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Analysis of Users' Accessibility and Wayfinding in Tamarind Square Cyberjaya

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Abstract

Space syntax is a set of techniques to describe and analyze spatial configurations concerning human social activities which have been widely used by many researchers to understand and describe pedestrian movement. This paper analyses the building space planning based on the level of permeability and wayfinding through the different types of users for Tamarind Square, Cyberjaya, Malaysia. This research is conducted by using qualitative analysis with the graphic illustration of the justified graph. The study will be classified into four different levels of permeability. Results of the analysis showed that different blocks and different floor levels in Tamarind Square have different levels of depth of permeability and wayfinding for different types of users. This study also concludes that the degree of permeability and wayfinding in Tamarind Square has a moderately clear distinction between office and retail spaces, defining the spatial configuration when designing both spaces in a mixed-use building.

Discipline: Architectural Engineering, Landscape Urban Design & Built Environment.

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1 Introduction

Space syntax has contributed to the built environment as a useful tool for explaining a building's appropriateness (Nes, 2014). This paper is to study the space syntax of Tamarind Square as a guide to design a similar building typology in the future. Tamarind Square serves as a

commercial building typology with a building design that combines retail and office properties together (Sicola, 2017). For an effective office design, Zoltan (2014) suggested that mobility and flexibility should be paid attention to determine spatial configuration space efficiency. Spatial configuration can affect spatial behaviour and human navigability (Hillier, 1999). Space syntax method can be applied for this study as it is relevant on a wide-scale level in research on the built environment making it possible to compare built environments from a spatial point of view (Nes, 2014). The process of this research can give a better understanding of wayfinding and determine the weaknesses and strengths in the design as the spatial layout of buildings influences the way people use them (Hassan, 2001).

The case study is chosen, Tamarind Square has won two awards for its construction which are the Malaysia Landscape Architecture Awards (MLAA12) and Pertubuhan Arkitek Malaysia (PAM) Awards (Tujuan Gemilang, n.d.). During MLAA12 Ceremony, Tamarind Square has received an Excellence Award under Landscape Construction category and Malaysian Institute of Architects (PAM) had also awarded the PAM's Gold Award 2019 as a recognition for its architectural design advancement under the Commercial Low-Rise category (Tujuan Gemilang, n.d.).

This research aims to understand the different types of privacy levels needed for different types of commercial building categories by analyzing the level of permeability and wayfinding of the private and public spaces based on the design intentions learned from the selected case study.

2 Literature Review

A space syntax method is an approach developed to analyse spatial configuration related to humans' relationship and the space they inhabit (Mariana et al., 2017). Space syntax aims to describe spatial models and represent them in numerical and graphical forms, thus facilitating scientific interpretation (Hanson, 2003; Franz et al.,2005; Manum, 2009). These models can later determine two measurable factors which are the level of permeability and wayfinding by using a justified graph. The term 'wayfinding' is commonly used to refer to finding the path or paths leading to one's destination and finding that destination itself which influenced by the factor of familiarity and the different spatial configurations (Hedhoud et al., 2014). Whereas, the term 'permeability' is the flow of spaces, from one to another (Ephes, 2006). It is described as the peoples' opinion in satisfaction of the spaces based on the properties of the place's environment (Yavus et al., 2012).

3 Tamarind Square

Tamarind Square is a commercial hub with the intention to become an urban village for the community to gather especially the young generation by reinventing the traditional Malaysian shop-office characteristics on a 14.5-acre (58679.42m^2) site (Tamarind Square, n.d.). The "urban village" concept itself is indistinct. However, the term was formed by combining the fundamental characteristics of the physical, social and economic environments in the village and the urban area (Samsurijan et al., 2010). According to NAF Architect (n.d.), the construction was completed at the end of 2016 with the contract value of RM220 million. The project developer is Tujuan Gemilang,

whereas the architect and the project manager is Garis Architects. The lush landscape which has won the Excellence Award for Landscape Construction in MLAA12 Ceremony was designed by a local landscape architect, Seksan Design.

