

Examination of Outdoor Lighting Design Principles: The Case of Istanbul Lounge

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Abstract

Outdoor lighting design is the process of planning and implementing lighting in outdoor areas. This design usually focuses on factors such as aesthetics, safety and functionality. A correct outdoor lighting design ensures the safety of the space and improves the atmosphere by increasing night use. The placement of lighting fixtures is a critical factor for the success of this design. This study aims to provide inspiration for similar housing projects by analysing the successful principles of outdoor lighting design of Istanbul Lounge housing estate and suggesting inappropriate principles. Within the scope of the study, international sources on the subject were reviewed, and it was determined that the lighting design principles cover the lighting of space, comfort, emergency, security, landscape, plant materials, sculpture, architectural structures, signboards, walkways, stairs and water elements. These principles are discussed in the example of Istanbul Lounge, and their effects on the general atmosphere of the site, user experience and visual comfort are analysed. Outdoor lighting design has been handled in a holistic manner covering the roads, gardens, playgrounds and common areas throughout the site. The applied examples of all lighting design principles were identified, and a checklist based on their equivalents in the literature was created and evaluated on a five-point Likert scale and suggestions were made for the inappropriate sections. As a result, it is seen that outdoor lighting design criteria are handled in a wide range, and these principles are successfully applied in the example of Istanbul Lounge housing estate.

Introduction

The use of lighting in architecture is recognized as a fundamental element in design. Solid masses, open and closed volumes, colour and texture can only be fully appreciated when properly illuminated. Lighting levels vary according to the type and size of the space. The level of illumination envisaged within the area to be illuminated is based on the understanding of how the spaces can fulfil their specified functions, the efficiency of the tasks and how they affect visual perception [1]. Lighting in architecture can be done indoors, semi-outdoors or outdoors (in urban open spaces).

Outdoor space is defined as publicly accessible open spaces such as parks, streets, squares and gardens.

Architectural design principles in outdoor spaces are formed in line with the user needs for the determined function of the space. This list of needs may change in line with the common purposes of different users and the meaning attributed to the outdoor space. The different ages, genders, and cultural backgrounds of the users are also among the different principles to be considered in the design of the outdoor space. For this reason, the planning and design of outdoor spaces should be done by first reviewing the basic needs of the users [2].

Individuals' accurate perception of their physical environment depends on a high quality of visual comfort. Visual comfort is necessary for individuals to see their surroundings clearly and for their visual perception to be effective. Factors such as proper illumination of

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this environment, harmony of colours, and regulation of visual stimuli come together to enable individuals to see comfortably and perceive their environment effectively. Therefore, providing visual comfort is of great importance for people to understand and interact with their environment [3].

Factors such as light, colour, sound, temperature, and humidity are key elements of the physical environment that have a direct impact on individuals. Lighting refers to the use of light to make objects, their surroundings, and spaces of various sizes visible. It plays a fundamental role in how people perceive their environment, recognize objects, and evaluate environmental conditions. Since visual perception is largely dependent on lighting, it serves as the primary element that allows individuals to perceive and interact with their surroundings. One of the core principles of this perception is lighting design. In this study, the focus is on outdoor lighting design [4], [5].

Outdoor lighting design has become an important principle in urban design components. Outdoor lighting differs from indoor lighting. Outdoor lighting includes features such as safety, security and aesthetics [1]. At the same time, the layers of light in successful outdoor lighting define the characteristics of the environment and spatial space by emphasizing architectural features. Lighting used in urban space is used as a background in areas such as sidewalks, trees, building facades, pedestrian crossings, stairs, bridges, sculptures, and important reference points. These illuminations also emphasize the interesting aspects of these points [6]. For this reason, proper planning of outdoor spaces necessitates the design of appropriate lighting.

A well-planned lighting scheme design adds colour, dimension and vibrancy to the environment, giving a sense of security and allowing people to find their way around and feel safe. On the other hand, an improperly implemented lighting scheme design can lead to various problems in terms of safety, visual quality and eye health. In order to create good lighting, it is critical to use lighting tools with appropriate light distribution at the right points [7], [8].

The purpose of this study is to examine the application of outdoor lighting design principles in the Istanbul Lounge housing estate and to identify both successful aspects and areas needing improvement. The study aims to explore the effects of fundamental lighting design principles, such as safety, aesthetics, and functionality, on housing estates and to provide recommendations that can serve as a guide for similar projects. Additionally, the study evaluates the applicability of lighting design principles outlined in international literature, encompassing aspects like space, comfort, safety, landscape, and architectural structures. By analyzing how these principles are integratively implemented in the Istanbul Lounge example, the study delves into their impact on user experience and visual comfort.

I. Literature Review

Lighting in cities is analyzed in two main categories: functional and architectural. Functional lighting generally covers areas related to urban use, such as traffic, transportation, pedestrian areas, sports fields, shopping malls, industrial zones and billboards. The priority in this category is to provide the necessary visual conditions for the realization of a specific activity or function. Architectural lighting includes the illumination of historical, artistic, cultural and natural assets, pedestrian zones and landscape areas. The priority in this category is to ensure that urban assets are visible at night. The common feature in both categories is the use of various types of luminaires to provide illumination [9].

