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Health Aspect Study on T-36 House Typology Based on Paola Sassi's Sustainable Concept and Government Standards

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Abstract

Study of T-36 houses (T-36) are increasingly emerging to improving the quality of life of its occupants, especially in terms of nurturing health condition. However, the spatial typology of T-36 houses is often faced with the challenge of utilizing limited spaces that meet basic requirements of physical comfort and health in housing standard. This study aims to analyze the health aspects of T-36 houses based on sustainable building criteria by Paola Sassi and governmental standards. The health aspect comprises three factors of natural lighting, occupant comfort, and harmony with nature. The study uses descriptive qualitative method by analyzing design variation of T-36 houses that are available in the housing market. This analysis of 10 designs of T-36 houses indicated varying compliance with the three factors identified in the study; some houses met the criteria, while others did not.

INTRODUCTION

The need for affordable and functional housing continues to grow alongside population growth and urbanization in Indonesia. According to a decree by the Ministry of Public Works and Housing, Republic of Indonesia, housing is considered a fundamental human need and plays a vital role in enhancing human dignity. Data from the *Dinas Pekerjaan Umum dan Penataan Ruang* (PUPR), a government body under the Ministry of Public Works and Housing, shows that the demand for housing in Indonesia reached 12.7 million units in 2024. A T-36 house is one solution for lower-middle-class families who wish to own their own house. However, the limited size of the building presents challenges in creating a comfortable and healthy living environment. Poor design and spatial arrangement often negatively impact the physical and mental health of its occupants. While providing testimony as a factual witness presented by the government in the continued hearing on the judicial review of Law No. 1 of 2011 concerning Housing and Residential Areas at the Constitutional Court on Wednesday, 25 April 2011, Umang Gianto, CEO of PT. Bulan Terang Utama Malang, stated, "*In 2007, we built both type 27 and T-36 houses on plots of 65 square meters, and the majority of consumers chose the T-36 houses*." He added, "*T-36 houses are best suited for prosperous families with two children. At the time, the cost and selling price differences between T-36 and T-27 houses were not significant, but the difference in room space was substantial T-36 houses have two bedrooms, whereas T-27 houses have only one*." This aligns with the Minister of Health Regulation No. 39 of 2016 on the implementation of the Healthy Indonesia Program with a Family Approach. It emphasizes that clean and healthy living behavior is a set of behaviors practiced consciously as a result of learning, enabling individuals, families, groups, or communities to independently care for their health.

Regarding health, this aligns with the principles of sustainable architecture, where the well-being of residents is a key factor in creating living environments that holistically support prosperity. To achieve optimal health, the relationship between indoor and outdoor spaces must be well-integrated (D'Onofrio & Trusiani, 2018).

According to Rice and Drane (2020), the time spent indoors has been increasing, particularly in urban areas. This trend is concerning as it reduces opportunities to gain physical, mental, and social health benefits typically

derived from outdoor activities, especially in green and blue spaces. The United States Environmental Protection Agency (EPA) highlights that indoor air pollution is 2 to 10 times more hazardous than outdoor air pollution, posing significant health risks. This demonstrates that spending more time outdoors is positively associated with health and well-being, whereas excessive time indoors is linked to various health issues.

In this context, health becomes increasingly relevant, especially in small houses like T-36. The limited size of these homes can influence the well-being of their occupants. Sassi (2006), an architect and sustainable architecture academic, argued that a "healthy residence" is determined by factors that support the comfort and quality of life of its inhabitants. Sassi highlighted cross ventilation and sufficient natural lighting as key elements in creating healthy living spaces.

This is supported by SNI 03-6572-2001, which states that natural ventilation should include permanent openings, such as windows or doors facing open terraces, open spaces, or adjacent rooms. Cross ventilation is especially effective for naturally cooling spaces, particularly in climates that allow for airflow from the outdoors to indoors. This strategy requires adequate openings on opposite sides to ensure proper air circulation, allowing indoor heat to escape. Optimizing sunlight during the day also reduces reliance on artificial lighting. Thus, even small homes must prioritize air circulation, natural lighting, and functional layouts to maintain a healthy living environment. In Indonesia, the Ministry of Health defines a healthy home as a residential building meeting health standard, including good ventilation and appropriate occupancy density (Ministry of Health, 2013). Similarly, Winslow and the American Public Health Association (APHA) emphasize that healthy homes should fulfill physiological needs such as lighting, ventilation, adequate space for movement, and freedom from noise.

This study aims to explore 10 T-36 houses by applying three sustainable architecture factors proposed by Paola Sassi: natural lighting, occupant comfort, and harmony with nature. This study also examines alignment with SNI-03-6572-2001, SNI-03-1733-2004, and Law No. 26 of 2007. Using a descriptive qualitative analysis method, the study identifies and examines design elements applied to 10 already-built T-36 homes in Indonesia that cater to the lower-middle-income community. The descriptive analysis is based on observations of floor plans, elevations, and sections compared to ideal standards, with compliance rated on a Likert scale hierarchy.

ACCORDING TO PAOLA SASSI AND SNI PARAMETERS

In her previous studies, Paola Sassi explored sustainable design within the context of developed countries, including an energy efficient housing project in Cardiff, which adhered to standards typical in such regions. To achieve natural lighting, Sassi implemented triple-glazed large windows on the southern side to maximize sunlight absorption. For occupant comfort, she utilized walls with specific thicknesses to maintain warmth indoors. Additionally, to harmonize with nature, Sassi incorporated rainwater harvesting systems. She emphasized, "*I wanted to prove that it is possible to build a house in a city center that is sustainable, comfortable, and cheap to run*." However, applying these concepts in tropical climates like Indonesia requires adjustments. For this reason, the principles of natural lighting, occupant comfort, and harmony with nature were not only analyzed theoretically but also tested in the architectural context of T-36 houses. This was achieved by examining architectural elements, including land area, variations in plot shapes (length-to-width proportions), and configurations of open spaces and openings within the indoor-outdoor spatial arrangement.

To understand the impact of each architectural element, this study refers to relevant theoretical frameworks and technical standards. Natural lighting will be analyzed based on the placement of windows and skylights within various land configurations. Occupant comfort will be assessed by examining cross ventilation and spatial layouts that enhance natural air circulation. Meanwhile, harmony with nature will be evaluated through the design of green open spaces, scaled to fit T-36 houses. Thus, the study not only adapts Paola Sassi's theories to tropical contexts but also demonstrates their application in T-36 house architecture using a physical element-based approach. Natural lighting, for example, plays a crucial role in occupant health. Adequate exposure to natural light can elevate mood, boost energy, regulate sleep patterns, and improve overall bodily functions. Without sufficient natural light, individuals may experience fatigue or even Seasonal Affective Disorder. As Greene and DeYoung (2023) emphasized, “Meeting natural light and ventilation minimums makes rooms brighter and healthier. Thoughtful window placement provides uniform light and utilizes sunlight’s advantages.”

To achieve optimal lighting and ventilation, Paola Sassi proposed the use of skylights in kitchens or family rooms. The integration of spaces, or open-plan design, can help distribute natural light throughout the house. Historically, natural ventilation has proven more effective than mechanical systems in preventing the spread of viruses (Zhai, 2020). Additionally, according to SNI 03-6572-2001, window placement should provide openings covering at least 5% of the floor area in spaces requiring ventilation, with openings facing open terraces, parking areas, or similar spaces. For occupant comfort, it is essential to consider various factors, such as thermal, visual, and air comfort, achieved by using adjustable ventilation systems. SNI 03-6572-2001 also emphasizes that rooms with

toilets or restrooms should not open directly towards kitchens, pantries, communal dining areas, meeting rooms, or workspaces with more than one occupant.

According to SNI 03-1733-2004, the formula to determine the minimum floor area per person is as follows L = U/Tp, where L Floor area per person, U Fresh air requirement per person per hour jam (m^3), dan minimum ceiling height, which is 2.5 m. For adults, Fresh air requirement U adult / Tp = 24 m^3 / 2,5 m, which produces area 9,6 m^2 per adult. For children, Fresh air requirment U children / Tp = 12 m^3 / 2,5 m, which produces area 4,8 m^2 per children.

