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Editor's Message

This issue of JAH-Digital International Journal of Architecture Art Heritage is dedicated to Heritage topic. In such a period when the importance and conservation of cultural heritage is becoming better understood all over the world, it is of great importance to make a scientific contribution to the subject. Our most important task in this regard is to promote and highlight the work of academicians, researchers and innovators in the area of heritage.

As editorial chief of this issue, I collaborated with Prof. Dr. Salah Haj Ismail to select and review editorial proposals that could be representative of such an important topic as cultural and architectural heritage. On behalf of the journal and on my own behalf, I would like to thank all the colleagues who contributed to the refereeing process of the articles, help in enhancing the quality of the research and the production of this issue. I would also like to thank the proof-readers and the layout and production editors who worked hard to have the final version of this issue.

The articles published in this issue confirm the importance of the theme of heritage in the contemporary world and reaffirm the need to preserve cultural heritage and pass it on to future generations.

Assoc. Prof. Dr. Filiz KARAKUŞ
Issue Editor

Digital International Journal of Architecture, Arts & Heritage (JAH) is a scholarly peer-refereed journal serving the needs and goals of development and resilience in Architecture, Arts and Heritage-related fields, which is published each two months (6 issues per year) and digitally. Our journal is open access and accepts articles in English, Turkish and Arabic. Submissions from the fields Industrial Design, Interior Architecture, Architecture, Landscape Architecture, Urban and Regional Planning, Traditional Turkish Arts, Plastic Arts, Design, Movable Cultural Heritage/Art Works Restoration and Conservation are accepted to our journal. JAH publishes original research papers, state-of-the-art review papers, novel industrial applications, and insightful case studies in a broad scope of topics related to these disciplines.

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Content

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History and Architectural Implementation of Terzi Baba Mosque as a Symbolic Structure/Value of Erzincan

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ABSTRACT

In Anatolia, especially in the mosques built after the 20th century, the search for different forms from the old periods and modern designs that change in architecture comes to the fore. Terzi Baba Mosque, which has become one of the symbols of Erzincan province in Eastern Anatolia, is a structure that can be considered in this sense. The construction of Terzi Baba Mosque, designed by the architect Danyal Tevfik Çiper (1932 – 2008), started in 1990. It laid its foundation in 1991 and was open to worship in 2002. The building of approximately 7000 congregation capacities has taken its place in the literature as the largest mosque in Eastern Anatolia.

The study aims to analyze in detail the architectural features and facade designs of the symbolic mosque of Erzincan, which was designed by Çiper, who had many different and modern building designs at the time it was made. In addition, the differences and similarities between the architectural planning of the first construction with the current application were examined and compared in detail on the plans, appearances, and sections. The research method discusses in two stages. First, its spatial analysis was made by observing the build in place. At this stage, the first construction plans, sections, views, and building details were used as the primary source referenced in the examinations In the second stage of the research, the application differences were revealed due to the comparison of today's structure with the primary source. On-site photography, written notes on the building, and the differences in the architect's first design had been transferred to the plans in the computer environment.

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KEYWORDS
Terzi Baba Mosque, architectural project, modern mosque architecture, architectural practice, spatial transformation.

INTRODUCTION

After the 20th century, as a result of the flexible use of building materials and the expansion usage areas of the materials, exciting forms and building designs began to be applied (Aydın & Büyükşahin, 2017). In the last century, as a result of the development of technology, the production of different materials in desired forms and the effective use of materials such as reinforced concrete and steel being designed large span and original mosques. As a result, mosques have been built with different plan schemes, design approaches, and material selection in different periods and regions from the past to the present. Factors such as the location of the region where the mosque will be built, cultural structure, climate, appropriate building materials, access to technology, and environmental and architectural approaches constitute the differentiating mosque designs (Duysak, 2000).

The research aims to compare the first planned and built versions of the Erzincan Terzi Baba Mosque. In addition, the aim is to reveal the difficulties of the implementation plan. Finally, inspired by the original design of the differences revealed after the comparison, presenting a new spatial suggestion by today's conditions is among the research aims.
The research's main problem is the application differences between the Terzi Baba Mosque's first planned and built versions, which is the subject of the study. The reasons for these application differences were investigated, and implementation differences were given comparatively in the form of the first design and today's build. The study seeks answers to the following research questions based on the hypothesis that 'The reasons for the differences in the implementation of the Terzi Baba Mosque design have shown spatial, functional and formal effects in the structure':

1. Did the Erzincan Earthquake that occurred in 1992 affect the construction and implementation of the Terzi Baba Mosque, which was started in the same year?
2. In which architectural stages (planning, facade design, material selection) did the differences between the initial design and implementation of the Terzi Baba Mosque occur?
3. Were the costs and earthquake disasters effective in changing the material selection during the implementation phase of the mosque?
4. How did the specified factors (cost, earthquake disaster) affect the building spatially, functionally, and formally during the implementation phase?
5. Can suggestions be made for the functions created by the application differences in the spaces based on the first design ideas?
6. Do spatial suggestions ensure that the building is used more effectively and suitable for its original design?

The answer to the research questions regarding the hypothesis makes this study different from other studies written in the literature on the subject. Sources encountered while searching for the literature (Karaman, 1991; Miroğlu, 1995) state that the mosque's construction coincided with the 1992 Erzincan earthquake, and since many mosques/masjids were damaged in the earthquake, it was the subject of current news. This sources states that the destruction after the 1992 earthquake increased the mosque need in the Erzincan center. In an interview with mosque architect Danyal Tevfik Çiper (URL-3), there are the following words about this subject.

We built the mosque, but the collection is difficult with money, of course; that is, donations will be made … At the moment, the construction is almost finished, that is, almost assembled. But we couldn't finish the roof because we didn't have enough money.

In this speaking, it is understood that there were financial difficulties during the building construction period, and therefore there were problems in the building implementation.

It would be required to briefly mention before the architectural approach and the project construction stages of the Erzincan Terzi Baba Mosque, which will be discussed within the scope of the study, Terzi Baba, who gave the mosque its name. Based on the rumor that Terzi Baba, known to have died in 1848, was 59 years old at the time of his death (Albayrak, 2011; Aşkun, 1956 & Tahir, 1333), it is have reached that he was born in 1789[1]. It is stated that Terzi Baba, known by his real name Mehmed Vehbi (Hayyat Vehbi2), was originally from Erzurum. However, his house is between Kurşunlu Mosque in Erzincan and Güllabi Bey Mosque (Camii Kebir) (Şevkistan, 2021). Terzi Baba, who died in 1848 in the cholera epidemic that broke out in Erzincan, was buried in the tomb built by Mecid Efendi, one of the governors of Erzincan, and Fehmi Efendi, one of his caliphs. The Municipality of Erzincan built a tomb in the 1980s instead of the tomb that was in ruins after a fire (Albayrak, 2011). They have given named the city cemetery in Erzincan Terzi Baba. Terzi Baba's tomb is in the Terzi Baba Cemetery, where his lodge is today (Aktepe, 2009). In addition, an association name of Terzi Baba was established and a complex was built in the center with a mosque. The mosque construction and application processes within the study's scope will be discussed.

A BRIEF HISTORY OF ERZİNCAN

Located on the Silk Road, Erzincan is in the Eastern Anatolia Region of Turkey. The city, which has not lost its importance in different periods starting from the ancient period, had served as a crossroads in transporting materials in the Black Sea and Mediterranean ports to Iran and Turkistan. For this reason, it is in a very important position regarding commercial and economic aspects. It is stated that the city of Erzincan was called 'Aziris' in the ancient

period, it was named 'Ezirgan' and 'Erzingan' by the Turks after the 11th century (İnbaşı, 2009), and these discourses eventually turned into the current name 'Erzincan' (Kaya, 2001).

According to Albayrak (1983), Erzincan province, which has seen many wars throughout history and has been wiped off the map eleven times in the last thousand years, can be defined as 'mountainous around and vineyard in the middle.' The east of Erzurum, west of Sivas, south of Tunceli, north of Gümüşhane and Bayburt, southeast of Bingöl, and northwest of Giresun surrounds Erzincan. It is estimated that the first settlements in the region date back to three thousand BC (Miroğlu, 1995).

Information about the history of Erzincan is obtained through academic studies on the first ages (Özgüç, 1969). Studies scope created with the data obtained from the city's history, the states that have dominated from past to present are revealed in the table (Table 1).

Table 1. *Principalities, states, and kingdoms that ruled according to the dates of the Erzincan city (The author created a table by making use of the sources (Kaya, 2001; Bezgin, 2019; Aydın, 2019; Naldan, 2016 and 2019)).*

Dates	Dominance
B.C. 1850 - 1180	Hittites
B.C. 1200 - 600	Urartians
B.C. 612	Medes
B.C. 550	Persians
B.C. 334	Kingdom of Macedonia
B.C. 70	Byzantine Domination
A.D. 655	Hz. Osman time
655 - 1288	People of Mengücek (Mengücek Ahmet)

Table 1 (continued). *Principalities, states, and kingdoms that ruled according to the dates of the Erzincan city (The author created a table by making use of the sources (Kaya, 2001; Bezgin, 2019; Aydın, 2019; Naldan, 2016 and 2019)).*

1288 - 1243	Anatolian Seljuk
1243 - 44	Mongols
After 1244	İlhaniler
1327 - 1380	Principality of Eretna
Up to 1445	Akkoyunlu people
1473	Ottoman Empire
1502	Safavids (Shah Ismail)
1514	Ottoman Empire
1877 - 78	Russian Invasion
1916 - 18	Russian Invasion
1918 (13 February)	The city was liberated.

As can be seen from the table, the city has been subject to different occupations and seizures in different periods. In addition, different national dominations have led to differences in geographical, social, socio-cultural, economic, and architectural issues. As a result, the city hosts different cultural assets together. The Russian occupations, which started in 1473 and took place in 1877-78 and 1916-18 under the long-lasting Ottoman domination, have caused difficult conditions in the city. Erzincan have gained its freedom on February 13, 1918 (Aksüt, 1932). After the Republic proclamation in 1923, in the 1939 and 1982 earthquakes, there was great destruction and loss of life. Nevertheless, despite all these, the city was restructured and has been brought to its present status.

TERZİ BABA MOSQUE PERIODIC CLASSIFICATION

TERZİ BABA MOSQUE FIRST CONSTRUCTION (1990-2002)

The lack of a central mosque to meet the needs after the earthquake was affected in the construction of the mosque located on Erzincan Fevzipaşa Street. Before the earthquake, it was possible to partially benefit from the Selimoğlu, Big Bazaar, Red Crescent, Municipal Site, Foundations Office Block, Ünsal Office Block, Fevzipaşa and Manifaturacılar Site masjids located in the basement floors (under the offices) of the central market. However, most of them were destroyed and damaged in the earthquake (Karaman, 1991). In addition, the fact that they are located on the basement floor caused even the masjids, which can be considered less damaged than the others, to be unusable.

In order to respond to this need and end the use of risky places of worship, it was essential to complete the Terzi Baba Mosque, whose foundation was laid in 1991, per the technical and earthquake specifications.

In the literature, it is the largest mosque in Eastern Anatolia regarding prayer space capacity and area covered by square meters. There is much information about the mosque's foundation in the 7th issue of Diyanet magazine (Karaman, 1991). In the news made by Erzincan reporter Mehmet Ateş, Erzincan Terzi Baba Mosque had been laid with a ceremony by the Prime Minister of the time, Yıldırım AKBULUT. In addition, ministers, Deputies, Erzincan Mayor, Governors of Erzincan and neighboring provinces, Vice President of Religious Affairs Rıdvan ÇAKIR, TDV (Turkish Religious Foundation) Chairman of the Board of Trustees Rıza SELİMBAŞOĞLU, Heads of Departments and TRT press members with a large community of citizens attended the ceremony.

The main mosque sections, which were designed in such a way that 7000 people can pray under its roof at the same time, are as follows:

1. Places of Worship (7000 people capacity)
2. Conference Hall
3. Library and Reading Hall
4. Education - Seminar and Study Sections
5. Courtyard – Open and Closed Funeral Places
6. Cleaning Spaces
7. Soup Kitchen and Services
8. Independent Workplaces
9. Two Massive Minarets with Stairs and Elevator
10. Total Construction Area of 12,500 square meters[3]

It is seen that the mosque, which has a very large floor area, also includes places that serve many different functions (service spaces, social and commercial areas) in addition to places of worship. It is understood from the news information of October 1992 that its foundations started to be laid that year. The same magazine report stated that the mosque construction, known to be in the design phase in 1991, started after the earthquake (1992). The basement floor of the building, whose foundations were laid, has been made ready for concrete casting by laying the decks. Terzi Baba Mosque, designed by architect Danyal Tevfik Çiper (1932 – 2008) in 1990, was completed in 2002 as a result of delays due to the 1992 earthquake and unresolved cost problem (Karaman, 1991; Cengizkan, 2013; Kansu, 2013; URL-2).

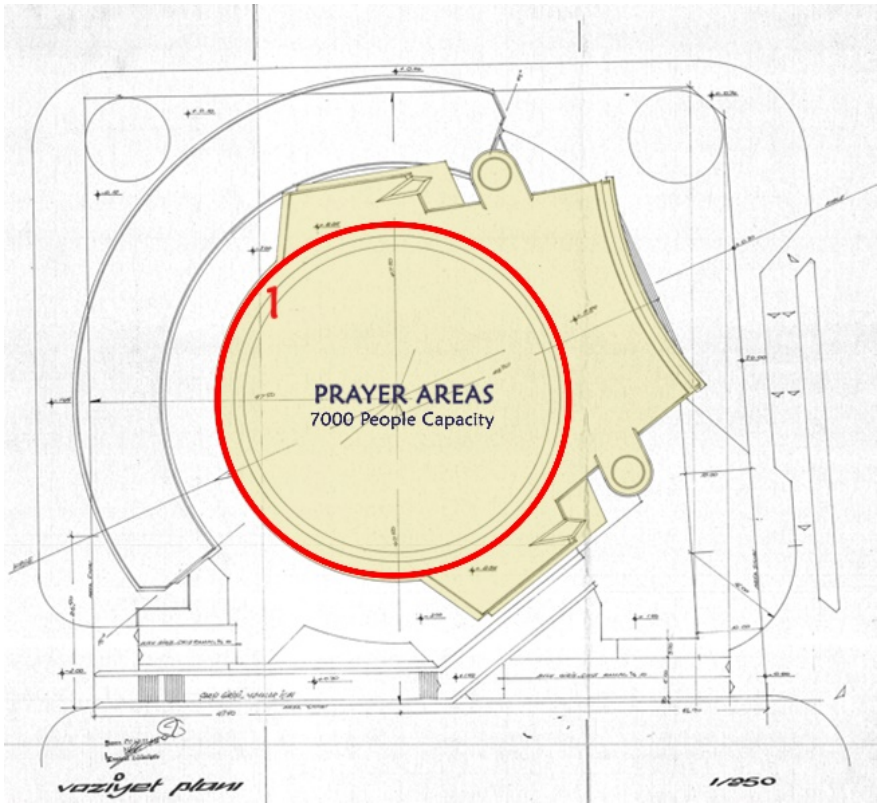

Figure 1. *Terzi Baba layout plan, designed by Danyal Tevfik Çiper, 1990 (first design).*

The area highlighted in a red circle of the site plan (Fig. 1), which belongs to the first design project of the architect in 1990, is the place of worship. The form design of the area, which attracts attention with its 7000-person capacity[4], the use of contemporary materials in the construction of the mosque, and its original design, which is far from imitation, shows that it is a work of modern architecture. A three-armed quarter-turn staircase accesses the women's mahfil. It has a capacity of approximately 500 people. The dome is 14 meters high and 37 meters in diameter. In the main entrance

located at the bottom of the terrace of the mosque, there are 6-step stairs that continue horizontally throughout the entrance to reach the ground level. There are also four separate entrance gates, one on the right, the other on the left (Mosque Entrance A and Mosque Entrance B), and two in the middle.

Figure 2. *Terzi Baba Mosque, three-dinemsional visual, Danyal Tevfik Çiper, 1991 (URL-1).*

In the 3d model (Fig. 2) of the building, it is understood that the building was built with a modern architectural understanding from the contemporary construction techniques, the use of contemporary materials (steel and glass), and its original design (dome, minaret). In an interview published after the death of architect Çiper on October 25, 2008 (URL-3), the following information is obtained from the architect's language about the building.

The architect said to the question of, «There is a nice mosque you built in Erzincan, can you talk a little bit about this building?» replied as «There was a wonderful gentleman mayor, and mufti. They were delighted that we were going to build a modern mosque, can you imagine?» This answer is understood that the construction of modern mosques was welcomed by the authorized persons of the period, and architect was warmly interested in this issue. Editor's «Is the dome glass or transparent?» question of his answer has been «A transparent dome». Afterward, he mentions that due to

occuring the Erzincan earthquake, built in 1992, the dome to be built with reinforced concrete material will damage the structure (as it will increase the structural load). It is emphasized that steel material is preferred because it is very light and easy to construct.

In order to reduce the heat intake of the dome, which has a diameter of 50 meters, double walled[5] design. While the hexagons in the covering system (Fig. 2) designed in a hexagonal form will be completed, made from the outside, and combined on the dome, the hexagons could not be made because they could not be divided per the desired design. The cost was stated as another factor in not being able to the dome (Kansu, 2013; Cengizkan, 2013). As the cost could not be met, many parts were built differently than designed. Architect has aim to facilitate the water flow by leaving gaps at the points where the hexagons join each other (it is stated that they are copper coated). In addition, umbrellas are designed on it to protect it from the sun (Fig. 3), umbrellas can be seen in the section and view). While the umbrellas stay in the air on the south side, it is desired to ensure that hot air comes out between the double walled (Kansu, 2013). The architect stated that the expected application on the dome could not be made, and they had to cover the top of the dome with polycarbonate sheets (Kansu, 2013).

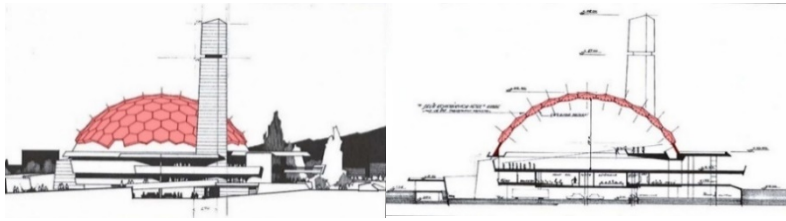

Figure 3. *Terzi Baba Mosque dome and the designed hexagonal top cover section and view (URL-1).*

TERZİ BABA MOSQUE IMPLEMENTATION DIFFERENCES AND CURRENT SITUATION

The spaces in the Terzi Baba Mosque design planned in 1990 by master architect Danyal Tevfik Çiper are marked with different colors as 1,2,3, and 4 in (Fig. 4).

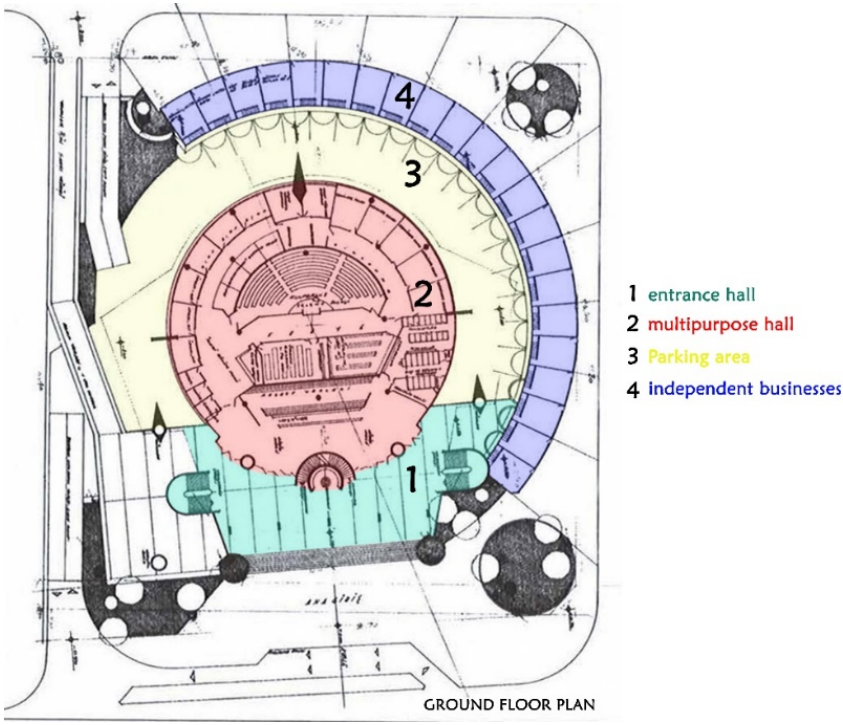

Figure 4. *Terzi Baba Mosque ground floor plan, first design in 1990, D.Tevfik Çiper (URL-1).*

In part indicated by number 1 of these places is the entrance hall, which can be reached from the area raised by steps on the entrance level. In this section, two spiral staircases are on the right and left. In addition, there is a three-armed quarter-turn staircase, which is still in use today, just across the entrance. Section 3, at the back of the hall, takes the vehicles from the upper

level to the parking garage area with a ramp. Independent workplaces accessible from outside in the -5 level have been designed in area 4, located behind the deaf façade, which coincides with the parking area. This way, spaces with different functions that can operate independently at two different levels have been resolved. Deaf façades corresponding to the soil level were preferred for the parking area with appropriate ramps.

Although the multi-purpose hall is not used today, independent workplaces are used by different businesses. One of them is Erkarpaş a chain market actively using area today. On the 1st floor plan (Fig. 5, the first design), the prayer area is painted red, and the middle of this area is noted as having a capacity of 3000 people. The spiral staircase across the entrance hall provides vertical circulation to the upper floor of the main prayer area (women's lounge).

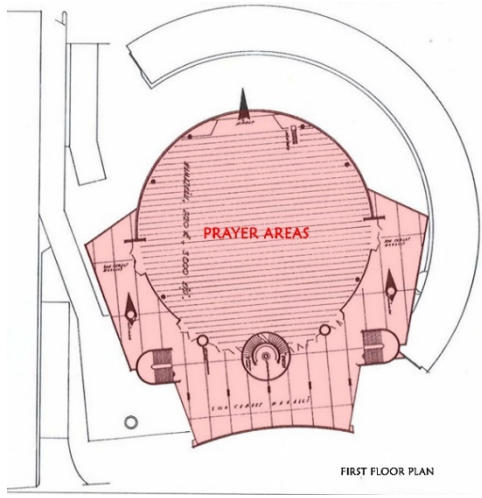

Figure 5. *Terzi Baba Mosque 1st floor plan, first design in 1990, D.Tevfik Çiper (URL-1).*

The dome has an elevator and ladder system to be used for maintenance and repair indoors and outdoors. This ladder system can opened and moved manually (Fig. 6).

