

Original Article

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Façade lighting designs in historical buildings: The case of Mersin Kızkalesi

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Abstract: This study discusses the illumination of cultural assets, a live topic worldwide. While any kind of lighting demands expertise, the situation becomes more sensitive in historical building lighting. The necessity of this study is due to the inadequacy of design approaches for historical building lighting, which is becoming increasingly widespread in Türkiye. Lighting examples in the world and in Türkiye are examined and positive-negative aspects identified. The examples are evaluated in terms of various criteria such as illuminance levels, colour, accents, visual order, and architectural suitability, and the necessary criteria for lighting design were established. Based on the theoretical background of the study, a lighting design process has been defined for Kızkalesi. The lighting design proposal was developed not only for touristic and architectural purposes, but also in line with basic principles such as increasing the night visibility of the cultural asset, revealing the values of the structure, and taking into account ecological sensitivities, environmental management, and light pollution. It is thought that this plan, which defines how the process should be handled from beginning to end and which experts and actors should guide the process, can also be helpful in the illumination process of other historical buildings.

Keywords: façade lighting, lighting design, historical building, conservation, Mersin Kızkalesi

1. Introduction

According to the definition adopted by the International Commission on Lighting, lighting is the application of light to ensure that the environment and objects are properly visible. At the beginning of the twentieth century, the façades of important buildings in the city began to be illuminated [13]. Cities were considered as a whole, and lighting designs that

would emphasise their symbolic features and identities began to be discussed [16], [23]. Towards the end of the twentieth century, scripted lighting designs came to the fore. With the use of coloured lights, lighting designs have assumed an active role in the promotion of cities beyond ensuring visibility [26]. Thus, the lighting of buildings has ceased to be a functional need and turned into an aesthetic concern.

The issue of illumination of cultural assets is a very current issue that is constantly progressing and developing depending on technologies [34]. In this context, it is possible to develop lighting as a separate field of expertise through training organized in national and international environments [8,30]. Developments such as the formation of lighting communities with the gathering of various professional groups, experts and people interested in the subject, and the organisation of light festivals have opened a space for the use of lighting as a means of communication beyond being a functional need [20]. In this field of communication, which grows in parallel with constantly developing technologies, cultural assets can act as a stage and find the opportunity to exhibit themselves directly or indirectly, depending on the lighting theme.

As in the rest of the world, current practices on the illumination of cultural assets are increasing in Türkiye. In recent months, within the scope of the night museology project in the country, the ancient city of Ephesus, the ancient city of Hierapolis, and the ruins of Aspendos and Patara have been illuminated, and these areas have been opened to night visits [25]. Although lighting is carried out professionally, especially in big cities and some important buildings, professionalism on this issue has not yet been established on a national basis. This study aims to determine the basic criteria for the facade lighting of cultural assets by discussing the issue through the example of Mersin Kızkalesi (Maiden's Castle).

While the illumination of cultural assets is a subject open to the studies of different disciplines, this study focuses on the design aspect of lighting. It emphasises that the illumination of cultural assets cannot be only a technical application, but requires a planning in the axis of architectural design and conservation. As a result of lighting design, identity, symbolism, and visual perception and their relationship with cultural heritage are placed in focus. Starting from the theoretical basis of the subject, an evaluation of the past and present illumination of Kızkalesi is made, and alternative lighting design principles are proposed.

2. Methodology

The study was planned methodologically in four steps, the examination of sample applications, creating the theoretical framework, current situation analysis, and lighting design suggestion for the case study (Fig. 1). During the study library research, archive research and field study were used by benefiting from relevant institutional archives and sources in the literature.

A study methodology has been followed by taking into account the theoretical and practical aspects of the subject. Firstly, a preliminary literature research on Kızkalesi was conducted. The lighting problems and requirements of the castle and sample applications with similar characteristics were analyzed. Based on these similar applications and the theoretical research in the literature, the elements to be addressed in the façade lighting of historic buildings within the scope of conservation were determined. Thus, the theoretical basis for the study has been constructed. In the case study part, the castle's context and architectural features were examined, and its past and current illumination were analyzed. Visual inspection and photography work are necessary to identify the nature of the lighting as an indicator of the current situation. Again, through observation, the architectural features of the building, the functionality of the existing lighting, its harmony with the

building, and the effect of the luminaires on the building were analysed from the perspective of architectural conservation. Then, a new lighting design proposal was prepared for Kızkalesi in line with the criteria determined in the theoretical part of the study. 3D modelling of the castle was made in a digital environment, and sample lighting visuals were designed. As a result, working methodology of the lighting design, experts and institutions that should take part in these studies were defined in the management plan.

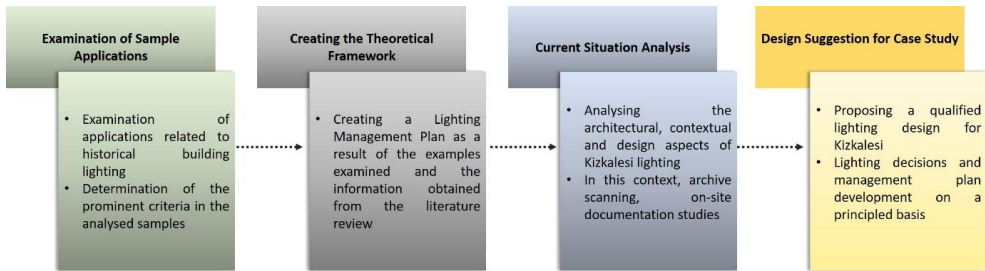


Fig. 1. Methodology of the study. *Source:* By the authors

3. Lighting design of historical buildings

3.1. Lighting applications

Urban lighting, which started to be seen in the early 20th century, became more comprehensive project that also addressed building details towards the end of the 1980s. France has been a pioneer in this regard, especially with the Lyon light festivals, encouraging city economies to invest in urban lighting [26]. The results of lighting projects such as the one in Lyon have shown that the professional design of lighting adds value to the urban image [17]. In 1989, Lyon was the first city to implement a lighting master plan to reveal urban assets such as roads, buildings, monuments, etc., and to increase the value of these urban components. The lighting master plan of the city was deemed worthy of the UNESCO World Heritage List, and was updated in 2004 with creativity, new lighting techniques and new technologies, especially to include and emphasise ancient buildings [10]. With this plan, it has been proven that good, correct, and efficient lighting is an important step in urban, social, economic, and environmental developments. The fact that the buildings forming the silhouette of a city can be perceived at night is very important in terms of city image. The lighting master plan developed for the Lighting and Traffic Department of Stockholm Municipality between 2009 and 2010 can be given as an example (Fig. 2). While the coexistence of the historical and new buildings of Stockholm can be perceived effectively in the daytime view of the city, it has been observed that this perception is lost at night. With the lighting plan proposal developed based on this problem, it is aimed to create a city image that can accurately convey the city identity of Stockholm and can be read at night. In this context, with the main theme of telling the history and showing the future, the elements that make up the silhouette were handled as a whole, and silhouette lighting was installed, and this lighting also became a communication platform between users and the city [12].