3.1 Building Typology

Office and retail are two different categories; however, they fall on the same typology, commercial typology (Amadeo, 2019). An office is a workplace which held the information and knowledge processing activities of an organization, including filing, planning, designing, supervising, analyzing, deciding and communicating. Office buildings developed from the need to plan, coordinate and administer these activities (Kaplan & Aronoff, 1996). Retail is a building that includes all stores, from kiosks and small groceries to supermarket chains and shopping malls that sell products and services to the final consumer for personal and household use (Hameli, 2018). This commercial complex is a public building with spatial arrangement designed intended for public and private users. Each type of users may have different levels of permeability and wayfinding depending on the kind of spaces in the building, and each of them plays roles that affected the design and function of the space (Munir et al., 2019).

3.2 Location, Composition & Activity Space of Tamarind Square

Figure 1: Perspective View of Tamarind Square

Tamarind Square is located in Cyberjaya, Malaysia's IT City about 37.8km from Kuala Lumpur (Jessop & Sum, 2000). Cyberjaya is a 'powerful national symbol' created by the political elite 'romanticizing the future' (Evers, 1997; Evers & Gerke, 1997). The town was planned and developed with the idea of advancing a 'new economy, embracing capitalism and modernity' (Yusof, 2010). The building (Figure 1) has three main components which are 30 four and five-story semi-detached shop offices, 72 three-story garden mall shop offices, and a 15-story SOFO block. This mix is because the developer's research shows that shop offices and SOFOS are very much in demand in Cyberjaya (Brooker, 2012). A study has shown that commercial building is the primary carrier of urban complexes and shopping centres are an essential part of an urban complex (Jin & Zhang, 2013). The semi-detached shop offices will be sold in pairs, with those on Levels 1 and 2 or Levels 3 and 4 sold together as a unit. For the 5-storey shop offices, levels 3, 4, and 5 will be sold as one unit.

The idea is to lay the shops at Tamarind Square around two gardens, in a figure 8, an advantage of double frontages. The building intended to become a community centre through commercial activities by promoting traditional Malaysian shophouse and modern-day mall setting with lush tropical landscaping. The architect seeks to create a healthy built environment that enhances the natural environment, society and economy (Shao, 2013). The change can promote traditional concepts as an alternative for sustainable urban development in Southeast Asia (Hassan, 2001). The core activity spaces that focus on the square's central design encourage public interactions everywhere, promoting community integrations. Integration in space is necessary for harmonious development and a community's effective functioning (Bal & Podolska, 2019). It represents the most consequential process among building design's influential factors, particularly regarding the function (Mustafa & Hassan, 2010).

4 Method

This research uses the qualitative analysis with the graphic illustration of the justified graph. Spatial syntax and the building typology study are reviewed preliminarily in the literature review to provide general information on the case study. The case study spaces will be broken down into components, analysed as networks of choices, as certain geometric spatial configurations that measure the level of permeability and wayfinding of the architectural spaces based on the level of movement or depth. This method has been used in Hassan and Mustafa (2010). The users' categories will also analyse the graph. From the result of the level of movement graph, level of permeability and wayfinding will be rated using the Likert scale to classify the result based on the quality of spatial networking (Hillier & Hanson, 1988).

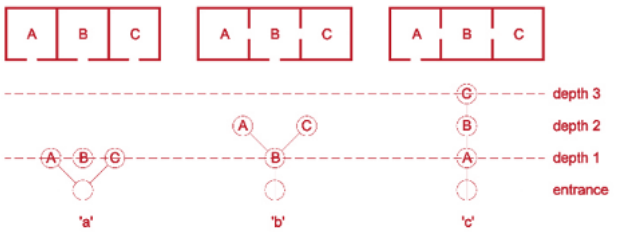


Figure 2: An elementary representation for space syntax analysis. 'a' and 'b' represent minimum depth (symmetric system) while 'c' shows a linear sequence of maximum depth (asymmetrical system).

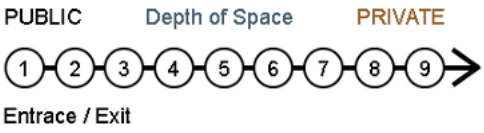


Figure 3: An elementary representation of level of movement of graph. The number shows the depth of space. The higher the number, the higher depth of the space; the private the space is.

