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CHAPTER 1

NET-ZERO ENERGY HOMES: EVALUATION OF CASE STUDIES FROM DIFFERENT CLIMATE ZONES

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INTRODUCTION

Among all building types, residential buildings consume the most energy. According to the Global Status Report for Buildings and Construction, buildings consumed 35% of total energy consumption worldwide in 2019. The share of residential buildings in this consumption is 22% (this is equivalent to approximately 63% of the total energy consumed in buildings). Residential buildings are also responsible for about 39% of the buildings' total carbon emissions (Url-1) as shown in figure 1 below.

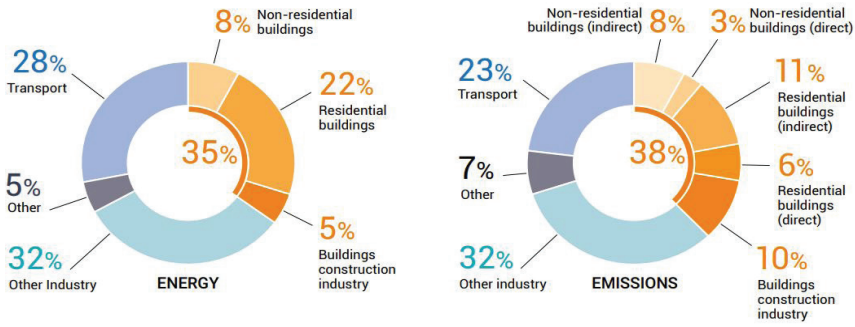

Figure 1: Building and construction energy and emissions in 2019 (Url-1)

As a result, it is evident that residential dwellings are a critical component in minimizing energy use and emissions (Selvig, 2015, p. 1). These data explain why net-zero and near-zero energy houses are becoming more popular.

The first section of this article provides an outline of what net-zero homes are. The chosen case studies will next be analyzed. The purpose of this article is to compare several net-zero house (NZEH) case studies from various climate zones. An overview of the climatic situation of the location in which the residence is located is discussed for each case study, followed by an analysis of the applied technologies and solutions.

DEFINITION OF NET-ZERO ENERGY HOMES (NZEH)

A NZEH can be defined in a variety of ways. Net-zero field energy, net-zero source energy, net-zero energy costs, and net-zero energy emissions are the four basic definitions (Austin, 2021, p.4). Each definition has a separate renewable energy source and uses the electricity grid in a different manner. As a zero energy design objective, any NZEB definition that corresponds to a distinct energy usage calculation technique has significance. However, there is no optimal definition (Pless & Torcellini, 2010, p.1-8):

- **Net-Zero Site Energy:** A building that generates as much energy on-site as it consumes over the course of a year.
- • **Net-Zero Resource Energy:** A house that generates at least as

much energy as it consumes over the course of a year (when calculated at the source). The principal energy utilized to create and convey energy to the location is referred to as source energy. The imported and exported energy is multiplied by the relevant field-to-source conversion coefficients based on the facility's source energy type to compute the total resource energy of a building (Url-2).

- **Net-Zero Energy Costs:** The amount paid to the building's owner by the public utility for renewable energy exported to the grid is at least equal to the amount paid to the utility for energy services and energy used during the year.

- **Net-Zero Emissions:** A net-zero emissions building produces (or purchases) enough emission-free renewable energy each year to offset all of the building's emissions. Common emissions mitigated by net-zero energy buildings include carbon, nitrogen oxides, and sulfur oxides. The imported and exported energy is multiplied by the appropriate emission multipliers based on utility emissions and onsite generation emissions to calculate a building's total emissions (if any).

Any effort made by a consumer of energy goods that minimises energy usage is referred to as energy efficiency improvement (without affecting the level of service provided). "Require less energy to obtain the same result," "need the same amount of energy to produce a better outcome," and "need less energy to reach a better result" are three approaches to achieve energy efficiency (Rodriguez -Ubinas et al., 2014, p. 23). The optimal option, on the other hand, is to use less energy and create more energy from sustainable sources. To conclude, NZEHs are designed to achieve yearly energy balance (i.e., they create as much energy as they consume), as illustrated in figure 2. (Dietrich et al., 2014, p. 486).

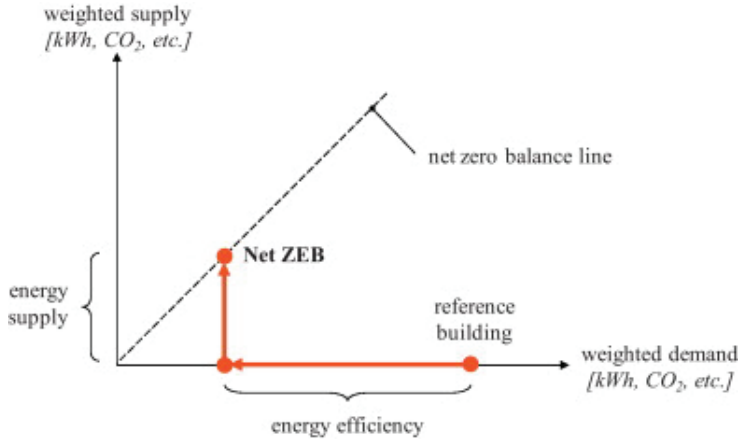

Figure 2: Graph representing the concept of NZEB balance (Sartori et al., 2012, p. 222)

As a result, the definition requires that the building should be low-energy. A low-energy structure must first minimize its energy requirements, adapt appropriately to environmental circumstances, have an appropriate envelope, and apply passive design solutions, as shown in Figure 3. (Sartori et al., 2012, p. 220). It also means that building-integrated renewable energy technology can be installed on building facades, roof surfaces, and site floors (Dietrich et al., 2014, p. 486). Within the scope of this research, the case studies presented in the next section accept all NZHE definitions discussed previously.

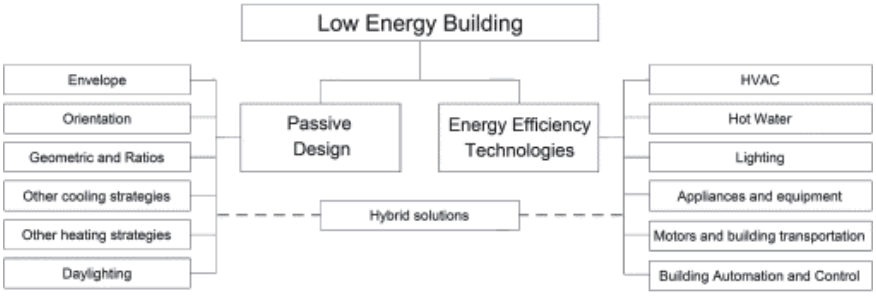

Figure 3: Low Energy Buildings (Rodriguez-Ubinas et al., 2014, p. 24)

EVALUATION OF CASE STUDIES

Three case studies of NZEH from various climatic zones are evaluated in this section. The goal is to compare the data of net energy use and output acquired from these case studies annually and determine if these homes are actually net zero.

All of the examples chosen are stand-alone residences of roughly the same size. When choosing case studies, the availability of data on energy production and consumption was also a major consideration. Because the samples are from various climatic zones, there are no restrictions on the passive or active technologies that may be utilized, as this varies widely based on the region's climatic demands and the scenario. Canada (cold climate), Oman (hot and arid climate), and South Korea were chosen as samples (subtropical climate) as displayed in figure 4 below.

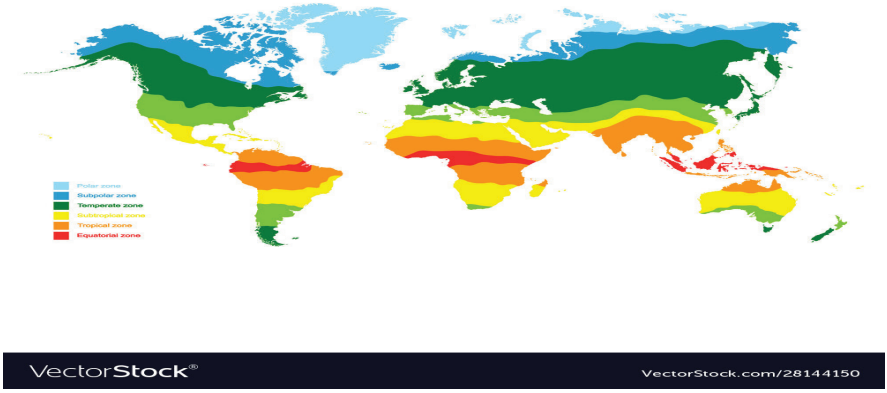

Figure 4: Climate zone map (Url-3)

Case Study 1: Cold Climate (Canada)

This section of the article analyzes a detached (2013) ready-made house of 222 m2 in Edmonton, Alberta, Canada. Edmonton has a severe climate, with an annual average temperature of 3.1 degrees Celsius. Edmonton, which receives considerable precipitation even during the driest months of the year, has an average of 3060.76 hours of sunlight each year, including snowfall in the winter months. The weather conditions are summarized in Table 1 (Url-4).

Table 1. Weather averages for Edmonton (Url-4).

	Average Temperature °C	Minimum Temperature °C	Maximum Temperature °C	Avg. Precipitation mm	Humidity (%)	Rainy days (day)	Avg. Sun (hour)
January	-10.9	-14.7	-6.0	22	77	5	5.0
February	-10.4	-14.5	-4.7	15	84	3	5.8
March	-5.0	-9.3	0.8	20	73	4	7.3
April	3.3	-1.9	9.9	37	60	5	9.4
May	10.4	4.7	16.8	55	55	7	11.7
June	14.9	10.0	20.3	90	63	10	12.3
July	17.7	12.8	23.2	93	68	10	12.0
August	16.6	11.8	22.3	63	67	7	10.7
September	11.3	6.9	17.2	40	66	6	8.9
October	4.1	0.5	9.3	25	69	4	7.2
November	-4.4	-7.6	-0.1	25	74	5	5.6
December	-10.7	-14.4	-6.3	19	77	4	4.8

Net zero energy houses have shown to be viable in cold areas over the years (Iqbal, 2004; Tse, 2007, Thomas, 2013), yet these homes have been perceived as costly and difficult. Landmark Group has proposed the "NetZero (Ready-made) Home project (Url-5), which intends to produce cost-effective net zero energy home solutions for Canada's typical homes" in an effort to simplify and popularize such homes.

To cope with this climate, several solutions are supplied to the house to maintain the internal temperature warm, especially during the winter. The house faces east and has a south-facing roof. It is an energy-efficient home with the following features: (1) high performance insulation is applied to the building's envelope, including the facade wall, roof, open floor, and basement wall, is also insulated; (2) triple-glazed windows are used to improve the thermal performance of building windows; and (3) heat pump technology is used for space heating and hot water heating (Li et al., 2020, p.1685). Tables 2 and 3 describe the home's design profile. In addition, in terms of power generation, this home relies only on PV cells mounted on the building's roof. 361) (Li et al., 2016). Figure 5 illustrates a sample image of the net zero energy detached house under consideration in this case study.

Table 2. Edmonton house information profile (Li et al., 2020, p.1686).

General Information			
Area (Year)	222 m^2 (2013) - Landmark Group		
Certificate	Energy Guide 100	**Estimated annual energy use**	19.146 kWh
Latitude	53.403◦	**Estimated annual heating load**	11.812 kWh
Thermal conductivity of the building envelope	90.7 W/K	**Electricity Generation**	12.94 kW solar PV system
MEP Systems			
Heating and Cooling System	Air source heat pump (with backup heater)		
Ventilation	Heat recovery ventilator (HRV)		
Water Heating	Air source heat pump hot water tank (DWH)		

Table 3. Facade profile (Li et al., 2020, p.1686).

Elevation Profile	
Outer wall	Insulated with 12.7 cm SPF (Spray Polyurethane Foam) and 6.73 cm spray fiberglass (Thermal resistance: R40)
Roof	Insulated with 8.89 cm SPF + 41.8 cm blown insulation (R80)
Basement Wall	Drywall insulated with 8.89 cm Batt + 8.89 cm SPF (R30)
Basement Flooring	10.16 cm EPS II, with wall heat and underfloor insulation (R16)
Floors	Insulated floor structure with 17.78 cm SPF (R42)
Window U-value	South-facing 0.184 W/(m2•N), all other directions 0.124 W/(m2•N)

Figure 5: Sample photo of the analyzed detached house with net zero energy (Url-5)

Simulation tools were utilized to estimate the energy consumption of the prefabricated dwellings. HOT2000 software is used to simulate power generation, whereas RetScreen is utilized to model energy consumption (Li et al., 2016, 361). HOT2000 is an energy simulation modeling software (Url-7) developed and maintained by Natural Resources Canada to assist the EnerGuide Rating System, ENERGY STAR for New Homes, and R-2000 residential energy reduction programs. RETScreen is free software provided by the Canadian government to help in the evaluation of renewable energy and energy efficiency projects' feasibility and performance (Url-8). The R2000 mode in HOT2000 is set to simulate energy consumption for the heat pump in energy efficient buildings, including NZEHs, where only uncooled space heating is simulated and the energy need of a given NZEH is assessed by category: heating and cooling, HRV, DWH, and foundation loads (Li et al., 2016, 361).

When the estimated loads and real consumed energy are compared, heating and cooling consume 27.0 percent more than the estimated total, but overall DHW energy consumption is 14.0 percent less than the simulation use. HRV's actual overall energy consumption is somewhat greater than the estimated 7.5 percent, and in most months, the estimated energy consumption does not match the actual performance (Li et al., 2016, 362). The following is a breakdown of the difference between actual and estimated energy use (table 4).

Table 4. Reasons for real and estimated energy difference (Li et al., 2016, 362).

	Reason
Heating and cooling	1) In comparison to the 25-year average temperatures prior to the study, the actual average temperature during the study year was greater (the monitored period is warmer, thus increasing cooling loads). 2) The energy used for space cooling is not taken into consideration in the HOT2000's R2000 mode, resulting in under-estimated simulation results.
HRV	The user must manually run the HRV application, which can make a significant difference.
DWH	Hot water usage determines energy usage for DHW heating, and the HOT2000 model, which replicates heat pump technology for average DHW usage, produces close results.

The energy simulation model of HOT2000 is based on the assumption that two adults reside in a family with two children, which is the same demographic composition as the actual occupancy rate of the monitored home. The measured house's fundamental loads are on average 50% less than the simulation findings, and the real consumption of big household appliances, lights, and other external uses is likewise much less than the energy simulation results. This is because the equipment used are certified energy efficient devices, which helps to lower daily electricity use (Li et al., 2016, 362).

The observed house used 16,381.24 kWh of electricity during the study period, while the solar PV system produced 15,711.86 kWh, resulting in a 669.38 kWh energy deficit (4.1 percent of total consumption). Table 5 shows monthly energy consumption, production, and balance, and energy deficits are observed in winter (October 2014–February 2015) due to increased heating loads, while energy surpluses are observed in other seasons (Li et al., 2016, 361).

Table 5. Monthly energy performance (Li et al., 2016, 356).

	Sept. 2014	**Oct. 2014**	**Nov. 2014**	**Dec. 2014**	**Jan. 2015**	**Feb. 2015**	**Mar. 2015**	**Apr. 2015**	**May 2015**	**Jun. 2015**	**Jul. 2015**	**Aug. 2015**
Consumption (kWh)	968	1247	2178	1996	2095	1915	1421	1129	926	748	965	744
Energy Production (kWh)	1386	1160	273	294	413	520	1649	1795	2292	1981	2151	1796
Energy Balance (kWh)	418	- 87	-1904	-1702	-1682	-1394	228	667	1366	1233	1186	1002

The 12.94 kW energy producing system is made up of 42 solar PV panels with a total power of 308 W. Electricity production appears to be 10.0 percent lower than expected. It is also worth noting that between No-

vember 2014 and February 2015, less energy was produced, and the estimated and measured solar radiations were nearly identical. Snow cover has a negative impact on solar PV performance in the winter (Li et al., 2016, 362).

The goal of net-zero energy dwellings is to achieve zero energy balance every year; however, real energy performance may differ from the design. The following example displays a 669.38 kWh energy deficit (4.1 percent of total energy consumption). Space heating and cooling is the key factor in this scenario, which accounts for the bulk of annual energy use in Edmonton, Canada (Li et al., 2016, 362). While these are better results than NZEH homes, they still fall short of meeting the criteria of a net zero home, which is a home that achieves a zero energy balance by the end of the year.

Case Study 2: Hot and Dry Climate (Oman)

Muscat's climate is described as arid. Muscat has an average annual temperature of 27.3 °C and receives nearly no rain throughout the year. Throughout the year, Muscat receives roughly 3905.57 hours of sunshine, with June being the hottest month with the greatest sunshine. Table 6 highlights the weather patterns over the course of the year (Url-6).

Table 6. Weather averages for Muscat (Url-6).

	Average Temperature °C	Minimum Temperature °C	Maximum Temperature °C	Avg. Precipitation mm	Humidity (%)	Rainy days (day)	Avg. Sun (hour)
January	19.9	16.0	23.3	18	63	2	9.0
February	21.2	17.2	24.8	15	59	1	9.8
March	24.0	19.7	27.7	18	53	2	10.5
April	28.3	23.7	31.9	7	45	1	11.4
May	32.1	27.4	35.7	0	42	0	11.9
June	33.1	28.8	36.3	10	49	0	12.1
July	32.8	29.0	35.5	4	56	0	12.0
August	31.7	27.8	34.5	1	57	0	11.6
September	30.5	26.2	33.8	0	57	0	11.0
October	28.5	23.9	32.4	1	52	1	10.4
November	24.5	20.6	28.1	13	60	1	9.6
December	21.2	17.6	24.6	13	62	2	9.0

The two-storey net-zero energy house (called Eco-house) in Muscat, Oman has a floor area of approximately 231 m^2. The house is designed to keep the temperature between 25°C-27°C and relative humidity between 50% and 70% throughout the year. It works with a 22.8 kW grid-connected solar system at the top of the house as shown in figure 6 (Sharif et al., 2020, 350).

Figure 6: Photo of Eco -house in Muscat (Sharif et al., 2020, 350)

Eco-home again has insulated walls, floors, and roofs to maintain indoor warmth. In addition to solar panels, double-glazed windows are installed (Sharif et al., 2020, 350-351). The house has a U value of 0.233 W/m2K and a roof made of hollow plates with a U value of 0.339W/m2K and is covered with solar panels. Double-glazed windows have a shading coefficient of 0.28 and a total U-value of 1.88 W/m2K. The house is equipped with energy recovery fans and variable refrigerant heat pumps (one for each floor) to ensure comfort conditions in year-round operation. An electrically assisted solar hot water system is also one of the solutions in this house (Sharif et al., 2020, 350-351).

Table 9 shows that Eco-ev has the capacity to generate extra energy each month. The results also show that the Eco-ev can generate 32.7% extra energy at the peak of the energy-hungry month (June). The results show that even with a margin of safety of 10%, the home can reach net-zero energy status each year with a 40% smaller PV system installed (Sharif et al., 2020, 355).

Table 9. Eco-house energy performance according to monthly (Sharif et al., 2020, 355).

	Jan.	**Feb.**	**Mar.**	**Apr.**	**May**	**Jun.**	**Jul.**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Consumption(kWh)	888	822	1180	1542	2165	2290	2201	1876	1795	1738	1144	937
Production (kWh)	2256	2482	2795	3025	3528	3402	3319	3278	2986	2801	2267	2100
Balance (kWh)	1368	1660	1615	1483	1363	1112	1118	1402	1191	1063	1123	1163

Unlike the Canadian case study, it was observed in this case study that the Eco-home was able to stabilize as a NZEH at the end of the observation year. In addition, 1221 kWh of energy was exported to the grid (Sharif et al., 2020, 356).

Case Study 3: Subtropical climate (South Korea)

We'll look at the examination of two residences in South Korea in the next part. Lim et al. (2021) investigated the two current NZEHs' extensive energy systems and information. The goal of this study was to look at the costs and benefits of implementing NZEHs. Electricity usage and output were measured in the last three years using the remote monitoring system.

The floor plans and images for the two dwellings are shown in Figures 7 and 8. Gongam House (September 2015) and Gwangdeok House (April 2016) are two houses in Gongju and Cheonan, Korea. There is no variation in climate between the two places, which are around 36 kilometers apart (Lim et al., 2021, 6410). Table 10 compares and contrasts the meteorological conditions in both cities, revealing that there is no substantial difference between them.

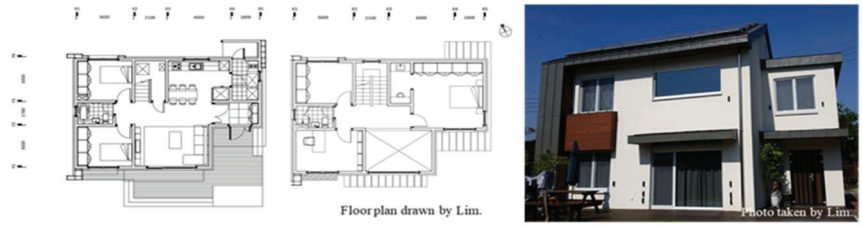

Figure 7: Floor plan and south facade of Gongam house (Lim et al., 2021, 6410)

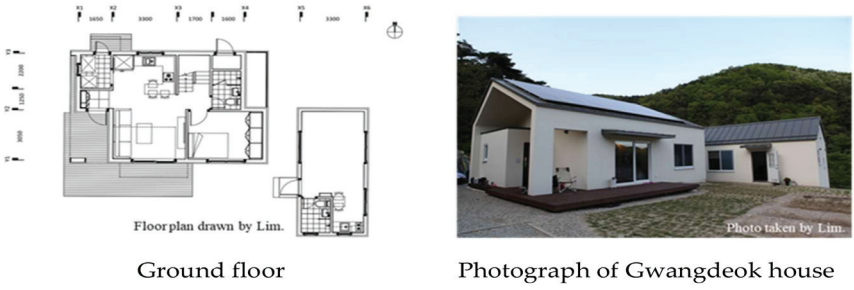

Figure 8: Floor plan and south facade of Gwangdeok house (Lim et al., 2021, 6410)

Table 10. Weather averages for Gongju and Cheonan (Url-9; Url-10).

