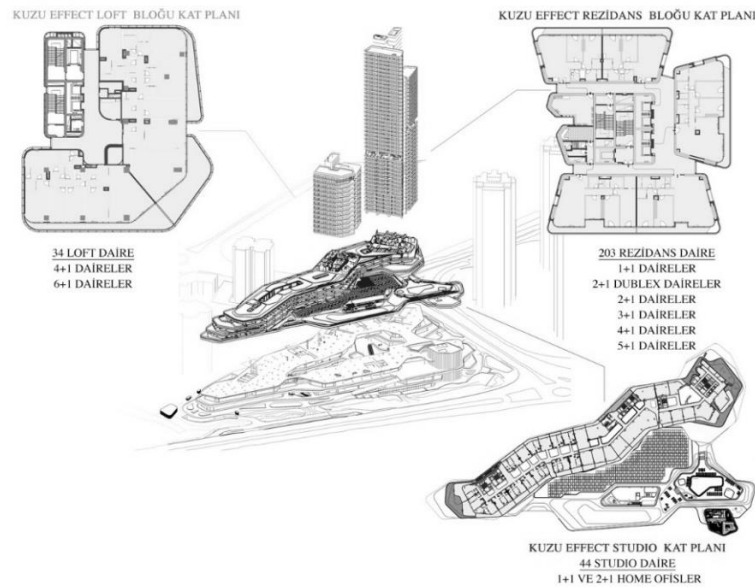


Figure 12 - Kuzu Effect Blocks and Floor Plan  
(Taken from URL-11 source and edited by the authors)

