# Analysis of Lighting Intensity and Visual Comfort of Workers at PT PLN (Persero) UID Jawa Timur

Rafi Bayuaji[1*], Endang Dwiyanti[2]

[1, 2]Fakultas Kesehatan dan Keselamatan Kerja, Universitas Airlangga, Surabaya, Jawa Timur 60115, Indonesia
[*] Corresponding author:
Email: rafi.bayuaji-2024@fkm.unair.ac.id

***Abstract***.
*Lighting is an important factor in supporting visual comfort, eye health, and work productivity. This study aims to analyze the level of lighting intensity in workspaces at the Heritage Building of PT PLN (Persero) UID East Java and evaluate its compliance with applicable standards. This research used a quantitative descriptive method with direct measurements using a lux meter at five work areas, namely Distribution, Commerce, Planning, Finance, as well as Communication and General Affairs. The results showed that most workspaces had lighting intensity below the minimum standard of 300 lux based on Minister of Manpower Regulation No. 5 of 2018. Only the Finance Division met the standard with an average of 339 lux. Inadequate lighting conditions may cause visual fatigue, decreased concentration, and reduced work productivity. Therefore, improvements in the lighting system are needed through additional lamps, optimization of natural lighting, and regular lamp maintenance.*
***Keywords:*** *lighting, occupational safety and health, ergonomics, visual fatigue and work productivity.*

## I. INTRODUCTION

Lighting is a crucial work environment factor supporting the health, safety, and productivity of workers. In the context of ergonomics, adequate lighting not only helps workers see work objects clearly, but also plays a role in reducing visual fatigue, improving concentration, and minimizing the risk of work errors. Substandard lighting intensity can cause various negative impacts, such as eye strain, headaches, decreased focus, and even long-term health problems affecting the visual system. Proper lighting management is a crucial aspect of implementing occupational health and safety (OHS), particularly in office environments. Regulatory standards for work lighting are stipulated in the Indonesian National Standard (SNI) 6197:2011, Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2018, which stipulates a minimum lighting level for administrative and office work of 300 lux.

Cultural heritage buildings have unique characteristics, requiring them to maintain their historical value and architectural authenticity. Therefore, the implementation of modern work environment standards often faces various limitations. One major challenge is the difficulty of optimally modifying lighting systems due to the limited freedom of building renovations. This condition causes many work spaces in cultural heritage buildings to have inadequate lighting, especially if the building design does not support the maximum entry of natural light. PT PLN (Persero) Distribution Main Unit (UID) East Java is one of the agencies that utilizes cultural heritage buildings as operational facilities and administrative work spaces. Based on the results of initial observations, it was found that several work spaces in the Cultural Heritage Building of PT PLN (Persero) UID East Java have uneven lighting intensity and tend to be below the recommended standards. This is thought to be caused by the limited number of lamps, less than optimal lighting distribution, less than optimal lighting conditions, and minimal natural lighting due to the building design.

## II. METODE

This quantitative research with a descriptive design aims to describe the actual lighting intensity in workspaces and evaluate their compliance with applicable occupational safety and health standards. The variable in this study is the lighting intensity in the workspaces in the Cultural Heritage Building of PT PLN (Persero) East Java Distribution Main Unit (UID). The study

population included all administrative workspaces used as office facilities in the building. The research sample was determined using a purposive sampling method, a technique for selecting samples based on specific considerations in line with the research objectives. The criteria used included workspaces actively used for administrative activities and high visual activity. Based on these criteria, five workspaces were selected as samples: the Distribution Division, the Commerce Division, the Planning Division, the Finance Division, the Communications Division, and the General Division.

The data used is primary data obtained through direct measurements using a lux meter at predetermined points in each workspace. Measurements were conducted three times at each point to increase the reliability of the results, and then the average value was calculated. The data were analyzed descriptively by comparing the measurement results to the minimum lighting standard of 300 lux according to the Regulation of the Minister of Manpower of the Republic of Indonesia Number 5 of 2018. This analysis aims to determine the level of lighting suitability and identify potential risks to visual comfort, eye health, and work productivity. The study was conducted in July–August 2025 during working hours from 08.00–16.00 WIB so that the lighting conditions obtained are representative of normal work activities.

## III. RESULT AND DISCUSSION

The study results show that lighting intensity levels in workspaces at the PT PLN (Persero) UID East Java Cultural Heritage Building vary, with most failing to meet established standards. Measurements using a lux meter revealed average lighting intensity in the Distribution Division at 180 lux, Commerce Division at 127 lux, Planning Division at 264 lux, Finance Division at 339 lux, and Communications and General Affairs at 96 lux. Compared to the minimum lighting standard for administrative work of 300 lux as stipulated in Ministerial Regulation No. 5 of 2018, only the Finance Division met the standard; the other four spaces fell below the recommended minimum.

