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# A Study of Natural Lighting and Quality of Lighting in Production House for Cinematography (Case Study: Residential House at Cinere)

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## ABSTRACT

The tendency of certain television stations to present television soap operas and films as their main programs around the 2000s has increased the demand for television series and film productions. Along with that, there has also been an increase in product advertisements that will be shown on television. The number of soap opera shows, television films, and advertisements on television have spurred production houses to meet market demand by producing them in various places, including certain residential houses. The residential house that is used as a case study is a house in Cinere, Depok, West Java, whose initial design in 2007 was only for residential houses. The problem under study is the amount of natural lighting intensity that can support shooting at home. This study using mixed methods. The research was conducted by measuring the intensity of natural light with a light meter and observing the object's position in obtaining natural lighting. The purpose of this study was to determine the mapping of residential lighting quality, which can be used as a reference for the proposed addition of the required light intensity according to the desired lighting needs for filmmaking (effect) related to the film scenario. This study indicates that the intensity of natural lighting is most significant for people (objects) sitting in the living room, dining room, and standing in the kitchen room, respectively, from the east, south, north, and west sides. The average amount of natural light intensity from 07:00 to 17:00 when the weather conditions are sunny, cloudy to cloudy, 7,976.20 lux to 647.70 lux, has met the minimum lighting intensity requirement for the film set locations 600 lux. The quality of space with a quantity of natural lighting can be fulfilled in this case study residential house.

**Keywords:** Residential House, Shooting, Natural Lighting, Light Intensity

## 1. INTRODUCTION

The tendency of certain television stations to present soap operas as their main program around the 2000s has increased the demand for soap operas production. The soap operas presented consist of various soap operas, including drama soap operas, comedy soap operas, action soap operas, fantasy soap operas, and other soap operas. Along with that, it also increases the production of product advertisements displayed on television.

The making of soap operas, television films, and advertisements on television has led to many production houses trying to meet market demand.

The production house makes soap operas in specific locations according to the scenario/ theme of the story (results from an interview with Mr. Damar, a shooting location seeker from MNCTV). It looks for locations for making soap operas in various places. One of the locations is a residential house located in a residential area.

The scenes recorded by the camera are to show the visuals that are told in the scenario. One of them uses natural lighting and artificial lighting related to film lighting techniques [1].

Lighting is an essential element in film production [1] because, without light, the audience cannot see anything. Shooting film, which is related to the science of photography, is painting with light [1]. The lighting element is an essential element of artistic arrangement in filmmaking (soap operas, television films, advertisements, and others).

Lighting in film production has the following functions [1]:

- a. Illuminate the object
- b. Creating artistic images
- c. Remove unnecessary shadows
- d. Create special effects

The use of natural lighting that supports lighting techniques in the film will be investigated in the case study residence.

The residential house that is used as a case study is a house in Cinere, Depok, West Java, whose initial design in 2007 was only for residential houses. The residence was selected and used as a place for making soap operas, television films, and advertisements since July 2012 were investigated:

- a. Natural lighting intensity
- b. The quality of natural/ existing light in the room makes it easier to add artificial lighting for shooting.

The purpose of this study was to determine the mapping of residential lighting quality, which can be used as a reference for the proposed addition of the required light intensity according to the desired lighting needs for filmmaking (effect) related to the film scenario. The benefit for architectural science is to study natural lighting in filming a residential house for a residential design guide that can be used as a film shooting location. In addition, it also gets a reference to the quality of natural lighting in a residential house. The benefit of this research for researchers is to gain knowledge and lighting requirements in making films in a residential house that can be used to design in the future.

## 2. MATERIAL AND METHOD

### 2.1. Theoretical Review

The amount of change in the brightness of light that falls on a specific surface area unit is called the power of light (illuminance) with the unit of measure is lux (= 1 lumen/m<sup>2</sup>), the unit symbol = E. The power of this light emission can not be caught directly by the eye but is visible through the impression of irradiation that makes the surface of an object appear brighter or less bright, which depends on the magnitude of the light-emitting power of a source and the reflectance of the surface [2].

Illumination intensity/ illuminance is a quantity determined in the field of photometry. Those are used to measure the intensity of illumination, for example, at an office desk. The International Unit (SI) of this quantity is lux (lx). The luminance unit of 1 lux corresponds to a luminous flux of 1 lumen per square meter (1 lm/m<sup>2</sup>). This is roughly what the full moon's light on the earth's surface achieves [3].

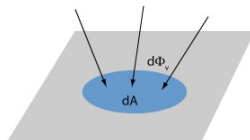


Figure 1 Illuminance is received luminous flux per unit area.

