

Conference Paper

Space Configuration of Vertical Housing for Optimal Social Interaction Support

Irene Wijaya Wie and Julia Dewi

Architecture Department, Universitas Pelita Harapan, Lippo Karawaci, 15811 Tangerang, Indonesia

Abstract

The ever-growing demand for living space and its limited availability has invigorated the need for vertical housing as a solution. Increasing the number of stacks to optimize density has many impacts especially to social interaction within the community. Several factors can affect social interaction in vertical housings. Social interactions in the vertical house can be observed from their public access, programs, hybridization, and periscopes. This research examines how social interaction occurs in each of building massing types and try to find how space configuration can be created to support social interaction. This research observes two vertical housings as a precedent to study how the spatial arrangement as physical support social interaction. Result of the study is used to create a model of the new vertical house with good social interaction in Kebon Melati, Jakarta as a project. The methods used in this research are using qualitative analysis through literature and precedent study. Through this method, the research is expected to find the excellent space configuration containing social interaction's element used in different vertical housing type building.

Corresponding Author:
Irene Wijaya Wie

Received: 24 May 2019
Accepted: 25 July 2019
Published: 4 August 2019

Publishing services provided by
Knowledge E

Keywords: space configuration, vertical housing, public space, social interaction

© Irene Wijaya Wie and Julia Dewi. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the ISTECS 2019 Conference Committee.

1. Introduction

As discussed by Vitor [11-2] “Urban form refers to the main physical elements that give structure and shape the city—urban tissues, streets (and squares), urban plots, buildings, to name the most important.” Streets and plazas are the more fixed elements, while urban plots and buildings can usually be more flexible with urban development. Urban growth strongly correlates with an increasing number of the urban population, which increases the needs for land occupancy per person. With the growing number of density, the constructed urban land will destroy the non-build land space.

Uytenhaak said in [10-11] that, “Density in urban tissues is achieved, once an optimum balance between built and non-build space has been reached, by making deeper or stacking higher. Both operations result in a loss of certain qualities. However, a mutual proximity of urban activities, and therefore urban dynamism and efficient land use, are

 OPEN ACCESS

gained. This idea states that increasing development needs should do city development without reducing the non-build space to maintain a certain quality. If we see Jakarta city from above, 69 percent of the area is covered by the roof of the houses. Green space is only 9 percent while the optimal number is 36 percent. [2] The ratio between built and non-build area proves that development in Jakarta has not reached its equilibrium. To do so, the government of DKI Jakarta attempted to control urban development by generating a policy regarding density limits on the city. Developers are encouraged to utilize the land efficiently by increasing its intensity of use, which results in housing solution that can accommodate a higher density but still following government planning.

Traditional residential development usually occupies significant urban spaces but can be controlled by pushing for increased vertical housing development. This concept of vertical housing can help urban developments in developing open spaces into green spaces. However, the realization sometimes results in reducing social aspects within the community. Therefore, it is essential for architects to build vertical housing with a humanist concept to maintain the quality of social interaction within the community.

Public spaces that can accommodate social interactions become the solution to maintain the social quality. With open spaces, people can interact with each other without certain restrictions. This quality is often lost in vertical housings. These public space programs can be used by the residents to build social interaction to avoid individualism and achieve common goals such as welfare, social closeness, and collective security. Public housing in Singapore such as Pinnacle @Duxton offers a unique concept of mass housing for densely populated cities most notably by linking towers with open space at height. It was a bold experiment in the field of high-rise housing, resolving numerous functional, economic, and social issues, and in practice confirming that high-rise buildings can generate a comfortable living environment for people of average or below-average means. [3-42]

Hence, space configuration between the housing and spaces that support social interaction become an essential aspect of maintaining, enhancing social communication within the community in vertical housing residents. The vertical house itself can help urban development issues physically, while public spaces itself can help within social problems.

2. Social Interaction in Vertical Housing

2.1. Vertical housing

Cities in the world are expected to be more dense and taller in the future. It is the only way to accommodate the global population of 9 billion and more people and improve life for urban living (70 percent of the population may live in cities by 2050, according to some projections). The alternative is worse, and urban development took away the land from the few remaining green spaces. The concept of “vertical city” shows a lot of building towers, but there are also still parks, schools, hospitals and restaurants at elevation. [5]

According to the Auckland Design Manual [7], there are three primary forms of building type most commonly used for vertical building: block, tower, and courtyard. A block building type is usually more extensive than it is tall, composed of corridors that can be single or double-loaded. A tower building type has a vertical shape and is generally free-standing, has a thinner and more elegant proportion. (Fig. 1) This type of building has typically one central core and a few numbers of apartment units on each level. If tower buildings are designed properly, it can increase the level of solar access and ventilation while the courtyard building type provides open sides of construction that include open space on the site. (Fig. 2) The open space functioned as a communal space to provide high-quality landscape environment. Based on the size and orientation of the courtyard, the height of the building requires restrictions to ensure adequate sunlight access to the enclosed open spaces and the building itself. Some of these buildings can also have a base of two or more floors that can be used as a podium. Podium’s roof can function as a landscape and add more open space for residents.

In her research [13], Wood found that “tower in the park” concept follows the opposite form of the courtyard building type. Tower type buildings use green spaces that separate building structures from the surrounding city context. (Fig. 3) However, this type of construction usually does not offer the facilities that people want. Unlike the communal space created on courtyard type buildings, the green spaces in this building are often considered unsafe and unattractive. Courtyard type buildings are commonly used to increase the sense of community from the communal area created in the courtyards. Usually, residents have to use the yard as a path to reach their units from the main road, making the courtyard functioned as a foyer. (Fig. 4) The negative aspect of this type of building gives inward focus problem, so the building does not interact with the main road like other buildings that communicate through the use of doors, shop windows and other activities.

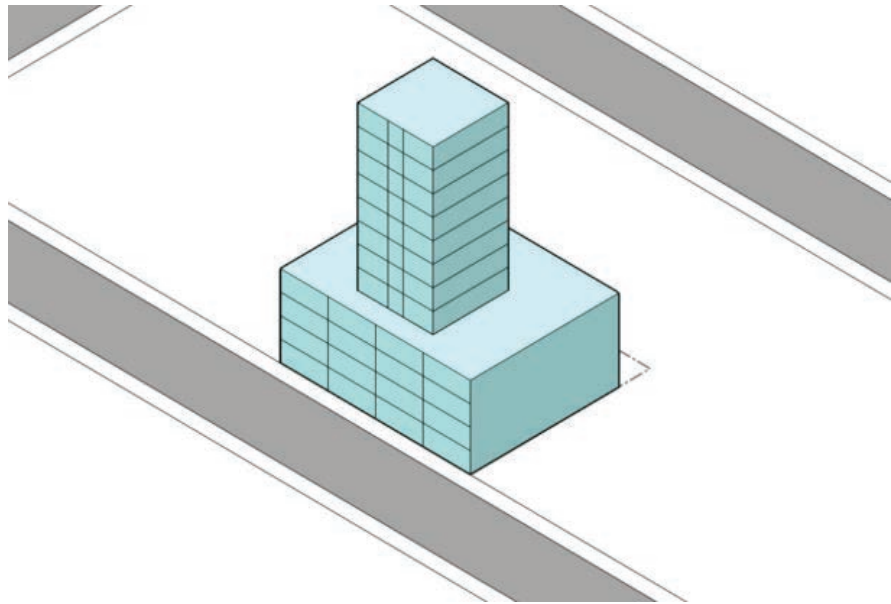


Figure 1: Tower type of building. (Source: [7])

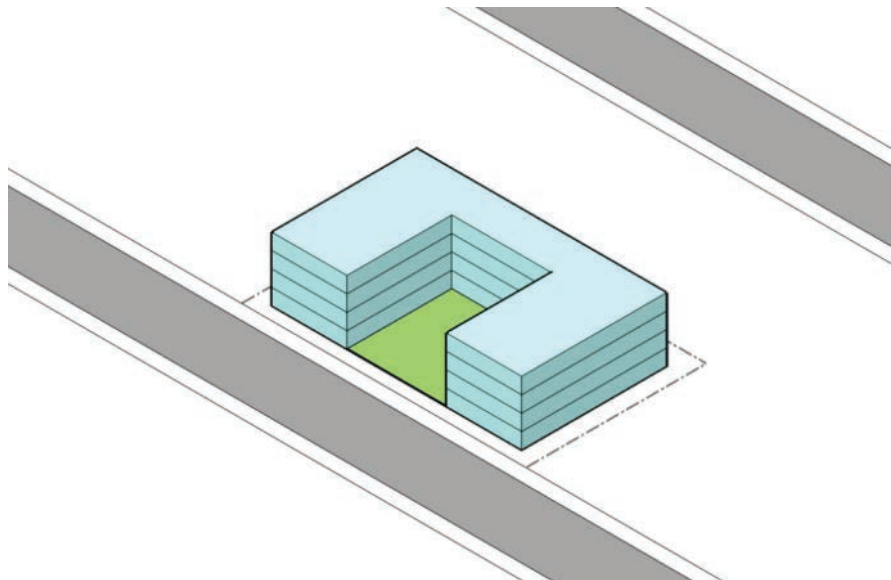


Figure 2: Courtyard type of building. (Source: [7])

Vertical connections are explored as a tool to enhance social interactions between multiple public spaces that located in the building, by providing visual links as well as conditions where it allows people to go beyond the typical social separation that can live in the public space. Hitzler said in her journal that public spaces play a significant role in our social order by helping us understand our place and expected behavior within the community. Participating and interacting in public spaces will give us a sense of security and sense of belonging. Public spaces are also where power and resistance are displayed to the public, providing a stage for arts, performance, and self-expression for the community.