The low lighting intensity in most workspaces indicates that the visual conditions of the work environment are suboptimal. The Communications and General Affairs Division had the lowest value, at 96 lux, indicating very inadequate lighting levels. The Planning Division had a relatively better value of 264 lux, but still fell short of standards. This situation indicates an imbalance in lighting distribution between workspaces, which can significantly impact worker comfort and performance.

Inadequate lighting can directly impact workers' eye health and visual comfort. In distribution and commercial spaces with low lighting intensity, workers are at risk of eye strain, headaches, decreased concentration, and an increased risk of work errors. Administrative activities requiring high precision, such as reading documents, processing data, and working on computers, require adequate lighting for optimal performance.

According to ergonomic theory, low lighting causes the eyes to work harder to maintain focus, increasing the visual workload. This condition can trigger visual fatigue, characterized by sore eyes, blurred vision, and decreased work productivity. Poor lighting can also affect work posture, as workers tend to hunch over or bring objects closer to their eyes to see more clearly. In the long term, this condition can increase the risk of musculoskeletal disorders, particularly in the neck, shoulders, and back.

The Finance Department's office, with an average lighting level of 339 lux, demonstrates better conditions because it meets standards. Adequate lighting helps workers see work objects clearly, reduces visual fatigue, and increases efficiency and comfort. This suggests that good lighting quality has a positive relationship with productivity and workplace safety.

The majority of workspaces that do not meet lighting standards are thought to be caused by several factors, such as a limited number of lamps, uneven light distribution, dim lighting, and suboptimal natural lighting. In cultural heritage buildings, limitations in renovation or structural changes are a major challenge

in improving lighting quality. The old building's design, which was not designed for modern administrative work, means that natural lighting from windows or ventilation cannot optimally support visual needs.
The characteristics of the PT PLN (Persero) UID East Java Cultural Heritage Building, which requires maintaining the building's historical value, also limit flexibility in installing new lighting systems. This prevents lighting improvements from being carried out as freely as in modern office buildings. Lighting solutions must consider the balance between ergonomic needs and building preservation.

Lighting system improvements can be implemented through several approaches that still consider the characteristics of cultural heritage buildings. One solution that can be implemented is the use of LED lights, which have high light intensity but are energy efficient and do not require major structural changes to the building. Adding task lighting or work lamps to desks can also be an effective alternative to increase local lighting without disrupting the building's authenticity.

Optimizing natural lighting through the use of existing windows and openings is also necessary. Regular lighting system maintenance is crucial to ensure all lamps are functioning optimally. Dim or damaged lamps should be replaced immediately to maintain lighting quality. Repositioning lamps for more even light distribution can also be a simple yet effective step in improving worker visual comfort.
The results of this study indicate that improving lighting quality is not only aimed at meeting regulatory standards but also at creating a healthy, safe, and productive work environment. Appropriate implementation of these recommendations is expected to improve worker visual comfort without compromising the historical value of the PT PLN (Persero) UID East Java Cultural Heritage Building.

## IV. CONCLUSION

Berdasarkan hasil penelitian, dapat disimpulkan bahwa sebagian besar ruang kerja di Gedung Cagar Budaya PT PLN (Persero) UID Jawa Timur belum memenuhi standar intensitas pencahayaan minimal 300 lux sesuai Peraturan Menteri Ketenagakerjaan Nomor 5 Tahun 2018. Dari lima ruang kerja yang diteliti, hanya ruang Bidang Keuangan yang memenuhi standar dengan rata-rata intensitas pencahayaan sebesar 339 lux, sedangkan ruang Bidang Distribusi, Niaga, Perencanaan, Komunikasi dan Umum masih berada di bawah standar. Kondisi pencahayaan yang tidak memadai berpotensi menyebabkan kelelahan visual, menurunkan konsentrasi, meningkatkan risiko kesalahan kerja, berdampak pada produktivitas pekerja. Diperlukan perbaikan sistem pencahayaan melalui penambahan sumber cahaya, pemerataan distribusi lampu, optimalisasi pencahayaan alami, dan perawatan rutin terhadap lampu yang digunakan tanpa mengabaikan nilai historis bangunan cagar budaya. Penelitian selanjutnya disarankan untuk mengkaji hubungan antara intensitas pencahayaan dengan tingkat kelelahan mata produktivitas kerja secara lebih mendalam, sehingga hasil penelitian dapat memberikan rekomendasi yang lebih komprehensif dan aplikatif dalam mendukung penerapan keselamatan dan kesehatan kerja.

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