

The Concept of Cross Ventilation in the Type of House Growing Model 21m²

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Conference Paper

The Concept of Cross Ventilation in the Type of House Growing Model 21m²

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Abstract

21 m² type housing is a house provided by the developer with a limited area. The available space is very limited both in terms of area and type of space that is only one bedroom, bathroom and shared space. While the activities that occur in the process of inhabiting are quite numerous and complex. This is what causes nearly 90% of residents of type 21m² homes to renovate / add space to their homes. In the field observations, it was found that 86% of the 21m² residents of the houses who had renovated their houses had not paid attention to the matter of natural ventilation so that their occupancy felt hot. For this reason, we need a cross-brushing concept on a 21m² type of home design growth model that provides a solution in terms of effective ventilation design in order to optimize natural ventilation in buildings. In this research, the method used is descriptive exploratory method that is describing the object as it is, namely some studies of the shape and position of the occupancy of a residential type 21m² that has undergone renovation. Then the data is analyzed qualitatively and quantitatively to clarify the qualitative. In accordance with the purpose of the research, which is to find the concept of cross-sectioning on a 21m² residential growth model design model, a deeper survey was conducted, measurements and data collection through cameras and sketches. The results showed several cross-air concepts in the home design model of growth with optimal openings design analysis in terms of natural ventilation. The concept of cross handling in a 21m² type of growing house will benefit the comfort of residents of a 21m² type of house as well as various parties both the general public, residents, developers and researchers in the field of housing and interior.

Keywords: cross ventilation, house growing, type 21m²

Introduction

Reservation in a residential home is a basic need that determines the comfort of residents and creates a healthy home. However, in some houses in the city the air in this house cannot be fulfilled ideally. Some communities can only reach cheap land with minimal area, one of which is 21 m². This is due to the density of land so it is not possible for open space in the back of the house. The absence of perforation angina or windows on the back causes the air cannot flow alternately. Room conditions in the house become hot, humid and musty. In a small type of house, openings that are used to enter the light also function for air circulation and reduce moist air in the house (Ashadi *et al.*, 2016).

Movement of air flowing inside the house can be produced by utilizing the wind depending on the orientation and arrangement of the hole where the wind enters. For a building to produce cross ventilation, holes or openings must be made on the opposite side (Lippsmeier, 1980). Ventilation is the process of naturally flowing clean air from outside the room into the room and removing less clean air

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from inside the room to the outside space. The process of air flow is obtained by utilizing the difference in temperature and pressure in space. However, there are limitations in the flow of air into the space that is done naturally that is not controlled by the size of the incoming wind. The design of the openings, placement of doors, windows and ventilation can control the entry of air as desired (Pudjiastuti *et al.*, 1999). Cross ventilation is an important factor for the creation of room comfort, especially for buildings in humid tropical regions. The position of the building that crosses the direction of the wind takes precedence over protection against sunlight. Because by putting as much wind into the room will cool the room inside the house and heat inside the house due to solar radiation will be blown out.

In most 21m² houses, they do not use a cross ventilation system but instead use one sided ventilation. One-sided ventilation is that openings are only placed on one side of the room. The air that enters the room depends only on turbulent fluctuations and fresh air cannot be ensured to enter the room continuously and the room feels hot. To overcome this usually by making openings large enough so that air can enter freely and move naturally to follow the flow from lower temperatures to higher temperatures. Therefore, to overcome the inconvenience of ventilation, a cross-ventilation concept in the design model of a growing house of type 21m² is needed in order to optimize the natural ventilation of the building. With the achievement of space comfort both in terms of function and in terms of natural ventilation, it is expected that activities that can be carried out in the house will be more optimal (Mauliani L & Sudarwati, 2018).

Research Method

In this research, the method used is descriptive exploratory method that is describing the object as it is, namely several studies of the shape and position of the occupancy of a 21m² type house that has undergone renovation. Descriptive understanding is a form of research to describe phenomena that occur both natural and artificial that can be in the form of activities, characteristics, changes, similarities and differences between phenomena. Then the data is analyzed qualitatively and quantitatively to clarify the qualitative. In accordance with the purpose of the research, which is to find the concept of cross-sectioning on a 21m² type of housing growth model design, a deeper survey, measurement and data collection through cameras or sketches were taken. Observations were made on 10 21m² type house objects that have undergone renovation. The method of taking an object as a research sample is done by purposive sampling, namely the selection of samples with specific objectives.