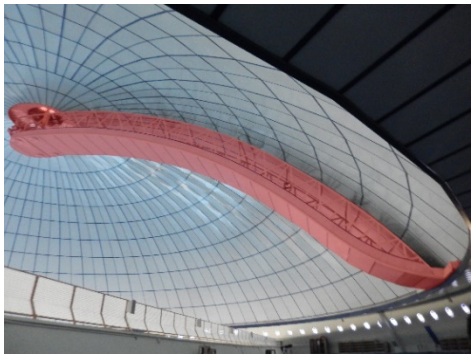

Figure 6. *Terzi Baba Mosque todays roof ladder system (manual opening and closing system, 2022, author archive).*

Inside the mosque are three prayer area (namazgah) pools (Cengizkan, 2013), whose plan and section are included in the initial design details. In addition, there is a mihrab, sermon pulpit, and muezzin mahfil in the mosque's interior (Fig. 7).

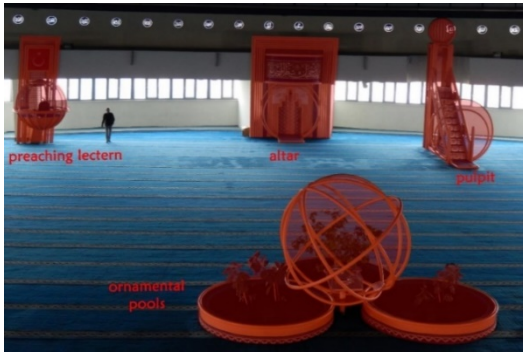

Figure 7. *Terzi Baba Mosque todays mihrab, sermon pulpit, and muezzin mahfil*

The mosque has two minarets, and the sword inspired the minarets. The more pointed parts of the minarets, which are likened to swords, are designed to turn towards the qibla (Fig. 8). In addition, when the building is viewed from the qibla perspective, the space in question almost resembles a space shuttle.

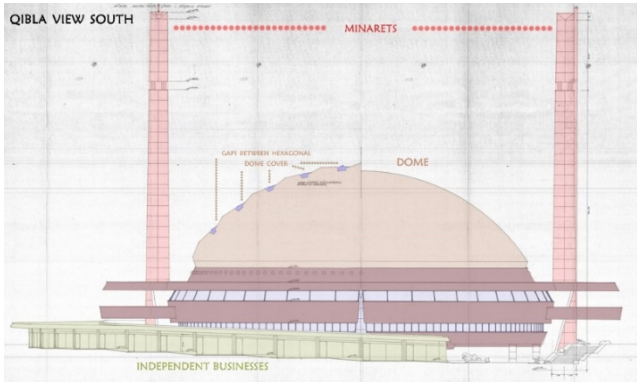

Figure 8. *Terzi Baba Mosque qibla view south, first design in 1990, D. Tevfik Çiper (Erzincan Municipality Zoning Directorate).*

Figure 9. *Todays Terzi Baba, 2022 (author's archive) (left), the first designed version of the mosque, D.Tevfik Çiper, 1990 (URL-1) (right).*

A comparison of the current and first versions of Terzi Baba Mosque, which is suitable for the way it was designed from its first construction to the present, and where changes were made in practice for different reasons, was made (Fig. 9).

Table 2. *Differences and changes between Terzi Baba Mosque's first version and today's application (created by the author).*

	The first design version (1990 - 2002)	**Present-day structure (applied construction)**	**Application difference**
1. NAMAZGAH Places of Worship (7000 people capacity)	different periods (large programs, seminars covering the region, sessions) different uses (academic units, library, reading halls)	just prayer area (namazgah) mihrab, sermon pulpit, and muezzin mahfil	Spatial
2. SOCIAL PLACES	Conference Hall Library and Reading Hall Education - Seminar and Study Sections Courtyard – Open and Closed Funeral Places Cleaning Spaces Soup Kitchen and Services **Independent Workplaces**	**Independent Workplaces**	Functional Spatial Formal
3. INDEPENDENT WORKPLACES	designed for 22 different independent units by dividing into 22 axle	Erkarpaş, a chain market using area today use as idle warehouses	Functional Spatial
4. DOME	Hexagonal form With umbrellas (protect the sun) Gaps (facilitate the water flow) Double walled (hot air comes out)	With polycarbonate sheets change of material and design detailed elevator and ladder system	Spatial Formal

The differences between the first construction of the Terzi Baba Mosque and the present application are classified in (Table 2). These differences caused by the conditions of the period (earthquake, financial inadequacy, problems in practice) were revealed within the scope of the study. Therefore, the recommendations and discussions, in conclusion, offer an idea of how to deal with differences in future practice.

CONCLUSION AND RECOMMENDATIONS

Terzi Baba Mosque, which has become one of the symbol structures of the province of Erzincan, was built 20 years after its construction (2002), despite many difficulties, most of which were caused by financial difficulties, including the difficulties experienced in practice. Compared to its first design, the dome observed today was built almost completely different from the original's material and design. It is understood from the words of the architect in an interview made at that time that the hexagonal transparent forms desired to be used on the upper cover of the dome could not be made during the application phase. The spaces left between the hexagonal covering can also be seen in the details, and the umbrellas thought on the covering could not be made during the application phase.

Apart from the differences in the first post-construction application of the building, there are also different functional uses of the spaces today. The multi-purpose hall and the training, seminar, and study sections considered in addition to this do not continue their functions today. The soup kitchen and service parts included in the first production program have yet to be found today. The spaces reserved for workplaces and operating from the side level with different entrances were combined and have been given to use a chain store. Apart from this, a few single workplaces are used by different commercial enterprises. In addition, the fountain (a place for

ablution) in its garden today was not found in the old plans. It is thought that it was built later per today's conditions.

As a result, it is seen that one of the reasons for the application differences and functional changes between the preliminary project of Terzi Baba Mosque and today's structure is the budget problem. The financial inadequacies experienced during the first construction period caused spatial, formal, and functional differences in the building. In addition, the budget constraint caused the materials used in the building to differ. These reasons made the implementation plan of the original design of the building difficult. The difficulty of the implementation plan has resulted in:

1. As a result of spatial and functional differences, effective use of spaces has become difficult.
2. The preliminary project is planned to design the top covering in the form of steel-structured hexagons (together with water troughs between them). The spaces between the hexagons should be opened towards the dome bottom and it is thought to connecting the structural system. However, due to budget constraints, the top of the dome was covered with polycarbonate sheets. As a result of the inability to make this top cover designed in the dome and the lack of spaces to be left in between, the prayer place (namazgah) could not receive enough light and turned into a flattened space.
3. Because the spaces belonging to the kulliye, which are included in the original design, cannot be implemented and used out of function today, building social spaces (library, multi-purpose hall, reading areas, madrasah study rooms) are not used.
4. The parts used as independent commercial areas are now closed (unused, dysfunctional) and are called material warehouses. These parts, which are divided into different commercial spaces, are used by a single private market today, makes the area one piece and causes it to lose its diversity and sustainability.

Suggestions for the solution to these results arising from the difficulty of the implementation plan have been put forward. These recommendations also seek answers to hypothetical research questions.

- It has been observed that the spaces used outside their functions today include the social areas in the first design program. In this context, after discussions on the spatial use of the building with experts in the field, it should be ensured that the building is turned outward in a way that allows social use. In this way, the building will allow more effective spatial use.
- Reconsideration of this structure with a capacity of 7000 people in different periods (large programs, seminars covering the region, sessions) in a way that allows for different uses (academic units, library, reading halls) will enable both conformities to the original design and will allowed the public social use outside of worship.
- Independent trade units, designed in the oval shape, on the north and north-east parts of the mosque on the ground floor of the mosque, should be used as foreseen in the first design program. In addition, the commercial areas that will serve the public with separate entrances at different levels will contribute to the sustainable use of the spaces. In addition, the sections designed for 22 different independent units by dividing into 22 axle in its first design will allow different commercial uses, and provide financial resources for the mosque. This resource can be used as financial support for the necessary maintenance, repair, and all kinds of activities of the mosque.
- The dome cover, due to the difference in materials and design, leaves the place of worship (prayer) condemned to insufficient light. For this reason, even in the brightest and sunniest hours of the day, place cannot get enough light and remain dark. Furthermore, the

fact that the dome covers a large-scale space brings the space to a flattened position due to the use of gapless materials. Therefore, the dome material should be reconsidered with the support of the relevant institutions. Applying the dome material and design detailed in the preliminary project within the possibilities is possible.

After this, what needs to be done is to preserve the building in accordance with its original form and to transfer it to future generations as the heritage of the city, despite the differences in application. However, providing the suggested changes, if deemed appropriate as a result of the necessary research, will ensure that the original design of the building is adhered to and more efficient use of space.

THANKS AND INFORMATION NOTE

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The article complies with national and international research and publication ethics. Therefore, ethics committee approval was not required for the study.

AUTHOR CONTRIBUTION AND CONFLICT OF INTEREST DISCLOSURE INFORMATION

All authors contributed equally to the article. There is no conflict of interest.

ANNOTATIONS

[1] Yurt (2011), in his book Terzi Baba and Erzincan, states the date of birth of Terzi Baba as 1779 Gregorian.

[2] In the book "Erzincan," published in 1977 by Süleyman Öztürk, this name is referred to as the his original name.

[3] While the total mosque construction area is stated different square meters on different sources the total mosque construction area, (including the floor area of the building), has comprised the all prayer places area the square meter mentioned here (fountain, funeral prayer areas, services, social and commercial areas).

[4] In the site plan of the building in "Arkiv", (n.d.), the prayer area is indicated as the marked circular red area (number 1) in (Fig. 1). This marked area has a capacity of 3000 people. The capacity stated as 7000 people are estimated to cover the entire area marked in color (In another electronic source (URL-4) this area states with the front balcony can reach this capacity and even up to 10,000 people).

[5] Wall means wall, barrier (tr.çeper). The use of double walls means the use of double walls and barriers (tr.çeper) (Hasol, 2020).

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Seismic Bracing for Earthquake-Resistant Design: Architectural Functioning and Enhancing Building Safety and Aesthetics Suggestions, Case of Istanbul

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ABSTRACT

This research paper examines the integration of seismic bracing in building design to enhance both safety and aesthetics, focusing specifically on Istanbul, Türkiye. The paper presents a case study of a 40-year-old apartment building, with three stories above ground and two basement floors, measuring 19 meters in length, 14 meters in width, and approximately 11 meters in height. Seismic bracing is an essential technique used to strengthen buildings and protect them from earthquake damage. The study evaluates various seismic bracing styles, including planting, lighting, and Art Deco, using modeling to assess their effectiveness in enhancing building safety and aesthetics. The paper emphasizes the importance of considering the aesthetic aspect of the retrofitting process in synchronization with safety measures. The implementation of seismic bracing styles such as planting, lighting, and Art Deco has shown significant improvements in building safety and aesthetics. Through modeling techniques, the effectiveness of these styles has been demonstrated. The integration of seismic bracing styles into architectural design provides a unique opportunity to enhance the safety of buildings while also improving their aesthetic appeal. In conclusion, this research paper highlights the potential for seismic bracing styles to be used effectively in architectural design to improve building safety and aesthetics. The results indicate that seismic bracing styles significantly enhance building safety and aesthetics, particularly in earthquake-prone regions like Istanbul. By emphasizing the importance of seismic bracing in earthquake-resistant design, this paper underscores the potential for seismic bracing styles to be utilized in architectural design to enhance building safety and aesthetics.

KEYWORDS

Architectural Aesthetics, Seismic Retrofitting, Facades Beautification, Building Safety, Architectural Functioning.

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INTRODUCTION

Istanbul, Turkey, is located in one of the most seismically active regions in the world, making it susceptible to significant earthquake risks (Sesetyan, 2019). The city's location on the North Anatolian Fault Zone has caused several deadly earthquakes in the past. Due to the high population density and numerous critical infrastructures, including hospitals and government buildings, it is essential to design and construct earthquake-resistant buildings to mitigate potential damage and loss of life (Korkmaz and Yilmaz, 2020). The Kahramanmaraş Earthquake in southern Turkey resulted in widespread destruction and motivated architects to prioritize safety and resilience. Seismic bracing is a common technique used in earthquake-resistant design in Istanbul, and several successful case studies have been reviewed to enhance building safety and aesthetics (Akkar et al., 2016). According to the United States Geological Survey (USGS), Istanbul has experienced several significant earthquakes in the last century, including a magnitude 7.4 earthquake in 1999 that killed over 18,000 people and caused extensive damage to buildings and infrastructure. The USGS notes that Istanbul's high population density and large number of vulnerable buildings make it particularly susceptible to earthquake damage. To mitigate future earthquake risks, the USGS recommends improving building codes and retrofitting existing buildings to withstand seismic forces (URL-1). The potential impact of an earthquake on human lives, buildings, and infrastructure is catastrophic (Akinci and Akbas, 2020). Istanbul, a city located in a seismically active zone, faces a considerable risk of earthquakes. To make matters worse, many of the structures in the city were erected prior to the implementation of modern building codes and seismic regulations, leaving them susceptible to seismic activity (Yilmaz and Korkmaz, 2019). The need for retrofitting and seismic bracing to fortify the earthquake resistance of these buildings has become more pressing than ever. Despite technological advances in building construction, the safety of buildings in Istanbul cannot be taken for granted. In Istanbul, a significant number of

buildings are constructed with reinforced concrete because it is a widely used material. However, the ability of RC buildings to withstand earthquakes is dependent on their design, construction, and maintenance (Kaya and Dumanoglu, 2021). Many older reinforced concrete buildings may not meet current seismic standards and may be susceptible to collapse in the event of an earthquake. Retrofitting these buildings with seismic bracing is a proven method for enhancing their earthquake resistance and ensuring the safety of their occupants (Akkar et al., 2016).

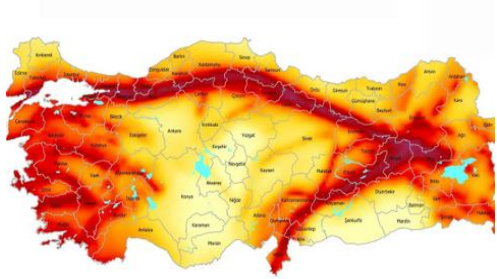

Figure 1. *Anatolian Fault Line (URL-2).*

CONTEXT

Designing buildings in seismically active regions presents a significant challenge for architects and engineers due to the risk of earthquakes. Istanbul, located on a fault line, is no exception and experiences frequent seismic activity (Akkar & Bommer, 2007). The 1999 İzmit earthquake, which had a magnitude of 7.4, caused massive destruction and loss of life in the city (Kalkan & Gülkan, 2011). To address these risks, seismic bracing has become an essential technique in earthquake-resistant design. This paper aims to explore the role of seismic bracing in enhancing building safety and aesthetics. It delves into the architectural aspects of seismic bracing and suggests ways to improve the safety and aesthetics of buildings in seismically active areas.

PURPOSE AND STRUCTURE

The focus of this paper is to investigate how seismic bracing can improve building safety and aesthetics from an architectural perspective. The paper is divided into four sections: a case study, providing suggestions, presenting the results and conclusion, and conducting a literature review.

LITERATURE REVIEW

Previous studies have also explored the use of aesthetics in seismic bracing design, with a focus on incorporating decorative elements into the bracing. Several previous studies have emphasized the significance of using seismic bracing as a retrofitting technique to improve building safety in earthquake-prone areas. For instance, Kunnath and Reinhorn (2008) demonstrated that seismic bracing can significantly decrease building damage during seismic events. A study by Chen et al. (2014) highlighted the effectiveness of using seismic bracing in retrofitting buildings to resist seismic forces. This research paper focuses on the integration of seismic bracing in building design to enhance both safety and aesthetics in Istanbul, Türkiye. The paper presents a case study of a 40-year-old apartment building and evaluates various seismic bracing styles, including planting, lighting, and Art Deco, using modeling techniques to assess their effectiveness in enhancing building safety and aesthetics and architectural functioning.

METHODOLOGY AND OBJECTIVES

Seismic events are a serious concern for architects and engineers working in regions with high seismic activity. Istanbul, Türkiye, is situated on a fault line and is often affected by earthquakes, with the 1999 İzmit earthquake causing significant damage and loss of life. As a result, architects and engineers have turned to seismic bracing techniques to enhance the safety and aesthetics of buildings. This paper explores the use of seismic bracing in building design, with a focus on Istanbul, Türkiye. The paper proposes various techniques to enhance the aesthetic appeal of seismic bracing, such as the use of natural

elements like plants to soften the visual impact of the bracing and art patterns to add a decorative element to the building's design. This research aims to develop a comprehensive understanding of how seismic bracing techniques can be effectively integrated into architectural design to enhance building safety and aesthetics.

CASE STUDY

The case study presented in this paper is a 40-year-old apartment building in Istanbul. The building has a reinforced concrete frame structure and is located in a high-risk seismic zone. The building was retrofitted with seismic bracing to improve its earthquake resistance.

DEFINE SEISMIC BRACING: DETAILS AND IMPORTANCE

Seismic bracing is a structural system that reinforces a building's ability to withstand seismic forces and minimize the risk of damage or collapse during an earthquake (Rinne et al., 2019). The system involves a combination of techniques, materials, and components such as cross braces, shear walls, and damping devices that work together to enhance the structural integrity of a building (Takewaki, 2018). The importance of seismic bracing cannot be overstated, especially in areas prone to earthquakes, as it helps to reduce the risk of loss of life and property damage (Baker et al., 2020). Buildings that do not incorporate seismic bracing are at a greater risk of damage and potential collapse, which can result in significant economic and social impacts. In addition, retrofitting existing buildings with seismic bracing can significantly enhance their earthquake resistance, thereby improving their safety and durability. Seismic bracing is not only crucial for the safety and protection of buildings and their occupants but also plays a significant role in mitigating the economic impact of earthquakes (Baker et al., 2020).

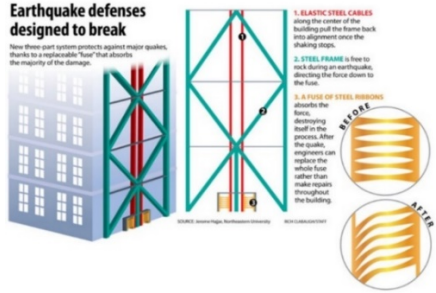

Figure 2. *Commonly Used Seismic Bracing Technique (URL-3).*

SEISMIC BRACING: TYPES AND EXAMPLES

The use of seismic bracing can prevent or minimize the potential loss of life and property damage in the event of an earthquake. This design and construction technique involves the use of various components and systems such as cross braces, shear walls, and damping devices to reinforce the structural integrity of a building and help it withstand the forces of an earthquake (National Institute of Standards and Technology, 2012).

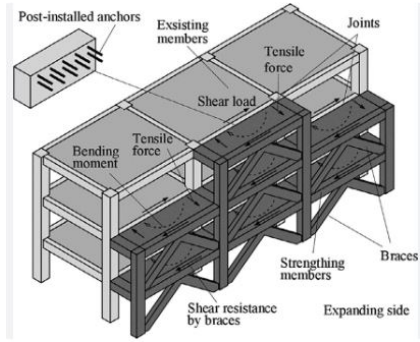

Figure 3. *Diagram Shows External Seismic Retrofit Forces Behavior (Pillai, S. U., & Menon, D, 2019).*

In addition, seismic bracing can enhance the building's resistance to seismic forces and reduce damage and loss of life. It is essential to consider seismic bracing in the design of new buildings and retrofitting existing buildings to

ensure their earthquake resistance (National Institute of Standards and Technology, 2012).

Figure 4. *Seismic Bracing Example applied on a residential building at Istanbul, Turkiye (URL-4).*

Seismic bracing is an important technique used to strengthen buildings and protect them from earthquake damage. It involves installing various types of bracing and support systems in order to enhance the structural stability of a building during a seismic event. The observation of negative aesthetics and visual pollution caused by seismic bracing on the building in Figure 4, despite its safety benefits, highlights the complexity of balancing form and function in architectural design. This realization is not typical to AI, as it requires human judgment and a nuanced understanding of the relationship between safety, aesthetics, and environmental impact. In this paper, the aesthetics development of building bracing retrofitting suggestions will be discussed due to its safety benefits.

ADVANTAGES AND DISADVANTAGES OF SEISMIC BRACING

The installation of seismic bracing can provide several benefits, such as increased safety for occupants and reduced damage to the building (ASCE, 2011). However, the process can be expensive and may require additional maintenance costs over time. It is important to weigh the benefits and drawbacks before proceeding with any seismic bracing project.

TYPES OF SEISMIC BRACING

There are various types of seismic bracing techniques available. Steel braces are one of the most used and can be bolted to the building's frame to provide additional support. Cross-bracing is another popular method that involves diagonal bracing members, while shock absorbers can help to dissipate seismic energy (Bolt, 2003). The choice of bracing type will depend on the specific needs of the building including major types of bracing: Vertical and Horizontal Steel Bracing. Vertical bracing systems are designed to provide stability to a building by resisting lateral forces that can cause it to sway or collapse. They typically consist of vertical elements such as columns or beams that are connected by diagonal bracing members. Horizontal bracing systems prevent buildings from twisting or overturning by providing resistance against wind or earthquake forces. They typically consist of beams, trusses, or cables that are placed horizontally across the building's frame (URL-4).

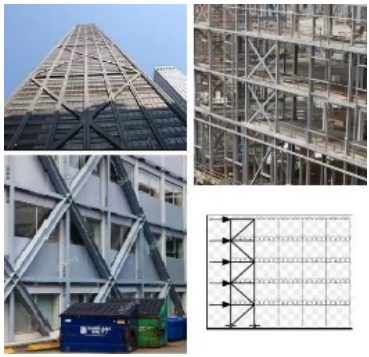

Figure 5. *Seismic Bracing Types Examples (URL-5).*

FAMOUS BUILDINGS with SEISMIC BRACING in ISTANBUL

The case study presented in this paper is a 40-year-old apartment building in Istanbul. Several buildings in Istanbul have undergone seismic bracing to protect against the damage caused by earthquakes. One example is the Bakirkoy 6-story building, which was retrofitted with a steel bracing system

to improve its seismic performance (Tasdemir et al., 2013). Another building that underwent seismic retrofitting is the Galatasaray University Library, which suffered significant damage during the 1999 Marmara earthquake. The retrofitting involved the installation of steel braces and cross-bracing to enhance the building's structural stability (Dicleli et al., 2006). The Sapphire Tower, one of the tallest buildings in Istanbul, features a unique seismic bracing system designed to mitigate seismic forces. The building's structural design includes outriggers and belt trusses, along with dampers and shock absorbers that help to absorb the energy generated by seismic waves (Karadeniz et al., 2011). These seismic bracing systems have been proven effective in reducing the risk of earthquake damage in high-rise buildings.
The building has a reinforced concrete frame structure and is located in a high-risk seismic zone. The building was retrofitted with seismic bracing to improve its earthquake resistance.