Fig. 2. Stockholm night silhouette and designed night silhouette. *Source:* [12]

Like many cities around the world, a city lighting plan has been developed for Zurich. As a general theme, low levels of illumination with white light that does not strain the eyes were used (Fig. 3). Detailed urban analyses were carried out to provide a balanced urban appearance. A respectful dialogue between urban heritage elements and new buildings was created with these light levels, which were determined by taking into account local culture and urban identity. The historic bridge in the city silhouette is also modestly illuminated, and the light reflections on the water make the view even more attractive. In addition to the general silhouette view, the sculptures and decorations on the buildings were illuminated to make the detail elements visible. Thus, all the details referring to the city's identity were transferred in a planned way in the night view [28].

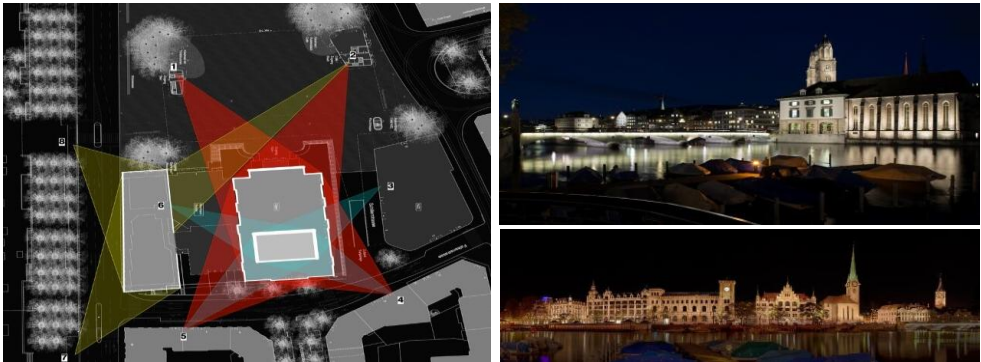


Fig. 3. Zurich lighting plan and night views. *Source:* [28]

When the individual scale lighting is considered, there are various lighting applications such as silhouette emphasis, architectural hierarchy emphasis, and ornamental details emphasis. For this, the lighting theme must first be determined. A different lighting technique and design will be needed if the silhouette is to be emphasised, and different lighting techniques and designs are required for the architectural hierarchy and details to be emphasised. For example, when we look at the old lighting of the Mitchell Library in Glasgow, neither silhouette nor detail lighting can be perceived [19]. Since all surfaces are illuminated at the same rate, the architectural character of the building cannot be understood. This lighting, which is not suitable for the identity of the building, was abandoned, and a new design was made. In the new design, the lighting theme of the building is seen as silhouette lighting. The hollow parts of the building are illuminated, and the columns in front are left in the dark, allowing these columns to be perceived as silhouettes. The upper parts of the building are illuminated very lightly, and a soft blended finish is achieved. The domed part in the centre is illuminated more than the rest of the building, emphasising that it is more prominent and higher (Fig. 4).



Fig. 4. The old and new lighting designs of the Mitchell Library. *Source:* [19]

Context is an important element in building lighting. Flora and fauna in the surroundings of the building should be taken into account in rural areas with little settlement or in buildings with water as a context. In particular, the illumination of open space or tall structures in a relatively dark area can cause orientation problems for migratory birds [15]. Similarly, illuminated façades are known to cause mass fatality, especially as a result of directing some insect species to the light [21]. Bridge lighting that reflects direct light into the water is known to alter the behaviour of bats [3] and to adversely affect the migratory movements of fish such as salmon [7]. It has been observed that light pollution from the iconic Sundial Bridge lighting in Redding, California, almost halted salmon migration in the river between 2011 and 2013. For this reason, in the illumination of structures whose context is water, it is necessary to determine the creatures that may be harmed in the aquatic ecosystem and to design lighting accordingly [33]. When the lighting of the 15th-century Charles Bridge in Prague is examined from this perspective, it is seen that the arches of the building are illuminated with warm coloured LED lights and the light is directed upwards (Fig. 5). The upward direction of light has resulted in less light falling into the river, thus reducing the share of the river ecosystem directly affected by the lighting.



Fig. 5. Lighting design of the Charles Bridge. *Source:* VisitCzechia.

<https://www.visitczechia.com/en-us/things-to-do/places/landmarks/urban-architecture/c-prague-charles-bridge-and-bridge-towers>.15.07.2024

The lighting of the Erzurum Çifte Minareli Madrasa is one of the most up-to-date in Türkiye. Built in the 13th century and a UNESCO Tentative Heritage Site, the monumental silhouette of this building is designed to be visible at night. Although the silhouette of the building is perceived as a silhouette, when analyzed in detail, it is seen that the references

that this lighting gives to the identity and architectural elements of the building are not appropriate. The minarets are illuminated from bottom to top in a way to emphasize the perception of height and at the same time give a sense of infinity. However, since the upper part of the minarets is not illuminated, it causes a perception as if the end elements are missing and the minarets are truncated. The illumination of the entrance door of the building with muqarnas with a high brightness caused the hierarchy of the other elements on the façade not to be perceived. In the areas illuminated with cold white light upwards from the tree on the façade, the lights remained spotty, and the material texture on the façade could not be perceived. When the courtyard lighting of the building is analyzed, it is seen that it is a lighting that is disconnected from its identity, function, and historicity. The interiors of the arches are illuminated with a very intense warm colour, and the surfaces remain contrastingly dark. This situation makes it very difficult to read the columns, arches, surfaces, and fullness-void relationships (Fig. 6).



