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Identification of Natural Lighting Quality in Several Development Types of Subsidy House †

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Abstract: The function of a house can be achieved via residential comfort. Several studies have shown that natural lighting affects the comfort of a dwelling. Previous research discussed the typology of subsidized housing development in Kupang City and Kendal Regency. The result was the addition of space according to the needs. This article discusses the analysis of natural lighting in the original form of subsidized housing and after development in Kupang City and Kendal Regency through simulations using Dialux. The simulation results show that natural lighting in the house cases does not qualify SNI 03-6197-2000 both in the original plan and the after-development plan.

Keywords: natural lighting; subsidized house; Dialux

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1. Introduction

A house is a human need that needs to be met after the need for food and clothing [1]. Referring to the General Guidelines for Healthy Simple Houses in 2002, there are three indicators of lighting that is air conditioning, temperature and humidity [2]. One indicator of comfort in a dwelling is the presence of natural lighting [3]. According to SNI 03-2396-2001 [4], natural lighting in a building can be said to be good if the building is illuminated from 08.00 to 16.00 without excessive glare. Light can enter a building through the envelope and both walls and roofs [5].

Housing problems in big cities include low housing supply and low-quality housing [6]. A subsidized house is a house intended for low-income people with affordable prices and certain specifications. Dissatisfaction with subsidized housing that cannot accommodate user activities raises new problems. In their development, residents of subsidized houses independently carry out a gradual and planned transformation of their homes [7]. However, the transformation of these dwellings adds to the population, structural and utility loads, as well as issues of natural lighting and ventilation [8].

This article discusses natural lighting in subsidized homes when they were first built and after they were developed by users. Measurements were made through the Dialux Evo on the lightscene feature to determine the light illumination per unit area.

2. Material and Method

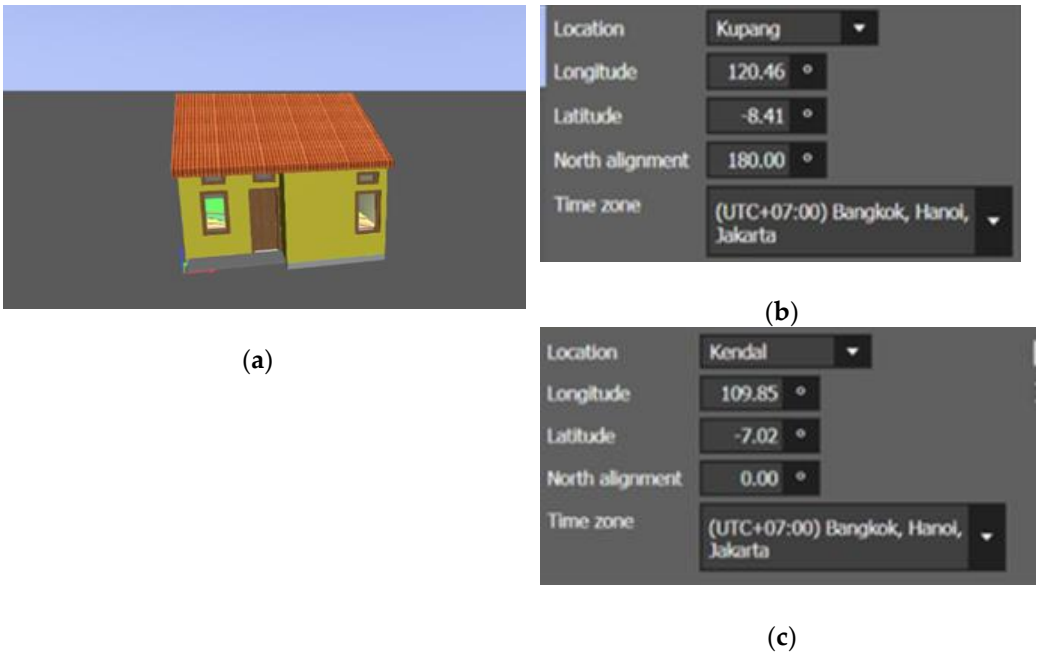
2.1. Case Study Material

We carried out two case studies based on previous research on the typology of subsidized housing development in Kupang and Kendal cities. Quoting from Hardy [8], in Kupang, a common development that occurs in the initial plan of a house is to use the vacant land at the back to become a kitchen. Then, additions to the front include fences, changes in façade elements and additional business space. This development occurs gradually according to the user's priorities and capabilities. In addition, research conducted by

Pratama [9] in Kendal showed that the development of a basic plan for subsidized houses in Kendal City was caused by dissatisfaction with the original plan. The addition of space functions include the addition of business space in the front due to economic factors. Space transformation also occurs in the living room, which increases the area of space to the front porch of the house, which results in the comfort of privacy not being fulfilled.