MODELING AND FEATURING SEISMIC BRACING STYLE AND ITS ARCHITECTURAL FUNCTIONING

The city of Istanbul is currently emphasizing the principle of safety and the importance of retrofitting buildings. To demonstrate the effectiveness of natural stone in external facades, an experimental sample apartment identified, and a three-dimensional model created. Seismic bracing is a crucial aspect of architectural design that combines aesthetics and functionality. The choice of bracing style is essential in ensuring the building's structural integrity during an earthquake while also contributing to the overall architectural functioning of the building. Architects can incorporate various seismic bracing strategies, such as cross braces, shear walls, and damping devices, to enhance earthquake resistance and enable greater flexibility in design and layout. Retrofitting existing buildings with seismic bracing systems can also enhance their earthquake resistance and safety, but it requires careful analysis of the building's current design and construction to ensure compatibility and effectiveness.

Figure 6. *Building's Location (URL-6).*

BUILDING MODELING AND RETROFITTING THE BUILDING WITH SEISMIC BRACING

The building in question is a five-story structure, with three stories above ground level and two basement floors. It measures 19 meters in length and 14 meters in width and an approximate height of 11 meters. The structural system utilized in the building is the solid slab and concrete beam system. This system consists of reinforced concrete slabs that are supported by reinforced concrete beams. The concrete beams are placed between columns and are connected to them using steel reinforcement and concrete casting, and its approximate age is around 40 years. In the event of a 6-magnitude earthquake, there is a significant risk of collapse due to the building's age and potential deterioration over time.

Figure 7. *Building Modeling.*

Before the application of seismic bracing, the building's model had a more simplistic and streamlined appearance, with clean lines and a sleek profile. However, after the addition of seismic bracing, the building's aesthetic appearance was negatively impacted. The added structural elements disrupted the building's original design, resulting in a more cluttered and visually busy appearance. The bracing system, which is often bulky and utilitarian in appearance, did not blend seamlessly with the building's original design, resulting in a jarring visual contrast. Overall, the addition of seismic bracing may have improved the building's structural integrity, but it negatively impacted the building's aesthetic appeal. Therefore, it is imperative to consider the aesthetic aspect of the retrofitting process in synchronization with safety measures. Retrofitting with seismic bracing not only enhances safety but can also be executed in a way that enhances the building's overall aesthetic appearance which also in addition can play a major role in the building's social and environmental adaptation (Hou, J., & Wang, Y, 2020).

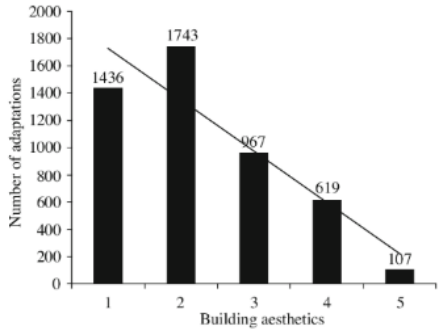

Figure 8. *Building Aesthetics and Enhancing Adoption (Yehia, S., & Elnokaly, A., 2014).*

The process can include designing the bracing elements in a way that blends seamlessly with the building's original design, resulting in a more visually appealing and safer structure. Overall, retrofitting with seismic bracing is a recommended strategy to enhance the earthquake resistance of existing

buildings, while also taking into consideration the building's aesthetic appearance.

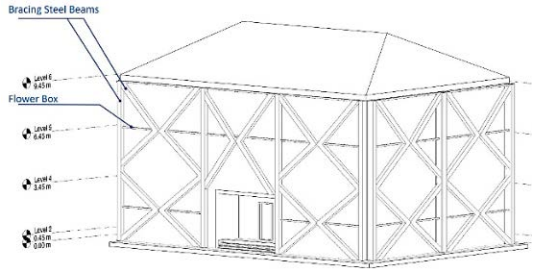

Figure 9. *Building Modeling with Bracing Applied.*

As part of the retrofitting process for a residential building, the cross external horizontal bracing technique was utilized on a 3D model. This technique entailed adding horizontal bracing elements, such as cables or beams, to the building's exterior to improve its structural stability and aesthetic appearance. The model was used to visualize the effectiveness of the retrofitting works and observe the positive impact on the building's aesthetics.

CONDUCTING STYLES and SUGGESTION of the BUILDING'S SEISMIC BRACING AESTHETICS

When it comes to seismic retrofitting aesthetics, the Art Deco style is known for its ornamental and geometric designs, and it can be utilized in seismic bracing to enhance the aesthetics of buildings while also providing safety. One way to incorporate Art Deco style into seismic bracing is through lighting.

Figure 10. *Art Deco Pattern (URL-7).*

By using decorative light fixtures with geometric shapes and patterns, the bracing elements can be incorporated into the building's lighting design, creating an attractive and functional solution. Additionally, Mediterranean style can also be utilized in seismic bracing. The style is characterized by its warm colors and natural materials, such as stucco and terracotta. By using these materials in seismic bracing, the building's structural elements can blend in with the surrounding environment and provide an aesthetically pleasing solution. Incorporating Art Deco and Mediterranean styles into seismic bracing can not only enhance the safety and resilience of a building, but also add to its visual appeal.

The building was retrofitted with seismic bracing to improve its earthquake resistance.

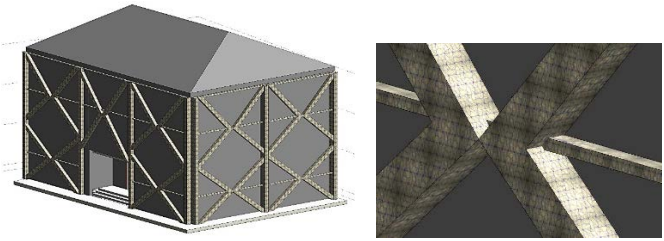

Figure 11. *Applying Art Deco Style on the Bracing.*

GREEN SEISMIC RETROFITTING

The use of bracing in planting facades is an effective method to enhance the seismic resistance of buildings while adding aesthetic value. Bracing systems,

such as cable and rod systems, can be utilized to support the weight of plants and ensure they remain in place during an earthquake. Moreover, planting facades can contribute to the thermal regulation of buildings, leading to energy savings and a reduction in the building's carbon footprint. Furthermore, the use of greenery in urban environments has been shown to have a positive impact on mental health and overall wellbeing. However, careful consideration must be given to the selection of plants and the maintenance of the system to avoid potential hazards such as falling branches or excessive moisture leading to damage (The University of British Columbia, 2021).

Figure 12. *Seismic Bracing to be used for Planting and Green Facades (URL-8).*

RESULTS

The results of this study demonstrate the potential benefits of seismic bracing for earthquake-resistant design. Retrofitting buildings with seismic bracing significantly increases their earthquake resistance and improves their structural stability, leading to a higher level of safety for occupants during seismic events. In addition to the structural benefits, incorporating decorative patterns on seismic bracing elements can enhance the aesthetics of a building while maintaining its structural integrity. Furthermore, incorporating greenery, such as planting vines, on seismic bracing can improve the visual appearance of the bracing while also providing additional

benefits, such as shading and improved air quality. Additionally, this can lead to a reduction in carbon emissions as plants absorb carbon dioxide and release oxygen during photosynthesis. Urban green spaces can help reduce carbon emissions by up to 12% in urban areas (Gómez-Baggethun et al., 2013). The design of seismic bracing elements can also be optimized to enhance their functionality while minimizing their visual impact on the building, improving both safety and aesthetics (Lee & Choi, 2018). In the case of the 40-year-old apartment studied in Istanbul, retrofitting the building with seismic bracing, and incorporating decorative patterns and greenery on the bracing resulted in a significant improvement in both building safety and aesthetics, demonstrating the potential benefits of seismic bracing in earthquake-resistant design.

CONCLUSION

In conclusion, this research paper highlights the importance of seismic bracing in earthquake-resistant design and its potential to enhance the architectural functioning, safety, and aesthetics of buildings. The implementation of seismic bracing styles such as planting, lighting, and Art Deco has shown significant improvements in building safety and aesthetics. Through modeling techniques, the effectiveness of these styles has been demonstrated. The integration of seismic bracing styles into architectural design provides a unique opportunity to enhance the safety of buildings while also improving their aesthetic appeal. In the context of Istanbul, where earthquakes are common, seismic bracing is a crucial aspect of building design that can significantly enhance the safety of buildings and their occupants. In summary, this paper demonstrates the potential for seismic bracing styles to be used effectively in architectural design to improve building safety and aesthetics, particularly in earthquake-prone regions like Istanbul.

SUGGESTIONS

Various techniques were employed to enhance the appearance of the seismic bracing, such as the use of plants to soften its visual impact, lighting to highlight its form at night, and the incorporation of Art Deco patterns into its design. These techniques added a decorative element that complemented the building's style. In addition to their aesthetics benefits, seismic retrofitting can play a critical role in improving earthquake engineering in the future by increasing the seismic resilience of existing structures. Retrofitting techniques such as base isolation and strengthening of critical components can help buildings withstand strong seismic activity, minimizing damage and potential loss of life. A study conducted by the National Institute of Standards and Technology found that retrofitting can significantly reduce the damage and economic losses caused by earthquakes (National Institute of Standards and Technology, 2017).

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From Power Plant to Energy Museum: Spatial Perception of Santralistanbul

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ABSTRACT

In this study, examining the spatial effect of old-new technologies combination in the utilisation transformations of industrial areas was examined. The study aimed to pave the way for the old–new concept provided to the visitors by approaching the industrial buildings that have become symbols of industrialisation and contemporary architecture within the context of handing down the historical identity phenomenon to the future in terms of space perception. The study focused on examining the transformation of the Silahtaraga Power Plant to Santralistanbul and investigating the qualities of the energy museum building. This work concentrated on examining the transformation of Silahtaraga Power Plant area, investigating the qualities of the energy museum buildings in the area, and evaluating them in the context of industrial archaeology. The study has three main constituents; literature review, fieldwork, and data analysis. The factors determining the spatial sense in the study were examined under ten sub-topics. One of the original aspects of the study is to conduct and comprehensively evaluate all three of the literature study, fieldwork, and data analysis within the scope of the study.

Historic industrial buildings, which reflect the old industry and technology and have lost their purposes, receive new functions through the change in their utilisation, allowing them to maintain their existence. The power stations, which were transformed into energy museums, are buildings that still preserve their equipment and reflect the production techniques and processes. This paper is among the few works that evaluate the energy museum transformed from an industrial building.

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KEYWORDS

Energy museum, Transformation, Adaptive reuse, Santralistanbul, Spatial perception.

INTRODUCTION

The industrial revolution first began in Great Britain, spreading to Europe and across the world. With the industrial revolution, the industrialisation process began, and industrial facilities were developed in numerous nations. From the late 18th century onwards, the reduction in the fabrication sector and the growth in the service and different economies resulted in the redundancy of countless industrial structures and areas (James, 2006). With the change in technology and the disappearance of some industry branches, these installations lost their functions and remained inactive. The locations of industrial installations became deposit sites in cities. For these historic industrial buildings and sites, much of their value lies in the evidence of change and development in societies they display (Foster, 1995). Today, architecture itself has become more concerned than ever with the memory of space and the inscription of temporal dimensions in spatial structures (Lorenz & Huyssen, 1996). Building conservation is a means of preserving our physical cultural heritage for future generations, its historic, aesthetic, scientific and social value (Foster, 1995).

The lifestyle of the past, the sense of aesthetics, constructive art, and the traces of customs and traditions are handed down to the next generations through historic buildings. In this sense, protecting landmark buildings, which are the witnesses of the past, means protecting the link between the past and the future of society and handing down the material and nonmaterial values of the natural and cultural environment to the future by claiming them (Feilden, 2003). The reasons for the preservation of cultural values are aesthetic - artistic value, tourism income, being a social product, and ensuring that the heritage from previous generations is passed on to future generations (Kesavaperumal et al., 2020).

In general, the best way to preserve historic buildings and sites is to keep them in active use. For the vast majority, this should mean economically viable benefits for their survival. Therefore, the scope and acceptability of possible services should often be an important consideration regarding the future of buildings in protected areas (Circular 8/87, 1994). Abandoned industrial zones contain a contemporary figurative and social essence. Often there stays a social bond, mutual liking, and honor communicated by the people, sustained even after abandonment (Cenci, 2018).

Priority has been given to upgrading these disused industrial buildings and areas to revitalize them with new roles and architectural shapes (Cenci, 2018). The significance of industrial spaces in providing social infrastructure at the urban scale is undeniable. Due to the conditions of the time, various social areas may be needed to meet user needs. In this sense, it is thought that the use of structures with historically different functions positively affects the social infrastructure (Ismailoglu & Sipahi, 2021).

In this study, the spatial effect of gathering old industrial technologies and new technologies together in the utilisation transformations of industrial areas was examined. Historic industrial buildings, which reflect the old industry and technology and have lost their purposes, receive new functions through the change in their utilisation, allowing them to maintain their existence. This transformation means that old technology meets new technology; the old meets the new; and the past meets the future.

The study aimed to pave the way for the old–new concept provided to the visitors by approaching the industrial buildings that have become symbols of industrialisation and contemporary architecture within the context of handing down the historical identity phenomenon to the future in terms of space perception. The buildings transformed from industrial buildings primarily function as museums. However, only a few of them were

transformed into energy museums. This study thus aimed to evaluate the energy museums transformed from industrial buildings. The scope of the study is restricted to the buildings that once functioned as energy generators and then became energy museums after being re-functioned in Turkey. Therefore, primarily the energy museums in Turkey were detected. The example chosen is that the sole structure, Santralistanbul, which was once used as a power generation factory is now being used as an energy museum.

The study examines the historical industrial architecture phenomenon used by adaptive reuse. In this context, the research's main problem was how the industrial building's potential could be used more effectively and sustainably by preserving and refunctioning the historical and cultural structure. So research hypothesis is that architectural values could be preserved and transferred to future generations.

LITERATURE REVIEW

CONSERVATION AND ADAPTIVE REUSE

De-industrialisation is a phenomenon that has affected many regions in complex ways during the 20th century (Auclair & Fairclough, 2015). Industrial buildings and areas are traces of history, and each trace is important. It is undesirable to abandon historical rural buildings, as they determine the characteristic identity of the settlements they are located in and at the same time are concrete documents of the social life and cultures of the past periods (Akturk and Ediz, 2020). The Nizhny Tagil Charter defines industrial heritage as consisting of the remains of industrial culture which are of historical, technological, social, architectural, or scientific value (TICCIH, 2003). Farmhouses, factories, stations, workshops, and mining sites are some of the heritage sites that can be studied under the heading of industrial heritage (James, 2006).

Their conservation has in many cases been instigated since the inauguration of The International Committee for the Conservation of Industrial Heritage (TICCIH) in the United Kingdom in 1979. The dereliction of industrial buildings due to the emergence of new technologies raises the issue of future uses for them (Vehbi et al., 2019). Industrial buildings and areas, which are important indicators of a country's social and cultural past, lose their functions primarily due to rapid technological advancements. When the protection of industrial heritage buildings and economic approaches are combined, we encounter the concept of re-functioning (Edwards & Llurdes i Coit, 2017). By this means, it is desired to draw attention to the decrease in energy raw materials, which is the most crucial problem in the world, and to raise awareness. By this means, it is desired to draw attention to the decrease in energy raw materials, which is the most crucial problem in the world, and to raise awareness.

For many industrial buildings, their original functions may have ceased altogether, thus requiring conversion to avoid the problems of disuse, destruction, and decay (Foster, 1995). This necessity gains importance in reducing the damage to the natural environment by making good use of the existing building stock and maintaining cultural and historical continuity (Aydin & Yaldiz, 2010).

The TICCIH states the aim of adaptive reuse of industrial heritage as the protection of buildings from becoming old and unusable and preventing their possible collapse. Industrial heritage has a social value that provides an important sense of identity, scientific and technological value in the history of construction, manufacturing, and engineering and has a considerable aesthetic value for the quality of its design, architecture, and planning (Url-1). The opinion of taking over these buildings and turning them into signs of renewal has become an appealing choice for both stakeholders and society. Historical industrial buildings are tangible elements that transfer the

economic and technological conditions, cultures, and social lives of the societies they belong to the next generations, as well as being a source for the history of architecture. Due to the developing technologies and changing social needs over time, structures also have to change (Maxwell 1997). Adaptive reuse has been successfully applied in many types of facilities. It is possible to see examples of culturally significant industrial buildings' adaptive reuse. These culturally important structures characterize other looks of cities as living observers of the production culture in those cities (Babutsali Alpler et al., 2020).

An industrial structure or area may represent the splendor of one or more past and the social or financial assistance that the land and its residents have made regarding heritage and communal identity. This historical significance should be seen as an asset, a support instrument for evolution, not as a limitation that needs protection and redevelopment. Therefore, once an area has been specified, it is essential to find a place in a regional dynamic and remain involved as long as the community exists. To achieve this, the area needs to have a symbolic identity, and as a result, the desire to invest in the building is inspired by a program in line with the needs and expectations of the community. Historical understanding of the area and symbolic ownership of the site is essential for a sustainable, material change (Cenci, 2018).

As an option for pure conservation, preserving abandoned industrial areas for use as museums can be economically and socially possible. Yet this choice is suitable especially for old industrial structures. For instance, disused factories, mine structures, and mills are ideal living models of old-fashioned work practices, if not extinct. The abandonment of historical industrial buildings, which have important values for the society, and their idle state, eliminates the local people's sense of belonging and experience over time (Ahunbay, 2010).

FROM INDUSTRIAL SETTLEMENT TO ENERGY MUSEUM

Throughout its growth, architectural elements in the industry were characterized by technological and financial consequences. The industrial revolution led to technical inventions connected to the raised production capability of the industry (Cenci, 2018). When industrial buildings are physically examined, they have a structural installation, spatial order, and interior atmosphere that distinguish them from other buildings. The main reasons for this differentiation are the technology of that period and the function that shaped the building. The appearances of industrial structures differ mainly from famous typologies of ancient heritage (Giuliani et al., 2018). Overall, they are unique, both in height and shape (Babutsali Alpler et al., 2020). At the beginning of the 20th century, inventions related to the improved consumption of electricity, oil, and chemistry were additionally in the industry. Factories have become marks of industrial architecture (Cenci, 2018).

Their wide-open spaces and volumes are significant parts of industrial structures such as power plants (James, 2006). The symbols of the power station industry are big machines and vast crane bridges. Many of these structures have escaped demolition as survivors of the battle and have experienced technical transformation, urban regeneration, or changes in international finances (Crisman, 2007).

In the beginning, the perception of the industry was optimistic. It imaged improvement and modernity, despite plant employees' dirty and tiring work (Cenci, 2018). However, by the mid-20th century, industrial buildings were seen as a symbol of poor working conditions and slow technology (Neaverson & Palmer, 2012). Today, the general thought has grown to the point that industry should not leave its preservation work because the abandoned industrial structures significantly contribute to urban renewal and the visual quality of a city (Babutsali Alpler et al., 2020).

To a different degree, contemporary cities are filled with a messy and harmful industrial area that stems from previous manufacturing movements. The remnants of industrial manufacturing have often been converted into contemporary museums, artistic platforms, educational buildings, and offices through different cleaning and transformation processes and reconstruction (Crisman, 2007).

Museums are significant among these because they constantly hold new exhibitions and have visitors (Stratton, 2000). The use of industrial heritage areas, which have lost their functions as museums, aims to constitute historical consciousness and the past to contribute to the future by claiming society's shared values. By the ICOM Statutes, adopted by the 22nd General Assembly in 2007, the current museum definition: A museum is a non-profit, endless organization for the benefit of humanity and its evolution, available for people, which develops, preserves, studies, and displays the heritage of society and its atmosphere for the objectives of education and research (Url-2).

Industrial areas' adaptive reuse for exhibiting modern art grew in the 1960s and continues to grow (Crisman, 2007). Andreas Huyssen may have attributed the wish to maintain left industrial areas as part of the memorial culture and the present desire with the past, which he explains is a response to the accelerated momentum of modernization, as an attempt to claim a sense of time and memory (Lorenz & Huyssen, 1996).

During the last decade, countless empty industrial buildings in the world have been turned into cultural spaces, both formally and functionally. They often offer excellent places in the metropolitan center and appropriate physical requirements for museum function, including big and unrestrained areas for flexible hall space and public assemblage, a ton of natural light and high tops for showing extensive painting, and structurally stable

constructions that may be recycled better economically than new building (Crisman, 2007).

It is essential to respect that the method of making a tabula rasa from a retired industrial area converts it into natural heritage while changing the harmful notion of an industrial area into a tangible part of heritage (Cenci, 2018).

The industrial areas that have lost their functions are re-functioned with many different functions. Some of these areas maintain their function as museums. Only a few of these industrial buildings, which functioned with contemporary art, selected the energy topic as a major theme. The transformation of these areas into museums dedicated to the things they once produced is fundamental in terms of witnessing the traces of the past. The energy installations, which have a unique industrial heritage quality and accept visitors as if they were in a museum, constitute a basis for comparing the past, the present, and the future.

Energy museums are places where individuals of all ages participate in educational activities, which can be considered a purpose for energy museums. In today's world, where discussions on energy continue, pollution increases rapidly due to technology, and world politics is focused on energy raw materials, the topic of energy has gained universal importance. The objective of energy museums is to highlight the significance of energy through industrial production materials and reflect the impact of energy on the development and transformation of civilisation through interactive areas.

METHODS

This work concentrated on examining the transformation of Silahtaraga Power Plant area, investigating the qualities of the energy museum buildings

in the area, and evaluating them in the context of industrial archaeology. The examination has three significant components: literature study, fieldwork, and data analysis.