Fig. 6. Lighting design of the Erzurum Çifte Minareli Madrase. Türkiye Culture Portal. <https://www.kulturportali.gov.tr/turkiye/erzurum/gezilecekyer/cifte-minareli-medrese>. 24.02.2025

The biggest problem caused by lighting today is light pollution. It is known that uncontrolled city and façade lighting also causes light pollution [27]. In addition, the issue of energy saving, which is also one of the current world problems, is of great importance in lighting designs. Avoiding unnecessary energy expenditures is important in terms of using resources effectively. In order to prevent light pollution and provide energy-efficient lighting, scripted lighting is preferred [24]. The lighting of the Lyon Palace of Justice is an example of such lighting (Fig. 7a). After determining the basic lighting decisions for the building, such as silhouette lighting, the relationship between the columns and the full façade surface behind, and the illumination of ornamental details, various scenarios were developed. The criteria for the formation of these scenarios are the duration of use of the building and its surroundings, and the density of users. It was observed that the user density of the building and its surroundings is at the highest level after dark until 10.30 pm (Fig. 7b). For this reason, the maximum illuminance values of the building were used between these hours. In parallel with the decreasing user density in the following hours, between 10.30 pm and 11.30 pm, only the columns in front of the building are illuminated, and the rest of the building is left in darkness. From 11.30 pm until midnight, the columns of the building are blacked out and the full façade surface behind is illuminated with low illumination values, so that the columns are displayed as sculptural silhouettes (Fig. 7c). After midnight, the building is completely darkened due to the decreasing user density (Fig. 7d). This intensity analysis was also evaluated for weekdays and weekends, and since the weekend intensity continues until later hours, the darkening time of the building was determined to be half an hour longer on weekends [17].



Fig. 7. Lighting design of the Lyon Palace of Justice (a: day view, b: the view until 10.30 pm, c: the view between 10.30 pm and 00.00, d: the view after 00.00). Source: Donna, J . <https://lightingdesignmag.com/lyon-palace-of-justice>. 07.01.2025

While cultural heritage is emphasized in lighting, in some cases, various moving visuals are projected on the façades and used as a means of communication on important days and events. Within the scope of light festivals, monumental buildings, urban landscapes, and squares are illuminated with different themes such as reuse, light pollution, urban change, illumination of historical heritage, smart lighting techniques, urban attraction, and illuminated road maps. Thus, lighting was used as a communication tool to convey messages through the cultural heritage of cities. Establishing this dialog through cultural assets also contributes to the creation of historical heritage awareness in the city. Today, we see that historical building façades are illuminated with themes determined on special occasions other than light festivals. The reflection of the colours of the country's flag on the building during national holidays, and the display of symbols and visuals related to the special day on the building with light are examples of these. To give an example from Türkiye, during the commemoration events organized on the anniversary of Atatürk's death in 2021, images of the Turkish leader were projected on the Galata Tower, one of the landmarks of Istanbul, and installation shows were organized as part of the commemoration events (Fig. 8a). Sometimes visuals related to the identity of the building and the values it symbolizes can be exhibited on the façade. For example, as a special day illumination of the Maiden's Tower, which is also one of the landmarks of Istanbul, a show on the theme of reunion in the legend of the Maiden's Tower was exhibited on the façade of the building (Fig. 8b).

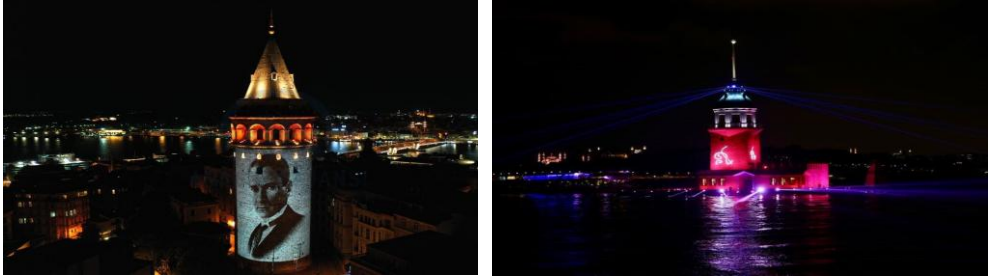


Fig. 8. a) Lighting design of the Galata Tower. *Source:* [1], Anatolian Agency, <https://www.aa.com.tr/tr/pg/foto-galeri/galata-kulesine-turk-bayragi-ve-ataturk-fotograflari-yansidi->. 14.03.2025, b) Lighting design of the Maiden's Tower. *Source:* Anatolian Agency, <https://www.aa.com.tr/tr/pg/foto-galeri/kiz-kulesi-ile-galata-kulesinde-her-aksam-isik-ve-lazer-gosterisi-yapiliyor/2>. 12.03.2025 [2]

3.2. Criteria for lighting design

As seen from the examples above, the lighting of each historical building requires a special planning and design, but in general, it is an important common point to design lighting that is suitable for both conservation and the identity, architecture, function and location of the building in the city [6]. When designing the lighting plan, the message, visual perception and therefore the lighting theme should be meticulously determined from the very beginning. In the lighting part, both at the urban scale and at the building scale, the building's own architectural features as well as its surroundings are also important. Factors such as ecological life, other buildings, and human density in the context of the building also shape the design (Table 1).

Table 1. Criteria to be considered in façade lighting of historic buildings

Criteria	Scope	Measure of Success	Outputs
Scale	Singular scale or master plan scale	Ensuring that the singular lighting of the building is legible in its surroundings or that the lighting hierarchy between it and other buildings is provided in the master plan	Qualified visual design
Function	Original function and current use of the building	Presenting a night view that can refer to the physical and semantic values of the building from its original function and its current use today	Qualified visual design
Architectural element	Forms of architectural elements on the facade and their hierarchy with other elements	Each architectural element to be perceived on the façade can be read with its own formal features and the composition it forms together with other façade elements can be perceived as a whole with lighting	Qualified visual design
Facade material	Variety, colour and texture of materials on the façade	Colour and texture differences arising from the material on the facade are determinant on the light colour and light direction to be used in lighting	Qualified visual design

