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Analysis of the level of Permeability and Wayfinding of a Retirement Village: The Case of Kampung Admiralty, Singapore

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ABSTRACT

The dramatic rise in the aging population has become a formidable global phenomenon, especially in developing countries, including Malaysia. A retirement village or modern senior living facility is a new residential typology for older people to cater to an increasing number of aging population in Malaysia. This study investigates the spatial characteristics of sustainable design of aging facilities. A case study of the Kampung Admiralty in Singapore is chosen due to its prominence. The spatial design qualities of the selected case study are meticulously examined using the space syntax analysis to evaluate the level of permeability and wayfinding. A qualitative research method is applied via the space syntax's justified graph and visibility graph analysis (VGA) using the DepthmapX simulation program. The outcome of the study finds that Kampung Admiralty is a well-designed retirement village typology embodying a spatial configuration that promotes social interaction among visitors and senior residents. Ultimately, the study underscores the overall space syntax performance of Kampung Admiralty, which is dominated by semi-public spaces accounting for 47.62% which corresponds to the 'easy' permeability and high level of clarity in the wayfinding. In essence, the study found that the Kampung Admiralty has excellent level of permeability and wayfinding in the spatial configuration to meet the basic needs of the elderly residents. Therefore, the spatial planning of Kampung Admiralty can become an outstanding reference when designing a retirement village in an urban area.

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1. Introduction

Among the recurring issues surrounding the design of aged care facilities in Malaysia is due to the outdated facilities and insufficient infrastructure that does not meet the basic needs of the elderly. This problem rises to the extent includes poor accessibility for those with mobility issues. With the gradual rise in elderly population in Malaysia, the need for improved design in aged care facilities nationwide have become increasingly critical. As the design of the living spaces have a profound impact on the wellbeing of the elderly, it is pivotal to provide them with ideal social environments that support their daily routines (Hu et al., 2020). Among the most fundamental traits to designing a well designed aged care facility include to cater to various health and mental conditions that elderly individuals may face, such as dementia or chronic illnesses. Accordingly, the design of aged care facilities like retirement village should incorporate elements that are important for the mental and emotional well-being of the elderly, such as communal spaces for social interaction and activities that align with their social and cultural practices. A retirement village is a type of housing typology designed as specialized accommodation that caters the needs of the elderly people (Hu et al., 2017). Simultaneously, the aged care facility needs special attention in the design of spatial configuration to facilitate a clear wayfinding and promote socially sustainable environment. The development of a sustainable living environment of retirement villages in Malaysia is urgently needed, where the residents' social, and environmental requirements can be achieved. Therefore, it has become the premise of the present study to determine the aspects of spatial design and evaluate its performance towards spatial and social sustainability viewed from the spectrum of retirement village.

Among the most prevalent design of a retirement village typology can be seen in the design of Kampung Admiralty. The retirement village is built in 2017 to meet the needs of Singapore's aging population. The building typologies of Kampung Admiralty comprised of senior living apartments, medical healthcare, and community facilities. This case study is considered unique because the building is the first integrated building with a new combination of mixed-used building typologies in Singapore. The reason for selecting this case study is to study the space syntax analysis of this building with a new combination of different building typologies. The practice of incorporating mixed-use building typologies in the design of retirement village is uncommon as retirement village is commonly designed to cater the unique needs of the elderly especially pertaining the privacy and user's movement. Understanding the spatial configuration of this new typology of retirement village can proovide insights on the effectiveness of the design in integrating different typologies from the spectrum of spatial permeability and wayfinding. Based on Samsudin (2023), a retirement village is a facility that provides specific services and assistance for seniors in their daily activities. It accommodates independent living seniors with various lifestyles, including several recreation facilities and an elderly care centre for assisted living seniors. Kampung Admiralty is designed for intergenerational activities, which are defined as activities that facilitate and promote interactions between people from different generational groups (Vanderbeck, 2015). Kampung Admiralty adopts a biophilic architecture style. Based on Zhong, Schröder and Bekkering, (2022), biophilic design is an approach in architectural design that intends to connect building occupants with nature (Ryan & Browning, 2020).

Singapore's Kampung Admiralty is designed as a vertically integrated mixed-use building by WOHA in response to issues such as the increment of Singapore's aging population (Azzali et al., 2022) and limited land resources (Gopalakrishnan, 2023). Kampung Admiralty is being chosen as the most suitable case study in this paper due to its good vertical spatial planning (Gopalakrishnan, 2023) and its complexity in integrating public housing for seniors with healthcare, wellness and medical facilities and a childcare center. Kampung Admiralty differs from other retirement villages because a normal retirement village only accommodates older people. Based on Yusoff (2019), public space and private space configurations must be designed accordingly to ensure the successful spatial planning of a building.

The significance of studying wayfinding and permeability of Kampung Admiralty is understanding the subdivision of public, semi-public, semi-private and private spaces, which can enhance the users' experience (Fuad, 2022). This building, designed by WOHA, won World Building of the Year at the World Architecture Festival 2018. It has also won multiple awards, such as a commendation for commercial architecture at the 2018 International Chapter Architecture Awards and the Best Commercial Mixed-Use Future Project award at the 2016 edition of the festival. Seah Chee Huang, the Singapore Institute of Architects president, recognized Kampung Admiralty as a big achievement for WOHA and Singapore (Goh et al., 2018). Therefore, this study aims to analyse the users' level of permeability and wayfinding in the retirement village by studying the spatial arrangement of the case study.

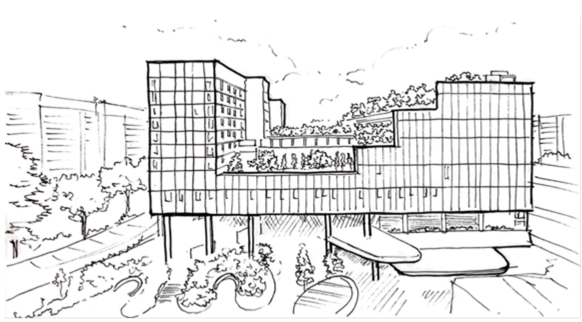


Figure 1. Facade Illustration of Kampung Admiralty, Singapore (Source: Author)

2. Literature Review

2.1 Space Syntax

In 1970, Bill Hillier and his colleagues at Bartlett Scholl of Architecture developed space syntax (Van Nes et al., 2021). Space syntax is a theory or method that analyses the relationship between spatial patterns and human behaviours (Lee et al., 2023; Ooi et al., 2024). Space syntax studies the spatial transition of human movement from one space to another (Chee et al., 2022). For instance, building, building groups, neighbourhood or urban areas, and people's activity within these spaces (Ergün et al., 2022). It uses the concept of graph theory to analyse the relationship between space and human behaviour (Yusoff et al., 2019). Analysis of spatial patterns using space syntax methods such as justified graph analysis and Visibility Graph Analysis (VGA) found that spatial configuration and level of permeability, wayfinding, connectivity, and integration are all related (Abd Rahaman et al., 2019).

Originally developed by Bill Hillier and colleagues at the University College London (Dettlaff, 2014), the space syntax analysis method is used to examine the influence of the spatial layout of buildings on social outcomes of human movement and social interaction (Dawson, 2000). The theory of space syntax aims to analyze space and its configuration, focusing on its implications for social relations and pedestrian movement. Space syntax is a mathematically derived theory that provides a means of understanding the spatial configuration of a building from the perspective of the social interactions between inhabitants (Dawes & Ostwald, 2013). Space syntax theory attempts to describe configured spaces as the patterns of embodied experiences (Ooi et al.,2024), which humans encounter in daily life through the notion of spatial configuration (McLane, 2013). The three conventional approaches to space syntax research are convex space, axial line and visibility graph analyses (Dawes & Ostwald, 2013).

2.2 The Level of Permeability

Permeability refers to the level of connectivity between spatial units, which allows for easy and direct access to each spatial unit within a building. Different spaces inside a spatial configuration have different levels of permeability determined by the adjacency of the spaces from the main entrance. The surrounding space around a person is characterized by the interpersonal distance classes, measured based on scales of intimate, personal, peri-personal or social and public (Hall, 1966). This spatial characteristic is synonymous with the concept of permeability of a spatial configuration that determines the level of privacy of space from the defined root space (entry) measured by qualities involving public, semi-public, private and semi-private (Abdul Nasir et al., 2021). The level of permeability measures the embedded quality of space in architecture from the interface of external layout to spatial organization in the internal layout of buildings (Abdul Nasir et al., 2021). The level permeability allows for analysis and interpretation of the hierarchy and spatial efficiency of indoor spaces in a building (Mustafa & Hassan, 2013).

The level of permeability in a spatial configuration can be described in terms of direct and controlling permeability. Direct permeability describes the relationship of adjacency between the cells, while controlling permeability puts some cells in the relationship of control and containment of others (Hillier & Hanson, 1989). Permeability characterizes the potential movement and patterns of navigation inside the building by the occupants in between spaces within a configuration. The level of permeability can be easily determined using the space syntax justified graph. As the spatial node in the justified graph located further apart from the root, the spaces can be considered as reduced level of permeability and vice versa. In principle, the spaces that possess low level of permeability tend to be more private and vice versa. Apart from the justified graphs and integration value, the convex maps and the axial line maps are two alternative methods to measure the permeability of spaces (McLane, 2013). Convex space maps reveal a level of complexity of spatial configuration: the more steps one should take to get from a point to another, the more complex the configuration becomes, leading to higher degree of segregation between building spaces (McLane, 2013) leading to reduced permeability. Understanding the level of permeability of different spaces for a retirement village is critical in determining the location of spaces with different functions in the spatial configuration, thus, facilitating effective navigation and wayfinding of the elderly people.

2.3 The Level of Wayfinding

Wayfinding determines the effectiveness of the connectivity between the users, spaces or zones and the available programs. The term "wayfinding" was originally introduced by Kevin Lynch in 1960, and it is commonly defined as "the process of determining and following a path or route between an origin and destination (Wiener et al., 2009)." In general terms, wayfinding is navigating oneself from a present location to a desired destination (Youssef & Youssef, 2022). The element of path is the most prominent among the elements identified by Lynch (1960) in determining wayfinding due to parameters of orientation and connectivity of indoor spatial arrangements. An effective wayfinding of indoor spaces can be achieved through the design of paths that allows occupants to maintain their orientations by relying on clear directional cues through the impression of the continuous path. On the other hand, the absence of clear directional cues can cause disorientation, triggering users' confusion and reliance on assisted means of wayfinding options.