Literature study: In the literature, it is seen that there are very rare scientific studies on the refunctioning of the industrial power plant heritage to Energy Museum in the historical. There is no study that examines Santralistanbul in the Golden Horn district for sustainable tourism from the perspective of spatial perception. The literature study was performed similar to the area survey. The main concepts and sub-concepts that constitute the subject of this study were discussed. Within the scope of this study, internationally valid legislation and regulations on restoration and preservation were also examined. Within the scope of international conventions on historical sites, legal regulations such as the Venice Charter (ICOMOS, 1964), Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1972), The Declaration of Amsterdam (ICOMOS, 1975), Convention for the Safeguarding of the Intangible Cultural Heritage (UNESCO, 2003), Charter for The Conservation of Historic Towns and Urban Areas (Washington Charter) (ICOMOS, 1987), International Cultural Tourism Charter (ICOMOS, 1999), Vienna Memorandum (UNESCO, 2005), The Valletta Principles for the Safeguarding and Management of Historic Cities, Towns and Urban Areas (ICOMOS, 2011) cover important criteria for reuse and have been examined in detail in order to create the legal framework of the study.

Fieldwork: Two architects specialising in architectural design and conservation carried out this in a 3-year period between 2019 and 2022 with some site visits. It was performed in the following phases: recording observations, including photos, and notes on areas.

Data analysis: Data gathered from the fieldwork were studied regarding architectural components (including location, setting, design, architectural

parts, structural strategy, and building methods), machinery, structure changes, material pollution, and structural damage.

Data were collected through on-site observation, analysis of relevant documentation during multiple site visits. One of the original aspects of the study is to conduct and comprehensively evaluate all three of the literature study, fieldwork, and data analysis within the scope of the study.

ANALYSIS OF THE CASE STUDY: THE TRANSFORMATION OF SILAHTARAGA POWER PLANT

CASE SELECTION

Within the scope of the study, Santralistanbul, which was transformed into a museum in Istanbul, was selected as the study's sample due to its place, role, and historical quality in the historical process in terms of industry and trade. The first function of this building was to generate energy. After losing its function, it was transformed into an energy museum. Silahtaraga Power Plant is an emblematic building of a historical period characterised by technological progress and economic and political conditions. The historical background, the re-functioning process, and the situation today of Santralistanbul chosen from Istanbul were evaluated, and the interventions to the building were determined.

SILAHTARAGA POWER PLANT

The Silahtaraga Power Station was established in 1913 to provide electricity for lighting the streets and the palace, the consumption of residences and industry, and the tramway plant. The factory, which was the first thermal power station in Istanbul and Turkey, provided electricity for Istanbul on its own. With the decision dated 1983, the production had to be stopped because the technical system of the station had become old; raw material could not be provided; the stream from which cooling water was provided

was polluted; technical equipment such as machines and appliances could not meet the requirements of the period; the production was not economic anymore; and the station was causing pollution around the Golden Horn (Neziroglu & Yilmaz, 2013). Since they witnessed the history of the city and had an essential architectural identity, they were recognised as industrial and cultural heritage and put under protection according to the decision of the Ministry of Culture's Cultural and Natural Heritage Preservation Board.

The engine rooms numbered 1 and 2, considered to have been built in 1913 and 1921, were transformed into an energy museum (Fig. 1). The machines and equipment were preserved. The turbines in this building were preserved, and they were being used to exhibit the power-generation process. The museum exhibits the turbine generators with AEG, Brown Boveri, Siemens, and Thomson Houston brandings, which were the most essential elements of production in the Silahtaraga Power Station and reflect the typical characteristics of the advanced technology of that period to the visitors. The escalators, podiums, and steps that were added later to the building offer an opportunity to watch these turbines from different angles. The Santralistanbul Museum of Energy, a field containing 22 interactive units and bringing entertainment and science together, was established to allow visitors to generate their own power, touch thousands of volts of electricity without any hesitation, and perform many more experiments; the Control Room, where the power generation and distribution to diverse neighbourhoods of Istanbul were controlled, is preserved with its detailed command devices and appliances. The energy museum exploits the drama of the internal spaces and skilfully contrasts old and new elements.

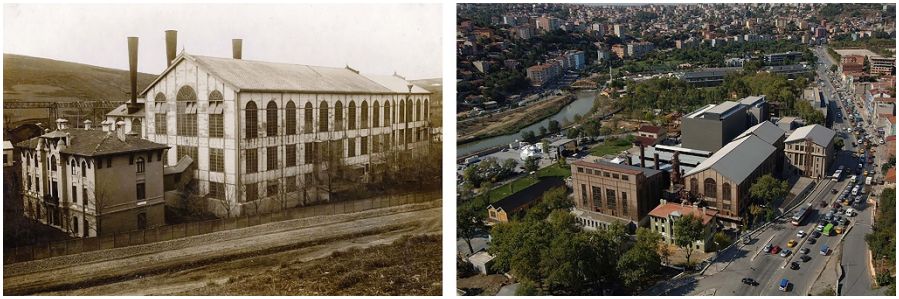

Figure 1. *From power plant (left) to energy museum (right) (Url-3).*

DATA COLLECTION

Santralistanbul presents three principals to lead other transformation projects in terms of designing a method:

– Utilizing history as a lever by combining an industrial culture with the protection and usage of the industrial site as a symbol,

– Reversing a place's harmful notion and famous thought by making cultural affairs in its old place,

– Creating a modern image in the sight of heavy pollution.

While re-functioning was performed on the structures, which are, in fact, the factory's machines, it was attempted not to impair the existing integrity and aesthetic of the building with the concern of touching the building as little as possible. It was also aimed at creating flexible and transformable places. Structural elements inside the buildings from the factory period, machines, machine bases, and all the parts have survived.

In the museum, the chaotic situation caused by the original functions of equipment was fixed, and it was transformed into a science and entertainment area where several experiments are performed. The museum offers visitors the ability to attend educational programs with the themes of electricity and energy. The visitors were informed during these programs about the history of the Silahtaraga Power Station, the sources of energy

down the ages, energy-saving, and the methods of obtaining electricity. It offers the ability to practice with electricity-themed game units in the Energy Play Zone, attracting the attention of all age groups. These programs are significant for the promotion of the unique identity of the factory.

This resulted in a consistent series of transformations that radically altered the appearance of a prominent one-time industrial site. Their rough and unfinished condition evokes history. The tension between the two languages creates a material connection and solid aesthetic knowledge. Santralistanbul guests are instantly encountered with the material facts of the last industrial processes, where their textures and artifacts are not upgraded or maintained for the sake of memories but are preserved for educational objectives and exist amid the daily life of the areas, strange reminders of the activities and culture that once dominated the power plant complex and the entire Golden Horn region. However, the museum differs from the others in its architectural techniques, displaying other perspectives on industrial dirt and leftover materials.

The selected case is a significant example of industrial areas with metaphoric significance, reminiscent of several industrial zones. Factors determining the spatial sense in the study will be examined under 10 sub-topics through the example of Santralistanbul. These factors are the user's visual perception, lighting, material, circulation, security, floor, ceiling, accessibility, technological use, and guidance.

Visual details:
Every detail of the business; movable/immovable production machines that have remained original and retained their original function; overhead crane mechanisms; warning boards; and even tool sets are exhibited in the re-functioned museum (Fig. 2) (Fig. 3). Particularly in areas where the unique identity was displayed by conserving the production equipment, the noise, every technical element, and the natural surroundings, it has become a

location that provides tourists with knowledge about the history of that time, such as workers' daily lives. The minimally revitalized interior, with its vast machinery, oxidized steel frame, and diverse pipes, raises the viewer's understanding of contrasts in technology and culture.

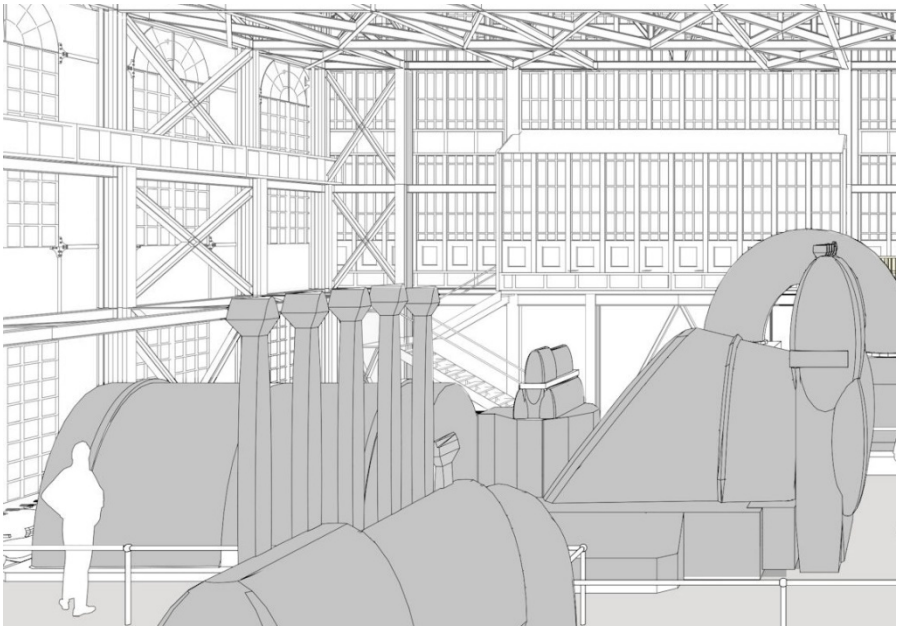

Figure 2. *Old production machines (Url-4).*

Lighting details:

This structure receives excessive sunlight through the large windows, except on the ground floor (Fig. 3). The ground floor is lit with artificial lights. A different atmosphere showed up with the use of blue and red artificial lighting. The coloured and hidden lights influence the glory of the objects. Colour-changing lights were placed between the machines, and at the entrance, attractive hidden lights were used under the metal grate.

Material details:

The steel fortifications made with contemporary materials were painted a different shade of brown, revealing the distinction between the old and the new (Fig. 3). On the floors of the corridors leading to the control room, less-processed wood was preferred, and for the balusters, glass was used. Furthermore, it was revealed that these were added later. The blank spots on the panels were shown by using transparent plexy material.

Figure 3. *Visual (left), lighting (centre) and material (right) details.*

Circulation details:

There are escalators whose mechanisms can be clearly seen when entering the place where coal bands slide horizontally.

Another critical circulation intervention in the place is the sightseeing pier, hanging 12 meters off the ground to allow visitors to perceive turbine-generator groups comfortably and to wander (Fig. 4). The sightseeing pier was designed to let visitors see the machines easily, and it was newly constructed on a steel structure with a wooden floor and glass balusters (Fig. 5).

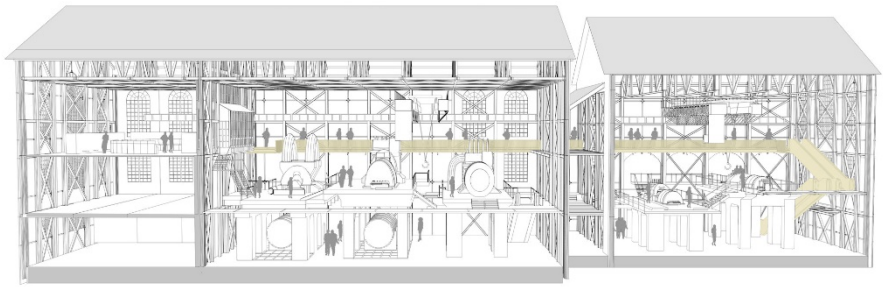

Figure 4. *The sightseeing pier (Url-4).*

Security details:

During the re-functioning, the steel carcass external skin of existing structures and the scissor system roof were fortified with thin steel according to the earthquake code. The steel fortifications on the top and the walls affected the volumetric perception of the place, and the excessive steel intervention on the roof caused the volume of the building to become narrow perceptively.

In addition, balusters were built on every circulation area, and to prevent objects from falling, a safety net system was constructed (Fig. 5).

Floor details:

To close the level gaps on the floor; concrete, metal grate, wooden-steel stairs, and wooden platforms were used partly. The ramps and stairs were renewed very similarly to the originals. It is seen that there are four types of tiling intervention. The interventions to the tiling were as follows: preserving it as it is, renewing it with a material similar to the existing material, adding tiling that did not exist before at some parts, and obliterating the existing tiling (Fig. 5). The ceramic diamond tiling around the exhibited production structure was preserved, and by not completing the missing parts, it was referenced to the past of the building. The metal parts of the tiling, which

were in the exact location on the floor before the transformation but damaged in time, were renewed using a different colour.

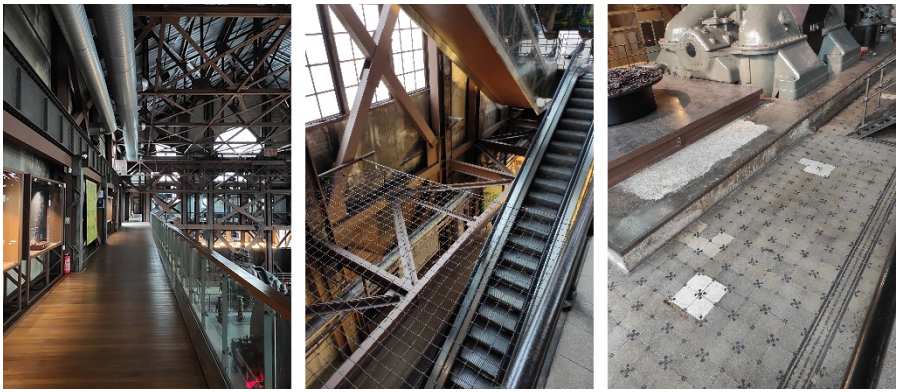

Figure 5. *Circulation (left), security (centre) and floor (right) details.*

Ceiling details:
Installation pipes and electric cables were not hidden and were left exposed with a naked structure (Fig. 6). Through the air ducts, air circulation to the place is provided by flanged blow mouths. Industrial elements such as lights left exposed and air ducts contributed to the unique identity of the building.

Accessibility details:
An elevator was added to the building, and wheelchairs were allowed to pass with the ramps (Fig. 6). Another accessibility intervention in the place is the sightseeing pier, allowing disabled visitors to perceive turbine-generator groups comfortably and to wander (Fig. 7). Disabled visitors can experience all buildings without any help, thanks to the elevator, inclined ramps, and sightseeing pier.

Technological use details:
The industrial background of the building and its situation today is shown on the digital displays placed on the wall at the entrance and on the floor. Also,

the user-interacted digital displays in the control room and at the walking port give information about the building (Fig. 6).

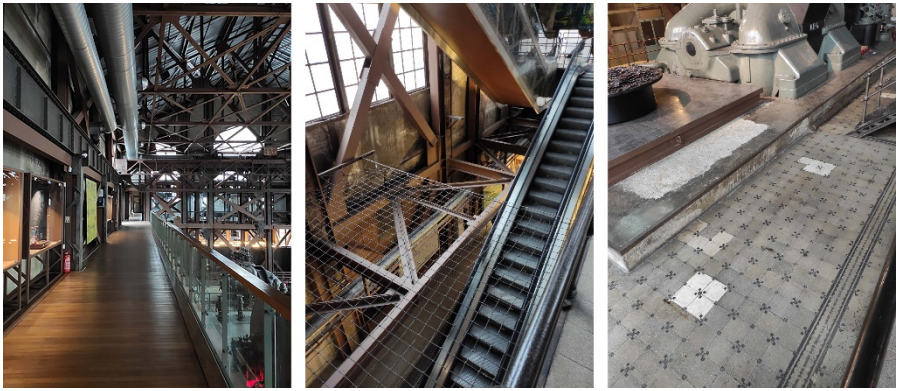

Figure 6. *Ceiling (left), accessibility (centre) and technological use (right) details.*

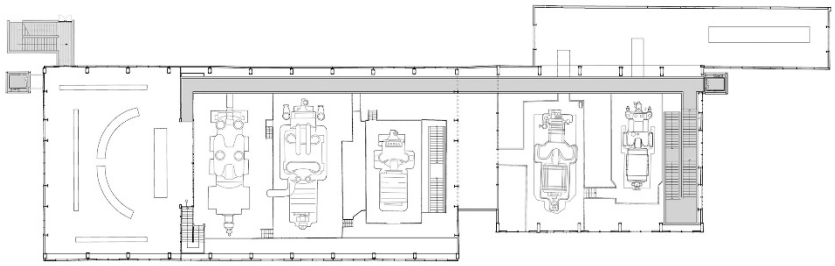

Figure 7. *Accessibility parts on the second floor (Url-4).*

Guidance details:

There is some vagueness related to guidance. Due to the café and standard fields, that the visitors encounter as soon as they enter, it was observed that finding direction gets difficult.

DISCUSSION AND CONCLUSION

In this study, the criteria establishing the spatial perception of Santralistanbul were identified by evaluating the existing structures and historical data and assessed using a literature study. This literature study could have been better in establishing adaptive reuse priorities in the study area. Thus, the literature study was quantified using fieldwork and data analysis methods to be objective while making the spatial perception of Santralistanbul decisions. Therefore, the method used in this study is expected to provide guidance to future research and practice worldwide to detect spatial perception and planning decisions of adaptive reuse.

Adaptive reuse of historical industrial buildings' policies to be developed for the future of the settlement can only be successful if the internal and external factors affecting the settlement are taken into consideration. It is very important that this situation be taken into account in future reuse projects. It is impossible to evaluate Santralistanbul's goals of preserving buildings and spatial perceptions of its cultural and industrial heritage for the future and reviving them independently of each other and from high-level design policies and decisions. Conservation and adaptive reuse policies should provide insights on how to build strengths, maximize opportunities, reduce threats, and eliminate weaknesses.

It is vital for people who use and visit the re-functioned building to see the traces of the past and be aware of its historical identity. However, it isn't very likely whether such sites have the potential to translate the benefit to society profitably. The answer is that some areas have a more excellent heritage significance than other areas. Still, many have a rich history that includes part of the originality of residents, cities, or provinces. Within the context of the relationship between place and time, the transformed buildings connect us to both the past and the future. The proposed new use at Santralistanbul reflects contemporary culture, valuing architectural heritage, and promotes a more robust environmental understanding.

When informing about the functioning of the factory and the technological situation of the period in terms of electricity, several recordings and information boards were used excessively. From the introduction of energy sources to the generation and productive use, all the links in the chain are presented to visitors. The power stations, which were transformed into energy museums, are buildings that still preserve their equipment and reflect the production techniques and processes. The goal of the energy museum is to reveal the historical layers of the building to visitors.

Within the scope of the Venice Charter, in the additions made during the re-functioning process, modern techniques were used, different colours were used, and the distinction between the old and the new was revealed. The industrial background, which can be clearly perceived at the front of the building, can also be perceived from the interior. Santralistanbul is a critical industrial and cultural heritage in Istanbul. These kinds of facilities are the memory of the cities. The restoration of this facility, sharing its story through writings and pictures, and planning the environment to make it suitable for cultural events are extremely valuable for Istanbul.

Factors determining the spatial sense in the study had examined under 10 sub-topics through the example of Santralistanbul. These factors are the user's visual perception, lighting, material, circulation, security, floor, ceiling, accessibility, technological use, and guidance. All these factors examined showed that during the conservation and adaptive reuse of historical industrial Santralistanbul buildings, it was aimed to clearly convey the distinction between the old and the new to the visitors, and design decisions were taken in that direction. The technical details of the changes made to the structure and how the least intervention to the structure was made can be seen in graphic explanations (Fig. 2) (Fig. 4).

The interior setup of the industrial heritage buildings was planned to allow flexible uses instead of the strict uses in the factory period, to be entertaining, and to give room to users from every age group and every profile. The effects in structural and interior in terms of reuse were calculated by considering the interior and exterior characteristics of the industrial buildings chosen from Istanbul. It is believed that it will be helpful in the studies in this area with similar practices.

In addition, we hope that this examination will guide further study and analysis of similar subjects, particularly in Turkey, and help global study.

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Heritage of Arabic Geometry: Al–Samarqandī's Work in Fundamental Geometric Theorems

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ABSTRACT

The manuscripts of Arabic scientific heritage are full of invaluable knowledge which was lost or neglected even by Arabic speaking scholars. Moreover, the authors of the available manuscripts were not studied enough by Arab scholars even though their work had established the basics of different modern sciences, beside the fact that methods and terminologies used in Arabic manuscripts are still used today.

In this paper we shed light on the work of one of the founders of the science of geometry in the Arab heritage, Shams al-Samarqandī , namely Ashkāl al-Tā'sīs, which is translated into English as Fundamental Theorems, that is considered as one of the early writing, in which different basic geometric propositions and their properties are explained. By studying and analysing the information he presented, we try to show the importance of his work, demonstrating some salient examples that present the paramount quality of al–Samarqandī's work for the Arab heritage of geometry. Discussing his methodology and comparing it with the scientific facts established nowadays in geometry, the results show, that he was a pioneer scholar and mathematician of the scientific heritage written in Arabic whose work should be studied more carefully and thoroughly to understand his influence on the science of geometry with a manuscript of less than thirty pages, forming the current used terms nowadays in Arabic geometry. Finally, the conclusions and results suggest some recommendations to preserve and present the rich scientific heritage written in Arabic.

KEYWORDS

Geometry, Arabic Mathematical Heritage, Geometrical Theorems or Propositions, Al–Samarqandī, Qaḍī Zādih.

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INTRODUCTION

The manuscript entitled in Arabic Ashkāl al–Ta'sīs fī al–Handasah was written by Shamsuddīn Muḥammad ibn Ashraf al-Ḥusaynī al–Samarqandī in the second half of the 13th century. If we translate the title literally from Arabic to English the title will be (Basic shapes in geometry), but when examining the work it is clearly means: fundamentals theorems or propositions in geometry, which is widely accepted by the scholars who translated the work into English (De Young, 2001). On the other hand Fazlıoğlu in the paper (The Samarqand Mathematical-Astronomical School: A Basis for Ottoman Philosophy and Science) debate that the actual meaning is basic forms of the existent (Fazlıoğlu, 2008). It is considered one of the early and most writings in the heritage of geometry written in Arabic (Fazlıoğlu, 2007). al- Samarqand had discussed in it the basics for establishing the fundamental theorems of Euclid's plane geometry. The text presented, explained, and discussed 35 of the main important theorems of the plane geometry.

Shamsuddīn al-Samarqandī was born in the middle of 13th century in Samarqand, which is nowadays the capital of Uzbekistan. His death date is between 1302 and 1320 since there is no agreement on his exact date of death. He authored books in different fields, namely, Theology, Logic, Mathematics and Astronomy. His works were the main references taught in the madrasas (schools) in the Arab world for many centuries (al-Zirikli, 1926) and (İhsanoğlu, 2004). After studying the standard curriculum in the basic religious sciences, al–Samarqandī also mastered logic and the science of geometry. One of the clearest characteristics of his works is the idea of understanding the existent due to geometrical forms.