		Average Temperature °C	Minimum Temperature °C	Maximum Temperature °C	Avg. Rain mm	Humidity (%)	Rainy days (day)	Avg. Sun (hour)
Jan.	Gong.	-1.7	-5.1	2.2	26	64	4	5.5
	Cheon.	-2.1	-5.7	1.9	25	63	3	5.7
Feb.	Gong.	0.4	-3.2	5.0	33	61	3	7.1
	Cheon.	0	-3.7	4.8	31	61	3	7.2
Mar.	Gong.	5.2	0.6	10.8	50	60	5	8.7
	Cheon.	4.9	0.1	10.5	46	62	5	8.8
Apr.	Gong.	11.6	6.6	17.5	82	60	5	9.6
	Cheon.	11.4	6.1	17.3	74	61	5	9.7
May	Gong.	17.4	12.4	23.2	86	63	6	10.4
	Cheon.	17.3	12.1	23.1	83	64	6	10.5
Jun.	Gong.	22.2	17.7	27.4	141	67	7	10.0
	Cheon.	22.1	17.6	27.4	135	68	7	10.1
Jul.	Gong.	24.7	21.7	28.4	266	81	12	7.6
	Cheon.	24.7	21.6	28.4	252	68	12	7.8
Aug.	Gong.	25.1	22.0	29.0	234	79	12	8.6
	Cheon.	25.1	22.0	28.9	229	80	12	8.8
Sept.	Gong.	20.6	16.8	24.9	150	74	7	8.5
	Cheon.	20.5	16.7	24.7	141	70	6	8.6
Oct.	Gong.	14.2	9.9	19.1	59	69	4	8.3
	Cheon.	14.0	9.7	18.9	57	70	4	8.4
Nov.	Gong.	6.9	3.0	11.4	47	70	5	6.6
	Cheon.	6.7	2.6	11.1	47	70	5	6.6
Dec.	Gong.	0.1	-3.3	4.1	28	67	4	5.7
	Cheon.	-0.2	-3.8	3.8	28	66	4	5.8

All of the residences' lighting systems were upgraded to LED, and heat recovery ventilation systems were added. In addition, to control sun radiation, moveable shutter systems were installed in the bedrooms and guest rooms on the south façade. Both residences were designed to be totally electric, with electricity providing all energy needs, including heating and cooking, as well as simplicity of maintenance and repair and zero cost. In both residences, an LG AHUW166A1 air source heat pump (ASHP) and split type air conditioners were used for cooling. The thermal performance

of an ASHP is lower than that of a ground source heat pump, but it has the advantage of a smaller initial expenditure. The features of the two dwellings are shown in Table 11. The ASHP heated water, which was then kept in a household hot water tank and a space heating buffer tank (Lim et al., 2021, 6411).

Table 11. Edmonton house information profile (Lim et al ., 2021, 6411).

General Information			
		Gongam	**Gwangdeok**
Area (Year)		149 m ^{2} (2015)	109 m ^{2} (2016)
building envelope heat conductivity	Roof	0.18 W/m2 K	0.18 W/m2 K
	Teeth wall	0.18 W/m2 K	0.21 W/m2 K
	Ground	0.22 W/m2 K	0.22 W/m2 K
Electric production (average 3 years)		10,396 kWh	9,785 kWh
MEP Systems			
warming up and cool down	Weather welding heat pump (ASHP) - split type air conditioners		
This heating	Weather welding heat pump hot water reservoir (DWH)		

The dwellings' insulation performance was marginally better than the existing insulation norm, although they were planned lower than Passivhaus' current insulation level. 140 mm thick cellulose insulation materials were put between the building woods on the Gongam house's outside wall, and 100 mm thick EPS (Expanded Polystyrene) was inserted to prevent heat loss in the construction woods. Between the structural timbers of the Gwangdeok home, 185 mm thick cellulose insulation materials were put, as well as 30 mm EPS. Two residences have triple-glazed windows with a U-value of 0.98 W/m2 K. (Lim et al., 2021, 6410).

When looking at energy use, it's clear that imported power rises in the winter and falls in the spring, whereas on-site PV generation falls in the winter and rises in the spring (an annual pattern has been determined). In April 2020, the greatest PV generation was 1228 kWh, with 537 kWh going directly to the electrical load and 691 kWh going into the grid. In January 2018, the minimum generation was 437 kWh, with 51 kWh being directly used and the rest being sent to the grid. December 2018 had the greatest electricity use (1102 kWh) while May 2018 had the lowest (525 kWh). Although the Gwangdeok home's power use increased somewhat in the winter compared to the Gongam house, the consumptions were almost identical (Lim et al., 2021, 6413). Figures 10 and 11 illustrate energy consumption and production for each year, whereas tables 12 and 13 indicate average monthly energy consumption and production for two residences during the three years studied.

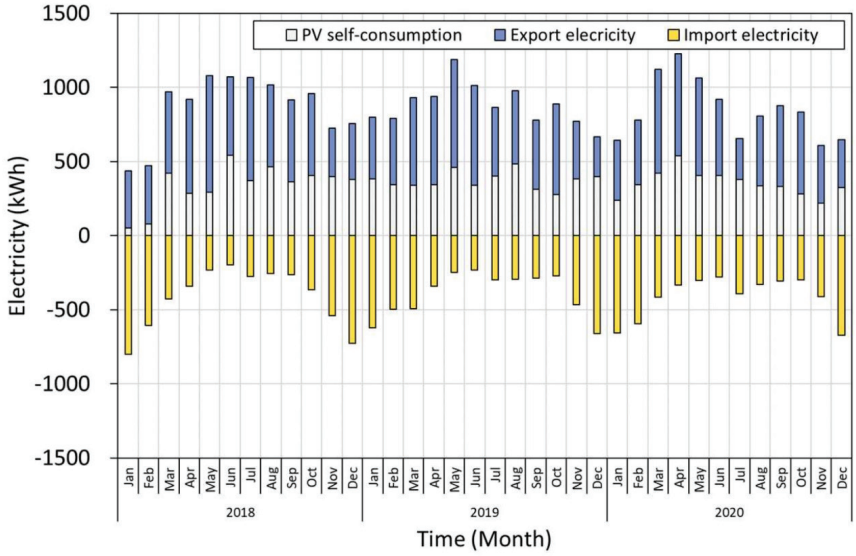

Figure 9: Three-year energy profile of Gongam house (*Lim et al., 2021, 6413)*

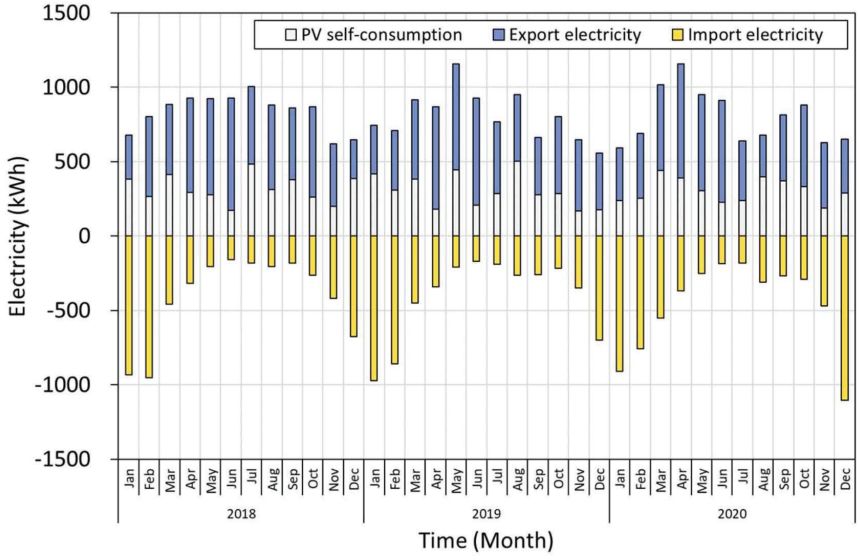

Fig.10: Three-year energy profile of Gwangdeok house (Lim et al., 2021, 6413)

Table 12. Gongam case average monthly energy balance (Lim et al., 2021, 6413).

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Consumption(kWh)	685	566	440	336	260	232	316	292	284	312	475	685
Production (kWh)	637	665	999	1018	1072	1022	823	888	837	871	638	688
Balance (kWh)	-48	100	558	682	812	790	507	596	554	559	164	3

Table 13. Gwangdeok case average monthly energy Balance (Lim et al., 2021, 6413).

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Consumption(kWh)	686	560	440	343	260	231	322	293	286	306	401	683
Production (kWh)	632	689	1016	1035	1114	1010	871	940	865	902	709	698
Balance (kWh)	-54	129	576	693	854	779	549	647	579	596	308	15

During the winter, when energy was utilized for space heating, exported electricity declined in both buildings, but climbed gradually during non-winter seasons, such as summer. The capacity of the PV system in both residences is slightly over the ideal specification due to the steady growth in the quantity of power exported (Lim et al., 2021, 6414). For three years, from 2018 to 2020, two homes were realized as self-sufficient net-zero energy for all energy kinds.

ANALYSIS AND RECOMMENDATIONS

Under this article, four approved NZEH buildings were tested in diverse climatic conditions: one in a cold climate, one in a hot dry environment, and two in a subtropical climate. A pattern in the behavior of these dwellings may be established by evaluating the solutions used and the findings of the energy balance, which might lead to a number of suggestions for various climate conditions.

Renewable Energy Source

In the case studies above, all four homes depended on PV solar panels as the main source of renewable energy for power generation. However, it is beneficial to use solar panels along with other sources to achieve the expected results. For example, in the cold climate case study in Canada, the house examined did not meet its goal of becoming NZEH. While there are other reasons for this observation, which will be discussed later in this section, this is partly due to the fact that the house is simply connected to the PV solar panel on the roof. This is particularly a problem because, as observed, energy production decreased due to snowfall on the panel during

the winter season, and this observation has been shown well in other case studies (Osman, 2015). Indisputably, this is not a problem in a hot climate, as in the case of Muscat, as solar energy is reliable in such a climate. Although this issue does not result in a problem for subtropical climate, it is recommended to combine other energy sources such as wind power or geothermal energy.

Direction and Sunlight

Passive solutions are as important to NZEH as smart and energy solutions. Proper orientation of the building mass alone can reduce energy loads for cooling or heating, depending on the climate. As can be seen, in cold and subtropical climates, it is recommended to orient the building to the south by including large windows that contribute to the heating of the interior with sunlight in winter. On the other hand, in hot climates, it is recommended to orient the house to the north and keep openings to a minimum on the south façade since the main issue is with the cooling of the building.

Building envelope and insulation

High resistance to heat flow (low U-value) is important in climates where energy use services are used to maintain the large temperature difference between indoor and outdoor. Window U value is less important in hot climate zone and average U value building envelope in a hot humid climate is higher than other case studies because heating demands are not as important in this climate zone as other climates. The difference between comfort temperature and outdoor temperature is not high, so passive techniques such as ventilation can contribute. However, in other climatic regions, if the window and average U value of the building envelope is low, they can achieve better energy-saving results.

Heating and Cooling

As discussed earlier, heating is an important issue in a cold and subtropical climate. Therefore, with proper south orientation, large glass windows are highly recommended to provide a low U-value for the building envelope and to use heating technologies such as geothermal energy or water heat pumps to reduce cooling energy loads. On the other hand, proper insulation together with the appropriate air conditioning system can keep the indoor air temperature comfortable in hot climates. Loads of the air conditioning system can be easily met with renewable solar energy.

Energy Balance

Three of the four samples were observed to function properly as NZEHs. However, the Canadian case does not fulfill this purpose. Annual re-

sults are summarized in Table 14 below. Due to low solar radiation in a cold climate, it is difficult to accurately predict the environment. In addition, the software programs used can tolerate a number of inaccuracies. When combined with natural conditions and human interaction, these programs can give misleading results.

Table 14. Summary of annual energy balance for case studies

	Case 1 (Canada)	Case 2 (Muscat)	Case 3 (Korea)					
			Gongam			Gwangdeok		
	2014-2015	2013	2018	2019	2020	2018	2019	2020
Consumption (kWh)	16.332	18578	4.969	4.700	4.975	4.990	4.470	4.971
Production (kWh)	15.710	34239	10.286	10.223	9.964	10.468	10.690	10.289
Energy Balance (kWh)	-622	15661	5.317	5.523	4.989	5.478	6.220	5.318

CONCLUSION

The building sector consumes the most basic energy resources on the planet. Petroleum, coal, peat, shale, natural gas, nuclear, hydro, renewable, biofuels, and waste are the most regularly utilized main energy sources for generating power. Energy experts advocate Net Zero Energy Buildings (NZEBs) as the best answer for reducing the substantial burden on primary energy resources produced by the construction sector. There is a small discrepancy between the estimations generated during the design process and the actual energy performance of residential structures, owing to a lack of awareness of the elements that influence energy usage and the limits of any building modeling tools. The goal of this study was to compare real energy usage with estimates of case study NZEHs from various climatic zones.

In this research, it was found that the case study from Canada (known for its cold climate) did not reach the balance of net-zero energy homes. While further research is recommended, there seems to be a pattern in regions with harsh winters where the energy consumed is much higher than the energy produced. This observation was also seen in study 3 from South Korea. As a result, it is recommended to pay extra attention to the thermal insulation of exterior facades. However, according to the observations in the Muscat case study, NZEHs were found to be productive in warm climate regions.

Of course, more research needs to be done in the field of assessing the currently existing NZEH to arrive at a definitive answer, but it is safe to conclude that there is net zero energy, although a case study underperforms when it comes to purely net zero energy. Net zero energy homes behave as expected (zero energy per year or offset as surplus). Such houses can ensure the conservation of non-renewable energy resources for the present and the future, and their extraordinary benefits are predicted in hot climate regions.

It is important to emphasize that this study may have limitations such as being dependent on measurements from previous studies. When acquiring data, it is recommended to monitor several case studies from the same field over a longer period of time. However, the findings and recommendations found in this article can serve as a guideline for future research.

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CHAPTER 2

AN EXAMPLE OF THEORY/PRACTICE INTEGRATION IN ARCHITECTURE EDUCATION: DESIGN- BUILD PROGRAMS

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1. INTRODUCTION

Learning is the permanent changes that occur in the behavior of living things through repetition and experience. In other words, “learning” is the reinforcement of a response to a stimulusLearning; It is discussed under three main headings as affective, cognitive and psychomotor. Since there is a very close relationship between these three parts, it is not possible to distinguish them from each other. (Özkalp, 2001; Erbil, 2008). There are many different ways of ‘learning’, and which way is more efficient often differs from person to person. There are various alternatives such as learning by listening, reading and experimenting. When the recent studies in the field of education are examined; It has been observed that students can learn better in learning activities where knowledge is not only transferred theoretically, but also put into practice through experiments and practices. In this student-centred approach, students learn more effectively and efficiently by practicing and gaining experience themselves. (Veznedaroğlu and Özgür, 2005; Erbil, 2008).

Vitruvius (80-70 BC - 15 BC), who has a very important place in the history of architecture, said that for a successful architecture, the factors of ‘durability, utility and beauty’ must be provided. This understanding is also a powerful expression in today’s architecture. Considering these factors, it is seen that architecture has serious ties with the fields of art, science and technology. For this reason, it has been observed that architects should have sophisticated knowledge and go through a serious education phase. (Nalçakan, 2006; Mun, 2019). When the institutions that provide architectural education in the world are examined, it is seen that the education models change according to the schools. However, there are basic principles of all institutions in architectural education. These principles are to provide students with skills such as planning, designing and producing and to acquire a critical perspective during their education. Architectural design studios are where students acquire many of these skills. In design studios, which are the center of architectural education, the perception and comprehension of the connections between the concepts of design-planning-implementation takes place. Design courses are supported by courses under the main headings such as “Construction Technology”, “Building Knowledge”, “History of Architecture” and “Restoration” in the architecture program. In this context, the conceptual knowledge that students learn in courses such as building knowledge and architectural history should be integrated with the applications in building and design knowledge courses. It is thought that one of the most effective ways for students to establish a relationship between these courses is learning by doing. Learning by doing activities help to bridge the gap between the design and implementation process of a building, at the

same time they help the participants to adapt to the collective working environment and increase the social interaction among the participants. Within the scope of the program, students who produce a real structure have the opportunity to put into practice the education they received in the design studios. Universities in many different countries around the world include design-build practices as an elective or compulsory course in their programs. Design and build programs in Turkey are generally carried out as summer internships and workshops. (Erbil, 2008; Bayl and May 2011).

The first examples of design-build programs are found in the 19th century. Design-Build programs are closely related to the educational theories of the American philosopher John Dewey (1859-1952), which puts practice at the center of learning, in terms of the importance it attaches to experimental education, group work, and civil society services. As part of a social responsibility project in Oxford, England, John Ruskin (1819-2019) and his students voluntarily worked in the construction of a swampy road and both gained professional practical experience and contributed to social responsibility projects. As another example, Booker T. Washington (1856-1915) who completed 4 of 40 buildings at Tuskegee University in the USA with his students, enabled his students to improve their professional skills and gain field experience with this education. In the 20th century, Bauhaus workshop-oriented vocational training, which was established under the leadership of Walter Gropius, improved the practical skills of the students and ensured the establishment of strong links between the design process and production. Therefore, Bauhaus can be shown as the first design-build example of the 20th century (Hayes 2012, Şahin 2013). In this period, 1:1 scale application practices were also applied in other universities. Richard Buckminster Fuller designed and built geodesic dome prototypes with students at Black Mountain College, which was founded in North Carolina in 1933. Later, Richard Buckminster Fuller, who also went to Yale University in the 1950s, made geodesic dome and model house projects with students at the university and the Architecture Center of New Zealand. Modernist architect Harwell Hamilton Harris, dean at the University of Texas, and six of his students built the House Beautiful Pace-Setter home in 1955 with donated materials. Another school that included the design-build program in its curriculum in the 1960s was Yale University, the most inspiring institution on this subject. Yestermorrow Design-Build School, a non-profit organization that emerged as another design-build approach in the 1980s, continues its activities today. Not only architects or engineers, but also people from all profiles who are interested in design and build programs can participate in the program. In the 90s, Rural Studios, which was founded by Samuel Mockbee and D.K. Ruth in 1993 and continues its activities within the

scope of the Architecture and Urban Planning Departments of Auburn University, can be found. The program, which performs design and build applications outside the university campus, serves people who cannot get proper architectural services in Alabama (Carpenter, 1997; Hayes, 2007; Hayes, 2012; Şahin, 2013; Uskan Demir, 2020).

When the design-build history in Turkey is examined; The Summer Practice Program, which was added to the curriculum as a compulsory internship by the Middle East Technical University, which was established in 1958, is accepted as the first academic design-build program established in our country. Internships are based on the construction of buildings by students in different regions of Anatolia, financed and supported by the Ilbank. Buildings such as schools, guesthouses, government offices and dormitories built in a different village each summer are indicators of a social education for the society. Some of the projects carried out within the scope of this program; Coffeehouse, Agla/Mugla (1958), Museum, Ildiri/ Izmir (1964), Multi-Functional Building, Kutludügün/Ankara (1966), High School Building, Eminlik/Nigde (1967), Municipality Building, Pınarbasi/ Kastamonu(1968), Motel, Ocaklar/Balikesir (1970), Guard Cabin, Eymir/ Ankara (1973), House for Primary School Teachers, Eminlik/Nigde (2000), Additional Building to Ordos Mountain House, Demirkazik/Nigde (2002), Library Renovation, Yassihoyuk/ Ankara (2004), Village Clinic, Yahsihan/Kirikkale (2005). The students who participated in this summer school had the opportunity to learn about the implementation stages of the designed building, and also to get to know the rural areas in Turkey. At the same time, good social relations have been established between the students and the local people who are helping in the regions in need. When the post-program feedbacks are examined, it is seen that the design-build program can be very beneficial both for the students to gain experience by being involved in the construction process and for helping social development. Unfortunately, this program implemented at METU does not continue today. One of the other design and build programs operating in Turkey is the Herkes Için Mimarlik Association, which was founded in 2011. Volunteers from all over Turkey can participate in this volunteer-based program. This program, which carries out applications in line with the needs of the society in urban and rural areas, continues with donations and sponsorship supports. One of the main objectives of the program is to produce architectural structures that take care of the benefit of the society and meet the needs of the society. With this goal, the participants get the opportunity to gain experience in solving social problems, while getting the practice of building construction. The program has been in many applications since its establishment. Among the project examples; There are many different applications such as women's and children's spaces,

park furniture design and manufacture, interior renovations, new building construction. MEF FADA Design and Build Studio, which is part of MEF University, which was established in 2015, is an important design and build program operating in Turkey. With this program, which is included in the curriculum of the Architecture and Interior Architecture Departments, students have the opportunity to review and experience the design and production stages of a building, starting from the first design phase. Within the scope of the program; studies are carried out in many different areas such as playground furniture, huts, urban furniture, seating areas, interior renovations. As with the institutions mentioned above, institutions such as Beton Art Summer School and Nevzat Sayin Summer School also carry out similar activities (Turgay, 2005; Şahin, 2013; Erbil, 2016).

The aim of the design-build programs is to make students aware of the limitations and responsibilities brought by the project in practice-oriented studios, to understand the field of construction, and to realize what architecture includes from thought to construction, compared to the theoretical principles given in the education process and the design problems based on fiction. One of the main goals of the program is that students working as a team understand that teamwork is important in design and construction and learn to respect different ideas. In addition, with these programs, students are expected to present their designs to customers and participate in meetings with municipal officials to test their ideas outside of the academy (Huge, 2009; Turgay, 2011; Bayl and May 2011; Canizaro, 2012; Şahin, 2013).

In design-build programs, there are positive situations that support the education that occurs spontaneously in the process, as well as the targeted goals. For example, since these programs require group work by their nature, they ensure the socialization of the participants. In addition, in cases where the project is carried out in another region, the participants have the opportunity to establish relations with the people of the region, so they can improve the human relations of the participants (Şahin 2013). The main motivation of design-build programs is to introduce students to the art of building. Students have the chance to turn their 2D drawings, which are only fiction, into a real structure with their own hands. With these programs, students can personally observe the production phases. All the processes of the product they work with and create will be an unforgettable experience for the students. Most design-build programs aim to serve local communities in the area. While students learn about the construction processes, they also gain a sense of social responsibility by serving the society. Another benefit of design-build programs is that students gain professional experience. Students deal with all aspects of the design and implementation process. They learn new things while dealing

with solving the problems that may occur in these processes. They also learn to communicate and establish relationships with all other disciplines with which the architectural profession is related (contractors, engineers, inspectors, product suppliers, etc.). Students' efforts to solve environmental, technical or political problems in the construction process enable them to be more effective individuals in the architectural profession. Students learn to be more attentive to environmental and climatic conditions in the area where the building will be built. These non-fiction-based programs like those in design studios add greater responsibilities to students. They realize that the smallest thing they can ignore in any of the characteristic features of the region such as culture, climate and topography will cause serious problems during or after the construction process. In addition, students find new sources of inspiration for their designs by meeting new cultures in the regions where they will be designed. They experience that the climate of the region where the building will be built is highly influential on the design. They learn to analyze the comfort conditions such as natural ventilation and lighting of the building according to the climate of the region. They understand that the environment plays a major role in the material selection of the building, the architectural style, form of the building, and the site plan. One of the most important advantages of the program is that architect candidates, who will constantly work in teams throughout their professional life, meet with teamwork thanks to design-make. Students who learn new things by exchanging ideas within the team also learn to express themselves. Students generally make the selection of building materials based on aesthetic concerns during the editing stages of the designs.

They may not be aware of the physical results of the material they have chosen after the application. With the design-build programs, they learn what they need to pay attention to when choosing materials for buildings that will exist in real life. They understand the potentials of materials, they learn by trying the things to be considered in the design process of a building and material selection. (Dean, 2001; Hoppa, 2002; Brouard, 2007; Sokol, 2008; Bayl and May, 2011; Canizaro, 2012; Şahin, 2013; Amer, 2015; Maclean, 2019).