A method of the numbering system in a justified graph is used to study the space syntax of the building within the inventory of the plan layout and graph of the building to analyze the wayfinding and the permeability of the buildings. For example, from Figure 4, the numbering' 1,2,3...' in circle show a different type of spaces like a corridor, administrative office, office 1, office 2, retail, pantry etc. The alphabetical 'E' in green diamond indicates the main entrance whereas the alphabetical 'S' in an orange circle indicates vertical circulation like a staircase, lift etc. For this case study, there are two indicators to differentiate users. Red colour indicates restricted areas and blue colour indicates the public spaces. The graph will explain the visibility of the spatial arrangements

from the numbering methods and space syntax method. To facilitate the wayfinding and permeability, the Likert scale will be used as an approach to scaling responses in survey research which is on a four-category scale: (1) public; (2) semi-public; (3) semi-private; (4) private. This will help assess the level of the permeability in the case study. The graph of Likert Scale (Table 1) will then be interpreted in order to assist the wayfinding and permeability more efficiently:

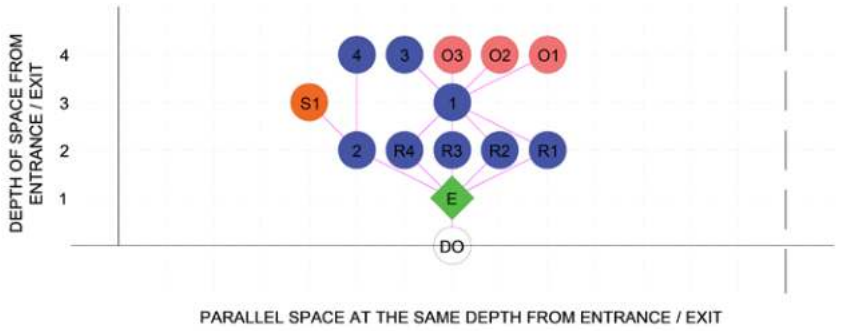


Figure 4: Example of Justified Graph for a retail plan.

Table 1: Example of Likert Scale to identify the type of space.

Likert Scale Numbering	Level of Permeability	Level of Wayfinding
0	-	-
1-3	Public	Very Easy
4-6	Semi-Public	Easy
7-9	Semi-Private	Difficult
10-12	Private	Very Difficult

5 Result

This research chooses the building's spatial aspects based on the building typology. The analysis starts from the site plan to show the overview of the overall site configuration then going into detail to the floor plan starting from the main lobby at Level 3 going up to Level 3M and then to Level 4. The study of the level of permeability and wayfinding is defined by using this building based on the plan and justified graph. In this study, primary user categories identified are public and private users. The remote users are the staff or authorized personnel to the office building, whereas the public is the customers and visitors.

5.1 Site Plan

Figures 5 and 6 respectively show the redrawn Level 3 plan and the Measurable Scale of Tamarind Square's Level 3 plan. The list of spaces for the level 3 plan is also listed in Table 2.

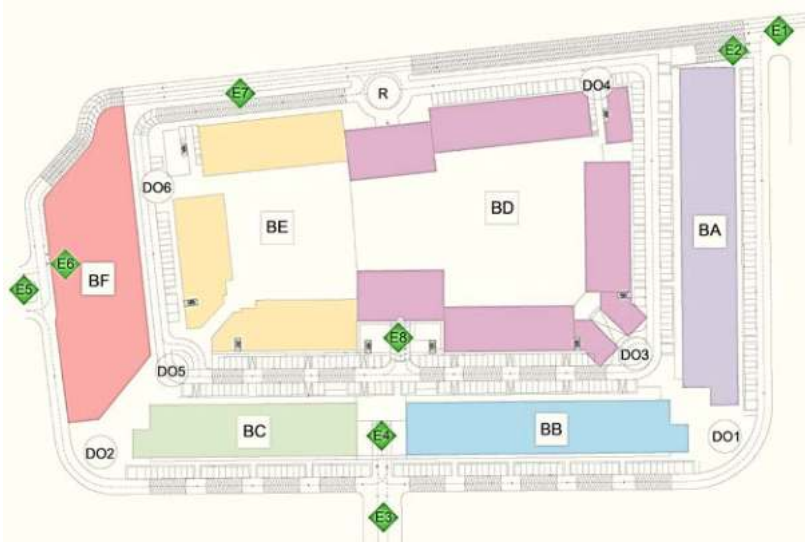


Figure 5: Site plan of Tamarind Square.