Space syntax analysis has been increasingly used in applications related to predicting human wayfinding behaviors. The space syntax methods have been utilized to capture surrounding environmental elements that determine individual human navigation decisions (Khozaei Ravari et al., 2022). Numerous accounts have demonstrated a strong relationship between human wayfinding behavior and the indoor environment (Iftikhar et al., 2021). The complexity of the spatial layout is an important aspect to understand wayfinding behavior (Natapov et al, 2020). One way to analyse wayfinding using space syntax is through analysis of spatial integration and segregation of the justified graph. In the graph, the symmetrical and asymmetrical relationships between the nodes determine the spatial complexity that corresponds to wayfinding behavior of the occupants.

2.4 Sustainable Retirement Village

Spatial sustainability refers to geometric and configurational arrangement of spaces that contributes to aspects of sustainability. Hu (2023) refers social sustainability of retirement village from the social spectrum defining it as an aspect in the development of communities to enhance livability through improved social cohesion and well-being. In examining the aspects of social sustainability, the study finds, social connectivity and public engagement coupled with daily life support among the prominent indicators (Hu, 2023). Safety and security are also found to be among the crucial considerations of older people after retirement (Hu, 2023). Accordingly. Hu et al. (2017) underscores the importance of services provision and accessibility, social interaction, secure and independent living as the main qualities of social sustainability in the retirement village.

While, Chandler and Robinson (2014) explores the aspects of wellbeing and suggesting that the environment is a major source of wellbeing among the elderly. The study added that a retirement village experience should contribute to increased social life and activities; reduction in feelings of loneliness; more manageable and suitable dwellings. Among the effective strategy as indicated in the study includes encouraging a more permeable divide between the village occupants and the surrounding community (Chandler & Robinson, 2014). The reason is promote the sense of reality to the occupants that the occupants of the village is part of the community and preventing disengagement for the external world (Chandler & Robinson, 2014). Incorporating social sustainability features into community environments is one of the effective strategies to facilitate a healthy ageing environment of the elderly groups (Hu et al., 2020).

3. Methodology

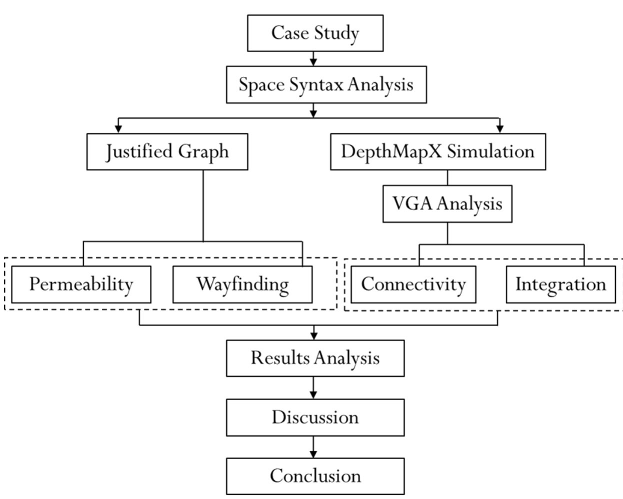


Figure 2. Research Methodology Framework

3.1 Methodology Framework

The research methodology framework is depicted in Figure 2 which started with the selection of case studies, followed by space syntax analysis based on the justified graph and depthMapX simulation. Kampung Admiralty (see Figure 1) is chosen as case study as it is uniquely designed to integrate housing for the elderly with various social, healthcare, communal, commercial, and retail facilities. The whole mixed-used building complex consists of an 11-story retirement village that features 104 apartments for the elderly with a community park, a two-story medical center, an Active Ageing Hub co-located with a childcare center, dining and retail outlets, and a hawker center. The designer of the residential complex, WOHA, designed Kampung Admiralty with 32,332 square meters of gross floor area, and the construction was completed in May 2017. Besides meeting the increasing needs of Singapore's aging population, this building aims to promote an active aging community lifestyle and support inter-generation bonding.

Kampung Admiralty (Figure 1) is a mixed-use building (Handoyo, N.D.) organised in three layers with three main building typologies. The lower levels consist of community facilities with commercial shops. Medical healthcare is located at the middle levels of the buildings, whereas the topmost layer consists of senior living studio apartments and the green community garden (Block, 2018). The lower levels of community facilities are designed for the public, followed by semi-public medical healthcare facilities and private senior living studio apartments. The level of privacy increases when the level of the building increases. The architect intends to promote inter-generational and ageing in place (Ter & Isa, 2020). Therefore, the ground level of the building is designed as a public area for community activities that encourage social interaction. The level of privacy increases when the users reach the higher level of the building because privacy is needed for senior residents.

Kampung Admiralty is located on a 0.9-ha urban site in Woodlands New Town, Singapore, with a height limit of 45m (Yuen, 2019). People can access the building via Woodlands Drive 71. Kampung Admiralty is also strategically location beside Admiralty MRT Station. Kampung Admiralty shows biophilic architecture by creating nature-centric neighborhoods to improve liveability and community health in the building. Overall, 4,730 square metres of total green areas are provided at the building, spanning about 53 percent of the total plot area. The green areas serve as community gardens and farming, besides acting as a scenic backdrop to attaining desired levels of liveability and sustainability (NA, 2023).

3.2 Justified Graph

The method in analyzing the space syntax relationship patterns is through the justified graphs. The graph features the depth of space is described as the depth distance of space from the main entrance (root) on the y-axis. Whereas the bottom of the graph described the parallel space with the same depth among the spaces coded and drawn on the graph as shown in Figure 3. Qualitative research based on a Justified Graph is being implemented to analyze the users' level of permeability and wayfinding in the case study building based on Abdul Nasir et al. (2021). Qualitative methodology aims to produce in-depth and illustrative information to understand the various dimensions of the problem under analysis instead of concerning numerical results (Queirós et al., 2017). Space syntax is used to analyse the spatial configuration in buildings and different spaces (Dursun, 2007). This study uses analytical justified graph and visibility graph analysis (VGA) to provide qualitative references and analyse the level of permeability and wayfinding for the site layout plan and internal spatial planning.

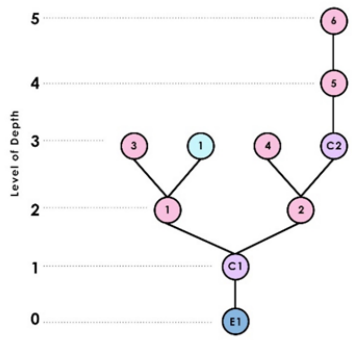


Figure 3. A sample of a justified graph (Source: Author)

A justified graph is drawn to restructure the building, with all the spaces laid out from a specific space at different reference levels (Klarqvist, 2015). Figure 2 shows a sample of the justified graph. The vertical axis of the justified graph represents the level of depth, whereas the justified graph's horizontal axis represents the building's nodes. Likert Scale is the most commonly used tool to scale responses in survey research (Mustafa & Hassan, 2013). Thus, each space's permeability and wayfinding level are examined using a Likert Scale in Table 2 based on the level of depth.

Table 1. Labelling of spaces in hierarchical order

Elements	Design Coding & Colour	Design Coding in Hierarchical Order
Entrance	E	E1, E2, E3, …
Space for Visitors	SV	SV1, SV2, SV3, …
Space restricted for residents.	SR	SR1, SR2, SR3, …
Space restricted for staff	SS	SS1, SS2, SS3, …
Lift	L	L1, L2, L3, …
Escalator	R	R1, R2, R3, …
Staircase	S	S1, S2, S3, …
Corridor	C	C1, C2, C3….

It is important to indicate spaces in different zones with numbers or alphabetical symbols and colour codes (Chee et al., 2022). In this case study, there are three indicators to differentiate the spaces based on the type of users, which are visitors, residents, and staff, by using three different colours and design codes. Based on Table 1, the pink colour and design code (SV) indicate that the space is permeable by visitors, and the green colour and design code (SR) indicate that the space is restricted for residents. The cyan colour and design code (SS) indicate that the space is restricted for staff. This will help in assessing the level of permeability in the case study. Vertical circulations such as lifts, escalators, and staircases are indicated in yellow, and each element has its design codes (L), (E), and (S), respectively, as shown in Table 1. The horizontal circulation, such as the corridor, is indicated in purple with design code (C) to better understand how people navigate the spaces in the case study building. Entrances are indicated as E1, E2, E3, … which marks the first space to navigate. Alphanumeric characters differentiate the nodes with circulation, whereas SV, SR, and SS, which have two alphabets, are nodes. In contrast, E, L, R, S, and C, which have one alphabet, are circulation. By using the design codes with colours, the spaces are indicated in the justified graphs and grouped based on their floor levels in the justified graph for clearer understanding.

Table 2. Labelling of spaces in hierarchical order

Level of Depth	Level of Permeability	Level of Wayfinding
0 1	Public	Straightforward
2 3	Semi-public	Easy
4 5	Semi-private	Difficult
6	Private	Very Difficult

The justified graph is analysed using the Likert Scale in Table 2 based on previous study by Khozaei Ravari et al. (2022). To facilitate the permeability of spaces in the case study building, the spaces are measured based on the four-category scale: (1) public, (2) semi-public, (3) semi-private, and (4) private. On the other hand, the level of wayfinding of spaces is measured based on the four-category scale: (1) straightforward, (2) easy, (3) difficult, and (4) very difficult. From the justified graph's depth level result, the permeability and wayfinding level will be rated using this Likert Scale. For example, spaces in the lowest depth level 1 tend to be public and straightforward in wayfinding, whereas spaces in the highest depth level 7 tend to be private and very difficult in wayfinding.