Moreover, al–Samarqandī wrote a commentary (sharḥ) on Naṣīr al–Dīn al–Ṭūsī's (Taḥrīr), a "Recension of Ptolemy's Almagest" in the field of theoretical

astronomy. The Arabic title is Al-Tadhkira fī ʻlm al-Hayʼa. Unfortunately, many of al–Samarqandī's astronomical works have not been studied yet. Al–Samarqandīʼs most influential work was his different textbooks in which he provided various information about the works of scholars prior to him, thus he greatly impacted future generations, who studied those books.

His geometrical work entitled Ashkāl al-Taʾsīs (hereafter AT) contains 35 theorems or propositions from Euclid's Elements; the first 30 ones are strictly geometrical, while the last five deal with what is called "geometric algebra". It was the textbook used for students of middle level in the Arabic madrasas. Later it was supplemented most often with Qaḍī Zādih al-Rūmīʼs commentary. For many centuries in Arabic schools both before and after the ottoman era the work was not studied thoroughly by Arabic speaking scholars. Although AT formed the reference for many centuries in Arabic schools, the work was not studied thoroughly, even countries such as Syria and Iraq used to teach and research using Arabic language, especially that Arab academies in Damascus and Cairo claims to study the scientific heritage written in Arabic, it was not well presented in the modern Arabic scientific literature. This paper will shed light on al-Samarqandīʼs work, demonstrating its contents and methods, showing its importance in shaping the heritage of geometry in the Arab world. We are neither verifying the tract, nor translating it into English since this work have been done previously, our focus is the comparison between his Arabic terminology and nowadays used terms in the science of geometry, and the methods he used to prove his theorems and the implemented methods recently in Arabic school courses, for example the Syrian new curriculum teaching mathematics started to use English terminology despite of the claims of teaching totally in Arabic language.

MANUSCRIPT

The version studied in this paper was obtained as a digital format, scanned from the original manuscript saved in Egyptian book house Cairo, Dār al-

Kutub, riyāḍ 826, under the number 1571 which dates back to 1650-1651 and contains of 20 pages and a hard cover (URL-1). We can notice the comments on this text of Qāḍī Zādeh al-Rūmī (d.1436), director of Ulugh Beg Madrasa in Samarqand, who wrote a very popular commentary on this manuscript later, explaining by his comments on this tract of al–Samarqandī. Nevertheless, we don't know if the original manuscript contained drawings or figures, we assume that those figures on the copy studied in this paper were also added by Qāḍī Zādeh al-Rūmī since they were in the margins with his comments.

METHODOLOGY

The methods we followed in this paper did not aim to edit the manuscript rather than presenting the contents of the manuscript, discussing the author's methodology used in his work, then analysing and checking the correctness of the information the author included in his work. In addition to that, the paper uses a comparative method to study the similarities and differences between the terminologies the author used, and nowadays used terms in geometry in Arabic language.

Finally, the results are related to the influence of the manuscript on the geometric heritage in the Arab world, and the future possible uses and development of the methods and techniques he used to prove his hypothesis.

VERIFICATION OF THE MANUSCRIPT

The commentary of Qāḍī Zādeh on Ashkāl al-Taʾsis was edited by Muḥammad Souissi (1984) in Arabic language. This is the only version studied and tried to recover into modern Arabic scientific language an important and extra ordinary treatise. The objective of this verification and recovery was not to present the value of al–Samarqandī's work but rather than introducing it to Arabic readers using modern Arabic language. Souissi's

work did not discuss the importance of a work that established the basis of geometry scientific heritage written in Arabic. Moreover, in his book Souissi did not analyse the methodology and mathematical approach of al–Samarqandī, which he followed in the text of his manuscript. Analysing and discussing the afore-mentioned characteristics of the original treatise may form a part of the scientific heritage itself.

BIBLIOGRAPHICAL WORK

Although the work of al–Samarqandī contributed to the establishment of geometry science in the Arabic written heritage, it did not draw the attention of modern Arab scholars. Looking up the literature, we can find very few articles which deal with this work. Most of the papers are sort of biography of al–Samarqandī, as (Čelebī, 1941), and (al-Sharīf, 1985) for example. Other papers are an inventory of his all manuscripts as (Brockelmann, 1943) and (Dilgan, 1980). We have also found very few papers giving an overview of al–Samarqandī's manuscript: AT and the later scholars who commented on it as (Bingöl, 1991). Only few papers presented and discussed al-Samarqandī's work given in AT, demonstrating the invaluable heritage he left as basis of geometry in the history of Arabic science heritage, for example by (Dilgan, 1960), and (Bağdadlı, 1955) tried to show the importance of his work, but still there were very few papers in English (Dilgan, 1980) and (De Yong, 2001), and even less studies in Arabic discussing and clarifying the importance of his work.

PRESENTATION AND DISCUSSION

In this chapter we present a summary of the manuscript's contents, then we examine the information presented and proved by al–Samarqandī through various examples in the book, and finally we will show some errors and discuss the reasons behind, and suggest possible corrections of them.

SUMMARY OF CONTENTS

The structure of al–Samarqandī's manuscript appears to be in a gradual hierarchical way, distributing the basic geometrical theorems into 35 ones. He began presenting information about lines and angles, then studied triangles, and from that information he moved to explain polygons. Nevertheless, he did not discuss the establishment of circles. On the contrary he used the properties of circles to prove some of his ideas in the afore-mentioned topics. It seems that he considered the theorems on circle and arcs as well established and proven with well-known geometrical properties.

The contents are distributed as following, from theorem 1 to 3 discussed lines and angles, 4 to 8 the triangles and their congruence, then 9 to 12 discussed again lines with angles focusing on the establishing of perpendicular line from a point out of a straight line or inside it. Using the previous information he discussed from theorem 12 to 20 the triangles and their angles, and moved to parallel lines and parallelograms from theorem 21 to theorem 26, while from 27 to 30 he focused on calculating areas of different quadrilaterals. On the other hand he used these areas to prove some what we call nowadays algebraic identities in the theorem from 30 to 35, although the debate in mathematical history was intense about this point (Herz-Fischler, 1987).

PRESENTATION AND METHOD OF PROOF

Al–Samarqandī used different methodologies and approaches to prove his theorems, mainly constructive proof by the geometric properties of the shapes, in addition to proofs by contradiction of hypothesis. We present in the following some examples of both methods:

PROOF USING CONSTRUCTIVE PROPERTIES OF GEOMETRIC SHAPES

In the 17th theorem (correspond to Euclid I,4), page 10 al-Samrqandī proves the congruence of triangles where they had one equal side and two equal angles. He said "If two angles and one side of a triangle were equal to opposite two angles and one side of another triangle, the other angle and two sides will be equal to their opposites, i.e. angle $\hat{A}$ in the triangle $\overset{\Delta}{ABC}$ is equal to angle $\hat{D}$ in the triangle $\overset{\Delta}{DEF}$, and angle $\hat{B}$ equal to $\hat{E}$, and the side [AB] is equal to [DE]. Imagine plotting [AB] on [DE], then [AC] will coincide with [DF] because $\hat{A}$ is equal to $\hat{D}$, and [BC] coincides with [EF] because $\hat{B}$ is equal to $\hat{E}$". We notice that the method of al–Samarqandī uses multi-steps: firstly, to imagine plotting one triangle upon the other then depending on the logic that according to geometric characteristics he had proved his hypothesis according to what he has established in the previous theorems. Representing his explanation with geometrical figures following his description will result in Figure 1.

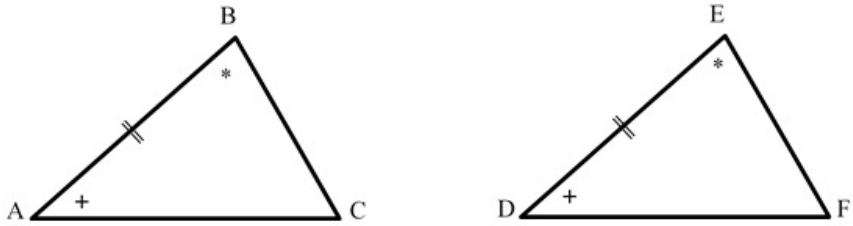

Figure 1. *Constructive proof of two triangle congruence.*

PROOF BY CONTRADICTION

The use of this method was repeatedly applied in many proofs, such as theorems number 5, 6, 7, and 18. For example, in theorem number 7, al–Samarqandī stated that: " If two angles of triangle are equal, the adjacent sides will be equal. For instance Figure 2, the angles $\hat{B}$ and $\hat{C}$ of the triangle

$\overset{\Delta}{ABC}$ are equal, thus [AB]=[AC], otherwise if one of them [AC] is longer than the other, we subtract [DC] from it which is equal to [AB] and we connect D to B the angle $\widehat{DBC}$ will be expectedly equal to $\widehat{DCB}$, but $\widehat{DCB}$ is equal to $\widehat{ABC}$, so compulsory the angle $\widehat{DBC}$ equal to $\widehat{ABC}$ because the part is the whole". Here it is clear that the writer proved the equality of the sides adjacent to equal angles by contradiction, considering them unequal and created equal sides that creates two angles which are supposed to be equal. Figure 2 shows the process of hypothesis contradiction he used to prove in his discussed idea.

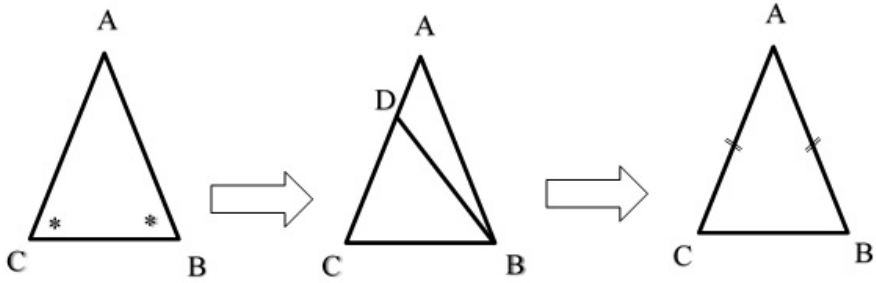

Figure 2. *Proof of two equal sides of triangle by hypothesis contradiction.*

NON MATHEMATICAL PROOF

Although al–Samarqandī used scientific mathematical methods to prove his hypothesis about different geometric theorems, in some cases he just relied on common logic without clear scientific proof. For example, when he tried to discuss theorem number 8 he explained that: "If each side of a triangle is equal to each side of another triangle their opposite angles will be equal and the triangles will be equal. Let a triangle $\overset{\Delta}{ABC}$ and $\overset{\Delta}{DEF}$, if [AB]=[DE], [BC]=[EF] and [AC]=[DF] thus $\widehat{A}$ =$\widehat{D}$, $\widehat{B}$ =$\widehat{E}$, $\widehat{C}$ =$\widehat{F}$. And $\overset{\Delta}{ABC}$= $\overset{\Delta}{DEF}$ because if we imagine plotting [AB] over [DE] it is obligatory that [BC] will plot over

[EF] and [AC] over [DF] otherwise one angle will be smaller than the other and [AC] will not be equal to [DF].” From this paragraph we notice that al–Samarqandī has considered the congruence (used the word *Tasawī* which means equal instead *of Taṭabuq* that means congruence) of two triangles as a logic of their equal areas instead of proving the congruence mathematically. In Figure 3 we demonstrate the previous paragraph explained.

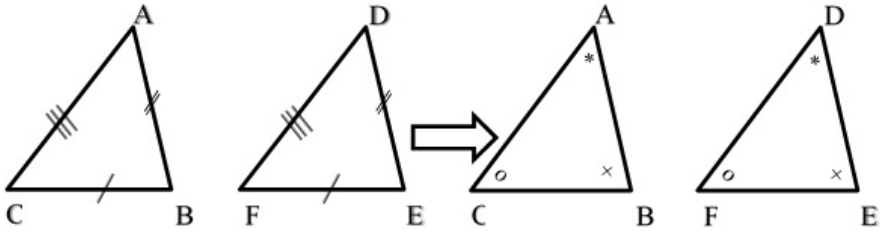

Figure 3. *triangles with equal sides have equal areas and angles.*

Another example where al–Samarqandī used logic to prove a proposition was in the theorem number 13 when he stated: “The longest side in a triangle corresponds to the biggest angle. Let [AB] be longer than [AC] in the triangle $\overset{\Delta}{ABC}$ so the angle $\hat{C}$ is bigger than $\hat{B}$ because if we deduct [AD] from [AB] such that [AD] = [AC], then the angle $\widehat{ADC}$ will be bigger than $\hat{B}$ and equal to $\widehat{ACD}$, and the angle $\widehat{ACB}$ is bigger than $\widehat{ACD}$ so bigger than $\widehat{ADC}$, which is bigger than $\hat{B}$, thus the angle $\widehat{ACB}$ is too much bigger than the angle $\hat{B}$.” Reading the previous text doesn't show the proof why $\widehat{ADC}$ will be bigger than $\hat{B}$, which nowadays is a proven fact that if we have a tringle and one of its vertices is moving out on the strait of its edge, the angle of this vertex is becoming smaller. Moreover, he used some none scientific terminology comparing the angles (too much bigger), and he even did not emphasis the conclusion he was trying to present. Figure 4 is the demonstration of the explained paragraph.

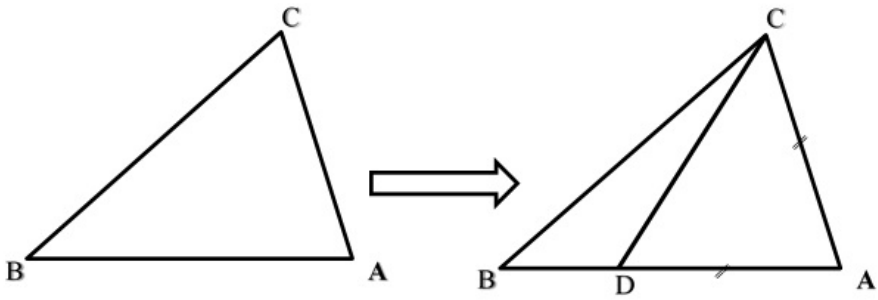

Figure 4. *Proving that if AB>AC then C^ >B^.*

UNPRECEDENTED PROOF

Through his manuscript, the author has proven many geometric properties using an innovative proof unprecedented by other previous mathematicians. For example when he tried to prove the equal areas of two parallelograms without using the formula to calculate geometric areas as in theorem number 23, he stated that "every two parallelogram surfaces sharing one base in one side between two parallel lines are equal. For example ABDC and ABEF, sharing the base [AB] while [AB] is parallel to [CE], are equal because [CD] and [EF] are equal to [AB]. [FD] is shared between the triangle $\overset{\Delta}{ACF}$, $\overset{\Delta}{BDE}$ and the sides of those triangles [CF] and [DE] are equal, and also [AC], [BD] are equal, moreover the angles $\widehat{ACF}$ and $\widehat{BDE}$ are equal internally and externally thus the triangles are congruent. Subtracting and adding the shared triangles $\overset{\Delta}{DGF}$ and $\overset{\Delta}{ABG}$ respectively, the parallelograms result equal." Instead of using the formula to calculate areas, the author divided the shape into triangles and used their geometric properties he proved in previous theorems, in order to confirm the equal areas of the parallelograms he explained in this theorem. Figure 5 presents the methodology he followed in his proof.

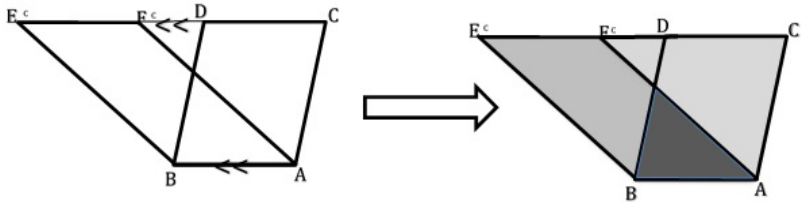

Figure 5. *Dividing the shape into triangles to prove that the areas of two parallelograms sharing the same base and limited by two parallel lines are equal.*

CLASSIFICATION OF INFORMATION PRESENTED

According to what mentioned in the overview of the manuscript contents, we could classify the information presented in the manuscript into different categories as following:

1- Information about the properties of different geometric shapes.

2- Methods for constructing geometric shapes:

3- Proofs of algebraic identities using geometric theorems.

In the following paragraphs we will present and discuss some examples of these categories, and analyse their contents.

INFORMATION ABOUT THE PROPERTIES OF DIFFERENT GEOMETRIC SHAPES

The theorem number 20, al–Samarqandī stated clearly and proved that the sum of the interior angles of a triangle is 180º. He said in page 11 "Every triangle … its angles are equal to two right angles." It was a common knowledge that the measurement of the angles in the Arabic geometric heritage was by parts or multiplications of right angles (90º degrees) so when he said that the interior angles of a triangle are equal to two right angles, he has proved that they are equal to 180º. In the discussion of the theorem, he has proved that fact by using the straight angle rule, which also is equal to 180º, a fact he has presented and proved in the first theorem of his manuscript.

METHODS FOR CONSTRUCTING GEOMETRIC SHAPE

The glorious heritage of Arabic geometric mosaic was constructed using two simple instruments, a straightedge and a compass. Maybe al–Samarqandī was one of the earliest scholars who had established and explained the usage of these two instruments to produce a combination of different geometric shapes. Throughout his manuscript we see many different examples explaining how to construct various shapes using a ruler and a compass, for instance in theorems number 9, 10, 15 the shapes are explained to be drawn using the same tools and methods. In theorem 15, al–Samarqandī explains how to draw a triangle which its sides' lengths are known, he says "We want to make a triangle in which each side is equal to one of three known lines with the condition that the sum of each two is longer than the third. In Figure 6 let the lines A, B, C and let [DE[a straight line we deduct from it [DF] = A and [FG]=B and [GH]=C, we draw from F a circle with a radius equal to [DF], and from G a circle with a radius equal to [GH]. The two circles will intersect in K and L, otherwise [FG] will be equal or longer than the sum [DF] and [GH] together. We connect K with F and G thus the triangle $\overset{\Delta}{KFG}$ is the required triangle because the side [KF] is equal to [DF] equal to A, and [KG] is equal to [GH] equal to C. There is no need for the ruler because the compass is enough to construct."

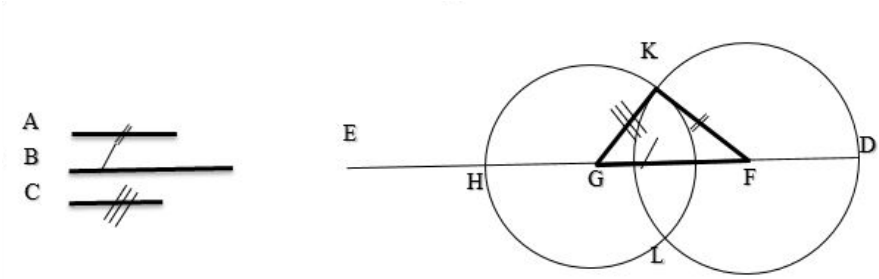

Figure 6. *Drawing a triangle its sides are equal to three known lines, using only a compass and a ruler.*

The author used the features of the circle to construct triangle without the measurement of the lengths of the lines, just by opening the compass directly equal to the predefined lines. This became a common practice in Arabic and Islamic geometric designs production as shown in Figure 6.

ALGEBRAIC IDENTITIES PROVED USING GEOMETRIC THEOREMS

Looking to the theorems 31 to 35, we find that al–Samarqandī had proved some algebraic identities using the theorems of areas calculating of geometric shapes.

For example, in theorem 21 he proved that the multiplication is distributive as in T.K=TX+TY+TZ, where K=X+Y+Z using the geometric characteristics of dividing a line and creating rectangles from the divisions. He explained that "Multiplication of X with Y is equal to the multiplication of X with the parts of Y. For example, multiplying the line A with the line [BC] is equal to multiplying A with the parts of the line [BC], I mean [CE], [ED] and [DB]. Let's consider that [BF] is a column on [BC] equal to A and we complete the shape into a rectangle its area is equal to multiplying A with [BC]. We assume that [DG], [EK] parallel to [BF] thus they are parallel to A, so the sum of the areas of BFGD and DGKE and EKLC is equal to A multiplied with [DB] plus [ED] plus [CE], and all are equal to [BC]." We demonstrate in Figure 7 the description previously translated from the manuscript.

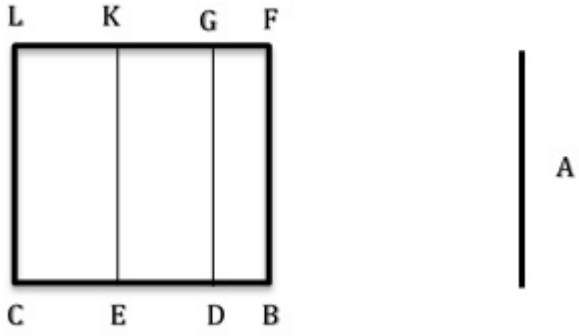

Figure 7. *Proving that T.K=TX+TY+TZ, where K=X+Y+Z using areas of rectangles.*

AMBIGUITY AND ERRORS

Despite the brilliant work of al–Samarqandī, we still can spot some ambiguous ideas and unclear phrases in Arabic, which sometimes lead to misunderstanding of his conclusions, thus we can recognise some very few errors in his discourse compared to our modern knowledge. Following in this paragraph we will present some examples of ambiguous cases and errors committed in his work in the manuscript, although we are not sure if the errors were because of the copying process, the copier of the manuscript, or committed by the author himself.

AMBIGUITY

Although the language used in the manuscript is clear Arabic, and most of the terms are still the same in Arabic science nowadays, hence some of the phrases and terms are ambiguous. For example, the diamond shape named in modern Arabic as Mu'ayan, he used to call it as Mutasaūī Alaḍlā', literally means equal sides geometric shape. Diamond shape is a special form of parallelogram, called in modern Arabic as Mutawazī Alaḍlā, including that each two opposite sides are parallel, he only considers that diamond shape

has equal sides length, thus in modern Arabic terminology the Mu'ayan is used to refer for both properties.