Harmony with nature through green spaces has proven to reduce stress, improve mental well-being, and offer physical health benefits. For example, natural elements like trees help absorb carbon dioxide, reduce water pollution, and provide calming psychological effects, contributing to healthier urban environments overall. One of the most influential climatic factors is air and wind movement. According to Widyanto (2018), horizontal and vertical wind movements differ in speed, caused by variations in air pressure across locations. Air moves from areas of high pressure to areas of low pressure. Wind speed affects thermal comfort, with faster airflow reducing indoor temperatures and creating a cooling effect (Melita et al., 2017, cited in Muhammad Agytia Syahriza, 2023). In addition, Law No. 26 of 2007 on spatial planning mandates that urban areas must allocate at least 30% of their total area for green spaces. For residential areas, particularly simple housing, this ranges from 10% to 20%.

CONCEPTUAL FRAMEWORK: HEALTH ASPECT IN T-36 HOUSE ARCHITECTURE

This research builds its conceptual framework on Paola Sassi's theory of sustainable design, particularly concerning occupant health, which is then adjusted to suit Indonesia's tropical climate conditions. It is further supported by government standards, namely SNI 03-6572-2001, SNI 03-1733-2004, and Law No. 26 of 2007. Within this framework, three key factors serve as essential health aspects in residential architecture.

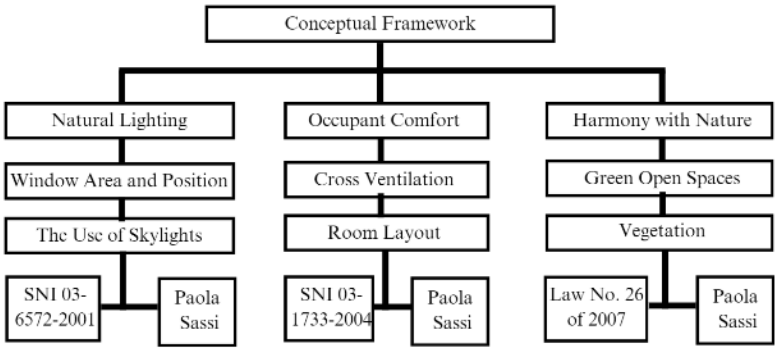


Figure 1. Conceptual Framework

Natural lighting plays a pivotal role in maintaining the human circadian rhythm, elevating mood, enhancing productivity, and preventing psychological disorders such as Seasonal Affective Disorder. Occupant comfort is integral to overall health, encompassing thermal, visual, and air quality aspects. Paola Sassi emphasizes the use of walls with specific thicknesses for thermal insulation; however, in tropical houses, cross ventilation proves more effective. The design of spaces and openings must facilitate air circulation while avoiding cross-contamination between functional areas, such as toilets and kitchens. Regarding harmony with nature, Sassi integrates elements like rainwater harvesting and gardens to foster a connection with the environment. In Indonesia, green spaces within residential scales serve functions such as reducing heat, absorbing rainwater, and providing interaction zones with nature. The presence of greenery significantly impacts the mental and physical health of inhabitants, promoting well-being, and a healthier urban lifestyle.

METHODS

According to the PUPR, T-36 houses are residential units with a building area of 36 m^2, typically consisting of two bedrooms, a living room, a kitchen, a bathroom, and a guest room. These houses fall under the category of simple housing, aimed at middle to lower-income communities. T-36 houses are usually designed with varying land sizes, ranging from a minimum of 60 m^2 to a maximum of approximately 90-120 m^2. Based on PUPR Regulation No. 7 of 2022, Article 15, Paragraph 4, completed T-36 houses must minimally have plastered roofs, walls, and floors. Meanwhile, according to the 2002 Ministerial Decree of Settlement and Regional Infrastructure, T-36 houses built

on a minimum land area of 60 m² must include one bedroom, one multipurpose room, and one bathroom or washing area.

This study aims to explore 10 T-36 houses by evaluating three sustainable architectural factors proposed by Paola Sassi: natural lighting, occupant comfort, and harmony with nature. A total of ten houses were selected as samples from five different cities: Sidoarjo, Musi Banyuasin, Parung, Bekasi, dan Sekayu. These locations were chosen based on data from BTN (National Land Agency of the Republic of Indonesia), which indicates an average annual growth of 4.24% in the demand for the T-36 housing in Java, as well as over 120 hectares of the T-36 housing development in Sumatra. Sample 1 to 5 were taken from Sidoarjo, sample 6 from Musi Banyuasin, sample 7 from Parung, samples 8 and 9 from Sekayu, and sample 10 from Bekasi. The design drawings of the houses were obtained from each respective property developer. For instance, Bersatu Sukses Group, established in 1998, has developed various projects such as Taman Anggun Sejahtera 1–9 and Bess Mansion. Additional samples were taken from Kayuara Residence, known for its T-36 houses and shop houses; Waru Selia Housing, which built 70 T-36 units; and Mangun Jaya Housing, which features numerous T-36 homes. The method used in this research is descriptive qualitative analysis, focusing on spatial configuration variations across these 10 samples. Floor plans, building elevations, and sections were critically analyzed to highlight and compare design features based on sustainable architectural principles.

Each house features unique room configurations, with variations in the placement of bedrooms, living rooms, kitchens, and bathrooms. The analysis relied on Paola Sassi's parameters, SNI standards (03-6572-2001 and 03-1733-2004), and Law No. 26 of 2007. A visual analysis technique was employed using floor plans, elevations, and sections, as these representations clearly illustrated spatial arrangements, air circulation, and natural lighting in each room. Elevations were utilized to evaluate openings in each space, while sections facilitated the assessment of ceiling height. This analysis examined the positioning and dimensions of windows relative to room size, ceiling heights, and the layout and area of gardens. Such criteria align with the Ministry of Health's definition of a healthy home, emphasizing proper ventilation and appropriate occupancy density (Depkes RI, 2013).

The 10 houses were categorized into three groups: the first group featured two bedrooms aligned side by side, the second group placed a toilet between the two bedrooms, and the third group had the two bedrooms arranged non-aligned. The first grouping ensured more efficient circulation with minimal obstacles. The second grouping enhanced privacy between bedrooms while allowing easy access to the toilet. The third grouping increased privacy between bedrooms due to their non-aligned positioning. Following this categorization, the compliance level with established standards was evaluated using a Likert scale.

RESULTS AND DISCUSSION

The grouping of 10 houses was divided into 3 groups: the first group featured two bedrooms aligned, the second group placed the toilet between the two bedrooms, and the third group arranged the two bedrooms, so they were not aligned. This grouping was presented on the following table.

Table 1. Grouping of the ten houses into three categories

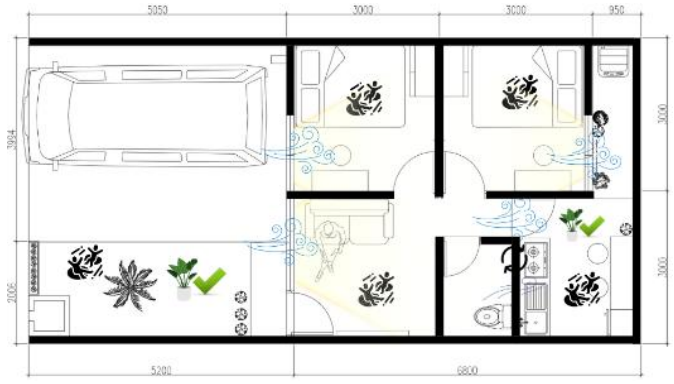
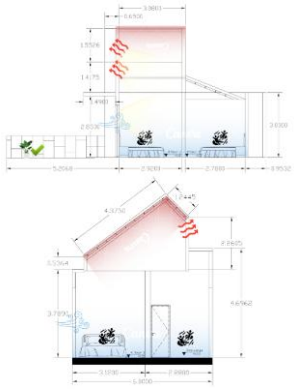
No	Catagory	House Sample Name
1	The first group, with both bedrooms aligned	House Sample 1- 6
2	The second group, toilet positioned between two bedrooms.	House Sample 7 and 8
3	The third group, two bedrooms not aligned	House Sample 9 and 10

Afterward, the standard compliance level was evaluated using a Likert scale to determine how well the three sustainable architectural factors proposed by Paola Sassi had been addressed: natural lighting in response to SNI 03-6572-2001, occupant comfort in response to SNI 03-1733-2004, and harmony with nature in response to Law No. 26 of 2007. The Likert scale described ranged from 1 to 6, where 1 indicated no response and 6 indicated highly responsive

Group One: Houses with Two Aligned Bedroom

Group One, featuring houses with two aligned bedrooms as depicted in the house plans from Table 2 to Table 7, represents Types 1 to 6.

