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Study of The Effect of Artificial Lighting on The Condition of The Exhibition Objects of The Jakarta History Museum

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ABSTRACT

The impact of artificial lighting on visual comfort and the preservation of exhibition objects at the Jakarta History Museum, a cultural heritage building in West Jakarta, is the subject of this research. Field observation methods were employed to conduct the study in four main rooms (1A11, 1A12, 2A06, and 2A07). Light intensity was measured using a lux meter in accordance with SNI standards, and the materials of the exhibition objects and layout were analyzed. The results indicate that the current lighting is not ideal for providing visual comfort and preserving objects. The main focus is on poor light distribution and less strategic lamp positioning. To reduce damage, it is recommended to use LED lamps, rearrange the lighting system, and utilize reflective materials. It is hoped that these findings will assist museum management in enhancing visitor experiences and preserving objects in line with their historical value.

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1. INTRODUCTION

Artificial lighting is a crucial aspect of museum management because it plays a dual role in supporting the visibility of exhibition objects while preserving the collection (Sriwahyuni & Sahid Indraswara, 2022). Improper lighting can accelerate damage to sensitive materials such as textiles, paper and colour pigments, causing permanent discolouration and physical degradation (Dewi Wiryanti, 2021). Research shows that lighting damage is one of the main factors affecting the shelf life of museum objects, especially for coloured artworks and organic materials (Huijiao, T., & Rui, D. 2022). Museum lighting standards according to SNI 03-6575-2001 recommends light intensity in showrooms between 500-750 lux to optimise visual comfort and minimise the risk of damage to collections (M. fauzi, 2020). A study at the Indonesian World Records Museum revealed that the dominant use of natural lighting led to unstable light intensity and often fell short of standards, potentially jeopardising the collection (Sriwahyuni & Sahid Indraswara, 2022). On the other hand, research at the Brawijaya Museum in Malang shows that the artificial lighting is not optimal, causing visitors' visual comfort to be disturbed and the risk of damage to collections to increase (Rivaldi, 2018).

LED lighting technology is increasingly being adopted due to its advantages in reducing heat emissions and ultraviolet radiation harmful to collections, as well as better energy efficiency (Piccablotto dkk., 2015). The use of LEDs also allows for more precise settings of light intensity and spectrum that can be customised to suit conservation and aesthetic needs (Choi & Kim, 2017). Well-designed lighting can highlight important details and create an atmosphere that supports the interpretation of artefacts (Lee,& Kim. 2019). Therefore, a study on the effect of artificial lighting on the physical condition and perception of visitors at the Jakarta History Museum is very important to support conservation and improve the quality of museum services.

The novelty of this study lies in the analysis of artificial lighting in the Jakarta History Museum, one of the cultural heritage museums in Indonesia, which integrates measurements according to national standards (SNI) with a cultural heritage preservation approach. This study provides specific recommendations on light distribution, intensity, and lighting layout that have not been widely discussed in the context of cultural heritage museums in Jakarta. Optimising the distribution and intensity of artificial lighting in the Jakarta History Museum can improve visitors' visual comfort while better preserving exhibits.

2. RESEARCH METHODS

This research method uses field observation, measurement, data processing, and analysis approaches. The research process began with visual observation and documentation using photos and videos on the facade and interior of the Jakarta History Museum, especially in rooms 1A11 (1527), 1A12 (Arrival of VOC), 2A06 (The Betawi's The Jakarta's), and 2A07 (The Birth of a City). Data in the field was obtained through interviews with the manager, as well as measuring the strength of artificial lighting using a lux meter according to SNI standards and measuring room dimensions using a laser distance meter.

The next process is data processing, which includes managing the results of documentation and measurements on the interior of the museum, such as space dimensions, layout of exhibition objects, and existing lighting. To support the analysis, secondary data was used in the form of 3D SketchUp models obtained from Sketchfab, which were then modified according to research needs. Analyses were conducted on the collected data to identify the influence of lighting quality on visual comfort and the condition of the exhibit objects,

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followed by proposals for lighting improvements. The following is a graph of the research methods and stages.