Criteria	Scope	Measure of Success	Outputs
Brightness in the immediate neighbourhood	Night views of the immediate surroundings and background	Determining the illumination situation in the immediate vicinity of the building according to the urban or rural area where the building is located, keeping the illumination values at the optimum level for facade lighting, thus minimising light pollution	Ecological design
Context	Flora, fauna	Selecting appropriate lighting values and light colours by taking into account the flora and fauna life in the immediate vicinity of the building that may be affected by the lighting	Ecological design
Intensity of use	User profile of the building and its surroundings	The lighting levels can be changed in accordance with the analysis of the intensity of the existing users and visitors of the urban or rural area where the building is located, seasonally during the year, and during the night hours.	Energy efficient design
Conservation	Material and facade integrity	Positioning the luminaires in appropriate places to minimise the damage to the structure by anticipating the heat effect that may arise from the lighting and the damage to the structure that may arise from the positioning of the luminaires	Conservation orientated design

In this lighting process, first of all, it is necessary to understand the architecture of the historical building as a whole. It is important to determine the theme and target of the lighting according to the architecture and needs of the building. Analyzing the contextual elements of the building and its surroundings is necessary in terms of considering both the ecological and economic aspects of lighting and the creatures that will be affected by the lighting [18]. In this regard, the illumination periods of buildings should be limited in relation to the user density analysis [29]. Moreover, at the point of determining the lighting intensity to prevent light pollution, the background of the building and the illuminance of its surroundings gain importance.

After the lighting analysis of the immediate surroundings, appropriate luminaires should be selected to provide values such as lighting intensities, light colors, and brightnesses, and not to harm the daytime appearance of the building. The illumination realized with these luminaires should be in a balance that will refer to the horizontal-vertical relations on the façade of the building. Light layers and color variations to be created in lighting should be included in the design as elements that can bring dynamism to the design. Energy efficiency and sustainability should be taken into account to prevent light pollution from the beginning to the end of the whole process [24]. In addition, it is known that the heat emitted by the lighting fixtures together with the light can cause deterioration of the materials on the façade [3]. For this reason, the luminaires and light intensities with the lowest heat effect that will cause the least damage to the structure should be selected. In order to design

a professional lighting project, factors such as light calculations, illuminance levels, visual perception, and the damage that light and luminaires will cause to the historical building should all be taken into consideration. For this reason, each lighting project requires an interdisciplinary team of lighting designers, engineers, architects, conservation experts, and urban planners who are experts in their respective fields [9]. It is important for this team to examine the master plan at the urban scale and, where necessary, the lighting sequence at the building scale in order for the lighting project process to proceed systematically [4].

4. Lighting design for Mersin Kızkalesi

4.1. General Information

Kızkalesi is located on an island in the Erdemli district of Mersin in Türkiye. The castle was built in 1151 AD, together with the land castle on the coast, to create a defense system for the ancient city of Korykos. In 1361, Kızkalesi came under the sovereignty of the Kingdom of Cyprus, and in 1448, the Karamanoğulları Principality captured it. In 1471, it came under the rule of the Ottoman Empire [11]. Today, Kızkalesi is a registered cultural heritage, used as an open-air museum (Fig. 9), which belongs to the Mersin Museum Directorate under the General Directorate of Museums of the Ministry of Culture and Tourism.



Fig. 9. Kızkalesi (both the name of the district and the sea castle). *Source:* Republic of Türkiye, Mersin Governorship. <http://www.mersin.gov.tr/kizkalesi>. 10.03.2025

The castle, with its sculptural presence on the open sea, is a center of attraction for regional tourism. It is also visible from nearby roads that provide intercity transportation. The castle hosts important scientific, social and cultural events in Mersin. Therefore, it plays an important role in the promotion of Mersin city. In this respect, it is one of the leading landmarks of the city (Fig. 10).



Fig. 10. Kızkalesi and close surroundings. *Source:* By the authors, marked on Google Earth view

It is known that the castle was used for surveillance purposes during the period it was built, especially against attacks from the sea. For this reason, the west body wall, which is the façade facing the sea, and the window openings on the bastions on this façade have very narrow sections when viewed from the outside. These openings run along the wall section of the castle and have a wider area as you move inwards, allowing for long-term surveillance. Since the window openings are wide on the inside and have an angular form that narrows as you move towards the outside, they are perceived as narrow-sectioned linear lines positioned on the façades when viewed from the outside of the castle. These window openings are found on the body wall in the west of the castle and on the watchtowers on all façades (Fig. 11).

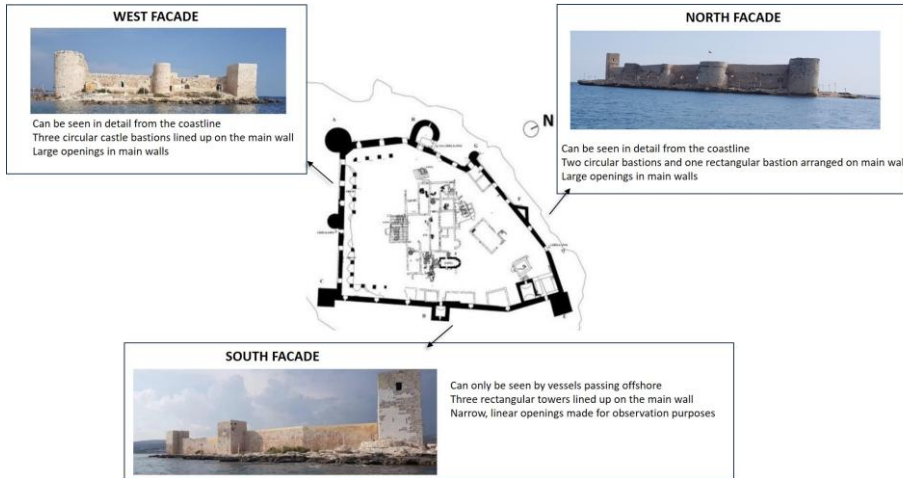


Fig. 11. Kızkalesi and its façades. *Source:* By the authors, photos - 21.10.2019

The area is located on the coast of the Mediterranean Sea, which has the highest sunbathing time during the year. For this reason, tourism in the region is not limited to the summer months, but spreads over a wider period of time (April to December) throughout the year [14]. The summer population of the area has increased significantly, from approximately 2,000 to 40,000 people, with an additional daily influx of up to 100,000 visitors, especially on weekends [32].

