

Determination of Priority Urban Elements for City Lighting Master Plan

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Abstract – Urban illumination has great importance for reasons such as exhibiting the beauty of the city, facilitating night life, emphasizing important functional, aesthetic, historical and social spaces and works of art in terms of the city, besides the city's importance for safety. In areas where urban illumination is going to be examined, an assessment system needs to be established to identify urban elements and identify the items that need priority clarification. Some criteria have been established such as transportation status, architectural value or characteristics, historical value and urban silhouette influence, speed, traffic density, traffic pattern, environmental illumination, visual guidance on the road; for the identification of buildings, the engineering works, the works of art, the areas such as parks and squares and the roads with priority. According to the characteristics of these criteria, numerical values were given to each item. Each urban element will be classified as 1st, 2nd and 3rd class according to these numerical values. Thus, urban elements in the region will be determined in the order of priority in illumination.

Keywords – lighting, city lighting, lighting master plan

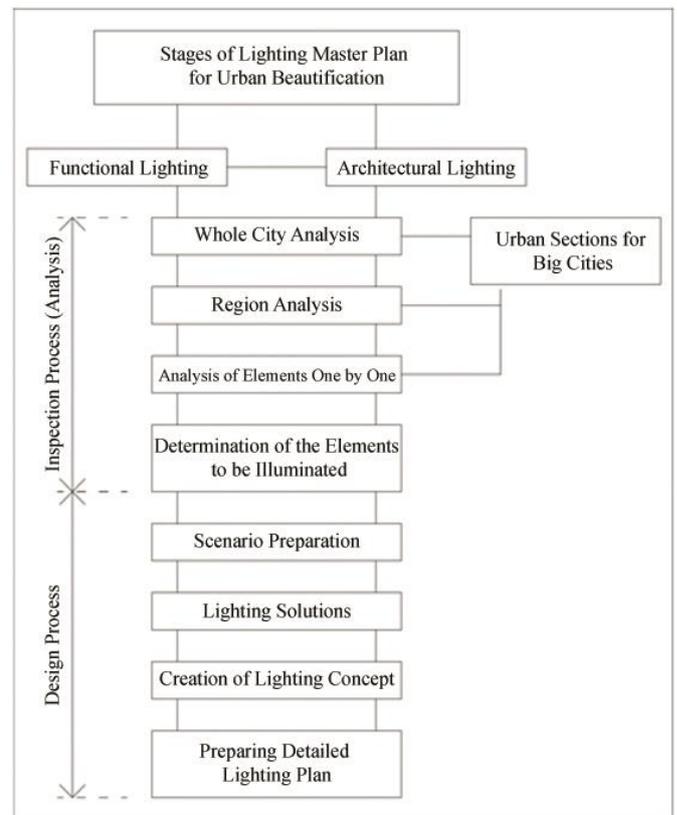
I. URBAN LIGHTING

Urban lighting includes not only security lighting of pedestrian and vehicle traffic routes and squares, but also the illumination of the city, which makes the city attractive and visually attractive. Exhibiting the beauty of the cities by illuminating under the lamp light at night is important in many respects, such as the provision of night life of the cities, enabling social relationships and interactions, revealing the functional, historical, social, aesthetic, importance, meaning of important and interesting buildings and spaces in terms of the city, contributing art works to night environments. [1]

II. LIGHTING MASTER PLAN

The lighting master plan includes the basic decisions regarding the illumination of a city. In order to make this planning, different characteristics of all regions of the city should be analysed in detail. In line with the lighting master plans, city lighting and lighting solutions can be decided. For the selection, design and layout of lighting elements used in urban areas, lighting master plans where urban lighting issues are planned should be used. In Table 1, the master plan stages are shown schematically. [2]

Table 1. Stages of lighting master plan for urban beautification. [2]



As shown in Table 1, city lighting;

- Functional lighting
- Architectural lighting

to be divided into two groups.

A. Functional Lighting

Functional lighting is a group of lighting, mainly involving technical issues, in urban lighting. It covers traffic and transportation, safety, sporting activities, entertainment, shopping, orientation in the city and the lighting of pedestrian areas at night. Being able to make the city liveable at night is possible with functional lighting. The roads, intersections and squares that form the basis of the functional illumination play an important role in terms of the use of the city as well as the visibility of these, as they constitute the transportation network in urban planning. [2]

B. Architectural Lighting

The priority of architectural lighting is to make urban values visible at night. The illumination of urban elements such as historic or new buildings, engineering structures, natural areas, art works and parks, and their functional, historical, architectural, social and aesthetic importance can be explained by architectural lighting.

