

The Implementation of Artificial Lighting on Residential Interior Design in Green Village Cluster, Tangerang

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ABSTRACT

During home activities, humans need both natural and artificial lighting with different intensities. Artificial lighting is lighting produced by light sources other than natural light. Artificial lighting is very necessary when the room does not get natural lighting or when there is insufficient natural lighting. Along with the times, artificial lighting has various types of lamps, lighting procedures, lighting color display and color temperature. So that artificial lighting is needed in order to achieve the ideal visual view for activities in every room. The placement of artificial lighting in the interior design of the Cluster Green Village residential house in Tangerang is needed to support every activity carried out at home and create a warm and comfortable space atmosphere. This design applies quantitative methods. In this study, the data obtained were sourced from the results of the design on the object of research. The measurement data obtained will be adjusted to the SNI lighting standard. The effect of artificial lighting on residential homes can be seen from the activities of users in each room. The main considerations in this design are the selection of lamp types, lighting procedures, lighting color display and color temperature applied to the Cluster Green Village residential house in Tangerang.

Keywords: Artificial Lighting; Interior; Residential; Green Village Cluster

1. INTRODUCTION

Home is a place that meets the requirements of a decent life, viewed from various aspects of community life (Frick and Muliani, 2006) [1]. Based on this understanding, a residence can be interpreted as a place to live that has various functions for a decent human life. One of the important elements in the interior of a residential house is lighting, because it greatly affects the activities that take place in the house.

Researchers will discuss how the effect of lighting on the comfort of residents in the house. This residence was chosen because the use of artificial lighting is quite dominant due to the lack of natural lighting that enters the house.

Light is a ray that allows the eye to capture the shadows of objects around it. Artificial lighting is lighting that comes from man-made light sources known as lamps or luminaires. In bad weather and at night, artificial lighting is needed. The development of artificial light source technology provides artificial lighting quality that meets human needs. (Lechner, 2001) [2].

Artificial lighting requires energy to be converted into bright light. Efficient artificial lighting has a focus on fulfilling lighting in the work area. (Satwiko, 2004) [3] states the importance of directing light to a point that requires lighting as a priority.

The factors that affect the brightness of the light are the condition of the closed or open space, the position of the lamp placement, the type of lamp used, the color of the walls and the diagram pattern of each lamp. Glare is a visual disturbance factor, namely the reduced ability to see objects due to a mismatch in the distribution or luminance range.

Lighting in residential homes is designed based on the theme, needs and activities of users. In addition, lighting can also strengthen the atmosphere or ambience and aesthetics of the space.

Lighting plays a very important role in providing visual information. (Darmasetiawan, 1991) [4]. Light can have an impact on human psychology during indoor activities. The lighting quality of a building is largely determined by the feelings that arise in someone who visually accesses it (Steffy, 2002)[5].

This study aims to identify artificial lighting in the Green Village Cluster Residential House, Tangerang, to find out the atmosphere or ambience of the room caused by artificial lighting and the comfort of the room users.

Atmosphere [6] is a direct form of physical perception and is recognized through emotional sensitivity (Peter Zumthor, 2006) [7]. In relation to interior design, the term atmosphere refers to what the five senses perceive from a space. The atmosphere of a new space can get its meaning if it is relevantly related to the desired human condition of

the user (Hidjaz, 2012) [8]. So it can be said that the atmosphere of space is an environmental condition that is absorbed by the human senses which is then perceived by humans as something that has meaning.

Kelly's approach to lighting design centers around three key techniques — highlighting objects, washing surfaces, and creating sharp details. He used the terms "focal glow," "ambient luminescence," and "play of brilliants" to describe these ideas. These three techniques are always present in his work, although certain project criteria may require one element to be more clear than others. "Focal glow is the follow spot on the modern stage. It is the pool of light at your favorite reading chair". "Ambient luminescence is the uninterrupted light of a snowy morning in the open country. It is fog light at sea in a small boat, it is twilight haze on a wide river where shore and water and sky are indistinguishable". "Play of brilliants is Times Square at night. It is the eighteenth-century ballroom of crystal chandeliers and many candle flames" (Richard Kelly, 1952) [9]. He was also an early proponent of natural lighting and believed natural light to be the primary type of light that defines a space, and that electric lighting should play a complementary role. This layered approach to lighting creates a solution that balances interior and exterior lighting.

2. LITERATURE REVIEW

2.1. Lighting System

The lighting system is divided into three parts (SNI 03 - 6575 - 2001) :

2.1.1. Equally Lighting System

The light illumination is uniformly scattered evenly throughout the room. This lighting system suitable for rooms that are not used for perform special visual tasks. On this system a number of armatures are placed regularly in the ceiling.