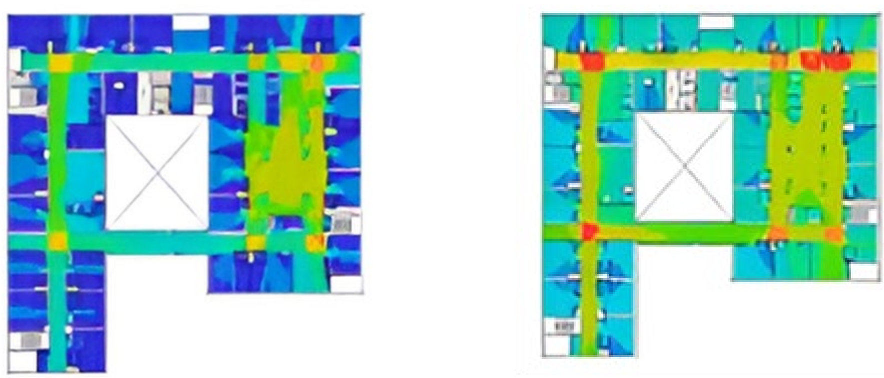


Figure 4. A sample of the visual connectivity (left) and visual integration (right) maps (source: Lee & Lee, 2020)

Figure 4 depicts examples of the visual connectivity and integration graphs, respectively. The visual graph analysis, connectivity graph, and integration graph are analysed based on the colour generated on the floor plans by using DepthmapX software. The result will be analysed in terms of visual connectivity, visual integration, level of permeability, and level of wayfinding based on the Likert Scale shown in Table 3. Different colours represent different degrees of visual connectivity and integration and different levels of permeability and wayfinding. To facilitate the permeability of spaces in the case study building, the spaces are measured based on the four-category scale: (1) public, (2) semi-public, (3) semi-private, and (4) private. The level of wayfinding of spaces is measured based on the four-category scale: (1) straightforward, (2) easy, (3) difficult, and (4) very difficult. For example, the red colour shows very high visual connectivity and integration, and this area is classified as public and straightforward in wayfinding.

Table 3. Visual connectivity, visual integration, level of permeability and level of wayfinding based on colour scale (Source: Author)

Colour Scale	Colour	Visual Connectivity	Visual Integration	Level of Permeability	Level of Wayfinding
	Red Orange Yellow	Very High High	Very High (Most integrated)	Public	Straightforward
	Green Mint Tifanny	High	High (Integrated)	Semi-public	Easy
	Cyan Blue	Low	Low (Segregated)	Semi-private	Difficult
	Dark Blue	Very Low	Very Low (Most segregated)	Private	Very Difficult

The levels of permeability and wayfinding are identified based on the percentages of space for each level. For the levels of permeability, the percentages of space for public, semi-public, semi-private, and private are identified, and these levels of permeability are discussed in hierarchical order. For the levels of wayfinding, the percentages of space for straightforward, easy, difficult, and very difficult are calculated, and these levels of wayfinding are discussed in hierarchical order.

4. Results Analysis

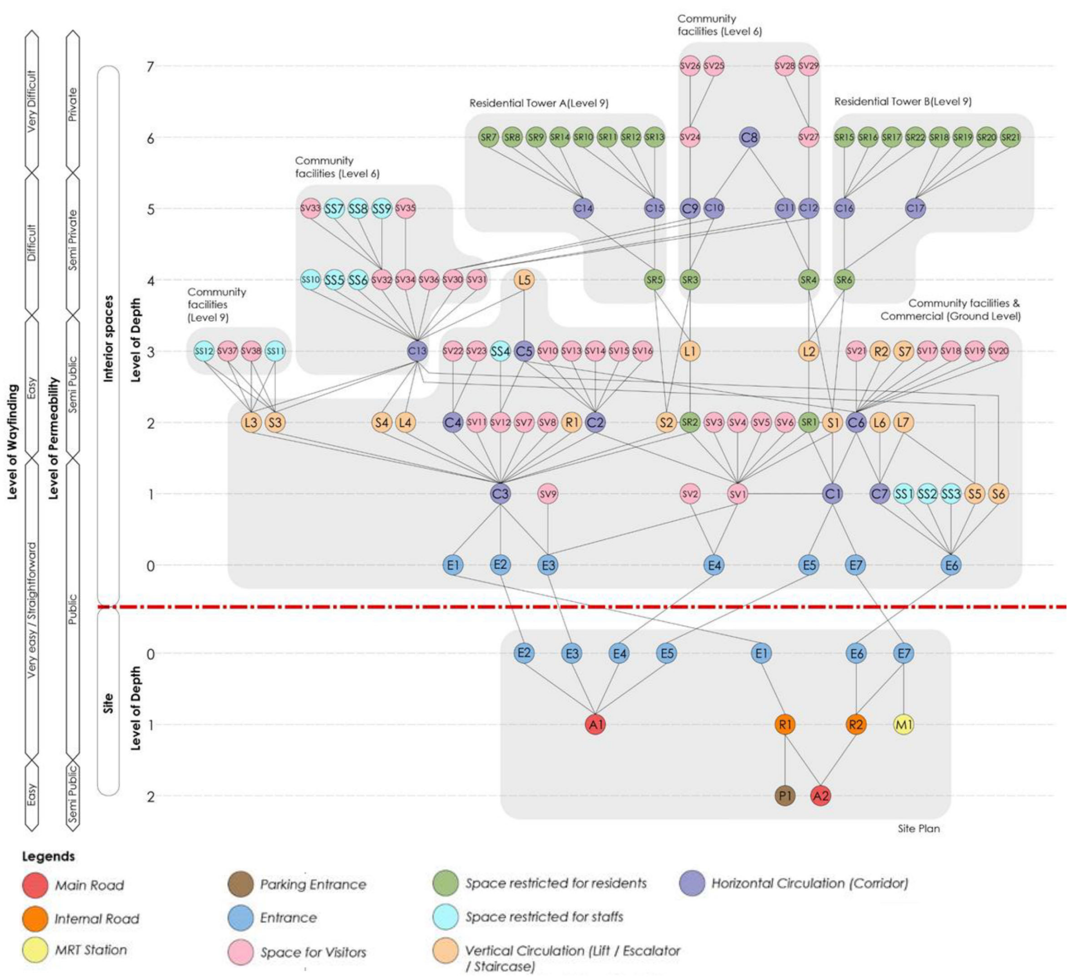


Figure 5. Justified Graph of Kampung Admiralty, Singapore (Source: Author)

Figure 5 illustrates the overall Justified Graph of Kampung Admiralty, Singapore. The Kampung Admiralty's spatial configuration is generally examined by referring to users' categories. A total of three user categories are identified, which are visitors, residents, and staff. Visitors are indicated in pink, residents are indicated in green, and staff are indicated in cyan.

4.1 Analysis of Site Plan

Legend

Code	Space	Code	Space	Code	Space
A1	Woodlands Ring Rd	E1	Main Entrance (Drop Off)	E6	Loading Unloading Bay
A2	Woodlands Drive 71	E2	Pedestrian Entrance 1 from Woodlands Ring Rd	E7	Pedestrian Entrance from North (Admiralty MRT Station)
M1	Admiralty MRT Station	E3	Pedestrian Entrance 2 from Woodlands Ring Rd	E1	Main Entrance (Drop Off)
R1	Entrance road	E4	Pedestrian Entrance 3 from Woodlands Ring Rd	E2	Pedestrian Entrance 1 from Woodlands Ring Rd
R2	Service Road	E5	Pedestrian Entrance from East-west	P1	Basement Parking Entrance

Figure 6. Site Plan of Kampung Admiralty, Singapore (Redrawn from source: archdaily.com)

There are two depth levels for site access, 0 to 2, as illustrated in the justified graph in Figure 5. Based on the justified graph in Figure 5 and the Site Plan in Figure 6, Woodlands Ring Road (A1), entrance road (R1), service road (R2) and Admiralty MRT Station (M1) are classified as public from the building entrances, E1, E2, E3, E4, E5, E6 and E7 with depth level 1. Although the service road (R2) has the same depth level as A1, R1 and M1, the location is more hidden from the main access road, Woodlands Ring Road (A1) and Woodlands Drive 71 (A2). Besides, the service road (R2) has restricted vehicle access for service purposes only. Parking entrance (P1) and Woodlands Drive 71 (A2) are classified as semi-public with depth level 2.

Based on the justified graph in Figure 5 and the Site Plan in Figure 6, Woodlands Ring Road (A1), entrance road (R1), service road (R2) and Admiralty MRT Station (M1) show a very straightforward wayfinding with depth level 1. The entrance road (R1) can be easily accessed from the main entrance (E1) before reaching Woodlands Drive 71 (A2) with depth level 2. Besides, Woodlands Ring Road (A1) can be easily accessed from entrances E2, E3, E4 and E5, whereas service road (R2) can be easily accessed from entrances E6 and E7. However, the service road (R2) and entrances, E6 and E7, are restricted only to staff. With straightforward wayfinding, the Admiralty MRT station (M1) will benefit the building users because they can easily reach the Admiralty MRT station (M1) and use public transport. Parking entrance (P1) and Woodlands Drive 71 (A2) show an easy wayfinding with a depth level 2.

4.2 Analysis of Groundfloor Plan

Legend

Code	Space	Code	Space	Code	Space	Code	Space
E1	Main Entrance (Drop Off)	SV9	Underground Bicycle Storage 2	SR1	Resident Lobby 1 (GF)	S3	Staircase 3
E2	Pedestrian Entrance 1 from Woodlands Ring Rd	SV10	Shop 3	SR2	Resident Lobby 2 (GF)	S4	Staircase 4
E3	Pedestrian Entrance 2 from Woodlands Ring Rd	SV11	Restaurant 5	SS1	Services	S5	Staircase 5
E4	Pedestrian Entrance 3 from Woodlands Ring Rd	SV12	Pharmacy	SS2	Services	S6	Staircase 6
E5	Pedestrian Entrance from East-west	SV13	Restaurant 6	SS3	Services	S7	Staircase 7
E6	Loading Unloading Bay	SV14	Shop 4	SS4	Pharmacy Storage Room	R1	Escalator 1
E7	Pedestrian Entrance from North (Admiralty MRT Station)	SV15	Shop 5	C1	Corridor 1	R2	Escalator 2
SV1	Community Plaza	SV16	Shop 6	C2	Corridor 2	L1	Lift 1 (Resident)
SV2	Underground Bicycle Storage 1	SV17	Restaurant 7	C3	Corridor 3	L2	Lift 2 (Resident)
SV3	Shop 1	SV18	Shop 7	C4	Corridor 4	L3	Lift 3
SV4	Restaurant 1	SV19	Shop 8	C5	Corridor 5	L4	Lift 4
SV5	Restaurant 2	SV20	Shop 9	C6	Corridor 6	L5	Lift 5
SV6	Restaurant 3	SV21	Restaurant 8	C7	Corridor 7	L6	Lift 6
SV7	Restaurant 4	SV22	Male Washroom	S1	Staircase 1	L7	Lift 7
SV8	Shop 2	SV23	Female Washroom	S2	Staircase 2		