Outdoor lighting at night plays an important role by fulfilling various functions and satisfying different human needs. The basic classification of outdoor lighting depends on the type of outdoor space, typical tasks and activities performed. In this context, standards and guidelines on outdoor lighting set requirements and recommendations for four different types of outdoor spaces. In general, the purpose of providing outdoor lighting can be defined as supporting business and general activities, ensuring the safety of drivers and pedestrians, aesthetic ornamental purposes and supporting sports activities [10].

The main purpose of electric lighting applications during dark periods in outdoor spaces is to ensure human safety and visual comfort [11]. Achieving these conditions requires the provision of appropriate lighting conditions and lighting layout designs to fulfil visual perceptions effectively and comfortably [12].

Outdoor luminaires are classified according to their mounting type (floor, pole, wall) and the light intensity they emit, while floodlights are classified according to their beam patterns. Lighting fixtures are classified according to their application areas, photometric properties, mounting methods, light source and materials used [13].

Devices used in outdoor lighting applications can generally be categorized under four main categories according to their height and design purposes [14], [33].

- Lighting poles: Tall posts that support light fixtures, commonly used for illuminating streets, parking lots, and large outdoor areas. They provide broad illumination over a wide area.
- Wall lights: Fixtures mounted on building walls, used for both aesthetic and security purposes. They are often placed at entrances, along corridors, and on exterior walls.
- Ground lights: Fixtures embedded in or mounted on the ground, providing low-profile lighting for pathways, steps, and garden areas. They are designed to offer illumination without obstructing the view.
- Spot lights: Fixtures designed to highlight specific objects or areas, such as sculptures, plants, or

architectural features. They offer focused, directional light.

- Flood lights: Powerful fixtures that provide broad, high-intensity light. Typically used for large areas such as sports fields, parking lots, and security applications.
- Path lights: Low-level fixtures used to illuminate walkways, garden paths, and outdoor spaces. They enhance safety and guide pedestrians by providing subtle illumination along pathways.
- Recessed lights: Fixtures that are installed flush with surfaces, such as floors or ceilings. They offer a sleek, unobtrusive lighting solution for walkways, terraces, and building exteriors.
- Recessed LED strips: Flexible LED lighting installed in recesses or hidden channels. Ideal for architectural highlighting, stairways, and continuous linear lighting effects.
- High bay lights: Fixtures designed for high ceilings or open spaces, providing intense illumination for areas like warehouses, sports arenas, and large outdoor areas.
- Decorative lights: Fixtures designed for aesthetic enhancement, including coloured LEDs and special effect lighting. These are used to create ambience and highlight design features.

Planning and designing lighting design in outdoor spaces is related to lighting principles. The lighting scheme design in outdoor spaces appears with different lighting principles [15]. When we look at the literature research on the subject, lighting principles are discussed under different general headings according to their subjects.

A. Area Lighting

Area lighting, the location and characteristics of lighting devices are determined according to the social and functional elements in the environment. Some lighting installations are placed around social structures, allowing pedestrians to rest and benefit from these areas. Such lighting installations are usually located in public spaces such as parks, gardens or urban squares [16]. In area lighting, a safer and more efficient working area is created by planning the environment correctly. There are two basic forms of this type of lighting – low mounted systems and high mounted systems. In the case of small to medium-sized areas, even floodlights with wide beam light distribution and road lighting lights can provide a satisfactory level of illumination. In open areas, large areas can be well illuminated using high mast floodlighting techniques [17].

B. Lighting for Amenity

Lighting for amenity, is a type of lighting that has both general and subjective principles on the design. It

should help the space to provide the conditions required by its function and be suitable for the human form. This means a lighting arrangement that is easy on the eyes and where shadows are not disturbing. Most comfort lighting is to provide a fairly large amount of lighting variation. Comfort lighting should also not be dominant. It should not overwhelm the atmosphere of the space or overshadow other design elements of the space. Instead, it should provide a balanced illumination to harmonize with the overall design of the space.

C. Emergency Lighting

Emergency lighting is the type of lighting that should be used in situations where daylight is insufficient and in case of failure of the light source. The purpose of emergency lighting is to ensure safety in the area, prevent panic, reveal fire alarm devices and illuminate escape routes for safe, rapid evacuation [17].

D. Security Lighting

Security lighting is a type of lighting that helps to create a good concealment area during system patrol surveillance with luminaire arrangement in all possible areas due to crime and antisocial incidents. In these areas, lighting can be more effective than other security measures during the hours of darkness. The correct placement of luminaires provides security personnel with a good visual perception.

E. Landscape Lighting

Landscape lighting describes a large part of an area and the arrangement of elements within it. The design of these areas is based on meeting the needs of various activities [17], [18]. Outdoor landscape elements and spaces can be illuminated with various lighting techniques according to the desired purpose, design and intensity of use. The position of the lighting fixtures is an important factor that determines the appearance of the illuminated landscape elements. In this way, an object, plant or plant groups that do not attract attention in daylight become remarkable with appropriate lighting at night. Lighting should reveal level changes and the route. In landscape lighting, the designer can use light to make objects stand out, emphasize patterns with directed lighting patterns, and give a sense of depth and perspective to the space. All these design approaches can be applied to a neighbourhood as well as to a park area or the garden of a house [19].