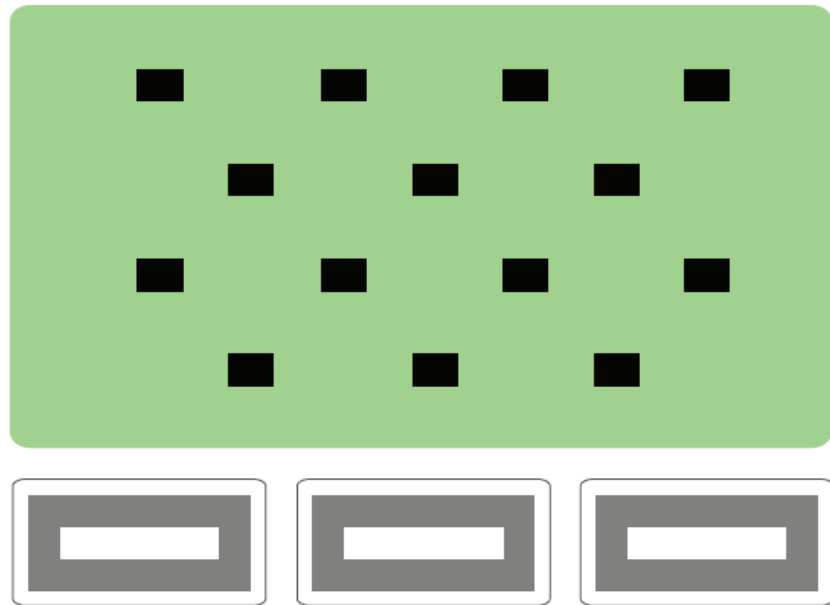


Figure 3: Tower type building scheme compared to other typical building. (Source: [13-10])

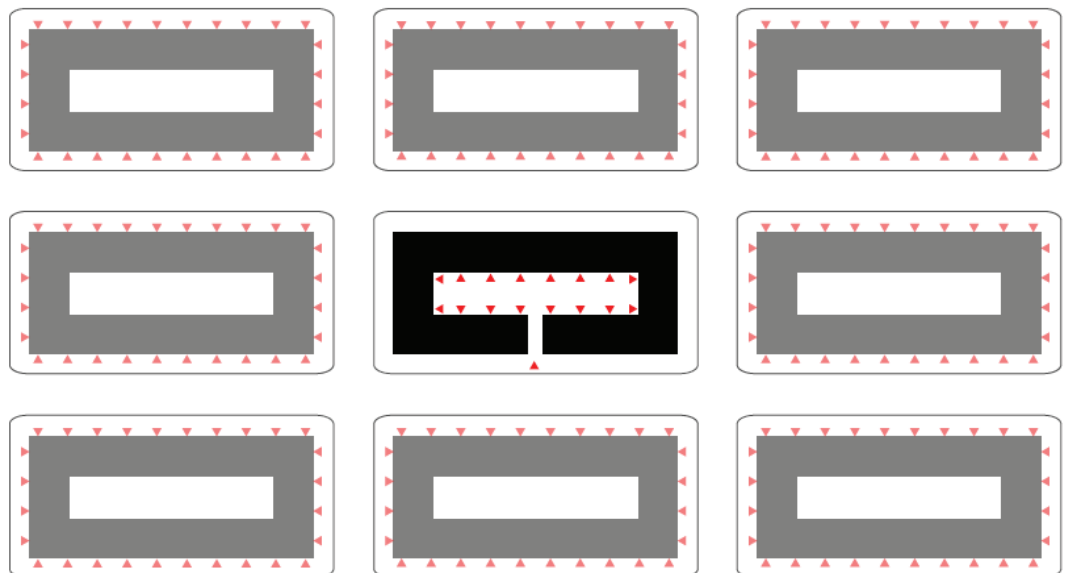


Figure 4: Courtyard type building entrances compared to other typical building. (Source: [13-8]Social Interaction)

In her journal, Hitzler [4] argue that several design elements can help to encounter social segregation in urban communities by empowering positive associations openly. These elements include public access, programs, hybridization, and periscopes. The spaces will give some quality which will be essential to increase social interactions and eventually lead to a stronger sense of community. Moreover, another sort of open space is implied through the vertical layout of public components with consideration of the legibility of open space and to the consolation of “chance encounters.” This design aims

to give more chances for individuals to interact with each other as they do in the ground. (Fig. 5) Also, to make the public space open, accessible and connected for everyone at above ground level. (Fig. 6)



Figure 5: Interaction in ground. (Source: [4-38])



Figure 6: Vertical meandering. (Source: [4-36])

Firstly, public access is the condition where the ground floor is opened to give a different open space in the city, which might be utilized for any number of open capacities. (Fig. 7) The transparency permits one to enter the building without any boundaries, physical and mental, where people choose to be in public rather than their private lobby – a nondiscriminatory and public space. Open roof is another way of public access application, where a periscope extends above the building, which gives the public access to the unique view. (Fig. 8) Also acts as a periscope to create access for the open roof by making this normally un-seen space noticeable.

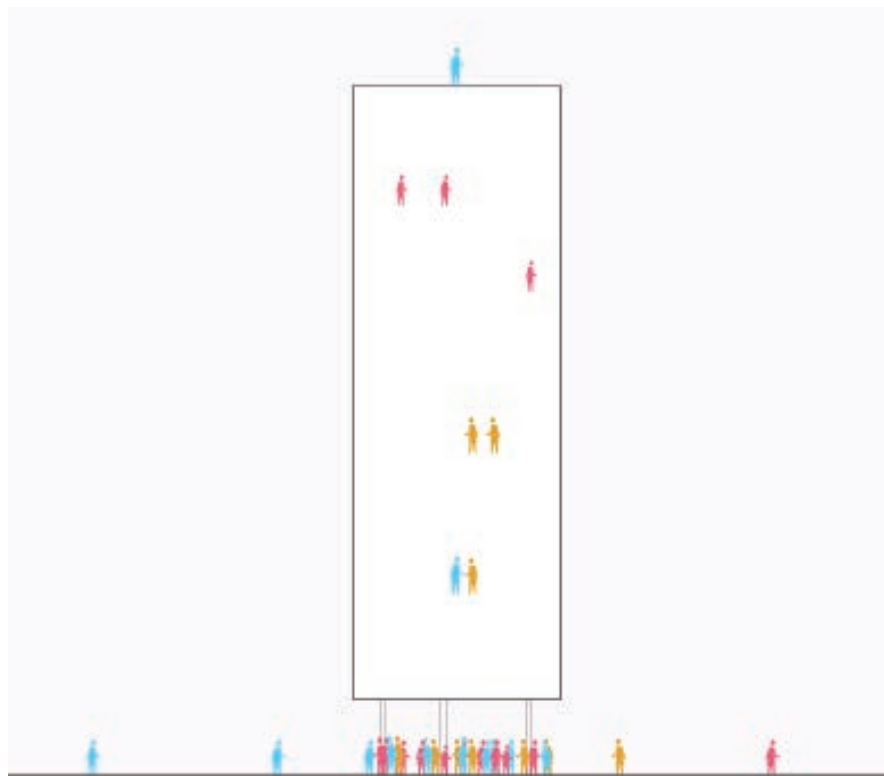


Figure 7: Public access such as open ground floor. (Source: [4-41])

Secondly, programs are the condition in which some functions of their own daily routines are reinterpreted into joint activities. (Fig. 9) For instance, a hall replaces singular leisure activity such as individual television, or a big swimming pool replaces personal exercise equipment. The idea of community life in a vertical building is emphasized by the arrangement of triple-height shared facility spaces.