Especially in order to reveal the identities of cities and / or different urban regions, to display their beauties, to place them in memory or to make them attractive with different effects, lighting applications are made. [3]

C. Advantages of City Lighting

In urban lighting, the city's night-use purposes are very important. For urban users, lighting for different functions is essential. Besides, the discovery of city beauties at night can make this city attractive for tourists.

In light of all this, it can be said that urban lighting brings many advantages to the city such as the following items;

- Security,
- Orientation,
- Introduction,
- Landscape,
- Identity,
- Initiative,
- Social Interaction. [4]

D. Light Pollution

Light pollution is the use of light at the wrong place, wrong amount, wrong direction and wrong time. Generally, it occurs when light is used excessively. For this reason, the building, which is desired to be perceived, creates a negative situation such as the failure to easily track the details of the monuments or areas. In addition, most of the energy consumed goes to waste. [5]

III. THE METHOD OF DETERMINATION OF THE STRUCTURES, ARCHITECTURAL ITEMS AND ROADS WITH PRIORITY IN TERMS OF URBAN LIGHTING PRINCIPLES

A determination system should be established in a region to identify urban elements and those that with priority.

It is not necessary to design a lighting for each item in the work area and is not also always possible in terms of application. For this reason, the criteria for determining the items that need to be lighted in this section are set

and it's been proposed that determination these elements by considering the criteria.

Depending on the characteristics of each criterion, the lower levels are determined and numerical values are given to each level.

Each urban value is assessed depending on the total number it receives;

- 1st degree; which need to be illuminated for the priority,
- 2nd degree; which need to be illuminated in the second stage,
- 3rd degree; which is not necessarily illuminate. Safety lighting is sufficient.

Thus, by making an determination, some urban values in the region will be determined the place in lighting prioritization. [6]

A. Determination Methods for Buildings, Engineering Structures and Art

Located in the study area; the following criteria were used in determining the priority in lighting of the important urban values such as mosques, baths, educational structure, hospital, tower-monument, bank building etc.;

- Transportation Status,
- Historical Value,
- Architectural Value,
- Effect on The City Skyline.

Each criterion was assessed on 5 points. The maximum score from this criterion group is 20.

For Transportation Status

This section is examined according to the transportation conditions of the buildings.

- 5 points for buildings on the highway,
- 4 points for buildings very close to the main road,
- 3 points for buildings close to the main road,
- 2 points for buildings away from the main road,
- 1 point for buildings very far to the main road.

For Historical Value

In this section, the historical importance of the structures are examined.

- 5 points for buildings built before 1900,
- 4 points built between 1900-1925,
- 3 points between 1926-1950,
- 2 points between 1951 and 1975,
- 1 point to buildings after 1975.

For Architectural Value

In this section, the status of the buildings according to their architectural values is examined.

- 5 points for buildings with the architectural characteristics of the period, close to the original architecture and well maintained,
- 4 points for buildings with the architectural characteristics of the period and the where changes are appropriate,
- 3 points for buildings with the architectural characteristics of the period but where the changes were not suitable,
- 2 points for buildings with the architectural characteristics of the period but rather neglected,
- 1 point for buildings without any architectural style and rather neglected.

For Effect on The City Skyline

In this section, the effects of structures on the city skyline were examined.

- 5 points for buildings which all facades visible from the other parts of the city and/or which on the main road,
- 4 points for buildings which a facade visible from the other parts of the city and/or which on the main road,
- 3 points for buildings on the main road and / or all of the facade only visible from the main road,
- 2 points for buildings close to the main road and / or a part of the facade only visible from the main road.
- 1 points for buildings away from the main road and unseen. [6]

Note: Structures with an effect on urban silhouette 1 are not included in the determination regardless of other substances.