Kızkalesi can be easily perceived not only by the users in the coastal areas but also from the D-400 highway that provides transportation between Mersin, Antalya, and Konya. Kızkalesi can also be visually accessed while descending from the highway connecting the ancient city of Diocaesarea (Uzuncaburç) in the mountainous area north of Kızkalesi to the coast. For all these reasons, Kızkalesi creates a visual focus of interest due to its location and structure, both by the places on the coastline and by the transit passages on the highway descending from the north and the D-400 highway in the east-west direction. However, the south façade facing the open sea can only be seen during boat tours.

4.2. Illuminations of Kızkalesi until today

Declared as archaeological site in 1985, the first work on the illumination of Kızkalesi began in 1992, but this work was more basic than a lighting design (Fig. 12). In 2002, in the reports submitted to the Conservation Regional Board, the cables carrying electricity to the castle were repaired and the cables, which were randomly distributed underground around the castle, were systematically positioned to follow the walls [1]. The illumination of the castle during this period was provided by luminaires positioned on the ground. However, since these luminaires were not resistant to waves, they were removed.

In 2018, the lighting project submitted to the regional conservation board consisted of luminaires and point lighting areas placed only at the end lines of the bastions and body walls of the castle, with no concern for the architectural features of the castle. The locations are incompatible with the architecture of the castle. The lighting does not refer to the forms and voids formed by the architectural elements of the castle. The fact that the lighting fixtures are located on the façade walls is a proposal that may cause irreversible physical damage to the structure in terms of installation and maintenance. Moreover, the recyclability of the interventions made within the scope of the conservation of a cultural property is one of the basic criteria in conservation. In the board decisions, the lighting proposal was rejected as it did not emphasize the features of the building, such as silhouette effect, fullness, and space hierarchy [2].

In the illumination of the castle that was applied in 2019, there are bursts of light on the surface of the building because the light is not reflected at right angles to the façade. As a result, uncontrolled dark areas are formed. As seen in the photograph (Fig. 12), the glare on the façade prevents the relationship between the body wall and the bastions of the building from being recognized. This makes it difficult to perceive the architectural features correctly. Similarly, the façade walls and the towers located in front of these walls are illuminated with the same color tones. The lack of a hierarchy between the warm and cold colored lights on the surfaces makes the illumination seem random.

In 2021, the 2018 lighting proposal submitted to the Adana Regional Board for the Conservation of Cultural Assets was put into practice. The colors in the lighting of the castle were chosen randomly, and silhouette lighting was not taken into consideration. Due to the point lighting, uncontrolled shadow areas were created, and it was very difficult to perceive the castle correctly at night.

As a result, when the lighting projects that have been implemented or submitted to the Conservation Board as a proposal for the illumination of Kızkalesi are examined, it is seen that these illuminations do not sufficiently emphasize the value of Kızkalesi, which is an important symbol for the city of Mersin. The illuminations that are incompatible with the architectural features of the building and are realized without considering its identity value reveal the necessity of a professional lighting design for Kızkalesi.

ILLUMINATION OF KIZKALESİ OVER THE YEARS

1992 lighting scheme



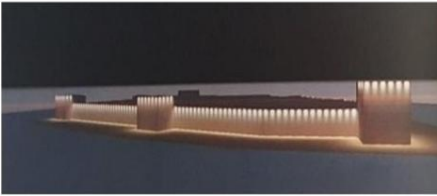
- Technical lighting
- Electrical cables and transportation to the castle are random

2002 lighting visual



- Removal of previous lighting elements
- Electrical cables have been systematically repositioned

2018 lighting suggestion visual



- Luminaires mounted on walls
- Point lighting incompatible with castle architecture
- No silhouette effect and no occupancy hierarchy

2019 lighting visual



- Random use of color
- Lighting without reference to castle architecture
- No silhouette effect and no occupancy hierarchy
- Uncontrolled lighting, uncontrolled dark areas

2021 lighting visual



- Point lighting incompatible with castle architecture
- No silhouette effect and no occupancy hierarchy
- Lighting without reference to castle architecture

Fig. 12. Illumination of Kızkalesi over the years. *Source:* By the authors, visuals: 1992 – Lighting scheme – Archive of Adana Cultural Heritage Conservation Board, accessed in 1992 from the reports of Kızkalesi, 2002 – lighting visual Archive of Adana Cultural Heritage Conservation Board, accessed in 2002 from the reports of Kızkalesi. 2018 lighting suggestion visual – Archive of Adana Cultural Heritage Conservation Board, accessed in 2018 from the reports of Kızkalesi, 2019 lighting visual – photos - 21.10.2019, 2021 lighting visual – Taken from the Kızkalesi illumination video published by the Mersin Provincial Directorate of Culture on 17/07/2021

4.3. Lighting design proposal for Kızkalesi: basic principles & management plan

While developing a lighting design proposal for Kızkalesi, the structural and contextual potentials and constraints of Kızkalesi (Fig. 13) were taken into consideration together with the basic criteria determined for the façade lighting of historical buildings in section 3.2. Also, the mythological value of Kızkalesi stemming from the associated legend, its historical value and its symbolic value for the city identity were all considered. These values are the main factors that reveal the necessity of illumination of the building. These values also constitute important inputs in terms of providing scenario diversity in lighting design. In addition, the process of illumination of Kızkalesi has been designed as a lighting management plan with basic criteria, experts and actors.