Result and Discussion

The house type 21m² is the object of research because of its quite unique characteristics, namely the existence of two sides of needs that must be met. A 21m² type of house must meet the requirements for occupancy while on the other hand the needs of the occupants evolve over time, meaning that in addition to meeting the requirements must also pay attention to the comfort of the occupants. Comfort can be obtained one of them from the aspect of air. The air that is meant here is a natural air that is obtained from the outside air. The ideal size of an opening in natural ventilation is an opening of at least 20% of LT and a minimum of 5% of LT. At the time of sampling there were a number of conditions that did not support, for example a house facing east west. Direct sunlight into the room and make it less comfortable. Another problem is the position of the house which is directly attached to the neighbors. Airing can only enter through the front and back yards. At the time of the renovation they did not think about the natural ventilation that occurred so that most of the tightly closed backyard area so the room felt stuffy of the ten cases observed it was found that 86% of occupants did not think of natural ventilation that could enter the room. This is indicated by the addition of full space in the backyard. They do not provide openings or

back garden because indeed the available land is not extensive. Additional space in the backyard area is the bedroom, kitchen, and some supporting space.

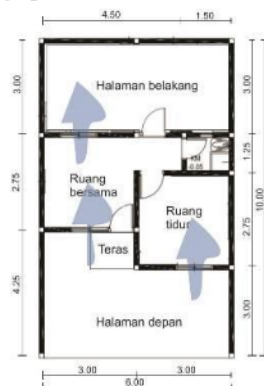


Figure 1. The ventilation of existing houses is 21m²

In Figure 2, additional space is visible at the back which does not get natural air flow due to the absence of openings that can enter the outside air. So, the room feels stuffy and humid. In the bathroom there are also no openings as a place to enter the air. This results in the bathroom becoming damp and lots of germs. In a small type of simple house, especially for those located in the middle, the bathroom should be an important concern in terms of air conditioning. The bathroom must also get natural air to be a healthy and comfortable bathroom. If you cannot get from the side, you must try to get air in through the top of the bathroom (Ashadi *et al.*, 2017).

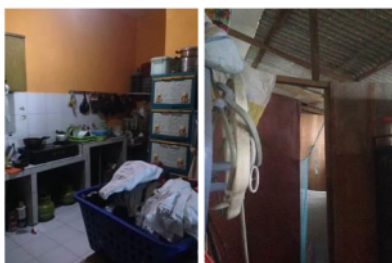


Figure 3. Photo of the back of a renovated 21m² type house

The solution that can be given to homes that have been renovated but not yet maximal in terms of airworthiness is to make openings towards the top to enter the air and light.

The Concept of Cross Ventilation in a 21m² Type Growing House Model

A house that applies the concept of cross ventilation requires having openings that can enter and release the wind and drain hot air out of the room. In a 21m² type house which has minimal land area and building and no openings that can be placed in the right or left position of the house making it difficult to achieve comfort in the house. The application of the concept of cross ventilation, for example, by raising the ceiling, making openings as optimal as possible towards open space, making open space in the back, making perforations placed at the top such as the bouvenlight to anticipate the conditions of the wall clinging. It also can be made perforation on the top of the roof by designing a pile roof so that the wind can get into the roof and will impact on cooling the space. The pattern of the spatial structure can also

affect the movement of wind that enters the house. Good spatial patterning will provide an opportunity for the wind to move freely throughout the interior of the house.

In the 21 m² type house there is a core space provided by the developer including a shared room, a bedroom and a bathroom. In the concept of a growing house there are three stages of developing a 21m² type house, among others:

1. Stage 1, the addition is carried out horizontally in the area behind the core house, which is the change in the function of the backyard. room added to the back area is the kitchen. The addition of the kitchen must still pay attention to natural air conditioning and try not to cover the flow of air or sunlight entering the core of the house either through the bedroom or shared space by using a partition with a height of half, so that air can still flow into the core house. In addition to the kitchen that can be added to the rear area is the bedroom. The addition of an effective bedroom is when it can still be associated with the backyard and can still enter the air into the room.
2. Stage 2, namely adding horizontally to the front area of the core house. Space that can be added is the living room, garage and bedroom. The addition of the living room is placed in the front yard area, with the sharing of space with the garage or on the opposite side of the garage. The living room partition is arranged not to be covered but has a roof and floor. This is because the nature of the living room as a public space and must be able to enter the air into the core house. The addition of sleeping space is done if the number of occupants increases. However, the addition of sleeping space must still pay attention to the health and comfort of the core home.
3. Stage 3, which is the last addition that can be done by residents by adding vertically. At this stage 3 a large amount of funds is needed compared to stages 1 and 2. At stage 3 the demolition of the roof, the addition of walls, the casting of the floor are carried out. But do not demolish the construction stages 1 and 2 to achieve effectiveness in the process of growing houses. Some space is added, among others, the bedroom, shared space, drying room and KM. The stairwell area needs to be planned with not much demolition of partitions on the 1st floor so that in addition to achieving effective construction of a growing house it can also be maximized comfort of residents in their daily activities. Natural care must also be taken into account when planning additional space vertically. Because it will also affect the facade of the appearance of the house after renovation.

Of the three stages of the house growing model, we are provided with several ventilation models for the 21m² type of growing house, including:

a. *Ventilation model at home grown 1a (land area 60m²)*

In model 1a for the existing building area of 21m² and land area of 60 m² (6m x 10m). The position of the shared room is more advanced than the position of the room. The location of the bathroom is next to the shared room. While the backyard is an empty land with an area of 3m x 6m. The front yard is an empty land with an area of 3m x 6m.



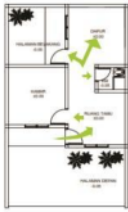


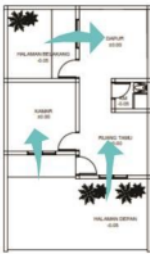
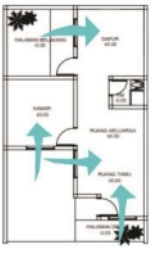
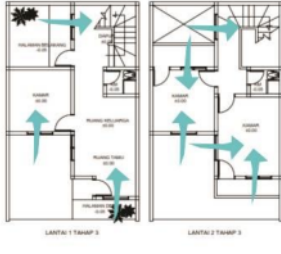
Figure 4. House plans of type 21m² growth with 60m² land area (from left to right: stage 1,2,3)



Figure 5. Front view of a house growing type 21m2 with a land area of 60m2 (from left to right: stage 1,2,3)

In stage 1, cross-over handling is implemented while still providing open space in the backyard, so that additional kitchen space can still get fresh air flowing from the backyard. Whereas in stage 2 the addition of the living room on the front yard remains by providing openings in the front wall so that air can enter the room. At stage 3 on the 2nd floor a hole or void is made in the back area straight with the back garden on the 1st floor so that air can flow directly into the 1st and 2nd floors of the building.

Table 1. Ventilation and home lighting analysis Model 1a

	Stage 1	Stage 2	Stage 3
Circulation			
Information	Circulation is still less comfortable in the bedroom door area, because when there are guests residents disturbed when entering and leaving the room	The addition of the living room in the front area provides a solution to the circulation in and out of the room. Giving a dividing partition between the living room and family room also adds comfort and privacy	Circulation is quite comfortable with the placement of stairs in the back area so that it is more private and free.
Ventilation and lighting			

Information

All rooms get air and natural lighting with doors and windows

All rooms get air and natural lighting with doors and windows

All rooms get air and natural lighting with doors and windows

b. Ventilation Model House Growing 1b (Land area 72m²)

In model 1b for the existing building area of 21m² and land area of 72 m² (6m x 12m). The shared room position is more advanced than the room position. The location of the bathroom is next to the shared room. While the backyard in the form of vacant land with an area of 4m x 6m. The front yard is an empty land with an area of 4m x 6m.

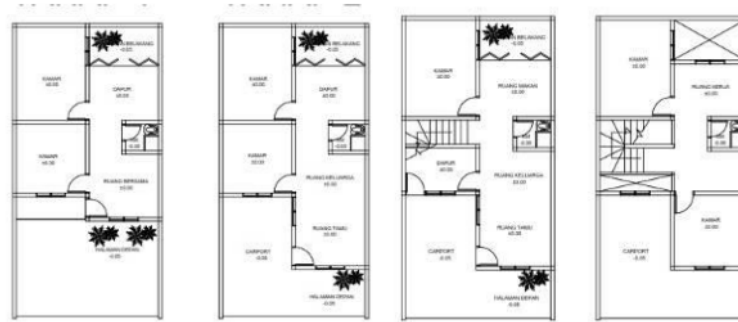





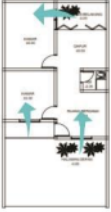
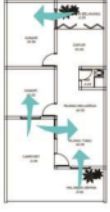
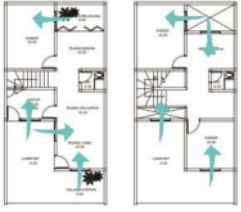
Figure 6. House plans of type 21m² growth with 72m² land area (from left to right: stage 1,2,3)