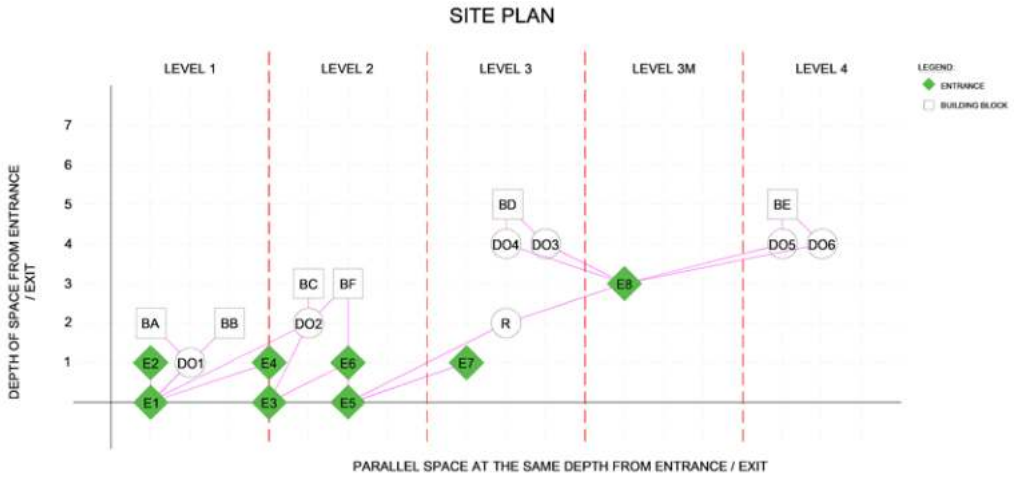


Figure 6: Measurable scale of the site plan.

Table 2: Schedule of accommodation for site plan.

No	Space	No	Space	No	Space	No	Space	No	Space	No	Space
E1	Entrance 1	E5	Entrance 5	DO1	Drop Off 1	DO5	Drop Off 5	BC	Block C	R	Roundabout
E2	Entrance 2	E6	Entrance 6	DO2	Drop Off 2	DO6	Drop Off 6	BD	Block D		
E3	Entrance 3	E7	Entrance 7	DO3	Drop Off 3	BA	Block A	BE	Block E		
E4	Entrance 4	E8	Entrance 8	DO4	Drop Off 4	BB	Block B	BF	Block F		

The spaces at Tamarind Square (Table 2) can be grouped into seven blocks which are Block A (BA), Block B (BB), Block C (BC), Block D (BD), Block E (BE) and Block F (BF). The entrance for each block is accessible at different floor levels. This commercial complex's main entrance is located on Level 3 at entrance E8. Secondary entries are also provided for pedestrians at each building block. BA and BB share the same entrance at drop off DO1 which can be accessed easily by the public from Level 1. BC and BF can also be accessed easily as the entries are still in the first level of permeability. However, pedestrians who wish to go to BD and BE may need to take a long walk as the entrances for both blocks are at the second level of permeability.

5.2 Level 3

Figures 7 and 8 respectively show the redrawn Level 3 plan and the Measurable Scale of Tamarind Square's Level 3 plan. The list of spaces for the level 3 plan is also listed in Table 3.

Figure 7: Level 3 plan of Tamarind Square.