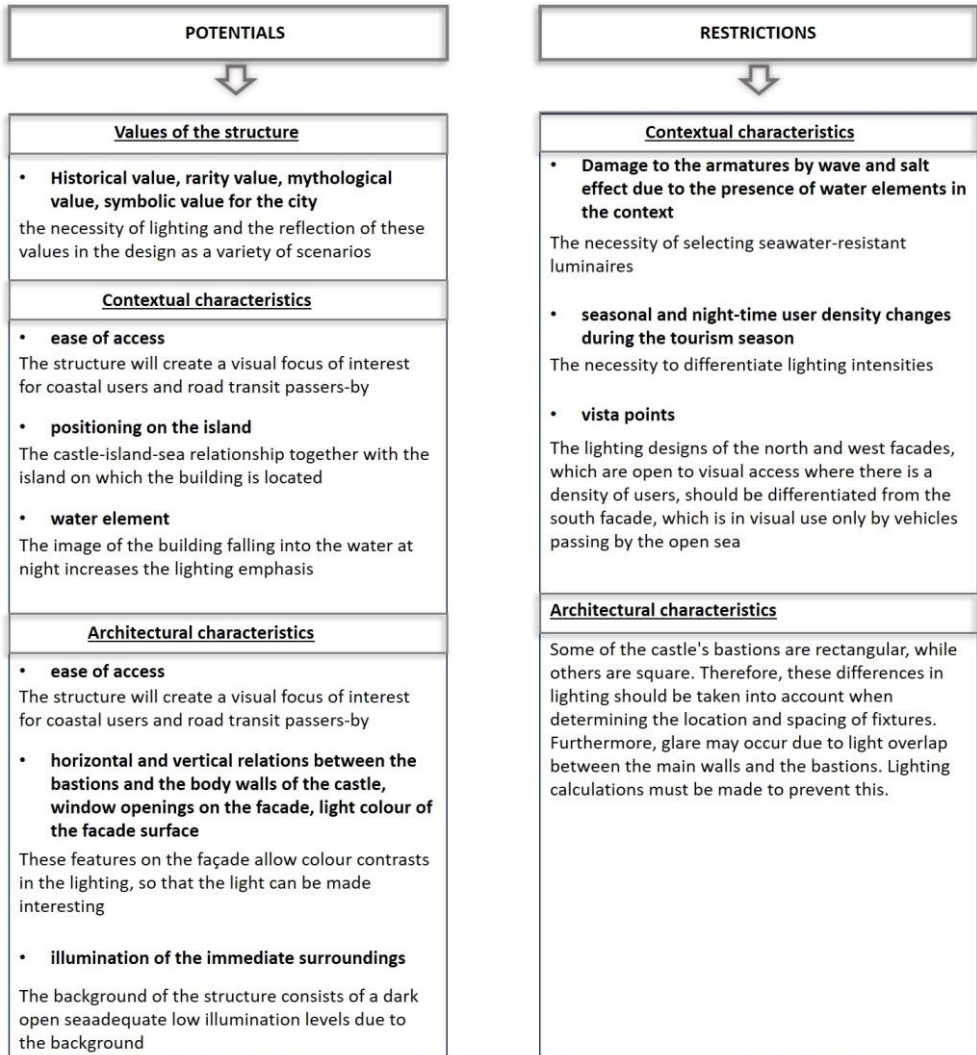


Fig. 13. Potentials and restrictions in lighting design of Kızkalesi. *Source:* By the authors

The contextual characteristics of Kızkalesi can be evaluated in terms of both potentials and constraints. The building creates a focal point for coastal users and people passing by on the motorway. Because Kızkalesi attracts attention as a sculptural silhouette during transit along the D-400 highway, which provides transportation between Mersin and Antalya and connects Mersin city center and the districts in the west, the user profile that exists permanently due to the use on the opposite shore of the building, and the potential of the building to be visited in four seasons due to its ease of transportation, it was deemed appropriate to use night lighting actively throughout the year.

Generally, regarding the ecological and economic inputs of lighting, the lighting design should also have an approach that respects nature. Therefore, lighting design should have both economic and ecological sensitivities. In this direction, lighting fixtures should have low maintenance and repair costs and be resistant to wave and salt effects from the sea. Another criterion related to the economic value of the design is the energy to be spent on lighting. In this context, it is of great importance that the luminaires selected are energy efficient [5]. In addition, it is important to reduce the lighting intensity of the building at night and in the off-season to prevent unnecessary energy consumption. Regarding the ecological value of the design, the living populations near the castle were investigated, and it was learned that the lighting design would not harm the wildlife in the region. However, in order not to harm the surrounding flora and fauna, it was decided to avoid unnecessary highlighting and to keep the lighting intensity at a level that would not negatively affect visual comfort. In addition, it is necessary to prevent light scattering to the environment and the sky during the placement and adjustment of the angles of the luminaires [22]. Thus, light pollution caused by lighting may be prevented.

Another factor to be considered in the lighting design of Kızkalesi is the timing, duration, and quality of the visual perception of the building. Changes in the number of users both seasonally and at night due to the tourism season in the district require adjustment of light intensity in lighting design. For example, during the winter months when the number of visitors is low, the light levels can be reduced to lower levels than the busy summer season, allowing only the visibility of the building to be maintained. In addition, the value of Kızkalesi as intangible cultural heritage is also an important design input in historical building lighting. Kızkalesi is the focus of a local legend [31] which thought that this legend should be a part of the lighting design. All these factors require different scenarios in lighting design.

Finally, four different lighting scenarios were determined (Fig. 14). As a standard lighting, while there is a need for more intense, long-term lighting in the summer season, low-intensity lighting will be sufficient in the winter season. Consisting of changing lighting intensities between seasons is also of great importance in terms of using energy efficiently and reducing light pollution. Similarly, in the tourism season, the same effect is desired to be achieved by reducing the lighting intensity after 02.00 am, when night activities decrease, and by completely darkening the south façade, which can be seen only from the sea. It is recommended that other facades be darkened after 04.00 am. It is thought that it would be interesting to reflect the legend of Kızkalesi with visuals on the castle, especially during the tourism season, and to use the castle walls as a stage for special day events. Also, non-illumination is suggested as an option. When there is lunar and star activity, for example, when the full moon already illuminates the environment or when there is a meteor shower, not illuminating the building should also be an option. Dimming the building's lighting after midnight, when the number of users is low, and after 04:00 am is also deemed necessary to ensure energy efficiency and prevent light pollution. This would also serve as a reminder that the façade of the castle was not originally illuminated.