Thirdly, hybridization is the condition where public programs are scattered among residential stories, creating irregular connections and adjacencies. (Fig. 10) Shared circulation for public and private programs increases the probability of meeting each other for the residents, similar to interaction at a horizontal street. Specific activities in some places like the atrium can also be noticeable from a distance.

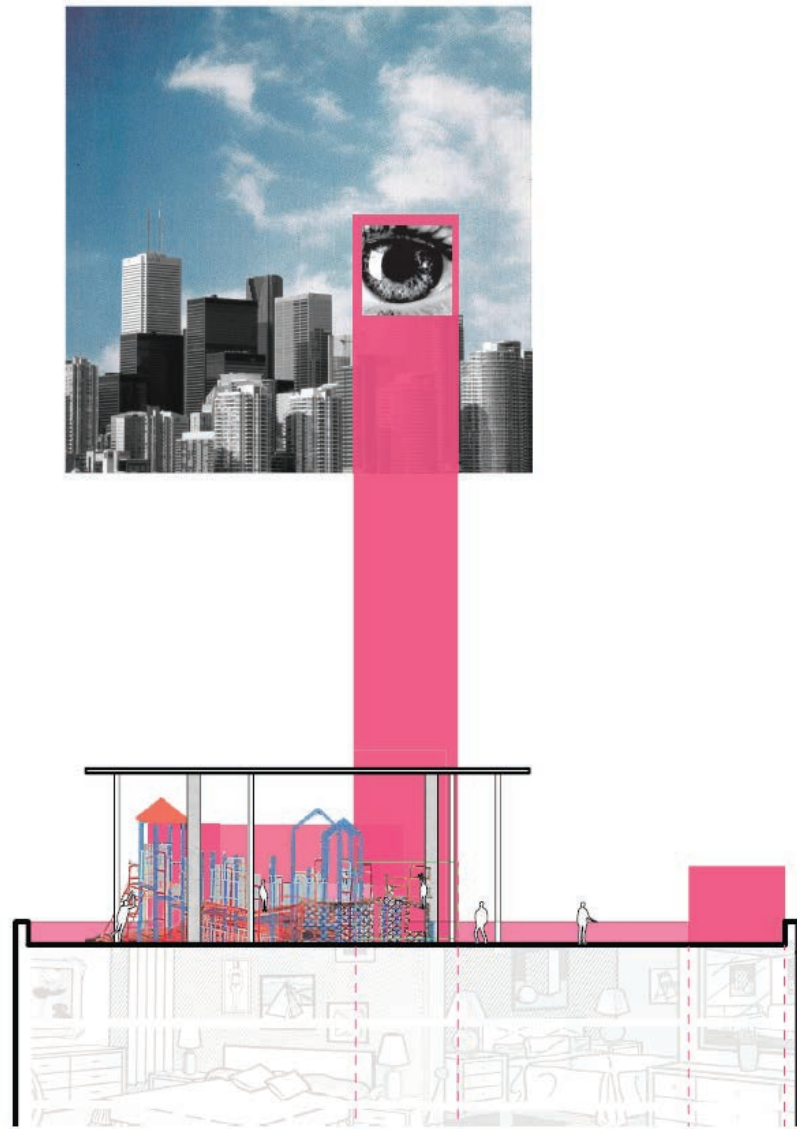


Figure 8: Public eye as periscopes to city skyline. (Source: [4-42])

Lastly, periscopes are the condition where periscope atriums worked as a media to connect the public spaces. The definition of periscopes itself is an apparatus that contains reflecting elements to permit an observer to see things that are otherwise out of sight from a position displaced from a direct line of sight. Here, they work vertically and horizontally offering perspectives to spaces that would in some way or another be covered up. They go through the shared rooms of residents like laundry etc. Every unit has their windows that open to the existing shared rooms or public areas, as in MVRDV's Markthalle, where units look into a large market hall in the center. The periscope atriums include visible periscope, extended periscope, periscope via communal space, periscope via public space and periscope from above. (Fig. 11)

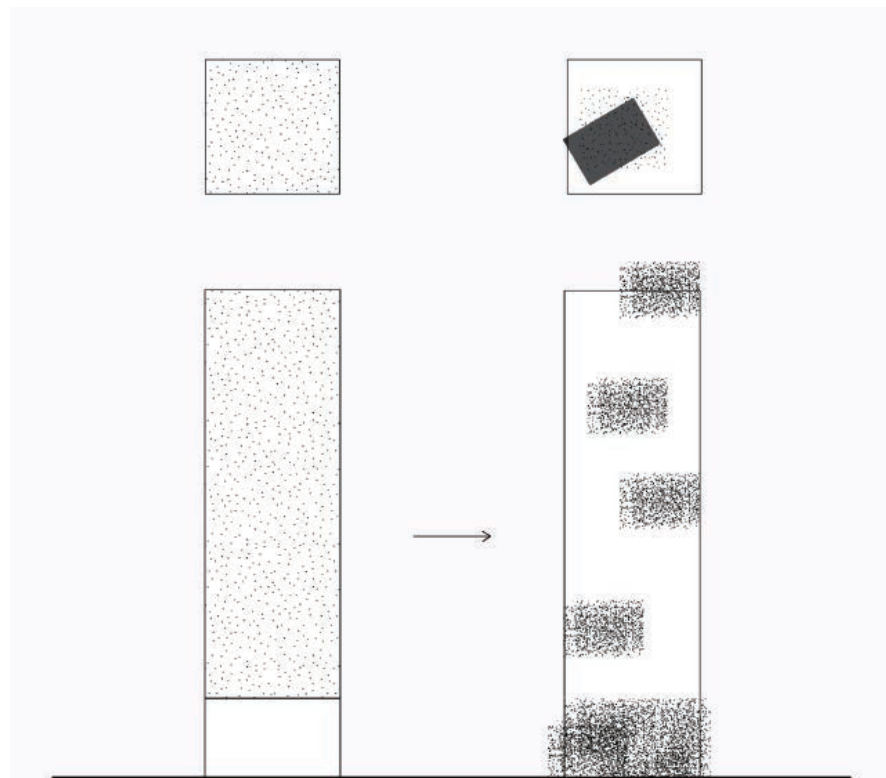


Figure 9: Individual to collective programs. (Source: [4-43])

As society improves communication through different media every day in non-physical environments, it causes the role of architects to become more critical, creating spaces that allow physical and direct communication within a community. These interpretations are necessary for making vibrant city life, into the vertical dimension, was here encouraged by periscope atriums. The atriums provide the means of the analysis of casual interactions that happened by chance in the city, into the vertical dimension. In such a hybrid building, it is a challenge to address the need of differences of users, from members of the general public to residents of the building. The most critical characteristics of vertically distributed public space are the definitive articulation of “public.” In this building, exterior circulation, periscope atriums, and an open ground floor try to obscure the apparent limit between outside public and interior private while additionally flagging the spaces above. While it is “a bit utopian to desire a certain kind of social mix,” aggregate living can give the social viewpoint under danger in densifying urban areas.