On the other hand, apart from the language used, the proposition sometimes or the proof are not clear. An example for this case is seen in the theorem number 33, where he was trying to prove that (x+y)^2=x^2+2xy+y^(2) using geometric theorems by explaining that "The square of the length of a line is equal to the square of its two parts plus the double of the multiplication of their lengths. In Figure 8 let the line [AB] divided into two parts on C we say that the square of [AB] is equal to [AC] square plus [CB] square plus double [AC] times [CB]. That is because if we create [AH] equal to [AB] and [CD] squares, and [CD] parallel to [AF], we connect B to F intersecting [CD] in G. We assume KGL parallel to [AB] the exterior angle of CGB equal to the interior angle AFB, …" The first ambiguous idea is when he said we create [AH], he did not mean the diagonal, he means the triangle where its two opposite corners are A and H.

Another unclear idea is the interior and exterior angles limited by two intersecting lines, they are not explained in the manuscript, despite that in the earliest theorems he discussed and explained the different types of angles and their relations.

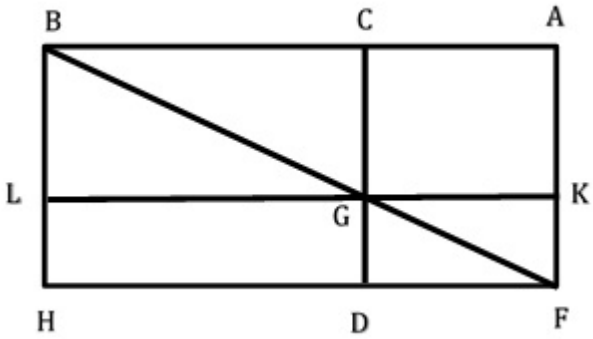

Figure 8. *The ambiguous idea of the interior and exterior angles when trying to prove that (x+y)^2=x^2+2xy+y^(2) using properties of squares and triangles.*

ERRORS

Essentially, we could not find what we can call an error clearly, but still we faced some mixing in using the correct reference of previously explained theorems, especially when he was trying to use it in order to prove the recent theorem, as in the theorem 16 instead of referring to theorem number 15 to use in the proof, he referred to theorem number 8. In the same theorem he committed an error by not defining the correct length of the constructed triangle in order to create an angle from a specific different point. He explained in page 10: "We want to create from a point of a line a given angle. i.e. from point A of the line [AB] an angle as $\hat{C}$, we define on the limited lines of the angle $\hat{C}$ two points D and F respectively, and we connect [DF], then we make on [AB] a triangle where its sides are equal to the sides of $\overset{\Delta}{CDF}$ let it be $\overset{\Delta}{ABG}$ but [AG] should be equal to [CF] and [AB] equal to [CD] and [GB] equal to [DF] thus the created angle on $\hat{A}$, is equal to $\hat{C}$ as seen in theorem 8." Figure 9 shows the process as he explained and demonstrate the error he committed.

It is clear to the reader that the author missed to explain that when choosing D and F from the sides of the angle the length of one of the created sides [CD] or [CF] should be equal to AB, otherwise we would not be able to create the triangle in which [AB] is equal to [CF]. Moreover, he asked to create an equal triangle in spite of that he did not explain yet the method to draw triangles from predefined lines.

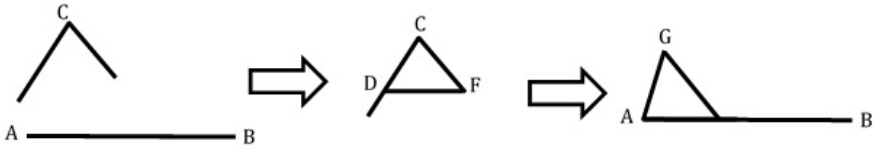

Figure 9. *If the Points D, F are not defined from the beginning that one edge is equal to AB, the triangle will not be constructed as required, and the angle will not be created.*

Finally, as we said he referred to the theorem number 8 in which he explains the congruent triangles instead of the theorem 15 which is explaining more about creating a triangle which its sides' lengths are defined. Nevertheless, even the theorem 8 was not proven mathematically, as we presented previously in this paper, and it relies on common logic discussion.

Another example of the errors is the utility of terminology in different theorems discussion. The author continues to use the term equal triangles meaning the congruent ones as mentioned before. But in one occasion, he mistakenly proved that two parallelograms are equal in areas and described them as equal parallelograms which, as we know from his work about triangles, refers to congruence. This error is seen when explaining in the theorem No. 24 that parallelograms which have equal bases' lengths and limited with parallel line to this base are equal in area. He said in page 13: "Every two parallelograms of equal bases on the same side between two parallel lines are congruent. For example ABCD and EFGH on the equal bases

[BC], [FG] in between the parallel [BG] [AH] lines, that is because connecting [BE], [CH] will make them parallel and equal that is because [BC], [EH] are parallel and equal as seen in theorem 21. Therefore the areas of the two parallelograms ABCD AFGH are equal to the area of the parallelogram EBCH …" He proved that the areas of the parallelograms are equal, but he described them as *mutasāūīān,* congruent in modern terms, at the beginning of his theorem. Figure 10 shows what he means in his discussion.

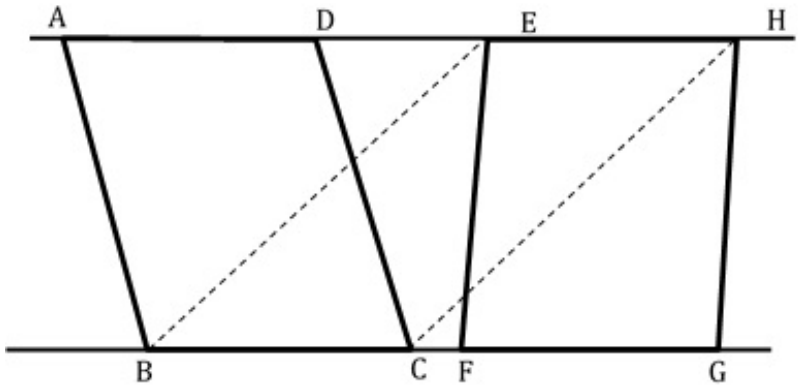

Figure 10. *Proving the equal areas of two parallelograms and considering them congruent.*

Another example about the errors in using correct terms, is when he used the word *Sutūh*, which could mean surfaces or areas to talk about the shapes themselves, when at the same time he used the same word to talk about the areas of these geometric shapes, thus it is difficult to understand which meaning without looking to the context.

Also he used surface of a parallelogram by calling it with the name of its diagonal, as we explained in the theorem 33 previously. For the first case, in the theorem 32 he explained: "The sum of the areas of a line in its segments is equal to its square… " He meant to say that the area of the

square created from a line, not the area of the line itself is equal to the sum of the areas of rectangles created from the line segments, where these rectangles depths has the same length of the square. Figure 11 demonstrates the correct meaning of the area of a line he talked about.

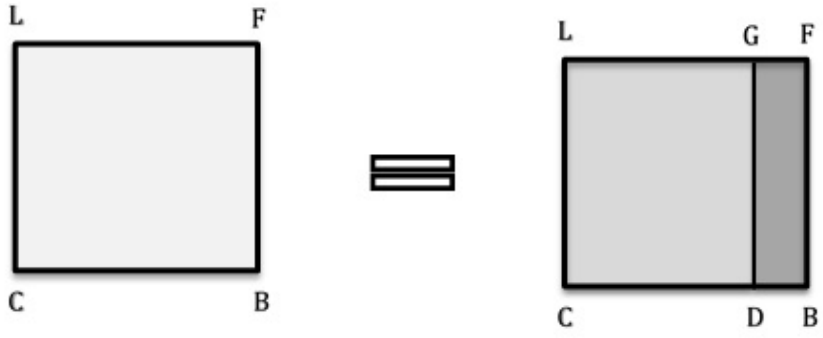

Figure 11. *Area of a line demonstrated by the geometric theorems as al–Samarqandī explained.*

The second case in which he called the area of parallelogram with the area of its diagonal was repeated in many theorems such as 25, 27, 28 and 33…etc. One example is the theorem number 33 where he stated that: "… Thus the area of the parallelogram [DF] is equal sides according to what we have seen in 22…" He means the parallelogram CDEF which its diagonal is [DF] as previously seen in (Fig. 8).

CONCLUSION

This paper shows the importance of the work of early Arabic scholars in establishing the heritage of both scientific research and methodology approaches in the field of geometry. It is of paramount importance to Arab scholars to document, study and analyse this hidden heritage in order to preserve it firstly, then introduce it to the modern scientific society revealing the secrets of the buried manuscripts for more than ten centuries.

One of the important scholars whose work highly impacted the heritage of the Arab science is al–Sasmarqandī, who with a relatively small manuscript had depicted the terminology and theories of geometry in the scientific Arabic history. His work deserves a deep study by Arab historians of science and scientific scholars instead of leaving it to foreigners, who sometimes face difficulties in understanding the language used in this era, in order to realise the role he played in his field.

The text of (Ashkal Al-Ta'asis) is a simple short manuscript of high value for the information it contains, and the methodology it follows. Although it was translated into both English by Gregg de Young, and to modern Arabic by Muhammed Souissi, it is not enough to visualize its influence on the Arabic heritage of geometry.

Despite that the manuscript has minor errors, it still forms a basic reference of geometry in Arabic scientific heritage. We could still use it nowadays to explain to Arab students the terminologies, methodologies and approaches to innovatively prove different theorems using diverse methods.

The information explained and the methods analysed varies from constructive proof to proof by contradiction, and from properties of geometric shapes to constructive methods and instruments. Al–Samarqandī's descriptive discourse needs a figurative interpretation, beside the commentaries by his student Qāḍī Zādeh al-Rūmī, in order to understand and present it better in the modern mathematical language, which we tried to produce, exemplifying by some figures in this paper.

It is also worthy to translate his other works, and similar scholars work into foreign languages to emphasis the cultural communication between different civilisations interacted to build the heritage of science. The future work will be the analysis of the work and comments written by Qāḍī Zādeh,

another important scholar, who studied al–Samarqandī's work, analysed, commented and explained the work of his teacher, and then he wrote his own studies contributing to the Arabic heritage of science.

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Gerede Aşağı Tekke Türbesi

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ÖZET
Türbe, Bolu ili Gerede ilçesi Seviller Mahallesinde Aşağı Tekke cami ile aynı avlu içerisinde yer almaktadır. Cami 1956 tarihli olması ve Türk sanatı açısından özellikli bir yere sahip olmamasından dolayı araştırma kapsamında değerlendirilmemiştir. Türbe, giriş kapısı üzerinde yer alan kitabesine göre H. 1259/M.1843 tarihlidir. Yapı, giriş kısmı ve asıl mekân olmak üzere iki bölümden oluşmaktadır. Giriş bölümü, enine dikdörtgen planlı içten aynalı tonoz dıştan üç yöne eğimli kırma çatı örtülü ve sac malzeme kaplamalıdır. Asıl ziyaret mekânı ise sekizgen planlı içten aynalı tonoz dıştan sekiz yöne eğimli kırma çatı örtülü olup, sac malzeme kaplama şeklinde tasarlanmıştır. Moloz taş ile inşa edilen türbenin içerisinde; giriş bölümünde iki, asıl ziyaret mekanında iki olmak üzere dört sanduka bulunmaktadır. Özellikle türbe giriş cephesi yüzeyinde ve türbe içerisinde yer alan taş, alçı ve kalem işi süslemeler önemli bir yere sahiptir. Süsleme; giriş cephe yüzeyi, iç örtü sistemi olan aynalı tonoz etrafında ve asıl ziyaret mekanı duvarlarında yoğunlaşmış olup çoğunlukla bitkisel karakterlidir. Mimari ve süsleme açısından dikkat çeken türbe üzerine şimdiye kadar yapılan az sayıdaki çalışmanın yüzeysel olması, araştırmamızı bu konu üzerine yoğunlaştırmıştır. Çalışmamamız kapsamında türbe; plan, malzeme, teknik ve süsleme özellikleri üzerinden değerlendirilerek türbenin Türk sanatındaki yeri ve önemi belirlenmeye çalışılmıştır.

ANAHTAR KELİMELER
Gerede, Aşağı Tekke, Türbe, Mimari, Süsleme.

ABSTRACT
The tomb is located in the same courtyard as the Aşağı Tekke mosque in the Seviller District of the Gerede District of Bolu. Since the mosque was dated in 1956 and does not have a special place in terms of Turkish art, it was not evaluated within the scope of this research. The tomb is dated H. 1259/M.1843 according to the inscription on the entrance door. The building consists of two parts: the entrance and the main spaces. The entrance section has a transverse rectangular plan, a mirrored vault from the inside, and a hipped roof that can be

[*] Sorumlu yazar.

sloped in three directions from the outside and is covered with sheet metal. The main visiting place was an octagonal planned interior mirrored vault with a hipped roof inclined in eight directions from the outside and designed in the form of a sheet metal covering. Inside the tomb built with rubble stone, there were four sarcophagi, two in the entrance section, and two in the main visiting area. Stone, plaster, and hand-drawn decorations on the entrance facade of the tomb and inside the tomb are important. Ornament: The entrance façade is concentrated around the mirrored vault, which is the interior covering system, and on the walls of the main visiting place, mostly in a vegetal character. The fact that the few studies on the tomb, which draws attention in terms of architecture and decoration, are superficial, focused our research on this subject. Within the scope of our study, we attempted to determine the place and importance of tombs in Turkish art by evaluating their plan, material, technical, and ornamental features.

KEYWORDS
Gerede, Asagi Tekke, Tomb, Architecture, Ornament.

GİRİŞ

Gerede, Ankara ve İstanbul arasında yer alan bir şehirdir. Tarih öncesi çağlardan günümüze kadar yerleşim alanı olarak tercih edilmiştir. Geçmişte Paflagonya olarak adlanlandırlan bölgede bulunan şehir sırasıyla Paflagonya M.Ö.300, Bitinya M.Ö. 260-228, Pontus M.Ö. 70-71 ve Roma'nın M.S. 395'te ikiye ayrılmasıyla da Doğu Roma, yani Bizans hâkimiyetleri görülmüştür (Aycan, 2000; ss. 11-12). Daha sonrasında 1197 yılında Anadolu Selçuklularına bağlanmış, 1354 yılında ise Osmanlı topraklarına katılmıştır (İdil,1997; ss. 23; Aycan, 2000; ss. 13). Tarih boyunca birçok medeniyete ev sahipliği yapmasından dolayı şehirde farklı kültürlere ait eser ve kalıntıları görmek mümkündür. Bu yapılardan biri ise Aşağı Tekke Türbesi'dir. Aşağı Tekke Türbesi üzerine şimdiye kadar çok az çalışma yapılmış ve yapılan çalışmalarda türbe yüzeysel olarak değerlendrilmiştir. Araştırmamız kapsamında türbe; plan, malzeme, teknik ve süsleme özellikleri üzerinden etraflıca değerlendirilerek türbenin Türk Sanatındaki yeri ve önemi belirlenmeye çalışılmıştır.

Aşağı Tekke Türbesi; ilçe merkezinde, Seviller mahallesi cami sokakta yer almaktadır (Şekil 1 , Şekil 2).

Şekil 1. *Türbenin Konumu (URL 1).*

Şekil 2. *Türbenin Genel Görünümü.*

Yapı, doğu cephede yer alan giriş kapısı üzerindeki kitabeye göre H. 1259/ M. 1843 tarihinde inşa edilmiştir (Şekil 3). Yapı, Ankara Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulunun 10.08.1988 tarih ve 10 sayılı kararı ile tescil edilmiştir (VGMA).

Şekil 3. *Türbenin Kitabesi.*

Kitabe, ahşap çerçeveli siyah zemin üzerine talik hattıyla altın yaldız renginde yazılmıştır. İnce çubuklarla iki sütun ve üç satıra ayrılan aruz veznindeki kitabe şöyledir (Tablo 1):

Tablo 1. *Kitabe Vezni*

دلیل-ی راه-ی هودا کوتب-و اریفیندی هم	فویوزو توتتو نام-ی هالیل فندینین
تجددود تتی یوزوندن تاریك-ی	کونوللر اولدو بکامی هالیل فندینین
بو ایرتیهالینه تاریه-ی تامدیر ایرفان	جینانه دوندو ماکام-ی هالیل فندینین
سر-هام-ی مهمد ریف'ات ۱۲۵۹	

Okunuşu :
Delil-i rah-ı huda kutb-u arifindi hem
Füyuzu tuttu enam-ı Halil Efendinin
Teceddüd etti yüzünden tarik-i Şa'bani
Gönüller oldu bekamı Halil Efendinin
Bu irtihaline tarih-i tamdır irfan
Cinane döndü makam-ı Halil Efendinin
Eser-hame-i Mehmed Rif'at (H.1259/ M.1844)

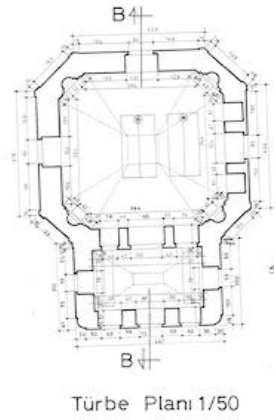
Türbe, Maliye nazırı Gazi Ahmet Muhtar Paşa tarafından yaptırılmıştır. İki ocaklı bir su değirmeni de vakfedilmiştir (VGMA). Yapının mimar ve ustaları hakkında bilgi bulunmamaktadır.

MALZEME VE TEKNİK

Türbe inşasında taş, ahşap, metal, alçı ve sac malzemeler kullanılmıştır. Yapı moloz taştan inşa edilmiş olup yalnızca doğu cephe sıva ve boyalıdır. Diğer cephelerde herhangi bir kaplama malzemesi olmadığından duvar örgü sistemi açıkça görülebilmektedir. Ahşap malzeme kapı ve pencere kanatları ile sandukalarından oluşumunda tercih edilmiştir. Pencere korkuluk şebekeleri metal malzeme ile oluşturulmuştur. Alçı yalnıza süsleme de görülmektedir. Sac ise türbe örtüsünde kaplama malzemesidir.

PLAN

Türbe giriş ve esas ziyaret mekânı olmak üzeri iki bölüm üzerine şekillenmiştir. Giriş bölümü enine dikdörtgen planlı içten aynalı tonoz dıştan üç yöne eğimli kırma çatı ile örtülü olup sac malzeme kaplamalıdır. Esas ziyaret mekanı ise sekizgen planlı içten aynalı tonoz dıştan sekizgen kasnak üzerine oturan sekiz yöne eğimli çatı ile örtülmüş ve sac malzeme ile kaplanmıştır (Şekil 4).



Şekil 4. *Türbe Planı (VGMA).*

DIŞ TASVİR

Türbe, Aşağı Tekke cami ile birlikte geniş bir avlu içerisinde yer almakta olup, türbe caminin güney tarafındadır. Türbenin etrafında şehrin ileri gelenlerinin mezarları bulunmaktadır. Bütün cephelerde köşeler taş sütunlarla belirginleştirilmiştir. Yapının giriş cephesi doğu taraftandır. Doğu cephe ortada aynalı kemerli kapı açıklığı ile birer aynalı kemerli pencere açıklığı şeklindedir. Cephe yüzeyi sıvanmış ve üzeri boyalıdır. Ayrıca cephe yüzeyinde kalem işi süslemeler mevcuttur. Batı cephe itibariyle sekizgen köşelerden dolayı pahlı görüntüsü mevcuttur ve yalnızca bir boyuna dikdörtgen pencere açıklığından ibarettir. Kuzey cephe itibariyle giriş bölümünden açılan bir

aynalı kemerli pencere ile esas ziyaret mekanından açılan bir boyuna dikdörtgen pencere açıklığı mevcuttur. Güney cephe; kuzey cephede olduğu gibi giriş bölümünde bir aynalı kemerli pencere ve ziyaret mekanı cephe yüzeyinde boyuna dikdörtgen bir pencere açıklığı şeklindedir (Tablo 2).

Tablo 2. *Türbe Cepheleri.*

 Doğu Cephe	 Doğu Cephe	 Batı Cephe
 Kuzey Cephe	 Güney Cephe	

İÇ TASVİR

Türbeye doğu cephede bulunan aynalı kemerli boyuna dikdörtgen tek kanatlı ahşap kapı ile giriş yapılmaktadır. Yapının içerisi giriş bölümü ve esas ziyaret mekanı olarak iki kısım şeklindedir. İlk bölüm olan enine dikdörtgen giriş kısmının kuzey ve güney taraflarında birer sanduka bulunmaktadır. Giriş kısmının batı tarafında ortada kapı açıklığı, açıklığın iki tarafında birer boyuna dikdörtgen pencere mevcuttur. Orta kısımda yer alan boyuna dikdörtgen yuvarlak kemer açıklıklı çift kanatlı ahşap kapı ile esas ziyaret mekanına girilmektedir. Bu bölümde, Şeyh Halil Efendi ve oğlu Şeyh Mustafa Efendi'ye ait iki adet sanduka yer almaktadır. Batı tarafının sekizgen köşelerinde birer

adet niş şeklinde çiçeklik, kuzey tarafta ise ahşap dolap bulunmaktadır (Şekil 5). Mekânı örten aynalı tonoz oldukça bezemeli vaziyettedir.

Şekil 5. *Asıl Ziyaret Mekanı.*

SÜSLEME

Yapı üzerinde taş, metal, alçı ve kalem işi süslemeler yoğunluktadır. Taş süsleme; kapı ve pencere düzenlemelerinde, metal; pencere korkuluk şebekeleri ve çatı aleminde, alçı; kapı kemer çerçevelerinde, kalem işi ise doğu cephe yüzeyi ve ziyaret mekanı aynalı tonoz kısmında görülmektedir. Kapı ve pencere düzenlemeleri aynalı kemer şeklinde oluşturularak dekoratif bir özellik kazandırılmıştır. Ayrıca doğu tarafta yer alan giriş kapısının bordürleri iç içe geçmiş kıvrık dal sarmalı şeklinde tezyin edilmiş, kapı alınlık bordüründe ise kıvrık dalların ortasına taç biçiminde palmet motifi yerleştirilmiştir (Şekil 6).

Şekil 6. *Yapı Giriş Kapısı Detay.*

Pencere korkuluk şebekeleri; ince metal çubukların düşey ve yatay konulması ile kare ve dikdörtgen göz formları oluşturulması şeklinde tasarlanmıştır. Esas ziyaret mekanı çatı örtüsünün ortasında yer alan alem metal malzemeden oluşturulmuştur.

Esas ziyaret mekanı giriş kapısı kemer çerçevesinin iki yanına alçı malzemeden oluşturulan palmet motifi uzanmaktadır. Kemer kilit taşı noktasına da alçı malzemeden gülbezek motifi bezenmiştir (Şekil 7).