In addition to many advantages of design-build programs, there are difficulties encountered during the program;

- *The inexperience of the participants in building construction.* The inexperience of the participants in production also affects the quality of the work. As design-build projects become more complex, the need for professionals increases.

- *Takes a long time to build.* Adverse weather conditions and late or non-existent materials may cause projects to take longer than planned during the construction process.

- *Limited resources and time.* The sustainability of design-build programs largely depends on the availability of regular financial resources to carry out projects. It often causes the programs to be edited and left once or twice, and therefore the programs cannot be continuous.

- *Not supported by the university administration.* Since design-build programs also require financial resources, the spending of university resources, which are often insufficient, for these programs is negatively perceived by the administrators.

- Requirements such as the protection of student safety and building materials during the construction process, the failure to meet user expectations, the fact that the construction process takes longer than expected and the programs do not match the academic calendar are among the difficulties of design-build programs.

- *Popularization of design-build programs.* The popularization of design-build programs by the media and by the advice of participating students may cause the programs to move away from their main goals and increase the number of student participants.

- *Increasing the number of participants.* It makes it even more difficult to control issues such as safety, learning, effectiveness, etc.

- *Suppressing the ideas of users and students.* In design-build programs, the worry of getting the job done on time can cause certain principles to be ignored. These principles are among the main aims of the programs, such as developing design skills, providing participatory design in communication with users, increasing the quality of the physical and social environment, reusing resources with a sense of responsibility, etc. (Canizaro, 2012; Şahin, 2013).

2. DESIGN BUILD PROGRAM EXAMPLES

In this section, the design and build programs implemented in the world and in Turkey are examined. Design and build programs at Tasmania University, Berlin Technical University, Zurich Federal Institute of Technology, Victoria Wellington University, Southeast University and Cape Town University from around the world were examined. The design and build program of MEF University from Turkey was examined.

2.1. University of Tasmania (UTas)

There is a serious and continuous construction culture in architectural education at Tasmania University. There is a well-established design-build program offered as both compulsory and elective courses. Permanent public buildings have been built by school staff and students over the years as part of the design-build program (Şahin, 2013).

Figure 1. Plywood Building Construction at the University of Tasmania (Bayl and May, 2011)

The flexible organization of workshops and service facilities in an open plan contributed to the development of this culture of the school. Studio spaces and building construction areas combine effectively. The proximity and accessibility of these areas further reinforces the 'doing' emphasis within the curriculum. It is mandatory for all students in the school to take part in a project as part of the Design-Build program. Design-build applications are included in both undergraduate and graduate programs. The student projects that are made are kept in a small size (bus stop, pavilion, etc.) so that they can be completed in a shorter time and are easier to learn (Bayl and May 2011; Şahin, 2013).

Figure 2. Construction of Bus Stops at the University of Tasmania (Bayl and May 2011)

2.2. Technical University of Berlin

The Technical University of Berlin offered its architecture students the opportunity to participate in a design-build program in Mexico. The Technical University of Berlin assists this program in Mexico in determining the place where the internship will take place. Students enrolled in the program travel to Mexico for three months to build structures (Bayl and May 2011; Şahin, 2013).

Figure 3. Design-Build Program Space in Mexico (Bayl and May 2011)

2.3. Federal Institute of Technology Zurich (ETH Zürih)

Design-Build programs are implemented at the Federal Institute of Technology in Zurich. Exploratory scale models, full-scale conceptual structures at the level of experimental prototypes and real construction projects are implemented within the scope of design-build. The relationship between design and construction is closely interconnected in all courses in the school. Students can gain experience not only in the construction process but also in the manufacturing process of some building materials (such as bricks) (Bayl and May 2011; Şahin, 2013).

Figure 4. ETH Zürich Brick Workshop (Bayl and May, 2011)

2.4. Victoria University of Wellington (VUW)

Made up of 20 universities from around the world, Solar Decathlon is an award-winning program where teams challenge each other to design, build and operate low-cost, energy-efficient and attractive solar homes. The aim of the competition is to enable students to gain professional experience and environmental awareness by using the design-build program (Bayl and May, 2011; Şahin, 2013). Figure 5 shows examples of buildings made by Virginia Wellington University students as part of the Solar Decathlon competition.

Figure 5. Building Examples from VUw Solar Decathlon (Bayl and May 2011)

2.5. Southeast University

The Lianhuadang Farm Project was carried out in Dingshu Town, Yixing, as part of the design-build program by Southeast University's Faculty of Architecture. Within the scope of the project, a total of 6 viewing facilities were built by tradesmen and students, and the existing toilet and administration building were renovated. Traditional craftsmanship experience was gained by using bamboo material during the project process (Şahin, 2013; Jiao and Tang, 2019).

Figure 6. Building Stages (Jiao and Tang, 2019)

Figure 7. Samples of Completed Products at the End of the Program (Jiao and Tang, 2019)

2.6. University of Cape Town

In June 2012, 16 volunteer students and several staff from the University of Cape Town Department of Architecture built a washing platform with the locals at the Imizamo Yethu campus in Hout Bay, South Africa. This project, which was carried out in Imizamo Yethu, one of the poorest and most neglected places in its geographical region, provided many social and cultural advantages as well as gaining design and construction experience for students. Students, who helped and worked with the local people within the scope of the project, acquired a sense of social responsibility by solving the problems of the local people (Louw, 2013).

Figure 8. Platforms Construction (Louw, 2013)

2.7. MEF University

The Design and Build Program, initiated by MEF University Faculty of Art, Design and Architecture in 2015, aims to solve the spatial problems of users who cannot reach the design. The implementation and design of the project was carried out by the students of Mef University, Department of Architecture and Interior Architecture. This project contributes to students gaining design and construction experience, the neighborhood's participation in the design process as a participant and informing them, cooperation between architecture students-school-local administration and the solution of a spatial problem (Url-1).

Design Build Studio – 2015 (Bridge to Dreams)

The project, named Bridge to Dreams, aimed to create a useful school garden and courtyard for the unusable garden of Ayazağa Primary School. The bridge divided the school garden into two with a canal and increased the usage area of the park from 1500 m2 to 4000 m2. This project was shown as an award candidate in the building group at the 2016 National Architecture Exhibition and Awards of the Turkish Chamber of Architects (Url-1).

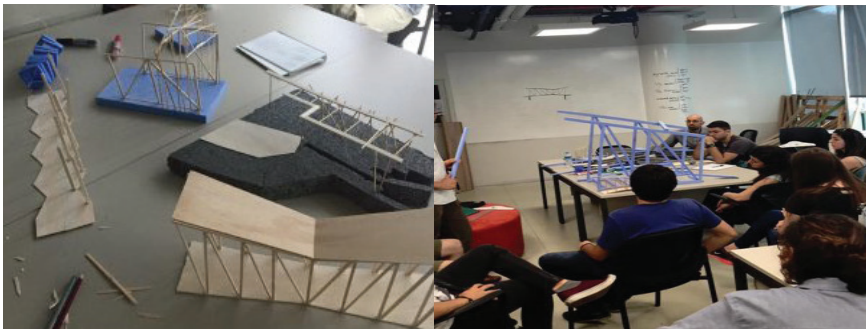

Figure 9. Design Phase (Url-1).

Figure 10. Construction Phase (Url-1).

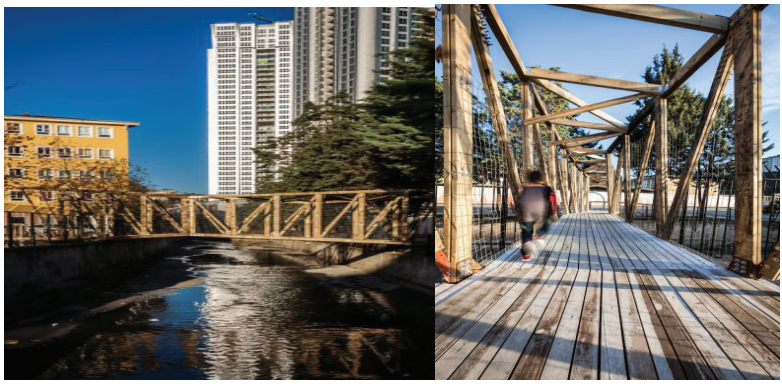

Figure 11. The Completed Bridge (Url-1).

Design Build Studio – 2016

With the help of institutions and administrations that support local development, a total of 5 projects were carried out, 4 in Sarıyer, Istanbul, and 1 project in Aydın's Kasaplar village. It was carried out simultaneously by 5 student groups: a multi-purpose room, a playground in Rumeli Kavağı Güney Kıldıran Primary School, a school garden in Ayazağa Primary School, an English room and Aydın Kasaplar Village Primary School playgrounds.

Figure 12. Güney Kıldıran Primary School Playground Construction Stage and Finished (Url-1).

Figure 13. Ayazağa Primary School Playgrounds Construction Phase and Finished (Url-1).

Figure 14. Aydın Kasaplar Village Primary School Playgrounds Construction Stage and Finished (Url-1).

Design Build Studio – 2017

With the Design and Build summer internship, 1st year students of the Faculty of Architecture at Mef University completed a total of 6 projects. The projects were designed and built to fulfill different functions with the demand and support of schools, local governments and non-governmental organizations. Three of the projects were realized in Istanbul Sarıyer Türkay Şoray Primary School. The other project in Istanbul was implemented for the new studios of Mef University, Faculty of Architecture. Two projects, the construction and design phases of which were completed outside of

Istanbul, were realized in Fethiye and Merzifon.

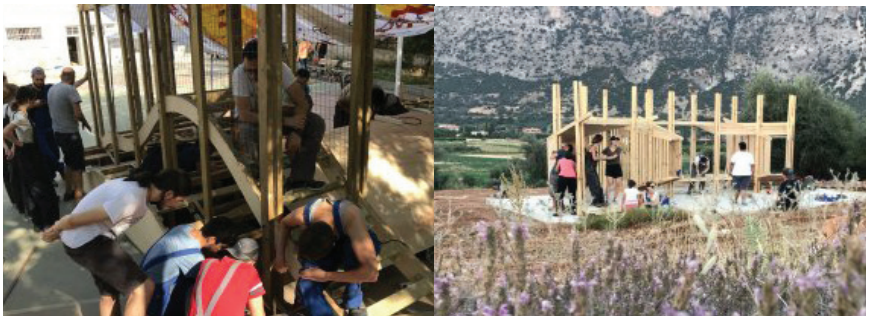

Figure 15. Fethiye, Kayadibi Village Playgrounds Construction Phase and Completed (Url-1).

Figure 16. Merzifon Rest Station Construction Phase and Finished (Url-1).

Design Build Studio – 2018

With the Design and Build summer internship, 6 projects were carried out by the 1st year students of the Faculty of Architecture of MEF University. Mef University Open Air Social Space, Gedikpaşa Playground, Hisartaşı Resting and Navigation Structure, Boğaziçi Kilyos Sarıtepe Campus View Area, Boğaziçi University Maritime and Sailing Club Boathouse are the projects built during this period.

Figure 17. Bogazici University Maritime and Sailing Club Boathouse Construction Phase and Finished

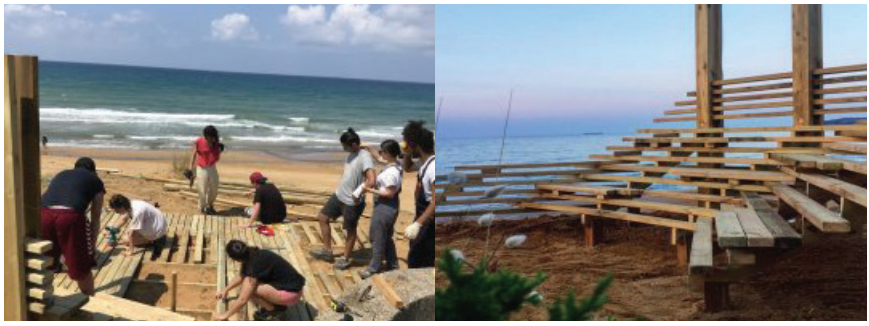

Figure 18. Kilyos Sarıtepe Campus View Area Construction Phase and Finished

Figure 19. Toroslar-Guzelsu Village Public Area Construction Phase and Final Version

3. RESULTS

Bursa Uludağ University, Faculty of Architecture, Department of Architecture, in the elective course named Design/Build Applications in Architecture in the 2019-2020 Fall Semester, students were asked to develop an architectural design proposal for people or communities

in need, emphasizing social responsibility. With this study, students presented suggestions for vulnerable groups in society such as homeless people, children, students, stray animals, and the disabled. Among the main suggestions developed are for stray animals (Cat House Project), playgrounds for children (Pop-up Places for Children), resting and socializing areas for Uludağ University students (Social Boxes for Uludağ University Students, Capsule for Uludağ University Students, Redesign of the Soup Fountain), for the homeless and those in need (Benches and Sleeping Area Design for the Homeless), in order to meet various needs in public spaces (Station Design, Flexible City Designs with Multi-Purpose Portable Units, Structure That Can Be Used in Public Spaces with Various Functions, Observation Terraces Design) . The architectural design proposals prepared by the students within the scope of the study are examined below.

Example 1 (Cat House Project): 100x100x80 cm wooden framed prisms were used in this project, which was prepared to find a solution to the shelter and food shortage of stray animals on the Bursa Uludağ University Campus. It is planned to cover some surfaces of the frames with plastic bottles and timber, which are recycled materials, to create semi-open or closed areas. These units, which have a flexible design as they have a modular structure, can be increased or decreased if needed. This system, which is easy to transport, can be installed anywhere on the campus in a short time (Figure 20).

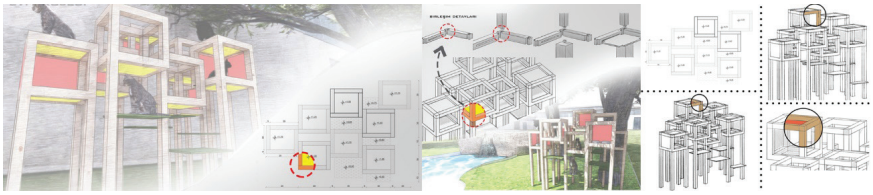

Figure 20. Cat House Project/Tuğçe Zeybek-İlaynur Zafer-Busenur Akıncı-Ceyda Özyurt

Example 2 (Pop-up Places for Children): In this project, the students aimed to create semi-open-closed playgrounds for children. This project, which consists of a steel frame and aluminum panels, is designed to be installed in any empty place in the city with its light weight and easy installation. Thermal insulation details have been added to the panels so that the building can be used both in summer and in winter (Figure 21).

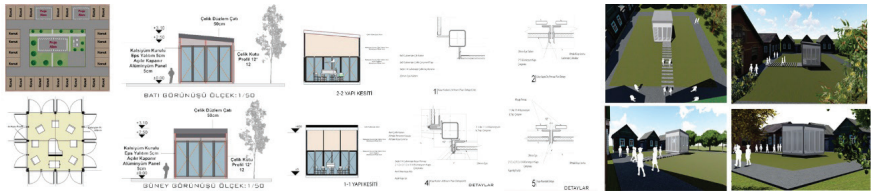

Figure 21. Pop-up Spaces for Children/Emin Utku Taşdelen-Onur Süngü-Seyfullah Esat Apaydın

Example 3 (Social Boxes for Uludağ University Students): Students at Bursa Uludağ University who thought that the social areas where students on campus could spend time between classes and during their spare time were very insufficient, offered a solution to this issue. Laminated wood collapsible panels are used to form the units. One of the main purposes of the design is that the structure is flexible and can be transformed to meet the wishes and needs of the user. Suggested functions for the structure; reading areas, playgrounds, individual study areas, free activity areas and sitting areas (Figure 22).

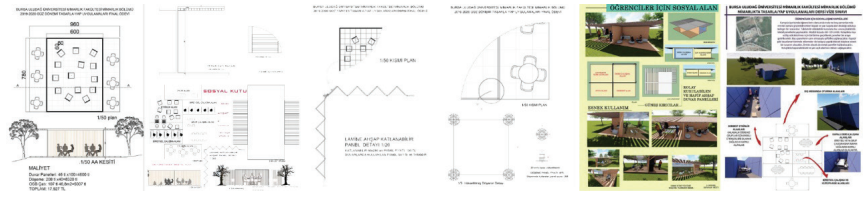

Figure 22. Social Boxes for Uludağ University Students /Reyhan Yiğit-Ayşenur Paşa-Bahar Kurkut

Example 4 (Capsule for Uludağ University Students): In this proposal prepared for Bursa Uludağ University students, sitting-waiting areas are designed for users. Semi-open spaces have been designed where students can spend time and socialize between classes. The connection details of these wooden capsules, which are planned to be easily installed anywhere on the campus in case of need, were planned by the students (Figure 23).

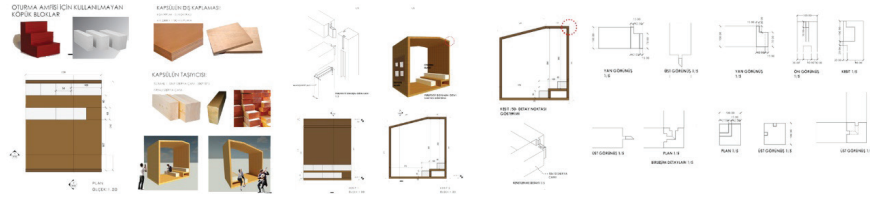

Figure 23. Capsule for Uludağ University Students /Ruhin Alibaylı-Zilan Gündüz-Juma Murat-İsmail Oruç

Example 5 (Observation Terraces): Social viewing areas have been designed at different points of the city where people can relax, sit and spend time. It is aimed that the viewing terraces can be easily installed and removed in the desired region of the city. For this reason, light and easy-

to-install wooden materials are used. With wooden platforms created at different elevations, it is aimed that people can watch the view at any height and spend time. Small seating and amphitheater areas are designed with foam blocks, which are recycled materials, on the platforms (Figure 24).

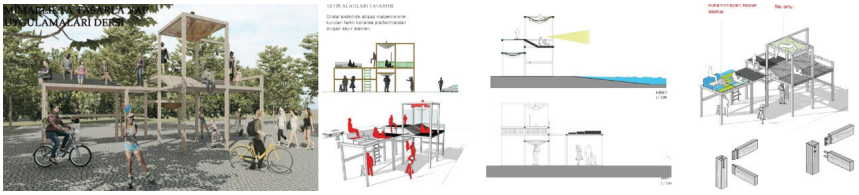

Figure 24. Observation Terraces / İsmail Oruç

Example 6 (Bus Stop Design): The students, who claimed that the bus stops in Bursa and in all cities in general were undefined, unsafe and inadequate, aimed to present a bus stop proposal that could meet these requirements. While designing the bus stops, care was taken to ensure that the materials are recyclable and sustainable. Recycled steel profiles are used in the rafters and seating units. By adding solar panels on the roof of the station, they aimed to generate the electrical energy needed by the station from these panels (Figure 25).

Figure 25. Bus Stop Design / Hasan Furkan Hancı-Şirin Hacıoğlu-Bedran Yenikan

Example 7 (Multi-Purpose Portable Units and Flexible City Designs): In this study, it is considered as a problem that the places where people spend time outside are generally limited to closed areas and there are very few activities that can be done inside. In this context, a unit compatible with all weather conditions has been planned anywhere in the city. These units, consisting of steel profiles and wooden plates, can be made in the desired size and number. These units are designed to be used in different parts of the city for people of all ages and for different functions. Projected Main functions; semi-open recreation areas, open-air cinema, open-air theatre, pocket cinemas and indoor seating areas (Figure 26).

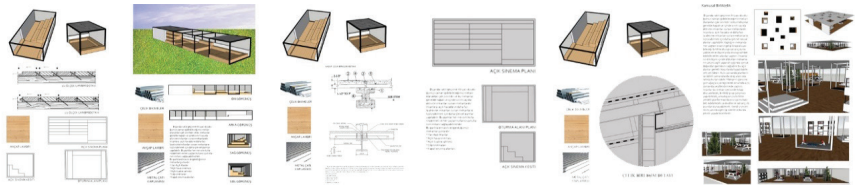

Figure 26. Flexible City Designs with Multi-Purpose Portable Units /Elif Bora-Fatma Bilgi-Z. Ceren Tiryaki

Example 8 (Bench and Sleeping Area Design for the Homeless): As in all countries in the world, there are many homeless people in Turkey. This situation has increased, especially due to the intense external migration in recent times. Paying attention to this situation, the students planned to offer a solution with the design of a bench that can be turned into an indoor area. The wooden framed, sliding top cover to be closed on the bench is covered with a waterproof awning. In this way, the bench, which is used as a sitting unit during the day, is designed to be transformed into a closed area for those in need at night (Figure 27).

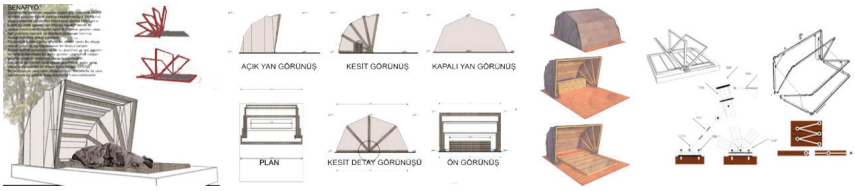

Figure 27. Bench and Sleeping Area Design for the Homeless /Şule Kula-Hakan Kepçik-F. Kerem Cigdem-Ersin Suvat

Example 9 (Structure That Can Be Used in Public Spaces): Students who think of public spaces as the areas where people interact most intensely, have designed a unit that enables to increase social and cultural interactions in public spaces. This system, which has a modular structure, offers a flexible design opportunity. Since the work is modular and easy to implement, it has been ensured that it is suitable for many different functions (Figure 28).

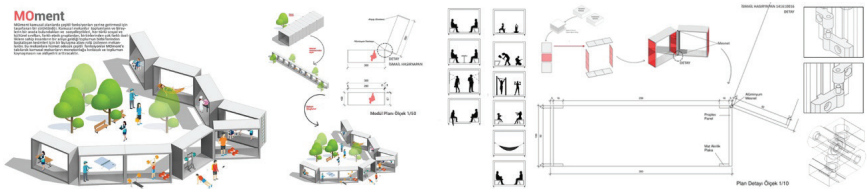

Figure 28. Structure that can be used in public spaces / İsmail Hasıryapan-Adem Ertekin

Example 10 (Redesign of the Soup Fountain): The lack of sitting areas next to the soup fountain located on Bursa Uludag University Campus,

being unprotected against weather conditions and not having a very inviting design are considered as the problems of this study. Based on these problems, it is planned to add a top cover to the fountain against adverse weather conditions such as rain and wind. Under the top cover to be added, mini benches are designed for students who take their soup from the fountain to sit on. While designing, a game wall was added to one side of the fountain for stray animals on campus. A small pool has been added so that the animals can drink the excess soup that is wasted or spilled from the fountain (Figure 29).