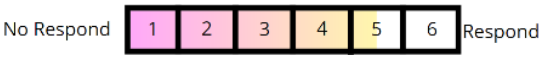
Table 2. Floor plan, elevation and section of house type 1

Floor Plan Type. 1	Elevation Type.1	Section A-A & B-B Type. 1
		

Source: Drawings reproduced from a brochure by Bersatu Sukses Group

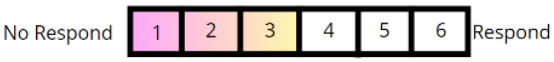
This T-36 house was built on a 72 m² plot with a building area of 29.3 m². It complied with the building setback regulation, maintaining a distance of 5 meters from the road. The land shape was elongated inward, characteristic of typical T-36 houses with the main opening at the front. Additionally, this house was positioned adjacent to other T-36 houses in its neighborhood

Natural Lighting



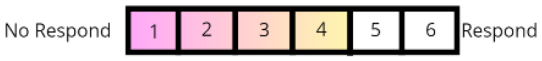
Natural lighting in the design of this house is influenced by the configuration of open spaces and openings, such as windows, skylights, and building orientation. The two bedrooms have visual access to the outdoors with windows measuring 2.75 m² or approximately 22% of the room area, meeting the SNI 03-6572-2001 standard. The living room also has direct access to exterior windows, with a window area of 3.75 m², or 14% of the room area, which fulfills natural lighting requirements. However, the kitchen is located at the back without visual access to the outside, limiting ventilation and natural lighting in this space. Air ventilation in the bedrooms is adequate, with direct access to the outside, but the living room lacks cross ventilation. Privacy in the toilet is maintained due to its placement, which does not directly face the main areas. However, the ventilation area in the toilet is only 1 m², while the toilet room area is 3 m², meaning it does not meet the SNI 03-6572-2001 standard.

Occupant Comfort



Occupant comfort is influenced by the plot area and variations in land shape, which determine the flexibility of spatial layouts and the effectiveness of natural ventilation. In this design, cross ventilation is implemented through opposing window openings, allowing fresh air to enter and warm air to exit more efficiently. According to SNI 03-1733-2004, the minimum floor area requirement per adult is 6.8 m² and per child is 3.4 m², totaling 17 m² for a household of two adults and one child. In this residence, the living room measures 9 m², which is insufficient for two adults and one child. Bedroom 1 has an area of 8.48 m² and Bedroom 2 measures 8.2 m², meeting the requirement for one adult per room or two children sharing a single bedroom.

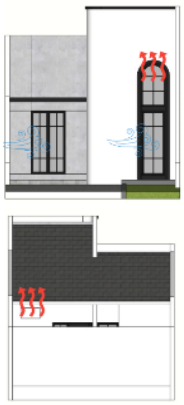
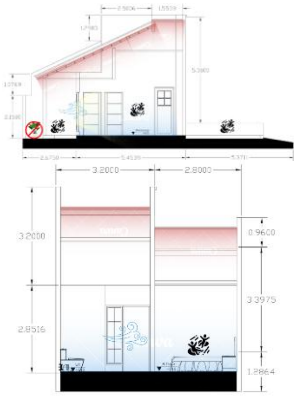
Harmony with Nature



Harmony with nature in this housing design is influenced by the configuration of open spaces, particularly the provision of adequate green spaces and visual access to the surrounding environment. The front garden spans 10 m², constituting approximately 14% of the total land area, which meets the minimum green space standard set by the

2007 Spatial Planning Law (requiring 10–20%). The living room benefits from good visual access to the garden, whereas the kitchen and toilet at the rear lack any external views.

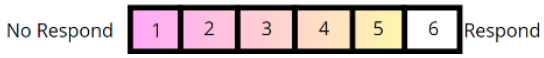
Table 3. Floor plan, elevation and section of house type 2

Floor Plan Type. 2	Elevation Type. 2	Section A-A & B-B Type. 2
		

Source: Drawings reproduced from a brochure by Bersatu Sukses Group

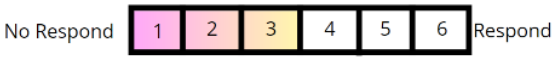
This T-36 house was constructed on an 80 m² plot with a building area of 29.38 m². It complied with the building setback regulation, maintaining a 5-meter distance from the road. The land shape was elongated inward, characteristic of typical T-36 houses with the main opening situated at the front. Additionally, this house was positioned adjacent to other T-36 houses in the neighborhood.

Natural Lighting:



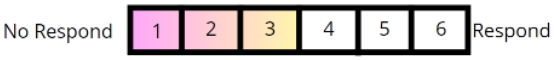
Natural lighting in the design of this house is shaped by the configuration of open spaces and openings, including tall vertical windows and skylights on the roof. Bedrooms 1 and 2 have windows measuring 1.24 m², or approximately 35% of the room area, which sufficiently meets the SNI 03-6572-2001 standard for natural lighting. Both bedrooms also have direct access to outdoor air, whereas the toilet lacks ventilation directly leading to the exterior. The living room is equipped with windows sized at 2.93 m², or 22% of the room area, fulfilling natural lighting requirements. The kitchen is located in an open area but lacks adequate visual access, as it is positioned at the back of the building.

Occupant Comfort:



Occupant comfort is shaped by the plot area and land shape variations, which determine the efficiency of spatial layouts and air circulation. This house optimizes natural ventilation through cross ventilation present in both the bedrooms and the living room. However, the toilet lacks sufficient ventilation, and its door faces the kitchen directly, making it less ideal for privacy and air circulation. According to SNI 03-1733-2004, the minimum floor area requirement for one adult is 8.7 m². In this house, the living room measures 13 m², sufficient to accommodate two adults. Bedroom 1 has an area of 8.27 m², meeting the standard for one adult, and the same applies to Bedroom 2 with a similar size.

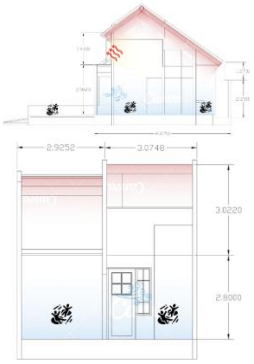
Harmony with Nature



Harmony with nature in this design is shaped by the configuration of open spaces, particularly the presence of gardens that offer access to green areas. The front garden spans 17 m², or 20.9% of the total plot area, meeting the minimum standard of 10–20% according to the Spatial Planning Law. The back garden provides visual access for Bedroom 2, while the front garden connects with the living room and Bedroom 1, fostering a connection with nature

in several areas. However, visual access for the kitchen and toilet remains limited due to their location at the rear of the building.

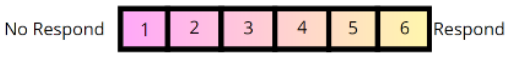
Table 4. Floor plan, elevation and section of house type 3

Floor Plan Type. 3	Elevation Type. 3	Section A-A & B-B Type. 3
		

Source: Drawings reproduced from a brochure by Bersatu Sukses Group

This T-36 house was constructed on a 66 m² plot with a building area of 29.9 m². It adhered to the building setback regulation, maintaining a distance of 5 meters from the road. The land shape was elongated inward, consistent with typical T-36 house designs, featuring the main opening at the front. Additionally, the house was positioned adjacent to other T-36 houses within its neighborhood.