Şekil 7. *Esas Ziyaret Mekanı Giriş Süsleme Detay.*

Doğu cephenin iki tarafında yer alan aynalı kemerli pencerelerin üst lentoları ile çatı arasında kalan bölümlere iki tarafta enine dikdörtgen çerçeve içerisinde aynı kompozisyonda kalem işi süslemeler işlenmiştir. Enine dikdörtgen çerçevenin alt köşelerinde selvi ağaçları, orta bölümde iki yana perde şeklinde biçimlendirilmiş akantus yaprakları, akantus yaprakları üst tarafta enine dikdörtgen form tarafından birleştirilmiş. Enine dikdörtgen formun üstünde ise taç şeklinde bir form yer almaktadır. Perde şeklindeki akantus yapraklarının alt uçlarında aşağıya doğru birer akantus yaprağı daha işlenmiş, yaprakların üst kısımlarından ise birer çiçek demetleri yükselmektedir. Perde şeklindeki akantus yapraklarını orta bölümde bulunan bir çiçek buketi birleştirmektedir (Şekil 8).

Şekil 8. *Doğu Cephe Süsleme Detay.*

Yapı içerisinde asıl ziyaret mekanının tavan örtüsü olan tonoz kalem işi tekniğinde yoğun olarak tezyin edilmiştir. Aynalı tonozun orta kısmında kare içersinde çarkıfelek formu yer almaktadır. Çarkıfelek formunun her kolunun içerisi iki veya üç dallı çiçek motifleri ile bezenmiştir. Kare formunun her bir köşesine lale motifleri işlenmiştir. Kare formunun dışında bir kare daha yer almaktadır. Bu kare formun etrafı farklı renklerde çiçek demetleri ile donatılmıştır. Tonoz köşelerine kare formunda üçgen şeklinde dört kuşak uzanmaktadır. Kuşakların içine aynı kompozisyonda ağaç dalı biçiminde lale ve yaprak motifleri yerleştirilmiştir. Tonoz tarafına gelen üçgen uçlarında ise vazodan çıkan çiçek demetleri barok karakterli çerçeve içerisine işlenmiştir. Kuşaklar arasında kalan dört geniş boşlukta ise birer tane beş ve altı yapraklı

çiçekler bulunmaktadır. Tonoz kasnak kısmı iki şerit halinde bütün köşeleri dolanmaktadır. Üstte bulunan kuşağın içerisi zikzak formu ile şekillendirilmiştir. Altta bulunan şeridin içerisi ise bitkisel motiflerle doldurulmuştur (Şekil 9).

Şekil 9. *Tavan Süsleme Detay.*

SONUÇ

Gerede Aşağı Tekke Türbesi ilçede Osmanlı döneminde inşa yapılardan yalnızca birisidir. Yapı üzerine şimdiye kadar yapılan araştırmalar Türk Sanatı metodolojisi kapsamında etraflıca incelenmediğinden yapı bu doğrultuda değerlendirilmeye çalışılmıştır. Yapılan değerlendirmeler sonucunda moloz taş örgülü yapının sekizgen plan şeması üzerine şekillendiği içte aynalı tonoz örtülü olduğu görülmüştür. Mimari özelliklerinin yanı sıra dış ve iç tasvirde yer alan süslemeleri açısından özellikli bir yapı şeması oluşturmaktadır. Doğu cephede ve asıl ziyaret mekanının çatı örtü bölümünde yer alan yoğun süslemeler yapıya estetik bir görünüm kazandırmıştır. Çalışmamız doğrultusunda yeterince bilinmeyen yapı literatüre kazandırılmış olacak, diğer yapılacak çalışmalara kaynaklık etmesi açısından değerlendirilebilecektir.

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Kent İçi Üniversitelerinde Planlama: Bursa Teknik Üniversitesi Mimar Sinan Yerleşkesi Örneği

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ÖZ

Üniversiteler eğitim, araştırma, barınma, dinlenme ve rekreasyon gibi işlevleri barındıran yerleşkelerde hizmet vermektedir. Kent içi ve kent dışındaki yerleşke alanları konum ve büyüklük gibi konularda çeşitlenirken bir yandan da yerleşke planlaması açısından farklı problem alanlarını ve avantajları ortaya koymaktadır. Kent içi üniversitelerin, çevresi ile daha iyi ilişki kurabilme, işlev ve aktiviteleri paylaşma gibi olumlu yönleri varken, kent dışı üniversitelerin daha büyük alanlarda kendi kurallarını koyarak yapılaşma ve genişleme şansları vardır. Bu nedenlerle, literatürde bulunan üniversite yerleşke planlaması hakkında yapılan inceleme sınıflandırma çalışmaları kent içi ve kent dışı olması durumuyla başlar ve detaylanır. Bu çalışmada Türkiye'de son dönemde kurulan üniversitelerden biri olan Bursa Teknik Üniversitesi Mimar Sinan Yerleşkesi, kent içi üniversite yerleşke planı örneği olarak incelenmiştir. Proje incelenmesi ile birlikte üniversite yerleşkeleri ve kent ilişkisi hakkında kavramsal çerçeve anlatılmıştır. Yerleşkenin bulunduğu konum ve çevresel ilişkilerine bakıldığında; mevcut yapıların ilişkilendirilmesi zorluğu, iç ve dış ulaşım ağının oluşturulmasını kısıtlayan faktörler, üniversite kullanımında olabilecek arazilerdeki farklı ihtimaller, mevcut yeşil doku, açık alana göre kıyasla muhtemel fazla yapılaşma gereği tasarım problemlerini oluşturmaktadır. Yerleşke planı, konulan ön kararlar ve sahip olduğu tasarım kurgusu nedeniyle bu problem alanında önemli yaklaşımlar ortaya koyan önemli bir kent içi üniversite yerleşkesi örneğidir. Bu nedenlerle sunulan yerleşke planı ve projeyi destekleyen görsel ve teknik materyalleri kent içi üniversite yerleşke planlaması tecrübesine ve alanına katkı sunmaktadır.

ANAHTAR KELİMELER

Kent içi üniversiteler, Yerleşke planı, Bursa Teknik Üniversitesi, Planlama, Esneklik.

ABSTRACT

Universities live on campuses with functions such as education, research, accommodation, and recreational activities. In-city and outer-city lands of universities differ in location and

size, and they put forth diverse problem areas and advantages for campus planning. In-city universities have positive features, such as establishing better relations with the city and sharing functions and activities. In contrast, outer city universities can be structured and developed by stating their own principles. For these reasons, the research and classification studies among university campus planning start with the location of universities. In this research, Bursa Technical University Mimar Sinan Campus plan, an in-city university, is investigated from the perspective of campus planning. The theoretical framework of university campus planning and its relation to the city is given in the project evaluation. By looking at the location and relation to campus surroundings, it can be stated that the difficulty of establishing a relationship to existing buildings, designing the circulation network, restricting factors, diverse possibilities in the usage of lands, existing green areas, building ratio against open areas shape the design problem. This campus plan is a case to be evaluated because of the approaches resulting from the statements and design framework. As a result, the presented case of campus plan and conducting technical and visual documents contributes to the campus planning area.

KEYWORDS

In-city Universities, Campus planning, Bursa Technical University, Planning, Flexibility.

GİRİŞ

Üniversite yerleşkeleri çeşitli işlevsel ve mekânsal içerikleri ile kent ile farklı ilişkiler kurarak var olabilirler. Bulundukları konum, kent ile sahip olduğu mesafe ve temas durumuna göre kent içi ve kent dışı üniversiteler olarak ikiye ayrılırlar (Güneş & Gökçe, 2022). Üniversitenin bulunduğu kent ile olan ilişkisi ve etkileşimi iki durum içinde farklıdır. (Kuyrukçu & Alkan, 2021). Yerleşke arazisinin büyüklüğü, formu ve kentin içinde veya dışında olması doğrudan yerleşkenin planlamasını ve yapılaşmasını etkiler. Bu nedenlerden dolayı üniversitenin kurulacağı yer seçimi ve buna paralel olarak hazırlanan yerleşke ve gelişim planları üniversite içindeki her türlü aktiviteyi ve bunların kent ile olan ilişkisini yönlendirir.

Türkiye'de 2000 yılı sonrasında yaklaşık 140 devlet ve vakıf üniversitesi kurularak toplam 208 üniversite sayısına ulaşılmıştır (URL-1). Bunlardan bazıları üniversite bulunan kentlere kurulurken bazıları da o kentteki ilk üniversite olarak kurulmuştur. 2006 yılında 16, 2007 yılında 22, 2008 yılında 15, 2009 yılında 9 ve 2010 yılında 17 üniversite kurulması son yıllarda yükseköğretim kurumlarındaki artış konusunu anlamak için önemli bir bilgi olarak verilebilir (Mevzuat Bilgi Sistemi, 2023). Kurulan yeni üniversiteler bir

veya birden çok sayıda, farklı büyüklüklere sahip yerleşkede yapılaşmaya ve gelişmeye başlamıştır. Kent içinde ve kent dışında seçilen ve tahsis edilen yerleşkeler sahip oldukları proje koşullarına ve hazırladıkları stratejik planlara göre tasarlanmaktadır.

2010 yılında kurulan Bursa Teknik Üniversitesi kent içindeki Yıldırım ve Mimar Sinan Yerleşkelerinde faaliyetlerine ve yapısal gelişimine devam etmektedir (URL-2). Kent içinde olan bu iki yerleşke, Bursa Teknik Üniversitesi'ne içlerindeki bazı yüksek öğretim binaları ile birlikte tahsis edilmiştir. Çalışmada ele alınan Mimar Sinan Yerleşke Planı kent içinde olması, planlamadaki arazi parçalarının mülkiyete geçme takvimlerinin farklı olması ve içindeki mevcut yapılaşmanın gelişim ve yerleşim planına dahil edilmesi sorunsallığı düşünüldüğünde; problemi çözmesi gereken bir tasarımdır. Bu özellikleri nedeniyle, son dönemde kurulan üniversiteler arasında kent içi üniversite yerleşkesi örneği olarak değerli ve öğretici olmaktadır.
Çalışmada öncellikle üniversite yerleşke planları ve kent ilişkisi hakkında kavramsal çerçeve sunulmuştur. Devamında yerleşke planlamasına konu olan arazinin ve üniversitenin koşulları, öncellikle belirlenen kriterler anlatılacaktır. Üniversite yerleşke planı tasarım kurgusu, ulaşım ve bölgeleme şemaları tartışılacaktır. Sonuç olarak ortaya çıkan problem tanımına ve koşullarına göre 2017 yılında tamamlanan Bursa teknik Üniversitesi Mimar Sinan Yerleşkesi tasarımı kent içi üniversite yerleşkesi örneği olarak değerlendirilmiş ve planlaması ortaya konmuştur.

ÜNİVERSİTE VE YERLEŞKELER

YERLEŞKELER HAKKINDA

Kampüs sözcüğü ilk olarak 18. Yüzyılda Princeton Üniversitesi'nde kullanılmıştır (Turner, 1984). Kampüsler kent içinde veya kent dışında farklı etkilere sahip olurlar. Ek olarak şehrin büyüklüğü de üniversite kampüsü ile olan etkileşimi çeşitlendirir. Örnek olarak küçük kentlerde kurulan üniversiteler tek başına çevrelerini şekillendirmede etkili olurlarken (Merlin, 2006), büyük şehirlerde ise bu ilişki göreceli olarak yakın çevrede daha fazla, kentin kalanında ise daha azdır.

Geçmişten gelen ve farklı kültürlere ait önemli eğitim kurum modelleri ve bunlara ait medrese ve kolej gibi yapılaşma örnekleri vardır. Bununla birlikte genel bir kampüs planlaması konusu 1940'lara kadar üzerinde çok durulan ve araştırma yapılan bir konu değildir (Sun & Chiou, 2019). Öncül olarak Dober (1992) yaptığı dört farklı seri içeren çalışmada yerleşke hakkında üç önemli konuyu; planlama, mimari ve peyzaj konularını tartışarak önemli planlama modüllerini ve bina standartlaşmasını ortaya koymuştur. Yerleşkeyi değerli ve fonksiyonel kılacak bu unsurlar; arazi planlaması, trafik ağ sistemi, fiziksel ortam , altyapı ve servis birimleridir (Dober, 1992).

Dünya'da olduğu gibi Türkiye'de de üniversiteler kurulurken kurumsal seviyede hazırlanmış stratejik planlar ile yerleşkelerini planlar. Bina analizleri, eğitim programları, yerleşke ve çevre gibi konuları değerlendirerek oluşturulan ihtiyaç tanımlarına ihtiyaç vardır (Lidsky, 2002). Türkiye'de kurulan tüm devlet üniversiteleri hazırladıkları stratejik planların onaylanması ve buna göre kısa, orta ve uzun vadede bu planların gerçekleştirilmesi yöntemi ile hizmet verirler (URL-3).

Birçok üniversitede yaya dolaşımını ve binalara erişimi ön planda tutan tasarımlar ve uygulamalar görmek mümkündür. Günümüz dünyasının önemli bir gereği olan taşıt ile de ulaşımın varlığı üniversitelerin planlamalarını taşıtlara da seçenek sunacak şekilde yapması gerekir (Kahveci, 2021). Dolayısıyla yaya ölçeği ve taşıt arasındaki ilişkiyi hangi seviyede ve özellikte tutacağı o üniversitenin insan ile ne kadar doğrudan ilişki kurduğunu belirler. Kent içindeki üniversite çeşitlilerinden parsel bazlı olanlarında bunu kontrol etmek zordur, çünkü dolaşım üniversiteye ait olmayan şehir ulaşım ağından sağlanır. Bir yerleşkenin kent ile ulaşım ilişkini bireysel ve toplu ulaşımda, yaya ve bisiklet ölçeğinde iyi kurması beklenir. Kentin de bu sisteme sahip olması bu duruma büyük bir katkı sunacaktır.

Türkiye'de bazı sosyal, idari ve coğrafi nedenlerle üniversite sistemi çeşitlilik sunmakta, dinamik bir yapıya sahip üniversitenin kurulması uzun ve aşamalı bir planlamayı beraberinde getirmektedir (Güneş & Gökçe, 2022). Ayrıca hızlı kentleşme ile de birçok üniversite şehir dışına yönelerek bu uzun süreci deneyimlemiştir. Şehir dışında bulunan üniversiteler şehrin sağladığı birçok

imkanı da beraberinde ve içerisinde sağlamak zorundadır (Körmeçli, 2022). Kent içindeki üniversitelerin ise başka avantajlarından bahsetmek mümkündür. Eğitim ve araştırma işlevlerinin yanında özellikle kent dışı üniversitelerde gereken barınma, yeme ve sosyal işlevleri kent dokusundan ve altyapısından sağlayabilirler. Ayrıca kendi içlerinde bunun gibi işlevler varsa kentin kullanımı ile üniversite kent ilişkisi kuvvetlenebilir.

Üniversite planlamaları üzerine birçok çalışma ve rapor mevcuttur. Bu çalışmalarda kentsel tasarım düzeyinden ele alanın üniversite örnekleri üzerinden sınıflandırma çalışmaları yapılmış ve farklı yerleşim tipolojilerinin etkileri araştırılmıştır. Bunlardan bazı örneklerler;(1) yaygın yerleşim, merkezi yerleşim, moleküler yerleşim, şebeke yerleşim ve lineer yerleşim; (2) çekirdeksel yaklaşım, çizgisel yaklaşım ve ızgara yaklaşım; (3-kent dışı) dağınık planlı, merkezi planlı, ışınsal planlı, yığınsal planlı, ağ örgüsü, çok kutuplu; (4-kent içi) organik doku içinde gelişen, yapı adalarında gelişen, ağ örgüsü, doğrusal olarak verilebilir. (Erçevik, 2008; Erkman, 1990; Güneş & Gökçe, 2022; Türeyen, 2002). Özellikle kent içindeki üniversitelerinde parsel yapısı ve mülkiyet gibi sorunlar, şehrin imar ve kadastral planına ait ulaşım ağına uyma zorunluluğu durumları üniversite yapılaşmasını çok etkilemektedir. Üniversiteye tahsis edilen arazi kendi iç ulaşımını kurabilecek büyüklükte değilse, bir yerleşkeden çok kent sokak ve caddelerinden servis alan parsel veya ada bazlı hizmet veren küçük ölçekli bir eğitim kampüsü olarak kalabilir.

ÜNİVERSİTE VE KENT İLİŞKİSİ

Kent içinde veya kent dışındaki kurulan üniversiteler kendi faaliyetlerine ek olarak kültürel ve sosyal açıdan kente aktif ve pasif olarak katkı sunan önemli aktörlerdir (Gürsoy, 2018). Bir yapı kümesi olmanın çok ötesinde, kentin aktivitelerine, gündelik yaşamına ve uzun süreli planlarına katılırlar. Ürettiği bilimsel ve kültürel etkinlikler, spor ve sosyal faaliyetler, yerleşkenin kendisinin sunduğu rekreasyon alanları ve fırsatlar sadece üniversiteyi kullanan akademisyenler ve öğrenciler için değil, yakın çevreden başlayarak tüm kent için önemlidir.

Üniversitelerin kent ile kurduğu ilişkinin gelişmesi ve bilim yuvası olmanın ötesine geçmesi güncellenen ve sürekli değişen eğilimlerle yeniden değerlendirilen bir konudur (Oktay, 2007). Bu açıdan düşünüldüğünde, Türkiye'de özellikle kent içinde ve yakınında kurulan üniversitelerin kentte katkı sunması beklenmektedir. Bir üniversitenin kurulduğu kent ile nasıl ilişkiler geliştirdiği ve orada neleri değiştirdiği her kent ve üniversite için farklıdır (Kuyrukçu & Alkan, 2021). Üniversitenin büyüklüğü ve misyonu, kentin tarihi, sosyal dokusu, sanayi ve üretimi, kültürel çeşitliliği gibi etkenler bu ilişki biçimini etkiler.

Üniversitenin kente göre konumu ve kente karşı kendini kapatıp kapatmaması ilişki biçimini belirler. Konumuna göre üniversitenin ve kentin sahip olduğu avantajlar farklı olur. Kent içi üniversitelerde birbirlerinin kültürel ve sosyal alanlarını, aktivitelerini paylaşma avantajı daha fazlayken, kent dışın üniversitelerde kendi rasyonel kurallarını geliştirme ve planlanma şansı olur (Erçevik & Önal, 2011). Bu açıdan bakıldığında kent ile kolay ulaşım sağlayacak konumda ve gelişme için yeterli olan bir yerleşkeye sahip olmak faydalıdır. Gelişimini büyük ölçüde tamamlamış şehirlerde kent içinde bir üniversite yerleşkesi olarak kendi iç ulaşım ağı ile hizmet verilebilecek arazilerin bulunması zor olabilir. Eski yıllarda, yerleşke arazisine sahip olmuş ve şu an kentin içinde kalmış üniversiteler bu yönden avantajlıdır. Son dönemde kurulan üniversitelerden bu çalışmada sunulan Bursa Teknik Üniversitesi gibi büyükşehirlere kurulan bazı üniversitelerin kent içindeki arazi varlığı ile kurulmaları kendilerine önemli bir değer katmaktadır.

Üniversitelerin kent ile olan ilişkisi üzerinde durulurken değerlendirilmesi gerek önemli konulardan biri kent kimliği kavramıdır. Kent kimliği doğal ve yapılı çevresel özellikler, sosyal çevre, kültürel değerler, mimari unsurlar, uygarlıklar, yaşayan insanları, ulaşım, iklim, diğer şehirlerle ilişkiler ve geçirilen önemli olayların bütünü tarafından şekillenir (Lynch, 1981; Ocakçı & Türk, 2012; Oktay, 2018). Yeni kurulan bir kent içi üniversitenin bu değerlerden etkilenmesi ve ilerleyen yıllarda bu şekillenmeyi göreceli olarak az da olması etkilemesi beklenmektedir. Dolasıyla evrenseler norm ve kriterlere göre eğitim ve araştırma işlevleri ile kurulan üniversitelerin içinde

bulundukları kentin değer ve kimlik durumlarını planlama ve yapılaşma aşamasında değerlendirmeleri gerekir.

İŞLEVLER VE ULAŞIM

Üniversite yerleşke tasarımlarında iç yaya ve taşıt ulaşım ağı planlaması yapılarak kent ile bağlantı kurulmaktadır. Şehir içi ulaşım ağına bağlantı noktaları hem yerleşke planı tasarım kriterleri hem de şehir ulaşım ağı prensipleri değerlendirilerek yapılır. Belirlenen alanlara tasarlanan giriş kapıları da bu ana prensiplere ve yerleşke planı ulaşım kriterlerine uymaktadır. Doğal olarak kent içinde kurulan üniversiteler mevcut yapılaşma durumuna uyarak geliştiklerinden planlamada ideal olan ulaşım ilişkilerine sahip olamama durumu gerçekleşebilir. Örnek olarak, Avrupa'da kentsel bir kurum olarak ortaya çıkan üniversiteler ilk başta kuruldukları şehirlerdeki kolej binalarına eğitime başlamış ve bunların bir kısmı zaman için kent dışındaki büyüyebilir ve gelişebilir bağımsız yerleşkelere geçiş yapmıştır (Kuyrukçu & Alkan, 2021). Şehirdeki ilk yerleşim alanlarında kalan ve kalmak isteyen üniversiteler bu koşullara uyum sağlamışlardır.

Erkman'a göre (1990) bir yerleşkenin içermesi gereken işlevler; çalışma işlevi, barınma işlevi, dinlenme ve rekreasyon işlevi ve ulaşım işlevidir. Bu işlevler içerdiği alt işlevleriyle birlikte çalışmalı ve bir örüntü içinde ilişki kurmalıdır. Kent içi üniversiteler de barınma ve beslenme gibi işlevlerinin kent altyapısında sağlanması seçeneği veya zorunluluğu olabilir. Bu nedenle kent içi üniversitelerde yerleşke arazisinin büyüklüğü ve kent dokusu değerlendirilerek bu konuda stratejik kararlar alınır.