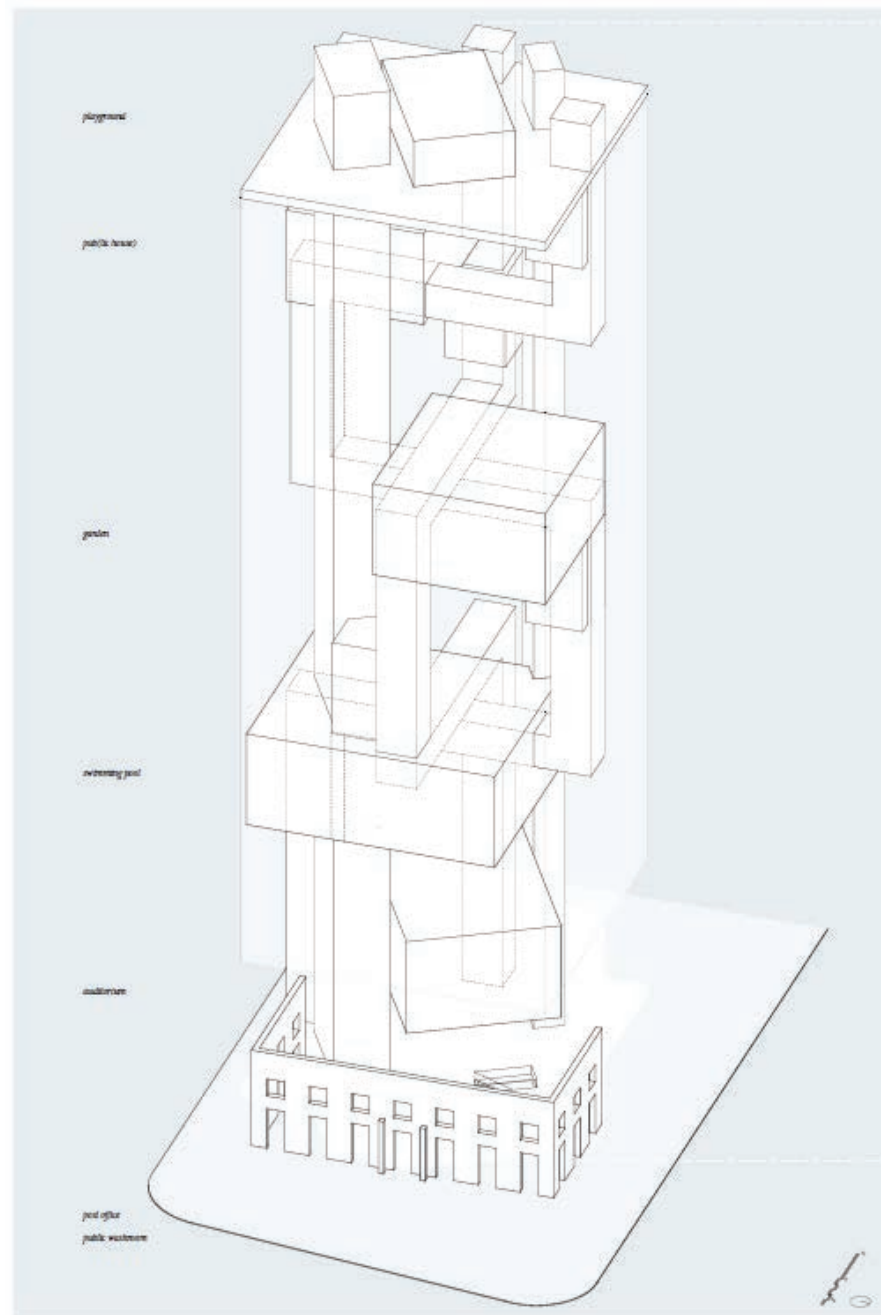


Figure 10: Axonometric view of public spaces, communal rooms, and periscope connections. (Source: [4-46])

3. Space Configuration that Supports Social Interaction in Vertical Housing

The precedent study is used as a method to learn how social interaction elements composed in a different form of building types. There are two precedents; each precedent presents one of the primary ways of building types which are tower and courtyard. Block type building is not included within the scope of this discussion, mainly because

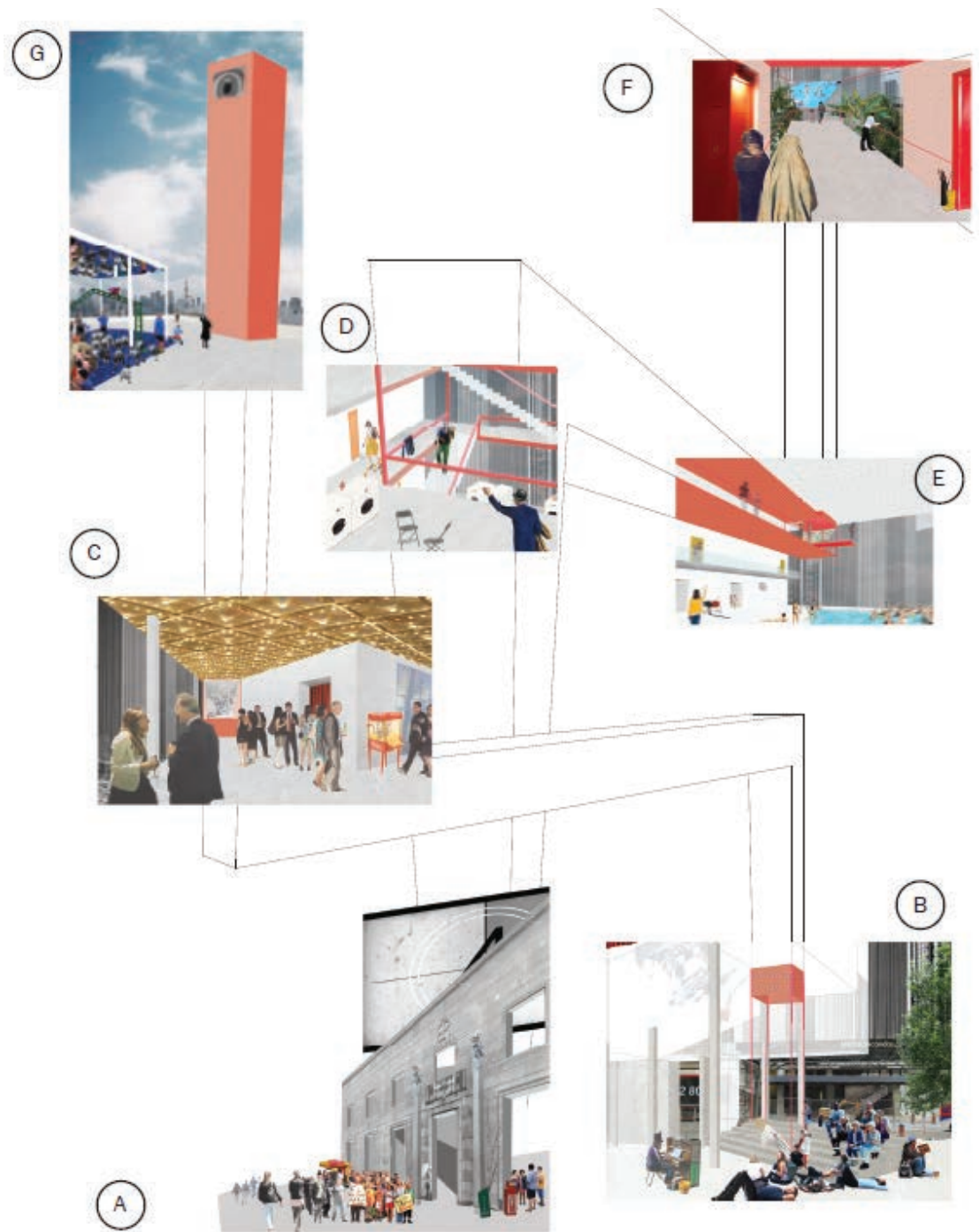


Figure 11: Illustrations of periscope atriums that connect open space and communal space. (Source: [4-52])

the current research indicates they cannot support social interaction quality. The two residential are both based in Singapore, where vertical housing has been their solution for density issues.

The first precedent is The Pinnacle at Duxton. With a tower type building, this housing consists of seven towers with 50 floors which are linked by two sky bridges. The Pinnacle implemented a new strategy for public spaces which involves vertical housing and

density. The open spaces are designed by elevating the ground floor to a low podium roof and with a bridge at the upper elevation. It gives precedent for what would happen when public spaces become a priority in development and are limited by the height of the building. In this building, public access was designed by providing an open ground floor and an open roof.

