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Visual analysis on the nightscape lighting for the pedestrian and greenery zone of a neighborhood park

Jun Kwon Jeong[1], Jack Ngarambe[1], Hong Soo Lim[1], Gon Kim[1]

[1]Department of Architectural Engineering, Kyung Hee University, Yongin 446-701, Republic of Korea
Corresponding Author: gonkim@khu.ac.kr

Abstract. Due to the recent development in the night-life culture, neighborhood parks have become frequent hang-out spots for urban residents. Neighborhood Parks are now being built to host all kinds of leisure activities including sports, cultural experiences and so forth. As such local authorities are putting extra emphasis on the evaluation of the environmental state of neighborhood parks. This study aims to improve effective use of spaces built in the parks and establish the standard model of night landscape lighting in the neighborhood park by analyzing and solving the problems found in night landscape lightings of the existing neighborhood parks.

Keywords: Night landscape, night landscape lighting, park lighting, visual analysis.

1 Introduction

The design of nighttime environments that instill feelings of both safety and enjoyment is of critical performance to the economic and cultural vitality of urban centers. This has been broadly recognized in Korea for several decades, but has only recently been seriously addressed is Seoul, the capital city.

Under the need of the activity space at night for citizens, there about 1,860 parks in Seoul which have been trying to provide more comfortable and safe space to citizens. Thus it is important to improve the night landscape lighting of parks. After giving an official status to general planning research of night landscape lighting in 2000 based on a poll about night landscape lighting in 1999, there have been consistent efforts to set up a long-term goal and its achievement. However, there is no definite standard including space and function. For example, there are only guidelines about some form of light fixtures to be used and the recommended illuminance levels of neighborhood parks.

A landscape lighting of a neighborhood park has been improved. But it can't make the most of space of characteristic because of putting brightness ahead of everything. And also, the use of inappropriate lamps cause the disappearance of some spaces' characteristic, glare and the lack of color rendering. The Neighborhood Park has become a new part of entertaining space and there are various characteristics and functions in different park area. Therefore, this can be the right time to carry out

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planning and management of lighting systems to ensure adequate and comfortable lit-environments. This paper considers lighting design for the urban nightscape through the examination of urban lighting of a park to issue the role of urban lighting design. For this purpose, a set of photometric characteristic such as luminance, illuminance and color temperature have been measured and conventional problems have been issued with recommended suggestions

2 Literature Review: OUTDOOR LIGHTING FOR PARKS

When designing for outdoor lighting, it is necessary to verify and consider not only high quality illuminance and uniformity factor but also light pollution, light trespass, glare, veiling, color and color rendering index. Moreover, outdoor lighting fixtures should be used in right places to maximize efficiency and minimize energy waste and light trespass. A couple of studies have been conducted by different researchers with different targets.

Hee Sung Kim [1] suggested the appropriate night scape lighting for COEX, located in Seoul city, based on the analysis of some domestic and foreign space lighting cases. Through this analysis, he recognized the various characteristics and values of an appropriate space lighting system. Furthermore, he recommended some approaches on how to maximize the positive effects of space lighting as a land scape factor. Hee sung Kim put emphasis on creating night image which is different from daytime by using various lighting systems and fixtures.Hye-Jin Park and Hoon Kim proposed some directions to be followed when choosing the best lighting system in terms of economic feasibility. They mentioned that the illuminance level must be decided in consideration of the brightness and reflectance of the surrounding. They suggested system for economical lighting design because there no standards in brightness [2] Sang-ho Baek conducted a study about the complete lighting design process from the selection of lighting fixtures and sources (color rendering, efficiency and distribution) to their installation classified by location (space). He stated the required illuminance, light source, fixtures and different luminaires installation ways. In his conclusion, he emphasized on the importance of selecting right lighting system in reduction of light trespass [3]