F. Plant Materials

The technique of lighting plant materials is determined by the visual effect of the plant and its role in the plant community. Variables to be considered for these techniques

are the direction of light, the location of the luminaire and the amount of light. In order to fully perceive the illuminated plant or object without glare, it is important that the light source is directed towards the point of view. This means that the light does not shine directly into the eye and that reflections are kept under control. Correctly directed light shows the details and colours of the plant or object more clearly and does not irritate the eyes. This is usually achieved by positioning the lighting fixtures correctly and adjusting the angle of light spread. In addition, the lighting source used must be correctly selected [20].

The direction of light varies from above, from below and from the side. The designer must decide whether the area will retain its daytime appearance or gain a new look when illuminated at night. Light from below casts shadows on the underside of the leaves, showing how the sun illuminates the plant. In both bottom and top lighting, it creates light filters that will mimic daylight on a cloudy day. When illuminated from above, the appearance of the plant is different from that of daylight. When light is used on plants, it creates shadows by emphasizing the upper texture and forms of the leaves. This creates a dramatic visual effect.

G. Sculptures, Architectural Structures and Signage

In sculpture and sign lighting design, sculptures are architectural design elements that help to recognize a hero or introduce a city or landscape. In public spaces, sculptures and signs contain information about how people will be oriented in the area. For this reason, it should be decided how these areas should be illuminated. In such lighting arrangements, there are several important strategies for the element to attract attention. First, the illuminance of the element should be at least three times higher than the illuminance of the background. It is also important to place items in daylight, as natural light shows the details and shape of the item more clearly. The lighting of sculptures and signs should be designed to provide a striking appearance both day and night. This is especially important when a remarkable work of art or an important sign needs to be displayed in an impressive way. All of these factors help to increase the visual impact of illuminating sculptures and signs while maintaining functionality [20], [21].

H. Walkways and Stairs

Walkways and staircase lighting is a type of lighting created so that these areas, which provide a way for outdoor movement, can be used at night, and people can move safely in these areas. Walkways allow pedestrians to find their way and see obstacles during their journey. But at the same time, they should be designed to deter property crime and create a sense of security. In these areas, the light level, luminaire type and lighting pattern should be

adjusted according to the type of walk. For a quick and simple lighting design, 9–13-meter-wide paths should be placed at 1-meter intervals along the length and width of the road. Since sidewalks also serve as main traffic routes in city centres and neighbourhoods, higher and evenly distributed light levels are needed in these areas [17], [18]. The lighting of stairs is critical for the safety of pedestrian movement. For this reason, stairs can be illuminated using different lighting methods. Lighting devices mounted on poles make pedestrian movements safe by directly illuminating the stair treads. Embedded luminaires can provide an aesthetic appearance on the stair surface or on the side walls while at the same time providing adequate illumination. Linear light sources placed under the dock can provide homogeneous illumination along the stairs and offer a visually attractive appearance. These lighting systems are especially preferred in areas with less dense pedestrian circulation because in less dense areas, it is possible to plan lighting fixtures more carefully and use fewer of them. However, in all cases, it is important that the luminaires used have sufficient lighting power and make pedestrian movements safe [22].

I. Building Elevation Lighting

Building lighting is a type of lighting that emphasizes structures, directs users' eyes or movements towards the landscape and enhances environmental interaction. By using multiple light sources, it reveals the architectural details of buildings and enriches the night view. At the same time, it also contributes to the safety of buildings. This type of lighting emphasizes buildings aesthetically while also playing a functional role. Building lighting can include multiple light sources that create a composition within themselves [17], [18], [21].

Building lighting is a type of lighting that helps identify a building or locate the site for potential users. Building lighting can be used to fulfil both utilitarian and decorative functions. It is a lighting that provides security and emergency lighting of buildings, emphasizes the building and reveals the building form by being placed in various locations. If the immediate surroundings are dark, illuminating the building with a small amount of light makes it appear much brighter. If there are many illuminated buildings, road lighting or signs in the immediate vicinity, the amount of illumination hitting the facade needs to be higher [18]. Successful facade lighting not only emphasizes the architectural structure aesthetically but also harmonizes it with the surrounding landscape design and creates a serene environment that is easy on the eyes. This type of lighting arrangement not only makes the building distinctive in the dark but also integrates it with the surrounding natural and artificial landscape elements. In this way, a visual balance is achieved between the building and the surrounding landscape elements. In

addition, bright lights are avoided, creating a relaxing environment that is easy on the eyes. This provides an atmosphere where people can easily spend time and experience the building in a more pleasant way [23].

J. Water Features

Water element lighting is a type of lighting that is based on the principle that the brightness relationship of water with the focal point of water elements, which are often used in outdoor spaces, is in harmony with the rest of the outdoor lighting. While designing these areas, designers should pay attention to how they should illuminate the water when they use it. Lighting elements on the side walls of water areas illuminate the pool walls and the water floor, emphasizing the shape of the water body or the materials used in the area.