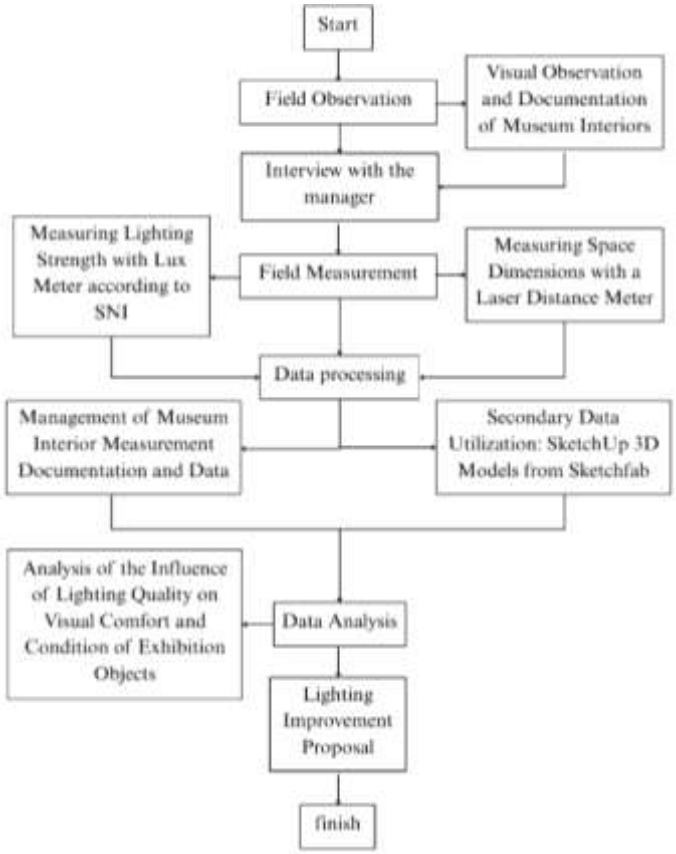

Chart 1. Method Chart
Source: Author, 2025

Research Stage

a. Field Observation
   Conduct visual observations and documentation in the form of photos and videos on the facades and interiors of certain spaces in the Jakarta History Museum (rooms 1A11, 1A12, 2A06, 2A07).
b. Interview
   Collect qualitative data through interviews with museum managers to obtain information related to the condition and management of lighting.
c. Field Measurements
   Measure the strength of artificial lighting with a lux meter according to SNI standards and space dimensions using a laser distance meter to obtain quantitative data.
d. Data Processing
   Organised the documentation and measurement results, including the layout of the exhibition objects and existing lighting. Utilised secondary data in the form of 3D SketchUp models modified according to research needs.
e. Data Analysis
   Analyse the data obtained to identify the effect of lighting quality on visual comfort and the condition of the exhibit objects.
f. Proposed Improvements
   Based on the results of the analysis, provide recommendations for improving lighting in the museum showroom.

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3. RESULTS AND DISCUSSION

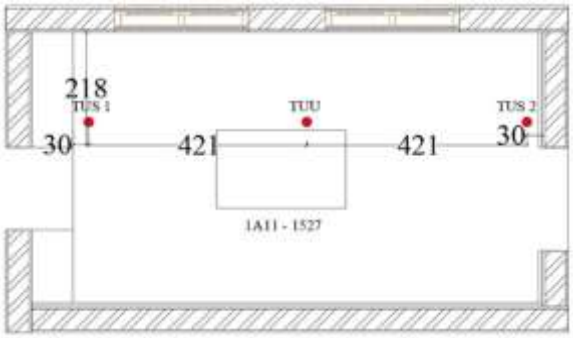
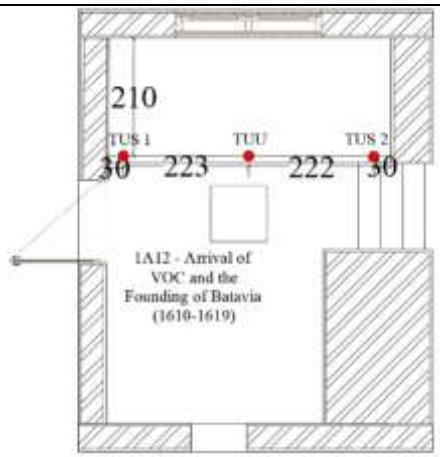
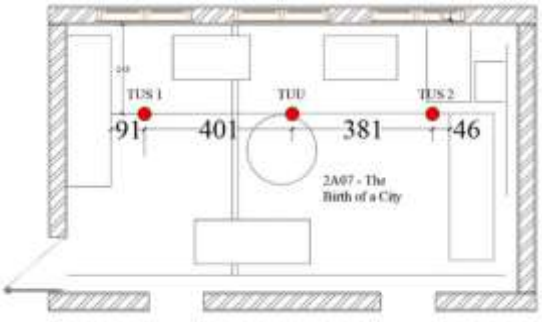
3.1 Visual Comfort Condition

Visual comfort is the main focus of this study, which relates to data on the strength of illumination and the position of artificial lighting. The analysed rooms include Room 1A11 - (1527), Room 1A12 - Arrival of VOC, Room 2A06 - The Betawi's The Jakarta's, and Room 2A07 - The Birth of A City. Measurement of lighting strength was carried out in three rooms, while for Room 2A06 - The Betawi's The Jakarta's no data was collected because there was no natural lighting available.

Strong Illumination

Measurement of strong illumination was carried out on Wednesday 23 October 2024, at 10.55 - 12.30 WIB, in conditions of closed windows & lights on.