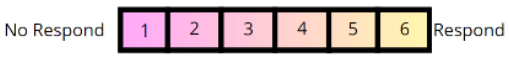
Natural Lighting:



Occupant comfort is influenced by the plot area and its shape, which affect the flexibility of space layouts and airflow. In this design, the bedrooms have direct access to outdoor areas, ensuring optimal air circulation and natural lighting. Bedroom 1 features a window area of 3.3 m², while the room itself measures 7.7 m², resulting in a window-to-room ratio of 42.8%, meeting the SNI 03-6572-2001 standard. Bedroom 2, with a window area of 1.6 m² and the same room size of 7.7 m², achieves a ratio of 20.7%, also complying with the requirements. The living room is designed to admit natural light through windows or doors, with a window area of 2.43 m² for a total room size of 11.32 m², yielding a 21.3% ratio that aligns with the SNI 03-6572-2001 standard.

The kitchen is placed outdoors to make the most of natural lighting. For the toilet, a skylight is added to introduce daylight into a typically low-light area. With a window area of 0.28 m² and a room size of 2 m², the toilet achieves a window-to-room ratio of 14%, which also fulfills the SNI 03-6572-2001 standard.

Occupant Comfort:



This house is designed with a compact and efficient layout, placing the living room as the central area for main activities. Accessibility between rooms is well-considered, connected by 90 cm-wide doors that allow smooth movement for residents. To ensure privacy, rooms like the bedrooms and toilet are equipped with non-windowed doors, maximizing privacy. Moreover, the toilet does not directly face the living room, kitchen, or other communal spaces, complying with SNI 03-6572-2001 standards.

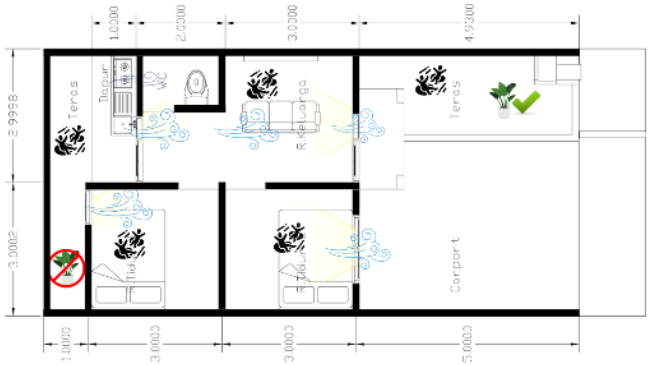
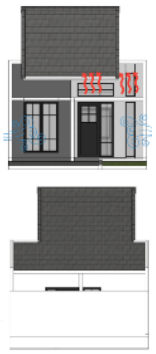
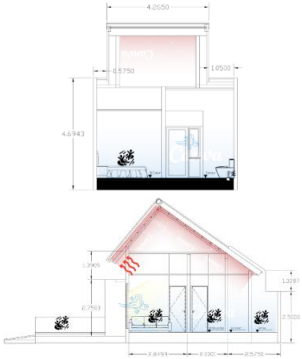
Regarding the minimum floor area per occupant, calculations show that the living room, measuring 11.31 m², can comfortably accommodate one adult, as the minimum standard per adult is 8.72 m² according to SNI 03-1733-2004. Similarly, Bedrooms 1 and 2, each with an area of 7.7 m², meet the requirement for one adult per room.

Harmony with Nature:

No Respond | 1 | 2 | 3 | 4 | 5 | 6 | Respond

Harmony with nature in this design is shaped by the configuration of open spaces, especially the presence of a front terrace and a rear open area that provide access to green spaces. The gardens in this house design are located at the front and rear, offering direct visual access to nature from various rooms. Bedrooms 1 and 2, along with the living room, all have views of the gardens, creating a fresh and unified atmosphere with nature. The total garden area reaches 15.09 m², covering approximately 20.9% of the total land area of 72 m², in compliance with the provisions of Law No. 26 of 2007 on Spatial Planning.

Table 5. Floor plan, elevation and section of house type 4

Floor Plan Type. 4	Elevation Type.4	Section A-A & B-B Type. 4
		

Source: Drawings reproduced from a brochure by Bersatu Sukses Group

This T-36 house was constructed on a 66 m² plot with a building area of 31.9 m². It complied with the building setback regulation, maintaining a distance of 5 meters from the road. The land shape was elongated inward, consistent with the typical design of T-36 houses, featuring the main opening at the front. Additionally, this house was positioned adjacent to other T-36 houses within the neighborhood.

Natural Lighting:

No Respond | 1 | 2 | 3 | 4 | 5 | 6 | Respond

Natural lighting in this residence is shaped by the configuration of open spaces and openings, particularly through front facade windows and openings in key rooms. The bedrooms are designed for maximum comfort with direct access to outdoor areas, ensuring optimal air circulation and natural lighting. Bedroom 1 features a window area of 3.5 m², while the room itself measures 7.35 m², achieving a window-to-room ratio of 47.6%, which complies with SNI 03-6572-2001 standards. Bedroom 2 has a window area of 1.6 m², with the room measuring 6.6 m², yielding a 24% ratio that also meets the required standards.

The living room allows natural light to enter through its windows or doors. The living room has a window area of 2.38 m² and a total room size of 11.7 m², resulting in a window-to-room ratio of 20.3%, which is in line with SNI 03-6572-2001. The kitchen is located outdoors, making full use of natural lighting.

Occupant Comfort:

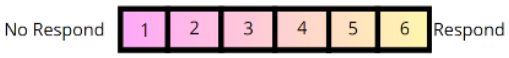
No Respond | 1 | 2 | 3 | 4 | 5 | 6 | Respond

Occupant comfort is influenced by the plot size and land shape variations, which determine the flexibility of spatial layouts and airflow. This house design prioritizes proper air ventilation by providing natural ventilation in bedrooms, the living room, and the kitchen to ensure optimal air circulation. In terms of privacy, rooms such as the bedrooms and the toilet are carefully designed to maintain sufficient privacy. The bedrooms do not directly face the

toilet, and the toilet is positioned away from the living room, kitchen, and other communal spaces, meeting the requirements stated in SNI 03-6572-2001.

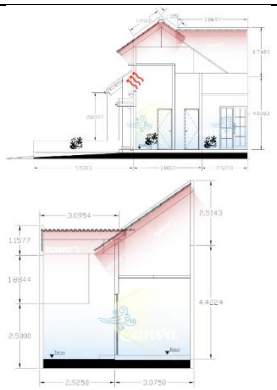
Regarding the minimum floor area per occupant, calculations indicate that the 13 m² living room can comfortably accommodate 1 to 2 people, adhering to the SNI 03-1733-2004 standard, which specifies a minimum of 8.57 m² per adult. Similarly, Bedrooms 1 and 2, each measuring 7.7 m², are sufficient to comfortably house one adult per room, also meeting the same standard. This design ensures occupant comfort in terms of privacy and compliance with applicable floor area standards.

Harmony with Nature:



Harmony with nature in this design is shaped by the configuration of open spaces, including a front terrace and a rear open area. The house features gardens situated both at the front and back, providing direct access to nature and fostering a fresh, soothing atmosphere. These gardens span 19 m², accounting for approximately 26.3% of the total 72 m² plot area, aligning with the provisions of Law No. 26 of 2007 on Spatial Planning. The design establishes a strong visual connection to nature, with Bedrooms 1 and 2, as well as the living room, enjoying direct views of the gardens.

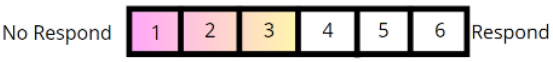
Table 6. Floor plan, elevation and section of house type 5

Floor Plan Type. 5	Elevation Type.5	Section A-A & B-B Type. 5
		

Source: Drawings reproduced from a brochure by Bersatu Sukses Group

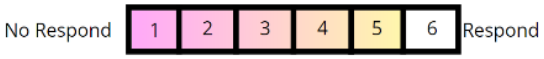
This T-36 house was constructed on a 72 m² plot with a building area of 31.97 m². It complied with the building setback regulation, maintaining a distance of 5 meters from the road. The land shape was elongated inward, consistent with the typical design of T-36 houses, featuring the main opening at the front. Additionally, the house was positioned adjacent to other T-36 houses within the neighborhood.