Figure 7. Ground Floor Plan of Kampung Admiralty, Singapore (Redrawn from source: archdaily.com)

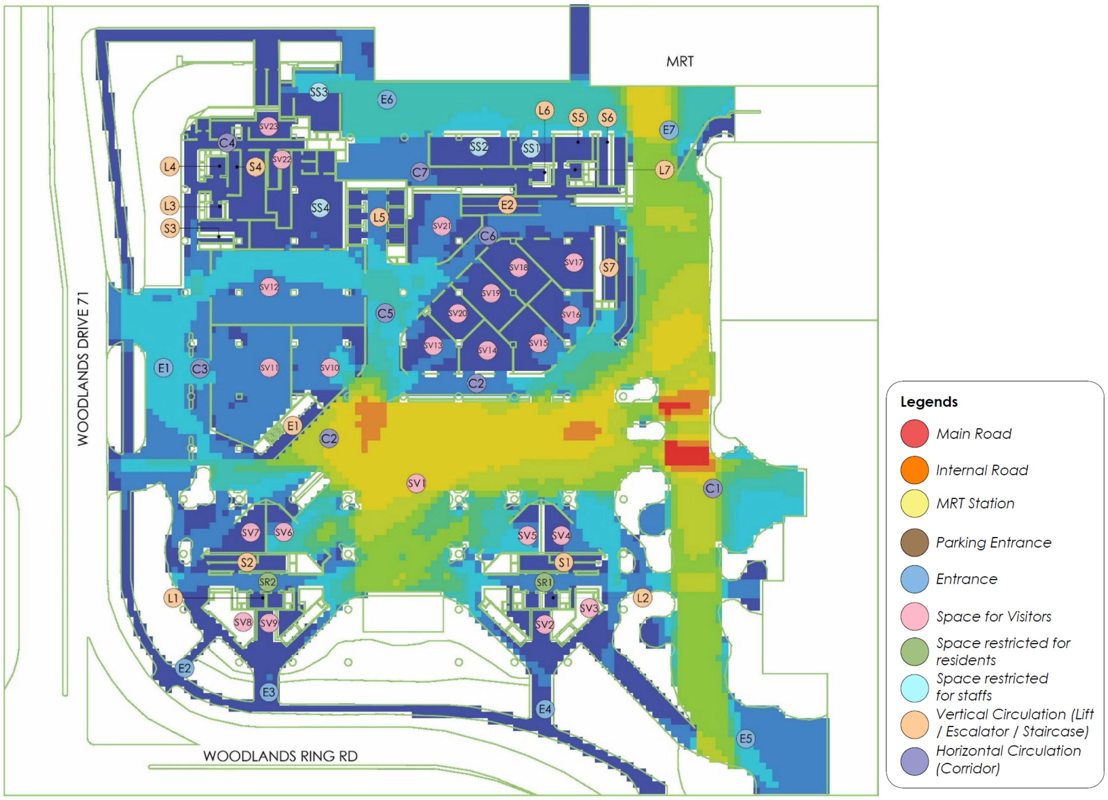


Figure 8. Visual Connectivity Graph of Ground Floor Plan (Source: Author)

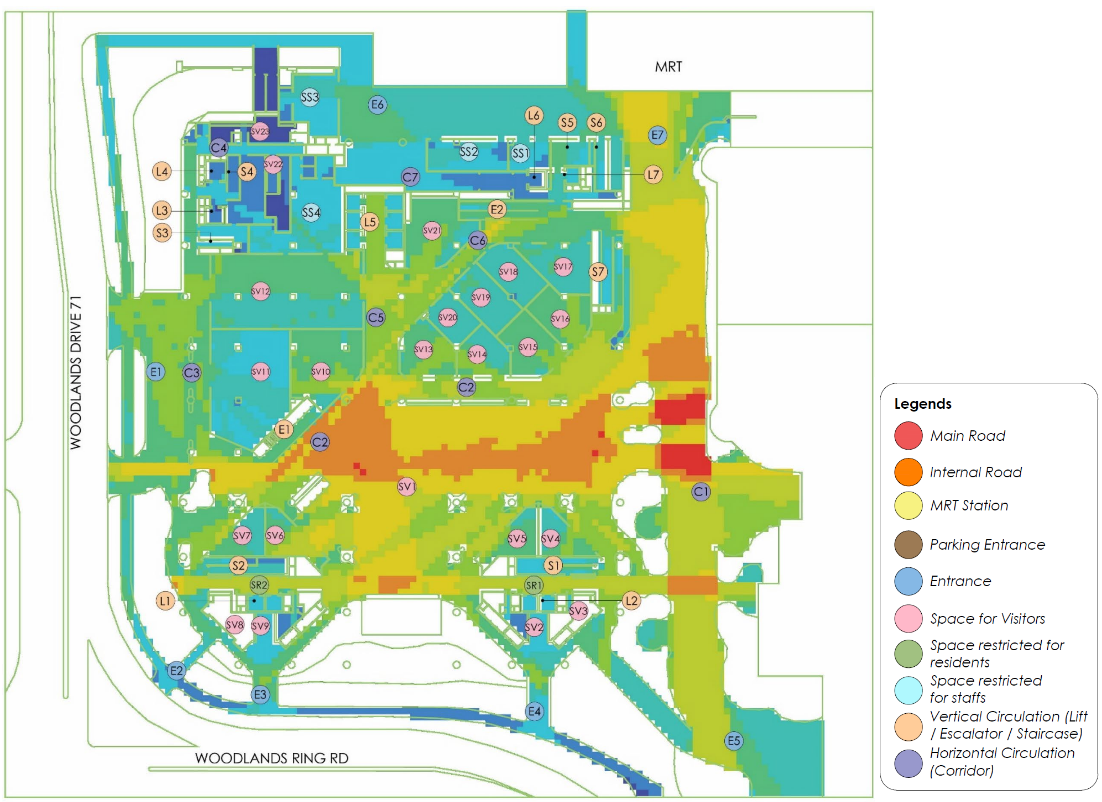


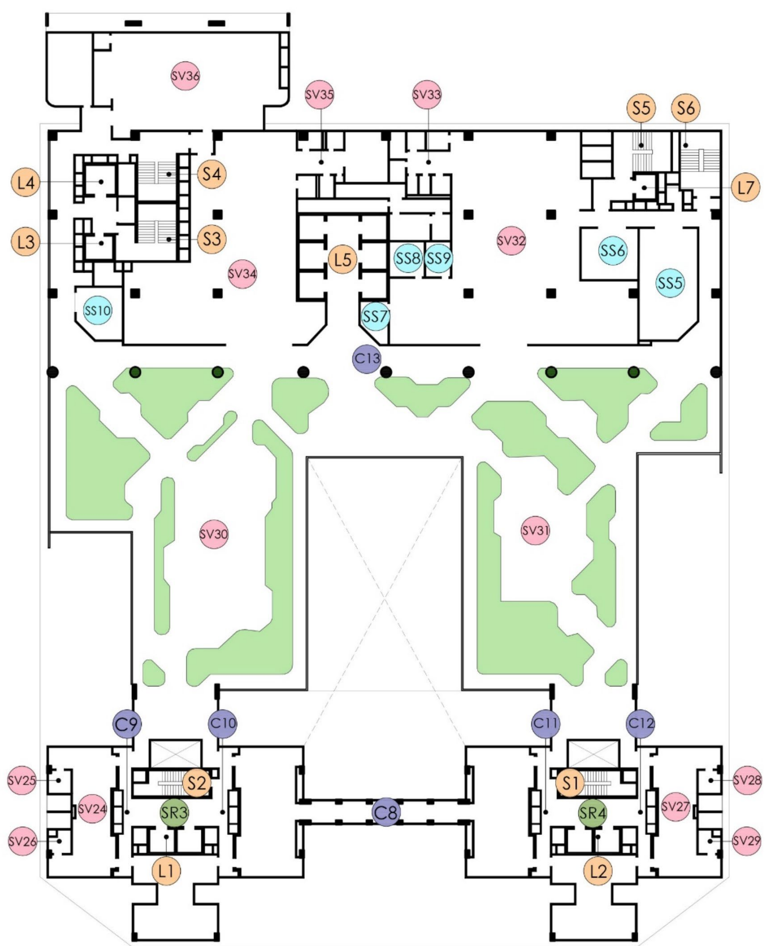
Figure 9. Visual Integration Graph of Ground Floor Plan (Source: Author)

The justified graph shows four depth levels from level 0 to level 5 for the ground floor of Kampung Admiralty, as illustrated in Figure 7.

Based on the justified graph in Figure 5, most of the spaces on the ground floor of Kampung Admiralty are placed at the lower levels of the justified graph. By referring to the Likert Scale in Table 2, depth levels 0 and 1 are classified as public space; depth levels 2 and 3 are classified as semi-public space, whereas depth level 4 is classified as semi-private space. Community plaza (SV1), underground bicycle storage 1 (SV2) and underground bicycle storage 2 (SV9) with depth level 2 in the justified graph are classified as public spaces in Kampung Admiralty. This is because the community plaza (SV1) is designed for events and aerobic exercise, which acts as the main public space of the building. The underground bicycle storage 1 (SV2) and underground bicycle storage 2 (SV9) are public facilities for the local community. The visual connectivity graph in Figure 8 and the visual integration graph in Figure 9 further validate the community plaza (SV1) as a public space with yellow and orange colours, respectively. Based on the justified graph and VGA graphs (Figures 5, 8 and 9), the shops (SV3, SV8, SV10, SV14, SV15, SV16, SV18, SV19 and SV20), restaurants (SV4, SV5, SV6, SV7, SV11 and SV21), pharmacy (SV12) and washrooms (SV22 and SV23) are classified as semi-public spaces in the building of Kampung Admiralty. Lift 5 (L5) is also classified as a semi-public space placed at depth level 4 to encourage higher user movements at shops and restaurants before using Lift 5 (L5) for vertical access. In general, spaces on the ground floor of Kampung Admiralty are mainly open to the public except for storage space (SS4) and services (SS1, SS2 and SS3), which are restricted only to staff.