It is important to choose the right light sources to emphasize the colour and texture of the water in the lighting of water features. Lighting power and colour tone should be balanced and light sources should be placed correctly. Underwater lighting elements should be concealed as much as possible and placed in such a way as to provide a homogeneous illumination under the water of the pool. It is also important that underwater lamps are fully protected against water leakage. Water leakage can cause electrical hazards and shorten the lifespan of lighting systems [20], [21].

Outdoor lighting design encompasses a range of principles, each specifically tailored to address distinct aspects of exterior environments. Area lighting aims to provide comprehensive illumination across extensive outdoor spaces, ensuring both visibility and safety. Lighting for amenity focuses on enhancing the aesthetic appeal and comfort of these areas, thereby creating a more inviting atmosphere. Emergency lighting is essential for directing occupants during power outages or emergencies, facilitating safe evacuation. Security lighting serves to deter criminal activity and bolster safety by illuminating vulnerable areas. Landscape lighting accentuates natural features such as trees and gardens, thus enhancing the overall visual appeal of the environment. Plant materials lighting highlights the texture and colour of vegetation, contributing depth and character to outdoor settings. Sculptures, architectural structures and signage lighting draws attention to artistic and functional elements, making them prominent focal points within the landscape. Walkways and stairs necessitate adequate illumination to prevent accidents and ensure safe navigation. Building elevation lighting underscores the architectural features of structures, enhancing their visual prominence after dark. Finally, water features lighting employs the interaction of light and water to create a serene and aesthetically pleasing effect within the environment. Collectively, these

principles offer a comprehensive approach to outdoor lighting design, optimizing both functionality and aesthetic value in exterior spaces.

When the subject of outdoor lighting is researched, we come across many design principles. It has been determined that the lighting design principles determined as a result of the literature research can be observed most comprehensively in a public housing estate. For this reason, this study aims to examine and evaluate the outdoor lighting design principles in the example of a public housing estate and to make recommendations as a result.

II. Methods

A. Study Area

Istanbul Lounge is located on a 68 307 m² plot of land registered in Istanbul Province, Küçükçekmece District, Atakent Neighbourhood, F21C21A2D Pafta, Block 801, Parcel 9. Istanbul Lounge consists of 25 blocks of residences, social facilities and green areas, children's playgrounds, sports areas, and outdoor areas consisting of water areas [37]. The satellite image and site plan of the Istanbul Lounge housing estate are presented in the visuals in Figs. 1 and 2).

Consisting of 792 independent sections, the project is a housing estate project that houses 2376 people, considering that each independent section is home to an average of 3 people. Istanbul Lounge was selected as the study area due to the fact that it is a public housing estate in Istanbul with extensive outdoor areas designed in a modern style, and all of the application examples of outdoor lighting design principles were seen. The identification of the Istanbul Lounge is shown in Table I.



Fig. 1. Istanbul Lounge (Coordinates: 41.03936870561023, 28.7646348184885) [36].

ISTANBUL-OUNGE



Fig. 2. Istanbul Lounge site plan [37].

TABLE I

Study Area Identification [by authors]

Istanbul Lounge			
Production company	Architect	Land area	Construction area
Eroğlu Gayrimenkul	Büyüamin Derman	68 307 m ²	145 720 m ²
Residential area	Number of apartments	Apartment types	Construction date
85 000 m ²	792	1+1, 2+1, 3+1, 4+1	2010–2012

K. Study Method

There are numerous sources published on the subject of outdoor lighting. A literature review was conducted, identifying 14 books published by internationally recognized publishers that could serve as resources for landscape architects, architects, urban planners, and designers working in this field. The bibliographic details of each book are shown in Table II. These books offer a broad perspective on various aspects of outdoor lighting. Below is a summary of the focus of each book.

- **Lighting Guide LG6:1992 & The Outdoor Environment [17]:** This book presents standards and guidelines for outdoor lighting design, addressing the impacts of lighting systems on the surrounding environment.
- **The Landscape Lighting Book [18]:** Focuses on the design and implementation of landscape lighting. It provides practical information on lighting for gardens, parks, and natural areas.
- **Architectural Lighting Design. Second Edition [24]:** Covers the fundamental principles and technical details of architectural lighting design, highlighting the differences between interior and exterior lighting.

- **Light for Cities: Lighting Design for Urban Spaces. A Handbook [25]:** Offers a comprehensive guide to lighting design for urban areas, discussing the role and effects of light in city environments.
- **Design for Outdoor Recreation. Second Edition [26]:** Concentrates on the design and lighting of outdoor recreational areas, including principles to enhance user experience.
- **Outdoor Lighting: Physics, Vision and Perception [27]:** Examines the physical and perceptual aspects of outdoor lighting, including light physics, visual perception, and user responses to lighting design.
- **Lighting Design Principles, Implementation, Case Studies [28]:** Provides detailed analysis of lighting design principles, their implementation, and real-world case studies, bridging theory and practice.
- **Road Lighting: Fundamentals, Technology and Application [29]:** Focuses on the fundamentals, technologies, and application methods of road lighting, offering insights into road safety and effective lighting strategies.
- **Lighting Design: A Perception-Based Approach [30]:** Introduces a perception-based approach to lighting design, discussing how users perceive lighting and its impact on design.

