CHAPTER I

PREFACE

1.1 Background

Building takes part in the improvement of life quality in a society which includes the living provision standard, comfort standard, design, and stability of the economy. [1]. However, they are responsible for resource consumption, such as raw materials and energy, as well as producing waste and carbon emissions, which harm the environment. [1], [2]. In this situation, the need for green building implementation becomes necessary as a response to the mitigating strategy. Green buildings can be defined as buildings that reduce environmental damage throughout their life cycle, starting from construction, operation, and maintenance which also serves to be beneficial in the economic and societal aspects [1], [2]. These advantages include but are not limited to cost and material saving, energy and water efficiency, waste reduction as well as carbon emission decrease. [1], [2], [3].

As buildings increase due to rapid urbanization which causes 40% of global energy [4], the world must inevitably respond to these issues through green building implementations. The Indonesian government has established several regulations such as *Peraturan Pemerintah Lingkungan Hidup* Number 8 the Year 2010 about Criteria and Certification of Green Buildings, Jakarta Governor Regulation Number 38 the Year 2012 about Green Building, *Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat (PUPR)* Number 21 the Year 2021 about green building standard, etc with additional reference such as from Standard Nasional Indonesia (SNI) [5], [6]. Buildings themselves must be assessed based on their form which are categorized into new building and existing building. In detail for new building aspects, according to PUPR Number 21 Year 2021, several parameters or criteria regarding the green building standard can be summarized in the following categories [7]:

- Site Management = Land usage categories that assess building orientation, accessibility and circulation, contaminated land management, open green area private plan, pedestrian tracking, basement management, parking area facilitation, outdoor lighting system, and location of the building from the underground, underwater, or public facilities.
- Energy Efficiency = Energy efficiency includes building envelopes, ventilation systems, air conditioning systems, lighting systems, transportation systems, energy efficiency calculations, and electrical systems.
- Water Efficiency = Water efficiency includes water source, water usage, and water fixture.
- Indoor Air Quality = Indoor air quality includes the prohibition of smoking, Carbon Dioxide and Carbon Monoxide control, as well as refrigerant control.
- Environmentally friendly Material Usage = Material usage includes control of dangerous material and eco-labelling material usage.
- Waste Management = Waste management includes Reduce, Reuse, Recycle principle implementation, waste processing, and waste generation planning.
- Wastewater Management = Wastewater management includes wastewater processing facilitation before depositing to city sewer and recycling from domestic wastewater.

This report focuses on the aspect of the lighting system as a requirement to fulfill the criteria for energy efficiency aspect. In this case, the energy efficiency aspect of PUPR rating in relation to the lighting system can be shown by numbers 4 and 6 in Table 1.1 below.

Table 1.1 Energy Efficiency Criteria for Green Building Rating according to PUPR [7]

4. Lighting System				
a Artificial Lighting that suffices the requirement as follow			**Point**	**Description**
1	The artificial lighting system is planned to have maximum power and illuminance according to SNI 6197:2020.	1. Figures with lighting fixture's location; 2. Dialux Output on artificial lighting simulation as well as Light Power Density (LPD) according to SNI-6197-2020; 3. Working plan providing lamp specification.	2	
2	Installation of one switch for a room with area below 30 m^2.	1. Technical drawings that show: a. Floor plan on rooms function and area; b. Lamps location in every room with respective classifications; c. Switches location; 2. Data on room area as well as the respective number of lamps and switches.	2	
3	The use of lighting sensors for specific rooms according to SNI 6197:2020.	1. Sensor specifications in the working plan (occupancy, motion sensor or timer) 2. Figures that show sensor location in specific rooms such as toilet, mushola, etc.	2	

b. Daylighting that suffices the requirement as follow			Point	Description
1.	Area that is exposed to daylighting with classification for exposed lamps and the opposite.	1. Floor plan with natural daylight zone and artificial lighting zone. 2. Wiring diagram that classifies the two zone. 3. Daylight calculation using software simulations.	4	
2.	Area that is exposed to daylighting integrated with lux sensor to control the lighting system operation in accordance with standardized illuminance.	1. Floor plan with sensor positions and Isolux line. 2. Sensor specification. 3. Daylighting calculation using software.	2	
6. Energy consumption calculation			Point	Description
1.	Energy consumption conservation below the given baseline with every 2% electricity conservation accounted as 1 point, maximum of 5 point. The base line criteria are specified by: a. SNI 6197:2020 (Energy Conservation on Lighting System) b. SNI 6389: 2020 (Energy Conservation on Building Envelope); c. SNI 6390:2020 (Energy Conservation on Building Air Conditioning)	Energy consumption calculation for electricity conservation using the provided excel template.	5	

Thus, this report stresses the analysis of the planned lighting system in a new building called Pakuwon Mall and Hotel in Ibu Kota Nusantara (IKN) based on the criteria given in the prior table. The building itself is noteworthy to be assessed

since the mall and hotel are integrated with unique designs. In detail, 3 aspects will be analyzed, consisting of artificial lighting in the aspect of illuminance and light power density as well as daylighting. The findings of this analysis are expected to contribute significantly to enhancing the preparation of Pakuwon as a certified new building in green building standard by PUPR and are expected to contribute to giving insights that will inspire further research in similar domains.

1.2 Internship Aims and Objectives

This internship is attempted as the pre-requisite for passing the Engineering Physics Studies Program while also aiming to gain and increase the experience and skills of engineering-industrial working regarding certification methods and green building implementation concepts and practices in the case of Indonesia based on green building standard by PUPR. The specific objectives include:

1. Involving and participating in the professional world of Green Building Certification specifically *Bangunan Gedung Hijau* by PUPR through the internship in PT Ganitri Nityasa Harita.
2. Gaining skills in identifying, formulating, analyzing, and assessing engineering problems on Building Science's lighting aspect based on Dialux and Light Power Density calculation in the case of mall-hotel integrated building by Pakuwon in Ibu Kota Nusantara (IKN).
3. Providing solutions and/or recommendations for the case study to increase compliance rate to BGH PUPR specifically on the lighting aspect.

1.3 Time and Procedure of Internship

The internship period started on 29 July 2024 and ended on 29 November 2024 with a total of 640 working hours. The procedures for the internship carried out involve Working from Home (WFH) using tools such as Zoom, Google Meets, WhatsApp, and Gmail as well as working from the Office (WFO) in Scientia Business Park, Boulevard Raya Road, Gading Serpong, Tangerang, 15810.