2.2. Method

The method used was quantitative–descriptive. In the first stage of this study, a literature review was conducted of previous studies that examined the typography of development in subsidized housing. The initial and after-development plan was described through AutoCAD to then be simulated on Dialux (Figure 1).



(**a**) (**b**) (**c**)

Figure 1. (**a**) Creation of house model in Dialux; (**b**) Input location of Kupang in Dialux; (**c**) Input location of Kendal in Dialux.

3. Result and Discussion

The simulation was carried out on the Dialux Evo application version 8.0 through the lightscene feature to measure the illumination of broad unit lighting. The discussion will explain how the initial floor plan of a residential building takes shape and will then show how the natural lighting that entered the initial floor plan was simulated (Table 1). The next stage was to make a development plan and re-simulate it. The cases studied were in two different locations. This difference in location affected the simulation input used. The similarity of the plans is that they consisted of two bedrooms, one bathroom, and a living room. The difference between the three plans was in the spatial organization.

The development of the initial plan included the addition of space due to the needs of the user in the kitchen and the front and back area of the house and changes to facade elements.

Table 1. Table of initial plan and development plan simulation in Kupang and Kendal case studies.

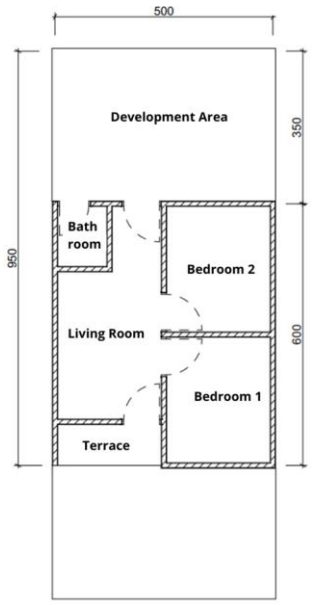
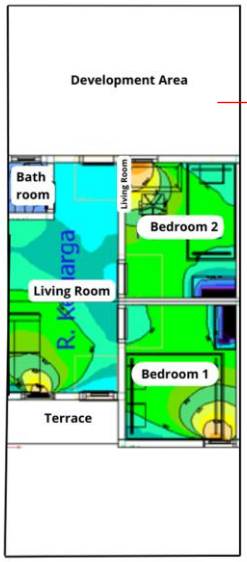
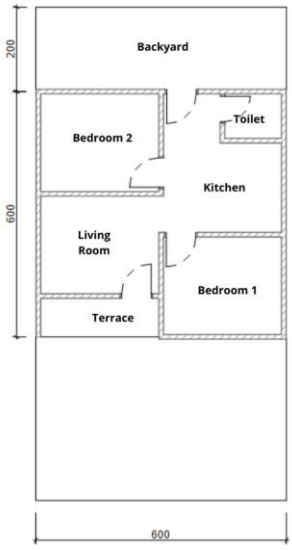
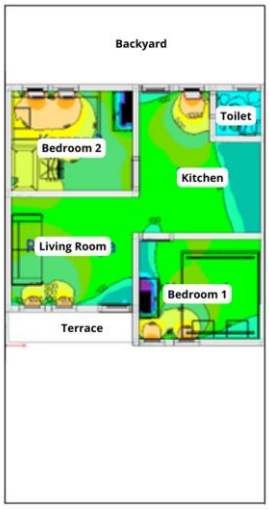
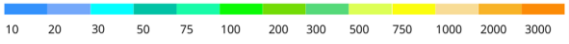
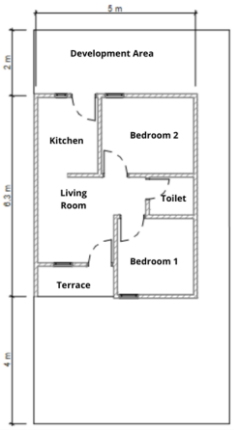
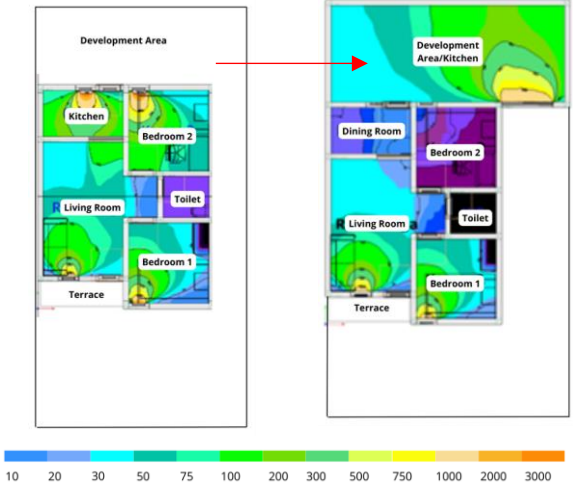
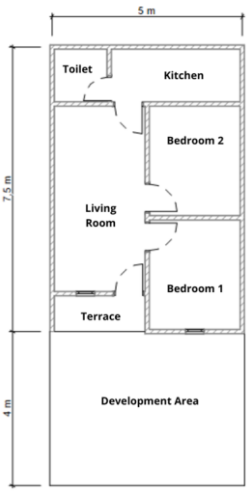
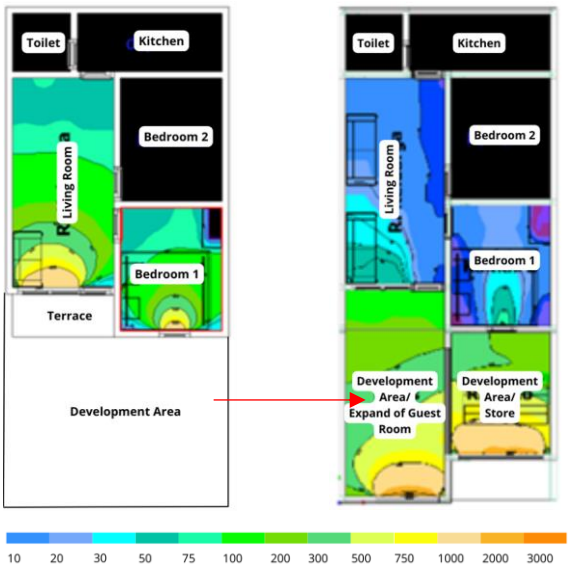
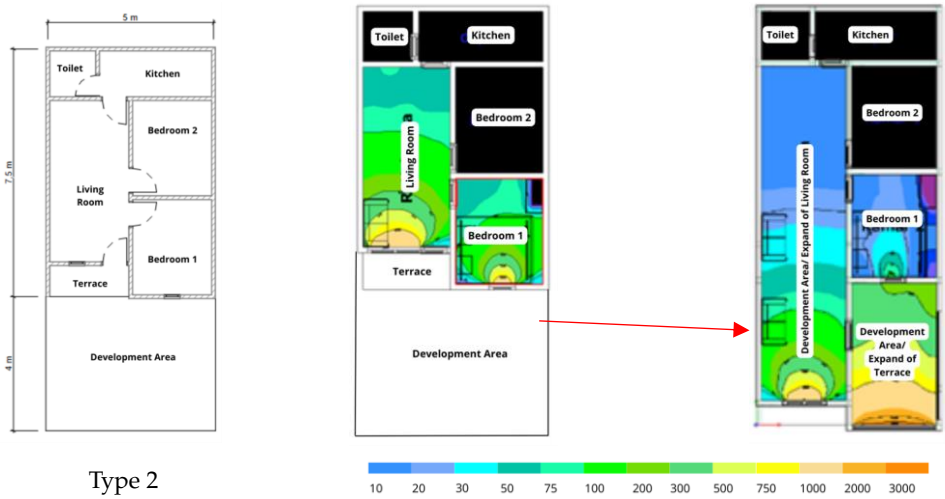
Initial Plan in Kupang	Initial Plan Simulation	Developed Plan Simulation
 Type 1	 	
 Type 2	 	No space development

Table 1. *Cont.*

Initial Plan in Kupang	Initial Plan Simulation	Developed Plan Simulation
		
Type 3		
Initial Plan in Kendal	**Initial Plan Simulation**	**Developed Plan Simulation**
		
Type 1		
		
Type 2		

In the initial ground plan, the rooms at the front such as the family room, front room and back room of the subsidized house receive natural lighting that meets the Indonesian National Standard 03-6197-2000 concerning energy conservation in lighting systems. This is due to natural openings that let in light through windows and ventilation. However, on the floor plan that has been developed at the back of the kitchen, there is a decrease in the quality of natural lighting so that standards are not fulfilled according to the SNI (Indonesian National Standard) both in the Kupang and Kendal case study (Tables 2 and 3).