Table 1. Strong illumination data

	Layout Plan	TUS 1	TUU	TUS 2
Room 1A11 – (1527)		127,4 lux	112,8 lux	103,5 lux
Room 1A12 – Arrival of VOC		124,5 lux	113,5 lux	33,5 lux
Room 2A07 – The Birth of A City		81,7 lux	47,3 lux	57,2 lux

Source: Author, 2024

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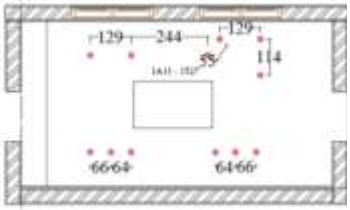
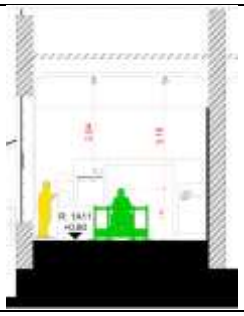
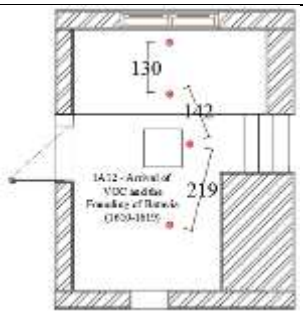
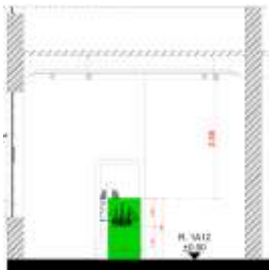
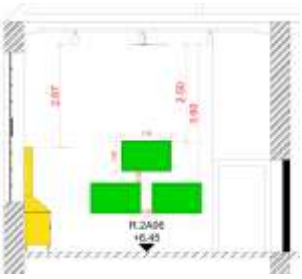
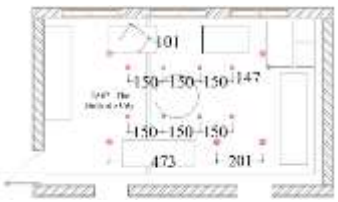
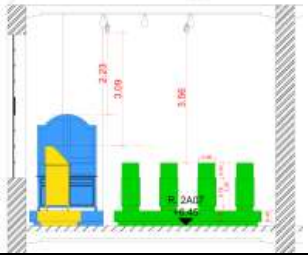
Artificial Lighting Position

Table 2. Artificial lighting position data

	Image	Lamp Position Plan	Section	Description
Room 1A11 – (1527)				The lighting position is 5.58 m high from the ground floor and the distance between the lamps is not constant.
Room 1A12 - Arrival of				The lighting position is 5.58 m high from the ground floor and the distance between the lamps is not constant.
Room 2A06 – The				The lighting position is 5.58 m high from the ground floor and the distance between the lamps is not constant..
Room 2A07 – The				The lighting position is 5.58 m high from the ground floor and the distance between the lamps is not constant.

Source: Author, 2024

In each room there are two types of lights, namely General lights and Localised lights. The lamps used are assumed because there are obstacles when trying to see the lights up close (too high) and can only rely on information from photos and interviews with museum staff.

Figure 1. General lamp types and specifications
(Source : Sustainable LED lighting solutions Philips lighting, 2024)

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Figure 2. Types and specifications of localised lamps
(Source : Efficient LED architectural lighting ERCO, 2024)

3.2 Condition of Interior Materials

The condition of the analysed interior materials is on the floor, walls, ceiling. The rooms analysed are Room 1A11 - (1527), Room 1A12 - Arrival of VOC, Room 2A06 - The Betawi's The Jakarta's, Room 2A07 - The Birth of A City.

Floor

Table 3. Material condition data on the floor

Room Name	Colour	Texture	Image	Description
Room 1A11 – (1527)	Dark Brown	Smooth		Finishing on the floor uses wood material with a varnish coating so that the floor looks glossy.
Room 1A12 – Arrival of VOC	Black Dark Brown	Smooth slightly rough Smooth		The finishing on the floor uses black cement-based tiles with a smooth, slightly rough texture. The wooden floor is finished with a dark brown colour and smooth texture.
Room 2A06 – The Betawi's The Jakarta's	Dark Brown	Smooth		Finishing on the floor uses wood material with a varnish coating so that the floor looks glossy.
Room 2A07 – The Birth of A City	Dark Brown	Smooth		Finishing on the floor uses wood material with a varnish coating so that the floor looks glossy.

Source: Author, 2024

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Wall

Table 4. Wall material condition data

Room Name	Colour	Texture	Image	Description
Room 1A11 – (1527)	Dark White Dark Green	Smooth slightly rough Smooth		The finishing on the walls uses dark white and dark green wall paint with a slightly rough smooth texture on the dark white walls and smooth on the dark green walls.
Room 1A12 – Arrival of VOC	Dark White Dark Blue	Smooth slightly rough Smooth		The finish on the dark blue wall has a smooth texture and the dark white wall has a smooth, slightly rough texture.
Room 2A06 – The Betawi's The Jakarta's	Dark White	Smooth slightly rough		The finishing on the walls uses a dark white wall paint with a smooth, slightly rough texture.
Room 2A07 – The Birth of A City	Dark White	Smooth slightly rough		The finishing on the walls uses a dark white wall paint with a smooth, slightly rough texture.