Natural Lighting:



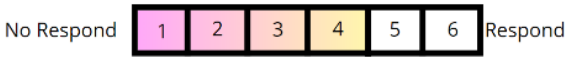
Natural lighting in this design is influenced by the configuration of open spaces and openings, primarily through windows. Bedroom 1 features a window area of 3.5 m², which is 47.6% of its total area of 7.35 m², meeting the requirements specified in SNI 03-6572-2001. However, Bedroom 2 lacks windows entirely. The living room has a window area of 3.8 m², covering 26.3% of its total area of 14.5 m², also complying with SNI 03-6572-2001 standards, though it is not equipped with a skylight. The indoor kitchen lacks active windows, which limits natural lighting, and the toilet also does not have any windows for either natural lighting or ventilation.

Occupant Comfort:



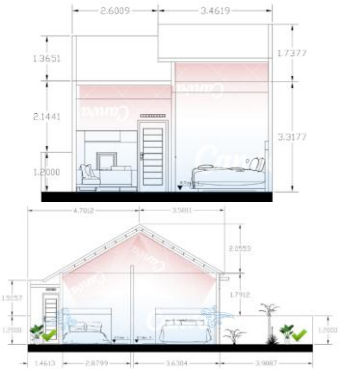
Occupant comfort is influenced by the plot size and variations in land shape, which determine the flexibility of spatial layouts and the effectiveness of natural ventilation. The toilet does not directly face the living room, kitchen, or other communal spaces, ensuring the design complies with the privacy standards outlined in SNI 03-6572-2001. For minimum floor area per occupant, the calculation for an ideal space for one adult is 6.85 m², based on the formula of air volume per person (24 m³) divided by ceiling height (3.5 meters). The living room, measuring 8.76 m², can comfortably accommodate 1 to 2 adults, adhering to the SNI 03-1733-2004 standard. Meanwhile, Bedrooms 1 and 2, each measuring 7.2 m², are sufficient to house one adult per room, complying with the same requirements. The kitchen, at 7.39 m², is also adequate for one person, meeting the SNI 03-1733-2004 standard.

Harmony with Nature:



Harmony with nature is influenced by the configuration of open spaces, particularly through the inclusion of a backyard garden and surrounding greenery. The gardens are located at the front and alongside the rear terrace, with a total area of 15.86 m², accounting for approximately 22.02% of the total 72 m² plot size. While these gardens meet the requirements set forth in Law No. 26 of 2007, both the front and rear gardens lack sufficient vegetation density. From Bedroom 1, there is a pleasant view of the garden, enhancing its connection to nature. However, Bedroom 2 lacks any visual connection to the garden due to the absence of windows. The backyard garden is designed as an outdoor dining area, offering a harmonious and refreshing atmosphere at the rear of the house.

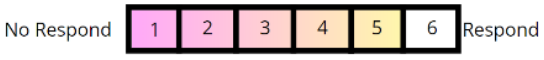
Table 7. Floor plan, elevation and section of house type 6

Floor Plan Type. 6	Elevation Type. 6	Section A-A & B-B Type. 6
		

Source: Drawings reproduced from a brochure by Pesona Lilin Residence

This T-36 house was constructed on an 84 m² plot with a building area of 33.4 m². It adhered to the building setback regulation, maintaining a distance of 4 meters from the road. The land shape was elongated inward, consistent with the typical design of T-36 houses, featuring the main opening at the front. Additionally, this house was positioned adjacent to other T-36 houses within the neighborhood.

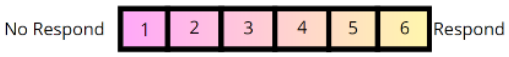
Natural Lighting:



Natural lighting in this design is shaped by the configuration of open spaces and openings. Bedroom 1 features a window area of 1.5 m², which accounts for 13.9% of its total area of 10.8 m², meeting the requirements of SNI 03-6572-2001. Similarly, Bedroom 2 has a window area of 0.75 m², which constitutes 8.3% of its total area of 9 m², and also complies with the standard.In the living room, the window area is 1.5 m², covering 12.7% of its total area of

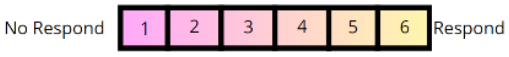
11.76 m², fulfilling the requirements of SNI 03-6572-2001. However, the kitchen and toilet lack any openings or windows for natural ventilation, which could negatively impact indoor air quality.

Occupant Comfort:



Occupant comfort is influenced by the plot size and the variations in land shape, which determine the flexibility of spatial layouts and the effectiveness of natural ventilation. The living room is positioned near the main entrance, serving as the central hub that connects various spaces within the house. Bedrooms 1 and 2 are located on opposite sides, creating distinct private areas separate from the living room, thereby enhancing privacy. The toilet does not directly face the living room, kitchen, or other communal spaces, ensuring that the design complies with the privacy standards outlined in SNI 03-6572-2001. Based on a calculation using an air volume of 24 m³ divided by a ceiling height of 2.8 meters, the required floor space per person is approximately 8.5 m². The living room, with an area of 13.8 m², can comfortably accommodate 1 to 2 adults, adhering to SNI 03-1733-2004. Bedroom 1, measuring 10.84 m², and Bedroom 2, measuring 9.31 m², are each sufficient for one person, also complying with the same standards.

Harmony with Nature:

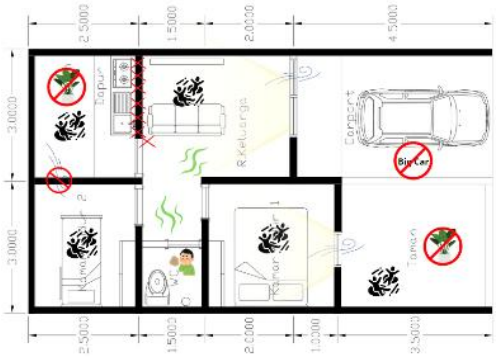
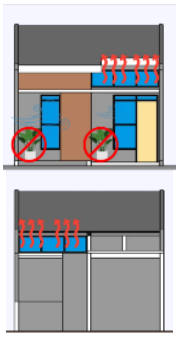
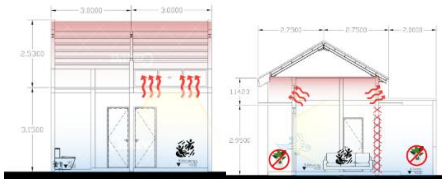


Harmony with nature is enhanced by the configuration of open spaces, particularly through the front garden and surrounding greenery. The garden is thoughtfully designed so that all bedrooms, the living room, and the kitchen have direct visual access to it, fostering a strong connection with nature. Each room benefits from calming green views, creating a comfortable and refreshing atmosphere. With a garden area of 26.54 m², comprising 31.5% of the total land size of 84 m², this green space meets the requirements stipulated in Law No. 26 of 2007, providing optimal open green areas around the house.

Group Two: Houses with Toilet Positioned Between Two Bedrooms

Group Two, featuring houses with toilet positioned between two bedrooms as depicted in the house plan from Table 8 and Table 9, represents Types 7 and 8.

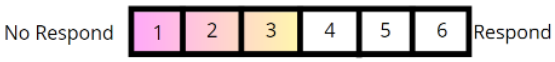
Table 8. Floor plan, elevation and section of house type 7

Floor Plan Type.7	Elevation Type.7	Section A-A & B-B Type.7
		

Source: Drawings reproduced from a brochure by Waru Selia

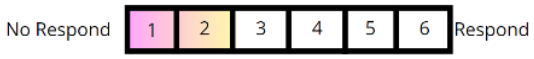
This T-36 house was constructed on a 63 m² plot with a building area of 32.95 m². It complied with the building setback regulation, maintaining a distance of 3.5 meters from the road. The land shape was elongated inward, consistent with the typical design of T-36 houses, featuring the main opening at the front. Additionally, the house was positioned adjacent to other T-36 houses within the neighborhood.