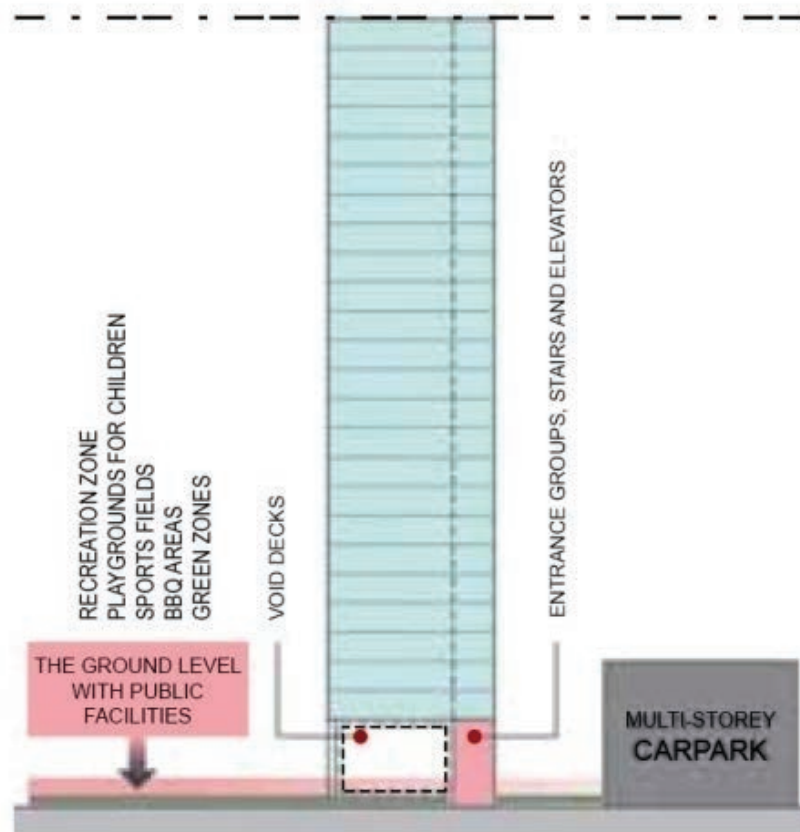


Figure 12: Open ground floor such as void decks in The Pinnacle. (Source: [3-42])

Open ground floor as the entire ground floor is all dedicated to the public area. The ground floor of each building is lifted to create a void deck which is used for everyday use such as circulation or shops, and other facilities. (Fig. 12) The rest is an open space with many accessible public facilities for residents and visitors. The two sky bridges form the open roof. Besides connecting the residential towers, the sky bridges contribute to add more public space, a place where residents can interact with each other. (Fig. 13) Open areas of The Pinnacle are prioritized for the public with the existence of cooperative federal programs. These federal programs include void decks, pavilions, four playgrounds (three on the ground floor and one on the 26th-floor sky bridge), sports center, seating area, green space or park, field, jogging tracks, walkways, and podium roof garden. Hybridization of The Pinnacle was designed by dispersed programs and shared circulation. (Fig. 14) The plans were dispersed horizontally and vertically to fulfill

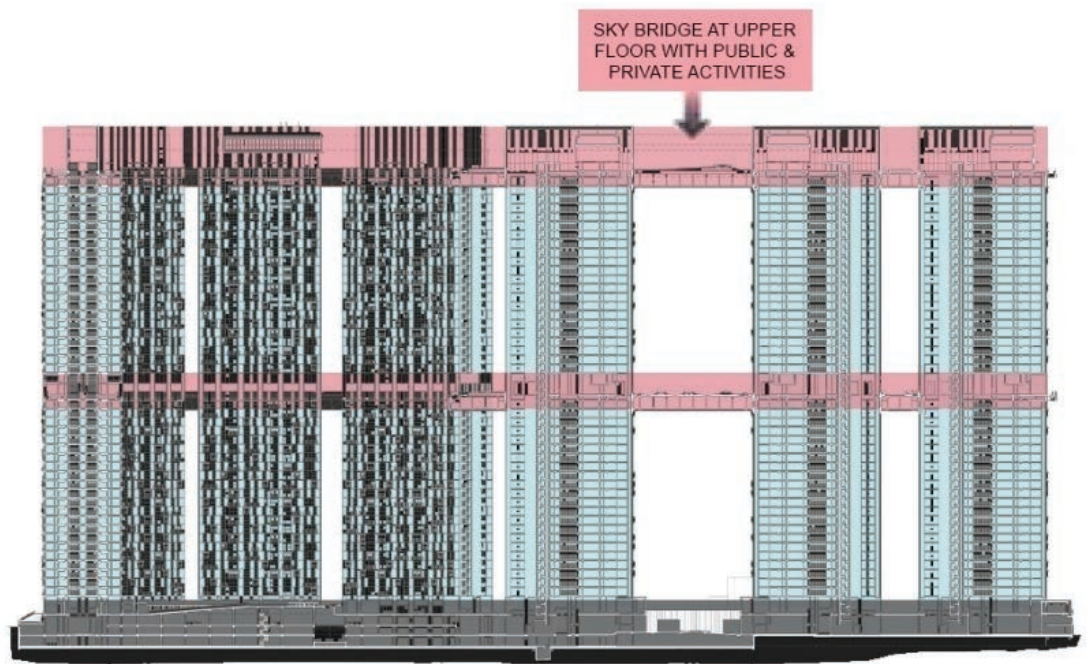


Figure 13: Open roof such as sky bridges in The Pinnacle. (Source: [9])

the needs of the residents. Distribution is also shared in the ground floor that allows pedestrians to walk along with residential areas through the public spaces and void decks beneath the building.

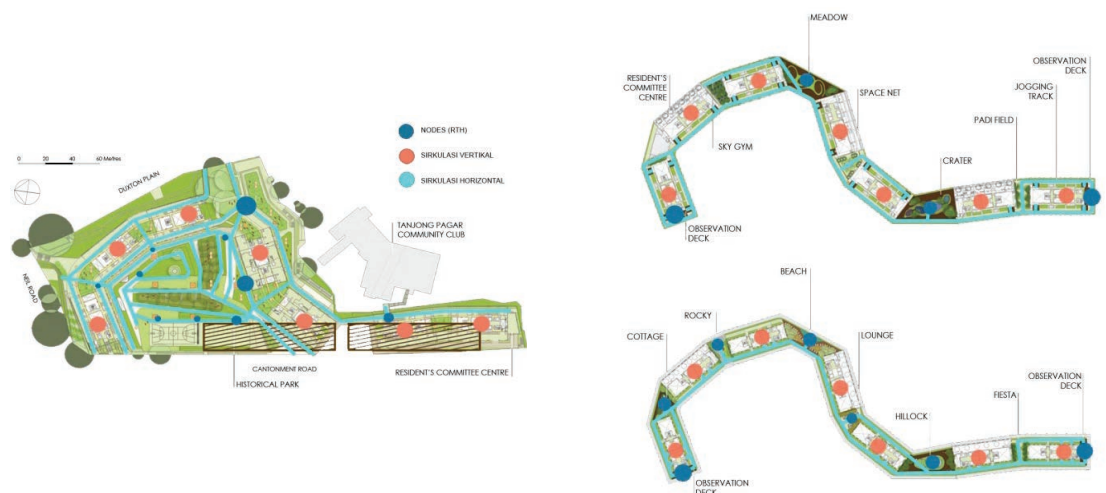


Figure 14: Shared circulation in The Pinnacle.(Source: [9])

With this space configuration, periscope atriums in this building are generated through a designated public space. Although the layout of the building blocked line of sights between units, the view, connection, airflow, and lights are optimized by minimizing solar heat exposure from the west. A large courtyard was created to maintain

visual connectivity with Tanjong Pagar Community Club which is the primary community node in this residential area.

The Interlace by OMA is the second precedent of vertical housing with courtyard type building. Instead of creating a group of isolated vertical towers, this building's residential design responds to the issues and challenges of the tropical environment by proposing an expansive network of recreational spaces and dwellings integrated with the natural environment. This building mass configuration was deliberately designed to be more responsive to the social needs of the inhabitants to fulfill the social obligations of society. The public access was also designed by providing an open ground floor and open roof like the previous precedent. In this building, spacious ground floor is formed by the stacked mass of six-story buildings in a hexagonal arrangement to form eight large courtyards with high permeability. The established yards were used as the public space where residents can enjoy their activities together. (Fig. 15) The interlocking blocks form sky gardens and both private and public roof terraces.

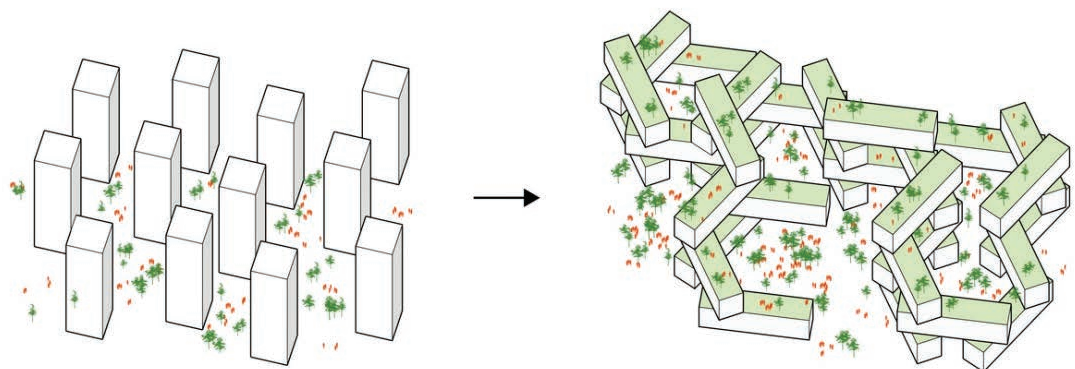


Figure 15: Stacked mass created courtyards in The Interlace. (Source: [8])

Shared programs are maximized by the number of public programs available in the open spaces which feature communal areas for shared activities. The public programs include swimming pools, tennis court, sports center, parks, spas, children's playgrounds, paths, and barbecue areas. Hybridization in this building was developed by the dispersed programs and shared circulation. The programs are scattered at eight different open spaces in each building to accommodate the needs of public activities for residents. (Fig. 16) The elevated spaces between stacked buildings form nine public sky terraces that are a semi-private area for residents, while some of the roofs of each block of mass are used as a private garden for units. (Fig. 17) The circulation is also shared on the ground floor as public space which allows pedestrians to access all public areas with different themes according to each area. With this composition, a living landscape was created along with the building and its private areas on every level. These designated public spaces can be considered as periscopes atriums. Angle

variations from the different level in this building provide unique views compared to surrounding structures.