Source: Author, 2024

Ceiling

Table 5. Material condition data on the ceiling

Room Name	Colour	Texture	Image	Description
Room 1A11 – (1527)	slightly white cream Dark red	Smooth slightly rough Smooth slightly rough		Room 1A11 does not have a ceiling. It shows exposed beams that have been painted using dark red wood paint and given a layer of varnish so that it looks glossy and a cream-coloured wooden floor plate with a slightly rough smooth texture.
Room 1A12 – Arrival of VOC	Brown Dark red	Smooth slightly rough Smooth slightly rough		In room 1A12 - Arrival of VOC there is no ceiling showing exposed beams that have been painted using dark red wood paint and given a coat of varnish so that it looks glossy and a brown wooden floor plate with a slightly rough smooth texture.

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Room Name	Colour	Texture	Image	Description
Room 2A06 – The Betawi's The Jakarta's	slightly white cream Dark red	Smooth slightly rough Smooth slightly rough		In room 2A06 - The Betawi's The Jakarta's there is no ceiling showing exposed beams that have been painted using dark red wood paint and given a coat of varnish so that it looks glossy and a cream-coloured wooden floor plate with a slightly rough smooth texture.
Room 2A07 – The Birth of A City	slightly white cream Dark red	Smooth slightly rough Smooth slightly rough		In room 2A07 - The Birth of A City there is no ceiling showing exposed beams that have been painted using dark red wood paint and given a coat of varnish so that it looks glossy and a cream-coloured wooden floor plate with a slightly rough smooth texture.

Source: Author, 2024

3.3 Exhibit Layout Condition

Exhibit objects at the Jakarta History Museum include several types, such as household furniture artefacts, weapons, jewellery, and statues from the Dutch empire. The following is the layout of the exhibition objects in each room that is the object of discussion, namely Room 1A11 - (1527), Room 1A12 - Arrival of VOC, Room 2A06 - The Betawi's The Jakarta's, Room 2A07 - The Birth of A City.

Table 6. Layout condition of the exhibition object

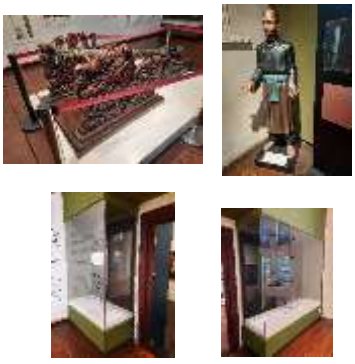
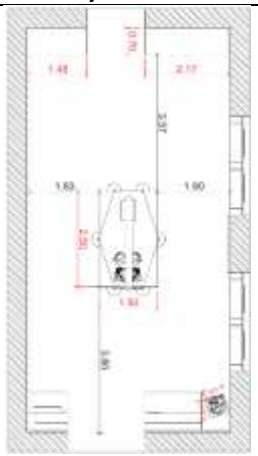
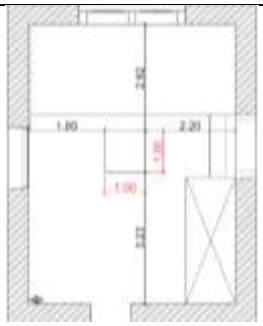
	Exhibit Object	Layout Plan	Description
Room 1A11 – (1527)			Room 1A11 - (1527) the exhibition objects in the room are large objects such as cannons, Fatahillah statue and some small objects such as sword dioramas.
Room 1A12 - Arrival of VOC			Room 1A12 - Arrival of VOC The exhibition objects in the room are small objects such as dioramas of ships, and some paintings on the walls.

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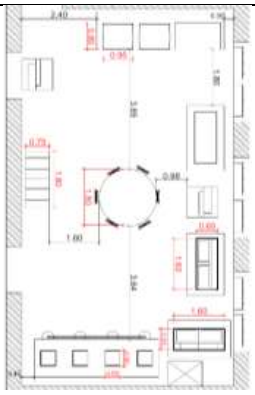
	Exhibit Object	Layout Plan	Description
Room 2A06 – The Betawi's The Jakarta's	  		Room 2A06 - The Betawi's The Jakarta's exhibition objects in the room are large objects such as cabinets and some small objects such as furniture and jewellery.
Room 2A07 – The Birth of A City	   		In Room 2A07 - The Birth of A City the exhibition objects in the room are large objects such as tables and chairs, cupboards, cabinets, and small tables.

Source: Author, 2024

3.4 Discussion

Visual comfort is the condition that individuals feel towards the visual aspects of the physical environment, especially in spaces where they perform activities. Lighting plays an important role in creating visual comfort, as the intensity, distribution and quality of light can affect the user experience (Fleta, 2021). According to Latifah's book Building Physics 2 (Fisika Bangunan 2, 2015). Visual comfort parameters are: Strong Illumination, Luminance, Colour Quality.