Natural Lighting:



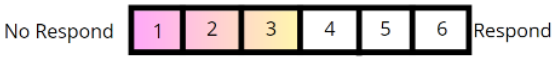
The bedrooms (Bedroom 1 and 2) in this design do not have sufficient windows for natural lighting, falling short of the standards specified in SNI 03-6572-2001. The living room, on the other hand, has an adequately sized window area of 1.79 m², which constitutes 12.7% of the room's total area, surpassing the SNI 03-6572-2001 requirement of at least 5% of the room's area. The kitchen benefits from abundant natural lighting as it is situated in the backyard. However, the toilet lacks any windows, resulting in no provision for natural lighting or ventilation. From the building's layout and section, natural lighting primarily enters through openings at the front and rear, leaving the central part of the house with limited light. The lack of flexibility in the land's proportions (length-to-width ratio) further exacerbates the uneven distribution of natural lighting across the house.

Occupant Comfort:



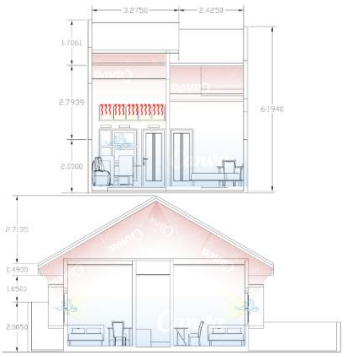
Air ventilation in the bedrooms is insufficient due to the lack of fresh air access, particularly in the bathroom. This contributes to unpleasant odors in the toilet, which are exacerbated by inadequate ventilation. The living room has limited ventilation as well, with windows only on one side of the room, preventing cross ventilation. As per SNI 03-1733-2004, the minimum floor area required per adult is 9.6 m², and for children, it is 4.8 m². In this residence, the living room, with an area of 11.57 m², is adequate for accommodating two adults. However, Bedroom 1, at 6.46 m², and Bedroom 2, at 6.3 m², fall short of the standard for adults. Additionally, Bedroom 2, with its area divided between 8 m² and 6.44 m², provides space for only one occupant uncomfortably, thus failing to meet SNI 03-1733-2004 guidelines.

Harmony with Nature:



The windows in the bedrooms and the living room face areas without views, failing to provide good visual access to the outdoors. While there is some greenery around the building, the open green space accounts for 20.2% of the total land area, meeting the 2007 Spatial Planning Law requirement of 10-20%. However, the limited visual connection to the outside restricts residents from feeling fully connected with nature. Additionally, wind movement, which impacts occupant thermal comfort, is influenced by the configuration of open spaces. In this house, the lack of cross-ventilation openings and minimal open spaces at the sides of the house limit airflow, leading to air stagnation.

Table 9. Floor plan, elevation and section of house type 8

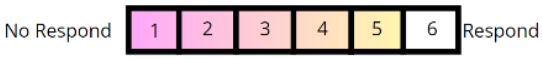
Floor Plan Type. 8	Elevation Type. 8	Section A-A & B-B Type. 8
		

Source: Drawings reproduced from Aswan Putra

This T-36 house was constructed on a 75 m² plot with a building area of 31.68 m². It adhered to the building setback regulation, maintaining a distance of 3.7 meters from the road. The land shape was elongated inward, which

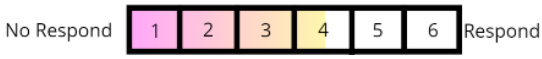
aligned with the typical layout of T-36 houses, featuring the main opening at the front. Additionally, the house was positioned adjacent to other T-36 houses within the neighborhood.

Natural Lighting:



Natural lighting in this design is influenced by the configuration of open spaces and openings, particularly through windows in the living room and bedrooms. The windows in Bedrooms 1 and 2 have a combined area of 1.75 m², which is 19.5% of the total area of both rooms (9 m²), meeting the standards outlined in SNI 03-6572-2001. In the living room, the window area is 11.4 m², accounting for 84% of the room's total area of 13.36 m², also complying with SNI 03-6572-2001 requirements. The kitchen, being located outdoors, benefits from excellent natural ventilation and lighting. However, the toilet lacks provisions for natural lighting, which could impact its functionality and comfort.

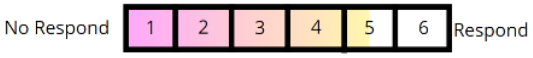
Occupant Comfort:



Occupant comfort is heavily influenced by the plot size and land shape variations, which determine the flexibility of spatial layouts and the effectiveness of natural ventilation. The layout of this house employs an open-plan concept for the living room, which not only creates a spacious impression but also enhances comfort by improving spatial efficiency. However, there is an issue with the toilet, as airflow around the area is inadequate, potentially causing odors that may affect occupant comfort. From a privacy standpoint, the toilet's location directly facing the living room, kitchen, or other communal spaces does not comply with the privacy standards outlined in SNI 03-6572-2001.

For minimum floor area per occupant, calculations based on an air volume of 24 m³ divided by a ceiling height of 3.2 meters result in a requirement of approximately 7.5 m² per person. The living room, with an area of 13.36 m², can comfortably accommodate 1 to 2 people, meeting the SNI 03-1733-2004 standard. Similarly, Bedroom 1, at 7.9 m², and Bedroom 2, at 7.2 m², are each sufficient to comfortably house one person, also complying with the same standards.

Harmony with Nature:

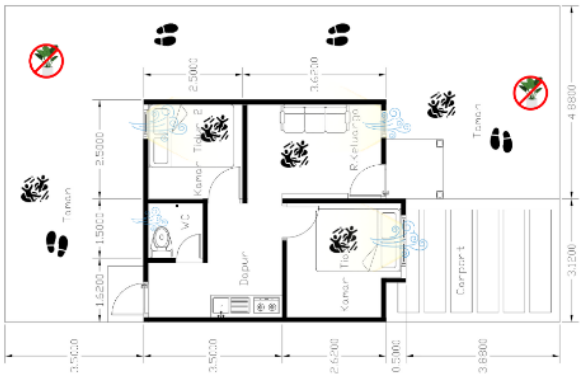
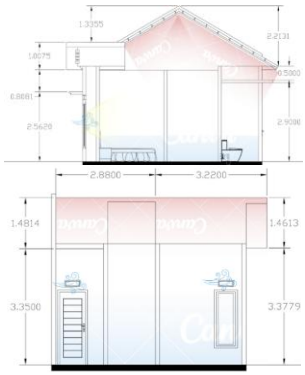


Harmony with nature is supported by the open space configuration, primarily through the front garden and the greenery surrounding the house. This house features two garden areas, the front and rear gardens, with a total area of 20.64 m², which constitutes 27.52% of the total 75 m² plot. This satisfies the requirements set out in Law No. 26 of 2007, ensuring adequate green space. The design employs an open-plan concept for the living and dining areas, merging them into a single, spacious environment. This layout not only enhances the sense of openness but also improves functionality. All rooms, except the toilet, have direct views of the gardens, fostering a stronger connection with nature and creating a serene and refreshing living atmosphere.

Group Three: Houses with Non-aligned Bedrooms

Group Three, featuring houses with non-aligned bedrooms as depicted in the house plans from Table 10 to Table 11, represents Types 9 to 10.

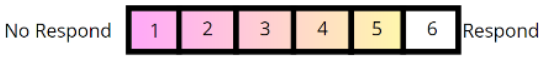
Table 10. Floor plan, elevation and section of house type 9

Floor Plan Type. 9	Elevation Type. 9	Section A-A & B-B Type. 9
		

Source: Drawings reproduced from a brochure by Kayura Grand Residence

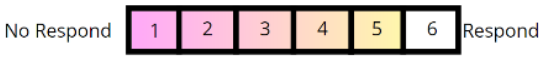
This T-36 house was built on a 112 m² plot with a building area of 32.6 m². It adhered to the building setback regulation, maintaining a distance of 3.8 meters from the road. The plot shape was elongated inward, typical of T-36 houses, with the main opening at the front. The house was also situated adjacent to other T-36 houses in the neighborhood.