Based on the VGA connectivity and integration graphs (see Figures 8 and 9), community plaza (SV1), underground bicycle storage 1 (SV2), and underground bicycle storage 2 (SV9) are straightforward in wayfinding. With this, visitors can easily reach the community plaza (SV1) and use the facility's underground bicycle storage system (SV2 and SV9) before entering the Kampung Admiralty. Corridor (C7) and spaces for services (SS1, SS2 and SS3) are designed at the depth level 1 to allow straightforward wayfinding for loading and unloading. Besides, the shops (SV3, SV8, SV10, SV14, SV15, SV16, SV18, SV19 and SV20), restaurants (SV4, SV5, SV6, SV7, SV11 and SV21), pharmacy (SV12) and washrooms (SV22 and SV23) are easy in wayfinding for the convenience of customers and visitors. As a result, the ground floor layout is straightforward, where the segregation of public spaces for visitors and private spaces for the staff is apparent.

4.3 Analysis of Typical Floor Plan: 6th Floor



Legend					
Code	**Space**	**Code**	**Space**	**Code**	**Space**
SV24	Active Ageing Hub	SR4	Resident Lobby 1 (L6)	S1	Staircase 1
SV25	Accessible Washroom	SR3	Resident Lobby 2 (L6)	S2	Staircase 2
SV26	Accessible Washroom	SS5	Services	S3	Staircase 3
SV27	Active Ageing Hub	SS6	Services	S4	Staircase 4
SV28	Accessible Washroom	SS7	Storage Room	S5	Staircase 5
SV29	Accessible Washroom	SS8	Office 1	S6	Staircase 6
SV30	Playground	SS9	Office 2	L1	Lift 1 (Resident)
SV31	Fitness Area	C8	Corridor 8	L2	Lift 2 (Resident)
SV32	Active Ageing Hub	C9	Link Bridge	L3	Lift 3
SV33	Accessible Washroom	C10	Corridor 10	L4	Lift 4
SV34	Childcare Centre	C11	Corridor 11	L5	Lift 5
SV35	Washroom	C12	Corridor 12	L7	Lift 7
SV36	Function Hall	C13	Corridor 13		

Figure 10. The 6th Floor Plan of Kampung Admiralty, Singapore (Redrawn from source: archdaily.com)

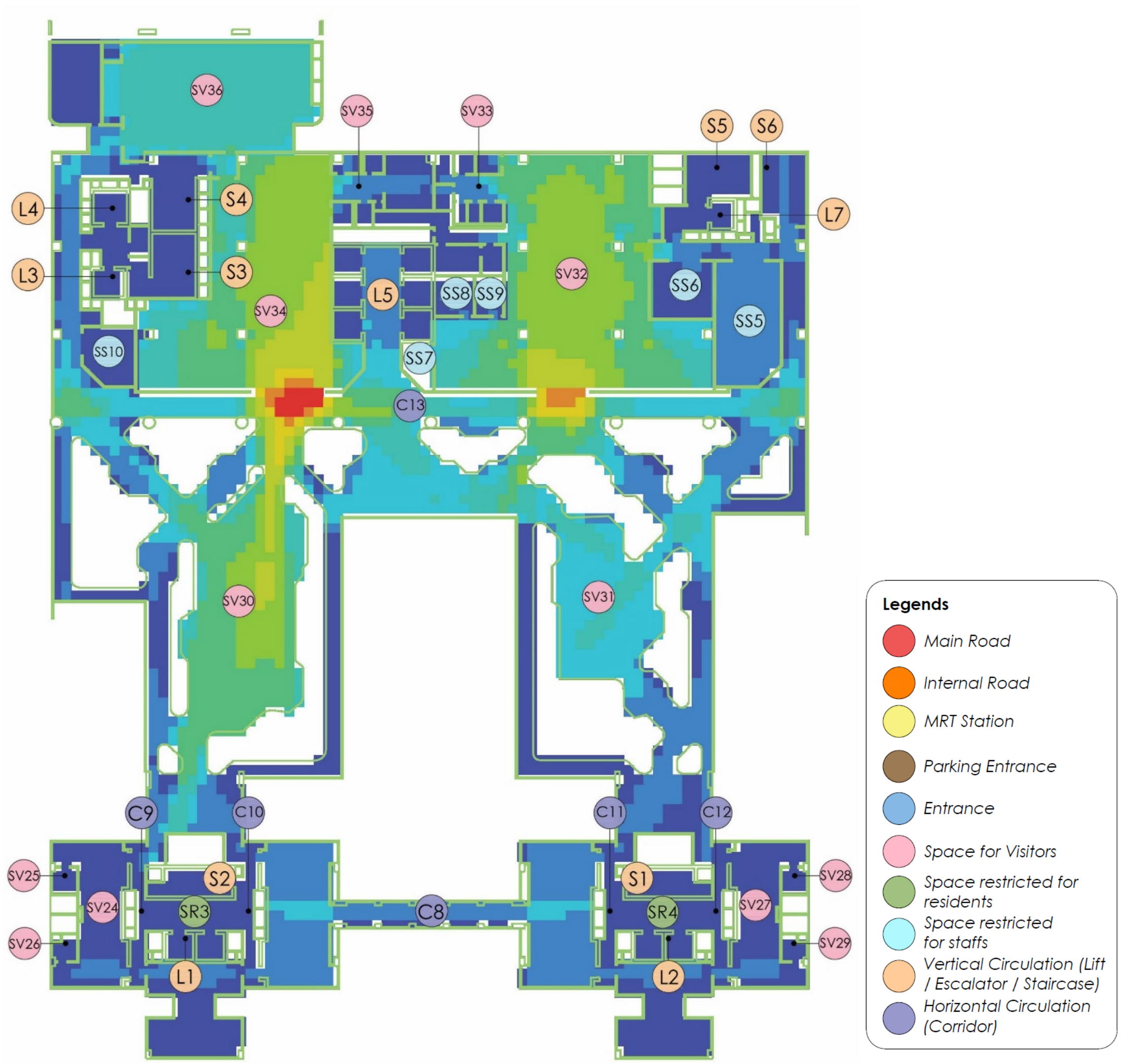


Figure 11. VGA Connectivity Graph of 6th Floor Plan (Source: Author)