Strong Illumination

The illuminance strength of artificial lighting is measured as the light current received by a field per unit area, and greatly affects visual comfort (Fisika Bangunan 2, 2015). According to SNI 6197-2020, the minimum standard for large object showrooms is 500 lux, which is a unit of illumination measurement (Standar Nasional Indonesia Konservasi energi pada sistem pencahayaan, 2020). Proper lighting is important so that exhibits can be clearly seen without damaging the artefacts. Museums generally use subdued and dim lighting, with variations in brightness depending on natural lighting and the type of objects on display (Wicaksono & Priyatmono, 2024).

Table 7. Strong lighting in the Museum

Museum Location	Recommended illuminance (Lux)
Entrance to the museum	150 – 300 Luk
Corridor or Hallway	100 – 200 Luk
Gallery or Exhibition	150 – 500 Luk
Sculpture Display	200 – 1000 Luk
Painting/Wall art	150 – 750 Luk
Historical Documents	100 – 300 Luk

(Source : LEDYi Lighting, 2024)

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Table 8. Lighting Level of the object

Category of Exhibit Objects	Lighting Level (lux)
Small	350 lux
Medium	450 lux
Large	500 lux

Source : LEDYi Lighting, 2024

Paintings require sufficient lighting, while large sculptures require brighter light. The ambience of the room also plays a role in the choice of brightness, but too dim lighting should be avoided to maintain visibility and a cosy atmosphere (Karolina & Nugroho, 2018). One of the rooms analysed is room 1A12 - Arrival of VOC, where there is a diorama of the ship.

Table 9. Analysis of strong illumination in room 1A12 - Arrival of VOC

Exhibit Object	Size (H x W x L)	TUS1	TUU	TUS2
	90cm x 100cm x 10 cm	124,5 lux	113,5 lux	33,5 lux
Description		Compliant Not yet compliant		

Source: Author, 2024

Based on the classification of the exhibition object category, this value is included in the medium classification but is still below the minimum required illumination standard of 450 lux. The results of this analysis indicate that the artificial lighting system has not been able to provide adequate illumination for the medium object category, giving the impression of an unlit room during the observation. Based on the analysis data above, it shows that visual comfort in terms of strong illumination (E) of artificial lighting has not met the minimum requirements, so the condition of room 1A12 - Arrival of VOC when observed is still dark

Colour Quality

Colour quality in artificial lighting is one of the important aspects that affect visual comfort and perception of the illuminated object (Kurniawan dkk., 2022). According to Latifah's book Building Physics 2 (Fisika Bangunan 2, 2015). Colour quality parameters related to visual comfort are: Colour Temperatur (CT) dan Colour rendering (Ra)

Color temperature (CT) refers to the measured temperature of an ideal black object that emits visible light of different colours, measured in Kelvin. The lower or higher the CT, the less colour-neutral the object appears; warm colours such as yellowish or reddish indicate a lower CT, while bluish colours indicate a higher CT (Fisika Bangunan 2, 2015). In the context of museums, a CT of around 3000K is considered ideal for creating a cosy atmosphere, although variations may occur depending on the type of museum. Different types of museums may require different CT settings to effectively display their collections and maintain the visitor experience (Standar Nasional Indonesia Konservasi energi pada sistem pencahayaan, 2020).

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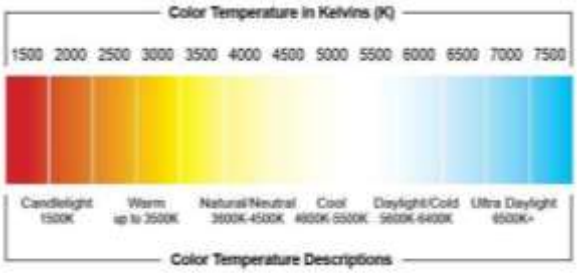

Figure 3. Colour Spectrum of White Light Based on Colour Temperature (CT)
(Source : R&C Lighting, 2024)

The recommended colour rendering index (CRI) is a minimum of 90, but for applications where colour display is critical, such as in art exhibitions, it is recommended to use light sources with a CRI value of 90 or more. This ensures that the product is displayed in the most accurate and eye-catching way possible (*Standar Nasional Indonesia Konservasi energi pada sistem pencahayaan*, 2020).