- Lighting Design Basics [31]: Explains the fundamental concepts and principles of lighting design, providing a comprehensive introduction for beginners.
- Urban Lighting for People: Evidence-Based Lighting Design for the Built Environment [32]: Presents evidence-based approaches and user-centred solutions in urban lighting design, assessing the social impacts of lighting in cities.
- The Outdoor Lighting Guide [33]: Serves as a general guide for outdoor lighting, including basic principles, design tips, and application strategies.
- Outdoor Lighting for Pedestrians: A Guide for Safe and Walkable Places [34]: Focuses on lighting design for pedestrian areas, offering solutions to enhance safety and walkability.
- The Art of Landscape Lighting: A Designer's Companion [35]: Addresses the artistic and design aspects of

landscape lighting, providing creative and aesthetic approaches for designers.

Among these books, two sources were selected for their comprehensive and practical information on outdoor lighting design: Lighting Guide LG6:1992 & The Outdoor Environment and The Landscape Lighting Book: 3rd Edition. The first book provides foundational standards and environmental considerations for lighting design, while the second offers in-depth insights into landscape lighting. Consequently, these two books were chosen as references for establishing design principles in this study. The principles found in the relevant sections of the books used to create the checklist are shown in Table III.

When the chapters of the books are examined, it is seen that there are common and different principles. By analyzing all of these principles and combining some of them, ten different design principles were determined

TABLE II

Important Books Covering the Subject of Outdoor Lighting [by authors]

Author	Year	Book	Publisher	Page
Chartered Institute of Building Services Engineers	1992	Lighting Guide LG6:1992 & The Outdoor Environment [17]	CIBSE	115
Janet Lennox Moyer	1992	The Landscape Lighting Book [18]	Wiley	282
Gary Steffy	2001	Architectural Lighting Design. Second Edition [24]	John Wiley & Sons	288
Ulrike Brandi, Christoph Geissmar-Brandi	2007	Light for Cities: Lighting Design for Urban Spaces. A Handbook [25]	Birkhäuser	168
Simon Bell	2008	Design for Outdoor Recreation. Second Edition [26]	Taylor & Francis	240
Duco Schreuder	2008	Outdoor Lighting: Physics, Vision and Perception [27]	Springer	448
Ulrike Brandi	2012	Lighting Design Principles, Implementation, Case Studies [28]	Birkhäuser	112
Wout van Bommel	2014	Road Lighting: Fundamentals, Technology and Application [29]	Springer	355
Christopher Cuttle	2015	Lighting Design: A Perception-Based Approach [30]	Routledge	136
Mark Karlen, Christina Spangler, James R. Benya	2017	Lighting Design Basics [31]	John Wiley & Sons	272
Navaz Davoudian	2018	Urban Lighting for People: Evidence-Based Lighting Design for the Built Environment [32]	RIBA	208
Institution of Lighting Engineers	2019	The Outdoor Lighting Guide [33]	Routledge	400
Frank Markowitz	2021	Outdoor Lighting for Pedestrians: A Guide for Safe and Walkable Places [34]	Routledge	200
Janet Lennox Moyer	2022	The Art of Landscape Lighting: A Designer's Companion [35]	Routledge	348

TABLE III

Relevant Chapters in Specified Books [17], [18]

Lighting Guide LG6:1992 & The Outdoor Environment	The Landscape Lighting Book: 3rd Edition
Lighting Techniques	Element of Design
1. Area Lighting 2. Lighting for Amenity 3. Floodlighting of Building, Structures and Feature 4. Emergency Lighting 5. Security Lighting 6. Roadway Lighting 7. Landscape Lighting	1. Plant Materials 2. Garden Evolution: Changes That Affect Lighting 3. Sculptures, Architectural Structures & Signage 4. Walkways and Stairs 5. Building Elevation Lighting 6. Water Features

TABLE IV
Outdoor Lighting Design Principles [by authors]

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Area Lighting	Lighting for Amenity	Emergency Lighting	Security Lighting	Landscape Lighting	Plant Materials	Sculptures, Architectural Structures & Signage	Walkways and Stairs	Building Elevation Lighting	Water Features

according to their subjects in outdoor lighting design. The ten principles are shown in Table IV.

These principles will be used as the study method. A checklist will be created in the context of the contents of each principle, and the outdoor lighting designs of the Istanbul Lounge housing estate, which is the study area, will be evaluated using a 5-point Likert scale in the research findings section.

III. Research Findings

When the area lighting was examined, it was determined that there were lighting elements at certain intervals in various areas serving different functions, such as site entrance, basketball court, parking lot entrance, and social facility areas. There are no lighting elements in the immediate surroundings of some areas. It is seen that the immediate surroundings of these areas are illuminated by the light reflected from the lighting elements used in the application area. In large areas such

as the basketball court, the high mast projector lighting technique was used at certain intervals. At the parking lot entrances, there are projector lighting elements with medium-height poles, and in the entrance areas of the social facility area, there is road lighting with wide beam light distribution.