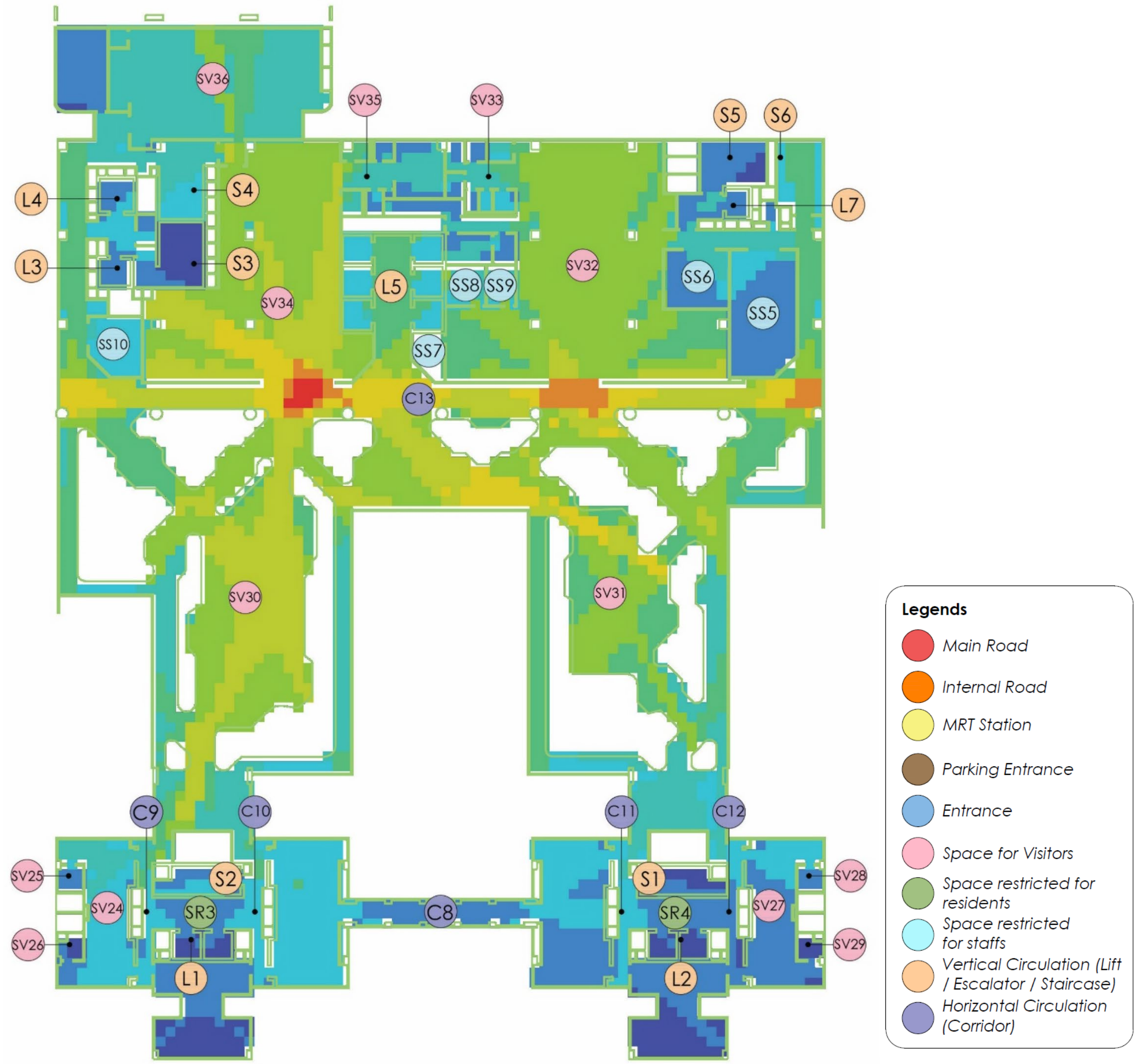


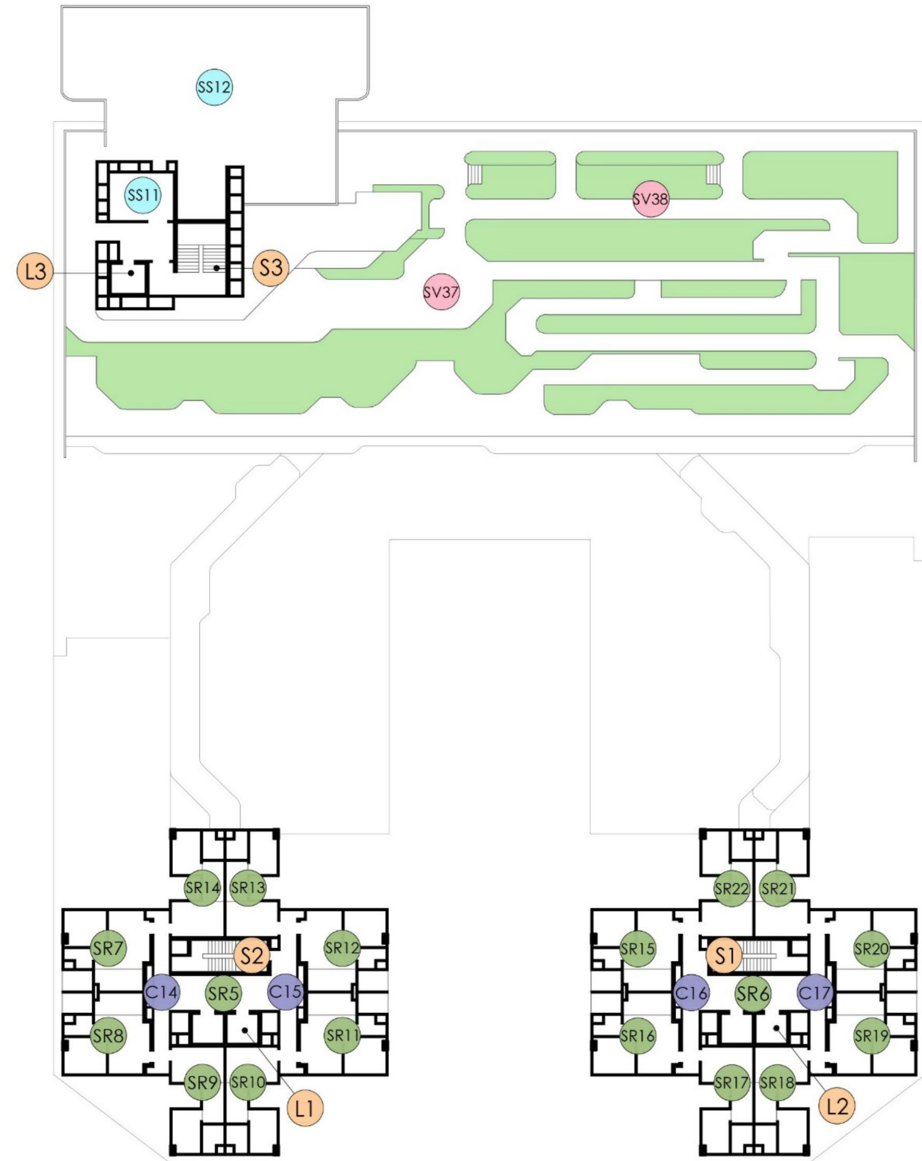
Figure 12. VGA Integration Graph of 6th Floor Plan (Source: Author)

There are five depth levels from level 3 to level 7 for the 6th floor of Kampung Admiralty in the justified graph, as illustrated in Figure 5.

The playground (SV30), fitness area (SV31), childcare centre (SV34), main active aging hub (SV32) and function hall (SV36) are classified as semi-private with a depth level of 4 in the justified graph (Figure 4). However, it shows a slightly different result in the visual connectivity graph (Figure 11) and visual integration graph (Figure 12). The green colour in these spaces, as shown in the graphs, indicates that these spaces are semi-public. However, children and elderly visitors can access these spaces. Therefore, these spaces are more suitable to be classified as semi-public spaces. The active aging hubs (SV24 and SV27) are categorised as private spaces based on the justified graph in Figure 5. This is because these areas can only be accessed by the staff and elderly users of the active aging hub. This is further validated by the result in the visual connectivity graph (Figure 11), which shows blue and dark blue colours in these spaces.

The playground (SV30), fitness area (SV31), childcare centre (SV34), main active aging hub (SV32) and function hall (SV36) show a difficult wayfinding result with depth level 4 in the justified graph (Figure 5). It differs from the visual connectivity graph (Figure 11) and visual integration graph (Figure 12), which shows an easy and direct wayfinding with green and cyan colours in these spaces. The playground (SV30) and fitness centre (SV31) aim for intergenerational activities, which have direct access from the childcare centre (SV34) and main active ageing hub (SV32) via corridor C13. The wayfinding for children and elderly visitors is easy as the Corridor, C13 directs them to the playground (SV30), fitness area (SV31), childcare centre (SV34) and main active aging hub (SV32). Besides, it is believed that the function hall (SV36) is used for the activities that involve users in the childcare center (SV34) and main active aging hub (SV32). Therefore, it has an easy wayfinding based on the visual connectivity graph (Figure 11) and the visual integration graph (Figure 12).

5.4 Analysis of Typical floor Plan: 9th Floor



Legend

Code	Space	Code	Space	Code	Space	Code	Space
SV37	Sky Terrace	SR15	Type A Resident Unit (45sq.m)	SR17	Type B Resident Unit (36sq.m)	C12	Corridor 11
SV38	Community Farm	SR16		SR18		C13	Corridor 12
SR5	Resident Lobby 5 (L9)	SR19		SR21		S1	Staircase 1
SR6	Resident Lobby 6 (L9)	SR20		SR22		S2	Staircase 2
SR7	Type A Resident Unit (45sq.m)	SR9	Type B Resident Unit (36sq.m)	SS11	Lift Motor Room	S3	Staircase 3
SR8		SR10		SS12	Cooling Tower	L1	Lift 1 (Resident)
SR11		SR13		C10	Corridor 9	L2	Lift 2 (Resident)
SR12		SR14		C11	Corridor 10	L3	Lift 3

Figure 13. The 9th Floor Plan of Kampung Admiralty, Singapore (Redrawn from source: archdaily.com)

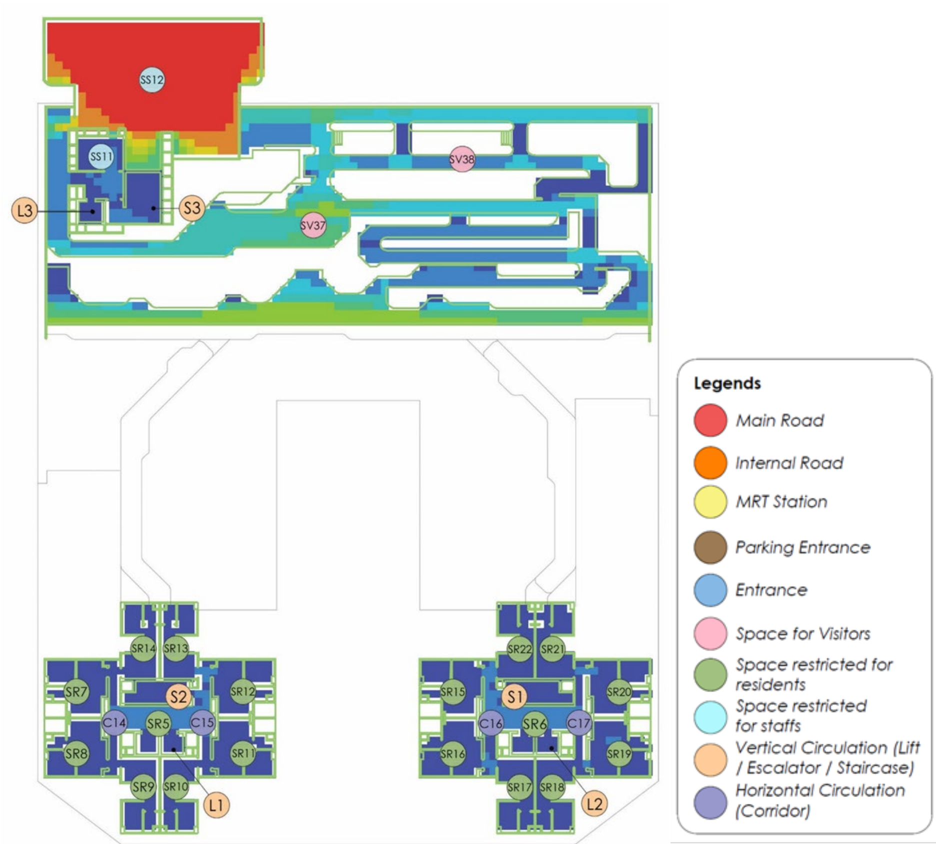


Figure 14. VGA Connectivity Graph of 9th Floor Plan (Source: Author)

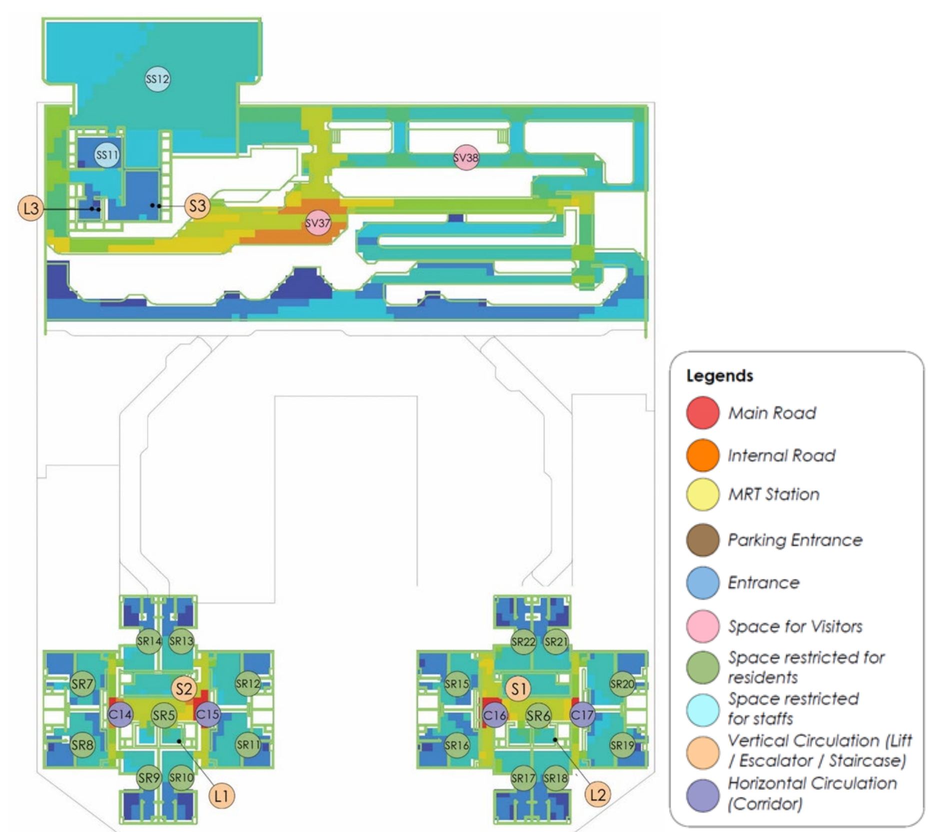


Figure 15. VGA Integration Graph of 9th Floor Plan (Source: Author)

The justified graph shows four depth levels from level 3 to level 6 for the 9th floor of Kampung Admiralty, as illustrated in Figure 5.