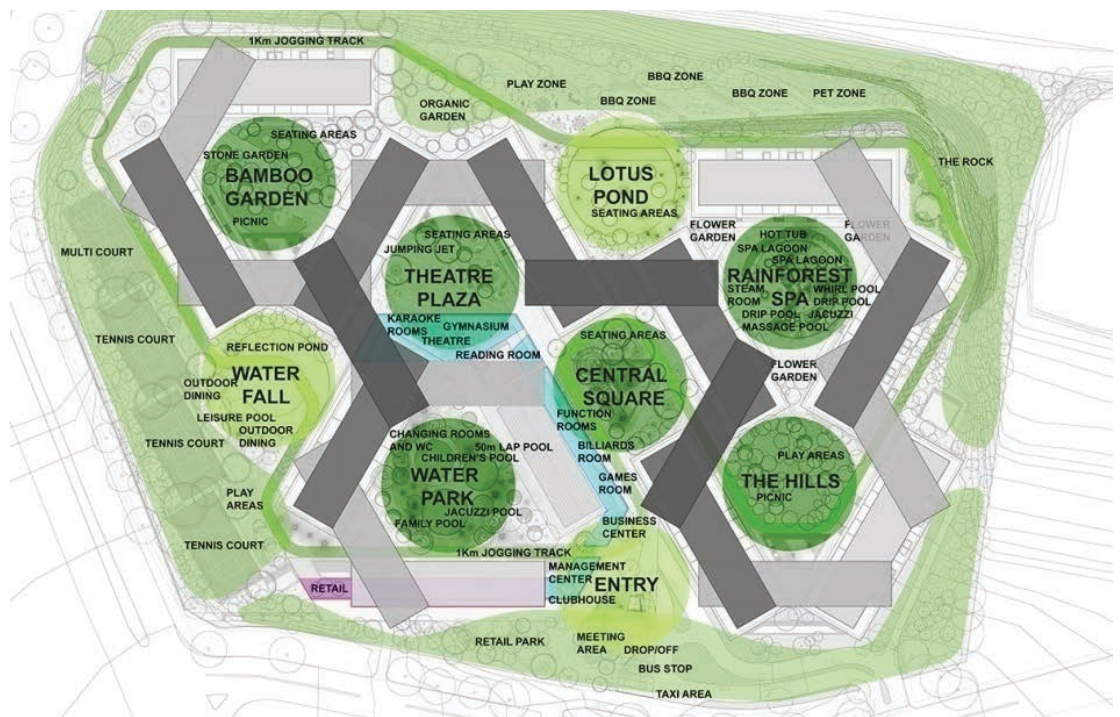


Figure 16: Dispersed programs with focal points in each courtyard. (Source: [8])

From the research, the precedents of different building types prove that the application of social interaction elements differs for each building types and can yield varying results. The table below summarizes the different implementation of design strategies when applied in two different types of buildings. The design can vary according to the form typology of each precedent buildings.

The precedent research above shows that tower type buildings can apply programs and periscopes better than courtyard type buildings, while public spaces and hybridization are better applied in courtyard type buildings. It is apparent from the distance of the range of residential units to the open space. The conclusion is courtyard type buildings can produce more intimate public spaces which support more social interaction, as a consequence of its design strategy.

4. Conclusion and Proposed Design Model

As mentioned on precedent studies, tower type buildings can apply programs and periscopes better than courtyard type buildings, while public spaces and hybridization are better applied in courtyard type buildings. Courtyard type buildings can also produce

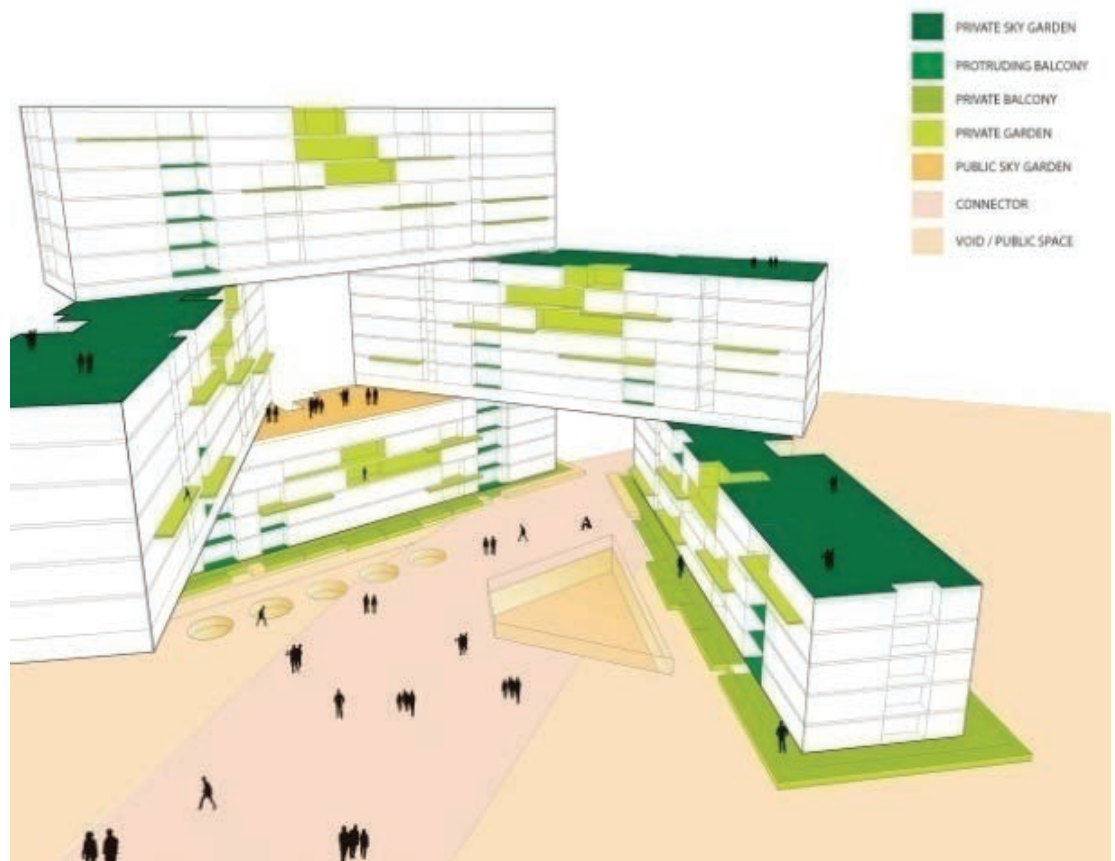


Figure 17: Open space functioned as public space in The Interlace. (Source: [8])

more intimate public spaces which support more social interaction, as a consequence of its design strategy.

The result of both literature and precedent studies are trying to implement on Kebon Melati. Kebon Melati is one of the highest density areas in Jakarta, as an administrative village in Tanah Abang district of Jakarta. High intensity of space utilization in the area can be seen from the high number of building coverage ratio and floor area ratio for housing even office and commercial sector. (Table 2) This configuration of spaces which support social interaction in a vertical house is believed to solve the problems of urban development functionally and socially.

The site for the housing area is surrounded by the office and commercial space by province local regulation of Jakarta capital special region year 2014 no.1 about Zoning spatial plan and zoning regulations. This site has a total area of 18,000 m², which are divided into three sections by existing roads. The first section (north) has an area of 5,965 m², the second section (center) has an area of 4,432 m², the last part (south) has an area of 5,417 m².

TABLE 1: Design strategies in different building typologies.