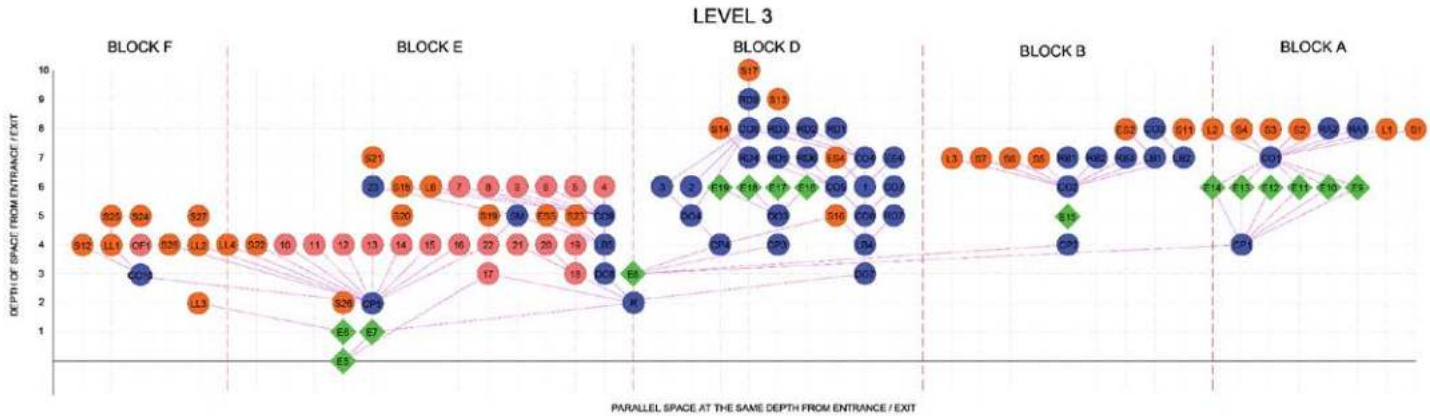


Figure 8: Measurable scale of the Level 3 plan.

Table 3: Schedule of accommodation for level 3.

No	Space	No	Space	No	Space	No	Space
R	Roundabout	CO1-10	Corridor	5	Men's Toilet	15	Mechanical Room
DO3-4	Drop Off	SM	Supermarket	6	Security Office	16	AHU Room
CP1-4	Carpark	RA1-2	Retail Block A	7	Storage	17	TNB Substation
ES1-5	Escalator	RB1-3	Retail Block B	8	Management	18	Loading Bay
S1-28	Staircase	RD1-9	Retail Block D	9	Management	19	Refused Chamber
L1-5	Single Lift	OF1	Office Block F	10	Utilities	20	Chemical Storage Area
E6,7,8,20	Vehicular Entrance	1	North Courtyard	11	Services	21	Utilities
E9-19	Pedestrian Entrance	2	Women's Toilet	12	Tank Room	22	Foyer
LB1-3	Lobby	3	Men's Toilet	13	Tank Room	23	Foyer
LL1-4	Lift & Lift Lobby	4	Women's Toilet	14	Mechanical Room		

There are four levels of depths of permeability and wayfinding at Level 3. Each block is accessible from Level 3 except for BC. To enter the main lobby (LB4 and LB5), visitors driving from E1 and E5 must take the roundabout (R) or go straight to the indoor parking area at entrance E6 or E7. Pedestrians who wish to go to BE and BD need to take the stairs or lift and go through BA, BB, BC or BF before reaching to BE or BD. Staircase S17 is located at the deepest permeability level as it is designed intended for private users. DO4 also functions as a loading area. Pedestrian entrances for BA and BD are at the third level of permeability, making pedestrians quite difficult to navigate their way to their desired destination. Most rooms inside BF and BE at level 3 are restricted to only authorized personnel.

5.3 Level 3M

Figure 9: Redrawn level 3M plan of Tamarind Square.