2.1.2. Directional Lighting System

The entire room gets lighting from one particular direction. This system suitable for exhibition or highlighting an object because it will appear clearer. More than that, directional lighting that highlights a single object. It acts as a secondary light source for the surrounding space, namely through the mechanism light reflection. This system can also combined with an even lighting system because it is useful to reduce the drab effect that may be caused by lighting equally.

2.1.3. Local Lighting System

In this system, light is concentrated on a certain object, such as a working place who need a visual assignment.

The lighting systems need calculations appropriate for a designer, implementer, the owner or manager of the building in design, operate and maintain systems lighting. This is done in order to obtain a system healthy, comfortable, safe, and fulfilling artificial lighting building regulations.

2.2. Light Spread

Most of the light which the eye responds indirectly to a light source, but after being reflected or through translucent objects. If we are in a room where there is a light source from a lamp, then there is two light sources, namely the primary light source which comes from the lamp and the light source which is secondary to the light fixture that. From the walls around the room [10] For example, there are 3 types of light scattering, namely direct scattering, indirect or mixed [10].

2.2.1. Direct Lighting

The direct lighting efficiency is very good. The light emitted by the light source entirely directed to the field that must be given lighting; the ceiling barely follows role. However, this lighting system casts sharp shadows.

2.2.2. Indirect Lighting

The light reflected by the ceiling and walls. The color of the ceilings and walls should be light and the shadows are almost non-existent. Indirect lighting used in the reading or writing rooms and other finer works.

2.2.3. Mixed Lighting

The efficiency of this lighting is lower than direct lighting and indirect lighting. Directed light sources to the walls and ceiling. Formation the shimmer shadow is much reduced. Mixed lighting is used in schools, offices and at working area.

2.3. Law of Illumination

The important units that used in lighting [11]:

Table 1 The important units that used in lighting

1.	Space Angle	W	Steradian (Sr)
2.	Light Intensity	I	Candela (Cd)
3.	Light Flux	F(Φ)	lumen (Lm)
4.	Lumination	L	(cd/m ²)
5.	Illumination	E	lux (lx)

2.4. Light Flux or Light Flow

The average flow of light is the current light or light flux. Light current defined as the total amount of light emitted by light source every second. The magnitude of the light

current with units of lumens (lm) expressed by equation 1 [12].

Equation 1. $\Phi = \frac{Q}{t} \text{ lm}$

Notes :

Φ = luminous flux in lumens (lm)

Q = light energy in lumen (hours or seconds)

t = time in hours or seconds

2.5. Illumination Intensity

According to history, the source of artificial light is candle (candela). Candela is a unit of light intensity from a source emitting energy light in all directions [13]

Equation 2. $E = \frac{\Phi}{A} \text{ lux}$ [10]

Notes :

E = lighting intensity (lux)

Φ = luminous flux in lumens (lm)

t = work area (m²)

Due to usage and depreciation factors due to dust on the luminaire and lamp, so the equation must be multiplied by coefficient of utilization (CU) and light-loss factor (LLF). The formula is stated with equation 3 [14]:

Equation 3. $N = \frac{E \times L \times W}{\Phi \times \text{LLF} \times \text{Cu}}$

Notes :

E = lighting intensity (lux)

L = length (m)

W = width (m)

Φ = luminous flux in lumens (lm)

LLF = Light Loss Factor

Cu = Coefficient of Utilization

2.6. Light Loss Factor

Light Loss Factor source influenced by 2 factors:

1. Decrease in the ability of the light source (lamp and armature) due to service life
2. Dirt on the armature, can contamination or change in properties caused by armature

2.7. Coefficient of Utilization

According to [15] the factors that influence CU are:

1. The current of light that reaches the work plane
2. Light distribution by luminaire
3. The height by the luminaire above the working plane
4. Space proportion
5. Surface reflectance

2.8. Method

The method used in this research is literature study, observation and quantitative approach. Literature Study is

data collection by collecting literature, both from journals, books, brochures, internet, and papers related to lighting design in residential homes. Observation is making observations in residential houses to examine artificial lighting that is in accordance with space activities. Quantitative [16] approach compares indoor artificial lighting (in lux) with SNI. This is a research based on the philosophy of positivism to examine a particular population or sample and take random samples with data collection using instruments, the data analysis is statistical (Sugiyono, 2015:14).

The Green Village Cluster, Tangerang has a modern contemporary theme where the wood texture materials is quite dominant. There are several rooms including living room, dining room, kitchen, master bedroom, kids bedroom.

2.8.1. Living Room

The living room has general lighting, indirect lighting and chandeliers. The ceiling in the living area uses a drop ceiling so the room looks wider.