Natural Lighting:



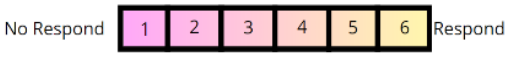
Natural lighting in this design is influenced by the configuration of open spaces and openings. The living room features a window area of 1 m², which constitutes 11% of the total room area of 9 m², meeting the requirements set forth in SNI 03-6572-2001. In Bedroom 1, the window area is 2.13 m², accounting for 27.4% of the room's total area of 7.8 m², also complying with SNI 03-6572-2001. Similarly, Bedroom 2 has a window area of 1.07 m², which represents 17.2% of its total area of 6.25 m², fulfilling the same standard. However, the kitchen lacks openings or windows for natural ventilation and lighting. In the toilet, the existing window has an area of only 0.08 m², covering merely 3.5% of the total toilet area of 2.25 m², falling short of SNI 03-6572-2001 requirements. This indicates that the placement and sizing of openings and windows are not yet optimized in certain areas, such as the kitchen and toilet, which can significantly affect the quality of natural lighting and ventilation.

Occupant Comfort:



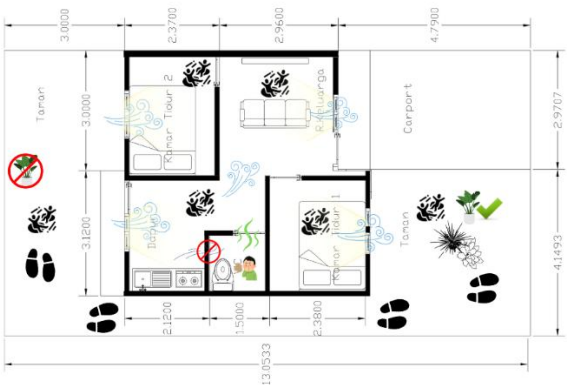
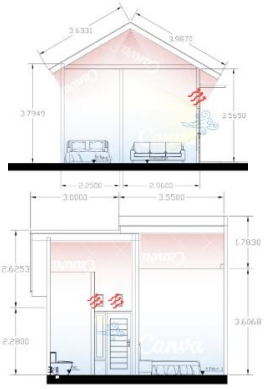
Occupant comfort is significantly influenced by the plot size and shape variations, which affect the flexibility of room layouts and the effectiveness of natural ventilation. From a land proportion standpoint, the relatively balanced length-to-width ratio of this house allows for effective cross ventilation, enabling optimal air circulation throughout the home. The floor plan has been designed with the potential for cross ventilation, enhancing airflow and overall indoor air quality. However, in terms of privacy, the toilet's placement, facing the living room, kitchen, or communal spaces, does not comply with the privacy standards outlined in SNI 03-6572-2001.For minimum floor area per occupant, calculations based on an air volume of 24 m³ and a ceiling height of 3.5 meters indicate a requirement of approximately 6.85 m² per person. The living room, with an area of 11 m², comfortably accommodates 1 to 2 people, meeting SNI 03-1733-2004 standards. However, Bedrooms 1 and 2, each with an area of 6.25 m², can only accommodate one person each with limited comfort, falling short of the 7.5 m² per person standard specified in SNI 03-1733-2004.

Harmony with Nature:



Harmony with nature is beautifully reflected in the configuration of open spaces, particularly through the interconnected front and rear gardens. These gardens create a broad and integrated open space, enabling seamless interaction with the surrounding greenery from every room in the house. This thoughtful design not only provides delightful natural experiences but also enhances residents' quality of life by offering space for various outdoor activities. With a total area of 60.33 m², these gardens comprise 53% of the 112 m² plot, fulfilling the requirements of Law No. 26 of 2007. The gardens serve not only as aesthetic features but also as functional areas that enrich the daily living environment of the occupants

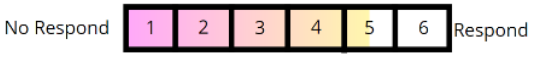
Table 11. Floor plan, elevation and section of house type 10

Floor Plan Type. 10	Elevation Type.10	Section A-A & B-B Type. 10
		

Source: Drawings reproduced from a brochure by Mangun Jaya

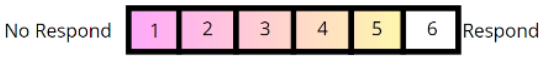
This T-36 house was constructed on a 92 m² plot with a building area of 32.07 m². It adhered to the building setback regulation, maintaining a distance of 4.5 meters from the road. The elongated land shape was characteristic of T-36 houses, with the main opening located at the front. The house was also situated alongside other T-36 houses in the neighborhood, creating a cohesive residential arrangement.

Natural Lighting:



Natural lighting in this design is influenced by the arrangement of open spaces and openings, particularly through windows in the living room and bedrooms. Bedroom 1 is equipped with a window area of 0.56 m², representing 8.5% of the room's total area of 6.56 m², meeting the SNI 03-6572-2001 standards. Similarly, Bedroom 2 has an identical window size of 0.56 m², which constitutes 9.3% of its total area of 6 m², also complying with the standard. These bedroom windows face directly toward the garden, providing ample natural light. In the living room, the window area is 0.56 m², accounting for 6.2% of the room's total area of 9 m², fulfilling SNI 03-6572-2001 requirements despite the absence of a skylight. The kitchen features the same window area of 0.56 m², covering 9.3% of its total area of 6 m², thereby meeting the standard as well. However, the toilet lacks openings or windows for natural ventilation, which may impact air circulation and lighting quality.

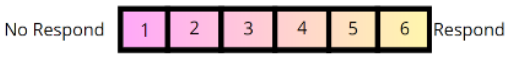
Occupant Comfort:



Occupant comfort is influenced by the plot size and land shape variations, which directly impact the flexibility of room layouts and the effectiveness of natural ventilation. The house layout includes room doors with a width of 90 cm, facilitating ease of movement between rooms for the residents. However, air quality inside the house is less

than optimal due to the lack of natural ventilation or air circulation in the toilet, which may result in unpleasant odors. From a privacy perspective, the toilet's location facing the living room, kitchen, or other communal spaces does not meet the privacy standards outlined in SNI 03-6572-2001. In terms of minimum floor area per occupant, calculations based on an air volume requirement of 24 m^3 per adult and a ceiling height of 3 meters indicate a need for about 8 m^2 per person. The living room, with an area of 8.76 m^2, comfortably accommodates one adult, complying with SNI 03-1733-2004. Bedrooms 1 and 2, each with an area of 7.1 m^2, are also sufficient to accommodate one adult each, meeting the standards outlined in SNI 03-1733-2004.

Harmony with Nature:



The harmony with nature in this house design is enhanced by the configuration of open spaces, particularly through the interconnected front and rear gardens. Together, these gardens cover a total area of 42 m^2, which constitutes 46% of the total land size of 91 m^2. This fulfills the requirements of Law No. 26 of 2007 regarding green spaces. The visual and physical connection with these garden areas provides excellent access to open spaces, allowing residents to enjoy the outdoors while supporting optimal air circulation throughout the property. The thoughtful integration of the gardens adds to the overall quality of life for occupants, ensuring a seamless connection with the natural environment.

In summary, the results of this analysis indicate that among the 10 houses reviewed, House Type 3 has the best performance in terms of natural lighting. House Type 4 demonstrates the most evenly distributed natural lighting, where all rooms receive sufficient daylight. In terms of occupant comfort, the best results are found in House Types 3, 4, and 6. These types offer spatial arrangements that support privacy, including toilets that have access to outdoor ventilation, preventing unpleasant odors from spreading inside the house. House Types 6 and 9 provide additional comfort due to their larger land area, which allows for more spacious gardens. Regarding harmony with nature, House Types 3, 4, 6, 9, and 10 perform the best. These houses feature generous garden spaces and well-organized layouts that allow each room to have direct access to nature. In other words, the first and third groups are the most supportive of healthy living, as they best fulfill the criteria of natural lighting and harmony with nature. The table below summarizes the analysis above.

