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The 1st International Conference on Computer, Science, Engineering and Technology

IOP Conf. Series: Journal of Physics: Conf. Series **1179** (2019) 011001 doi:10.1088/1742-6596/1179/1/011001

1st International Conference on Computer, Science, Engineering and Technology (ICComSET)

PREFACE

It's our great pleasure to welcome you to the 1st International Conference on Computer, Science, Engineering and Technology (ICComSET-2018), Tasikmalaya, West Java, Indonesia from 27-28 November 2018.

The International Conference on Computer, Science, Engineering and Technology (ICComSET-2018), provides an excellent international forum for sharing knowledge and result in theory, methodology an applications of Computer, Science, Engineering and Technology in theoretical and practical aspects. The aim of the conference is to provide a platform to the researchers and practitioners from both academia as well as industry to meet and share cutting-edge development.

ICComSET-2018 secretariat has received 250 submissions from 6 countries: Malaysia, Taiwan, India, Mexico, Tunisia, and Indonesia. The new program held in the City of Tasikmalaya was organized by the Universitas Muhammadiyah Tasikmalaya (UMTAS) at Santika Hotel, Tasikmalaya from 27-28 November 2018, and supported by several universities including: STIKES Bakti Tunas Husada, Universitas Perjuangan Tasikmalaya, STIKES Muhammadiyah Ciamis, Universitas Muhammadiyah Sidoarjo, and Indonesian Collaboration Publication Community (Komunitas Kolaborasi Publikasi Indonesia/ KO2PI).

Each paper has been reviewed by the program committee. Only 166 paper were accepted for the oral session (acceptance rate: 65.3 %). The conference program consist of 3 keynote speakers (90 min), 6 Invited speakers (120 min), 5 parallel session, one poster session and a round table.

We would like to thank scientific committee, and reviewers, as well as the committee of the Universitas Muhammadiyah Tasikmalaya who have participated in the success of this event so that this event can be held as planned. We also conveyed to the Rector of Universitas Muhammadiyah Tasikmalaya who had supported this event both in terms of finance and other supporting facilities.

The Editors
Dr. Mujiarto
Dr. Janner Simarmata
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CONFERENCE PHOTOGRAPH


The 1st ICComSET 2018
Computer, Science, Engineering and Technology
tion for Smart Society in Empowering Industry 4.0
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TASIKMALAYA


November 27-28,


New Paradigm
Law Practice Technology
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law practice management and
law practice technology is a
critical solution that will further
align the skill that law student
must have upon graduation with
the employment needs of a
radically changing legal market.


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The Application of Passive Design Chart on the Analysis of Natural Ventilation of Low and Middle Income Flats Case Study Sky View Apartment and 'Rusunawa' Manis Jaya, Tangerang

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The Application of Passive Design Chart on the Analysis of Natural Ventilation of Low and Middle Income Flats Case Study Sky View Apartment and 'Rusunawa' Manis Jaya, Tangerang

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Abstract. The biggest environmental problem of this century is global warming where the earth's surface temperature has increased since the pre-industrial era which damage the environment and threaten human life on earth. CO_2 Emission is the most influential cause in global warming from the fossil fuel combustion process. Buildings have great impact towards the increasing of CO_2 emission due to the electricity produced by the fossil fuel. On the other hand, Indonesian government has been trying to reduce the housing shortage of vertical housings or flats, specifically for medium and low income families. This study developed passive design charts for architects to design vertical housings which follow passive design principles to save energy consumption and provide living health and comfort. The researchers observed and analysed the design of two medium and low income flats in Tangerang using passive design charts. The research demonstrates that the design of the flats which comply with passive design requirement would not only cause energy savings in electricity, but also provide more comfort and healthy environment.

1. Introduction

The 2015 United Nations resolution emphasizes that global warming should not be more than 2^0 Celsius above the pre-industrial level in 2100 and to pursue efforts not to exceed 1.5^0 Celsius to reduce the risks and impacts of climate change. It also emphasizes that the Net Zero Emission target in the second half of the 21st century would encourage the use of renewable energy as a substitute for fossil fuels [1].

On the other hand, the Indonesian government is working hard to overcome the housing backlog which according to the Director General of Housing Provision of the Ministry of Public Works and Housing (PUPR) Khalawi, there is a backlog of 11.4 million houses based on the 2015 data. The government attempt to develop a million house program of which 70 % is prioritized for low-income families (MBR) [2], [3].

It should be the task of Architects to play a major role in the design of healthy flats and based on energy savings homes that are responsive to humid tropical climates in countries like Indonesia. Based on the observations of two flats in Tangerang, namely Sky View and 'Rusunawa' Manis Jaya Apartments, the design of Sky View Apartment do not follow to the principles passive design

requirements. The lack of natural ventilation leads to heavily use of Air Conditioner (AC) or fans throughout the day.