Table 10. Colour Temperature Index (CTI) Standard

Project Type	Example	Range CRI
Indoor/Housing	Kitchen, Study, Bedroom, Lounge	80 – 90
Hospitality	Restaurant, Cafe, Motel, Hotel	80 – 95
Retail/Trade	Malls, Fashion stores of all kinds, Car shows, Art fairs	90+
Business	Office, School, Studio, Hospital, Photography	90 – 97
Industry	Chemical/Metal Industry, Production Plants	90+
More	Parking, Garage, Shed and Backyard	70 – 80

Source : R&C Lighting, 2024

For general lighting in rooms 1A11 - (1527), 1A12 - Arrival of VOC, 2A07 - The Birth of A City, and 2A06 - The Betawi's The Jakarta's use Philips LED Bulb 45W A60S E27 lamps with a colour temperature of 6500 K (cool daylight). This lighting provides optimal brightness, allowing visitors to see the details of the artworks clearly and appreciate colours and textures better. As for the localised lighting in the same space, it uses Erco Optec New lamps for 220-240V track with a colour temperature of 4000 K (neutral white). This lighting creates a balanced ambience that is not distracting, helps visitors focus on the objects of the exhibition without distraction from the colour of the light, and brings out the details and original colours of the artworks.

The Colour Rendering Index (CRI) for general lighting in rooms 1A11 - 1527, 1A12 - Arrival of VOC, 2A07 - The Birth of A City, and 2A06 - The Betawi's The Jakarta's using Philips LED Bulb 45W A60S E27 lamps is very good, with a CRI of 90. This indicates that the lamp can reproduce the colour of the object accurately, close to real conditions, as a good Ra value ranges from 85% to 100%. As for localised lighting in the same room using Erco Optec New lamps for 220-240V track, the CRI was 92, also classified as excellent. This indicates the lamp's ability to produce colours that are close to the real thing, with the same Ra value of between 85% and 100%.

Material Reflectance

Light reflection is the phenomenon where light hitting a surface is reflected back in the direction it came from, without being absorbed by the surface. According to the IES Lighting Handbook (1984), light-coloured walls and ceilings, whether neutral or coloured, can distribute light more evenly and save more energy than dark walls. Lighter colours are able to reflect more light, thus affecting the lighting levels in the room. The light reflectance coefficient, or reflectance, ranges from zero to one hundred per cent, with higher numbers resulting in better lighting. One important component affected by this reflectance figure is

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the Coefficient of Utilisation (CU), where high reflectance contributes to an increase in the intensity of light received (Listiana Cahyantari, 2016).

Room 1A11 - 1527 uses a dark brown floor with glossy paint, which gives a dark effect to the room. The reflexivity level of the dark brown colour is only 8%, while ideally it should be between 15% - 25%, so visual comfort is not optimal. The walls of the room use slightly dark white and dark green paint. The slightly dark white colour has a reflexivity of 70%, while dark green is only 12%. Although the white colour increases the brightness of the room, the dark green colour still gives a dark effect, so the visual comfort is also not optimal. The ceiling uses slightly off-white beige and dark red paint. Slightly white beige has a reflexivity of 70%, while dark red is only 10%. The beige colour helps to increase the brightness of the room, but dark red still gives a dark effect, so the visual comfort is not ideal.

Room 1A12 - Arrival of VOC has two different floor colours: dark brown by the window and faded black tiles. The dark brown colour has a reflexivity of 8%, while the black is only 4%, far below the minimum standard of 15% - 25%. As a result, the room felt dark, reducing visual comfort. The walls of the room use slightly dark white and dark blue paint. White paint has a reflexivity of 70%, which is optimal enough to increase brightness, while dark blue is only 5%, giving a less-than-ideal dark effect. The ceiling uses brown and dark red paint, with reflexivity of 50% and 10% respectively. Both also do not meet the minimum standard of 60% - 80% reflexivity, thus adding to the dark impression of the room. Overall, the use of dark colours on the floor, walls and ceiling reduces the visual comfort of the space.

Room 2A07 - The Birth of A City has a floor painted with a dark brown colour and glossy paint type, which results in a slightly dark room effect. The reflexivity level of the dark brown colour is only 8%, whereas it should be at least 15% - 25% for the reflection field. This indicates that the visual comfort in the room is not optimal due to the use of dark colours. The walls of the room use a slightly dark white paint, which also gives a dark effect, but with a reflexivity level of up to 70%. This is optimal as it helps to increase the brightness of the room, especially on the parts that are exposed to the light. The ceiling of the room was painted in a slightly white and dark red beige colour. The beige colour has a reflexivity of 70%, which supports the brightness of the room and provides good visual comfort. On the other hand, the dark red colour with a reflexivity of only 10% is still not optimal because it adds to the dark impression of the room.

Room 2A06 - The Betawi's The Jakarta's has a floor using dark brown glossy paint, which causes the room effect to feel a little dark. The reflexivity level of this colour is only 8%, whereas it should be at least 15% - 25% for optimal visual comfort. Therefore, the use of dark colours on the floor does not support good lighting. The walls of the space were painted a slightly darker white, which also gives a dark feel but is better in terms of reflexivity, reaching 70%. This is optimal as it enhances the brightness of the room, especially in areas that are exposed to light. The ceiling of room 2A06 uses a slightly white and dark red beige paint. The beige colour provides good reflexivity (70%), which helps to illuminate the room. In contrast, the dark red colour with a reflexivity of only 10% is still less than optimal and adds to the dark impression of the room.