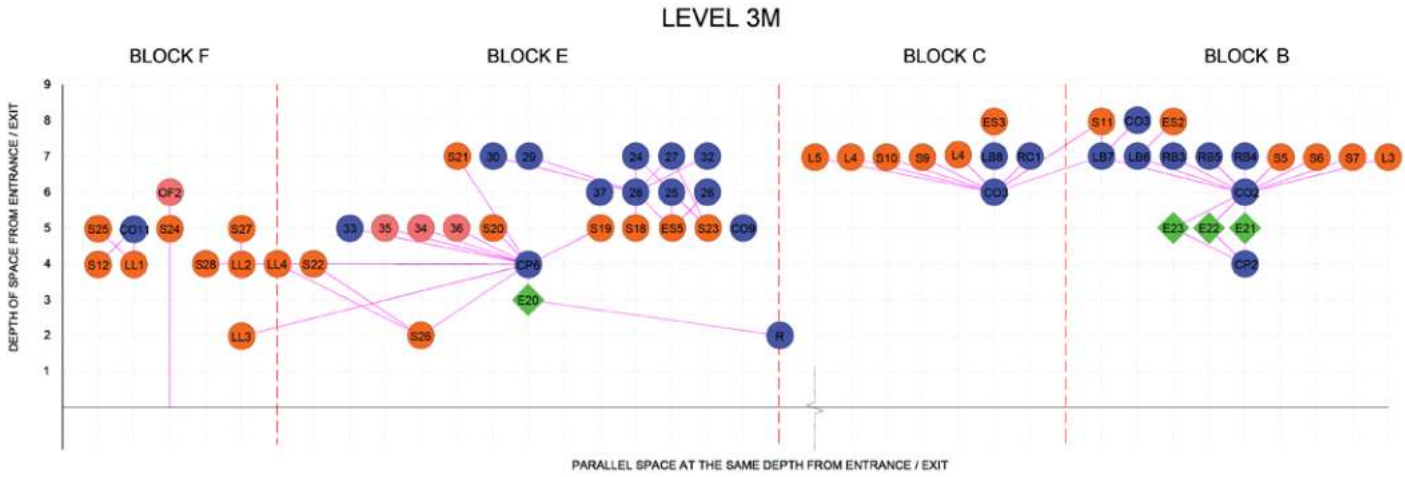


Figure 10: Measurable scale of the Level 3M plan.

Table 4: Schedule of accommodation for Level 3M.

No	Space	No	Space	No	Space	No	Space
E8,E20	Vehicular Entrance	LL1-4	Lift & Lift Lobby	26	Men's Toilet	33	Utilities
E21-23	Pedestrian Entrance	CO 2,3,11	Corridor	27	Women's Toilet	34	Services
CP2,6	Carpark	RB4,5	Retail Block B	28	Men's toilet	35	Utilities
ES2-5	Escalator	RC1	Retail Block C	29	Management Office	36	Mechanical Room
S1-27	Staircase	OF2	Office Block F	30	Storage		
L1-5	Single Lift	24	Courtyard	31	Storage		
LB6-8	Lobby	25	Women's Toilet	32	Storage		

Referring to the Level 3M plan in Figure 9 and the Measurable Scale of the Level 3M plan in Figure 10, the spaces at Level 4 (Table 4) have a lesser depth of levels of permeability compared to Level 3. The circulation of public users is controlled at this level as this level has management offices, private offices, storage, utilities, services, and mechanical rooms. The entrances for BB cater to semi-public users at the second level of the depth of permeability. Public users who are going to the retail shops RB3, RB4, RB3 and RC1 may experience difficulties finding their way if it is their first time visiting the building. Public toilets 29 and 30 are at the third depth of permeability levels, which can also result in difficulties in wayfinding.

5.4 Level 4

Figures 11 and 12 respectively show the redrawn Level 4 plan and the Measurable Scale of Tamarind Square's Level 4 plan. The list of spaces for the level 4 plan is listed in Table 5.