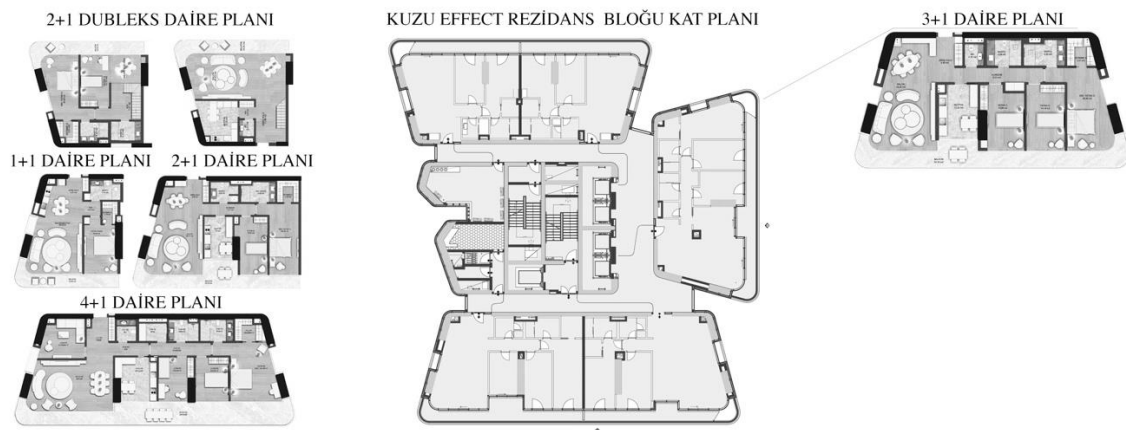
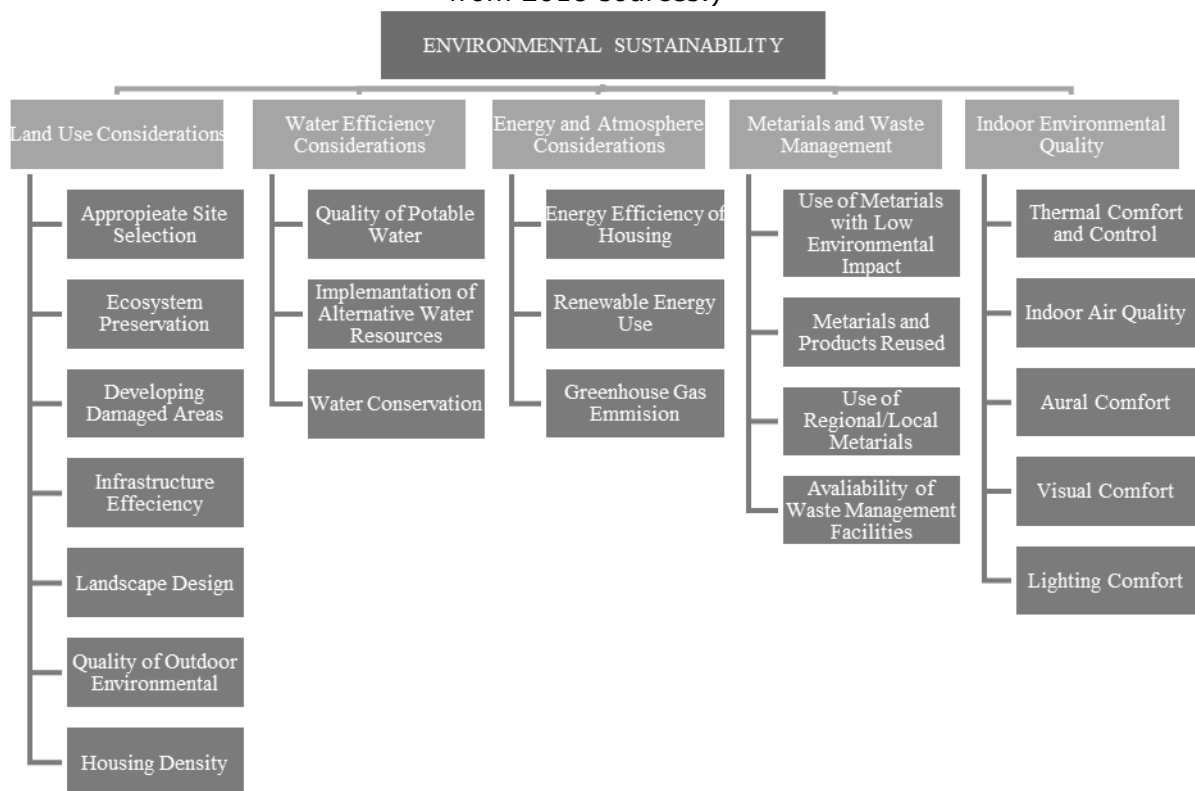


Figure 13 - Residence Block Floor Plan and 3 + 1 Flat Plan (Edited by authors from URL-11 source.)