Artificial Lighting Position

Architects and interior designers focus on creating spaces that are comfortable for users, where lighting plays an important role in shaping the visitor experience. While visitors often find it difficult to explain what makes their experience positive or negative, the use of the right light angles is essential to accentuate architectural details and enhance comfort. Elements such as ceilings, walls and floors also contribute to the quality of lighting. A

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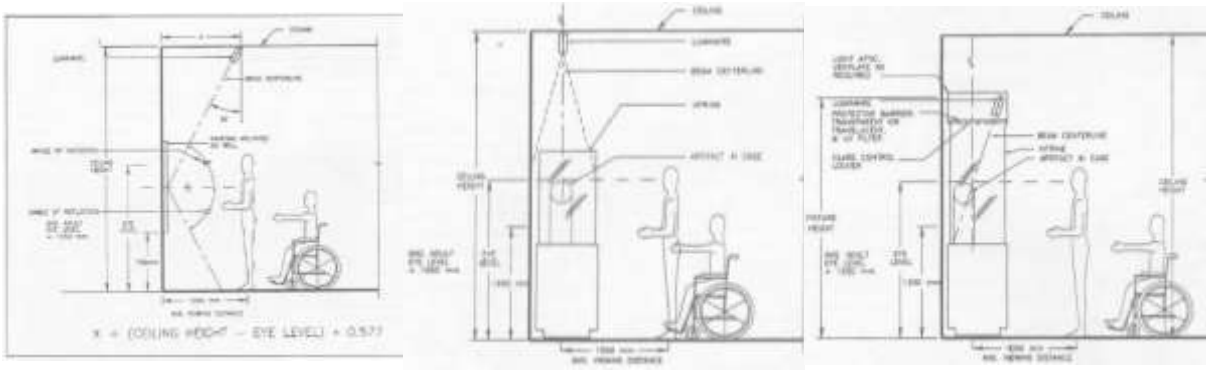
mismatch between architectural style and lighting can lead to discomfort, such as glare or inadequate lighting in the showroom, which impacts visitors' ability to observe the exhibits.



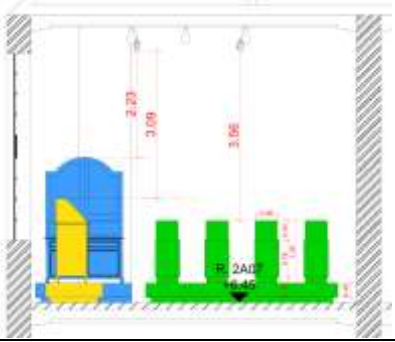
(Objects that stick) (Display object) (Diorama object)

Figure 4. Lighting position on the object
(Source : Galloway, 2009)

According to Elizabeth Gay Hunt in her thesis, lighting in museums should consider the shape and texture of exhibits with appropriately adjusted lamp angles. The IENSA standard recommends lamp angles between zero and twenty degrees to accentuate texture, and thirty degrees for two-dimensional objects to reduce shadows and glare. Optimally, the position of lamps for permanent objects should be between sixty and seventy degrees, so luminaire tilt and lamp placement are crucial factors in museum lighting design in accordance with the IESNA standard (Galloway, 2009).

The artificial lighting system used in Room 1A11 - (1527), Room 1A12 - Arrival of VOC, Room 2A06 - The Betawi's The Jakarta's, Room 2A07 - The Birth of A City is using light bulbs for the general type, and spotlights for the localised type. But for spotlights it is not known exactly the type and brand used, because the position of the lamp is too high so it is difficult to reach. In each room there are two types of lights, namely General lights and Localised lights. The lamps used are assumed because there are obstacles when trying to see the lights up close (too high) and can only rely on information from photos and interviews with museum staff.

Table 11. Artificial lighting position in space 2A07 - The birth of A City

Image	Section
	

Source: Author, 2024

The position of artificial lighting in each room is still not in accordance with the exhibition object, this is analysed based on the theory of the position of artificial lighting towards the exhibition object. so that the position of the lamp towards the exhibition object can affect the colour quality of the exhibition object. For example in room 2A07 - The birth of A City, where there are some exhibition objects that have not been exposed to artificial lighting and are still

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dark, as well as other rooms. The solution that can be done is to add the number of lights and adjust them to the exhibition object.

Exhibition Object Layout

Exhibit layout is the positioning of objects in an exhibit space that aims to enhance visitor visibility and interaction. An effective layout not only makes it easier for visitors to navigate the exhibition space, but also enriches their experience of the information presented. According to Wulandari (2014), the layout of exhibition areas can be divided into several patterns with different characteristics and purposes. One of the chosen patterns is Labyrinth, which is used in Room 2A07 - The Birth of A City because of its suitability to the rectangular shape of the room, the diverse size of the exhibits, and its position at the end of the room.