Kampüste dolaşım sistemini oluşturan elemanlar dört ana grupta; girişler, yollar, meydanlar ve otoparklar olarak ele alınabilir (Türeyen, 2002). Yollar kullanım biçimine göre taşıt, yaya ve bisiklet yolu olarak ayrılmakta, ayrıca ulaşım ağına farklı uzunluk ve genişlik ölçülerine sahip olmaktadır. Yaya yürüyüş mesafesi dikkat alınarak tüm yerleşkenin binaların erişim kolaylığını destekleyen bir şekilde planlaması, taşıt trafiğinden etkilenmemesi gerekmektedir. Üniversitelerin gelişimin, araştırmanın ve yeniliklerin merkezi de olduğu düşünülürse, insanları ve doğayı önceleyen, yenilikçi ve

araştırmacı, kapalı ve açık mekanlar sunan bir yerleşke beklenmesi doğaldır. Üniversitenin fiziksel formu, açık alanlara ve rekreasyon alanlarına ulaşımı sürdürebilir kampüs olmak için gerekli önemli prensiplerin içindedir (Yerli & Ozdede, 2017). Dolayısıyla sadece ulaşım ağı tek başına değerlendirilmemeli, yaya ölçeğinde açık alanlara ulaşım ve kullanım metotlarını içermelidir.

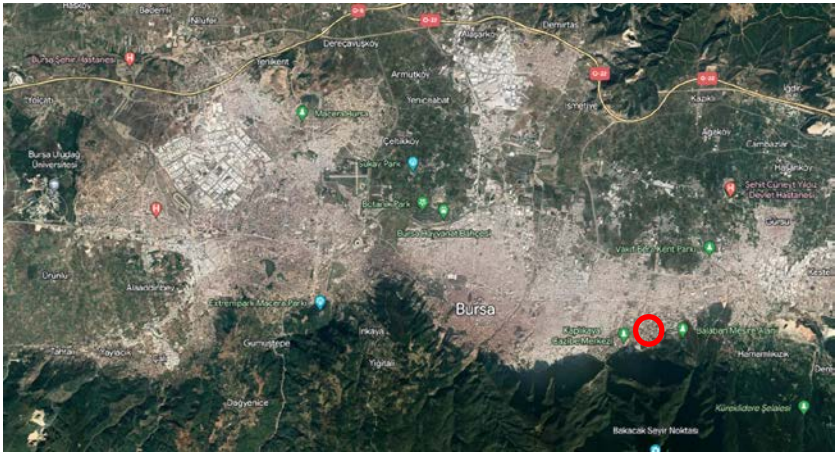
Erişebilirlik ve erişimde eşitlik insanların sadece üniversiteleri değil tüm yapı ve kentsel unsurları kullanımında dikkat edilmesi gereken evrensel bir kavramdır. Üniversitelerin bütüncül, sürdürülebilir ve geliştirebilir olmasının yanında mutlaka erişebilir olması gerekmektedir (Osman, 2018). Bina tasarım seviyesi ile sonuçlanan erişebilirlik, kampüs planlaması ana kurgusu ile başlar ve bu nedenle planlama aşamasında eğim, kot ve ulaşım ağı ile birleşik düşünülmelidir.

BURSA TEKNİK ÜNİVERSİTESİ MİMAR SİNAN YERLEŞKESİ

BURSA VE YERLEŞKE KONUMU

Üniversitenin kurulduğu Bursa şehri Türkiye'nin batısında, Marmara denizin ve Kocaeli'nin güneyinde bulunmaktadır. Tarım, eğitim ve sanayi açısından ülkenin önemli şehirlerinden biridir. 2022 adrese dayalı nüfus verilerine göre İstanbul, Ankara ve İzmir'in ardından yaklaşık 3.200.000 nüfus ile dördüncü sıradadır (URL-4). 1326 yılında fethedildikten günümüze kadar Türk şehri olan ve birçok tarihi eser barındıran Bursa şu an kendisine bağlı 17 ilçe ile büyükşehir statüsünde bir ildir (URL-5).

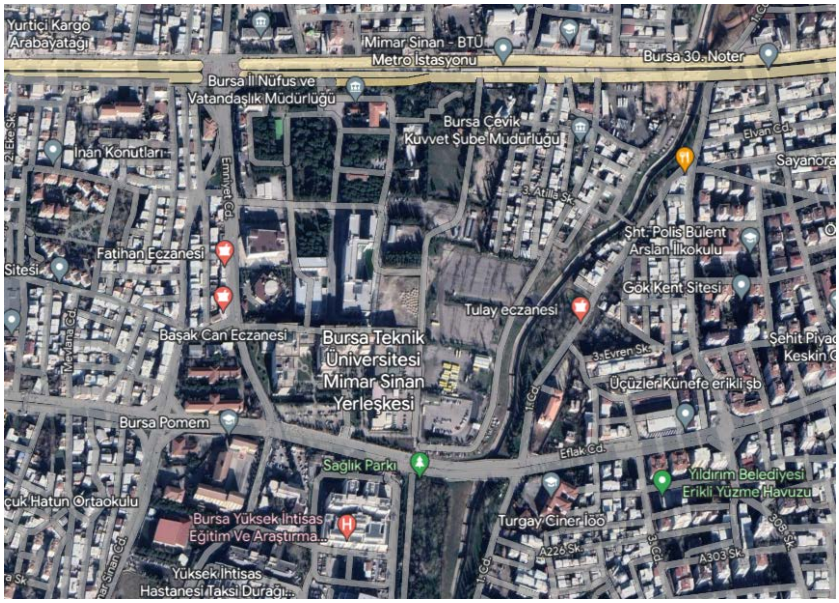
Bursa'da 1975 yılında kurulan ilk üniversite olan Uludağ Üniversitesi kentin batısındaki ana yerleşkesi ve diğer birimleri ile hizmet vermektedir (URL-6). Bursa Teknik Üniversitesi bir devlet üniversitesi olarak 2010 yılında kurulmuş olup kentin doğusunda yerleşmiştir (URL-2). Yıldırım Beyazıd Yerleşkesi ve Mimari Sinan Yerleşkelerinde 6 fakülte, 1 enstitü ve yabancı diller yüksekokulu ile hizmet vermektedir. Bursa şehri, Uludağ Üniversitesi ve Bursa Teknik Üniversitesi Mimar Sinan yerleşkesi konumları Şekil 1'de gösterilmiştir. Bu çalışmada 2017 yılında tamamlanan yerleşke planı, tasarımın yapıldığı zaman ve bağlam içinde anlatılmıştır.



Şekil 1 *Bursa ve Üniversite Konumu (URL-7)*[1].

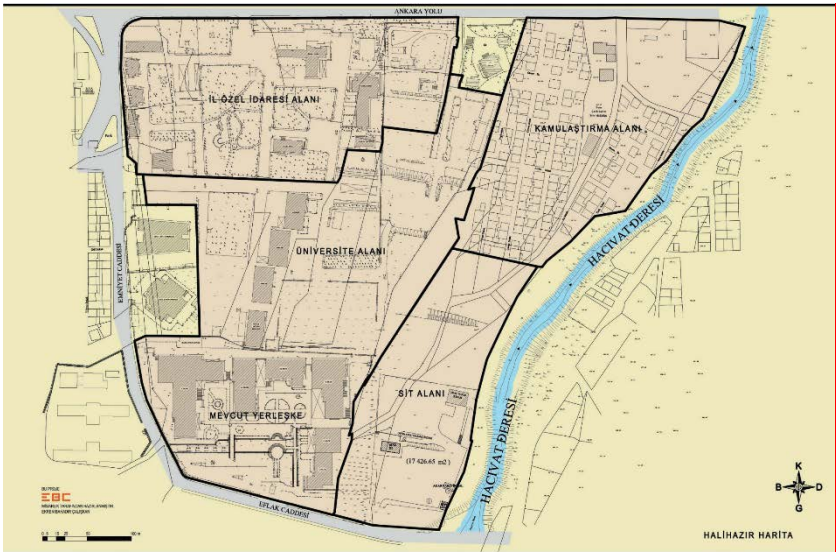
Mimar Sinan Yerleşkesi şehrin doğusunda, Yıldırım ilçesi Mimar Sinan Mahallesindedir (Şekil 2). 2016 yılında Bursa Teknik Üniversitesi kullanımına geçen yüksek öğretim yapıları ve bu yapıların bulunduğu arsa ile ilişkili tahsisli ve ileride üniversite bünyesine katılma durumu olan kamu ve özel arazilerinden oluşmaktadır. Planlama bu mülkiyet ihtimallerinin gerçekleşmesi veya gerçekleşmemesi ihtimalini düşünülerek yapılmıştır. Yerleşkenin kuzeyinden şehrin önemli ulaşım caddelerinden Ankara Yolu caddesi geçmekte, güneyinde ise Eflak Caddesi ile sınırlandırılmaktadır. Ankara Yolu caddesinde bulunan metro hattı ve üniversite ismi ile anılan durak ile batı ve doğu yönünde toplu taşıma sağlanmaktadır. Yerleşke adasının batı ve kuzey bölgesinde Valilik kullanımına ait bazı birimler bulunmaktadır. Güney tarafında Eğitim-Araştırma hastanesi, doğu tarafında ise dere ıslahı ile şekillenmiş rekreasyon alanları mevcuttur. Kuzey doğu köşesinde dini tesis, güneybatı cephesinde Yurtlar mevcuttur

[1] Çalışmadaki tüm plan ve uydu fotoğrafları kuzey yönü yukarı bakacak şekilde yerleştirilmiştir.



Şekil 2. *Mimar Sinan Yerleşkesi ve Yakın Çevresi (URL-7).*

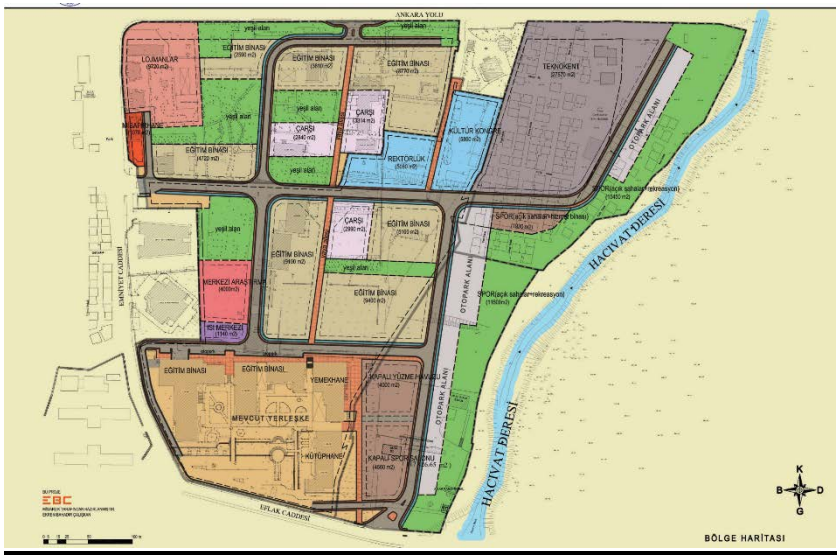
Vakıf üniversitesi olarak 37.000 m2 alan üzerinde planlanmış ve eğitim-öğretim için kullanılan binaları içeren arazi kullanım izni verilerek Bursa Teknik Üniversitesi'ne geçmiştir (Şekil 3). Bu alanda, Eğitim Binası olarak kullanılabilecek 3 adet bina, yemekhane, kütüphane gibi sosyal kullanımlar için 2 adet bina bulunmaktadır. Açık alanları ile birlikte %80'lik kısmı eğitim-öğretim ve idari kullanım için 2016-2017 döneminde açılmış olup, eksikleri tamamlanmak üzere planlama yapılmıştır. Arazi içerisinde yıkılacak baraka ve kullanıma elverişsiz binaların da olduğu yaklaşık 60 dönümlük arazinin de kullanım izini üniversiteye verilerek toplam 100 dönümlük bir kampüs büyüklüğüne ulaşılmıştır. Bunun dışında il özel idareye ait 60 dönümlük arazinin, özel mülkiyete ait 35 dönümlük arazinin de ilerleyen yıllarda yerleşke içine katılabilme ihtimali değerlendirilmeye alınmıştır. Bu arazilerin yerleşkeye katılma veya katılmama durumuna göre esneklik içeren bir yerleşke planı yapılması gerekmektedir. Yerleşkenin güney doğusundan yer alan 20 dönümlük sit alanı Hacıvat deresine paralel devam etmektedir.



Şekil 3. *Mimar Sinan Yerleşkesi Halihazır Durum (2016).*

TASARIM KURGUSU

Yerleşke planlamasında arazi ile ilgili önemli etmenler şu şekilde sıralanabilir; arazinin az eğime sahip olması, mevcut yapılar ile ilişki kurulması, yol ve toplu taşımalara göre giriş noktaları, güneş ve rüzgâr yönü, servis güzergahları ve tahsis edilmiş ve ihtimal dahilinde olan araziler. Planlama safhasında verilen ön kararlara göre yaya ulaşımı odaklı, erişebilirlik kriterlerine uygun, enerji verimliliği hedefli, bisiklet kullanımını sağlayan, ortak alanlarını merkeze alan ve yapılaşma etaplamalarına göre esneklik sağlayan bir yerleşke olması planlanmıştır. Bu nedenle ulaşım ağı ve yapı bölgeleri esnek yapılaşmaya uygun olarak planlanmış, yapılaşma için belirli kurallar belirlenmiştir (Şekil 4). Bunlara paralel olarak kampüs binaları ısıtma ve soğutma sistemleri için trijenerasyon sistemi tasarlanmış, yerleşke yapılaşmasına paralel olarak etaplayarak hizmete alınacaktır.

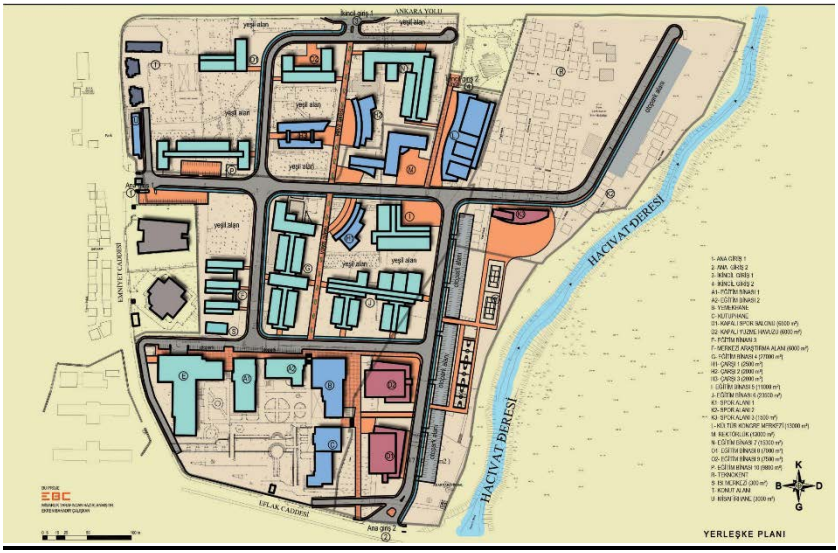


Şekil 4. *Bölge ve Ulaşım Planı.*

Tahsis edilen yerleşke ve içindeki A1, A2, B ve C blok fiili olarak kullanımdadır. Üniversite bu binalarda eğitim faaliyetlerine devam etmekte; rektörlük birimleri, yemekhane, kafeterya ve kütüphane hizmetleri vermektedir. E Blok kaba inşaat ve dış cephe imalatları tamamlanmış halde teslim alınmış olup, ihtiyaçlara göre iç mekân düzenlemeleri yapılmaktadır. Eğitim faaliyetlerinin bir kısmı da Yıldırım Yerleşkesinde devam etmektedir. Bu nedenle yönetim ile öncelikli olarak Mimar Sinan yerleşkesinde ve Yıldırım yerleşkesinde olacak birimler kararlaştırılmıştır. Bu kararlar verilirken hem iki yerleşkede devam eden birimlerin varlığı hem de Mimar Sinan Yerleşkesinde tahsis ihtimali olan alanlar dikkate alınmıştır.

Mevcut binalar güney cephesinde oluşturduğu avlu etrafında konulanmış, gelişme alanı olarak tahsis edilen araziye kuzey cephesi ile sırtını dönmüştür (Şekil 5). Bu binaları yerleşkesinin genişleme alanına bağlamak ve ilişkilendirmek gerekmektedir. Bu nedenle; A2-B blok arasından geniş bir geçiş, B-C blok doğusundan da ikinci bir yaya aksı oluşturularak bağlantı sağlanmıştır. Oluşturulan Yaya aksı, arazinin tahsisi sağlandığı takdir de tüm kampüsü geçerek toplam 500 metrelik kuzey-güney hattını bağlayacaktır. Bu

yol ile devlet karayolu bağlantısı sağlanacak ve raylı toplu taşımaya erişim oluşacaktır. Kampüs içinde minimum düzeyde araç trafiği olması düşünülmüş ve stratejik noktalarda açık veya kapalı otopark alanları konumlandırılmıştır.



Şekil 5. *Yerleşke Planı.*

Arazilerinin hepsinin kullanımının üniversiteye henüz geçmemesi nedeniyle, bina bölgeleri, açık alanlar ve yollar birbirlerine doğru ilişkiler kuracak şekilde eklenerek bağlanacaktır. Tahsis edilen ana yerleşke içinde 3 eğitim binası, araştırma merkezi, ısı merkezi, çarşı, meydan, kültür-kongre merkezi ve rektörlük binaları konumlandırılmıştır. İl özel idareye ait olan arazin ilerleyen yıllarda üniversite yerleşkesine katılma ihtimali nedeniyle bu alanda; 4 eğitim bina bölgesi, lojmanlar, misafirhane ve çarşı alanları oluşacaktır. Sit alanı, açık ve kapalı spor, rekreasyon ile otopark alanı için düşünülmüştür. Kamulaştırma ile yerleşkeye katılabilecek alan ise ileride kurulacak teknokent bölgesi için düşünülmüştür. Planlama yapılırken üniversite kullanımında olmayan potansiyel arazilerin kullanım ihtimalleri değerlendirilirken bir yandan da mevcut arazi sınırlarında kalındığında gereken temel üniversite işlevlerinin tamamlanmasına dikkat edilmiştir.

Mevcut giriş doğuya kaydırılarak ulaşım aksına bağlanmıştır. Ayrıca Emniyet caddesindeki giriş ana giriş olarak kullanılarak Ankara Devlet karayoluna ulaşım kolaylaştırılmıştır. İl özel idaresi arsasının yerleşkeye katılmama durumu için, kuzey cephedeki cami bölgesinden gelen giriş ile yerleşkeye yaya erişimi sağlanmıştır. Yerleşkenin kuzey cephesindeki devlet karayolunda hem raylı sistem hem de taşıt ile toplu taşıma mevcuttur. Bu alandan ilk etapta cami ve kültür kongre merkezinin olduğu bölgede oluşturulan yaya aksı ile, daha sonra ana yaya allesinin sonunda oluşturulacak yaya girişi ile ulaşım sağlanacaktır. Batı cephesinde Emniyet caddesi Ankara Devlet Karayoluna kavşak ile bağlanmaktadır. Bu nedenle Emniyet Caddesi'nden yerleşke ana girişi verilerek tüm istikametlere ulaşım sağlanmıştır. Bu girişten başlayan kampüs için servis yolu, yerleşke içinde ilk önce doğu, daha sonra güney istikametine devam ederek eflak caddesinde oluşturulan diğer ana girişe bağlanmaktadır.

Mevcut yapılara merdiven ile bağlanan ana yaya allesi kuzey-güney doğrultusunda katederek tüm yerleşkeye yaya ulaşımını sağlamaktadır. Yaya allesi sadece bir noktada servis yolu ile kesişmektedir. Bu durum yerleşke giriş noktalarında oluşturulan otopark alanları ile desteklenerek taşıt trafiğini azaltılması ve yaya-bisiklet dolaşım rahatlığının sağlanması hedeflenmiştir.
Yerleşke planı çalışmalarında bina ölçek ve koşulları için detaylı çalışmalar yapılmıştır. Her bir bina bölgesi için taban alanı, maksimum yükseklik ve yoğunluk, kotla ilişki, yaya ve servis giriş yönleri belirlenerek imar planlarının sınırları içinde kentsel tasarım kuralları geliştirmeye çalışılmıştır. Bu çalışmaları kullanarak yapılan taslak kütle analizleri hava fotoğrafları ile birleştirilerek sunulmuştur (Şekil 6, Şekil 7).

Şekil 6. *Yerleşke Görseli 1.*

Şekil 7. *Yerleşke Görseli 2.*

SONUÇ VE DEĞERLENDİRMELER

Bursa Teknik Üniversitesi Mimari Sinan Yerleşkesi kent içinde bulunan orta ölçekli bir alanda mevcut yapıların varlığı, birçok arazi ve çevre etkenleri ile birlikte kurulmuştur. Kent dışında kurulan büyük araziye sahip ve yerleşkeye kentsel ulaşım ağından giriş yapıldıktan sonra kendi rasyonel kurallarını belirleyerek planlamasını ve gelişimini boş bir arazide kuran üniversitelerden farklıdır. Kent içinde olmanın anlatılan birçok avantajı olmasının yanında,

yerleşkeye mevcut yapıların entegrasyonu, çevre ve kent dokusu ile iletişim, mikro ölçekte önemli ulaşım ve fonksiyon noktalarına erişim, yapı ve açık alan ilişkisini kurmaktaki zorluklar kent içinde bir yerleşke planlamasının tasarım problemi olarak değerlendirilebilir. Bu yerleşke planı tasarımı incelendiğinde, servis ve yaya ulaşım ağı, arazi kullanımına göre esneklik sağlayabilen yapılaşma bölgeleri, mevcut yapıları yerleşke ile ilişkilendirme, göreceli olarak küçük olan bir alanda merkezi bir sosyal-kültürel alan tanımlama çabası, mevcut yeşil doku ile ilişki kurmaya çalışan yapılaşma tavrı ön plana çıkmaktadır. Ek olarak yerleşkeye farklı büyüklükteki arazilerin eklenme ihtimali, planlamanın farklı senaryolara göre esnek çözümler içermesinin gerektirmektedir. Ulaşım ve yapılaşma tasarımı farklı durumlara göre geliştirilen senaryolara göre yapılmıştır. Bu değerlendirmeler neticesinde, kent içi yerleşke tasarımı ve problem çözümü yolları açısından çalışmanın öğretici olduğu ve alana katkı sunduğu düşünülmektedir.

TEŞEKKÜR VE BİLGİ NOTU

Bu çalışmada sunulun değerlendirmeler 2017 yılında tamamlanan yerleşke planı proje dokümanlarından yapılmıştır. Güncel yapılaşma ve gelişimi açısından bir değerlendirme yapılmamış olup farklılıklar olabilir. Çalışmada ve projede katkısı olan herkese teşekkür edilmektedir.

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