The purpose of this study is to provide guidelines for healthy and energy-efficient home design for architects and all parties involved in housing development. The guidelines were made in simple graphical charts for easy use.

2. Material and method

In humid tropical climates, the design of a house without proper natural ventilation will result in the occupants depending on artificial ventilation such as AC and fans that consume large amounts of energy. It would be appropriate to overcome the above problem using optimal passive design, to create buildings that are energy efficient as well as comfort and healthy. Natural ventilation is a part of thermal comfort.

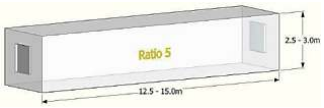
In addition to the significance of fresh air supply for the occupants, according to Indonesian National Standard (SNI) 03-6572-2001 [4], the purpose of natural ventilation is:

a. To eliminate combustion gases (CO_2) generated by breathing and combustion processes, and to reducing room temperature caused by the body heat, equipment's and others.
b. To remove the moisture from cooking, bathing and other activities.
c. To remove excessive heat.
d. To get thermal comfort.

Based on the standards of EDGE green building certification [5] and Governor Regulation No. 38/2012 concerning Green Building [6], [7], natural ventilation requirements are:

a. Comparison of room depth compared to ceiling height (D/H)

Table 1. Requirements for room depth to ceiling height ratio

Room/ Opening	Image/ Example	Maximum D/ H
Single-sided, single opening		1.5
Single-sided, multiple openings		2.5
Cross-ventilation		5

From the table above it shows that natural ventilation with a cross ventilation system is the most efficient. D/H chart can be seen in the following picture:

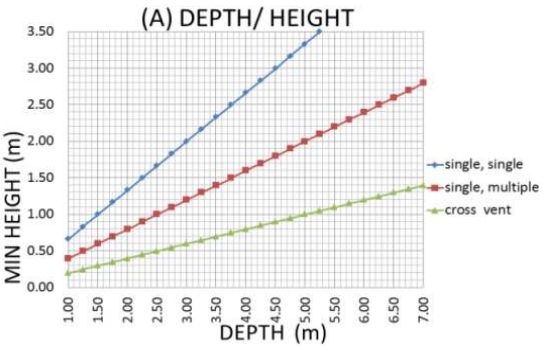


Figure 1. Chart of D / H

b. Minimum wall openings required for each type of room

Table 2. Minimum wall opening requirements

Room Type	Heat Gains	Total Area of Opening as a Percentage of Floor Area
Bathroom	< 15 Watt/ m²	10%
Bed Room	15 – 30 Watt/ m²	20%
Living Room	15 – 30 Watt/ m²	20%
Kitchen	>30 Watt/ m²	25%

The biggest wall opening is the kitchen because of the heat generated from cooking activities. The number of wall openings (transparent) also affects the heat of solar radiation entering the building. Openings chart can be seen in the following figure:

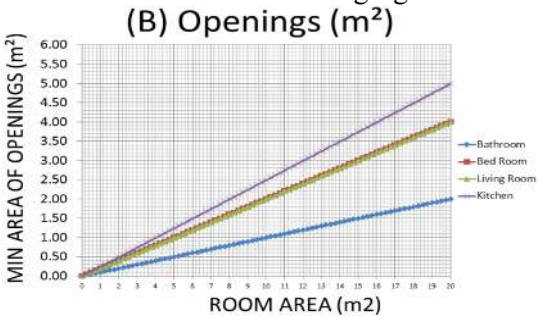


Figure 2. Chart of openings

c. Overall Thermal Transfer Value (OTTV)

Wide wall openings can cause the excessive solar heat that enters to building, so we need to control the heat with the measurement Overall Thermal Transfer Value (OTTV). Calculation of the heat entering the building is known by the calculation of OTTV, which has been included in the requirements for filing in a Building Permit (IMB) in Jakarta through The Governor's Regulation (Pergub) No. 38/2012 concerning Green Building where the OTTV of the building cannot be more than 45 Watt / m². Solar heat can enter the building through wall conduction, glass conduction or radiation entering through transparent glass on the wall openings. Factors that influence the magnitude of OTTV value are Window to Wall Ratio (WWR) and Solar Heat Gain Coefficient (SHGC) whose magnitude is 0.86 x SC, SC is the Shading Coefficient of glass which can be seen from the glass specification [6], [7]. The calculation formula for OTTV is:

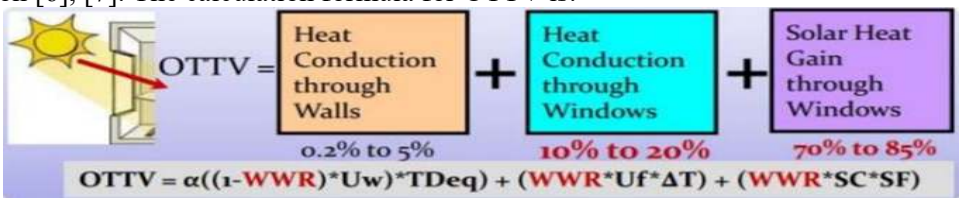


Figure 3. OTTV calculation formula

OTTV chart can be seen in the following pictures:

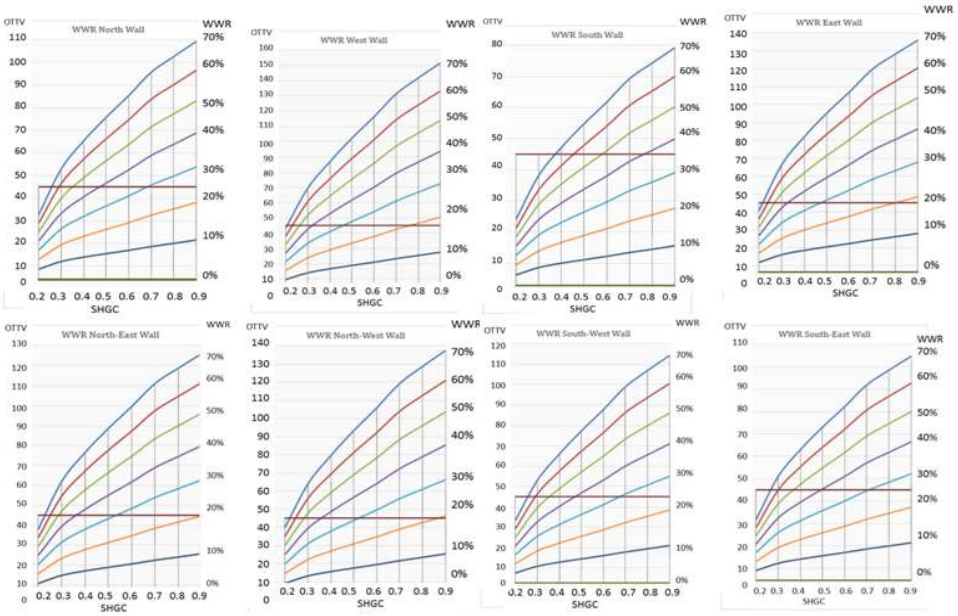


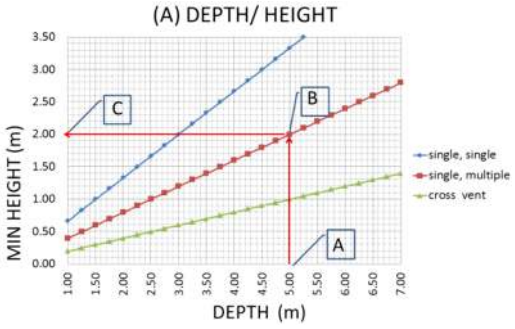
Figure 4. OTTV chart for all building orientations

Research Methods were pursued through the following procedures:

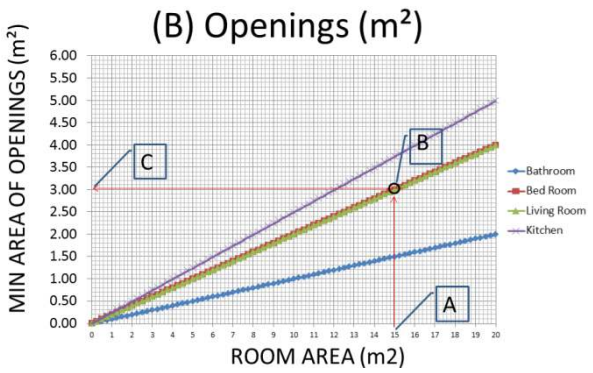
1. Measuring the amount of ceiling height, room depth, room area, wall openings area and the area of the transparent wall. Also check the type of glass, the thickness of the glass and the Shading Coefficient (SC) of glass obtained from glass specifications.
2. From these quantities plotted in the chart, cut the lines of type of wall openings, room types or WWR.
3. From the results of the intersection, the minimum ceiling height, minimum openings and OTTV were obtained.