2.2 Standard of lighting design for parks

There are no specific guidelines related to urban park directly, but there a lot of different studies related to night landscape lighting. There are various kinds of guidelines from light pollution to psychological factors affecting human and maintenance control. In Korea, the increase of night lighting is not only taking the enjoyable natural environment from people but also is bringing on new pollution factors. For this reason, studies related to night lighting are of high importance in Korea. The increase of night lighting is not only taking the enjoyable natural environment from people but also is bringing on new pollution factors. For this reason, studies related to night lighting are of high importance in Korea. Most of night lightings are installed for beauty and decoration of the buildings and this complicates

night lighting management. The commission international de l'Eclairage (CIE) has established four environmental zones with their basic regulations for outdoor lighting (CIE 1997). The environmental zone rating can be used to help ensure that the lighting goals of a given environment are appropriately defined and met, but not exceeded. The illuminating Engineering Society of North America (IESNA) has adopted the concept of environmental zones and recommends their use in developing new outdoor lighting (IESNA 1999). Environmental zones promise to reduce overall light pollution by helping to limit or in some cases eliminate light wastage. Environmental zones are explained in detail in [7].Due to a growing number of lighting fixtures in urban areas, Nae-young Ahn, Kyo-un shim and Gun-hyuk Ahn suggested the introduction of night lighting maintenance and control into Korean regulations through various researches on foreign cases about light pollution management [5]. This study clearly indicates the urgency of night lighting guidelines by showing the real state park users' inconvenience due to light pollution caused by the lack of space lighting management.

2.3 Quantitative approach in lighting design for parks

Brightness and color are major variables in night landscape lighting design. The brightness related to floodlighting's illuminance and luminance of buildings has been internationally recommended. Generally, brightness of lighting fixtures are set up depending on finishing materials of lighting targets (reflectance of materials) and the background brightness. To make objects look better, luminance contrast of the objects should be greater than the background luminance. The calculation of recommended illuminance must be carefully done. Furthermore, this calculation should consider compensation ratio of visual illuminance when using lighting system that mixes more than one type of lamp with a large difference in color temperature, and that recommended illuminance should be increased and decreased depending on the background. The degrees of warmth depends on correlated color temperature. It feels cold when the color temperature exceeds 5000K and moderate when it is between 3300-5000K.moreover, the feeling of light color temperature is affected by illuminance. In general, warm light source is preferred in low illuminance, and the preferred color temperature is risen with the increase of illuminance. The above studies have been analyzing illuminance, luminance, color temperature and color rendering which are based on IESNA,CIE, JIS and KS lighting standard and measuring them using illuminometer. Luminance meter, color meter and luminance distribution meter. Among studies of lighting physical quantity, Yoon Suk Choi [6], in his study about the optical evaluation method of landscape lighting classified by component, he suggested a new method to evaluate light color temperature, color degree and luminance contrast based on different view as well as the change of luminance according to the distance from Han river bridge which is used as night landscape lighting in his study. This study was very meaningful as it considered sidelight of landscape lighting.

3 Research Design

There are various facilities in parks such as landscape, resting area, amusement, exercising and refinement areas, convenience and park facilities management. So this study will suggest various improvement of night landscape lighting classified by facilities, space and function to provide night users with safe and comfortable space in the future. In this study, there is a considerations of books about human psychology, physical quantity of lighting, maintenance and control of electricity used for nightscape lighting of urban park and research of guideline such as KS recommended illuminance standard. And also it is significant to grasp present condition of study area and suggest improvement for the neighborhood park's nightscape lighting throughout the analysis of physical quantity, form of fixtures and lighting system. This study has been preceded through literature review and site analysis. First, it is necessary to make standards through the examination of domestic and foreign regulations on nightscape lightings and the analysis of lighting design through researches about nightscape lighting maintenance control, its psychological and behavior effects on the park users and the measurement of lighting physical quantity. Second, it is of high benefit to grasp location, time of foundation and purpose of Boramae Park and understand characteristic of space based on legislation related to urban park and green belt. Third, feasibility analysis of functional components including form of fixtures installed, material quality, types of light sources, stabilizer and way of flickering is needed. Fourth, it is necessary to judge suitability of required condition based on illuminance, luminance, color temperature and color rendering index of the installed luminaires.