When the lighting for amenities was examined, it was determined that circulation areas, gathering and parking areas with different functions, plants and water elements were illuminated with lighting elements of different sizes, light amounts and intervals. The identified lighting elements are at a level to provide comfortable vision and are designed in accordance with the human form.

When emergency lighting was examined, there were medium-height lighting elements in the evacuation routes and gathering areas within the work area. These lighting elements are placed at approximately 1-meter intervals. When the site management was interviewed, it was learned that the elements that illuminate the escape routes and gathering areas in emergency situations are connected to transformers, not directly to the city power plant, and that

TABLE V
Study on Area Lighting Armatures [by authors]

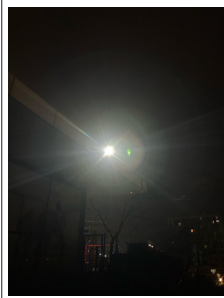
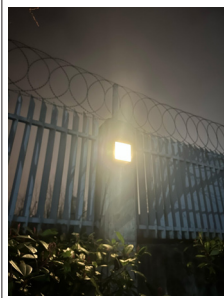
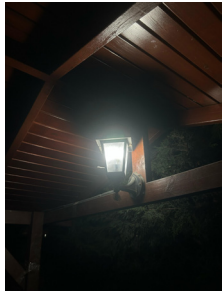
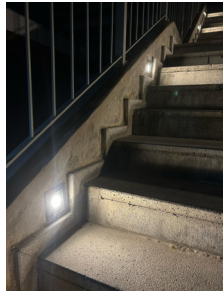
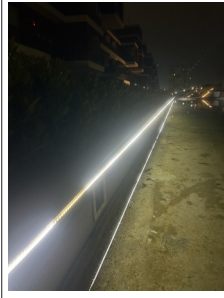
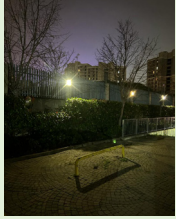
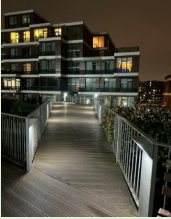
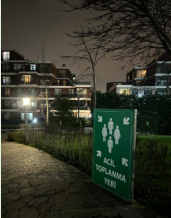
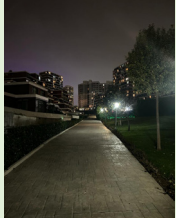
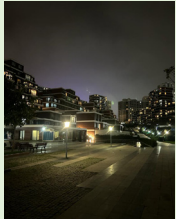
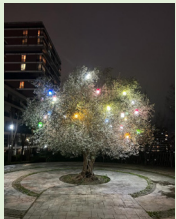
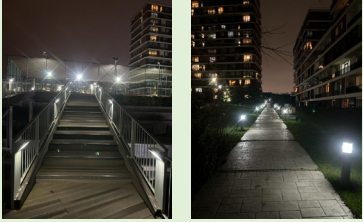
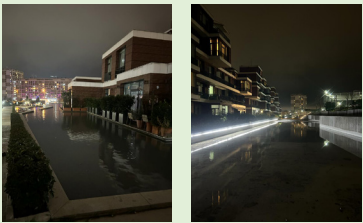
					
Lighting poles	Lighting poles	Path lights	Path lights	High bay lights	High bay lights
					
Wall lights	Decorative lights	Ground lights	Ground lights	Recessed LED strips	Flood lights

TABLE VI

Outdoor Lighting Design Principles Control List [by authors]

	Photos (taken by the author)		Control list	Very good	Good	Acceptable	Poor	Very poor
A1			• Lighting system • Area size • Area function	●	○	○	○	○
A2			• Area function requirements • User comfort • Human scale	●	○	○	○	○
A3			• Area highlighting • User redirect • Attention gathering	○	●	○	○	○
A4			• Seeing the surroundings • Security • Ease of control	●	○	○	○	○
A5			• Area highlighting • User redirect • Visual perception	○	●	○	○	○
A6			• Plant type • Plant form • Plant size	○	●	○	○	○
A7			• Object highlighting • User redirect • Lighting direction	○	○	●	○	○

	Photos (taken by the author)	Control list	Very good	Good	Acceptable	Poor	Very poor
A8		• Circulation security • User redirect • Material usage	●	○	○	○	○
A9		• Facade highlighting • Area highlighting • Visual perception	○	○	●	○	○
A10		• Circulation security • Visual perception • Lighting location	○	●	○	○	○

the lighting will continue in these areas even if there is a power outage in the houses.

When the security lighting was examined, it was determined that the security unit of the site selected as the study area, the entrance and exit areas of the site and the retaining walls surrounding the site were illuminated with lighting elements of different sizes, light amounts and spacing. While high pole projector lighting elements that provide a high amount of light are used in the areas where the entrance and exit to the site are made, it is seen that the walls surrounding the site are illuminated with ground and side lighting elements in the plants surrounding the road. The security unit of the site utilizes medium-height projector lighting elements in the circulation areas to provide good visibility during dark periods.