For more details, the steps in reading the charts can be seen in the following tables:

Table 3. Reading passive design chart

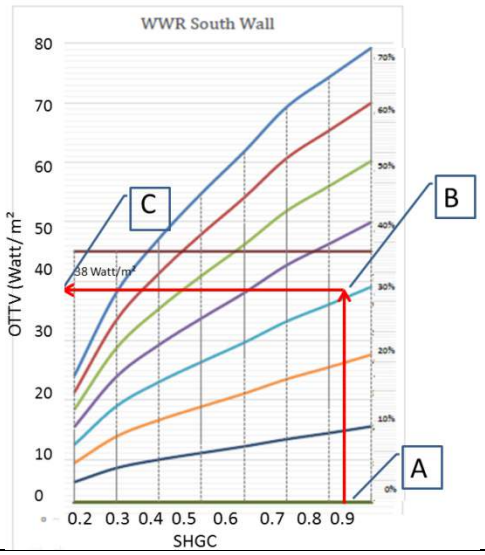
No	Chart	Procedures of reading the chart
1		Depth / Height Chart: 1. Measure the ceiling height, for example = 3 meters 2. Measure the depth of the room, for example = 5 meters, plot on the x axis (A) 3. Determine the type of wall opening, for example single sided, multiple openings 4. From point A, drag the vertical line up until it intersects the line type of the single wall opening, multiple and generated meeting points (B) 5. From the meeting point B, the horizontal line to the left is drawn; the minimum ceiling height is 2 meters (C). 6. Because the actual ceiling height is 3 meters, greater than the minimum ceiling height, the ratio of D / H meets the requirements.

2



Openings Chart:
1. Measure wall openings, including open windows and doors (the entrance is not included), for example wall openings = 2.5 m²
2. Measure the area of the room, for example 15 m² and specify a point in the axis of the Room Area (A)
3. Determine the type of room to be measured, for example Bed room
4. From point A, pull the vertical line up until it intersects the line of Bed room (B)
5. From the point of meeting B, a horizontal line to the left is drawn, resulting in a minimum wall opening area = 3 m² (C)
6. Because the wall opening = 2.5 m² is less than the minimum wall opening = 3 m², the wall opening does not meet the requirements, it must be added to the wall opening.

3



OTTV Chart:
1. Check the type of glass and the thickness of the glass, for example = Clear Glass, 6 mm thick
2. Look in the glass specifications, for clear 6 mm thick glass, Shading Coefficient (SC) is obtained = 0.96
3. Calculate SHGC = 0.86 x SC = 0.86 x 0.96 = 0.83
4. Plot on the SHGC axis, the SHGC = 0.83 (A)
5. Measure wall openings on the wall facing outside, for example = 2.5 m2 and wall area = 8 m². Examples of the outer wall facing south
6. Calculate WWR = Opening area / wall area = 2.5 / 8 = 31%
7. Take the OTTV chart for the south wall.
8. From the point (A), drag the vertical line up until it intersects the curve line WWR = 31% (B)
9. From point B, pull left horizontal to the OTTV axis, obtained OTTV = 38 Watt / m² (C)
10. Actual OTTV = 38 Watts / m² smaller than OTTV requirements = 45 Watt / m², meaning the southern orientation wall opening meets the requirements.

3. Result and discussion

3.1. Case study object

The object of this study case is two low and medium income flats in Tangerang, namely Sky View Apartment and Manis Jaya 'Rusunawa'. The reason of taking this object of study is based on the consideration that Tangerang is a buffer zone of the Capital City of Jakarta which has rapid housing growth. The study focused on low and medium income flats, the chosen units were studio type because low income flats are usually only studio unit, especially in 'Rusunawa' or 'Rusunami'.
The two flats locations are:

a. Sky View Apartment, Lengkong Gudang Timur Street, Serpong, South Tangerang City

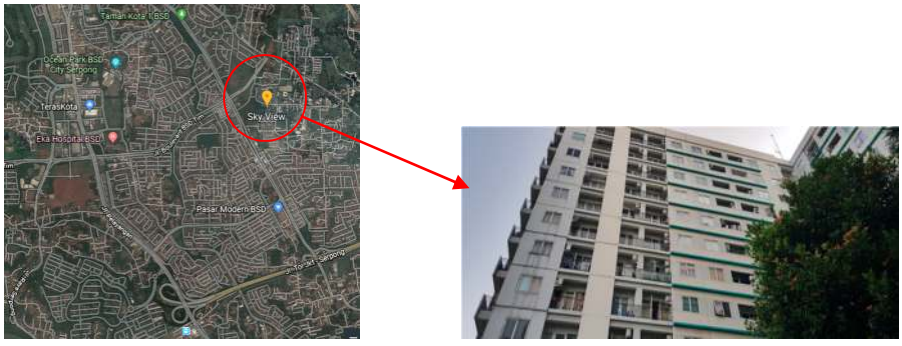


Figure 5. Sky View Apartment Location

b. 'Rusunawa' Manis Jaya, jalan Cikoneng Girang PLN No 60, Manis Jaya, Jatiuwung, Kota Tangerang

Figure 6. 'Rusunawa' Manis Jaya location

The shape of the interior and openings of the flats unit is as shown below:

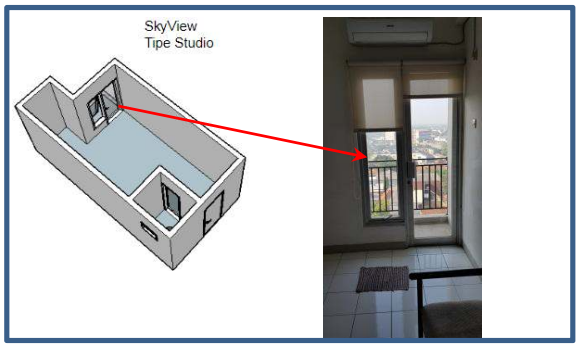


Figure 7. Apartment Sky View – Studio Type

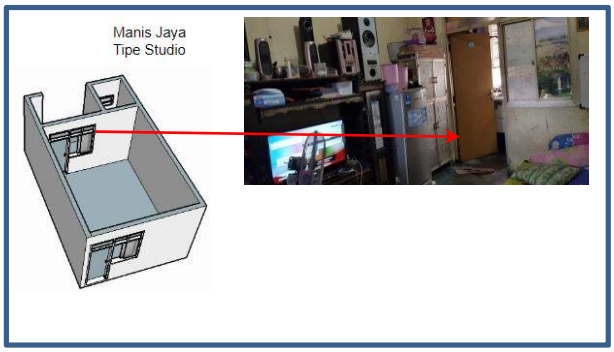
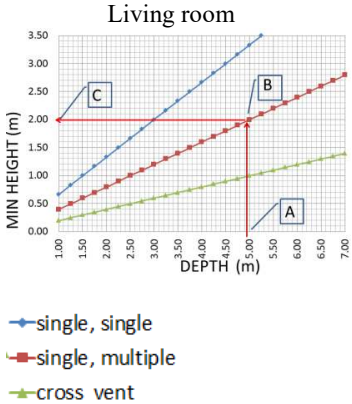
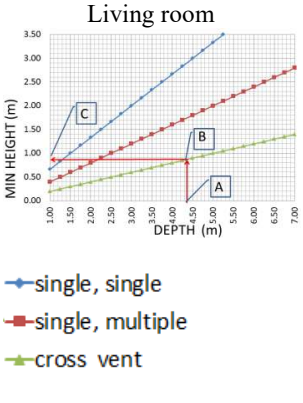
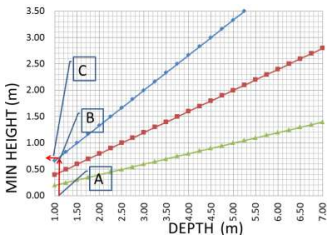
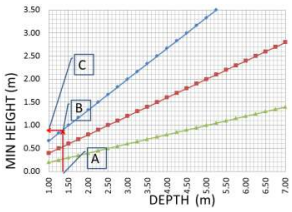


Figure 8. 'Rusunawa' Manis Jaya – Studio Type

3.2. Result

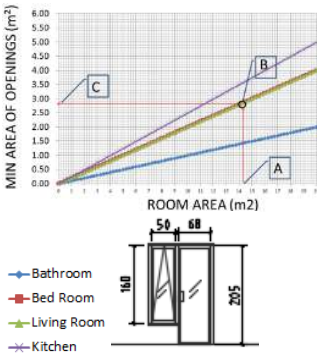
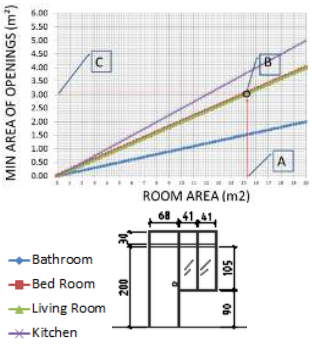
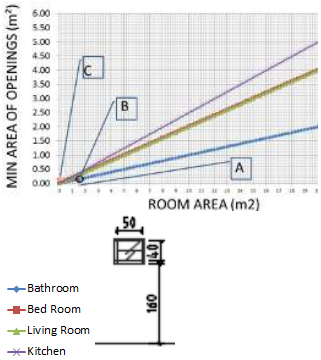
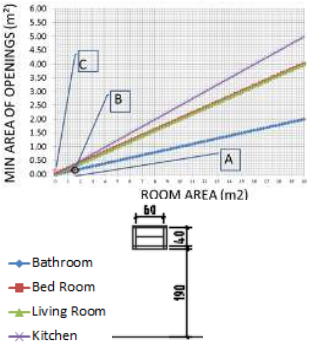
Table 4. Result D/ H

Apartment Sky View (Studio)	Observation	'Rusunawa' Manis Jaya (Studio)	Observation
Living room 	Measurement: 1. Measure the depth of space = 4.95 m Plot to x axis (A) 2. Single sided openings, multiple openings From point A it is pulled up to meet a single sided line, multiple openings (B) 3. From point B drawn a horizontal line to the left obtained the minimum height of the ceiling is 1.95 m (C) Ceiling height measurement = 2.80 m> 1.95 m Results: The ceiling height qualifies because it exceeds the minimum ceiling height	Living room 	Measurement: 1. Measure the depth of space = 4.35 m Plot to x axis (A) 2. Type of cross ventilation openings From point A pulled up to meet the line of cross ventilation (B) 3. From point B drawn a horizontal line to the left obtained minimum height of the ceiling is 0.85 m (C) Ceiling height measurement = 2.85 m> 0.85 m Result: The ceiling height qualifies because it exceeds the minimum ceiling height.