Elements that support social interaction	Strategies	Building Typologies Tower (The Pinnacle) Courtyard (The Interlace)	
Public access	Open ground floor Open roof	Void decks Sky bridges	Courtyard Sky gardens
Program	Communal activities	Commercial: small shops, Education: childcare, education center, Services: parking basements, food court, observation deck, committee center, Open space: parks, sky bridges, paths, playgrounds, seating areas, jogging track, pool.	Commercial: retail plaza, Education: reading room, Services: workspace, laundry, parking basements, Open space: park, sky gardens, court, jogging path, pool.
Hybridization	Dispersed programs	Dispersed linearly	Dispersed centrally with focal points in courtyards.
	Shared circulation	Horizontally in the ground floor between public areas: pathways Horizontally in upper level between open space to units: corridors Vertically between open space to groups: cores	
Periscopes	Periscope atriums	Visible periscope: sky bridges, Periscope via communal space: public areas and public facilities, Periscope via open space: big courtyards in the ground floor and sky bridges, Periscope from above: sky bridges at the roof.	Periscope via communal space: existing public spaces, Periscope via open space: courtyards and sky gardens, Periscope from above: sky gardens between the buildings.

Source: [12-39]

TABLE 2: Number of space utilization in administrative village Tanah Abang.

Administrative Village	Sub-block	Zone	Sub-zone	BCR	FAR	Building Height	Green Coverage Area
Kebon Melati	001	Office, Trade & Service Zone	K.1	40	5,00	40	30
Kebon Melati	002	Vertical Housing Zone	R.7	45	4,00	24	30
Kebon Melati	003	Vertical Housing Zone	R.7	45	4,00	24	30
Kebon Melati	004	Office, Trade & Service Zone	K.2	40	5,00	60	30

Source: [1]

From the area calculation table above, the number of occupants in this area is 3,600 occupants ($72,000 \text{ m}^2 / 100 \text{ m}^2$ (minimum of land requirement[6]) = 720 families, 720 families x 5 (1 family included 5 person) = 3,600 occupants)

The design process begins with site analysis and design conception from theories regarding the implementation of social interaction supporting spaces. Mass of the building with the basic shape of the courtyard is placed on the west side of the site

TABLE 3: Area calculation.

Area	BCR (45)	FAR (4,00)	Building Height (24)	Green Coverage Area (30)
	$45\% \times 18,000 \text{ m}^2 = 8,100 \text{ m}^2$	$4 \times 18,000 \text{ m}^2 = 72,000 \text{ m}^2 / 8,100 \text{ m}^2 = 8.8 \sim 9$ floors	$72,000 \text{ m}^2 / 24 = 3,000 \text{ m}^2$	$30\% \times 18,000 \text{ m}^2 = 5,400 \text{ m}^2$

Source: [12-45]

to provide shades for open space located at the east side of the site based on site analysis. (Fig. 18)

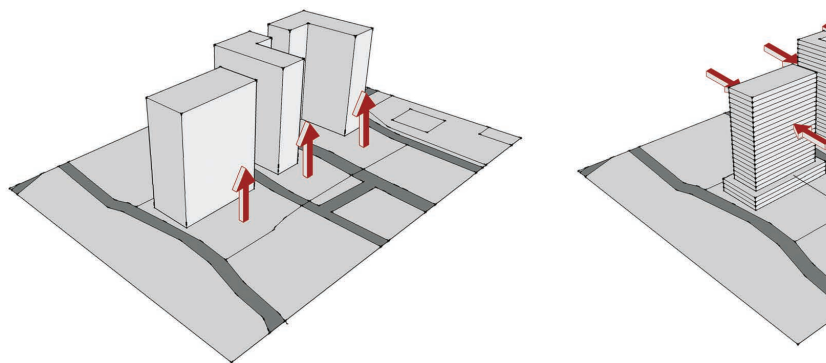


Figure 18: Basic shape courtyard with a podium. (Source: [12-64])

The distribution of the space program is based on the zoning plan adjusted with the building’s mass potential. The building’s open space is designated as public open space, such as park, playground or enclosed space such as shopping center on the ground floor; semi-private area such as multipurpose centre (including mosque), neighbourhood office, health centre and children’s study room on building podium; private area on upper floors such as residential units. Semi-private zoning is located in one area to create space for social interaction. Design of public access is translated as public spaces such as open ground floor and intended for the public, and upper floors are also used as a public space on the roof or the podium.

The design of periscope atriums is translated with the presence of a periscope through a public space at height such as sky bridge that connects every building mass. This sky bridge can also be utilized as an additional open space to increase the intensity of social interaction within the community. The other periscope atriums are visible periscope such as balcony in each side of the building facing the public space located in the east side of the site. Mass of the upper structure is also deliberately indented, to make the existing open space more visible from several angles. Furthermore, communal space in this building’s podium can also function as a periscope if space was designed as open space at least visually (using glass material). Hybridization is translated with

the separate communal spaces and public spaces in the whole area. Distance between each public space is designed based on the scope regulation of some programs with the corresponding number of occupants so that residents can access open space at a short distance in every six floors. The public area is also positioned on the same level as the sky bridge, so it can accommodate areas that support social interaction for residents.

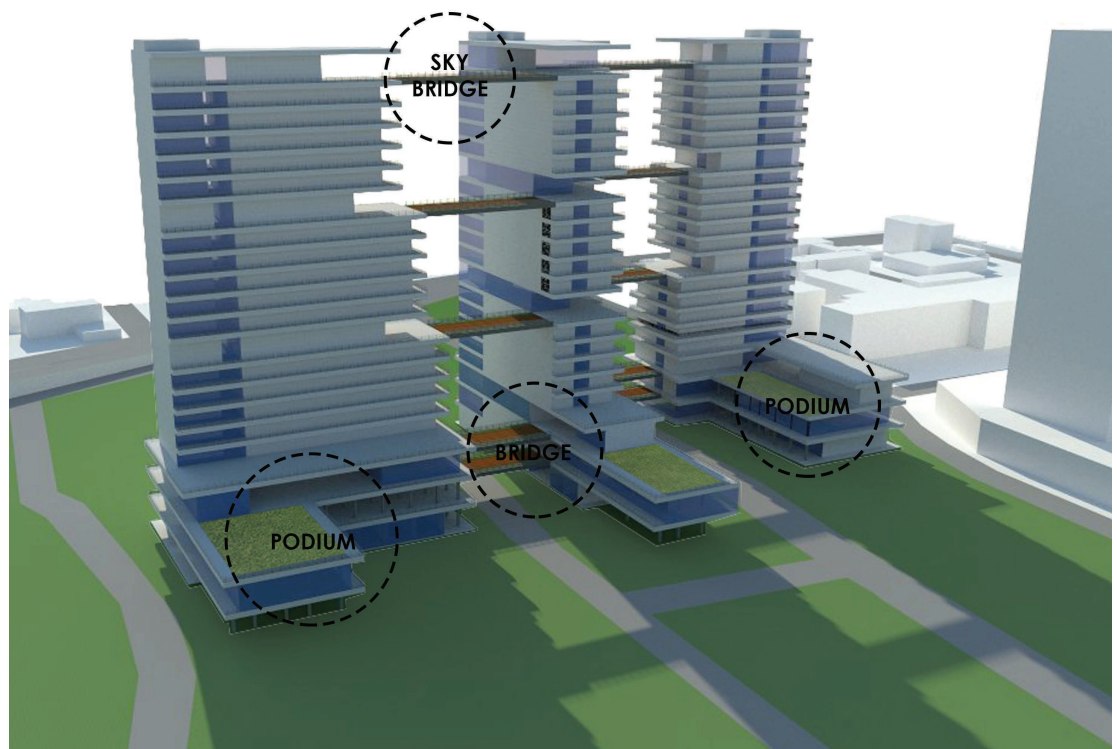


Figure 19: Configuration of spaces that support social interaction in Kebon Melati. (Source: [12-75])

After the analysis and design process, here is the final design of spatial configuration which supports social interaction in vertical housing based on the site analysis, theories, and precedent research, including podium, bridge and sky bridges. (Fig. 19) Shared activity venue was placed in one space to allow the residents to do their activities together in a commonplace. For every six floors of the building, there is a communal area at the sky bridges level which is used for additional social activities that can also function as a multipurpose room. (Fig. 20 & Fig. 21) The number of public spaces such as the sky bridges, garden, and children's learning space in each building is determined based on the public space need of the 3600 residents.