Table 12. Summary of Analysis

Group One: Both Bedrooms Aligned			
Paola Sassi			
a. Natural Lighting	Type 1 : Likert 4,5	Type 2 : Likert 5	Type 3 : Likert 6
	Type 4 : Likert 6	Type 5 : Likert 3	Type 6 : Likert 5
b. Occupant Comfort	Type 1 : Likert 3	Type 2 : Likert 3	Type 3 : Likert 6
	Type 4 : Likert 6	Type 5 : Likert 5	Type 6 : Likert 6
c. Harmony with Nature	Type 1 : Likert 4	Type 2 : Likert 3	Type 3 : Likert 6
	Type 4 : Likert 6	Type 5 : Likert 4	Type 6 : Likert 6
SNI / UU			
a. SNI-03-6572-2001	Type 1 : Likert 4,5	Type 2 : Likert 5	Type 3 : Likert 6
	Type 4 : Likert 6	Type 5 : Likert 3	Type 6 : Likert 5
b. SNI-03-1733-2004	Type 1 : Likert 3	Type 2 : Likert 6	Type 3 : Likert 6
	Type 4 : Likert 6	Type 5 : Likert 5	Type 6 : Likert 6
c. UU No 26 Tahun 2007	Type 1 : Likert 4	Type 2 : Likert 3	Type 3 : Likert 6
	Type 4 : Likert 6	Type 5 : Likert 4	Type 6 : Likert 6
Group Two: Toilet Positioned Between Both Bedrooms			
Paola Sassi			
a. Natural Lighting	Type 7 : Likert 3	Type 8 : Likert 5	
b. Occupant Comfort	Type 7 : Likert 2	Type 8 : Likert 3,5	
c. Harmony with Nature	Type 7 : Likert 3	Type 8 : Likert 4,5	
SNI / UU			
a. SNI-03-6572-2001	Type 7 : Likert 3	Type 8 : Likert 5	
b. SNI-03-1733-2004	Type 7 : Likert 2	Type 8 : Likert 3,5	
c. UU No 26 Tahun 2007	Type 7 : Likert 3	Type 8 : Likert 4,5	

Group Three: Bedrooms Not Aligned		
Paola Sassi		
a. Natural Lighting	Type 9 : Likert 5	Type 10 : Likert 4,5
b. Occupant Comfort	Type 9 : Likert 5	Type 10 : Likert 5
c. Harmony with Nature	Type 9 : Likert 6	Type 10 : Likert 6
SNI / UU		
a. SNI-03-6572-2001	Type 9 : Likert 5	Type 10 : Likert 4,5
b. SNI-03-1733-2004	Type 9 : Likert 5	Type 10 : Likert 5
c. UU No 26 Tahun 2007	Type 9 : Likert 6	Type 10 : Likert 6

CONCLUSION

The conclusion of the analysis based on Paola Sassi's, SNI-03-6572-2001, SNI-03-1733-2004, and Law No. 26 of 2007 principles for this design was that most of the samples reviewed had successfully accommodated important aspects such as natural lighting, occupant comfort, and access to nature. Type 7 in Group Two (Toilet Positioned Between Both Bedrooms) performed the worst among evaluated designs, receiving the lowest Likert scale scores due to significant issues in occupant comfort and compliance with national standards (SNI). Its design struggled with ventilation and privacy, likely aggravated by the central toilet placement, which impacted both noise levels and airflow. Furthermore, it failed to meet SNI requirements for natural lighting (SNI 03-6572-2001) and minimum floor area per occupant (SNI 03-1733-2004). Although Type 8 fared slightly better, it still exhibited moderate ventilation challenges and partial compliance with SNI standards, highlighting room for improvement in spatial configurations and lighting optimization. Both designs could have been enhanced through better ventilation strategies, such as skylights, and improved spatial planning to boost occupant comfort and adhere to regulations.

Successful house designs in creating occupant comfort utilized optimal ventilation design, including ceilings higher than 2.5 meters for air circulation. In addition, the use of open-plan living and dining spaces, along with front and back gardens, supported the well-being of the residents. Houses that failed to provide occupant comfort often had layouts that were overly dense or cramped, as well as inadequate ventilation designs, which frequently resulted in discomfort. The lack of space for cross ventilation or sufficient open areas for airflow made the house feel stuffy and uncomfortable, especially in housing types located in densely populated areas.

Houses that succeeded in providing access to nature typically had designs that harmoniously connected indoor and outdoor spaces, such as terraces, balconies, or windows covering a minimum of 5% of the floor area facing gardens or backyards. The presence of green open spaces around or within the house itself, such as vertical gardens or small backyard gardens, offered residents both visual and physical access to nature. This study yielded positive results for T-36 houses analyzed based on Paola Sassi's three principles, as well as regulations such as SNI 03-6572-2001, SNI 03-1733-2004, and Law No. 26 of 2007. However, the study had certain limitations as it focused solely on lighting and ventilation analysis based on existing regulations. Therefore, future research could have included interviews with residents or buyers of T-36 houses to gain a more comprehensive perspective on the effectiveness of spatial configuration on health and occupant comfort. Furthermore, future studies could have explored indoor facilities to enrich understanding of their impact on the psychological and emotional aspects of residents. Thus, the results of this study were expected to serve as a valuable reference for academics and practitioners in planning sustainable, healthy housing designs.

REFERENCES

D'Onofrio, R., & Trusiani, E. (2018). *Urban Planning for Healthy European Cities*. Springer.

Gianto, U. (2012). *Bangunan Tipe 36 Lebih Diminati Konsumen*. Hukum Online. Retrieved from https://www.hukumonline.com/berita/a/bangunan-tipe-36-lebih-diminati-konsumen-lt4f97e955c526f/?page=2.

Greene, L. and DeYoung, A. (2023). *Light & Ventilation — Rules & Regulations*, Expert On Improving Your Home, USA. Retrieved from https://todayshomeowner.com/general/guides/light-ventilation-rules-regulations/

Group Bersatu Sukses. (2023). *Taman Anggun Sejahtera*, BSG, Surabaya.

Hardianti, S., Hastuty, M., Agnesia, Y., and Kumalasari, R. (2021). *Analisis Kondisi Rumah dan Perilaku Hidup Bersih dan Sehat pada Tatanan Rumah Tangga di Desa Bangun Sari Kecamatan Kampar Kiri Hilir*, Universitas Pahlawan Tuanku Tambusai, Riau.

Independent. (2008). *Paola Sassi: Home is where the hearth isn't.* The Independent. Retrieved from https://www.independent.co.uk/climate-change/news/paola-sassi-home-is-where-the-hearth-isn-t-784826.html

Kepmen Kimpraswil. (2002). *Pedoman Umum Rumah Sederhana Sehat*. Jakarta: PUPR.

Keputusan Menteri Kipraswil (2002). *Keputusan Menteri Kimpraswil Nomor 403/KPTS/2002 tentang Rumah Sederhana Sehat*. Jakarta: PUPR.

Kementerian Pekerjaan Umum dan Perumahan Rakyat. (2024). *Laporan kebutuhan perumahan di Indonesia*. Jakarta: PUPR

Kementerian Kesehatan. (2016). *Peraturan Menteri Kesehatan Nomor 39 Tahun 2016: Pedoman Penyelenggaraan Program Indonesia Sehat dengan Pendekatan Keluarga*, Jakarta: Kementerian Kesehatan.

Rice, L., & Drane, M. (2020). Indicators of Healthy Architecture—A Systematic Literature Review. *University of the West of England*, Bristol.

Sassi, P. (2006). *Strategies for Sustainable Architecture*. Taylor & Francis, USA & Canada.

Sassi, P. (2008). *Defining Closed-Loop Material Cycle Construction*. Department of Architecture, Oxford Brookes University, Gipsy Lane, Oxford, UK.

Syahriza, M. A., Setiawan, A., & Survanti, N. (2023). *Pengaruh Desain Bukaan sebagai Optimalisasi Sirkulasi Udara dalam Ruang*. Sustainability and Resilience in the Future of Urban and Rural Living, Yogyakarta.

United States Environmental Protection Agency (EPA). (n.d.). *Introduction to indoor air quality*. Retrieved February 8, 2025, from https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality

Zhai, Z. (2020). *Facial Mask: A Necessity to Beat COVID-19*. Building and Environment, *175*, 106827. https://doi.org/10.1016/j.buildenv.2020.106827.