Bathroom 	Measurement: 1. Measure the depth of space = 1.1 m Plot to x axis (A) 2. Single sided opening type, single opening From point A pulled up to meet the single line, single (B) 3. From point B drawn a horizontal line to the left obtained minimum ceiling height is 0.7 m (C) Ceiling height measurement = 2.80 m> 0.7 m Results: The ceiling height qualifies because it exceeds the minimum ceiling height.	Bathroom 	Measurement: 1. Measure the depth of space = 1.35 m Plot to x axis (A) 2. Single sided opening type, single opening From point A pulled up to meet the single line, single (B) 3. From point B drawn a horizontal line to the left is the minimum height of the ceiling is 0.9 m (C) Ceiling height measurement = 2.85 m> 0.9 m Result: The ceiling height qualifies because it exceeds the minimum ceiling height.

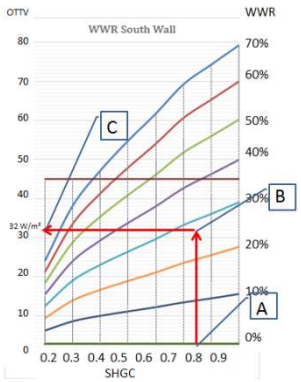
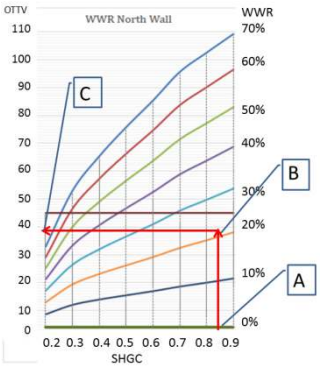
For calculation of D / H, both Sky View and Manis Jaya 'Rusunawa' flats fulfil the requirements, which mean that the depth of the room with the height of the ceiling allows natural ventilation.

Table 5. Result Openings

Apartement Sky View (Studio)	**Observation**	**'Rusunawa' Manis Jaya (Studio)**	**Observation**
Living room 	Measurement: 1. Measure room area = 14.11 m² Plot to x axis (A) 2. Type of living room From point A pulled up to meet the line of living room (B) 3. From point B drawn a horizontal line to the left obtained the minimum wall opening area is 2.82 m² (C) Measurement of wall openings = 2.19 m² <2.82 m² Results: Wall openings do not meet the requirements because they are less than the minimum wall opening	Living room 	Measurement: 1. Measure room area = 15.23 m² Plot to x axis (A) 2. Type of living room From point A pulled up to meet the line of living room (B) 3. From point B drawn a horizontal line to the left obtained the minimum wall opening area is 3.05 m² (C) Measurement of wall openings = 3.12 m²> 3.05 m² Results: Wall openings are eligible because they exceed the minimum wall opening
Bathroom 	Measurement: 1. Measure room area = 1.49 m² Plot to x axis (A) 2. Type of bathroom room From point A pulled up to meet the bathroom line (B) 3. From point B drawn a horizontal line to the left obtained the minimum wall opening area is 0.15 m² (C) Measurement of wall openings = 0.20 m²> 0.15m² Results: Wall openings are eligible because they exceed the minimum wall opening	Bathroom 	Measurement: 1. Measure the area of the room = 1.55 m² Plot to x axis (A) 2. Type of bathroom room From point A pulled up to meet the bathroom line (B) 3. From point B drawn a horizontal line to the left, the minimum wall opening area is 0.16 m² (C) Measurement of wall openings = 0.24 m²> 0.16 m² Results: Wall openings are eligible because they exceed the minimum wall opening

Sky View Apartments do not meet the requirements for wall openings. Openings in the bathroom were not effective openings. 'Rusunawa' Manis Jaya has a better a cross ventilation system.

