

An Evaluation on the Lightings of Artificial Turf Football Fields Owned by Official Organizations and Private Enterprises

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Abstract

The aim of this study was to investigate the lighting systems of artificial turf football fields of public and private sectors and to reveal and compare the current situation with the ideal one that it should be. 21 artificial football fields, 6 artificial turf football fields out of 9 from public sector and 15 artificial turf football fields out of 85 from privately owned organizations, have been examined in five province of Turkey. The general standards and the compliance to these standards by the present artificial turf football fields in terms of lighting of the place were studied. Data were evaluated with using descriptive analysis technic. Artificial football fields taken into consideration by researchers and experts were subjected to observation along with measurement. It was confirmed that out of 6 public and 15 private, totally out of 21 artificial turf football fields, 38% (8 of them) were below the minimum lighting level, 19% (4 of them) were at minimum lighting level and 43% (9 of them) were below average lighting level. As a result, for a competition to be played, brightness level should be at least $150 \text{ lx} < E < 500 \text{ lx}$. It was found out that, out of 6 public sector and 15 privately owned artificial football fields, 62% was on the minimum brightness level and the other 38% was even under minimum brightness level. It was confirmed that 4 out of 6 (67%) officially owned artificial turf football fields and 9 out of 15 (60%), privately owned artificial football fields were on minimum brightness level. It was also determined that 1 out of 6 (17%) officially owned Astroturf Football Fields and 5 out of 15 (33%) privately owned Astroturf Football Fields were between minimum and average brightness levels.

Keywords: Astroturf football fields, lighting, lighting on Astroturf football fields

1. Introduction

Carpet field, football to play the ground covered with a special synthetic material and surrounded by wire mesh is defined as the area. Most of these facilities are operated by private entrepreneurs. Sports fans go to these facilities a few times a week, here is a longing for football. Carpets are the first place they want to play football field of amateur athletes in Turkey (Tel, 2011), Illumination is to apply light to objects, environments, and small or large areas, so that they can be seen. The main aim of illumination was to get closer to day light as far as possible. Illumination is prominent in order to see the smallest pieces and details that need to be seen, to recognize shape of surface, to understand two and three-dimensional textures and to correctly detect all the features of mobility, direction, speed, acceleration etcetera. What is more, light is important to see the colors, to differentiate the smallest color separation and to sustain the visual recognition enabling to see comfortably (Sirel, 1994). With good illumination, it is possible to reduce working-accidents and increase efficiency at work (Aydoğan, 2017). Light production has effects on humans with its production and efficiency. Today, illumination technics are swiftly developing for various necessities. Electrical lighting, which started with glow filament, has continued with the proliferation of gaslight chandelier (Durmuş, 2003).

This study Light is the material used for illumination. In the electromagnetic wave spectrum was expressed by the light, it is the radiation that causes vision in the human eye, which is in between 380 wavelength (nm) and 780 nm (Enarun, 1998). Wellness and fitness centers all over the world and in Turkey as well as in a growing number of industry and services sector has become a large footprint. It is known that people who are exposed to intense work tempo and immobile life show a serious interest in healthy living and sports centers to complete themselves physically, socially and mentally (Öztürk, Adiloğulları, & Ay). The situation revealed the prominence of artificial turf football fields along with other sports fields. Working hours in the daytime usually has become an important

factor leading people to play sport at night on artificial turf football fields. With the ever-increasing technology, the opportunities offered by the artificial turf football fields have expanded and have become unchanging unaltered playgrounds for people.

It is important that the lightings on artificial turf football fields are enough and properly and correctly placed, in order to play sports in a healthy environment. Because, illumination, which is defined with applying light to see objects and environment, the production of light, and its distribution, efficiency and effects on humans, for the purpose of ideal vision, is also relevant for artificial football fields (Durmuş, 2003, p. 36). As a result of industrialization and similar developments that come with the contemporary society, it is natural that sport also has new tasks that are suitable for different conditions (Doğar, 1997). In order to specify the lighting condition of a place it is important to define the light level. Light level (E): Luminous Intensity E indicates the ratio of the falling light flow to the surface to be illuminated. The luminous intensity is 1 lux, in the case, where the light flow of 1 lm is falling evenly over 1 m². Its symbol is “lx”. The inverse square law is applied in the external lighting accounts. The illumination value is inversely proportional to the intensity of the source and the distance from the source to the source. The light intensity is indicated by I, and the area of a sphere with radius r is S = 4π, so the luminous flux is $\Phi = 4\pi I.E = \Phi/S = 4\pi I/4\pi = I/\text{found}$ (Dış Aydınlatma, 2018).

When the ability to see is mentioned, brightness and darkness sensitivity (contrast), shape sensitivity (sharpness) and visual speed comes to mind. Because vision threshold values, which are closely connected to the level of light such as values of brightness and smoothness factors, adaptation, glare, shadow etc., are variable abilities, these can only be increased by a good illumination, properly accorded to physiological-optical principles. If the eye is tired and uncomfortable due to a bad-lit environment, it can negatively affect the eye health. A good illumination provides to sustain eye health considering the structure, functioning, characteristics, physiological and optical principles of the eye. On the other hand, it creates positive effects on psychology (Özkaya, 2000). Not paying attention to these principles lead to inadequate or extreme lighting. This, not only may pose a risk to safety and comfort, but also could disrupt eyesight due to glare problems.