General lighting uses a spot light that can be adjusted to the activities in the room because it can be directed based on space requirement. The color rendering used is warm white so that it supports a warm and comfortable atmosphere.

Indirect lighting supports the creation of a comfortable and warm room atmosphere. While the chandelier serves as the aesthetics of the room.



Figure 1 Living Room
(Source : Author's Document)

The total number of lights used in this living room are:

$$N = \frac{E \times L \times W}{\Phi \times \text{LLF} \times \text{Cu}}$$

$$N = \frac{200\text{lux} \times 6.5 \text{ meters} \times 2.85 \text{ meters}}{(8\text{Watt} \times 75\text{Lumen}) \times 0.7 \times 0.5}$$

$$N = \frac{3705}{210}$$

$$N = 17.6 = 18 \text{ units}$$

According to the calculation above, the number of lights needed based on SNI lighting standard is 18 units. So this number represent the living room design with a total of 18 units.

2.8.2. Dining Area

The dining area uses natural lighting so that general lighting in the form of spot lighting is only needed at night. While the hanging lamp makes the atmosphere of the room warmer and more comfortable.



Figure 2 Dining Area
(Source : Author's Document)

The total number of lights used in this living room are:

$$N = \frac{E \times L \times W}{\emptyset \times LLF \times Cu}$$

$$N = \frac{200lux \times 2.75 \text{ meters} \times 2.6 \text{ meters}}{(8Watt \times 75Lumen) \times 0.7 \times 0.5}$$

$$N = \frac{1430}{210}$$

$$N = 6.8 = 7 \text{ units}$$

According to the calculation above, the number of lights needed based on SNI lighting standard is 7 units. So this number represent the living room design with a total of 8 units.

2.8.3. Kitchen

General lighting in the kitchen uses a spot light that can be adjusted to the activities in the kitchen. The color rendering used is warm white so that it supports a warm and comfortable atmosphere in the kitchen. The indirect lighting behind the cabinet supports the creation of a comfortable and warm kitchen atmosphere.



Figure 3 Kitchen

(Source : Author's Document)

The total number of lights used in this living room are:

$$N = \frac{E \times L \times W}{\emptyset \times LLF \times Cu}$$

$$N = \frac{200lux \times 3.85 \text{ meters} \times 2.65 \text{ meters}}{(8Watt \times 75Lumen) \times 0.7 \times 0.5}$$

$$N = \frac{2040.5}{210}$$

$$N = 9.7 = 10 \text{ units}$$

According to the calculation above, the number of lights needed based on SNI lighting standard is 10 units. So this number represent the living room design with a total of 10 units.

2.8.4. Master Bedroom

Similar to the living room, general lighting in the master bedroom also uses spot lights to support activities in the room. In addition, the addition of a hanging lamp also supports room lighting.



Figure 4 Master Bedroom

(Source : Author's Document)

The total number of lights used in this living room are:

$$N = \frac{E \times L \times W}{\emptyset \times LLF \times Cu}$$

$$N = \frac{200lux \times 3.85 \text{ meters} \times 3.45 \text{ meters}}{(8Watt \times 75Lumen) \times 0.7 \times 0.5}$$

$$N = \frac{2656,5}{210}$$

$$N = 12.65 = 13 \text{ units}$$

According to the calculation above, the number of lights needed based on SNI lighting standard is 13 units. So this number represent the living room design with a total of 14 units.

2.8.5. Kids Bedroom

General lighting in the kids bedroom also uses spot light and indirect lighting to support activities in the room. The color rendering uses warm white so that it adds a warm and comfortable impression.



Figure 5 Kids Bedroom
(Source : Author's Document)

The total number of lights used in this living room are:

$$N = \frac{E \times L \times W}{\emptyset \times LLF \times Cu}$$

$$N = \frac{200\text{lux} \times 5.6 \text{ meters} \times 3.85 \text{ meters}}{(8\text{Watt} \times 75\text{Lumen}) \times 0.7 \times 0.5}$$

$$N = \frac{4312}{210}$$

$$N = 20.5 = 21 \text{ units}$$

According to the calculation above, the number of lights needed based on SNI lighting standard is 21 units. So this number represent the living room design with a total of 20 units.

3. CONCLUSION

From the calculations that have been done, it seems that the lighting in the Green Village Cluster, Tangerang is close to SNI standard. So it can be concluded that users who are active in the room will feel comfortable, especially in the living room and kitchen. Although there is the addition of indirect lighting, hanging lamps, chandeliers won't change the atmosphere of the room but will make the room warmth and comfort. Besides, artificial lighting also increases the aesthetic value of the room which makes the room more lively and well-organized by the concepts and themes that have been set

when we start designing. The author suggests you to observe in the first place so you can find out the room measure and needs.

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