Table 6. Result OTTV

Apartment Sky View (Studio)	**Observation**	**'Rusunawa' Manis Jaya (Studio)**	**Observation**
South orientation 	Measurement: 1. Clear glass 6 mm SC = 0.96 SHGC = 0.86 x SC = 0.83 Plot to x axis (A) 2. Transparent openings = 2.19 m² Wall area = 7.98 m² WWR = 2.19 / 7.98 = = 27% Using OTTV chart South orientation From point A drawn upwards meets the WWR 27% curve line (B). 3. From point B drawn horizontal line to the left obtained OTTV = 32 Watt / m² (C) OTTV measurement = 32 Watt / m² <45 Watt / m² Results: OTTV is eligible because it is below the OTTV requirement of 45 Watts / m²	North orientation 	Measurement: 1. Clear glass 6 mm SC = 0.96 SHGC = 0.86 x SC = 0.83 Plot to x axis (A) 2. Area of transparent openings = 2.22 m² Wall area = 9.98 m² WWR = 2.22 / 9.98 = = 22% Using OTTV graphics north orientation From point A drawn upwards meets the WWR curve line 22% (B). 3. From point B drawn a horizontal line to the left obtained OTTV = 39 Watt / m² © OTTV measurement = 39 Watt / m² <45 Watt / m² Results: OTTV is eligible because it is below the OTTV requirement of 45 Watts / m²

For OTTV calculations, both Sky View and Manis Jaya flats are follow the requirements, which mean that the heat of solar radiation entering the unit is still under the guideline of Governor Regulation No. 38/2012.

4. Conclusion

Based on observation, analysis of natural ventilation using a passive design graph, the following conclusions can be drawn:

a. The design of flats in Tangerang, especially Sky View apartments, does not follow the principles of natural ventilation; therefore it has the potential to waste energy. Window openings in flats in Tangerang, especially in Sky View apartments, have not met the requirements for natural

ventilation. The window openings are very small, so natural ventilation cannot function properly. The natural ventilation in 'Rusunawa' Manis Jaya works well because in addition to the opening area, D/H ratios meet the requirements and use the cross ventilation system.

b. Problems arising from the non-fulfillment of natural ventilation requirements can be felt during field observations at Sky View apartments, namely: the temperature of the room temperature makes the occupants uncomfortable, so they have a tendency to use AC when indoors.
c. Passive design charts are very easy to use for architects in designing flats, because direct results can be adjusted using the graph without difficult calculations.
d. The design of flats should follow to natural ventilation requirements for comfort, occupant health and energy savings.
e. The reading instrument in the form of a passive design graphic can still be developed for further research to complement passive design parameters that have not been included in the charts and for the expansion of types of buildings other than residential and flats.

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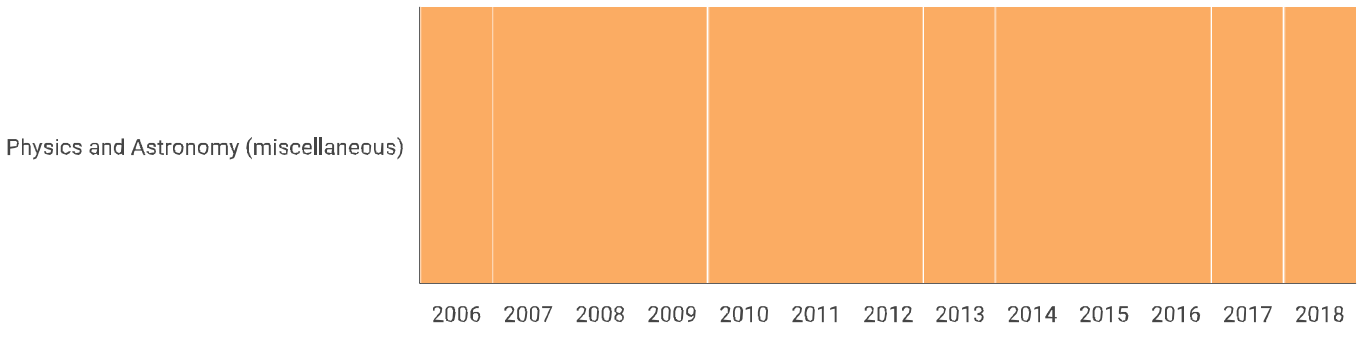

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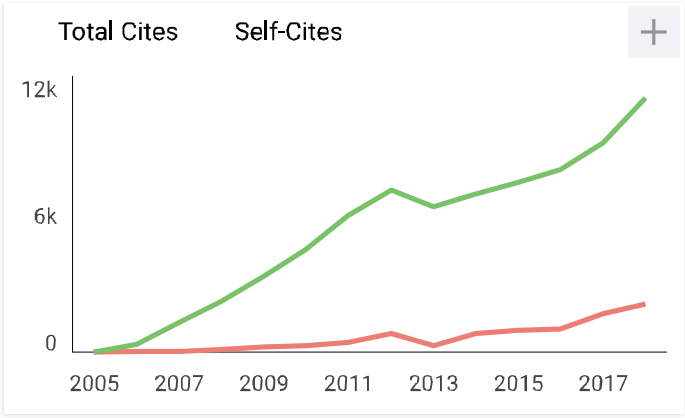