The entire ground floor functions as public space. Open spaces are designated as a green area such as garden, while the closed areas are allocated as a shopping center for residents' daily needs. Children's park and playground are placed on the podium floor so the children can play safely in the semi-private area. The podium floor also

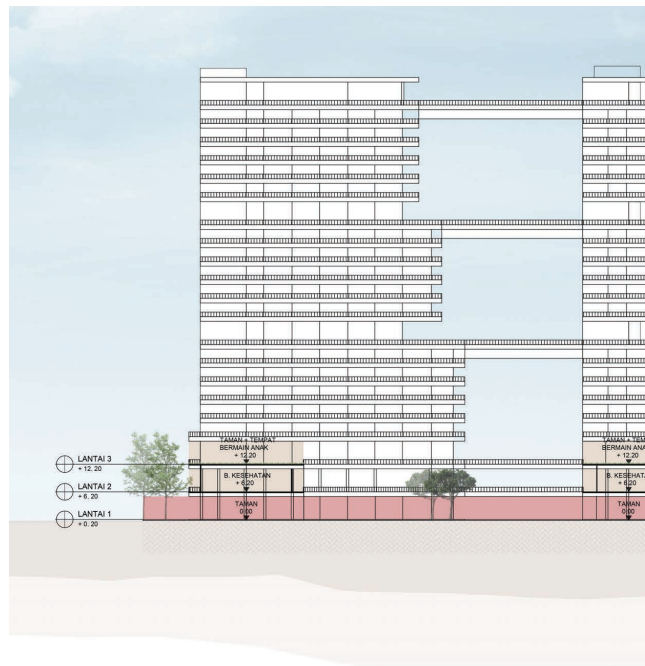


Figure 20: Section of building. (Source: [12-73])



Figure 21: Bridge between buildings in podium level. (Source: [12-76])

includes multipurpose rooms, office, health center, and children’s study area. (Fig. 22) On the typical floors of the building, there is a deliberately designed hallway facing the existing public space on the east of the site to allow social interaction between residents, also functions as a visible periscope. (Fig. 23)

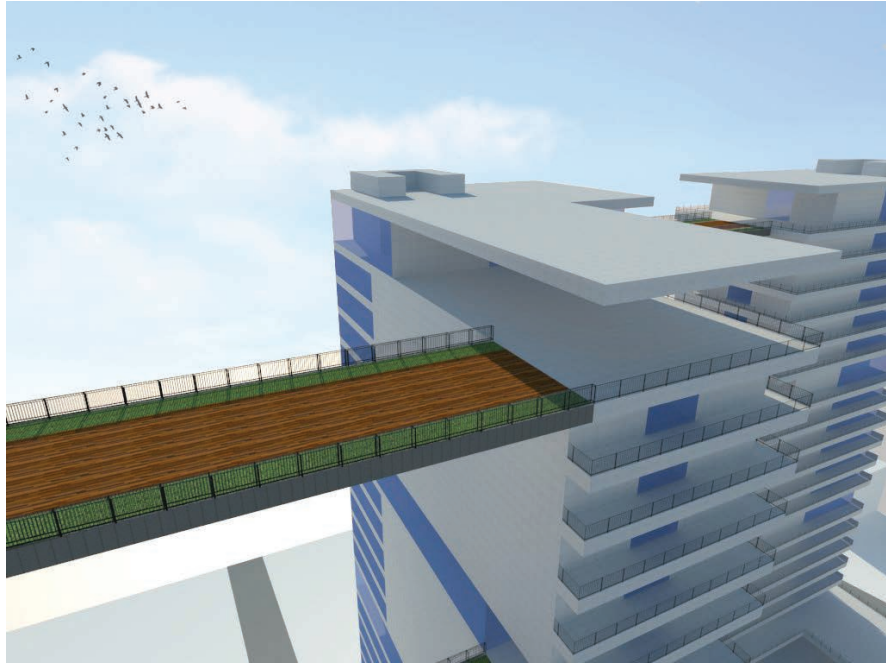


Figure 22: Sky bridge on the roof. (Source: [12-76])



Figure 23: Podium as a communal area. (Source: [12-74])

This partially thinner form of the building mass helps residents to see directly to the public spaces. All of the areas that support social interaction are equally spread horizontally and vertically. The areas are scattered at several points on the same level as the podium and sky bridge level, so the residents can have specific places to interact with each other.

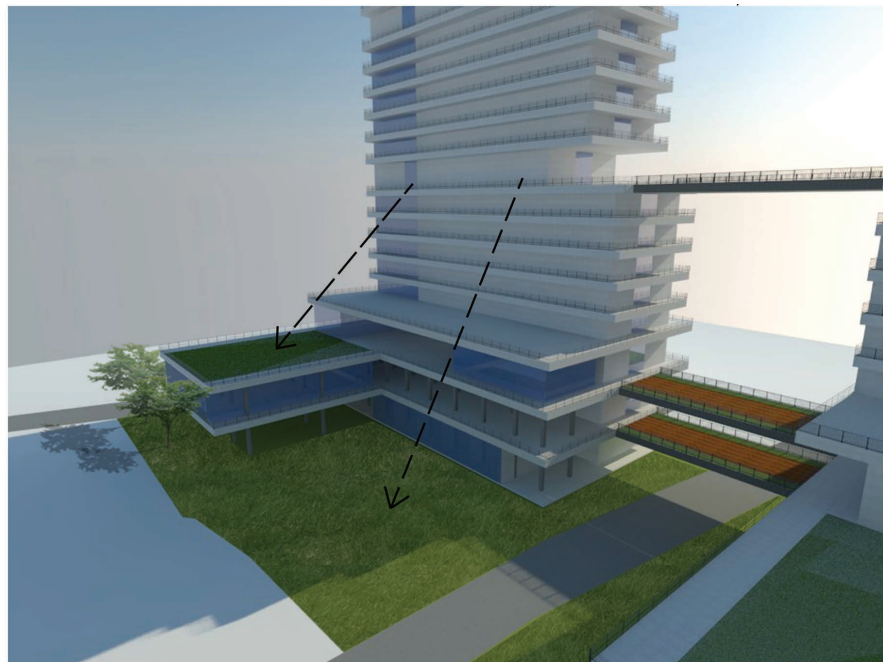


Figure 24: Mass building oriented to public space. (Source: [12-76])

References

- [1] Bappeda Provinsi DKI Jakarta. (n.d.). Retrieved March 27, 2018, from <https://bappeda.jakarta.go.id/>
- [2] Factory, V. (2014, March 22). Atap Jakarta Monthly Seminar Series I Symposium + Seminar 6-A: Exterior / Interior. Retrieved July 4, 2018, from <https://volumefactory.wordpress.com/2014/03/22/atap-jakarta-monthly-seminar-series-symposium-seminar-6-a-eksterior-interior/>
- [3] Generalova, E., & Generalov, V. (2014). Designing High-Rise Housing: The Singapore Experience. *CTBUH Journal*, (IV).
- [4] Hitzler, N. (2016). *People Meet in Public: Social Interactions in the Vertical City*. Dalhousie University, Halifax, Nova Scotia.
- [5] Shihai, J., & Huisheng, H. (2015). *Vertical City: A Solution for Sustainable Living* (1st edition). China Social Sciences Press.
- [6] SNI 03-7013-2004.pdf. (n.d.). Retrieved from <http://pip2bdy.com/nspm/SNI%2003-7013-2004.pdf>
- [7] The Building - Auckland Design Manual. (n.d.). Retrieved July 4, 2018, from <http://www.aucklanddesignmanual.co.nz/project-type/buildings-and-sites/housing/apartments#/project-type/buildings-and-sites/housing/apartments/guidance/the-building>

- [8] The Interlace / OMA / Ole Scheeren | ArchDaily. (n.d.). Retrieved July 4, 2018, from <https://www.archdaily.com/627887/the-interlace-oma-2>
- [9] The Pinnacle@Duxton, Singapore | THE 5 BOROUGH STUDIO. (n.d.). Retrieved July 4, 2018, from <http://www.msaudcolumbia.org/summer/?p=3032>
- [10] Uytengaak, R. (2008). *Cities are full of space: qualities of density*. Rotterdam: 010 Uitgeverij.
- [11] Vitor, O. (2016). *Urban Morphology: An Introduction to the Study of Physical Form of Cities*. Switzerland: Springer Berlin Heidelberg.
- [12] Wie, I. W. (2018). *Perancangan Konfigurasi Ruang yang Mendukung Interaksi Sosial pada Kawasan Hunian Vertikal (Kasus Studi: Kebon Melati)*. Universitas Pelita Harapan, Tangerang.
- [13] Wood, J. (2017). *Creating Better Public Housing in American Cities: A Study of Circulation and Common Spaces of Public Housing*. University of Arkansas, Fayetteville.