When the landscape lighting was analysed, there were many lighting elements with different functions, sizes and amounts of light in the open area of the site. High mast projector lighting is used to illuminate large areas such as the site entrance and sports field. There are generally ground lighting elements in plant and green areas. Medium-height projector lighting elements used in circulation and gathering areas are positioned at more frequent intervals. Some areas in the landscape remain dark.

When the lighting of plant materials was examined, it was seen that there were many plants of different sizes and widths within the site. Plants are illuminated with different amounts of illumination according to their form and size. Generally, the ground lighting technique is used, and illumination is provided from the ground or with

short projectors. Lighting elements are placed at certain intervals and on some plants. Not every short plant or tree is illuminated with a lighting element at different levels according to its function. When the lighting of sculptures, architectural structures and signs was analyzed, there were no lighting elements belonging to the structures. Signboards directing users within the site are not illuminated with their own lighting elements. Most of these areas benefit from the light of the walkway and plant material lighting elements. On the flagpole, a ground lighting technique was used.

When the walkways and staircase lighting were examined, low-mounted floodlights with wide beam light distribution were placed at approximately 1-meter intervals along the walking line on the walkways and sidewalks. On the stairs, there are side lighting elements on the steps. The stairs are generally made of light-coloured materials, and lighting elements that provide a higher amount of light are used on the stairs with darker materials. When the building facade lighting was examined, it was determined that there were no lighting elements belonging to the building facades. Since it is a dark area around the site, building facades are illuminated by utilizing landscape and area lighting sources.

When the lighting of water elements was analyzed, different lighting elements were used in the swimming pool and ornamental pools in the area. Lighting elements are placed at certain intervals on the side walls of the swimming pool and ornamental pools. In some ornamental pools, there is a strip lighting element on the side wall. There are also ornamental pools without lighting elements.

Before evaluating the principles of outdoor lighting design, it is crucial to identify the various lighting fixtures used in residential outdoor areas. This preliminary step provides a comprehensive understanding of the existing lighting infrastructure, establishing a foundation for subsequent analyses. Table V presents a detailed inventory of the lighting fixtures used in the site's external areas. This compilation not only highlights the diversity of the employed lighting elements but also lays the groundwork for a thorough assessment of their alignment with the established design principles.

Finally, Table VI presents the findings from an on-site assessment of the Istanbul Lounge, evaluated using a 5-point Likert scale supported by visual aids.

IV. Discussion

In area lighting designs, it was seen that the lighting elements had the appropriate size, height and amount of light for the areas to fulfil their functions efficiently. In the selection of lighting elements, the amount of light needed according to the size of the areas was taken into consideration. In large areas such as gymnasiums, the high-mounted system technique was applied, and the required high level of illumination was provided by using high pole projectors at frequent intervals. In the illumination of narrow areas such as parking lots and apartment entrances, it was seen that the appropriate level of illumination was achieved by using projectors suitable for the size of the area with wide beam light distribution [16], [17].

In lighting for amenity designs, it was determined that the characteristics of the lighting elements used in different areas were determined by considering user comfort. Lighting elements were selected in accordance with human dimensions with their form and dimensions. Compared to the dimensions of the area, the number of lighting elements is not dominant, which positively affects the visual perception of the users. In narrow areas such as playgrounds, where the user density becomes intense at certain hours, mid-height floodlights that provide a high amount of light with a wide beam are used at frequent intervals so that children can use the area safely and comfortably. In this way, parents can easily control their children from any area. The use of lighting elements that provide a high amount of light at frequent intervals in the circulation areas makes the journey of pedestrians and vehicles safer. In all areas within the site, lighting elements were selected by prioritizing user needs, the requirements of the area functions and design [16].

In emergency lighting designs, although the evacuation routes and emergency gathering areas within the site were illuminated with floodlights that provide a high amount of light at 1-meter intervals, there was a high possibility of confusion in going to the emergency gathering area

in an emergency due to the high circulation area in the area. For this reason, the circulation area leading to the emergency assembly area and the emergency assembly area should be illuminated with lighting elements with higher illumination levels [17].

In security lighting designs, elements that provide high illumination levels are used at frequent intervals in the area where vehicles and pedestrians enter and exit, making surveillance and control easier. The security unit and the walls surrounding the site benefit from the light of medium height and ground lighting elements in the site entrance circulation area and green areas. These areas have a lower level of illumination. This allows the security personnel to be hidden and the external situation to be controlled more effectively [18].

In landscape lighting designs, there are many lighting elements that emphasize objects, affect the visual perception of the area and meet the needs of the functions of the areas. Open areas, which are illuminated at higher levels according to their size and needs, are emphasized by lighting elements within the area. Projector lighting elements used at 1-meter intervals in the circulation areas create a perspective effect in the area and give a sense of depth. However, since the site has a large landscape area, some areas remain dark, and these areas should be analyzed and supported by lighting with low-mounted systems in accordance with the needs [17]–[19].