(Source: [3])

Except for certain focusing lighting fixtures, the intensity of the exposure decreases as the subject moves further away from the light source. This is known as light falloff. The rule for a typical open bulb is that the intensity of light falling is inversely proportional to the square of the distance (see Figure 2).

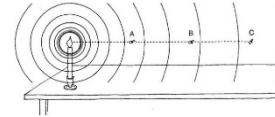


Figure 2 The Inverse Square Law (Source: [4])

The inverse square law in Figure 2 shows [4]:  
 (1) The falling light will decrease as the object moves away from the light source. The B moth is twice as far from the candle as the A moth but receives a quarter of light. The C moth is three times farther from the candle than the A moth and receives a one-ninth amount of light.

(2) There is less light falloff when the object is farther from the light source. Going from B to C is the same distance as going from A to B, but the light falls much less (light falls to about half the previous level, not a quarter).

Thus, moving an object twice as far from the light. It causes the object to be illuminated by a quarter of the amount of light. Because of this, the light falloff is very sharp when men are near a light source. For example, imagine a sofa lit by a floor lamp at one end of the sofa. A person sitting near the lamp gets four times brighter light than the person sitting next to him (two stops of exposure difference). This difference will look even more extreme if it is immortalized in a film or video [4].

Measurement of light intensity is carried out at a measuring point which is located at a certain height above the floor.

The National Standardization Agency in the SNI-03-2396-2001 book concerning Standard Procedures for Designing Natural Lighting Systems in Buildings exemplifies that the measuring point is taken on a flat plane which is located at the height of 0.75 meters above the floor. The flat plane is called the work plane [5].

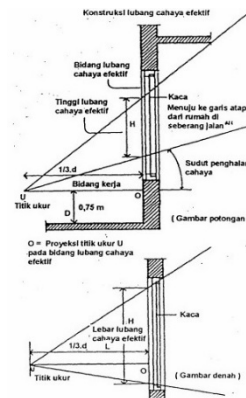


Figure 3 Effective Light Height and Width (Source: [5])

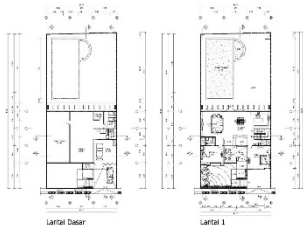
Natural film lighting refers to the use and modification of light already available on site. Before shooting, Men can bring the camera to the location to see how good the natural light is, so Men can decide what additional light might be needed or adjust the light. For example, using a bouncing board to reflect light or a black flag blocks it [6]. Some lighting intensity reference points [7]:

- a. Sunlight on an average day ranges from 32,000 to 100,000 lux.
- b. The TV and movie sets are running at about 600 lux.
- c. Bright office has about 400 lux.
- d. Moonlight represents about 1 lux.

**2.2. Method**

This study applies mixed research methods with case studies to obtain natural lighting intensity in filming (shooting) in a residential house. The intensity of the room's natural lighting is measured with a light meter. This study is to test the hypothesis through theoretical validation of data from the field. The intensity of natural light under certain conditions can meet the lighting requirements for shooting based on the desired scenario.

The house used as a case study is a house in Cinere, Depok, West Java. Residential houses whose initial function was only a place to live when they were used as locations for making soap operas, television films, and advertisements became interesting. This research is related to natural lighting and space design of residential houses that can support soap operas, television films, and advertisements. This research is limited to the use of the family room, dining room, and kitchen on the first floor of this residence as a background and object for taking moving pictures (film) to study the intensity of natural lighting.

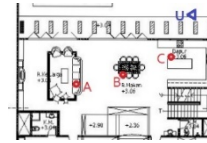


**Figure 4** Ground Floor Plan and 1st Floor Plan (Source: Personal Documentation, 2007)

**3. RESULT AND DISCUSSION**

This study divides three objects in the discussion of space, namely the family room, dining room, and kitchen, located on the first floor of the case study house. The three rooms discussed are in the form of three rooms united without a partition so that a spacious room is formed. Natural lighting in these three rooms is obtained through openings on the east side of the room in folding glass doors in the living and dining rooms and glass windows in the kitchen.

**3.1. Analysis of the Intensity of Natural Lighting According to the Direction of the Object**



**Figure 5** Light Intensity Measuring Point Plan (Source: Personal Documentation, 2021)

The size of the glass folding door openings and glass windows are as follows:

- The folding door opening (plain glass) in the family room is 4.11 meters x 2.40 meters.
- The folding door opening (plain glass) in the dining room is 4.95 meters x 2.40 meters.
- Window openings (plain glass) in the kitchen room 3.83 meters x 1.40 meters.