Figure 7. Front view of a house growing type 21m² with a land area of 72m² (from left to right: stage 1,2,3)

In stage 1, cross-over handling is applied while still providing open space in the backyard, so that additional space in the kitchen and bedroom can still get fresh air flowing from the backyard. Whereas in stage 2 the addition of the living room on the front yard remains by providing openings in the front wall so that air can enter the room. In stage 3 on the 2nd floor a hole or void is made in the back area straight with the back garden on the 1st floor so that air can flow directly into the 1st and 2nd floors of the building.

Table 2. Ventilation and home lighting analysis Model 1b

	Stage 1	Stage 2	Stage 3
Circulation			
Information	For this type Circulation is still not comfortable because the bedroom door directly leads to the living room.	The addition of the living room in the front area makes circulation more comfortable because the bedroom door leads to the family room.	Circulation is quite comfortable with 2 entrances, from the main door and from the kitchen. placement of stairs in the middle area is easily accessible
Ventilation and lighting			
Information	All rooms get air and natural lighting with doors and windows	All rooms get air and natural lighting with doors and windows	All rooms get air and natural lighting with doors and windows

c. *Ventilation model of the Grow House corner type*

In the corner type model for the existing building area of 21m² and land area of 80 m² (8m x 10m) and located in the corner. The position of the Common Room is more advanced than the room's position. The location of the bathroom is next to the shared room. While the backyard in the form of vacant land with an area of 3m x 8m. The front yard is an empty land with an area of 3m x 8m, and a side land with an area of 2m x 10m.




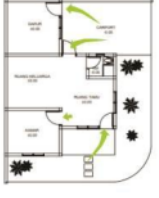

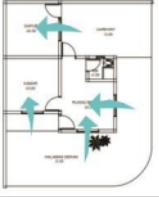
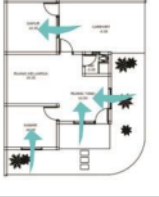
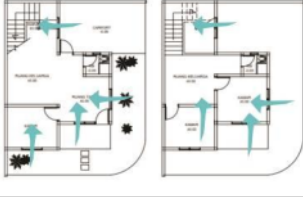
Figure 8. House plans of type 21m² growth with corner type land area (from left to right: stage 1,2,3)



Figure 9. Front view of a house growing type 21m² with a land area of corner type (from left to right: stage 1,2,3)

In the corner type of house can still put the window in the side position of the house. The outer space is pretty much on the front, right and rear sides. In stage 1, cross-over handling is applied by opening the kitchen space in the backyard so the kitchen can get fresh air flowing from the backyard. Whereas in stage 2 the addition of the bedroom in the front yard remains by providing openings in the front wall so that air can enter the room. In stage 3 on the 2nd floor a hole or void is made in the back area straight with the back garden on the 1st floor so that air can flow directly into the 1st and 2nd floors of the building.

Table 3. Ventilation and home lighting analysis Corner Type

	Stage 1	Stage 2	Stage 3
Circulation			
Information	For this type Circulation is quite comfortable because there are 2 entrances to the building, from the front and sides.	The addition of the room area at the front affects the shift of the main entrance.	Circulation is placed in the back area next to the family room so it is easy to reach .
Ventilation and lighting			
Information	All rooms get air and natural lighting with doors and windows	All rooms get air and natural lighting with doors and windows	All rooms get air and natural lighting with doors and windows

Conclusion

The position of the door and window is very influential on the successful application of the concept of cross ventilation. The principle of cross ventilation is to enter the cool breeze from outside the house and remove the hot wind from inside the house. The area of the window also affects the quantity of wind speeds that enter the house. The bigger the window, the greater the wind that can enter the house. In 21m² type windows can only be placed on the front and back of the house. Therefore, steps can be taken other than the placement of the window to be able to maximize the incoming winds such as raising the walls of the house, grating through the roof, stacked roof models and patterns of open space so that air can freely move into the house.

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