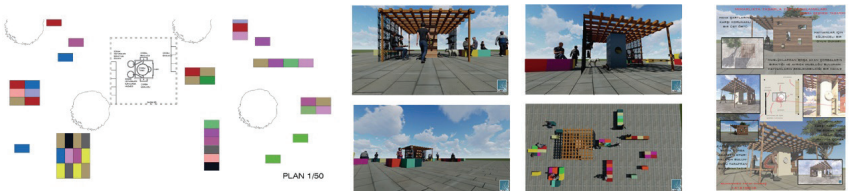

Figure 29. Redesigning the Soup Fountain /M. Fatih Dilmaç-Abdullah Yiğitbaşı-S. Emily Ozmen-M. Ali Ocakoglu

4. CONCLUSION

Architecture students try to learn architecture with projects that exist on two-dimensional planes, mostly consisting of fiction, throughout their education. It is a very difficult situation for students to understand the material without touching it, feeling it, not seeing what results it gives when used in a building, just by reading the features from the book. Although students apply this knowledge theoretically in their construction classes, they cannot reflect them to their projects in design studios. One of the solutions to this problem can be seen as design-build programs. In addition, it provides many benefits to students.

In design-build programs, projects that are oriented to application, use and have a certain deadline enable students to acquire a sense of work ethic and responsibility. In addition, the fact that these projects are carried out for those in need helps to increase the sense of responsibility of the participants. The intensive labor required in the design and construction stages and the cooperation of this labor ensure that the importance of teamwork awareness in architecture is emphasized. As part of the design-build programs, communication with the local people in different regions is ensured, and the participants provide a rich exchange of information and communication with different perspectives. With the experiences they have gained in the design and build programs, the participants understand that construction and design are processes that need to be considered together, not separate processes, by rethinking the design activity. For this reason, the spread of applied projects such as design and build programs in addition to fictional projects in architectural education will enrich architectural education and make significant contributions to education.

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CHAPTER 3

LANDSCAPE DESIGN OPPORTUNITIES IN RAIN CLIMATE CONDITIONS

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1.INTRODUCTION

Most of the world's population lives in cities, and this rate is expected to increase in the future. It is possible to reduce the negative effects of sudden and unexpected weather events caused by global climate change in the environment, to make cities resistant, with the benefits provided by ecosystems. People live in a physical environment. Environmental features have profound effects on all the activities people do. Instant weather conditions and climate are among these environmental factors. It can be extremely effective on human activities from time to time (Rudel et al. 2007). Climate is one of the most important factors affecting life styles on earth. Climate refers to the average weather condition in a particular region, formed by factors such as temperature, precipitation, humidity and wind. Climate affects the existence of living things in certain regions, the geographical distribution and abundance of plant and animal species, the chemical structure of oceans, seas and lakes, the formation of glaciers and soil, which is formed by the effect of many factors (Jackson, 2018).

People spend their entire lives in a physical environment. While some of these living environments are indoors, some activities take place outdoors. Whether indoor or outdoor, the conditions of the area are effective on people and human activities. Considering the climatic conditions, it is stated that the directing effect of humans on these conditions is low (Yılmaz et al., 2013).

The most obvious consequences of climate change; the gradual warming of the world, the melting of glaciers, the rise of sea levels, the exacerbation of extreme weather events and accordingly the change in the ecological structure. This physical feature has led to great loss of life and economy since the last quarter of the 20th century (Erkan, 2008). In recent years, climatic changes have been experienced differently in some parts of the world. While some regions have drought predominates due to topographic and other factors rains, floods and overflows are observed in other regions. It has scientifically revealed the existence and future dimensions of global warming. Climatic variations that are frequently experienced today can also be associated with global warming and can be shown as the cause of floods to a certain extent (Beden et al., 2014). One of the most important disasters that occur as a result of natural or human intervention is floods caused by excessive precipitation.

Cities are most affected by climate change, but large landscapes are also affected. Change in the global climate, warming and sea level rise negatively affect the infrastructure. Especially coastal ecosystems and landscapes, biodiversity, land structure, residential areas are affected by this situation. It is predicted that the new climatic conditions will lead to deterioration of air

quality due to increased temperatures and radiation, changes in landscape character and biodiversity, increases and decreases in the number of some species, as well as an increase in plant diseases. (LI, 2008).

As a result of the intense population growth in the cities, changes have also occurred in the land cover. Natural green covers in cities have been replaced by hard floor coverings, and natural landscape elements have been pushed further and further away from the city center (Bayramoğlu and Seyhan, 2019).

Landscape architecture is a professional discipline that should take an active role in the process of reducing the ecological, economic and socio-cultural effects of global climate change. With landscape planning, the structure and natural processes of the landscape in a certain space are evaluated, and land uses are recommended.

Landscape planning has three main purposes: These are; conservation of biodiversity, ensuring food production and safety, and supporting sustainable local lives (FAO, 2013). It is necessary to determine the climatic data affecting the Landscape Planning and to develop the climate in a positive way for the comfort of living things.

A very large part of human activities on nature depend on climatic events. These events play a decisive role in the lives of living things. Planning and designs; Since it is carried out to serve human life, first of all, it should be aimed to provide climatic comfort (Çetin et al., 2010).

In this study, the situation as a result of the effects of excessive precipitation due to climate change on cities has been examined. Cities and urban uses formed as a result of excessive and sudden precipitation have changed and will continue to do so. As a result of this situation, urban design approaches that aim to reduce the negative effects in cities and to solve them with natural approaches should be made.

1.1.Climate Based Designs

It is necessary to reduce the risks in cities related to the problems that arise due to climate change. In this way, increasing the quality of life and reducing the negative effects of climate change have become an important issue. Global climate change has become one of the most important environmental problems of our age. Floods and overflows caused by rising temperatures, forest fires, rising sea levels, and impermeable surfaces are increasing day by day. Although not directly, but indirectly, the result of this situation is the increase of epidemic diseases, decrease in plant-animal existence and environmental pollution. The threats posed by climate change are enormous. There is no single strategy to solve the climate crisis on its own.

Green areas are an important factor in controlling urban temperatures (Alpak et al., 2018). Plants, especially trees, affect the climate of their environment (Bayramoğlu et al., 2021). Trees perspire and cool the surfaces in the city by creating shade. Cities and landscapes of the future must be more resilient and adaptable to changing environmental influences. The cooling effect of the area covered with broad-leaved trees is higher than the others. With the increase in temperatures, "drier designs" came to the fore.

• Global warming and xeric landscape principles contribute to nature with their eco-friendly approaches as well as water conservation. The water requirement of green areas increases due to the increasing temperature and decreasing precipitation in the summer months. For this reason, the plant used and the place where they are used affect the microclimatic environment and bioclimatic comfort of that region (Walker, 1985). Vegetative tissue in arid regions should also be long-term. For this, maintenance operations must be carried out regularly and at adequate levels. Or it is necessary to build plantations suitable for these adverse conditions.

• Considering that the problems related to drought will increase gradually, xeric landscaping applications should be widespread in the urban texture. Construction and maintenance costs are less than gardens applied with other landscape styles in gardens organized with arid landscaping principles. Although it is thought of as less ostentatious than other landscape designs, it is sustainable and naturally advantageous over other landscape styles.

• Due to its sustainable structure and ease of maintenance, it preserves its quality and freshness for a long time. Green areas arranged with the principles of dryland landscaping are much longer lasting and more respectful to nature than a normal garden facility (Harris et al., 2004; Bayramoğlu, 2016).

Figure 1. An example of a Xeriscape study (URL 1, URL 2)

• The first step to make a water efficient landscaping is the planning and design phase. Correct planning prevents repetitive work and contributes

to saving time and budget (Barış, 2007). Selecting the plant species from the natural plant species of the region where the arrangement will be made will also contribute to minimizing water use. Natural plant species adapt immediately to the environment and maintenance costs are low. (Atik and Karagüzel, 2007).

• Green infrastructure systems have also gained importance in order to manage the water generated in the cities. These systems; conserves water resources and supports the natural cycle and flow of rainwater. Unlike gray infrastructure, green infrastructure uses vegetation and soil to manage rainwater where it falls (Fletcher et all., 2014). Ecosystem in rural and urban landscapes services and conservation of biodiversity organized for the purpose. It means a network in which it is planned holistically for managed natural, semi-natural and cultural of fields (Benedict 2000). Green infrastructure practices help restore the natural water cycle by adapting to existing features (Rutgers, 2016).

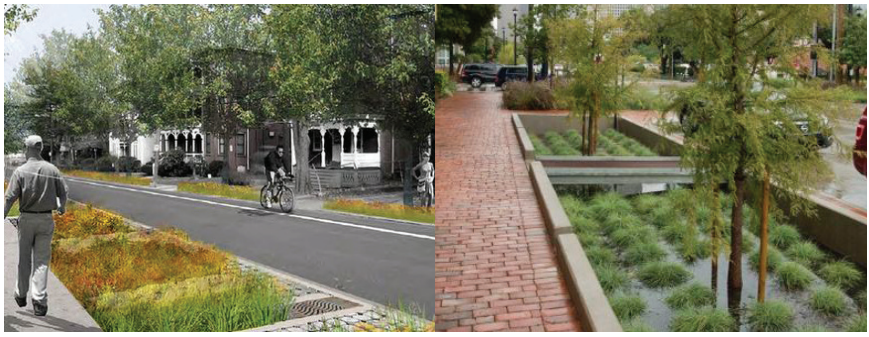

Figure 2. Green Infrastructure (URL 3, URL 4)

• Green infrastructure plans can be made at the scale of district, sub-region, district and neighborhood. At the regional scale, large protected areas such as national parks and major river corridors are addressed. purposes of planning; existing green spaces to evaluate and prevent loss and destruction, to increase the quality and diversity of green areas, to connect green areas with each other by approaching them in a strategic context. It is the protection and restoration of natural landscape elements such as forests, flood plains and wetlands, which are important components of rainwater infrastructure.

• It is a network in which open and natural areas are interconnected, which manages rainwater, reduces the risk of flooding and improves water quality. They are often less costly to implement and maintain than traditional forms of infrastructure. In addition, green infrastructure projects strengthen social solidarity as they involve residents of the relevant region/area in the planning, planting and maintenance stages. One of the most important elements of green infrastructure systems to protect water resources and

ensure their sustainability.

• Less water use, which has come to the fore with the increase in temperatures, has made it necessary to reduce excessive water use, especially in landscape areas. For this purpose, it is necessary to reduce the amount of water used in irrigation. limited irrigation approaches have replaced the use of less xeric plants instead of plants that consume a lot of water (Bayramoğlu et al., 2013).

• Choosing the necessary effective irrigation method is important in landscape architecture applications. In this case, the area to be landscaped should be made in accordance with the intended use. For this purpose, irrigation projects should be done considering the size of the area and the existing plant species. While the irrigation systems are being designed, it should be ensured that the water is economical, high-efficiency and ecological balance is protected.

• In recent years, traditional storm water analysis has been used within the scope of urban storm water management. However, sustainable urban storm water management models have also gained momentum. These approach models reduce runoff and flood risks, recharge groundwater, save energy and water, and reduce costs. (EPA, 2009).

1.2.Landscape Design in Rainy Climatic Conditions

Regions with rainy climatic conditions and these characteristic features are very decisive on the flow of daily life. Adverse weather conditions have negative effects on human life and activities, not only physically but also psychologically. Precipitation conditions can reduce the outdoor activities of individuals by restricting the accessibility of individuals in urban areas. Public open urban spaces that are not designed in accordance with rainy climatic conditions lose their accessibility. This situation limits the livability of the city.

Figure 3. Cities in Rain Conditions (URL-5, URL-6)

With the excess of precipitation water, some of the water seeps into the soil and is not used by the plants. It aims to transfer the water to the water resources in accordance with the natural flow system by holding the precipitation water. Rainwater management is added to urban planning. In this case, the water flows under the ground and reaches rivers and lakes.

Vegetative designs, especially trees, reduce the speed of precipitation water. Plants allow the passage of water to the soil and reduce the amount of water that passes into the surface flow. For this reason, especially in cities, vegetated surfaces are created to stop the water coming with the rains.

The excess of impermeable surfaces causes the natural flow system of water to change and the water cycle to be interrupted. In cities, care should be taken to ensure that the floors are permeable as much as possible, except for the mandatory hard floors. Floor coverings should consist of permeable materials as much as possible, and hard materials such as asphalt and concrete should be avoided.

In rainy climatic conditions, the places, which urban users are most frequently used, is closed or semi-enclosed areas. For this purpose, when designing urban reinforcement elements, it should be designed in accordance with regions in rainy climatic conditions. Sustainable approaches are obtained with cover systems that will be designed both half and open. In addition, in order to save energy, it is correct to choose materials that can pass the sun's rays in the selection of materials (Kurdoğlu et al., 2020).

Figure 4. Use of Cover Elements in Rainy Climatic Regions (URL-7, URL-8)

Due to these compelling features, rainy climatic conditions have a decisive role on the identity of cities. Identity is affected by the geographical characteristics of the people living on that settlement. It refers to the whole of material and spiritual values created by lifestyles. This also applies to rainy climatic regions. Floor coverings specific to this region (made of non-slip materials) come to the fore. It should be preferred that the reinforcement elements used in cities have the characteristics of collecting and accumulating water suitable for rainy conditions.

Figure 5. Water Collection Equipment In Rainy Climatic Regions (URL-9, URL-10, URL-11)

Precipitation is not always negative. Some cities are known for their heavy rainfall throughout the year. However, they turned this situation into an advantage and created a diversity of activities. Although urban use in rainy weather is less known, it is not actually like this. Activities, materials and usage areas for this stop are diversified. Although Manchester doesn't rain as much as British cities, it does have rainy days every year. Bergen, (Norway) is one of the wettest cities in the Scandinavian countries with heavy rainfall. Singapore has little or no seasonal variation.

Today, the concept of water sensitive city directly shapes cities. It has started to take place in the policies that shape the design. Tanner Springs Park, organized to revive the urban ecology; creates a natural wetland with its rain garden project. Wetlands not only regenerate the city, they also clean rainwater, There are natural processes in the wetland to manage water. Wide green areas and green steps in the park offer the users the opportunity to rest, play and socialize. The effect of park flora and fauna positively affects the environment. The plant design was completed by choosing plants suitable for the climatic conditions of the region, while remaining true to the natural vegetation. Tanner Springs Park is a fully natural and dynamic park with ecological impact.

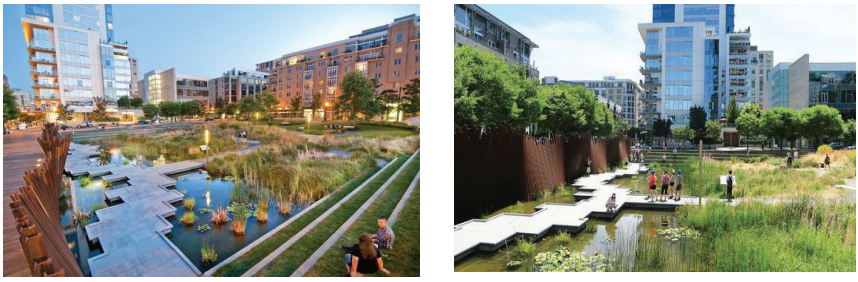

Figure 6. Tanner Springs Park, Organized to Revive Urban Ecology (Url-12)

Again in this context, sponge cities are planned in China for the purpose of storing and cleaning rain water with natural or artificial facilities and converting it into a water source that can be used during drought. The sponge city strategy is implemented as a model in the New Longhua District, with the adaptation proposal and streamlining water management. located in China; It has been rehabilitated by the ecosystem services of the Luan River and its surroundings, where garbage and sewage water were previously discharged. It was built with the aim of bringing green space to daily life. The river has dried up over time and the canal has become clogged with solid waste. In 2006, this model was implemented in sewage water management, ecological restoration and design of the riverside greenway. Storm water ditches (bioswales) were built, which absorb water like a sponge and provide habitat for wildlife. The Floating Gardens—Yongning River Park flooding was built to provide an alternative flood and storm water control solution. It is a wetland that is designed for the natural process of flooding rather than removing entire ecosystems.

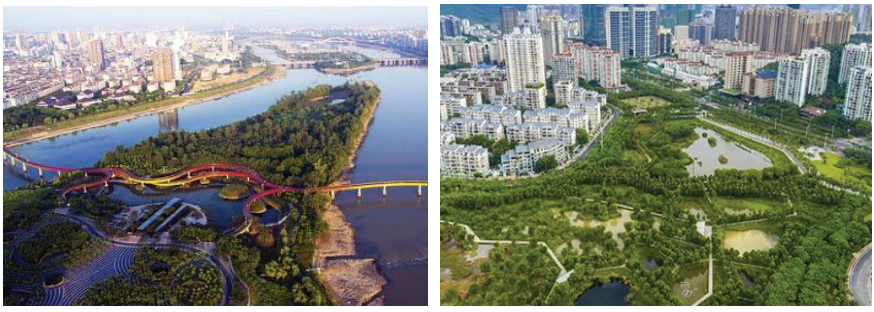

Figure 7. Sponge Cities Found in China(Url-13, Url-14).

For this purpose, it is necessary to manage rain water in cities intelligently. It is an approach to the planning and design of urban environments that support healthy ecosystems, life and livelihoods. It is an approach that integrates urban planning with the management and protection of the urban water cycle. Sustainable plans should be made by considering not only flood waters but also the whole cycle. Water Responsive Urban Design is a process that provides the interaction between the urban built

environment and water management.

It aims to reduce the hydrological effects of urbanization on the environment. It makes the urban design-water relationship meaningful. It aims to give importance to water in the urban design process. Landscape provides the design of multi-purpose green spaces to develop visual, social, cultural and ecological values in urban areas. However, water sensitive urban design and planning would not be sufficient without high-scale urban water management.

2.RESULTS

Landscape architects should also consider adapting to changing climates in their design and planning. First of all, the element most used by landscape architects is the plant, and the most effective factor on the development of plants is the climate. When choosing plants in landscape designs, it should be evaluated how the climate will be after decades and how the plants will be affected by it. It is known that climate change will cause warming and drought in many parts of our country. Therefore, emphasis can be placed on species that adapt to drought. Again, considering that droughts will increase, designs can be made that do not cover the soil surfaces with concrete and that will allow water to seep into the soil.

Water management steps should be taken. to save water less space can be given to grass areas in designs. While creating green textures, natural species of the region can be kept in the foreground. Permeable materials should be preferred instead of concrete or asphalt on roads and pavements. Systems for storing water should be established. One of the issues to be considered in water-related designs is the selection of the appropriate irrigation system and regime. Considering that the changing climate will reduce biological diversity, endemic and rare species should be protected.

With the uncontrolled growing population in cities, pressures and pollution disrupting the ecological balance brought with it many environmental problems. Climate change is expressed as one of the most important problems of the last century. Designs according to the climate are very important today. Especially when the negative effects of climate change are experienced recently, drought and flood events are observed. There is a correct relationship between urban planning and climate data, increasing the quality of urban life. This relationship can be achieved through urban design solutions.

While making a design, many criteria such as climatic conditions, topographic structure, income level, population density, transportation conditions of that region should be taken into consideration. It is certain that

the most obvious effect of the change that will occur on the climate will be on precipitation and temperatures. Therefore, depending on precipitation and temperature, it is expected that many sectors and areas from agriculture to economy, from groundwater to surface waters will be affected. For this inevitable future, it is extremely important to determine the status of existing systems and to produce policies for future projections. With the developing technology, the interaction of human and natural environment is constantly increasing and continues in different dimensions. Considering that there will be an increase in floods and floods, riparian ecosystems should be protected and measures should be taken to reduce the effects of floods. According to the modeling studies carried out in our country, it is predicted that precipitation will increase in the Black Sea Region. Landscape architects who work or will work in these regions need to focus on flood prevention.

In cities with rainy climatic conditions, there are open-green areas that people can use in the short-term summer months. Sudden and prolonged precipitation in cities oblige individuals to spend most of their time indoors. This situation is restrictive for individuals. For this reason, people had to choose multiple usage areas in order to spend their time in a quality way. For this reason, designs should be made to reduce the effect of precipitation in these regions. Green infrastructure systems should be proposed to prevent floods and overflows. Urban reinforcement elements should be designed to retain precipitation waters. Indoor landscape space should be designed in cities. landscape designs should be prioritized and urban identity should be emphasized with these elements. In this way, identity is gained in cities with rainy climates. The climate and topography of each region differs. Therefore, urban designs should be made according to regions.

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CHAPTER 4

THE INNOVATIVE STRATEGIES FOR SUSTAINABLE URBAN RENEWAL

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1. Introduction

In last decades, the cities have undergone an unexpectedly rapid urbanization process (Wang et al., 2021). Research on environmental, economical and social changes at the city level requires further attention. Environmental, economical and social issues can pose considerable challenges to cities and lead to global risks (Balta, 2021).

Urbanization is related with many components, but at the core of the phenomenon is not only population growth but also economic development and social behaviours of the citizens (Angelopulo, 2021). Fan et al, (2019) were modelled dynamics of urbanization, economic development, environmental and social changes. They mentioned the effects of economic development on urbanization and assessed the urbanization and economic development were contributed to environmental degradation. Therefore, urbanization is a global phenomenon which affects the society economically, socially and environmentally (Zhou et al.,2021).

Nowadays, a significant number of global risks such as infectious diseases are threatening the world by spreading at an alarming rate in cities (Malki et al., 2020). Since the beginning of 2020, the coronavirus has been spread rapidly all over the world. According to World Health Organization (2021) data, 236 countries were affected by the virus, more than 235 million cases worldwide and more than 4.800.000 deaths recorded (WHO, 2021). In addition to its effects on economy, psychology and public health, the Covid-19 pandemic has also been had significant consequences for urban lifestyle and the built environment.

The rate of spread of the virus increases mainly in crowded cities and unhealthy environments (Honigsbaum, 2020). A holistic approach combines environmental, energetic and economic challenges with the pursuit of sustainability should be adopted for post-pandemic urban development. Urban areas also create an infrastructure for pandemic control and sustainable development (Pinheiro and Luís, 2020). Urban planners and architects thought it was a solution to the problem of fast-growing cities as it affects urban design, urban planning and housing reform. Infectious diseases have been one of the driving forces of urban renewal that promoted urban planning, thus may also solve many problems such as slum clearance and waste management (Megahed and Ghoneim, 2020). In the 1850s, urban renewal emerged to create healthy cities as a result of the industrial revolution. Therefore, urban renewal as sanitary and building reform are seen to combat the spread of infections and diseases, as well as creating a healthy environment (Ahsan, 2020).

One of the main issues to be dealt today is “how cities are resilient to unexpected global crises”. In this context, cities play a significant role

in urban planning and design. The cities can become more resilient if the dynamic novel urban renewal strategies are considered and also urban environment may become healthier and sustainable.