Although the sky terrace (SV37) and community farm (SV38) are located on the highest floor of the podium, these spaces are placed at a low depth level of 3 in the justified graph in Figure 5. Referring to the Likert Scale in Table 3, these spaces are designed to be semi-public. However, visibility graph analysis gives slightly different results. The sky terrace (SV37) shows a large area of Tiffany colour in both visual connectivity and integration graphs in Figure 13 and Figure 14, respectively, which indicate it is a semi-private area. Besides, the community farm (SV38) shows a large area of blue colour in both the visual connectivity and integration graph in Figure 13 and Figure 14, which indicates it is a semi-private area. However, both spaces are designed for visitors and residents. Therefore, these spaces should be classified as semi-public and easy access from the entrances of the building.

Based on the 9th-floor plan of Kampung Admiralty in Figure 13, these public spaces are separated from residential Tower A and Tower B to ensure residents' privacy. The units in residential tower A and tower B (SR7, SR8, SR9, SR10, SR11, SR12, SR13, SR14, SR15, SR16, SR17, SR18, SR19, SR20, SR21 and SR22) are placed at a high depth level of 6 in the justified graph (Figure 4), which are designed to be private space when referred to the Likert Scale in Table 2. This is validated by the dark blue colour in these areas shown in the visual connectivity and integration graph in Figure 13 and Figure 14, respectively, which also indicate that these spaces are designed to be private and have a high level of privacy.

The units in residential tower A and tower B (SR7, SR8, SR9, SR10, SR11, SR12, SR13, SR14, SR15, SR16, SR17, SR18, SR19, SR20, SR21 and SR22) have a very difficult wayfinding level based on their placement at depth level 6 in the justified graph (Figure 5) and the dark blue colour in these spaces in the visual connectivity (Figure 13) and integration (Figure 14) graphs. This is to restrict these spaces' access only to the units' residents. In general, the 9th-floor layout of Kampung Admiralty performs good spatial planning, where the segregation of public spaces for visitors and private spaces for residents is apparent.

5. Discussion

Based on the justified graph (Figure 4), visual connectivity graphs (Figures 7, 10 and 13) and integration graphs (Figures 8, 11, 14), the building of Kampung Admiralty generally has more semi-public spaces. The justified graph in Figure 4, illustrates a uniform distribution of the nodes according to the intended level of privacy. Overall, it is clear from the justified graphs that spaces are well designed to meet different privacy requirements based on the level of permeability. This approach demonstrates unique spatial configuration of the retirement village conceptualized as a vertical village (Srikanth et al., 2022). It is clear from the justified graph the significance of corridor design as a point that integrates different spaces for different users which echoes similar observation by Srikanth et al. (2022) suggesting that the spaces on each level form clusters of nodes (communities). However, some crossings happen in the justified graph, which shows the lifts, staircases, escalators, and corridors are connected to various spaces mainly for visitors. This is validated by similar observation by Srikanth et al. (2023) and Gopalakrishnan et al. (2023) Most of the spaces restricted to the village staffs are segregated and possess difficult wayfinding, as depicted in the justified graph and visual connectivity and integration graphs. The design showcases good spatial planning as these spaces are visually and physically hidden from the outside visitors and village residents. The residents' paths in the Kampung Admiralty building is clear and straightforward. This is to ensure the wellbeing, safety and security of the residents. The residents' route starts from a depth level of 3 to a depth level of 6, showing a high privacy level. The visitors' route shows a segregated pattern in the justified graph to encourage social interaction between visitors and the elderly residents. Senior residents can easily join the intergenerational and social activities with the visitors by accessing the public spaces via lifts, staircases, escalators, or corridors.

5.1 *Level of Permeability*

The results as indicated in Table 4 demonstrates that a majority of the spaces in Kampung Admiralty are categorized as semi-public accounting for 47.62% of the total number of spaces in the spatial system, contributing the highest percentage of the overall schedule of accommodation. These spaces are found primarily on the ground floor, 6th floor, and 9th floor. These spaces consist of shops (SV3, SV8, SV10, SV14, SV15, SV16, SV18, SV19 and SV20), restaurants (SV4, SV5, SV6, SV7, SV11 and SV21), pharmacy (SV12) and facilities such as main Active Ageing Hub (SV32), childcare centre (SV34), playground (SV30) and fitness area (SV31). These spaces are classified as semi-public and designed for the convenience of visitors and residents in Kampung Admiralty which echoes the findings by Srikanth et al. (2022). Accordingly, 21.90% of the total spaces in Kampung Admiralty, equivalent to 23 spaces, are classified as private spaces. These spaces are totally restricted for residents and visitors among the customers of the Active Ageing Hub (SV24 and SV27). Based on the analysis of the justified graph, the spaces for residents are located on the 9th floor to achieve a high privacy level, whereas the Active Ageing Hub (SV24 and SV27) are located on the 6th floor to be easily accessed by the customers but still maintained as private spaces. It is worth noting that, 20% of the spaces at Kampung Admiralty are considered semi-private. These spaces are restricted to residents and staff only. Ultimately, only 10.48% of the spaces in Kampung Admiralty are public spaces, contributing the lowest percentage of the overall schedule of accommodation. All these spaces are located on the ground floor, so they are conspicuous and easy to figure out by people who visit Kampung Admiralty. For example, the open plaza (SV1) is a space for gathering, intergenerational activity, and events, and it is strategically located on the ground floor as a public space.

Overall, based on the results, it can be deduced that, the spatial configuration of the retirement village is ingeniously designed to meet the permeability requirements that corresponds to the needs of different building users. Some of these essential needs include, provision of accessible common space to facilitate social interactions (Azzali et al., 2022), security (Chandler & Robinson, 2014) and proximity to resources (Nguyen &

Levasseur, 2023). a majority of the spaces are in the permeability level of semi-public, this condition indicates a major emphasis is given in providing public engagement with the elderly residents on the village, thus provides the benefits of (Nguyen & Levasseur, 2023; Hu, 2023; Samsudin et al., 2023). While many traditional design of the elderly care facilities tend to be exclusively designed to accommodate private spaces to the occupants, the design of Kampung Admiralty appears to break this design tradition (Hou et al., 2023) allowing partial permeability into the private spaces (Srikanth et al., 2022; Gopalakrishnan et al., 2023). As the depth of space increases, the spaces tend to be more private (Abdul Nasir et al., 2021; Khozaei Ravari et al., 2022), defined by reduced accessibility (Natapov et al., 2020; Abdul Nasir et al., 2021). This can be seen in the design of the private residential areas and the level of permeability is gradually reduced. The impact caused the less connectivity between each spaces and increased segregation in spatial configuration (Lee et al., 2023; Khozaei Ravari et al., 2022). This can be considered suitable to give more privacy to the occupants as well as as sense security against intrusion from outsiders which is essential elements in the design of retirement village (Khozaei Ravari et al., 2022).

Table 4. Number and Percentage of Spaces based on Level of Permeability (Source: Author)

Hierarchical Order	Level of Permeability (Depth Level)	Visual Integration	Level	Spaces	Number of spaces	Total number of spaces	Percentage (%)
Quaternary Level	Public (0-1)	Very High (Most integrated)	Ground Floor	SV1, SV2, SV9, SS1, SS2, SS3, C1, C3, C7, S5, S6	11	11	10.48
Primary Level	Semi-public (2-3)	High (Integrated)	Ground Floor	SV3, SV4, SV5, SV6, SV7, SV8, SV10, SV11, SV12, SV13, SV14, SV15, SV16, SV17, SV18, SV19, SV20, SV21, SV22, SV23, SR1, SR2, SS4, C2, C4, C5, C6, E1, E2, S1, S2, S3, S4, S7, L1, L2, L3, L4, L6, L7	40	50	47.62
			6th Floor	C13, SV30, SV31, SV32, SV34, SV36	6		
			9th Floor	SS11, SS12, SV37, SV38	4		
Tertiary Level	Semi-private (4-5)	Low (Segregated)	Ground Floor	L5	1	21	20.00
			6th Floor	SR3, SR4, SS5, SS6, SS7, SS8, SS9, SS10, SR3, SR4, C9, C10, C11, C12	14		
			9th Floor	SR5, SR6, C14, C15, C16, C17	6		
Secondary Level	Private (6-7)	Very Low (Most segregated)	6th Floor	C8, SV24, SV25, SV26, SV27, SV28, SV29	7	23	21.90
			9th Floor	SR7, SR8, SR9, SR10, SR11, SR12, SR13, SR14, SR15, SR16, SR17, SR18, SR19, SR20, SR21, SR22	16		
		Total			105	105	100

5.2 Level of Wayfinding

As shown in Table 5, 47.62% of the spaces in Kampung Admiralty are classified as having the easy in wayfinding, contributing the highest percentage of the overall schedule of accommodation. These spaces allow visitors and residents to easily access these spaces as they are designed for the convenience of people in Kampung Admiralty. It is also discovered that 21.90% of the total spaces corresponding to 23 different spaces in Kampung Admiralty, have very difficult and unclear wayfinding. This is because these spaces are restricted for residents and visitors who are customers of the Active Ageing Hub (SV24 and SV27). Subsequently, 20% of the spaces in Kampung Admiralty are also considered to have difficult in wayfinding, and most of these spaces correspond to the spaces designed to be restricted to residents and staff only. The remaining 10.48% of the spaces in Kampung Admiralty have straightforward wayfinding, contributing the lowest percentage of the overall schedule of accommodation. The open plaza (SV1) is spacious and easy to see upon entering the building. It is designed to cater to a high concentration of people for activities and events to promote social interactions (Ma et al., 2017). SV2 and SV9 are underground bicycle storages that the local community can easily access to park their bicycles.