4 Overview of Boramae Park

Boramae Park was chosen as the target of this study since it is active, with an easy accessibility in terms of people transportation and has different kinds of spaces. Also, due to its day and night time crowdedness resulting in its favorable location.

Fig. 1. Night View of Boramae Park

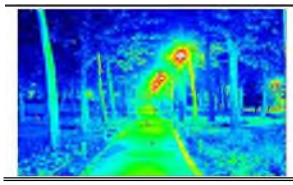
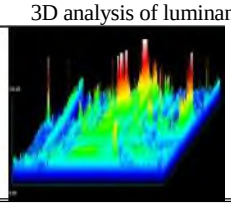
The users of this park experience an acute discomfort due to the lack of a proper arrangement and distribution of lighting fixtures. The present lighting design in this park was poorly done owing to the fact that it does not fit for the characteristics and

the functions of the park. This study will analyze all the lighting related problems in this park and some propositions for the improvement of Boramae's night view will finally be given.

5 Visual analysis on the pedestrian paths

This is one of major areas found in parks as it enables people to enjoy the beauty of the nature while sitting on the provided benches or walking around the park. Thus, the environment of this pedestrian zone should bring a relaxing and safety feeling to those stressful and tired users. Nevertheless, this is not the case with Boramae Park pedestrian zone due to the severe glare from lighting. In Boramae Park, most of lighting fixtures are downward and diffused lamps of 4~4.5m tall. Those lamps are situated on the pedestrian zone and trial and they are the source of visual glare in this park.

Table 4. Present conditions of pedestrian lighting fixtures

Form	Specification
	Material : wood, steel, aluminum, PC light source : MH175W color temperature : 4,200K color rendering index : 70Ra efficiency : 80lm/W lighting way : diffusion and downward
Daytime	Nighttime
	
Luminance distribution	3D analysis of luminance
	

In this park, lamps (metal 150W) are installed at intervals of 10 meters in narrow path of Boramae Park. The Luminance of bright place is over 26lx and dark place is under 5lx, this great difference of luminance is the source of discomfort. There were some lamps with the luminance over 200cd/m^2 coming into pedestrians' sight and there were some fixtures with the luminance over 58cd/m^2 on the ground (for the up-lighting system). Thought Luminance is necessary to recognize objects, it can bring a

discomfort feeling when there is a big difference. The studies done about color and human emotion showed that red can bring warm feelings, elevate people's feeling and it is effective to migraine and enhances agility. Thus color temperature under 4,000K is suitable for narrow path.

6 Conclusion

Conclusively, it seems no much efforts were made to bring upon an interesting and aesthetic scenery at this park. Most times, parks are lit for the mere sake of space lighting. This result in very bright, glare-producing and thus visually-impairing surroundings rather than beautiful and relaxing ones. It is of paramount importance therefore, that the function of a given space be considered when drafting a plan to light that space.

Briefly, the analysis of Boramae Park can be done in terms of emotional, functional and physical factors. Firstly, the park should bring emotional satisfaction to both day and night time visitors. Secondly, the use of non-cut-off luminaires not only is the energy waste but also causes light pollution. From the measurement made in this study, lot of luminaires have luminance over 100,000cd/m2 and that is a severe light pollution case in need of quick action. Thirdly, inadequate arrangement of light fixtures engenders uneven distribution of illuminance. Thus, a lack of illuminance where it is required and high illuminance where it is not needed. Finally, lighting of sign boards, monuments and trees must be carefully done to avoid glare while maintaining the esthetic of the park. It can be seen that esthetic elements were not attentively considered during light designing of this park.

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