Urban renewal is one of the important tools on steering of urban development in the rapid change process. It is an opportunity to solve several urban problems caused by unplanned urbanization which is occurred by rapid population change and also other consequences. Urban renewal processes can create infrastructure for the establishment of sustainable cities which is an important concept for cities to disasters, pandemics and environmental issues. The urban renewal process is related with various current urban planning issues in order to achieve effective and efficient sustainable urban renewal practice (Zheng et al., 2014). Sustainable urban renewal process ensures many opportunities to address urban challenges and achieve safe and healthy settlements (Huang et al., 2020). For this purpose, it may offer many opportunities to solve the various built environment problems.

Main challenges of the built environment such as climate change, global warming, energy consumption, greenhouse gas emissions, urbanization and rapid population growth have to be solved, immediately. Therefore, new solutions and strategies should be needed to establish the sustainable urban environment. Several parameters can be determined as the major factors of the sustainable urban planning strategies such as smart cities, energy efficiency, green buildings and urban density control which make cities resilient. Furtherly, one of the main theme in the recent years is sustainable development that offers various opportunities such as decreasing the acceleration of global warming by reducing the level of GHG emissions. Green, smart, net zero building design can be offered as the main solutions to urban built environmental problems. Consideration of energy efficient technics in urban planning and building design reduces the environmental impact and helps to prevent the climate change. Furthermore, cities should implement environmentally friendly practices such as sustainable urban renewal processes to maintain their competitiveness. Process evaluation for sustainable urban renewal has been proposed and given in Table 1. In this table, states, pressures, drivers, responses, impacts are identified with their sub-items which should be considered to establish the sustainable urban renewal process. In this context, the items and sub-items in the table are discussed in detail in the following sections.

Table 1. Process evaluation for sustainable urban renewal from states to impacts (adopted from Rayan et al., 2021)

States	Pressures	Drivers	Response	Impacts
✓ Environmental degradation ✓ Urban environmental problems ✓ Change in biodiversity ✓ Energy and ecological crises	✓ Increase global risks (catastrophic events and global pandemics) ✓ Population growth ✓ Land cover transformation	✓ Climate change ✓ Global warming ✓ Energy consumption ✓ GHG emissions ✓ Urbanization ✓ Economic development	✓ Developing new and dynamic sustainable urban renewal strategies ✓ Implementation ✓ Supervision	✓ Smart cities ✓ Energy efficiency ✓ Green buildings ✓ Green infrastructure ✓ Urban density control

Presently, cities can be developed by the new sustainable urban renewal strategies. The goal of this paper is to present new and dynamic sustainable urban renewal strategies after a comprehensive evaluation of urban renewal and sustainability, which will promote sustainable solutions for how to establish the sustainable built environment for policy makers. Results of the study can keep informed decision-makers to solve urban built environment problems and adopt dynamic approaches in the implementation process.

2. Sustainable Urban Renewal

Nowadays, the urban planning process is conducted on contemporary city challenges such as smart cities, geographic information system and mapping technology, urban green infrastructure, energy efficiency, urban density control and urban renewal. The scope and concepts required for sustainable urban planning and design are given in Table 2.

Table 2. Concepts of sustainable urban planning and design

Scope	Concept
Urban planning and design	Smart cities Geographic information system and mapping technology Urban green infrastructure Energy efficiency Urban density control Urban renewal

Urban planning provides the sustainability and livability of cities while reducing the effects of the global warming and protects the environment. In last decades, the smart cities paradigm is increasingly encompassing the sustainable development goals and resilient settlements in response to the impacts of global warming. The interpretation of smart cities can assist policymakers by emerging information and communication technologies (ICTs) to the implementation of urban strategic plans (Benites and Simões, 2021). Smart cities have ICT solutions to ensure sustainability, innovation, governance and collaborative planning and decision making (Khan et al., 2015).

It is well known that geographic information system (GIS) and mapping technology play an essential role in creating smart cities. GIS and mapping technology helps to improve the six dimensions of smart cities such as people, transport and mobility, environment, economy, life; and governance (Tao, 2013). GIS can be serve as an ideal tool which can provide many advantages in smart cities for urban planners and policy makers (Silva and Fernandes, 2020).

Urban green infrastructure (UGI) emerged as a new concept to make cities resilient for reducing the effects of urbanization, population growth, limited resources, environmental degradation and climate change (Oijstaeijen et al., 2020). Green infrastructure has become the key issue in urban policies, planning and management strategies, as it provides benefits to recreation, urban agriculture, cooling and storm-water absorption (Andersson et al., 2019). So, UGI is an important element of urban planning to ensure the better sustainable urban environment. Furtherly, for achieving the sustainable urban environment is required the implementing an energy performance programme for urban areas. Energy and ecological crises have also negative effects on global warming that effects in urban areas (Marić et al., 2016). One of the significant question is "how much primary energy is supplied to the cities as heat and electricity?". In this regard, efficiency is a key parameter which have to be take into consideration. Energy efficiency has become a major parameter that have to be considered in urban planning and design with the increase in awareness about global warming. This issue posed by global warming can be solved by planning the cities in a sustainable way. Recently, renewable energy sources and new renewable technologies have been an increase essentially in the use of infrastructure, industrial, residential and transportation solutions in cities. the rate of climate change increased by the urbanization have been caused by main factors of that have made of human activities. In this regard, the utilization of renewable energy sources and new efficient technologies should encourage that can reduce the energy demand and CO2 emissions of the cities. Energy efficiency should increase by using renewable energy sources and new efficient technologies for reducing the environmental impacts. Consequently, there is a growing interest in improving the energy efficiency of cities day by day. Maric et al. (2016) proposed to create a database in city level which includes the administrative, financial and other relevant fields. Database should include climate data, architectural data, primary energy potential and utilization, renewable energy potential and utilization, current and new efficient technologies, data on economic activities, relevant statistical data, legal documents and regulations. Therefore, this created database should consider for sustainable urban planning.

Migration from rural to urban areas increases with the industrialization which enables itself as an increase in urban density. Urban density also impacts on urban energy demand and utilization and life quality of the citizens. Global energy demand and utilization of cities also will increase with the increase in urban density. Considering the further expansion of urban density in the future, energy demand and utilization, as well as unexpected problems in urban areas, in urban areas will increase dramatically. Therefore, urban density control should be concerned by researchers, urban planners and scientists increasingly (Quan and Li, 2021; Yu et al., 2021). Güneralp et al. (2017) provided an analysis of urban densities in global scale and associated energy demand and utilization under various urbanization scenarios.

For this purpose, one of the first studies to dealt with the energy issue together with urban renewal was studied by Banham (1992). Banham (1992) mentioned that, there were several issues and many paradoxes that have to be balanced to intent on an easy life. Reduction of energy demand as well as greenhouse gas emissions of the cities is one of the main issue for planning sustainable urban environments.

Urban renewal can be determined as a process of reorganizing and updating existing locations adaptation to the changing environmental and social conditions in order to improve the urban settlements (Ferrini and Gori, 2020; Couch, 1990; Adams and Hastings, 2001; Lee, 2003). The framework of sustainable urban renewal should be considered under three main instruments such as environmental, economic and social as given Fig.1.

Fig.1. The framework of Sustainable Urban Renewal

Social sustainability aims to create sustainable places in people's social life environments that can increase welfare and meet their needs instantly and/or variable (Palich and Edmonds, 2013; Pan and Du, 2021). It is of great importance to increase the applicability of urban renewal projects, to provide the sustainability, which is considered one of the important tools on transforming the corrupted physical environment also designated for the healthy urban environment. It is aimed to contribute to social welfare by creating healthy urban environments by increasing the quality of urban life with sustainable urban renewal. Eizenberg and Jabareen (2017) discussed the concepts of mixed land use, diversity, passive solar design, greening, renewal for sustainable urban development. Yıldız et al. (2020) discussed accessibility, conservation of resources, urban environmental quality, protection of disadvantaged groups, commercial and economic opportunities in sustainable urban renewal (Yıldız et al., 2020).

Conventional urban renewal policies are mainly based on a "demolish and rebuild" concept, while lacking sufficient consideration of the environmental-social and economic aspects and parameters. Urban renewal projects have been conducted irrespective of the factors such as the actual technological solutions directed at settlement, energy efficiency, the usage of renewable energy resources, reduction of carbon emission. In the era of urban renewal, urban renewal processes should be planned in a sustainable way without causing negative societal and environmental impacts while considering the future generations. The comparison of conventional and sustainable urban strategies is given in Fig 2.

Fig 2. Comparison of conventional and sustainable urban strategies

Presently, sustainable urban renewal policies and energy efficient planning in urban settlements have become more important. Unhealthy urban areas become healthy settlements through the energy-efficient sustainable urban renewal. Sustainable urban renewal may also make contribution to the national economy by the use of the energy, effectively. Therefore, connection between "environment" and "urban design and planning" should be provided more strengthen.

Sustainable urban renewal is taken into consideration in two steps as main and sub categories and concepts. Determination of the main and sub categories and concepts of the sustainable urban renewal is illustrated in Fig 3.

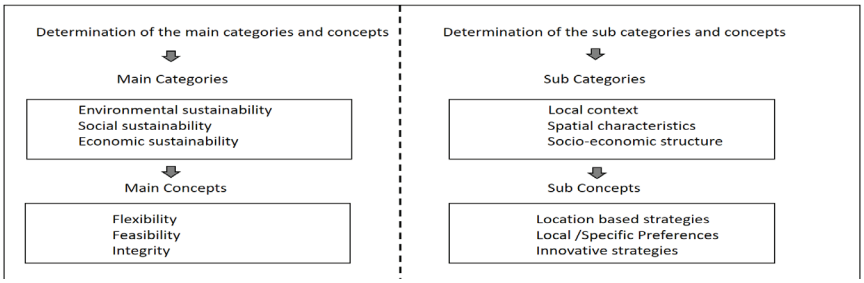

Fig 3. Determination of the main and sub categories and concepts of the sustainable urban renewal (adopted from Huang et al., 2020)

In this context, main concepts are identified as; flexibility (public space, green design, infrastructure etc.), feasibility (density control, energy efficiency, smart buildings etc.) and integrity (comprehensive urban development, mix usage, land use intensity etc.) as given Table 3. While flexibility means adapting to future changes, feasibility is economical and functionality. Integrity is a comprehensive assessment of the general state of urban renewal, from a systematic perspective. The success of sustainable urban renewal should focus on comprehensive analysis (Wang et al., 2017).

Table 3. Main concepts for sustainable urban renewal (Balta, 2021)

Main concepts for sustainable urban renewal	**Environmental**	**Social/ Economic**
Flexibility	Proactive for natural hazards Public space Recreational areas/green design Infrastructure development	Urban quality
Feasibility	Building density control Energy efficiency Accessibility and walkability Provision of open spaces Environmentally friendly practices Smart buildings	Provision of spaces for disabled, elderly and children Public participation
Integrity	Comprehensive urban development Mix usage Land use intensity	Mix usage for all users Integration of the built environment

3. **Sustainable Urban Renewal Strategies**

Determination of local and regional planning strategies and solution proposals are required for successful urban renewal. Identifying strategies for establishing the sustainable urban renewal process has become an important for governments as well as planners and researchers. Therefore, planners, researchers and decision makers proposed various strategies and/ or solutions for attaining sustainable urban renewal. In the literature, many dimensions are presented for improving the urban renewal strategies. In this study, main dimensions are determined while considering the literature and given in Fig 4.

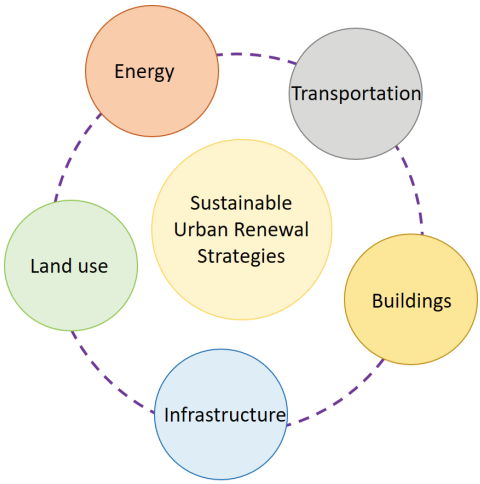

Fig 4. *Dimensions of Sustainable Urban Renewal Strategies*

3.1. Energy

Presently, global warming and climate change are the main critical issues caused by increase in green house gas (GHG) emissions. Therefore, one of the urgent solution is reducing the CO2 emissions by using renewables in an efficient way instead of non-renewable resources. Also new and renewable technologies will play utmost role for solving these negative consequences. Renewable energy resources have become a more important issue with the increase in energy demand of the cities.

Heating-cooling systems are the main energy intensive processes of the buildings which consumes about one third of total building energy. The effective and productive use of heating-cooling systems becomes unavoidable by considering the energy consumption of this process. In the literature there have been several energy efficiency studies on buildings while energy efficiency studies on urban settlement basis have been relatively restricted. In this regard, various strategy issues that should be considered at the energy dimension are given below (Balta, 2021).

- Reducing the non-renewable energy demand and its utilization.
- Increasing the utilization rate of renewable energy resources (solar, wind, hydro, tidal, etc.)
- Encourage the usage of new and efficient systems (eg. HVAC systems, hybrid/electricity/hydrogen vehicles, lightening).
- Increasing the usage of hythane instead of NG.
- Improving the efficiency of the energy conversion systems.

- Meeting the total energy demand of the urban renewal area from renewable energy farms to be established to around that area.

3.2. Transportation

Transportation is one of the urban planning parameters that has a great influence on the sustainability and livability of cities. Sustainable transportation planning is also important for its positive impact on the quality of life of residents. Sustainable transportation can be defined as the sustainable planning and development of transportation infrastructure and its implementation (Wey and Huang, 2018). The utilization of environmental-friendly and also new and efficient smart transportation systems is beneficial for physical health of residents (Zhou et. al., 2019). In this regard, Black (1996) mentioned that sustainable transportation should be realized without sacrificing the ability of next generations to meet their necessities (Wey and Huang, 2018). Sustainable transportation should be provided in a way that meets with the city's environmental, social and economic needs and impacts in an instant and/or variable manner (Reisi et al., 2014; Wey and Huang, 2018). The primary strategy issues which should be considered in transportation context are given below.

- Support the usage of public transportation.
- Design and manage plans for pedestrian and bicycle paths.
- Plan and manage the parking lots and public transportation stations.
- Promoting the usage of eco-friendly and/or non-motor vehicles.
- Creating the accessible and safe urban areas.
- Developing new and efficient smart transportation systems.

3.3. Building

In recent decades, the maintenance and rehabilitation of buildings in need of repair were taken into consideration. However, the design of buildings for privileged groups with special needs and the preservation of heritage buildings should also be evaluated in this context. One of the important aspects of the urban renewal process in older buildings and areas is proper maintenance and rehabilitation. By the way, this process also improves the urban built environment. In urban renewal process, new buildings should be built in modern standards and eco-friendly design as smart and sustainable buildings. Smart and sustainable buildings can be established with this approach. Sustainable urban renewal approach can facilitate and accelerate the access to sustainable cities. Additionally, owners of the old buildings and areas in need of repair should be promoted by technically and also financially for proper maintenance and rehabilitation

(Development Bureau, 2011). In this regard, main objectives are given below which should be taken into consideration under building issue.

- Developing new and efficient smart home applications.
- Considering the environmental factors in the positioning of buildings.
- Renewing the aged buildings.
- Reducing and controlling the building density.
- Supporting the usage of new and efficient HVAC systems.
- Use of specific and environmentally friendly building materials.

3.4. Infrastructure

Urban infrastructures require specific modifications for creating resilience in the urban area where it is located. Innovation in infrastructure design is based on especially modernising and managing the system. Some key remarks to be considered while designing and modernising the infrastructure systems are given below.

- Modernizing the exist infrastructure systems with new and efficient infrastructure systems.
- Managing the infrastructure systems and reducing the utilization of electricity, NG and water.
- Promoting the installation of smart infrastructure systems.

3.5. Land use

In this issue, urban areas in need of repair should be planned in a sustainable way, by taking into consideration the rationalization of land uses. Another theme that should not be ignored in the implementation of the sustainable urban renewal process is enhancing the urban area with green attractive design and green modern landscape and providing more open space for public health (Development Bureau, 2011). Many strategies to be considered under land use theme are given below.

- Accessibility of the urban functions
- Promoting the mix land use to increase the usage of comfort pedestrian and bicycle paths
- Developing the sustainability and livability of the built environment
- Managing the density control of the land use

• Well-planning the land use for managing the land resource in an effective way.

Green design and green urban landscape should be expanded for public health. Especially during the pandemic process, the design of streets and open/public spaces has changed to facilitate effective physical distance and the importance of open public spaces has increased (Honey et al, 2020; Sharifi and Khavarian, 2020). Open and green spaces support human health, increase urban comfort and thus contribute to sustainability (Jennings et al., 2016; Grigorovschi and Gheorghita, 2015). Rural areas and suburbs were considered as one of the safest places when considering many issues caused by rapid population growth. Urban density control and accessibility in urban fringe are one of the new urban issues which are under discussion topic (Nicola et al., 2020; Megahed and Ghoneim, 2020).

Meanwhile for public health, having adequate network of cycling and walking has been more important for cities. Implementation of the parks, gardens, terraces and green roof systems and improvement of their quality with increasing the capacities has many advantageous for sustainability. (Specht et al., 2014; Thomaier et al., 2015). An example of conceptual scheme for public spaces is given in Fig.5.

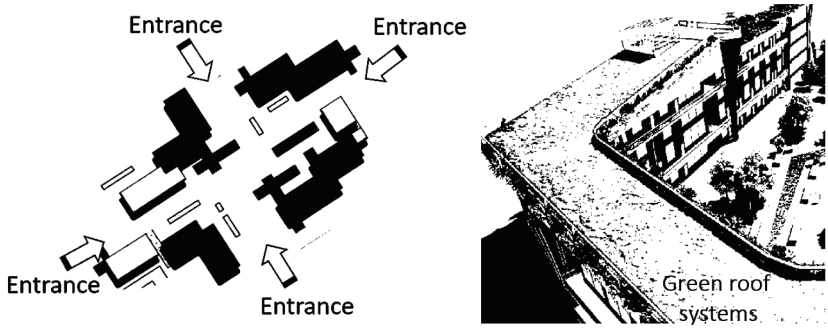

Fig. 5. An example of conceptual scheme for public spaces in sustainable urban renewal

4. **Results and discussion**

As a result of rapid urbanization, industrialization and population growth cities are faced to important environmental, economic and social problems, in recent years. Identified urban problems can be solved by the sustainable urban renewal process while considering the sustainability of settlements. Urban renewal offers many opportunities to create sustainable cities (Huang et al., 2020). The main theme of the sustainable urban renewal is improving the quality of life and welfare of the citizens by establishing the sustainable cities with implementing the given strategies.

The major achievement to transition towards a sustainable urban environment is related to develop main strategies. The main principle of the urban renewal strategies is aimed to increase the strengths and opportunities while solving the pressures of the urban renewal. In this regard, many sustainable urban renewal strategies are proposed to solve identified challenges of built environment. The sustainable urban renewal strategy is not just only a task of governmental strategy but also local authorities, planners and other stakeholders should support this strategy as well. The appropriate, specific, efficient and sustainable strategies should be identified and urban planners and decision makers' relevant considerations on this subject should be taken into account for sustainable urban renewal planning, objectively. And also, this study improves the connection of sustainability understanding with policy making on this issue and help local authorities and decision makers on making cities more resilient and sustainable.

5. Conclusions

Urban planning strategies to cope with recent urban problems should use more efficient to create sustainable cities. This study aims to present the role of sustainable urban planning in the process of urban renewal in order to create a sustainable urban environment. To achieve this goal, various sustainable urban strategies are proposed for solving several issues that cause environmental, energetic and economic crises

From the present study, some concluding remarks may be drawn as follows.

- Sustainable urban environment can be achieved by the considering the innovative and dynamic urban planning approaches.
- Sustainable design concepts for urban renewal is based on flexibility, feasibility and integrity.
- The sustainable urban renewal makes cities more resilient and provides a healthy urban environment for citizens.
- Interdisciplinary approach has become more important to build sustainable cities.
- Innovative solutions and new strategies should urgently implement in the era of urban renewal.
- The offered strategies can make cities more resilient and sustainable in terms of unexpected future crises.
- Built environment is modernised with sustainable renewal strategies for increasing the welfare and livability.

- Cities should be planned and renewed by considering the reducing GHG emissions and decreasing acceleration in global warming.

Conflict of Interests

The authors have not declared any conflict of interests.

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CHAPTER 5

EVALUATION OF GREENWAYS' CHARACTERISTICS BASED ON CASE STUDIES

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1. INTRODUCTION

Since the 1900s, different definitions have been made for greenways in the scientific literature. According to Ahern (1995), greenways are networks that contain planned, designed and managed linear elements that contain social, cultural, recreational, ecological, aesthetic purposes compatible with the concept of sustainable land use. Searns (1995) created a definition by examining the root words "green" and "road". The word "green" refers to natural or semi-natural areas with plants. The word "path" means moving from one point to another. Greenways are routes of movement for people, animals, seeds, and mostly water. Jang and Kang (2016) defined an urban greenway as a linear park and pedestrian friendly corridor, which can be natural or artificial. Urban greenways are traffic-calmed roads that connect open spaces, parks, and public spaces, allowing bicycle use (Ngo et al., 2018). Moreover, greenways are areas that establish relationships between places, environments and people, play an important role in improving social quality, protecting the environment and economic growth (Pinna and Saiu, 2021).

When all these definitions are examined, a number of common concepts such as linearity, being natural, allowing the use of pedestrians and bicycles, having ecological functions, establishing connections draw attention. However, the first purposes of greenways in America and Europe have been different. The main purpose of greenways in America is to link the cultural environment with the natural environment (Fabos, 1995). In Europe, it is to protect ecological infrastructure by incorporating greenways into ecological networks and to provide quiet and safe roads throughout the parks (Jongman & Pungetti, 2004; Liu et al., 2019). This situation has caused greenways to have different forms such as alternative transportation routes and ecological networks (Scudo, 2006; Von Haaren and Reich, 2006).

The concept of "greenway" is formed by the combination of the words "greenbelt" and "parkway". It was first used by Ebenezer Howard and Frederick Law Olmsted to denote the belt of green spaces around the city and different types of traffic (Pinna and Saiu, 2021). The greenway movement emerged as a response to the urbanization caused by the housing problem, which is the basic need of people (Searns, 1995). It seeks solutions to problems such as fragmentation and deterioration of landscapes, which are not taken into account in the urban planning process and caused by the urbanization problem.