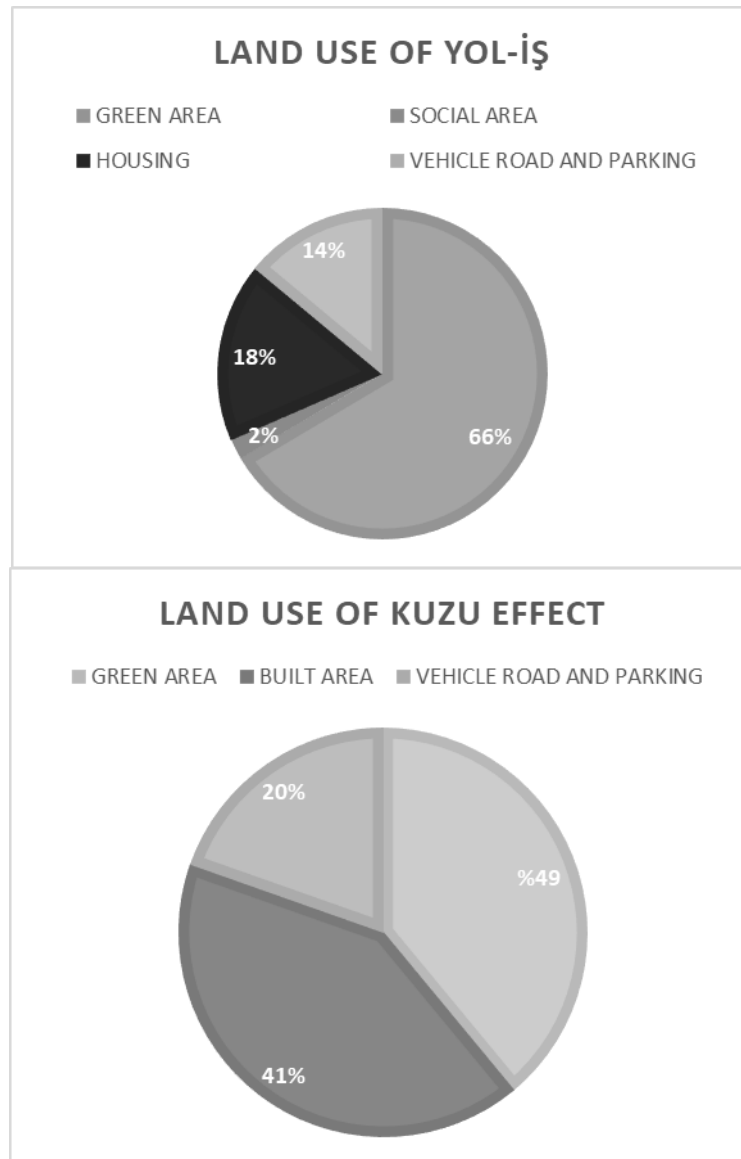
### ANALYSIS OF YOL-IŞ AND KUZU EFFECT SITES IN TERMS OF SUSTAINABILITY

The criteria based on environmental sustainability analysis of Yol-Iş and Kuzu Effect sites are presented in Table 1. In the assessment of environmental sustainability, the sub-headings of Land Use Assessment, Water Efficiency Assessment, Energy and Atmosphere Assessment, Material and Waste Management Assessment and Indoor Quality Assessment were taken into consideration.

Table 1 – Environmental Sustainability Assessment (Tupenait to, Kaklauskas, Lille, Geipel A, Naimavici me, Kanapecki valve and Kauskal to have been designed by the authors from 2018 sources.)



In land use assessment, both projects which also made programmatic choices about appropriate site selection, were determined not worked on farmland. In addition, the existing trees on the land were preserved in the Kuzu Effect project. Prior to the Ankara Yol-İş and Kuzu Effect projects, it was observed that there was no settled ecosystem in the construction areas, and there was no area that was destroyed. While the density of green areas associated with the soil is higher in the Ankara Yol-İş Project, green roofs and green terraces were created in places in the Kuzu Effect project, thus increasing the green area density. While there is a suitable place for outdoor activities such as children's playground, benches and open basketball court in Ankara Yol-İş, these activities are insufficient in Kuzu Effect. As a social area, there is often a referral to shopping mall use. There are 560 residences in Ankara Yol-İş site, in addition to 281 residences in Kuzu Effect site, there are 44 offices and 123 stores.



It was seen in the water efficiency assessment that the water quality reaching Çankaya and Yenimahalle is favorable in terms of standard potable water quality. However, considering the neighborhoods, the quality of the water reaching Yenimahalle is higher than the quality of the water reaching Çankaya. The use of gray-water from the residences of Kuzu Effect Project in shopping mall toilets after treatment; While it stands out with the fact that there are plants with less water consumption around the building

and its orientation towards a design that consumes 45% less water than the world average, there is no application regarding water consumption and saving in the Ankara Yol-İş Project.

Certifications stand out in the title of Energy and Atmosphere Assessment. Accordingly, while Ankara Road-İş Project has Energy Identity Certificate, Kuzu Effect Project has LEED Gold (69/100 points) certificate.