B. Determination Methods for Parks and Squares

Located in the study area; the following criteria were used to determine the priority in lighting of the parks and squares;

- Transportation Status
- Architectural Features (Landscape Value)
- Effect on The City Skyline

The transportation situation and the effect on the city skyline were evaluated with 5 points. The Architectural Features group consists of ten items and each item is worth 1 point. Thus, a park or a square examined in this group receives 1 point for each of the mentioned features. The maximum number of criteria in this group is 20.

For Transportation Status

- 5 points for parks and squares on the highway,
- 4 points for parks and squares very close to the main road,
- 3 points for parks and squares close to the main road,
- 2 points for parks and squares away from the main road,
- 1 point for parks and squares very far to the main road.

For Architectural Features (Landscape Value)

- There are children's play areas in the park,
 - The buildings surrounding the square are historic and / or important,
 - The park or square is well known by the public in the city,
 - There are pool and / or water elements in the park or square,
 - There is no buffet, café, tea garden, etc. in or near the park or the square,
 - There are statues, monuments, tombs, fountains etc. in the park or square,
 - The trees in the park or square are featured and / or age-old, the plants are well maintained,
 - There are views that can be viewed from the park or square,
 - Architectural arrangement or laying of flooring in the park or square contributes to the architecture,
 - City furniture in the park or square is original.
- One point is given for each item.

For Effect on The City Skyline

- 2 points to parks and squares that can be perceived by surrounding roads,
- 3 points to parks and squares that can be detected from 500m distance,

- 5 points for parks or squares that can be detected from 1 km or more distance. [6]

C. Determination Methods for Roads

Located in the study area; The following criteria were used to determine the priority in lighting of the roads;

- Road Speed
- Traffic Density
- Traffic System
- Environmental Lighting
- Visual Guidance / Traffic Control
- Other Substances

The traffic density criterion is 5 points; road speed, traffic system, environmental lighting, visual guidance / traffic control criteria were evaluated with 3 points. The other substances group consists of three items and each item has a value of 1 point. The maximum number of criteria in this group is 20.

Determining the priority of the roads in the study area in lighting, the parameters used to determine the lighting class M according to CIE 115-2008 are used.

For Effect on The City Skyline

- 3 points for high-speed path,
- 2 points for medium-speed path,
- 1 point for low-speed path.

For Traffic Density

- 5 points for roads with a lot of traffic density,
- 4 points for roads with very high traffic density,
- 3 points for roads with high traffic density,
- 2 points for roads with low traffic density,
- 1 point for roads with very little traffic density.

For Traffic System

- 3 points for only motor vehicle used roads,
- 2 points for both motor and non-motorized vehicle used roads,
- 1 point for only non-motorized vehicle used roads,

For Environmental Lighting

- 3 points for roads with high illumination,
- 2 points for roads with medium illumination,
- 1 point for roads with low illumination,

For Visual Guidance / Traffic Control

- 3 points for roads with very good visual guidance,
- 2 points for roads with good visual guidance,
- 1 point for roads with poor visual guidance.

For Other Substances

- The road is divided with a refuge,
 - Intensity of intersection in other ways is many,
 - There are cars parked on the roadside.
- One point is given for each item.

In accordance with the determination system described in sections A-B-C;

- Buildings, engineering structures, artworks, parks, squares and roads, which score between 15 - 20 need to be illuminated for the priority,

- Buildings, engineering structures, artworks, parks, squares and roads, which score between 10 - 14 need to be illuminated in the second stage,
- Buildings, engineering structures, artworks, parks, squares and roads, which score between 9 – 0 are not necessarily illuminate. Safety lighting is sufficient.

IV. RESULT

Urban lighting; to increase security in the city, to provide correct orientation, to promote the city, to show the landscape, to provide city identity formation, to increase the social interaction provides advantages. It also reduces or prevents the occurrence of light pollution at the wrong place, in the wrong amount, in the wrong direction and at the wrong time. For this, it is beneficial to prepare the master lighting plan of the city. In order to determine the urban elements with lighting priority, some criteria have been determined and a scoring system has been established. Urban elements should be analysed one by one in accordance with the determined criteria. As a result of the analysis; urban elements that need to be illuminated for the priority, the urban elements that need to be illuminated in the second stage, the urban elements that don't need to be illuminated are determined. Thus, the most suitable lighting methods should be analysed and the light pollution should be kept to a minimum. A more spacious and well-known city should be built with a master lighting plan.

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