2. GREENWAYS

Greenways are one of the most important elements of green infrastructure and represent bio-corridors that can provide different functions (Fabos, 1995; Melicher and Špulerova, 2022). It provides natural benefits such as increasing ecosystem resilience in urban and rural areas, supporting the reduction of the effects of climate change and contributing to sustainability (Benedict and McMahon, 2006). Greenways also connect natural habitats and reduce biodiversity loss and fragmentation (Ahern, 2013). Greenways, which provide open space in cities facing problems such as population density and traffic congestion, ensure that the land is used in the most appropriate way (Tan, 2006). It plays an important role in restoring ecological areas damaged by human activities in cities over time, and in the protection of natural elements such as air purification, water and soil resources (Fabos, 2004a; Sanesi and Chiarello, 2006; Zhao et al., 2021). Recent studies have shown that greenways can encourage more physical activity, increase interaction with nature, reduce greenhouse gas emissions and energy use by reducing motor vehicle use, and contribute to more job opportunities (Cohn and Scott Shafer, 2009; Dallat et al., 2014). ; Ngo et al., 2018). In addition to these, it also provides social and cultural benefits such as creating a positive landscape perception, providing recreation areas and increasing the level of welfare (Fabos, 2004b; Ahern, 2007; Melicher and Špulerova, 2022).

The first development of greenways occurred in the United States with the aim of connecting the urban and rural environment, and private and attractive corridors passing through cities were the first examples (Zapatka, 1987; Fabos, 1995). Frederick Law Olmsted was one of the first researchers to develop the idea of a park system connected by green corridors (Eisenman, 2013). This idea was brought to life in New York's Central Park, the first "parkway" model, designed with Vaux in 1857 (Figure 1). In 1865, Olmsted and Vaux designed the "Prospect Park" by taking the example of the wide boulevards of Paris and Brussels (Figure 2). Until the 1900s, greenways served aesthetic and recreational purposes, but after these years, they started to serve ecological purposes as well (Searns, 1995; Gobster, 2004; Liu et al., 2019). In addition, in the late 1800s and early 1900s, open space connections were formed in cities related to the topography and hydrology that characterized the landscape. The Boston Park System, known as the "Emerald Necklace" and recognized as the world's first major greenway, was designed in the United States in 1887 (Figure 3). The Boston Park System connects cities and the river. In 1908, H.W.S. Cleveland and Theodore Wirth designed the Bronx River Parkway, a green network in the city of Minneapolis, which is still used today as transportation infrastructure and recreational areas (Figure 4).

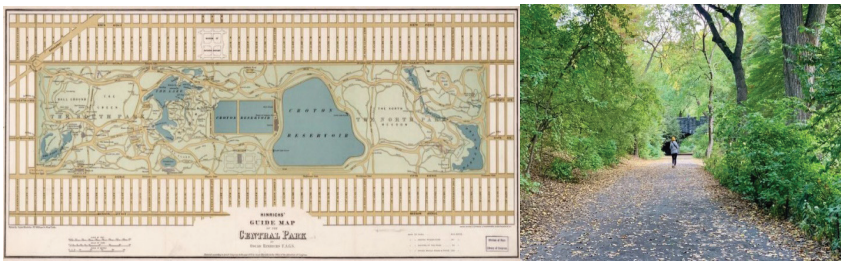


Figure 1. Central Park plan and walkway (Anonymous, 2022a; Anonymous, 2022b)

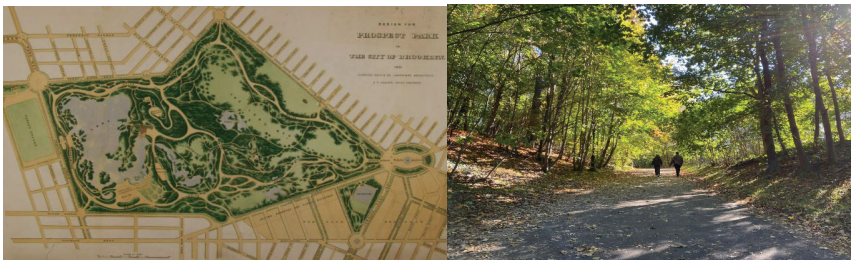


Figure 2. Prospect Park plan and walkway (Anonymous, 2022c; Anonymous, 2022d)

In the 1960s, greenways developed in the context of urban expansion. These years are a period in which non-motorized transportation is provided, pedestrian and bicycle paths increase, environmental awareness is formed and the development of cities is controlled (Little, 1990). In this period, greenways form the basis of landscape planning studies. The term greenway was first used in the literature in the late 1960s in the book "The Last Landscape" by William H. Whyte. In the book, different ideas and solutions are presented for the better use and protection of open spaces, and it is also suggested to connect green spaces regardless of their size (Searns, 1995; Whyte, 1968). Lewis (1996), on the other hand, proposes a system of green spaces, often connected by greenways along the river axes. By the 1980s, greenways were developing as a result of sustainable development policies. It has been a key method in sustainable management, with complex and diverse functions such as habitat protection, hydrogeological risk reduction, protection of historical sites (Pinna and Saiu, 2021).

Figure 3. The Boston Park System plan and walkway (Anonymous, 2022e; Anonymous, 2022f)

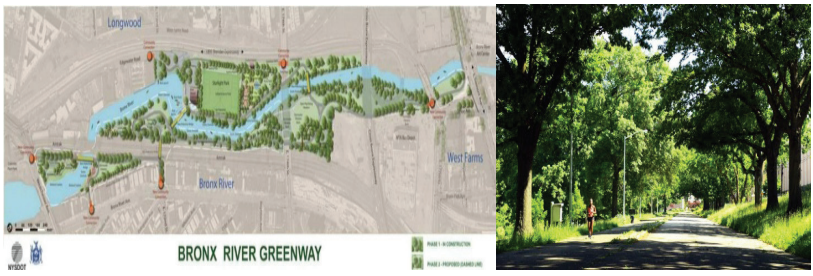


Figure 4. Bronx River Parkway plan and walkway (Kiper et al., 2017; Anonymous, 2022g)

2.1. The Main Features of Greenways

When the historical development of greenways is examined, the main features that make up the greenway are determined as a result of the definitions and applications. These features explain the strategic approach of greenways to landscape planning (Ahern, 1995):

Linearity: Greenways have a linear structure in terms of spatial planning and have the functions and possibilities of linear structures. These features distinguish greenways from other planning concepts.

Connection: The interconnectedness of landscape units of different scales creates a meaningful relationship between urban-rural, human-nature and wild life. Connecting the fragmented natural areas for various reasons is important for the protection and renewal of natural assets (Arslan et al., 2004).

Multifunctionality: Greenways can be multifunctional, be it ecological, recreational, social or cultural. However, these functions can create spatial compatibility or incompatibility with each other. For this reason, it is very important to determine the targets correctly in greenway planning. For example, ecological protection and recreational needs require different planning and management approaches. If a suitable solution cannot be found for this situation, the elimination of someone will be the most radical solution.

Sustainability: The concept of greenway is directly related to sustainable development. Greenways allow human use as well as being planned for nature protection. For this reason, there should be a balance between the principles of landscape planning and the protection-use of natural and cultural resources. The most important goal in sustainable greenway planning is to protect biodiversity. Greenways ensure the sustainable realization of recreational and cultural goals together with dynamic natural processes.

Spatial strategy: Greenways create a different spatial strategy from other landscape units, as they have a linear open space system. With this feature, greenways should be considered as a complement to physical planning (Ahern, 1995).

2.2. The Functions of Greenways

Greenways fulfill many functions on the natural and cultural environment. These functions are summarized under the main headings of ecological function and social-cultural function, using the studies of Ahern (1995) and Little (1990). The specified functions are performed according to the dominant functions of the greenways. Apart from the ones mentioned, they can also perform different functions. In addition, greenways can fulfill a single function or be multifunctional.

2.2.1. Ecological functions

Conservation of natural areas: The most important ecological functions of greenways are to protect natural areas and to provide a living environment for living things. It creates a safe shelter, feeding and movement area for animals with the approach of connecting the fragmented areas. With the coming together of different landscape units along the greenway, a mutual relationship and interaction is formed between the living environments, and the existence and integrity of the ecosystem is preserved. Apart from making functional connections, these units also connect with natural and cultural landscape elements such as forests, rivers, settlements, vehicle roads. With the establishment of connections between fragmented landscape units and surrounding landscape elements, positive effects are observed in the protection and re-creation of living environments, and the protection and development of biological diversity (Culcuoglu, 1997; Arslan, 2004).

Function related to water resources: Greenways have very important functions in the protection, restoration and management of water resources including water basins, river corridors, lakes and wetlands (Arslan, 2004). The aquatic plants in the water flow corridors filter excess plant nutrients, chemical wastes or substances from reaching the water. It ensures the preservation of the natural water level, slowing down the flow rate and preventing floods in wetland areas (Culcuoğlu, 1997). The greenways along the water and the waterfront allow water, plants, animals and people to move and live (Arslan, 2004).

Buffer function: The realization of nutrient, species and energy flows defines the function of the landscape (Forman and Godron, 1986). However, intensive land use can cause these flows to accelerate or deteriorate. For example, with urbanization, the hydrological characteristics of riparian systems are changing, as a result of which the flow volume of rainwater increases and peak flows increase. With the buffering function of greenways, the flows are decreased and the sustainability of the landscape function is ensured. In addition, erosion can be experienced with the movement of riverbank systems in harmony with the slope. Greenways along the river banks control erosion (Ahern, 1995). Apart from that, greenways in urban areas act as a buffer against wind, noise, dust and unwanted images.

2.2.2. Social-cultural functions

Recreational function: Greenways provide opportunities for walking paths, bicycle paths, sports fields and recreational activities. The fact that the greenways follow the natural corridors increases the interest for the users. In addition, being able to observe nature with its changes throughout the four seasons and to be in close relations with nature increases the environmental awareness of the society (Culcuoglu, 1997).

Preservation of historical and cultural resources: Greenways connect parks, historical sites, settlements, allowing users to move safely and be accessible to more users. These resources are protected by the decisions taken within the framework of greenway planning.

Control of urban development: Greenways have a strategic importance in defining, directing and controlling urban development (Ahern, 1995). It prevents unplanned urban sprawl in urban and rural areas.

2.3. Typology of Greenways

Greenways may differ in terms of spatial scales. These scales vary in terms of the area they cover, physiographic features, administrative units, and functional orientation. In terms of physiographic features, they are classified in terms of natural, cultural and geomorphological features such as mountains and rivers, as well as geographical relations such as countries and continents. Apart from these, there are also differences between the administrative units they are associated with. In addition, larger greenways have a policy orientation, medium greenways have a policy and coordination orientation, and smaller greenways have an implementation and management orientation (Ahern, 1995).

Greenways must be understood in the context of the landscapes in which they exist. Landscape context helps to understand the physical context, the landscape functions it is associated with, and the dynamic processes of changes in the landscape. Dominant land use and land

cover can define the landscape context. For example, agriculture is the dominant land use in Europe (Bischoff and Jongman 1993; Ahern, 1995). Agricultural landscape causes faster flow of nutrients, materials and energy due to slower land use change (Peterjohn and Correll, 1984; Ahern, 1995).

Planning strategy is a very important concept in terms of greenways. Greenways refer to a strategic approach to landscape planning. However, it does not represent a comprehensive landscape planning as it focuses on networks and linear areas. It advocates the strategy of spatially and functionally harmonizing land uses on networks. These strategies are against fragmentation, land degradation, urban expansion and uncontrolled land use changes. For this reason, strategic objectives have emerged as an approach to protect, defend, struggle and evaluate opportunities. Conservation strategy is used when the existing structure and processes of the landscape are supported. This strategy defines the permanent preservation of the greenway while changes may occur in the landscape around the greenway. The defensive strategy is implemented when the existing structure of the landscape is fragmented and the core area is reduced and limited. It tries to stop the negative effects of fragmentation. The strategy for struggle, unlike other strategies, allows environmental development and restoration by using new landscape elements in degraded or fragmented lands. This strategy, which is implemented in some countries in European countries, depends on planning, ecological restoration knowledge and financial support. Finally, the strategy that evaluates the opportunities is based on integrating the existence of unique landscape elements with other planning strategies. For example, the use of rails as paths in the United States is greenway planning that evaluate opportunities (Little, 1990; Ahern, 1995).

3. CASE STUDIES ON GREENWAYS

Three case studies were selected for the evaluation of greenways. The selected greenways are the Milwaukee River Greenway and Roanoke River Greenway in the eastern United States, and the Ohlone Greenway in the western United States. While selecting case studies, attention was paid to the existence of master plans. The characteristics of greenways are shown in Table 1, 2 and 3.

3.1. Milwaukee River Greenway

The Milwaukee River Greenway is a nearly 12 km stretch of the Milwaukee River with unique natural landscapes that cuts through the northeast side of the city. This section has natural land cover such as wetlands, forest, river valley. A rich biotic community lives in the Milwaukee River. There are 12 parks and more than 45 km of walking and cycling paths along the green corridor. Many native plant species are found along the river corridor. In addition, more than 181 native bird species,

more than 38 fish species, many reptiles and invertebrates live. Some of these species are endangered and were put under protection.

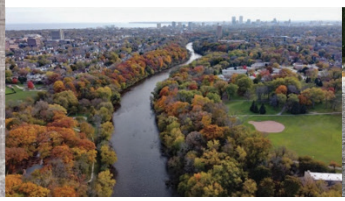
The use of the Milwaukee River by city dwellers has varied over time. The downstream end of the river has become a port over time. The upstream part meets the recreational needs of the city residents. However, as the industry developed, the need for drinking water and waste disposal increased. As the water quality deteriorated, the residents did not use the river area and it was neglected. Today, however, city dwellers have begun to rediscover the river corridor. A master plan has been prepared to make improvements to the river.

Table 1. Characteristics of the Milwaukee River Greenway

(Anonymous, 2010)

(Anonymous, 2022h)

(Anonymous, 2022j)



(Anonymous, 2022i)

(Anonymous, 2022j)

Features	Linearity Multifunctionality Sustainability Spatial strategy
Functions	Protecting natural areas Function related to water resources Buffer function Recreational function Protection of cultural resources
Physiographic features	River Valley Forest
Administrative units	Municipality
Functional orientation	Implementation Management
Land use/land cover	City structure
Planning strategy	Strategy for protection and defense

The prepared master plan aims to protect the recreational features and ecological value of this area. In addition, actions are put forward on river access and road improvements, pollution removal, habitat restoration

and creation of habitat protection areas. In addition, more than 12 km of riparian habitat and 847 acres of floodplain are protected by the Milwaukee River Greenway Overlay District legislation. With this legislation, sensitive lands will be protected against future urbanization pressure. A coalition led by various organizations, agencies, nonprofits and businesses drives the implementation of the Milwaukee River Green Mile master plan. The coalition's mission is to implement a master plan that develops recommendations for the conservation, revitalization, management and recreation of the Milwaukee River. The objectives of the coalition are to protect existing natural areas, not to damage the landscape along the river, to establish design guidelines for constructions to be built in the buffer zone outside the river, and to establish guidelines for erosion control. In addition, the protection of natural vegetation and wildlife habitat along the river corridor, and the promotion of land uses and activities that protect the greenway corridor are other important objectives. Within the scope of these objectives, the habitat map, recreation map and connectivity map of the greenway were prepared.

The fragmented private properties around the river were transferred to the public, allowing the city residents to meet their recreational needs more and to restore the road with ecological benefits (Anonymous, 2010).

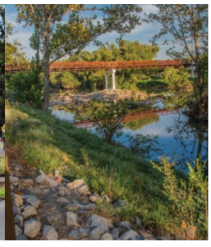
3.2. Roanoke River Greenway

The Roanoke river greenway is located within the Roanoke valley greenway, which is a regional network system and is the longest greenway in this system. The greenway has many functions such as recreation, tourism, health, environmental education, organizing special events and economic development. Many transport funds and private funds have been provided for the greenway.

Table 2. Characteristics of the Roanoke River Greenway

(Anonymous, 2018)

(Anonymous, 2022k)



(Anonymous, 2022l)

Features	Linearity Multifunctionality Sustainability Spatial strategy

Functions	Protecting natural areas Function related to water resources Buffer function Recreational function
Physiographic features	River Valley Mountain
Administrative units	Municipal Country Province
Functional orientation	Implementation Management Coordination
Land use/land cover	City structure
Planning strategy	Strategy for protection

The plan for the Roanoke Valley greenway defines the greenway system in which many greenways are connected and included. The specified greenway system encompasses more than an alternative transportation route and recreation facility. This plan addresses physical infrastructure, recreational opportunities, health needs, conservation of natural resources, educational opportunities and economic development potential.

The Roanoke River Greenway is recognized as the backbone of the regional greenway network. Approximately 50 km of bicycle and pedestrian paths are planned on the greenway. A large part of these roads have been opened for use, and the rest of them are planned to be opened. The specified road network connects the town of Roanoke and the town of Vinton. It also connects neighborhoods, industrial facilities and business centers, parks, schools, sports fields and some public buildings. Non-motorized transportation is provided by bicycle paths. There are bridges connecting the walking and cycling paths on the river.

The Roanoke River Greenway is expressed as an important structure for the region in local, regional and state plans. The greenway is versatile and multifunctional. It increases the quality of life of the society by providing transportation, health, tourism, environmental and economic benefits. In addition, commercial structures such as restaurants, entertainment centers, sports halls and organized festivals and races provide an economic contribution to the region.

Protection measures are taken regarding the proximity of the railway to the river, floods, overflows and endangered species. Support is provided with funds for flood repair and maintenance (Anonymous, 2018).

3.3. Ohlone Greenway

The Ohlone Greenway is a non-motorized vehicular route located in the East Bay of the San Francisco Bay Area. It begins in the north of Berkeley, near the train station, with bike paths running through the city, and continues through open green

spaces through the cities of Albany and El Cerrito. The approximately 4km bike and pedestrian path running through the city of El Cerrito connects to two stations, several bus lines, entertainment and shopping centres. The Ohlone greenway is a recreational resource that allows active and passive uses apart from its transportation function. With these features, it has become the most used open space in the city.

Table 3. Characteristics of the Ohlone Greenway

(Anonymous, 2009)

(Anonymous, 2022m)

(Anonymous, 2022n)

Features	Linearity Multifunctionality Sustainability
Functions	Recreational function Preservation of historical and cultural resources
Physiographic features	Transportation
Administrative units	Municipalities
Functional orientation	Implementation Management
Land use/land cover	City structure Trading units Transportation unit
Planning strategy	Strategy that evaluates opportunities

The past land use of the city of El Cerrito consists of large fields and farms. There is also a railway line passing through the city. However, as a result of the support of a demonstration, the beautification project was developed and the Ohlone greenway emerged. In the early 1990s, the road was afforested by volunteers.

A master plan for the Ohlone greenway was prepared in 2009. In this plan, design guidelines have been prepared that deal with issues such as road widths, material selections, safety measures, maintenance and lighting. In addition, improvement suggestions have been developed for active use areas, recreational facilities, and river restorations. Apart from these recommendations, there are also sustainable measures such as protecting the environment and existing habitat, minimizing plant maintenance, providing plant diversity, and reducing water use (Anonymous, 2009).

4. CONCLUSION

From the birth of the greenway concept to the present day, greenways have fulfilled different functions, their scale has changed, they have turned into network systems and a different planning strategy has been developed.

It has been in the role of complement to landscape planning and physical planning. In current case studies, it is seen that greenways, their functions, scales and planning strategies are different. This shows that each greenway planning will be different. Considering the common features of greenways, it is thought that the most important goal is to ensure sustainability. Existing biodiversity and its conservation along with other functions should be the primary objective. It is determined that 3 greenway studies are located in the urban development area. It is important to protect the greenways, which are mostly located on the river banks and valley corridors and have natural landscape features, against the pressure of urbanization and the unconscious use of people. But human uses don't always do harm, as studied on the Ohlone greenway. As a result of the afforestation of the road with the beautification project, it has created a recreation area for people and a habitat for animals and plants in the urban area. Or, as seen on the Milwaukee River Green Trail, people have abandoned their recreational activities in this region due to the river water polluted by industrial wastes over time and the region has become idle. However, this mistake was reversed and the river water was cleaned and protected with the restoration works.

In the view of all this information, greenways which have many positive functions such as connecting between fragmented landscape units, creating a living space for habitats, and providing recreation opportunities for people should be planned with the objectives and protection strategies determined by the administrative units.

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CHAPTER 6

THE DETERMINATION OF AESTHETICAL FUNDAMENTALS OF THE BRIDGE DESIGN IN TURKEY

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1 INTRODUCTION

In bridge design, as in architecture, excellence is achieved by integrating science, technology, and aesthetics. The bridge designer must strive to understand the creative artistic process as well as scientific and technical principles and merge the most fundamentals concepts into a unified theme for an exposed purpose. The principles are proportion, order, simplicity, balance, color, and texture. Excellence design requires aesthetic principles with physical and geometric components of a structure (Minnesota Department of Transportation 1995).

The blending of a bridge structure into its environment is also an important aesthetic consideration. When a bridge is constructed, it becomes a prominent landscape feature, immediately changing the character of the environment. Compatibility with the environment or developed areas is essential. It is essential that designers take into account these influences and incorporate aesthetic values into the design of bridges so the structures enhance the beauty and character of the immediate environment and community.

Aesthetic design fundamentals include consideration of the visual relationship of a bridge and its site, as well as the mass, shape, and form of the structure. The two visual concepts used to develop, describe and express visual ideas are; visual design elements and aesthetic qualities. Visual design elements define visual perception. These elements include line, shape, form, color, and texture. They can be used to articulate visual concepts. Aesthetic qualities result from the employment of visual design elements and are used to describe a visual composition. Aesthetic qualities include proportion, rhythm, order, harmony, balance, scale and unity.

A successful bridge design must be natural, simple, original and harmonious with its surroundings (Figure 1). A bridge is usually a large and very visible structure with its environment. It should look natural and fit well into the landscape. It should also be simple and not look superficial.

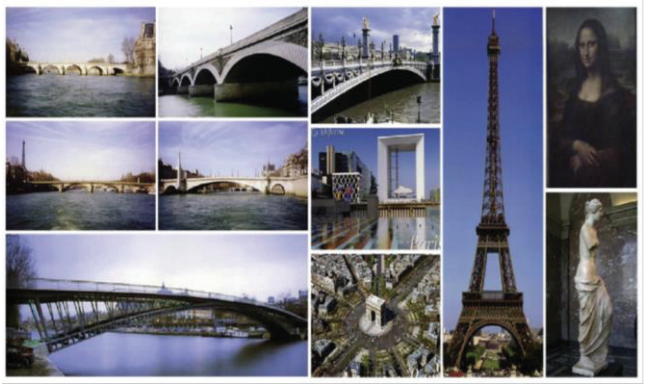

Figure 1. The relationship between landscape and the bridge

A structure looks more natural if it can convey an understandable improvement to the public about how it works.

Uniqueness is an important factor in any piece of art. Likewise, each bridge should be unique in and of itself. Each structure has its own requirements and distinct surroundings. Each bridge design should be based on its own particular condition. Therefore, each bridge should be original and have its own style, characteristics, and design.

Being harmonious with its surroundings does not necessarily mean that the bridge must only blend well with its environment.

A bridge is mainly comprised of girders, piers, towers and perhaps cables. The girders are relatively horizontal and the piers and towers are generally ver- tical. A bridge typically has 2 abutments, one at each end.