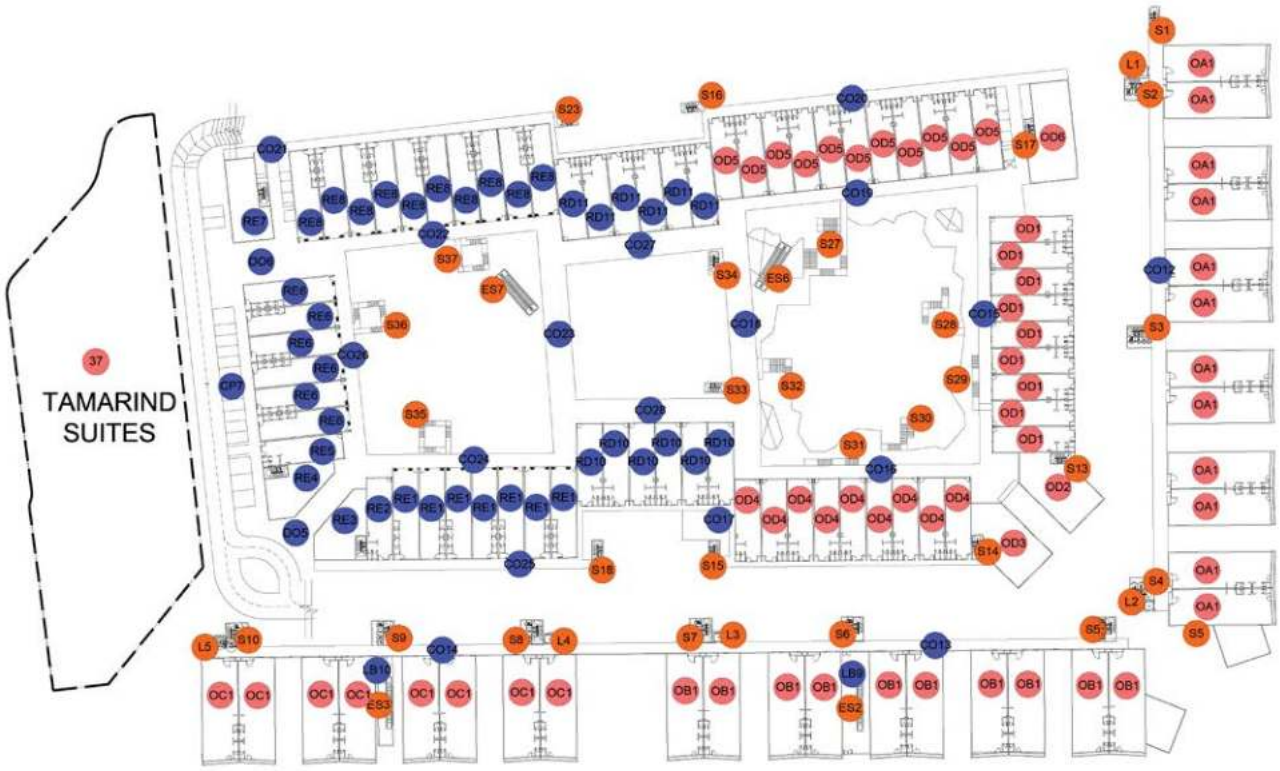


Figure 11: Level 4 plan of Tamarind Square.