Measurement of the intensity of natural light on one person (object) sitting in the family room at point A, in the dining room at point B, and a person (object) standing in the kitchen at point C was carried out on March 19, 2021. The measurement of natural light intensity was carried out on the four sides of the person (object), namely on the east, west, north, and south sides of the person (object).

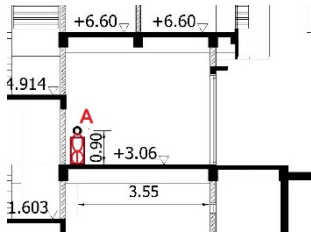
The height of the measuring point for the person (object) sitting in the family room (point A) is 90 (ninety) centimeters from the floor surface. The height of the measuring point for the person (object) sitting in the dining room (point B) is 110 (one hundred and ten) centimeters from the floor surface. The height of the measuring point for the person (object) standing in the kitchen is as high as 150 (one hundred and fifty) centimeters from the floor surface of the kitchen room, whose floor is 10 (ten) centimeters higher than the floor of the dining room and family room.



**Figure 6** Light Intensity Measuring Point Height (Source: Personal Documentation, 2021)

**3.2. Analysis of the Intensity of Natural Lighting on Objects in the Living Room**

The intensity of natural light on the object/ person (A) sitting in the family room is measured at a measuring point as high as 90 (ninety) centimeters from the floor surface. The object is 355 (three hundred and fifty-five) centimeters from the glass folding door opening area (the area of the effective light hole). Measurement of natural light intensity is carried out on four sides/directions towards the object.



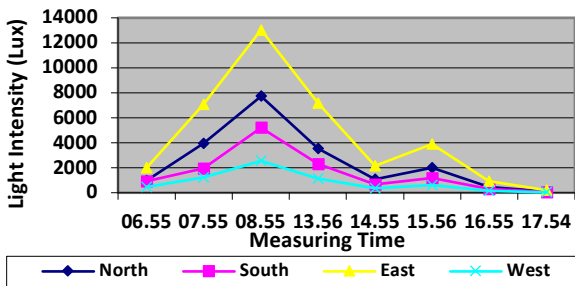
**Figure 7** Measuring Point Height and Object Distance (A) to Glass Door Opening in Living Room (Source: Personal Documentation, 2021)

The results of measuring the intensity of natural light on objects sitting in the living room at point A on March 19, 2021 are shown in Table 1.

**Table 1** Measurement of Natural Light Intensity on Objects in the Living Room (A) March 19, 2021

19 March 2021 Time	Cloudy	Cloudy	Cloudy	Overcast	Drizzling	Overcast	Overcast	Overcast
	06.55	07.55	08.55	13.56	14.55	15.56	16.55	17.54
North	992	3937	7721	3547	1067	2002	482	93
South	904	1935	5203	2291	656	1201	289	62
East	2022	7081	13038	7158	2176	3893	921	204
West	474	1221	2542	1149	362	612	141	27

The natural light intensity on the four facing sides of the object is translated into a graphic form showing the natural light intensity on the east side of the object is the highest at 13,038 lux at 08:55 in cloudy weather conditions. The natural light intensity on the north side of the object is 7,721 lux, then followed on the south side of the object at 5,203 lux and the west side of the object at 2,542 lux.



**Figure 8** Graph of Natural Light Intensity Measurement on Objects in Living Room (A) March 19, 2021 (Source: Personal Documentation, 2021)

Similarly, what happened to the measurement of the intensity of natural light on objects sitting in the living room at point A at different times in cloudy or drizzling weather conditions, showed that the highest natural light intensity was on the east side object. The highest to lowest natural light intensity is the east, north, south, and west sides of the object.

The natural light intensity measurement graph in Figure 8 shows the order of the highest natural light intensity on the object sitting in the living room is on the east side of the

object. This is due to the plain glass folding door opening on the east side.

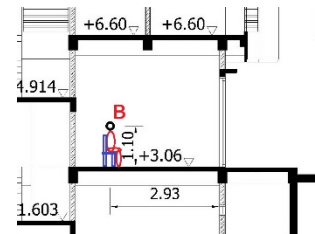
The intensity of natural light on the north side of the object is higher than on the south side of the object. It is caused by the measured object on the north side of the room gets more refraction and indirect natural light reflection on the east side of the wall on the object's north side than on the south side of the object. The intensity of natural light on the west side of the object is the lowest because there are no lighting openings. The object only gets light reflection from the wall on the west side without getting the east side indirect natural light refraction.