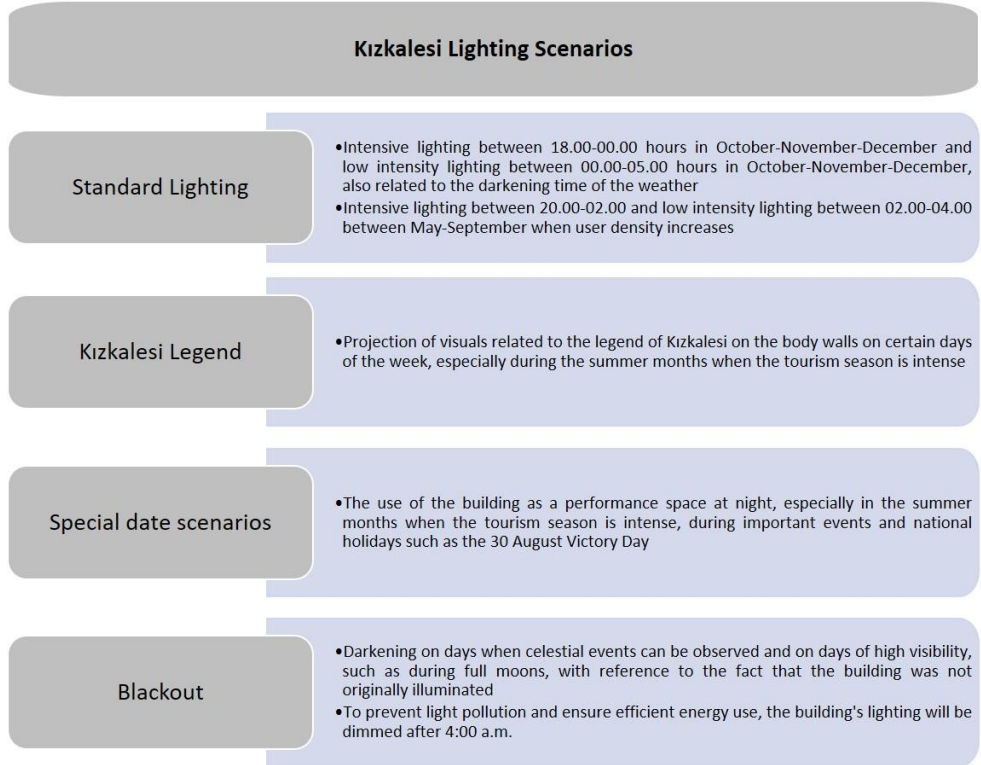


Fig. 14. Lighting scenarios of Kızkalesi. *Source:* By the authors

Considering the overall design theme and principles of the building, the lighting of a historical building should be compatible with its architecture and emphasize its values [5]. Therefore, the architectural elements of Kızkalesi and the hierarchies between them were accepted as a guide in the lighting design (Fig. 15). The relationship between the body walls of the castle and the bastions presents an effect of three-dimensional dynamism. Both the façade gaps and the relationship between the bastions and the body wall should be addressed in the lighting design. In this context, it was aimed to create a contrast effect by illuminating the castle bastions with a different color tone than the body wall. Similarly, the arched openings in the body walls were illuminated in a way to create a contrast with the castle's body wall. It was decided to position all luminaires to provide light from bottom to top. Moreover, the fact that the background of the building is a dark open sea will ensure that low illumination levels will be sufficient to perceive the building effectively. Thus, lighting will be approached with environmental sensitivity, and efforts will be made to minimize light pollution. Furthermore, the negative impact on marine life will be minimized.

The night image proposed for the northern façade of the castle, which has the potential to be perceived from the closest distance (between 400 and 600 meters), aims to highlight the towers. For this purpose, lighting fixtures with Smart Hue technology (RGB-White) were used to illuminate the façade walls and towers. Thanks to Smart Hue technology, these luminaires have a warm and cold color scale and allow the user to adjust the desired color temperature. Thus, lights with different color tones could be projected on the façade from the same luminaires. The intensity of the light, its variation and the contrast of warm and cold colors are intended to emphasize the differences between the towers and the façade walls. In

addition, thanks to the linear dark areas left in a controlled manner at the points where the façade wall and the towers meet, the wall and the towers are visually separated, emphasizing the end contours of the towers and highlighting the front-back relationship between them.

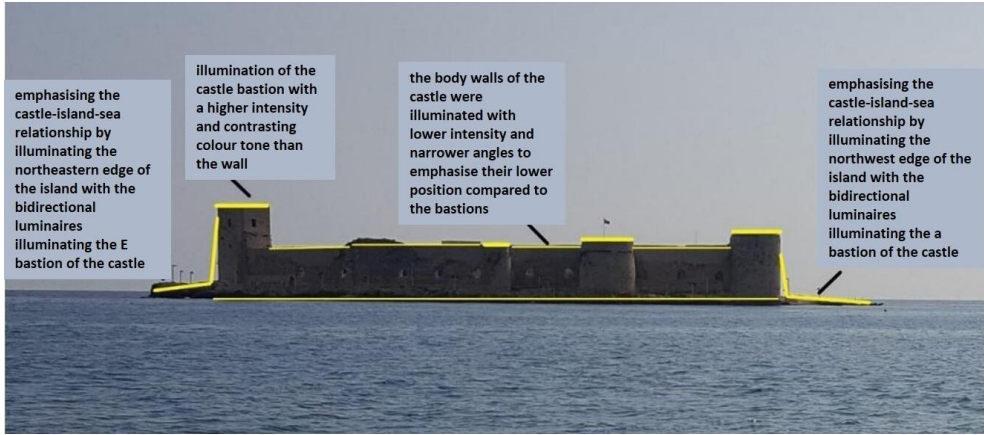


Fig. 15. Basic design proposals for façade lighting. *Source:* By the authors, photos - 21.10.2019

Luminaires that contrast with the façade wall in terms of color temperature were placed in the openings in the walls of the castle. In this way, especially when viewed from the coastal side, the gaps in the façade are emphasized and mobility is added to the façade lighting (Fig. 16). To realize different lighting scenarios, it is proposed to illuminate the openings with the accent lighting technique, using luminaires that provide changeable light and color tones. In the lighting design of Kızkalesi, special day scenarios were also designed, considering the urban symbol value of the structure. Here, the façade of the structure will also be used as a stage. For this purpose, it was suggested that visuals be projected onto the surface of the structure by using Go-Bo luminaires as projectors. In order to show the mythological value of the structure at night, it was suggested that a visual related to the Kızkalesi legend be projected onto the north and west façades using the media façade technique (Fig. 17).



Fig. 16. Illumination of north and west façades. *Source:* By the authors



Fig. 17. A 3D visual proposal for the reflection of the Kızkalesi legend on the façade and the illumination of north and west façades. *Source:* By the authors

As a result, the lighting design process of Kızkalesi and the experts and actors that should be involved in this process were determined under the Lighting Management Plan (Fig. 18). In this context, shaping the scale and theme of the lighting with the contextual inputs of the building is the primary stage. Afterwards, the quality of lighting design will be determined depending on the tangible and intangible characteristics of Kızkalesi. In this process, the relevant experts and the analyses they will reveal will guide the lighting design. In addition, the relevant administrative institutions involved in the reporting, monitoring, control, and approval processes within the scope of the lighting project of Kızkalesi have also been identified as the actors of the process.