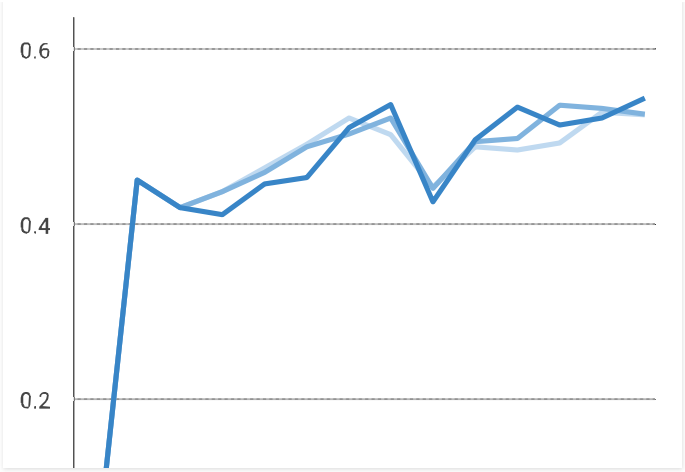

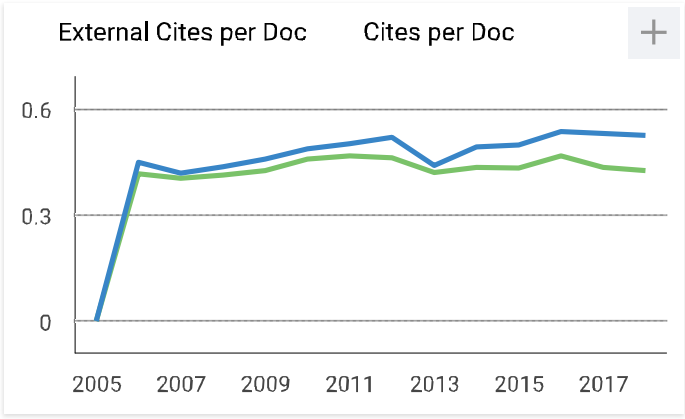

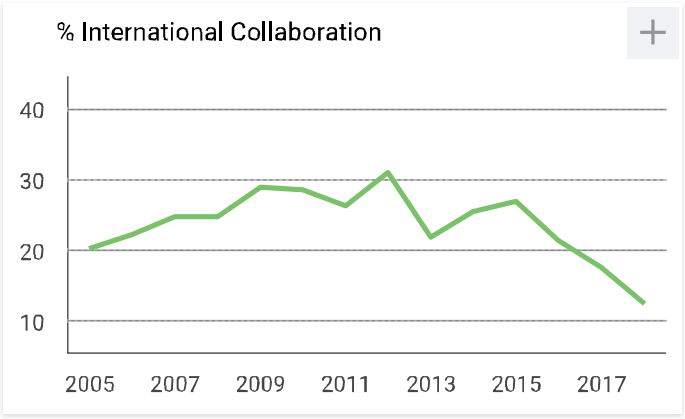

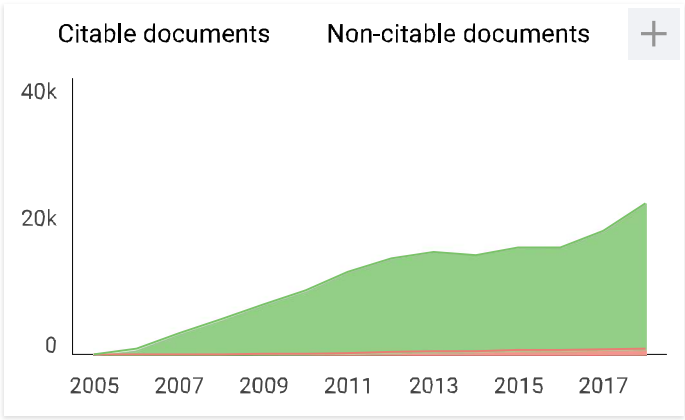

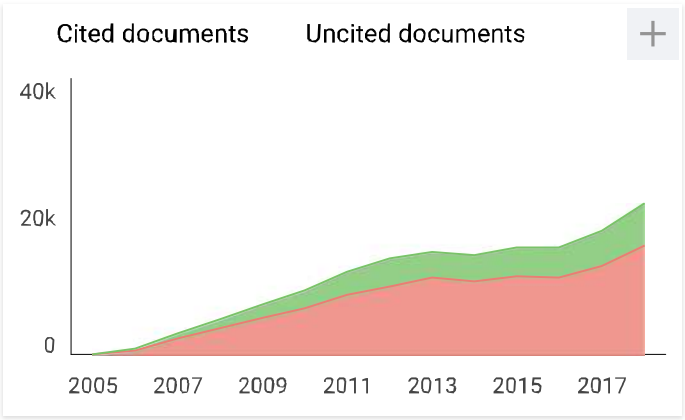

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