This research shows the intensity of natural lighting on the object sitting in the living room. The data are taken from 06:55 to 17:54 is between 13,038 lux and 27 lux.

The amount of natural lighting intensity of 600 lux for the location of the film set has been and can be met in the family room from 06:55 hours when the weather conditions are cloudy to 15:56 when the weather conditions are cloudy, 13,038 lux to 612 lux, as shown in Table 1.

### 3.3. Analysis of the Intensity of Natural Lighting on Objects in the Dining Room

The intensity of natural light on the person/ object sitting in the dining room (B) is measured at a measuring point as high as 110 (one hundred and ten) centimeters from the floor surface. The object is 293 (two hundred and ninety-three) centimeters from the glass folding door opening area (effective light hole area). Measurement of natural light intensity is carried out on four sides/ directions towards the object.



**Figure 9** Measuring Point Height and Object Distance (B) to Glass Door Opening in Dining Room (Source: Personal Documentation, 2021)

The results of measuring the intensity of natural light on people (objects) sitting in the dining room at point B on March 19, 2021 are shown in Table 2.

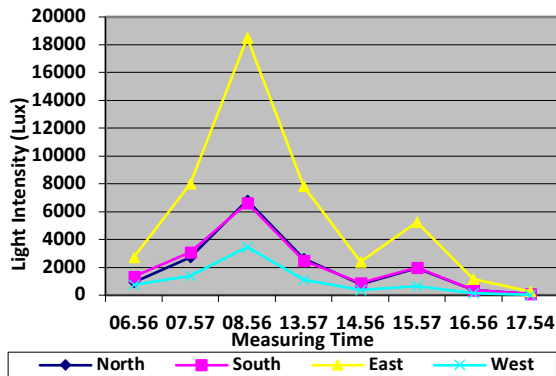
**Table 2** Measurement of Natural Light Intensity on Objects in the Dining Room (B) March 19, 2021

19 March 2021 Time	Cloudy	Cloudy	Cloudy	Overcast	Drizzling	Overcast	Overcast	Overcast
	06.56	07.57	08.56	13.57	14.56	15.57	16.56	17.54
North	921	2705	6814	2649	808	1924	370	82
South	1339	3067	6627	2502	890	1974	354	84
East	2699	8009	18501	7819	2408	5258	1154	267
West	722	1374	3469	1129	365	630	151	27



The intensity of natural light on the east side of the object sitting at point B of the dining room measured the highest at 18,501 lux at 08:56 in cloudy weather conditions. The intensity of natural light on the north side of the object is 6,804 lux, followed by the south side of the object at 6,627 lux and the west side of the object at 3,469 lux.

Almost the same graphic pattern also occurs in measuring the intensity of natural light on objects sitting in the dining room at point B at different times in cloudy or drizzling weather conditions. The graphic pattern shows the highest natural light intensity is on the east side of the object, followed by the north side, south side, and lowest on the west side of the object.



**Figure 10** Graph of Natural Light Intensity Measurement of Objects in the Dining Room (B) March 19, 2021 (Source: Personal Documentation, 2021)

The natural light intensity measurement graph in Figure 10 shows the order of the highest natural light intensity on the object sitting in the dining room is on the east side of the object. This is due to the plain glass folding door opening on the east side of the dining room.

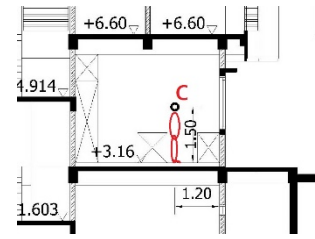
The natural light intensity measurement graph in Figure 10 also shows that the natural light intensity on the object's north side is almost the same as the natural light intensity on the south side of the object. This is because the measurement object is located almost in the middle of the room, refracted and reflected by indirect natural light on the east side. This is almost the same as the wall on the object's north side and the south side object. The intensity of natural light on the west side of the object is the lowest because there are no lighting openings. The object only gets light reflection from the wall on the west side without getting indirect natural light refraction on the east side.

The intensity of natural lighting on the object sitting in the dining room at the object's residence from 06:56 to 17:54 is between 18,501 lux and 27 lux. Therefore, the minimum amount of natural lighting intensity of 600 lux for the location of the film set has been and can be fulfilled in this dining room. This can be seen in Table 3, wherefrom 06:56 hours when the weather conditions are cloudy to 15:57 when the weather conditions are cloudy, namely 18,501 lux to 630 lux. The drizzle weather conditions at 14:46 caused

the natural light intensity to decrease to 365 lux on the west side of the object.