Ideal lighting could both save energy and prevent light pollution. For this; required design calculations should be made with known luminaires of photometric values, number and type of luminaire should be determined according to these calculations, sensor-fitted and time-controlled installations for light level should be used as needed with the required time (Onaygil, 2000). Extreme light level has also some significant inconveniences. It can create problems such as dazzling, light flux waste, need for protection of light sources from pollutants such as dirt, dust, oil and even aesthetics, comfort issues (Şerefhanoglu, 1972).

2. Method

In the study, 6 artificial turf football fields out of 9 from public sector and 15 artificial turf football fields out of 85 from privately owned organizations, totally 21 artificial football fields were examined in five province of Turkey (Osmaniye, Malatya, İzmir, Manisa and Muğla). The general standards and the compliance to these standards by the present artificial turf football fields in terms of lighting of the place were studied. What is more, proper lighting mechanism, needed by the important standards, which improve the athlete the status of how to exercise and follow the practice, was emphasized. In order to clear up this research, the necessary information (Sizes of artificial turf football fields, types and numbers of lamps used, direct position and numbers) were collected by going to the artificial football fields without any segregation. The method of this study was the qualitative method and its pattern was case study. Data obtained in the study were analysed using descriptive analysis technic.

Basic lighting for adequate light level for artificial turf football fields was considered as sunlight. Light is an electromagnetic wave that the human eye can see (Yalçın, 2017). For a competition to be played on artificial football fields, light level should at least be $150 \text{ lx} < E < 500 \text{ lx}$. In the calculations, light level values of minimum (E = 150 lx), average (E=300 lx) and maximum (E = 500 lx) were taken into consideration. Under the ideal lighting condition for an artificial football field to have, the factors of homogeneity and uniformity are discussed in the following format:

$$\delta l = E_{\min}/E_{\text{ort}} \text{ ve } \delta \eta = E_{\min}/E_{\max}$$

$$\delta l = 1.5 \quad \delta \eta = 1/3$$

E_{\min} = Minimum light level

E_{ort} = Average light level

E_{\max} = Maximum light level

The horizontal light level should be $150 \text{ lx} < E < 500 \text{ lx}$. There should be a minimum length of 7.5 meters in

artificial turf football fields. There should not be light beam at an angle of less than 250° , otherwise dazzling occurs.

Light flux, is calculated with three different methods as Yield Method ($E = \Phi \times \eta / S$), (S= a x b), Approximate Calculation Method ($E = \Phi / S$), (S= πr^2) and ($\Phi = \sum 2\pi \Delta h I$) and Space-Angle Method ($E = \Phi / S$), (S= $4\pi r^2$). Direct lighting devices should be used concerning external lighting (Özkaya, 2000).

Terms used for external lighting of artificial football fields according to yield method:

ΦL = Lamp light flux.

n_p = Total spotlight (lamp) number

D = Artificial turf football fields poles

$n_d = n_p / D$ Number of lamps per pole

$\Phi T = n_p \times \Phi L$ Total light flux

$\eta_p = 0.80$ Efficiency of spotlight

$F_e = 0.75$ Contamination factor

η_e = Light distribution factor

η = Lighting efficiency

$\eta = \eta_p \times F_e \times \eta_e = 0.80 \times 0.75 \times 0.73 = 0.438$

Lighting efficiency in standard big fields is accepted as 0.40.

E = Average light level

S = Lighting area

The interpretation of the findings are made according to the following formula:

$E = (\Phi T \times \eta) / S = (n_p \times \Phi L \times \eta) / S$

From; $n_p = (E \times S) / \Phi L \times \eta$ (Özkaya, 2000).

3. Data Analyses

Data were evaluated with using descriptive analysis technic. Artificial football fields taken into consideration by researchers and experts were subjected to observation along with measurement. In the assessment, minimum, average and maximum values were taken as base for the necessary ideal lighting.

4. Results

It was confirmed that out of 6 public and 15 private, totally out of 21 artificial turf football fields, 38% (8 of them) were below the minimum lighting level, 19% (4 of them) were at minimum lighting level and 43% (9 of them) were below average lighting level. Existing lighting conditions of public and private artificial turf football fields, which were subjected to survey, and minimum, average and maximum lighting levels determined according to the calculations of the size of these artificial turf football fields are given in tabular form and in total.