Table 2. Table of simulation results in Kupang City case study.

Name Room	Initial Plan			Development Plan		
	Type 1	**Type 2**	**Type 3**	**Type 1**	**Type 2**	**Type 3**
Room 1 (SNI: 250 lx)	275 lx	283 lx	132 lx	284 lx	No Development	123 lx
Room 2 (SNI: 250 lx)	172 lx	672 lx	196 lx	1 lx		2.43 lx
Main room (SNI: 150 lx)	213 lx	273 lx	81.6 lx	412 lx		196 lx
Kitchen (SNI: 250 lx)	-	-	391 lx	16.6 lx		196 lx
Toilet (SNI: 250 lx)	19.4 lx	46.3 lx	1.57 lx	0.6 lx		0.5 lx

Table 3. Table of simulation results in Kendal Regency case study.

Name Room	Initial Plan		Development Plan	
	Type 1	**Type 2**	**Type 1**	**Type 2**
Room 1 (SNI: 250 lx)	159 lx		0.27 lx	0.19 lx
Room 2 (SNI: 250 lx)	0.12 lx		20.6 lx	22.4 lx
Main room (SNI: 150 lx)	252 lx		22.4 lx	104 lx
Kitchen (SNI: 250 lx)	0.85 lx		0 lx	0.13 lx
Toilet (SNI: 250 lx)	0.8 lx		0 lx	0 lx

4. Conclusions

This study concludes that the quality of natural lighting in several types of basic and developed subsidized houses is not good. This is assessed from the simulation results regarding the light scene in the building using the Dialux application. The results showed that some spaces in the basic typology of subsidized housing have not yet reached the target of natural lighting set by SNI 03-6197-2000 concerning energy conservation in lighting systems. Furthermore, after the basic house plans were developed, the quality of natural lighting continued to decline.

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Conflicts of Interest: The authors declare no conflict of interest.

References

1. Kridarso, E.R. Space Territory of Batik Productive House in Kauman, Pekalongan-Central Java; 2018. Available online: https://web.archive.org/web/20180416101339/http://www.trijurnal.lemlit.trisakti.ac.id/index.php/lslivas/article/viewFile/2751/2377 (accessed on 1 October 2023).
2. Keputusan Menteri Permukiman dan Prasarana Wilayah Nomor: 403/Kpts/M/2002. Available online: http://www.pu.go.id/Satminkal/Itjen/Lama/Hukum/Km403-0211.pdf (accessed on 1 October 2023).
3. Ashadi, A.; Anisa, A. Simple House Design of Small Type by Considering Comfort of Space. *J. Nalars* **2017**, *16*, 1–14. [CrossRef]
4. Badan Standardisasi Nasional. Available online: https://www.scribd.com/embeds/652253611/content?start_page=1&view_mode=scroll&access_key=key-fFexxf7r1bzEfWu3HKwf (accessed on 20 September 2023).
5. Paramita, B.; Koerniawan, D.; Larasati, D. Daylight Consideration for Urban Renewal: Building Form and Massing Related Papers Solar Envelope Assessment in Tropical Region. In Proceedings of the 10th International Symposium on Social Management Systems, Abu Dhabi, United Arab Emirates, 21–24 November 2023.
6. Aryani, S.M.; Wahyuningsih, I.; Mulyadi, M. The Evaluation of Public Housing Growing Units Based on Design Transformation Tendency. *J. Archit. Discourses* **2016**, *14*, 64–72. [CrossRef]
7. Hardy, L.; Maromon, R.; Amabi, D. Typology Of Subsidized House Development By Residents In Kupang City, East Nusa Tenggara (NTT). *J. Arsit.* **2021**, *8*, 57–62. [CrossRef]
8. Tippe, A.G. Transforming Government-Built Housing: Lessons form Developing Countries. *J. Urban Technol.* **1999**, *6*, 17–35. [CrossRef]
9. Pratama, I.A.; Ratih, S.S. Perubahan Teritori Ruang pada Rumah Subsidi (Studi Kasus: Perumahan Mawar Indah, Kendal). *J. Arsit. Arcade* **2021**, *5*, 183–192. [CrossRef]