### 3.4. Analysis of the Intensity of Natural Lighting on Objects in the Kitchen

The intensity of natural light on objects standing in the kitchen (C) is measured at a measuring point as high as 150 (one hundred and fifty) centimeters from the floor surface. The object is 120 (one hundred and twenty) centimeters from the glass window opening area (effective light hole area). Measurement of natural light intensity is carried out on four sides/directions towards the object.



**Figure 11** Measuring Point Height and Object Distance (C) to the Glass Window Opening in Kitchen (Source: Personal Documentation, 2021)

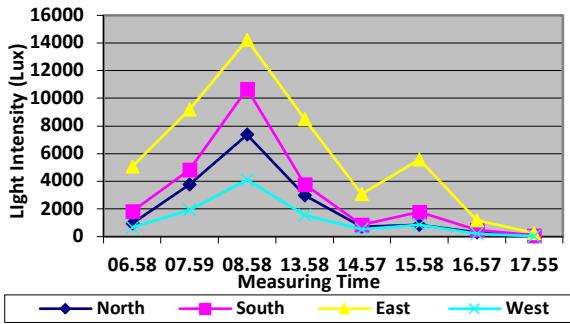
The results of measuring the intensity of natural light on objects standing in the kitchen room at point C on March 19, 2021, are shown in Table 3.

The natural light intensity on the east side of the object standing at point C in the kitchen measured 14,230 lux at 08:58 in cloudy weather conditions. The intensity of natural light on the south side of the object is 10,682 lux, followed by the north side of the object at 7,366 lux and the west side of the object at 4,113 lux.

**Table 3** Measurement of Natural Light Intensity on Objects in the Kitchen (C) March 19, 2021

19 March 2021 Time	Cloudy	Cloudy	Cloudy	Overcast	Drizzling	Overcast	Overcast	Overcast
	06.58	07.59	08.58	13.58	14.57	15.58	16.57	17.55
North	931	3765	7366	2995	702	860	316	39
South	1848	4857	10682	3782	837	1798	464	93
East	5081	9211	14230	8487	3092	5560	1196	268
West	685	1914	4113	1536	512	859	205	34

The intensity of natural light measuring's graph on people (objects) standing in the kitchen shows that the highest natural light intensity is on the east side of the object followed by the south, north, and lowest on the west side of the object.



**Figure 12** Graph of Natural Light Intensity Measurement on Objects in the Kitchen (C) March 19, 2021

(Source: Personal Documentation, 2021)

The highest natural light intensity in the kitchen space is on the east side of the object because the plain glass window opening is on the east side.

The intensity of natural light on the south side of the object is higher than on the object's north side. This is because the measured object on the south side of the room gets more refraction and indirect natural light reflection from the east side of the wall on the south side of the object than the north side of the object. The intensity of natural light on the west side of the object is the lowest because there are no lighting openings. The object only gets light reflected from the wall on the west side without getting direct natural light.

The intensity of natural lighting on the object standing in the kitchen room of the object's residence from 06:58 to 17:55 is between 14,230 lux and 34 lux.

The amount of natural lighting intensity of 600 lux for the location of the film set in this kitchen room has been and can be fulfilled. This can be seen in Table 1.3, wherefrom 06:58 when the weather conditions are cloudy to 15:58 when the weather conditions are cloudy, the intensity of natural lighting is measured at 14,230 lux to 685 lux.

#### 4. CONCLUSIONS

Different activities and different areas of work will require different lighting intensities.

1. The results of this study show that the most incredible intensity of natural lighting for people (objects) sitting in the living room, dining room, and standing in the kitchen, respectively, from the east, south, north, and west sides.
2. The results are the amount of natural lighting intensity of 600 lux as a requirement for the location of the film set has been met on:
  - a. The intensity of natural lighting on objects sitting in the living room is from 06:55 when the weather conditions are cloudy to 15:58 when the weather conditions are overcast, which is 13,038 lux to 612 lux.
  - b. The intensity of natural lighting on objects sitting in the dining room from 06:56 hours when the weather conditions are cloudy to 15:57 when the weather

conditions are overcast, which is 18,501 lux to 630 lux.

- c. The amount of natural lighting intensity on objects standing in the kitchen room from 06:58 hours when the weather conditions are cloudy to 15:58 when the weather conditions are overcast, which is 14,230 lux to 685 lux.

Thus, the average amount of natural light intensity from 06:55 to 15:58 during cloudy to overcast weather conditions, 18,501 lux to 612 lux, has met the minimum lighting intensity requirement for the film set locations 600 lux. Therefore, the quality of space with the quantity of natural lighting can be fulfilled in this case study residential house.

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