William Zuk (1990) has taken a more quantitative approach to bridge aesthetics. After compiling a set of 177 statements, criteria, or rules applicable to girder bridges, Zuk proposed a computer-based system that will use these "rules" to assign an aesthetic rating to a bridge, on a scale of 1 to 10. His rules con- sider the bridge as a whole, the details of the bridge, and in relation to its site.

Gottemoeller (2004) with examples characterized features of good-looking bridges: simplicity, relative slenderness, continuous lines and clear force flow in the structure. Gottemoeller describes possible points of view for a bridge. These points of view help an understanding of the visual design elements to be determined by visual perception (line, contour, shape, color, and texture). Aesthetic characteristics which result from the visual design elements and are used to describe the visual composition (proportions, rhythm, order, harmonium, balance, contrast, scale and unity).

Leonhardt (1982) formulates ten criteria for aes- thetically pleasing bridges: (1) fulfil the purpose/function, (2) proportions, (3) order, (4) clear form (form improvement), (5) integration in environment, (6) surface texture, (7) color, (9) nature and (10) involvement in nature. These criteria become as guidelines for bridge designers, however, the simple use of these guidelines will not result in a beautiful bridge. Similar conclusions in [9] are made by Christian Menn. He accepted that the bridges are not alone-standing structures, but the component of the surrounding landscape. Christian Menn emphasizes the bridge compatibility with the environment associated with the spatial components – scale, the character of the landscape and topography, as well as man- made environment and time component – history and tradition of local bridge construction, technology, and culture.

There are some principal steps which are used for the aesthetic evaluation of the existing bridges;

• Determination of the affected environment, including bridge location and viewshed.taking into account the distance of viewer location from the bridge

• Determination of main viewpoints, taking into account the view of the roadway crossed road and viewers (residents, recreationists or travelers),

• Assessment of bridge visual impact, including changes of visual environment and re- action of viewers: impact on the landscape and vegetation, impact from bridge integration degree into street network or landscape, impact on the spatial urban or landscape context, im- pact on the surrounding character (degree of integration between bridge elements/ design and scale/character of surrounding), taking into account that successful integration is based on the structural integrity and coherence (shape/scale, visual characteristics), relation- ship of bridge/elements and landscape elements and their action as integrated composition.

In this paper, according to the aesthetical fundamentals of bridge design, some bridge constructions in Turkey are investigated and evaluated. Therefore, the bridge constructions in different times should be compared with each other and the developments and aesthetic changes of the bridge design are determined. In regard to the results of this paper, the study should be a guide to the aesthetic design of the bridge construction in Turkey.

2 AESTHETIC BRIDGE DESIGN IN TURKEY

The bridge design in Turkey is determined by The Turkish Highway Council. The bridge should be monolithic, without dilation and especially low cost of management, maintenance and repairmen should be determined for the support, movement dilatation and drainage system of the bridge. (Turkish Highway Agency 2016). 5 bridges are investigated and evaluated according to the aesthetic fundamentals and de- sign parameters. The bridges are 15 July Martyrs, Calli, Nissibi, Golden Horn Metro Bridge, Osman Gazi.

2.1 Analysis of 15 July Martyrs Bridge

The 15 July Martyrs Bridge is a steel suspension bridge located in Istanbul, Turkey in Figure 2. The bridge is a well-used road bridge that has had a significant effect on Istanbul. It is a gravity-anchored suspension bridge with steel towers and inclined hangers. The aerodynamic deck hangs on zigzag steel cables. It is 1,560 m long with a deck width of 33,40m. The distance between the towers (main span) is 1,074 m and the total height of the towers is 165 m. The clearance of the bridge from the sea level is 64 m.

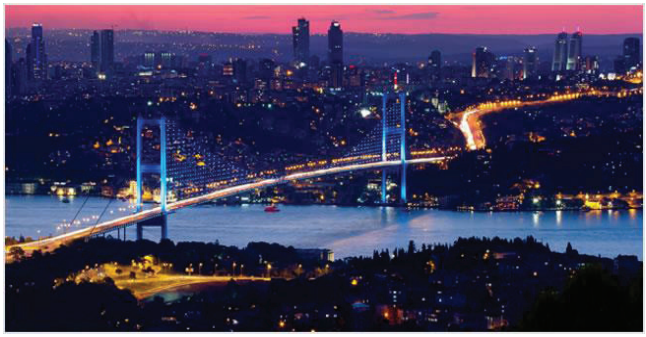

Figure 2. 15 July Martyrs Bridge

Proportions

The bridge has a very large span and a thin deck giving it a very slender look in elevation. The towers are large and bold, therefore compliment the thin deck. The proportions of the approach viaducts on either side of the main suspension bridge are less desirable as the supports look too slender, especially in contrast to the large tower. In general, the proportions of this bridge are very good.

Order

The Order of the bridge is very good as the entire deck is uniform and the spacing between the hangers is also uniform. The approach viaducts have a thicker deck, as this section is a multi-span beam bridge; however, this change occurs in the tower and does not negatively affect the aesthetics. The absence of cables from the approach viaduct has a negative in- fluence on the order (Figure 3).

Figure 3. The order of 15 July Martyrs Bridge

Refinement of design

The towers are tapered in the tradition of the Greeks which improves

the aesthetics of the bridge (Turkish Highway Agency 1998). Although done for structural efficiency the zigzag hangers and the dynamic deck are refinements that are very pleasing aesthetically. The choice to conceal all changes in deck depth to the tower makes the change less obvious and therefore a useful refinement.

Integration into the Environment

The local environment is urban on both sides of the straits and therefore a modern bridge, constructed using metal, fits well into the surroundings. The tall towers and sweeping cables fit well rolling hills and a large expanse of water.

Surface Texture

The deck of this bridge is a smoother texture than the tower which is widely recognized as a good aes- thetic choice (Turkish Highway Agency 1998). The deck is not so smooth to be shiny but combined with its slenderness works well with the surroundings giving the hint of a reflection of the water without looking too unnatural.

Color of Components

The dark color of the towers, cables, and deck work very well with the surrounding area and makes the hangers seem almost invisible during the day. There is nothing particularly impressive with the coloring until the night when the bridge is illuminated in a variety of different colors. Red and Purple work to the greatest extent giving a modern, sleek and attractive look to a 35-year-old bridge. One reason for the effectiveness of the lighting is the integration into the structure, giving the lighting a less forced feel (Turkish Highway Agency 1996). Despite being an old bridge, it is well maintained and has not been too badly affected through discoloring as some bridges are.

Character

There is nothing about this bridge that gives it great character in its structural system. It is a simple suspension bridge and blends well enough into the urban landscape during the day to mean it does not require character. During the night, however, the colored lighting makes it into an interesting and attractive bridge that does have character.

Complexity in Variety

Being a suspension bridge there is little that can be added structurally. So, anything extra would be solely to add complexity and would ruin the functionality and order of the bridge. This bridge works well in its simplicity.

Incorporation of Nature

The First Bosporus Bridge does not relate to nature any more than any other bridge and does not need to. It is situated in the middle of a city and above busy trade to try to incorporate nature into this design that makes it look out of place and absurd.

2.2 Analysis of Calli Bridge

Calli Bridge, the first extradosed bridge designed and constructed in Turkey, is under construction and is planned to be opened to traffic for Expo 2016, in Antalya.

Calli Extradosed Bridge is straight in plan with three spans: 50m+80m+50m totaling to 180m. Over each pier section, three pylons with 7m height are built. 2x4 sets of 4 extradosed cables (32 cables) are provided above the deck. The cables are designed nearly parallel (harp design) to one another. Side view of the bridge is shown in Figure 4.

The bridge has 2 x 15 m wide typical twin pi-decks separated 50cm, to minimize torsional and unbalanced load effects. The deck height is 2.5 m constant throughout the span. At pier locations, a solid pier diaphragm section connects the two pi-sections to provide torsional rigidity. At extradosed cable anchorage locations, shallower mid-diaphragms provide rigidity and distribute the force coming from stay cables. The mid-diaphragm does not connect the two pi-sections. To reduce top slab thickness, transversal post- tensioning tendons are provided in the top slab.

Figure 4. The Calli Bridge

Proportion

The Çallı Bridge has a very large span and a thick deck is supported by towers. The towers are small and are connected to the bridge with hangers.

Order

The bridge is straight in plan and looks more uniform and heavier.

Refinement of design

The towers and cables improve the aesthetic vision of the bridge. The

arch shape cables in the deck are pleasing aesthetically.

Integration into the Environment

Calli Bridge is a modern bridge which is located in urban. The reinforcement concrete construction is suitable for the urban environment. It supplies the traffic function in the center of the city. The rising and landing section separates the bridge from the via- ducts in Figure 5.

Figure 5. The Integration of Calli Bridge into Environment

Surface Texture

The towers and cables are aesthetic fundamentals of the bridge. They also supply a smooth texture for the aesthetic vision.

Color of Components

Due to the reinforcement concrete bridge construc- tion, it has a dark grey color and this color is compatible with the viaducts and surrounding roads.

Character

Since it is an urban bridge, it does not require character. The towers with the arch cables give more characteristic properties.

Complexity in Variety

Çallı Bridge is a simple urban bridge. Some structures might be added to increase the complexity.

Incorporation of Nature

The Çalli Bridge does not relate to nature. It is used to connect the roads in the center of Antalya. If it is an aesthetical bridge, it is not suitable to the surrounding roads and viaducts, and it looks absurd.

2.3 Analysis of Nissibi Bridge

Nissibi Bridge is a cable-stayed modern bridge which passes larger

spans like suspension bridges. The span of Nissibi Bridge is 400 m. The height of the pylons is 96 m and the length of the bridge is 610 m totally. The towers are reverse Y shaped (Figure 6).

Figure 6. The Nissibi Bridge

Proportion

The Nissibi Bridge has a very large span. It is a cable-stayed bridge. The thin deck is supported by two pylons. The pylons are bigger but there is no contrast between the pylons and thin deck. Generally, the pro- portions are good.

Order

The bridge is straight in a plan. The settlement of the cables is very compatible with the thin deck. The approach viaducts seem to continue through the deck of the bridge. Since the hangers are connected to both viaducts and deck, it has a positive influence on the order.

Refinement of design

The towers are tapered in the reverse Y-shape which improves the aesthetics of the bridge. Diagonal hangers are attached opposing to the thin deck from 2 pylons that are very sufficiently aesthetical.

Integration into the Environment

The local environment is a dam lake and geographic zone. The Y-shape towers are founded on hills and compatible with the environment with the diagonal hangers.

Surface Texture

The towers are made of concrete and texture is made on the towers by the surface of the molding. There are lines from the connection of the multi molds. The pylons are the aesthetic fundamentals of Nissibi Bridge in Figure 7.

Figure 7. The Surface Texture of Nissibi Bridge

Color of Components

The towers are light-grey and fit the cream color of the geographic zone. The color of the deck is a little bit the same as the color of the geographic zone. The cables are white and supply integrity with the towers and they are invisible during daylight.

Character

The bridge is a simple construction and fits the nature environment. The bridge is in the earthquake zone that's why it has only resistance against the earthquake and wind loads.

Complexity in Variety

Because of the earthquake zone, the bridge should be statistical strong and supplies its function as the connection of 2 sides. The bridge is simple without complexity.

Incorporation of Nature

Nissibi Bridge is very related to the local environment. It is very compatible with the natural surroundings. It does not seem a bridge, in other words, it becomes integrity with the natural environment.

2.4 Analysis of Golden Horn (Haliç) Metro Bridge

The total length of the bridge is 1000 m and it con- sists of 5 sections which are a cable-stayed bridge, open-close up bridge, 2 viaducts, and steel construction bridge. Since the project is close to the historical peninsula and in the center of İstanbul, the design of the Golden Horn Bridge should be slender and compatible with the urban environment. This structure passes a 45 m span. The height of the towers can be arranged as the low amount to prevent to affect the silhouette of the historical peninsula (Figure

8). The towers are attached to the deck with the diagonal cables.

Figure 8. The Golden Horn Metro Bridge

Proportion

The Golden Horn Bridge has a small span. It is a cable-stayed bridge. open-close up bridge, 2 viaducts connection and steel construction bridge. The height of the towers is low to fit the historical silhouette of the peninsula. Because of the aesthetical anxiety, the bridge has a little bit small and unbalanced proportion.

Order

The bridge is rising and landing over the piers in a plan. The settlement of the cables is very compatible with the thin deck.

Refinement of design

The towers have minaret shape which is compatible with the mosques in the historical peninsula. Diagonal hangers are attached to the towers and the thin deck and continue over the bridge. This situation gives an aesthetic vision.

Integration into the Environment

The local environment is the historical peninsula and center of Istanbul. There are mosques and older buildings in the surroundings. The towers have a minaret shape for the compatibility of the historical environment. The height of the deck is arranged not to disorder the silhouette of the historical zone. The structure of the bridge is compatible with the other bridges in Golden Horn.

Surface Texture

The towers are made of concrete and they have white color texture. Also, the tensile-membrane systems at the metro station disorder the continuous sur- face of the deck and give an aesthetic vision.

Color of Components

The towers and cables are white and fit the historical surroundings. The color of the structure of tensile membrane system is pink-orange and gives the different contrast color to the bridge. The color of the deck is light-grey and with the contrast colors of the tower, cable and the station the deck seems invisible.

Character

The bridge is a simple construction and an example of classical metro bridges. The bridge is close to the historical peninsula and it is a little bit compatible with the historical zone.

Complexity in Variety

The bridge does not have a greater character not to disorder the silhouette of the historical peninsula (Figure 9). It is one of the good examples of metro bridges around the world. Some additions should be made for good compatibility to the historical silhouette. This bridge works well in its simplicity.

Figure 9. The Relationship between the historical peninsula and Golden Horn Metro Bridge

Incorporation of Nature

Golden Horn Metro Bridge is not related to the natural environment. It is situated in the historical zone and middle of the city. It should be compatible with the historical silhouette.

2.5 Analysis of Osman Gazi Bridge

The Osman Gazi Bridge is a newly opened suspen- sion bridge constructed above the Gulf of Izmit or Izmit Bay, at the eastern edge of the Sea of Marmara, close to the city of Izmit and approximately 50km south-east of Istanbul, Turkey in figure 10. The six- lane bridge (three lanes in each direction) along with the 409km-long Gebze-Izmir Motorway connecting the cities of Istanbul and Izmir are part of the biggest freeway

project in Turkey. With a total length of 3,3km, the bridge is suspended 64m above sea-level and has a free span of 1,688m between its 230 m-high steel pylons.

Figure 10. Osman Gazi Bridge

Proportion

The Osman Gazi Bridge is a suspension bridge spanning the Gulf of Izmit at its narrowest point, 2,620 m. It has a larger span. The pylons are higher and the shape of the pylons is a little bit the same as 15 July Martyrs and Fatih Sultan Mehmet. The shape of piers is a triangle and they are high and heavy structure. The dimensions of towers and piers are suitable for this highest span of the bridge.

Order

The bridge is straight in a plan. The settlement of the cables is very compatible with the thin deck. Moreover, the vertical hangers supply integrity with the towers. The bridge seems a connector of 2 sides, unlike a bridge.

Refinement of design

The towers are suspension bridge towers. Vertical hangers are compatible with the towers and this situation is aesthetical fundamental of the bridge. De- signed to fit in with the local landscape and seascape, the bridge features components that blend with each other in terms of their color, finish and geometric configuration. The bridge's girder has a delicate and aerodynamically refined deck edge to give the appearance of a graceful ribbon of motorway suspended above the water. Transition piers and anchor blocks match the bridge's aesthetic and reinforce its elegance.

Integration into the Environment

The local environment is an industrial area and geographic zone. The girders are settled in the sea and piers used for the structural element are attached to the ground. The Osman Gazi Bridge seems a construction in the sea.

Surface Texture

The towers and deck are made of concrete and they have grey color. The bridge is an engineered building so it does not have texture and aesthetical fundamentals.

Color of Components

The towers, cables, and piers have a light grey color. This color gives a different structure from the environment.

Character

The bridge has the engineered construction character. It is a simple suspension that is constructed in the sea with a larger span. During the night, however, the colored lighting makes it into an interesting and attractive bridge with the viaducts and roads (Figure 11).

Figure 11. The lighting of Osman Gazi Bridge

Complexity in Variety

The bridge is an engineered construction to connect 2 sides of Izmit Bay. It is a simple suspension bridge with a long span. The bridge was constructed in one of the most earthquake-prone areas in the world, which placed additional demands on its design. To make the bridge earthquake-resistant, the steel pylons were constructed on a concrete foundation, which rests on a large gravel bed and allows the pylons to slide-on in the event of a major earthquake.

Incorporation of Nature

The bridge is in the industrial area and geographic zone. It can fit the natural environment. It is situated in both water and ground. The bridge seems like construction in the sea.

CONCLUSIONS

In regard to the analyses of some bridges in Turkey, generally the aesthetic fundamental is not essential for the bridge design. Especially, the compatibility with the natural environment and surroundings is tak- en into account in the bridge design. Since the general material of the bridge is reinforced concrete, the aesthetic fundamental is not supplied with this mate- rial. The urban bridge should be compatible with city

design or historical area. The bridge structure is generally engineered construction and only the aesthetical fundamental of the bridge design is like a monument. Coloring or decorative additions are not considered in the bridge design. Generally, the varieties for the aesthetic vision in the bridge design, lighting takes more place as the aesthetic fundamental. From the past to modern construction, the older bridges are more aesthetic than the new bridges in Turkey. The earthquake resistance might be restraining for the bridge design, there are a lot of aesthetic bridges with the earthquake safety around the world. Finally, the bridge architectural design in Turkey is only the design of the engineered construction. The aesthetical fundamentals such as proportion, order, and integration into the environment are essential for the bridge design. Also, the aesthetic vision is sup- plied by the shape of girders, piers, and deck. As a result of this work, the future bridge design should consider the coloring, decorative properties, texture and the eccentric shape of the bridge elements in the bridge design.

M.S. Yatagan declares that he has no conflict of interest.
Ethical approval: This article does not contain any studies with human participants performed by any of the authors.

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CHAPTER 7

USE OF URBAN DESIGN GUIDES IN ASSESSING URBAN IDENTITY

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INTRODUCTION

Turkish cities are changing and getting similar day by day. It is a commonly accepted and saddening fact that cities, such as Ankara, Izmir, Kayseri, Bursa cannot be distinguished from each other. The main reason of this problem is the diversion from traditional urban pattern and loss of characteristic features in every single urban space; in addition to the loss of common expression and harmony of buildings in city silhouettes. New settlements are built independently with their own aesthetic outlook and have no relation to traditional urban character of the city. Historical urban quarters which maintain an identity of traditional settlements, are generally accepted as "urban sites under conservation" in Türkiye and conservation plans should serve to protect both spatial elements and historical urban identities.

It is obvious that virtual harmonization cannot be achieved in cities of Türkiye, and despite all the differences they have in historical, regional, topographical, and climatic features; cities are rapidly getting similar. However urban spaces and cities should have their own characteristics and identity. In order to improve historic city characteristic and to catch the melody or harmonization, it is necessary to identify common denominators in their architectural and settlement styles. The main purpose of design guides is to find out and define such denominators and to implement them legally in new buildings.

Urban design guides or similar tools are widely and successfully used in many settlements in foreign countries (Konuk, G. & et al., 2016). But unfortunately the use of urban design guides is still very limited in Türkiye. The aim of this study is to evaluate the Kemeraltı Urban Design Guide, which was developed for the historic city center of Izmir-Kemeraltı an urban site under conservation (Taner, Aydoğan, & Ecemiş, 2003). The Kemeraltı Urban Design Guide (2003) might be the first attempt of this kind of design guides in Türkiye that aims to enhance the character of this precious heritage zone.

In this study we aimed to evaluate the spatial effects of The Kemeraltı Urban Design Guide using the visual material archives and spatial analyses produced in two different professional projects conducted in Dokuz Eylul University Faculty of Architecture. One of these projects was conducted in the historical Kemeraltı Area before the development and application of Kemeraltı Urban Design guide, whereas the other project was conducted after. Using this sample, we discussed strengths and weaknesses of such urban design guides in application.

1. Methods Used for Evaluating Kemeraltı Urban Design Guide 2003

In this retrospective study we aimed to evaluate the spatial effects of The Kemeraltı Urban Design Guide using the visual material archives and

spatial analyses produced in two different professional projects conducted in Dokuz Eylul University Faculty of Architecture. One of these projects was conducted in the historical Kemeraltı Area before the development and implementation of Kemeraltı Urban Design guide, whereas the other project was conducted after the design guide.

First Project[i]: Conservation Plan of The Kemeraltı Historical Area (Taner, Aydoğan, & Ecemiş, 2003)

This project was prepared by Dokuz Eylul University Faculty of Architecture for Konak and Izmir Metropolitan Municipality in the historical Kemeraltı Area between 2000-2003. With the project, a 1/1000 scale urban conservation-development plan was prepared for Konak Municipality for implementation at 88 hectares of historical city center. In addition, a 1/5000 scale conservation-master plan for 270 hectares of historical area was prepared for Izmir Metropolitan Municipality as a contribution to their master plan. During this 3-year project detailed urban analytic etude and spatial analyses were conducted. This project also induced the development of The Kemeraltı Urban Design Guide as a subproject.

Second Project[ii]: Izmir History Project – Avant Project for Operation Plan of Anafartalar Street Second Stage and First Ring Housing Area (Birol Akkurt, at al, 2015).

This project was also prepared by Dokuz Eylul University Faculty of Architecture for TARKEM, a company creating urban design projects for public interest sponsored by local governments. This project was set in 2015 and completed in 2016. With this project micro and macro level decisions were made for an important part of the Kemeraltı Historical City Center, on Anafartalar street adjacent to Agora Archeological Conservation Area (Roman Period).

Both these two projects included detailed urban analytic etudes.

Compatibility degrees of the buildings in the area were analyzed and mapped. In these analyses, monumental buildings listed by Ministry of Culture were considered as original buildings of the historical urban pattern. Other buildings, which were not listed but formed the majority of the buildings in the area, were classified as:

- Primary buildings of historical urban pattern,
- Old buildings compatible with historical urban pattern,
- Old buildings contradictious to historical urban pattern,
- New buildings compatible with historical urban pattern,
- New buildings contradictious to historical urban pattern.

According to this classification thematic maps and spatial analyses were produced. Using these analyses and thematic maps with visual material archives the development level of the historical urban pattern has been evaluated. As a consequence of this evaluation, the role of the Kemeraltı Urban Design Guide has been examined and strengths and weaknesses of such urban design guides in application has been discussed.

2. Kemeraltı Urban Design Guide 2003

2.1. The Need for Urban Design Guides

The loss or non-existence of identity of developed urban areas is often a subject of criticism. Buildings built without any aesthetic unity altogether form a chaotic urban landscape and an ugly picture. For example, cities which have different historical and geographical backgrounds such as Zonguldak, Antalya, or Muş gradually became similar with their new urban areas built according to modern city plans.