In terms of Material and Waste Management Assessment, both projects do not create a heat island effect; It was designed considering the conditions that would not heat itself and the city. While the Kuzu Effect Project stands out in terms of recycling materials and products, Ankara Yol-İş Project is more effective in the use of local materials. So much so that the buildings that were demolished before the Kuzu Effect Project were recycled 90%, and the construction waste generated during the project was recycled 75%. In addition, the building is made of 25% recycled content. Recyclable materials are used in the steel, aluminum, concrete and glass fabrications of the building. On the other hand, in the Ankara Yol-İş Project, local materials of the 1990s such as tiles and wooden frame windows were used.

When the Indoor Environment Quality was evaluated, it was determined that although the central system heating of the Ankara Yol-İş Project was used, the heat share meter was used in the Kuzu Effect Project. In terms of indoor air quality, while there is natural ventilation obtained through windows in the Ankara Road-İş Project, the Kuzu Effect Project has both natural and artificial air conditioning systems, therefore horizontal and vertical ventilation. While there is information that Kuzu Effect is efficient in terms of auditory comfort, no data could be obtained for Ankara Yol-İş. On the other hand, it has been observed that both projects have visual comfort criteria, as well as the orientation and facade design made according to daylight analysis, with maximum benefit from sunlight.

Table 2 – Environmental Sustainability Assessment Table (Created by the authors.)

	<b>YOL-İŞ SİTESİ (1990)</b>	<b>KUZU EFFECT (2019)</b>
<b>FIELD USE ASSESSMENT</b>		
<b>Selection of Appropriate Area</b>	- The project area is not an agricultural land.	All trees existing in the project have been preserved.
<b>Conservation of the Ecosystem</b>	All trees existing in the project have been preserved.	All trees existing in the project have been preserved.
<b>Destroyed Area Formation It</b>	It was established on the slum area.	It is built on an urban transformation area.
<b>Infrastructure Efficiency</b>	Yes	Yes
<b>Landscape Design</b>	-Project space, green space density is contemplated.	- The project area is considered to be green area intensive.
<b>Outdoor Quality</b>	There is a suitable place for outdoor activities. Such as children's playground,	There is no suitable place for outdoor activities.





	benches, open basketball court...	
<b>Housing Density</b>	560 residences	281 residences-102 offices
<b>WATER EFFICIENCY EVALUATION</b>		
<b>Potable Water Quality</b>	Turbidity 0.20 NTU No Smell Residual Chlorine 0.6 (mg / l) Conductivity 66.3 (25°C, mS / m) Ammonium <0.06 ( mg / l) Nitrite <0.006 (mg / l) Sulphate 81.2 (mg / l) Iron 9 (µg / l) Aluminum 58 (µg / l)	Turbidity 0.30 NTU No smell Residual Chlorine 0.6 (mg / l) Conductivity 69.6 (25°C, mS / m) Ammonium <0.06 (mg / l) Nitrite <0.006 (mg / l) Sulphate 88.1 (mg / l) Iron 16 (µg / l) Aluminum 50 (mg / l)
<b>Alternative water Resources Applications</b>	No	Project in purified water is used in the gray matter of the shopping center toilet
<b>Water Savings</b>	None	- 45% of the world average building consume less water. - There are plants with low water consumption around the building.
<b>ENERGY AND ATMOSPHERE ASSESSMENT</b>		
<b>Energy Efficiency of the House</b>	There are double glazing in the windows and ceiling insulation under the roof.	- 24% of the world average, consumes 65% less energy than the average of Turkey.
<b>Renewable Energy Use</b>	Outside 0.00%	Data could not be reached
<b>Greenhouse Gas Emission</b>	194.47 kg eq. carbon dioxide / m2.year	Data could not be reached
<b>MATERIALS AND WASTE MANAGEMENT</b>		
<b>Use of Materials with Low Environmental Impact</b>	- The project has a design that will not create a heat island effect and will not heat itself and the city.	- The building is designed not to create a heat island effect, and has a design that will not heat itself and the city.
<b>Recycling of Materials and Products</b>	No data available	Buildings destroyed prior to the project were recycled 90%.