In lighting designs of plant materials, it is seen that the designer creates a new appearance on the plants at night instead of preserving the daytime appearance while designing lighting. Plants are illuminated according to their form and size. Thin and tall plants are illuminated with floodlights with higher illumination levels, while short and wide plants are illuminated with floodlights with wide light beams to emphasize them in the green area. The placement of lighting elements at frequent intervals on large trees to emphasize the leaves and texture of the plants create a dynamic image in the area. The shadows created by the leaves and plant tissue with ground and side lighting cause a dramatic image. For this reason, while choosing lighting elements on plant materials, designs were made to affect the visual perception of the users, not only according to the form and size of the plant. Due to the large amount of green space in the area, the fact that not every plant is illuminated creates dark areas in some areas. For this reason, especially in areas where there is no road or area lighting, plant materials should be illuminated with lighting elements with higher illumination levels [20].

In lighting designs of sculptures, architectural structures and signs, it is suggested to use lighting elements to differentiate the building entrances from other areas, since there is no lighting element for architectural structures. In addition to utilizing the lighting on the walkway, it is suggested that the signs in the open space that direct the users should be illuminated with their own

ground lighting system and thus be more visible to the users [17], [18], [21].

In walkways and staircase lighting designs, it is ensured that pedestrian and vehicle circulation can be realized safely by using lighting elements with high illumination levels at 1-meter intervals on the walkways and sidewalks. The illuminance levels of these circulation areas and the number of lighting elements are quite sufficient. Lighting elements in these areas can even be a source of light for warning signs, green areas or a facade of the building. Light-coloured materials are generally used on the stairs within the site. Lighting elements are placed in such a way that the steps are easily visible, and there is no glare. They are illuminated with lighting elements with high illumination levels with side lighting technique. Stair lighting designs are determined in accordance with the material [22].

Building facade lighting designs, although there are no lighting elements on the facade of the building, create a dynamic image on the facade thanks to the lighting elements used by the residents of the apartment in the interior. However, in order to make the movements on the facade more emphasized and the building entrances more visible, it is recommended to use ground lighting elements on the facade [23].

In lighting designs of the water elements, the illumination of the water elements at certain intervals with the side lighting technique reveals the texture of the upper surface of the water and creates a dramatic image. Since the side wall of some water elements is illuminated with strip lighting, it creates a higher level of illumination around it. Since some of the elements in the central circulation line of the site are not illuminated and dark areas are formed, it is recommended that the lighting element be used frequently in all water elements in order to prevent users from mistaking these areas for hard ground at night [20], [21].

Conclusions

Outdoor lighting designs play a crucial role in both the aesthetic and functional aspects of open spaces. Proper lighting enhances the safety of outdoor areas while significantly influencing their atmosphere. Moreover, well-designed lighting increases the use of outdoor venues and activities, encouraging people to prefer these spaces more frequently. In summary, outdoor lighting designs are key elements that enhance the quality of life and optimize the use of spaces. When examining the existing lighting arrangement of the selected study area, the Istanbul Lounge complex, it was observed that examples of area lighting, comfort, emergency, security, landscape, plant

materials, sculptures, architectural structures, signage, walkways, stairs, and water features were all present. The positioning, form, size, lighting levels, and function of the lighting fixtures were identified through on-site examination.

Observations revealed that the selection of lighting fixtures within the complex was tailored to the size and needs of various functional outdoor areas. In sports facilities, vehicular paths, main walkways, and plazas, the use of floodlights, streetlights, and high-ceiling lighting fixtures ensured comprehensive illumination of these spaces. For walkways, path lights installed below eye level provided adequate lighting without disturbing users. In staircases, ground lights were used to illuminate the surfaces of steps, ensuring they were visible and reducing the risk of accidents. Common seating areas were equipped with wall lighting mounted on walls or seating area posts to create safe spaces for users to spend time. Decorative lighting was employed in plant materials to enhance the surrounding illumination and to present certain plants, like sculptures. For water features, recessed LED strips were used to delineate the boundaries of the water area during dark hours, ensuring proper illumination of the water. Examination of the site's lighting fixtures showed that, with a few exceptions, most were functioning effectively and had undergone regular maintenance. Overall, it was concluded that the lighting fixtures provided a comfortable visual experience in open areas, adequately meeting user needs and resulting in effective lighting design. Additionally, the variety of lighting elements serving different purposes in the study area made it possible to observe each of the lighting design principles. Furthermore, out of 10 types of outdoor lighting fixtures, eight were observed on the site.

This study aims to provide general guiding principles for outdoor lighting design, highlighting key considerations rather than establishing rigid, definitive rules. Through the analysis of aspects such as area lighting, aesthetic lighting, security lighting, and landscape lighting, a flexible framework is presented that enhances both the functional and aesthetic qualities of outdoor spaces. However, the intention of this work is not to prescribe fixed principles but to offer guidance that can be adaptively applied in various contexts. The novelty of this research lies in its reevaluation of the position of outdoor lighting design within the existing literature, contributing new theoretical and empirical insights. By addressing the impact of outdoor lighting on user experience, safety, and aesthetics from a holistic perspective, the study offers unique contributions to the field. Accordingly, the guiding principles proposed here serve as a flexible reference for future research and practice, emphasizing adaptability and contextual relevance.

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