On the other hand, traditional settlements such as Muğla, Bodrum and Kula, portray a good sense of unity and coherent landscape with their human scale buildings and these places have been designed according to a set of defined rules.

It is clear that all historical urban sites in Türkiye, with their various components, have succeeded in portraying harmonized urban landscapes; just as the different instruments of an orchestra playing different notes, but altogether forming a pleasant melody, (see Figure1 and Figure 2).

Figure 1: Traditional Şanlıurfa /Halfeti Houses Historical Landscape

Figure 2: Detail from Traditional stone House of Şanlıurfa

However Turkish settlements, despite their different geographic, climatic, topographic and historical features, are generally losing their authenticity. Both citizens and visitors of this urban areas desire to see original character of historical settlements and experience their authentic atmosphere. Therefore, in order to harmonize building features and to obtain urban identity, certain denominators must be formed for building details and urban spaces. The aim of urban design guides is to identify such common denominators and to guarantee that they are implemented by legal enforcements. These denominators can be developed by the examination of traditional historical buildings, and urban pattern of a city.

Urban design guides are very useful tools, preventing the loss of city identity which have limited use in Türkiye. On the contrary design guides, or similar tools, have extensive use abroad and are extremely useful in reaching successful results. The present study is an attempt to evaluate before- and after- effects of Izmir Kemeralti Urban Design Guide (2003) using the visual data at two different time points and thus examine how such tools can be used in Türkiye.

2.2. Development Process and the Purpose of Kemeraltı Urban Design Guide 2003

The purpose of developing Kemeraltı Urban Design Guide has been the idea that its implementation would gradually improve the authentic character and urban identity of Turkish settlements. In their absence

visual disorder, chaotic architectural picture and nonconformity of various buildings would increase, thus result in loss of urban identity.

One could easily dispute that existing planning tools are insufficient in reaching a desired end. Urban plans often propose serious new alterations to the existing urban pattern, but remain insufficient in the third dimension of design and in dictating building details. On the other hand, urban design projects often do not find the right ground for implementation. This is mainly due to their disregard to existing land ownership and other problems in the organization of finance and project management. It would be impossible to expect that without the compilation of individual buildings, an urban identity can be formed.

With this approach, during the development process of Conservation Plan of Kemeraltı Historical Area (between 2000-2003), a design guide has been prepared by DEU Faculty of Architecture and by Konak Municipality as a supplement of the plan. (Taner, Aydoğan, & Ecemiş, Kemeraltı Kentsel Tasarım Rehberi, 2003).

The objectives of The Kemeraltı Urban Design Guide could be defined as the following:

• To prevent the loss of existing urban identity especially in historical quarters.

Common features, which define identity, must be conserved as well as unique features, which exist within the urban pattern. This means protection of the features, those enable us to differentiate one urban area from another.

Figure 3: Deformation on historical buildings.

• To regenerate urban identity in urban areas which have lost their

character partially.

Loss of urban identity is a result of rapid changes in the social, economic, and cultural life of cities. Despite the fact that change is desirable and unavoidable, loss of identity should be prevented. With the implementation of this design guide, not only lost identity would be recuperated by small interferences in existing urban quarters, but also a sense of urban identity would be developed in new sites.

• To develop historical consciousness and to conserve historical quarters

It is clear that cultural values develop and live with the society. Members of societies must be made aware that their identity is formed by an amalgam of their historical and cultural values. In doing this, the approach must be objective and not discriminative.

• To attain public participation in planning and conservation.

Perhaps the greatest need in planning in Türkiye is greater public participation. Often conservation is not totally understood by the public and considered generally as a set of limitations enforced on the society by bureaucrats. Decisions related to spatial design must not only be made by designers, but made commonly by the public. Common decision-making would not only eliminate public resistance, but create public support, which is extremely needed in implementation.

• To make easy-to-implement proposals and to ensure that urban spaces are livable.

Urban plans cannot make sufficient and detailed decisions regarding the third dimension of urban design and architectural scales. The city planning experience in Türkiye clearly shows that urban design projects have serious problems of implementation. New methods and approaches as design guides are needed in order to reach defined ends and spatial decisions.

Preparation of the Kemeraltı Urban Design Guide involve two stages. In the first stage: we focused on the definitions of identity and related issues, because misunderstandings often exist in this field. We examined the cities that maintain an identity, in addition to factors which altogether form such an identity. At the same time, we gathered information on urban design guides and we examined examples. The use of design guides abroad was also studied. We questioned how such tools could be utilized in Türkiye in planning and urban design and how these tools might be integrated to existing legal framework. We chose a suitable urban design guide approach for current planning process and legislations.

In the second stage, we conducted a study in Kemeraltı (Izmir) in order to define existing features, which altogether form the urban identity of the area. An extensive study was carried out on historic buildings and building details to develop the Kemeraltı Urban Design Guide in 2003.

2.3. Definition of Urban Identity

Often the concepts of identity, urban identity, spatial harmony, design unity, symbols, symbolic features etc. are misused or confused. As a general concept, urban identity can be defined as follows: the composite of individual features of a city which differentiate it from other settlements and which altogether form an image as a result of socio-economic, cultural, spatial and societal values. In the case of sustainability and capability in a society, identity is formed naturally on its own (Aydoğan, 2001).

There are several different approaches and questions regarding urban identity, including:

- Does each settlement have an identity?
- What difference is there between personality or character and identity?
- Can identity be formed artificially and can it be altered?
- What is the reason for: while historic and traditional quarters have an identity, new development areas do not?

Such questions have helped to indicate the elements, which altogether form urban identity.

There are numerous reasons for settlements to lose their identity: rapid socio-economic changes, immigration, functional increases in land uses, land development based on speculation, globalization of cultural and other values, loss of human scale, loss of sensitiveness to nature and climatic factors, increase in construction materials and techniques, increase in legal tools are only few of these. Next, one would have to ask what benefits would a settlement gain if it maintains urban identity. It is obvious that identity forms a database for its society, liaises individuals to their towns, and it is a tool in the confirmation of the settlement's healthy existence.

2.4. The Use of Urban Design Guides

The use of design guides was examined nationally and internationally to clarify the role of design guides in city planning process. These tools do not specifically define a desired end state, but are means for shaping the physical environment through time, i.e., in a process. Design guides define a range of alternatives, rather than one specific alternative, within which designers can develop their own architectural compositions.

Design guides can be classified in different categories:

- Guides with limited content and specific aims. These might be related to street furniture such as billboards and shop signboards,
- Guides related to different urban elements, but maintaining a single goal (e.g. widespread precautions that might be taken as regards the disadvantageous groups in an urban area).
- Guides with widespread interferences that would be needed towards maintaining a certain goal. These would require the participation of different disciplines and multidisciplinary work (Aydoğan, 2001).

Design guides can also be classified according to their legal status: some may be legally forced, others may just offer recommendations which may be followed. For example, one design guide can include a color scale from which architects can choose; others may dictate certain colors. Legally imposed guides would also involve certain enforcements. But between these two extreme alternatives one can define other approaches. For example, the guide can be approved as "plan notes" of a certain "urban plan" and implemented together with the plan, or it can be approved as a form of regulations by the local municipality (as in the case of high-rise building regulations of Izmir Municipality) (Izmir Büyükşehir Belediyesi, 2022).

Design guides can be used in a variety of problems encountered in new urban areas. In such areas often the main problem are their loss of identity, disregard to traditional design elements, monotony lived in urban spaces, and design without any character.

In squatter settlements, main problems are related to that of infrastructure and the poor quality of their construction. Yet these are followed by poor urban landscape and nonexistence of identity due to their chaotic architectural look. Problems encountered in historic quarters is an end product of people's insensitiveness to cultural values. Unfortunately, not all Turkish citizens are aware of their historic-cultural values enough to have a positive approach to conserve historic areas. Therefore, conservation does not proceed as a natural process and those conservation areas soon become derelict thus creating problem zones within the urban pattern which are hard to tackle.

There lies a necessity in figuring out a planning tool which would unite conservation zones with the rest of the city and which would guarantee their continued life. Planning would define specific limits, but leave people free to move in between. But, this too, requires that people reach a certain degree of consciousness of conservation.

Design guides present many planning possibilities, which are not available in traditional approaches. They are useful not only in developed or new development areas, but also in historical zones under conservation. Their benefits can be grouped as the following: (a) they are informative, (b) they make citizen participation possible, (c) they are comprehensive, (d) they provide spot decisions and are local (e) they are easy to implement and not concerned with ownership, and finally (f) they are flexible in decision-making (Aydoğan, 2001).

2.5. Analysis of Kemeraltı Conservation Site

First, a general historic analysis of the city as a whole, as well as of the historical site was conducted. The original historical buildings under conservation are classified according to their ages, which allowed us to define the historical period of the urban pattern. We defined architectural elements in authentic buildings and historical urban pattern, which contributed the spatial expression of the historical urban identity the most. We found that, this commercial and accommodational area (Kemeraltı) exhibits the colorful urban life of Izmir created by a mosaic of different nationalities, religions, social and economic relations after 18th century.

In the second stage, the existing situation was examined. The fact that the citizens of Izmir were not sufficiently aware of historical value of Kemeraltı was a serious problem. In addition, the site was confronted with numerous other problems: loss of commercial diversity due to migration of foreigners, dispersal of commercial activities in Izmir, creation of new and big shopping centers, and many other problems related to different infrastructures were only a few of these.

Areas formerly accommodated by different nationalities were assessed and grouped under different subsections (or sub-regions). A further analysis was conducted to classify various building types and their characteristics under an architectural typology. With this typology, it was possible to classify existing buildings' role in the definition of urban identity and architectural language.

From the assessment of architectural elements, it was also possible to define rules which were integrated in the design guide, e.g. the rations of windows to the facade and height-width rations.

2.6. Components of The Kemeraltı Urban Design Guide

After these analyses, a specific design guide for Kemeraltı was developed (2003). In the design guide, first the general approach and policy was defined, followed by the presentation standards and criteria derived from general considerations to details. The design guide aimed to reach a common architectural language, which would be used by all

parties concerned: the local government, the inhabitants, the NGO's, and local population. The guide included certain rules and recommendations. The recommendations of the design guide differed for each sub-region or different land use of the historical urban pattern.

2.6.1. Decisions Regarding The Urban Pattern

These involved criteria related to the following: integration with topography, protection of facade silhouettes, and organization of infrastructure. There were three reasons for this approach: (a) to guide urban design projects, (b) to guide local government initiatives and (c) to enable people to understand the rationale for the decisions made as regards to plots and buildings (Aydoğan, 2001).

2.6.2. Decisions Related to Sub-Regions

These decisions were related to the following issues: transportation system, car parking system, organization of outdoor and open spaces, plot formation, and finally street furniture such as street lighting, street covers, billboards, advertisements, etc.

These decisions aimed to maintain sub-regional characteristics and to guide the use of similar new elements, as well as to exemplify for new building designs.

2.6.3. Decisions Related to Building Types

For each group of building type, different proposals were made. These groups involved housing, singular commercial buildings, "han"s, symbolic "vakıf" structures, old warehouses and production buildings, multi-story buildings serving one single function, buildings with ground floor passages, multi-story and multi-functional buildings, multi-story office buildings, and multi-story housing units.

The expected return here was the conservation of historic values and maintenance of specific characteristics of each group. As such buildings conforming to the historic texture would be better conserved, while new and non-conforming buildings would be upgraded through time. The latter involves improvements, which would have to be made by private property owners.

2.6.4. Proposals Related to The Maintenance of Spatial Functions

This type of proposals was related to construction alignment in streets, location of buildings within plots, height and placement of buildings in topography, and those related to roofs. Such proposals aimed to conserve desired spatial relationships and the enhancement of spoilt urban character. Recommendations related to buildings positions and dimensions were to be implemented by conservation plan decisions. The design guide did not

aim to define development rights in conservation area, but aimed to create diversity.

2.6.5. Facade Decisions

This group of decisions involved facade configuration, wall-window ratios, details related to windows, window sills, doors, extensions, balconies, colors, building materials, decorations, shade elements, greenery, and the like.

The conservation and regeneration of facade elements is of utmost importance if urban landscape is to maintain its historic identity. All information from historical pattern (such as facade elements) was gathered at the database (see Figure 4). Recommendations were produced to limit misuse of facade elements, which might be detrimental to the environment. The idea was to form a common language for all buildings, apart from those registered and examples of civil architecture, which could be attained with the proposed database system.

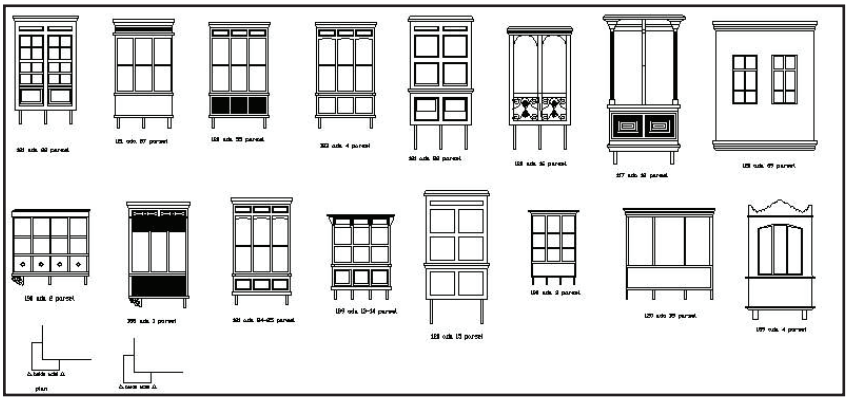

Figure 4: Determined facade element examples in database.

3. The Effects of the Kemeraltı Urban Design Guide

After the production of The Kemeraltı Urban Design Guide; Izmir Konak Municipality accepted this guide as a complement of the Conservation Plan of the Kemeraltı Historical Area (Taner, Aydoğan, & Ecemiş, 2003). Thus it would serve a practical purpose: it was to be used in junction with the conservation plan by the local government.

Design guides which accompany urban conservation plans, are more valuable than plan notes. As being accompanied with drawings and sketches, they are visually more effective and thus are much easily understood and accepted by the public. This in turn makes implementation of plan decisions easier. Despite these expectations, to date there has been no evaluation of the effects of Kemeraltı Design Guide.

In this retrospective study we evaluated the spatial effects of The Kemeraltı Urban Design Guide using the visual material archives and spatial analyses produced in two different professional projects conducted in Dokuz Eylul University Faculty of Architecture. One of these projects was conducted in the historical Kemeraltı Area before the development and application of Kemeraltı Urban Design guide between 2000-2003, whereas the other project was conducted after the design guide in 2016. Thus it was possible to analyze and evaluate the effects of the current urban design guide in this area.

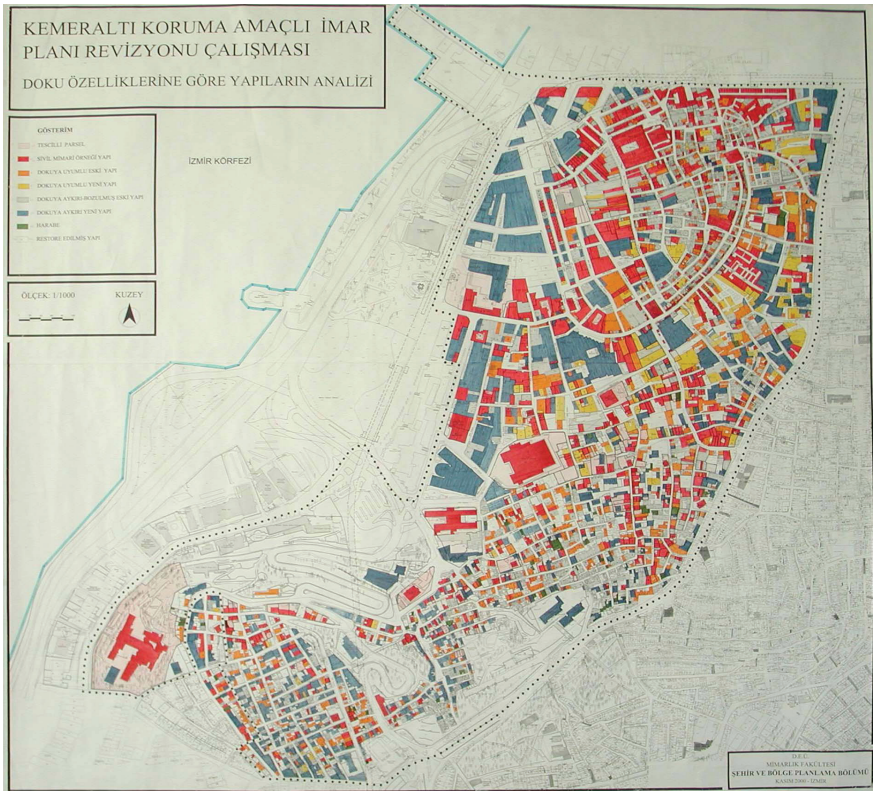

Figure 5: Historical pattern compatibility analysis of the buildings, from the first project (Taner T., et al, 2003; p:57).

The thematic map shows that the ratio of the buildings contradictious to historical urban pattern is similar to the ratio of monumental buildings in historical urban area.

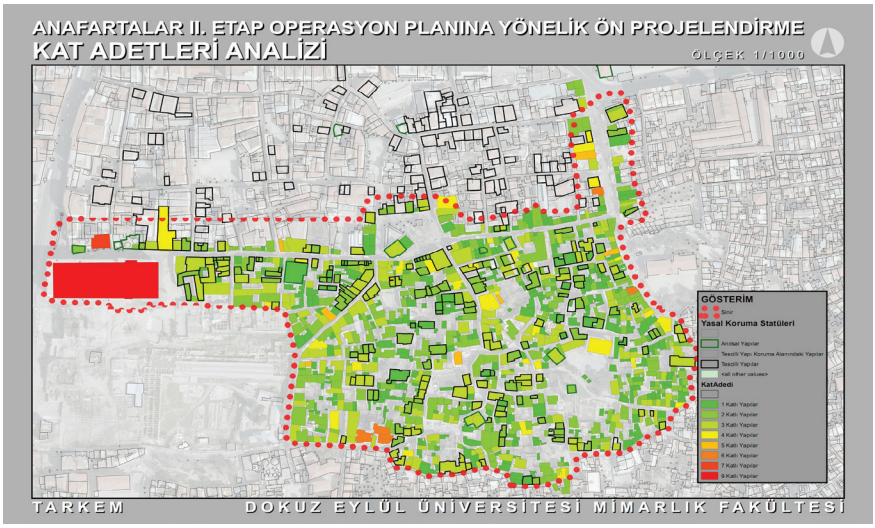

Figure 6: Buildings by number of floors and listed monumental buildings by the Ministry; from the Second Project (Birol Akkurt, at al, 2015) .

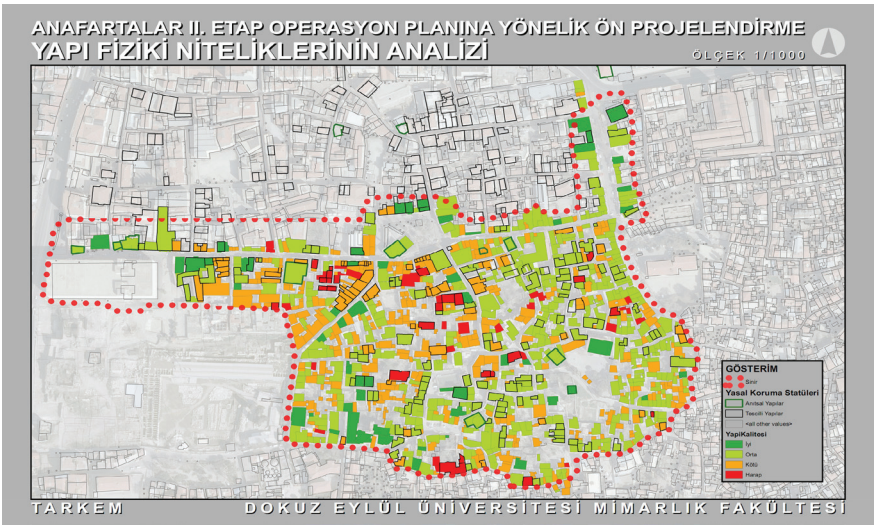

Figure 7: Buildings by physical features and listed monumental buildings by the Ministry; from the Second Project (Birol Akkurt, at al, 2015) .

Figure 6 and Figure 7 are included as examples for thematic maps from second project's analytic etude of the area. These figures show that even the monumental buildings have not been conserved properly. Moreover, other buildings in the historical area have lost their compatibility with historical urban pattern beyond expectations.

Figure 8: Current physical condition of the historical buildings.

Together with analytic etudes, evaluation of thematic maps and visual material archives, demonstrates that implementation of the Kemeraltı Urban Design Guide was not successful enough to reach the desired outcomes. Although there were visual improvements in some quarters of the historical area, these were mostly due to municipally financed projects.

The reasons underlying the implementation problem of the Kemeraltı Urban Design Guide:

- Urban design guides are not defined as a legal planning tool in current legislations. Thus, the degree of legal obligation is not clear for the residents.

- Personnel of the planning department of the municipality has changed through the years, the information regarding the design guide was not transferred to new staff as it was not mandatory.

- The local governments and companies (such as TARKEM), which develop projects for conservation of the historical urban areas; are not legally bound by the design guide as their primary purpose is public interest.

- Due to the economic depression at the accommodational quarters of the historical area, individual demands for building permits are limited. Few demands for new constructions can be amended by local conservation board of the Ministry of Culture.

Problems in the implementation of the Kemeraltı Urban Design Guide

does not necessarily indicate futileness of design guides. In order to benefit from urban design guides, their legal status should be clearly defined and they must be mentioned specifically in the building regulations.

Fortunately, during preparation of this chapter, the Ministry of Environment, Urbanization and Climate Change mentioned and defined "urban design guides" as a planning tool in Spatial Plans Preparation Regulations in March 13, 2022 as a recent legal change.

"The administration can prepare an urban design guide, when necessary, for implementation that involves guidance and recommendations which aim to arrange buildings in harmony and integration in the hierarchy of spatial planning, in order to bring imagery, purpose and identity to a space; to increase its aesthetic and artistic values." (Ministry of Environment Urbanizaton and Climate Change, 2022; item 5) With this legislation, urban design guides have become legal tools in planning process. This legal improvement may provide new opportunities for the implementation of urban design guides, instead of plan notes, especially in conservation sites. It is hoped that many of the planning problems encountered in conservation might be eased, with the use of such guides. Such guides encourage public participation and greater democratic involvement which is an advantage, that must be carefully protected.

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Endnotes

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(ii) İzmir Tarih Projesi - Anafartalar Caddesi 2.Etap ve 1. Halka Konut Dokusunun Bir Bölümünün Operasyon Planına Yönelik Ön Projelendirimesi, DEÜ Mimarlık Fakültesi Döner Sermaye Projesi. Hümeyra BİROL AKKURT, Sibel ECEMİŞ KILIÇ, Muhammed AYDOĞAN, Deniz DOKGÖZ, Deniz GÜNER, Fatma Feyzal ÖZKABAN