5. Conclusion

While lighting design is an issue that needs to be handled professionally, the lighting of historical buildings requires much more sensitivity. The aforementioned dialogue should be continued at night, and the symbolic values of a building should be perceived in the night skyline of the city. At this point, it is important to analyze the cultural property values, function, identity values, and architectural features of historic buildings and use them as a reference in lighting design. In addition, the contextual characteristics of the building, environmental elements that may be affected by lighting, and the duration of use of the building can also be determined, and the quality of the lighting can be created in response. Only as a result of such studies can building-specific lighting be designed. With professional lighting, historical buildings are made visible at night and actively participate in urban life.

Kızkalesi is a significant landmark in Mersin. Therefore, to maintain its value at night, it must be illuminated. The lighting of this landmark castle requires design and management planning. This study has developed a plan that includes scenarios related to lighting design, as well as environmental and ecological considerations such as light pollution, energy efficiency, and flora and fauna. The lighting proposal of Kızkalesi was planned not only for touristic and architectural purposes but also to draw attention to issues such as ecological life protection, environmental management, light pollution, and visual comfort at night. For this general reason, high levels of illumination were avoided, with low lighting recommended, given the dark background of the Mediterranean. Considering the incompatibility of the old lighting with the structure, a holistic lighting design that takes architectural elements into account is proposed as the general lighting concept, instead of uniformly illuminating every façade (or element) of the building.

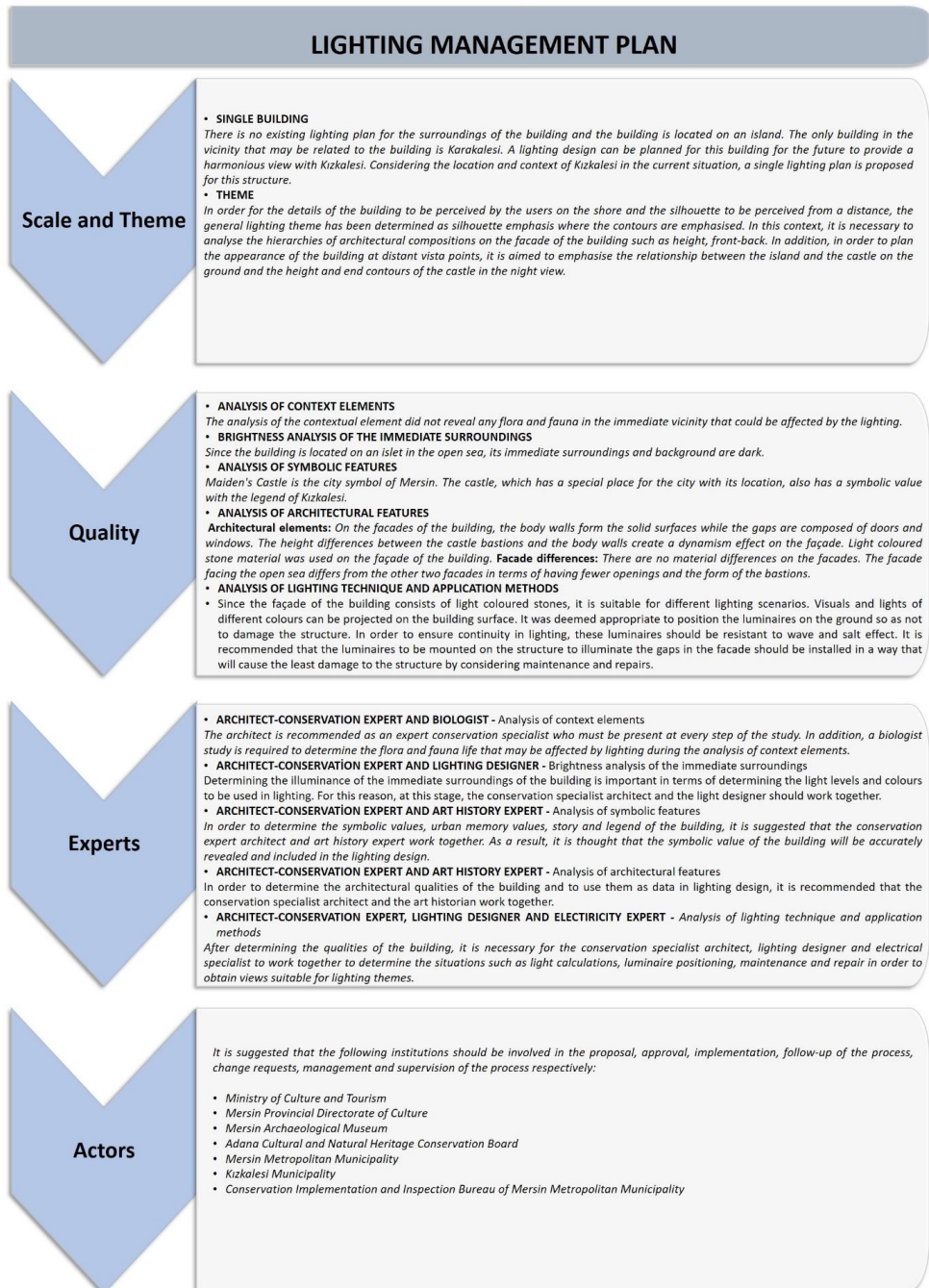


Fig. 18. Lighting Management Plan of Kızkalesi. *Source:* By the authors

In this design proposal, the architectural features of the building, its façade proportions, and the presentation of its form, texture, and colors with light were taken into account. While proposing a design that is suitable for the architecture of the building and that highlights its

identity, a lighting design that creates drama, ambience, and storytelling that integrates the legend of Kızkalesi with the building has also been proposed. Thus, it was desired to create a dialogue between the historical building and its users based on the creation of emotion through the play of light and shadow. Emphasizing that the lighting design of historical buildings is a comprehensive and multi-actor issue that requires professionalism, the lighting of Mersin Kızkalesi has been drawn on a principled scale in all its aspects. The lighting needs and problems of Kızkalesi were taken into consideration, together with the criteria to be addressed in lighting. The lighting management plan was designed as five main working steps: scale and theme, quality, experts, and actors. In the scale, theme, and quality steps, guiding explanations were made in order to make the necessary analyses. It is thought that this plan can be used as an example in the illumination of other cultural assets, and the explanations under the working steps are also considered as a checklist.

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