Table 1. Field area and lighting data related to artificial turf football fields

Facility Type	Facility Name	Dimension of the field	Number and Power of Lighting				Level of Conformity	
			Current Situation	150 Lux (Minimum)	300 Lux (Average)	500 Lux (Maximum)		
Public Enterprise	Cemil Şeboy	30x50 m	18x350W	18x350W	36x350W	54x350W	Minimum Level	
	Buca Belediye	25x50 m	18x350W	18x350W	30x350W	48x350W	Minimum Level	
	8 Eylül	55x110 m	54x400W	60x400W	120x400W	204x400W	Under Minimum	
	Tevfik lav	50x75 m	24x400W	18x400W	30x400W	48x400W	Under Average	
	İnönü Ün.v.	30x50 m	18x400W	18x400W	30x400W	48x400W	Minimum Level	
	Fantom	25x45 m	8x400W	12x400W	24x400W	36x400W	Under Minimum	
	Akdeniz	30x30 m	8x250W	24x250W	44x250W	72x250W	Under Minimum	
	Köşk-1	40x70 m	20x250W	40x250W	70x250W	110x250W	Under Minimum	
	Köşk-2	40x70 m	10x250W	35x250W	70x250W	115x250W	Under Minimum	
	Özden	40x60 m	12x250W	30x250W	60x250W	96x250W	Under Minimum	
	Zorkun	30x60 m	12x250W	30x250W	60x250W	96x250W	Under Minimum	
	Yüzok	25x45 m	16x350W	12x350W	24x350W	36x350W	Under Average	
	Private Sector	Şirinyer	24x48 m	18x400W	12x400W	24x400W	36x400W	Under Average
		Muğla GS	25x45 m	16x400W	12x400W	24x400W	36x400W	Under Average
		Çamlık	22x40 m	18x350W	12x350W	24x350W	36x350W	Under Average
Manisa FB		23x48 m	18x350W	12x350W	24x350W	42x350W	Under Average	
Santra		30x50 m	18x250W	18x250W	36x250W	60x250W	Minimum Level	
Ayıldız		25x50 m	21x250W	16x250W	32x250W	52x250W	Under Average	
Final		28x50 m	16x400W	18x400W	30x400W	48x400W	Under Minimum	
Milenyum	25x50 m	18x400W	12x400W	24x400W	42x400W	Under Average		
Polis okulu	20x40 m	16x250W	12x250W	20x250W	32x250W	Under Average		

It was confirmed that out of 6 public and 15 private, totally out of 21 artificial turf football fields, 38% (8 artificial turf football fields) were below the minimum lighting level, 19% (4 artificial turf football fields) were at minimum lighting level and 43% (9 artificial turf football fields) were below average lighting level. When official and private institutions taken in to consideration, out of 6 artificial turf football fields belonging to official institutions, 33%, (2 of them) were below the minimum lighting level, 50% (3 of them) had minimum lighting level and 17% (1 of them) were below the average lighting level. On the other hand, out of 15 privately owned artificial turf football fields 40% (6 of them) were below the minimum lighting level, 6.6% (1 of them) were at minimum lighting level and 53% (8 of them) were below average lighting level. According to these results, it is understood that there is no significant difference between private and public artificial turf football fields, in terms of lighting below the minimum lighting level. However, when compared in terms of the minimum lighting levels, it is seen that 50% (3 of them) of the artificial turf football fields belonging to the official units are more than 13% (2 of them) of the number of private sector artificial turf football fields. Public or private artificial turf football fields with an average or maximum level of lighting could not have been found. Thus, it has been found out that, lighting of artificial turf football fields is generally below the minimum illumination level, on minimum level or somewhere between the minimum and average lighting levels.

5. Discussion

According to the research results, light levels of artificial turf football fields not satisfied internationally. It was confirmed that out of 21 artificial turf football fields, 38% were below the minimum lighting level, 19% were at minimum lighting level and 43% were below average lighting level. When official and private institutions were taken in to consideration, out of artificial turf football fields belonging to official institutions, 33% were below the minimum lighting level, 50% had minimum lighting level and 17% were below the average lighting level. On the other hand, out of privately owned artificial turf football fields 40% were below the minimum lighting level, 6.6% were at minimum lighting level and 53% were below average lighting level. According to these results, it is inferred that that there is no significant difference between private and public artificial turf football fields, in terms of lighting below the minimum level. However, when compared in terms of the minimum lighting levels, it is seen that 50% of the artificial turf football fields belonging to the official units are more than 13% of the number of private sector artificial turf football fields. Public or private artificial turf football fields with an average or maximum level of lighting on the other hand, could not have been found. It is significant that 57%, of artificial football fields (12 of them) are either on minimum light levels or even under minimum light levels. Accordingly, It

is possible to think that this is because enterprises try to lower the lighting costs. One of the primary goals of enterprises is return profit. Mucuk described that these enterprises as economic units established to meet the needs of others (Mucuk, 1983). In this case, the idea of playing sports more technically, aesthetically and healthy, giving pleasure to the player and the audience, making sport more attractive and enabling more people to exercise under adequate illumination, was ignored. Aykaç however, emphasizing on successful companies giving prominence on coordination to increase efficiency, expressed that coordinating with people should come before profit (Aykaç, 1991).

6. Conclusion

It was understood that, low levels of illumination in both the official and private sector artificial turf football fields indicate that the present football fields do not provide the ideal lighting conditions required for healthy and efficient exercise. For this reason, light levels of artificial turf football fields need to be subjected to inspections that are more serious.

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