		<ul style="list-style-type: none"> <li>- Construction waste generated during the project was recycled 75%.</li> <li>- The building is made of 25% recycled content. Recyclable materials are used in the steel, aluminum, concrete and glass fabrications of the building.</li> </ul>
<b>Use of Local Materials</b>	Local materials such as tile, wooden frame windows were used.	No
<b>Availability of Waste Management Facilities</b>	No	Yes
<b>INDOOR ENVIRONMENT QUALITY</b>		
<b>Thermal Comfort and Control</b>	Central system heating	Heat share meter
<b>Indoor Air Quality</b>	Individual	Artificial air conditioning systems
<b>Auditory Comfort</b>	Data could not be reached	Yes
<b>Visual Comfort</b>	Yes	Yes
<b>Lighting Comfort</b>	<ul style="list-style-type: none"> <li>- With orientation and facade design based on daylight analysis maximum benefit from sunlight.</li> </ul>	<ul style="list-style-type: none"> <li>- With the orientation and facade design made according to daylight analysis, sunlight has been used to the maximum.</li> </ul>

## CONCLUSION

In sustainable and ecological infrastructure settlements; environmental awareness, keeping energy consumption at a minimum, good insulation, waste management, providing the necessary energies for heating and lighting with natural and active systems and protecting the existing green texture on the land; In addition, living spaces should be designed with an approach that will include self-sufficiency features.

Considering the results of the titles of Land Use Assessment, Water Efficiency Assessment, Energy and Atmosphere Assessment, Material and Waste Management Assessment and Indoor Environment Quality Assessment in the assessment of environmental sustainability of Yol-İs and Kuzu Effect sites, it has been observed that both projects meet the criteria in terms of land use, but It is seen that the possibilities of the Yol-İş Project are more in terms of outdoor activities. In terms of water evaluation criteria, it can be said that the Kuzu Effect Project has a more conscious design in terms of sustainability. What should be noted here is that the available water quality in Yenimahalle, where Yol-İş Sitesi is located, is better than the usable water quality

reaching Çankaya where Kuzu Effect is located. In terms of Energy and Atmosphere criteria, the periods of both projects should be examined in terms of architectural and construction possibilities. Kuzu Effect is expected to be relatively efficient in terms of these measures, since it is made in a much more recent time period and when sustainability measures are more important. The fact that both projects are designed not to create a heat island effect and have a design that will not heat itself and the city is important on the basis of material and waste management criteria. While the construction of the Yol-İş Site with local materials stands out, the features of Kuzu Effect in recycling and waste management are at the forefront. In terms of Indoor Environment Quality criteria, which is the final evaluation area, the positioning of both projects is designed to make the most of daylight, have visual comfort, are equipped with central heating and heat share meter systems; These are the productive features of projects in terms of sustainability.

On the whole, it can be said that Kuzu Effect has a more conscious design in terms of sustainability, but still the conditions and needs of the period in which it was built; Considering the budgets allocated for the construction of both sites and the socio-economic conditions of the residents of the neighborhoods where these houses are located, the fact that the Yol-İş site contributes relatively to sustainability should not be overlooked. In addition, considering the ratio of the part allocated for the green area to the building group, it should be said that the soil permeability of the project area is high and thus rain water is more successful in terms of reaching the soil and underground resources. The energy identity certificate obtained due to the exterior insulation made in 2017 indicates that efforts are made in terms of sustainability improvements.

Although the existence and acceleration of new constructions, which are sensitive in terms of sustainability in our country, which has been evaluated at a critical level in terms of global drought as of 2020, is considered positive, it is known that the number is quite insufficient when compared to the buildings licensed per year. In addition, it is observed that the measures taken in order to increase the sustainability of existing structures are insufficient.

While the responsibility of the construction sector, which has the largest share in energy consumption, in the field of sustainability is higher than anyone else; It becomes more evident day by day that administrations, as well as architects, engineers and employers serving in this field, should increase their responsibilities and their skills in this sense.

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