It is clear from the results that the level of wayfinding changes with permeability level. In general as the spaces tend to be more private, the level of wayfinding tends to become more difficult and vice versa (Abdul Nasir et al., 2021). In the case of Kampung Admiralty, the level of wayfinding shows clear and easy wayfinding on the ground floor spaces designed with the intention to be socially integrated overall especially with the presence of community plaza while maintaining limited connectivity between each of the spaces (Srikanth et al., 2022). This is achieved through presence of numerous corridors located adjacent to the shops and restaurants that provide a sense of welcoming, richness and freedom for outside visitors to visit the village. This spatial design facilitates senior-friendly environments that enable the elderly to participate actively in rather than being passive residents of the village (Chee, 2023). This is a contradiction to most of the conventional designs of the elderly facilities which are commonly designed with straightforward corridors, featuring lack of variation in forms (Hou et al., 2023). This inefficient design of the corridor can affect the elderly emotional well-being as the elderly more susceptible to experiencing spatial disorientation due to poor wayfinding design (Chee, 2023).

As the depth of space goes further into the spaces that accommodate the services the level of connectivity is gradually reduced causing increased difficulty in wayfinding due to navigation towards unfamiliar settings (Khozaei Ravari et al., 2022). This design approach intends to limit visitors while allowing the staffs to access these spaces thus providing a sense of privacy and security needed by the residents (Srikanth et al., 2022; Chandler & Robinson, 2014). On the 6th floor plan, the wayfinding becomes increasingly difficult to outside users and visitors as permeability is gradually reduced to accommodate uniquely to the visitors and residents to use the space. The space on the 6th floor becomes more segregated possessing difficult wayfinding. This spatial segregation will give more sense of security to the residents in the private spaces while maintaining engagement with outside visitors as suggested by Chee (2023), Ma et al. (2017) and Azzali et al. (2022). The presence of Active ageing hub, playground and fitness area allow for intergenerational engagement for the residents and the local community (Nguyen & Levasseur, 2023) which is essential to the well-being of the elderly residents as suggested by Hu (2021). Ultimately, the 9th floor is designed with most difficult wayfinding to accommodate the private residential spaces giving the residents sense of privacy and security Azzali et al. (2022). The space on the 9th floor is designed to be the most segregated which clearly intended for residential section to accommodate the private living spaces of the elderly residents.

Table 5. Number and Percentage of Spaces based on Level of Wayfinding (Source: Author)

Hierarchical Order	Level of Wayfinding (Depth Level)	Visual Integration	Level	Spaces	Number of spaces	Total number of spaces	Percentage (%)
Quaternary Level	Straightforward (0-1)	Very High	Ground Floor	SV1, SV2, SV9, SS1, SS2, SS3, C1, C3, C7, S5, S6	11	11	10.48
Primary Level	Easy (2-3)	High	Ground Floor	SV3, SV4, SV5, SV6, SV7, SV8, SV10, SV11, SV12, SV13, SV14, SV15, SV16, SV17, SV18, SV19, SV20, SV21, SV22, SV23, SR1, SR2, SS4, C2, C4, C5, C6, E1, E2, S1, S2, S3, S4, S7, L1, L2, L3, L4, L6, L7	40	50	47.62
			6th Floor	C13	6		
			9th Floor	SS11, SS12, SV37, SV38	4		
Tertiary Level	Difficult (4-5)	Low	Ground Floor	L5	1	21	20.00
			6th Floor	SR3, SR4, SS5, SS6, SS7, SS8, SS9, SS10, SV30, SV31, SV32, SV34, SV36, SR3, SR4, C9, C10, C11, C12	14		

Hierarchical Order	Level of Wayfinding (Depth Level)	Visual Integration	Level	Spaces	Number of spaces	Total number of spaces	Percentage (%)
			9th Floor	SR5, SR6, C14, C15, C16, C17	6		
Secondary Level	Very Difficult (6-7)	Very Low	6th Floor	C8, SV24, SV25, SV26, SV27, SV28, SV29	7	23	21.90
			9th Floor	SR7, SR8, SR9, SR10, SR11, SR12, SR13, SR14, SR15, SR16, SR17, SR18, SR19, SR20, SR21, SR22	16		
		Total			105	105	100

5.3 *Analysis of Spatial Design Configuration*

Based on Table 6, many spaces in Kampung Admiralty are single connecting spaces, with 42 spaces, equivalent to 40%. The spaces comprise shops, restaurants and resident units arranged in rows connected by a corridor. 5.71% of spaces in the building are double connecting spaces, which are some staff areas (SS11 and SS12), childcare centre (SV34), sky terrace (SV37) and community farm (SV38). 15.24% of spaces in Kampung Admiralty act as triple connecting spaces, whereas 12.38% act as multiple connecting spaces. Multiple connecting spaces function to connect more than three spaces. For example, resident lift lobbies (SR3, SR4, SR5 and SR6) and corridors (C1, C3, C5, C7, C14, C15, C16 and C17). The end rooms consist of washrooms (SV22, SV23, SV25, SV26, SV28, SV29 SV35) and service rooms (SS1, SS2 and SS3) which are concealed. Staircases, escalators and lifts contribute 6.67%, 1.90% and 6.67% of total building space, respectively.

Table 6. Number and Percentage of Spaces Based on Connecting Spaces (Source: Author)

Connecting Space	Spaces	Number of Space	Percentage (%)
End Room	SV22, SV23, SV25, SV26, SV28, SV29, SV33, SV35, SV36, SS1, SS2, SS3	12	11.43
Single Connecting Space	SV2, SV3, SV4, SV5, SV6, SV7, SV8, SV9, SV10, SV11, SV13, SV14, SV15, SV16, SV17, SV18, SV19, SV20, SV21, SR7, SR8, SR9, SR10, SR11, SR12, SR13, SR14, SR15, SR16, SR17, SR18, SR19, SR20, SR21, SR22, SS4, SS5, SS6, SS7, SS8, SS9, SS10	42	40.00
Double Connecting Space	SS11, SS12, SV34, SV37, SV38, C8	6	5.71
Triple Connecting Space	SV12, SV24, SV27, SV30, SV31, SV32, SR1, SR2, C2, C4, C6, C9, C10, C11, C12, C13,	16	15.24
Multiple Connecting Space	SV1, SR3, SR4, SR5, SR6, C1, C3, C5, C7, C14, C15, C16, C17	13	12.38
Staircase	S1, S2, S3, S4, S5, S6, S7	7	6.67
Escalators	R1, R2	2	1.90
Lift	L1, L2, L3, L4, L5, L6, L7	7	6.67
Total		105	100

6. Conclusion

In conclusion, sustainable design of retirement village is very important to prevent the village residents among the elderly from loneliness and social isolation after relocation. Among the strategies include to provide residents with a socially-interactive environment to ensure their continuous wellbeing. The efficiency of the sustainable design can be measured through the space syntax analysis based on the level of permeability and wayfinding. The study finds Kampung Admiralty showcases a well-designed retirement village that breaks the conventional design of retirement village typology with a spatial configuration that accommodates and promotes social interaction among visitors and senior residents. The incorporation of the large open plaza is an outstanding example of integrated spatial node with high permeability and easy wayfinding that allows outside visitors to congregate and mingle with the elderly residents, thus allowing for intergenerational activities with emphasis on barrier free design. The incorporation of shops and restaurants which surround the open plaza designed with clear wayfidnig also plays a prominent role in attracting customers among general public into the establishment. Service rooms are concealed by being located at the end are carefully placed at a highly segregated location and visually hidden wayfinding from public and semi-public spaces, while still maintaining easy accessibility to the village residents. In fact, the public and residents have easy accessibility with clear wayfinding to the village facilities acting as shared activity area including Active Ageing Hub, childcare centre, playground, fitness area, community farm and sky terrace.

In terms of the level of permeability, the study underscores the importance of large permeable spaces with clear wayfinding as an integrated space for sustainable shared community social area. The study finds the overall space syntax performance of Kampung Admiralty is dominated by semi-public spaces, which corresponds to easy and clear wayfinding, making up 47.62% of the total building spaces. As most of the conventional design of elderly care facilities tend to be restricted to outside users, Kampung Admiralty aims to promote active aging place and support inter-generational bonding, showcasing large permeable spaces for outside visitors. However, the design can be further improved through allocation of more semi-public spaces. In order to ensure the safety and security of children, visitors and senior residents, managing the accessibility of different users is critical. The study finds that 40% of built spaces in the building are single connecting spaces that have been successfully designed in facilitating and managing different user's accessibility. Public spaces of Kampung Admiralty features the model village that encourage social interaction as these spaces are easily figured out from the entrances with easy permeability and clear wayfinding. People will be attracted to public spaces like open plazas before heading to semi-public spaces such as restaurants and shops. Besides providing services and facilities to the local community, these semi-public spaces will help attract people to participate in the activities in public spaces. A clear and straightforward wayfinding design will facilitate social integration between the residents and outside visitors to participate in events and activities in the designated open space in Kampung Admiralty. Visitors will have a bigger tendency to approach the building if it has a clear and straightforward wayfinding. Therefore, a meticulous design of the wayfinding inside the retirement village proved to be a significant consideration in determining social integration among the communities while maintaining the privacy and security aspects of the residents.

The present study contributes to improve the understanding of spatial planning on improved user behavior of retirement village typology. The study underlines the significance of Kampung Admiralty as an outstanding reference to designing a retirement village in an urban area that facilitates safety and accessibility. More public and semi-public spaces will encourage social interaction and communication in retirement villages. On the other hand, if a retirement village has more semi-private and private spaces, it will have a high privacy level. The building users are segregated from each other and have less communication.

The study's limitation is that detailed floor plans with labels for all the spaces are not available. The floor plans obtained online are not detailed enough to indicate all the spaces, as some of the rooms are unknown and ignored in this case study. Hence, it is suggested that drawings be requested from the architect of the case study building to analyse the overall space syntax performance of the building more comprehensively.

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