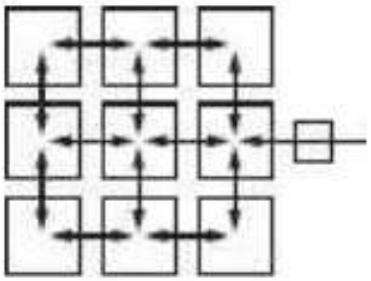

Figure 7. Labyrinth layout pattern
(Source : Lighting For Museums And Galleries, 2014)

The labyrinth pattern allows for variations in the relationship between exhibition areas and manages public circulation, creating a complex arrangement of exhibition areas. The focus of this research is on Room 2A07, whose layout does not fully conform to the theory of exhibit placement (Wulandari, 2014).

Table 12. Layout of exhibition object room 2A07 - Birth of a City

Existing Layout Plan	Labyrinth Pattern Layout Plan
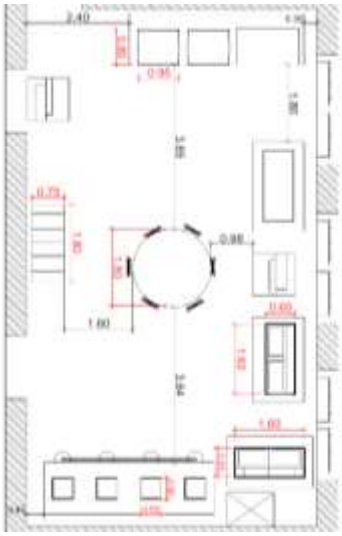	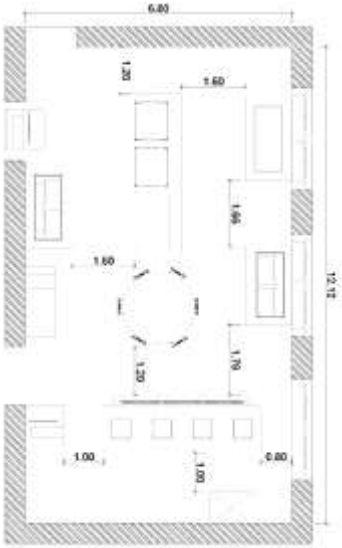
Figure 8. Layout of existing exhibits (Source: Author, 2024)	Figure 9. Labyrinth pattern exhibition object layout (Source: Author, 2024)

Source: Author, 2024

Room 2A07 - The Birth of A City has not applied a good layout theory, so the placement of exhibition objects is still less organised. Using a labyrinthine layout pattern can be a solution to improve visitor circulation, allowing them to see all the exhibits without difficulty and avoid crowds.

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4. CONCLUSION

Based on the analysis above, it can be concluded that from all aspects of building design related to visual comfort and class A cultural heritage building regulations, there are aspects that cannot be changed, namely the colour and texture of the exhibition objects. But other aspects can be changed, namely the type and type of lights and interior room materials (floors, walls, ceilings) so as to obtain better visual comfort. The following are solutions for aspects that can be changed and still maintain their authenticity.

Strong lighting was carried out in room 1A11 - (1527), room 1A12 - Arrival of VOC, room 2A07 - The Birth of A City, while for room 2A06 - The Betawi's The Jakarta's was not measured, because the room had no openings, so natural lighting could not enter the room. The room still does not meet the minimum standard of strong lighting, this is evidenced by the condition of the room which is still dark when observed. For example in room 1A12 - Arrival of VOC which still looks dark and so does the other rooms.

The colour quality analysed is based on colour temperature (CT) and colour rendering (Ra) on the type of lamp and lighting system used, where the type of lamp analysed is based on assumptions due to the difficulty to observe in detail the lamps used. Based on this, the colour quality in each room observed is good, so that the colours of the objects are clearly visible and provide good visual comfort for visitors.

The reflectance of the materials analysed is based on the colour and texture of the materials in each room, which does not meet the aspects of visual comfort. Because the Jakarta History Museum building is a class A cultural heritage building, there are aspects that cannot be changed, namely the colour and texture of the exhibition objects. But other aspects can be changed, namely the colour and texture of the interior materials of the room (floor, walls and ceiling) so as to obtain better visual comfort. For example, in room 1A11 - (1527), where the light reflecting on the walls can help increase the light in the room, some have not. Likewise in other interior room materials. So it is necessary to change the colour of the interior material so that it can help increase the light in the room.

The position of artificial lighting in each room is still not in accordance with the exhibition object, this is analysed based on the theory of the position of artificial lighting towards the exhibition object. so that the position of the lamp towards the exhibition object can affect the colour quality of the exhibition object. For example in room 2A07 - The birth of A City, where there are some exhibition objects that have not been exposed to artificial lighting and are still dark, as well as other rooms. The solution that can be done is to add the number of lights and adjust them to the exhibition object.

The layout of the exhibition objects analysed is in room 2A07 - The birt of A City, because the room still has an exhibition object layout that is not in accordance with the theory of the position of the exhibition object placement. So that the solution that can be done is to re-layout the exhibition object. Where the layout of the exhibit object chosen is the labyrinth layout pattern.

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