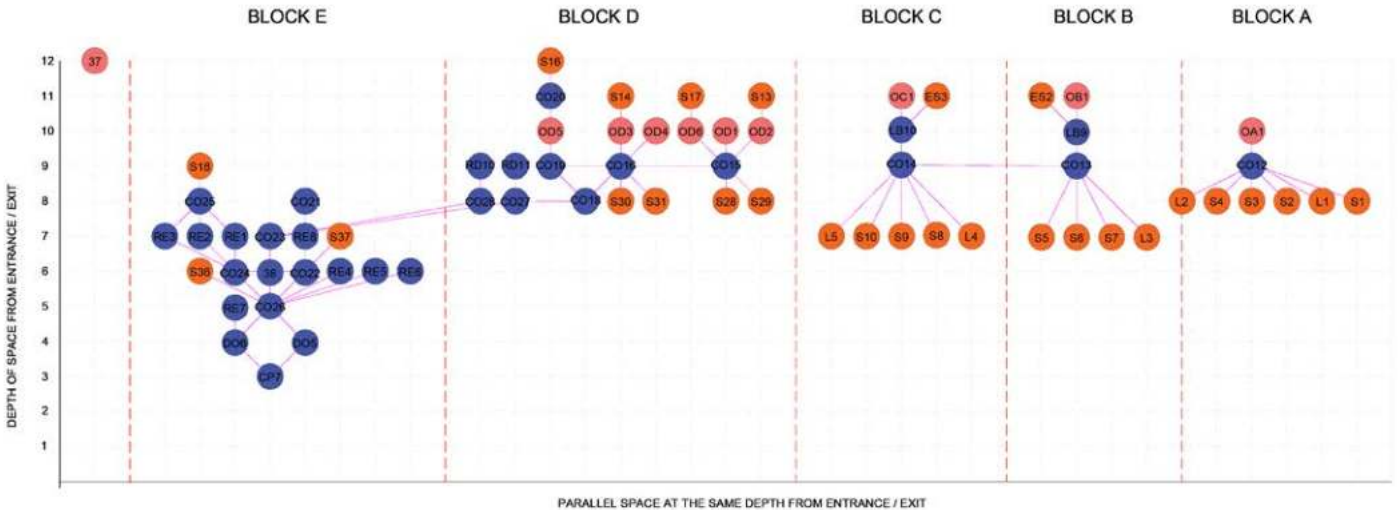


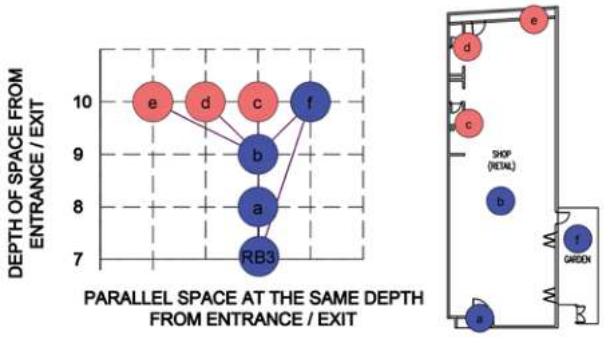
Figure 12: Measurable scale of level 4 plan.

Table 5: Schedule of accommodation for level 4.

No	Space	No	Space	No	Space	No	Space
CP7	Carpark	LB9,10	Lobby	OB1	Office Block B	RE1-8	Retail Block E
DO5,6	Corridor	L1-5	Lift	OC1	Office Block C	37	Tamarind Suites
ES2,3,6,7	Escalator	CO 1-10	Corridor	OD1-4	Office Block D		
S1-10,13-18,23,27-37	Staircase	OA1	Office Block A	RD10,11	Retail Block D		

At this level, the BF area at Level 4 is part of the Tamarind Suites development, the Small Offices Flexible Offices (SOFO) tower. The entry to this building is strictly for only authorized users. Therefore, the study will not focus on BF area for this level as it is no longer under part of Tamarind Square. BA at Level 4 caters for private offices at the highest depth of permeability and wayfinding levels. These offices (OA1) are accessible through staircases S1, S2, S3, S4 and lift L1 and L2. The same goes for BB, BC, and BD, the higher levels of these blocks are designed for private offices with the deepest level of permeability and wayfinding. BB and BC are connected through corridors CO13 and CO14. However, they are not connected to BA, BD, and BE by any walkway at this level. At this level, users are required to take the stairs or lift going down to another level if they wish to travel from different blocks. The entrances DO6 and DO5 are located on this Level 4 at BE. Figure 11 shows that the plan at this level has more staircases at the courtyard for aesthetic purposes and functional purposes, which are intentionally added to separate the public and private spaces of offices from the top level and retail stores on the lower levels.

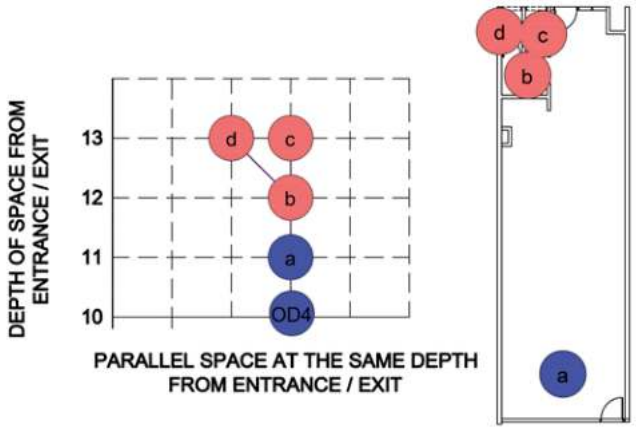
5.5 Typical Office and Retail Plans



LEGEND	
No	Space
RB3	Retail Block B
a	Store Front
b	Retail Area
c	Storage
d	Toilet
e	Balcony
f	Garden

Figure 13: Typical retail plan unit of Tamarind Square and Measurable Scale Graph of the typical retail plan.

Figure 13 shows the detailed, measurable scale graph of the typical retail plan inside BB. Each unit of a retail store has two depth levels of permeability: semi-private and private.



LEGEND	
No	Space
OD4	Office Block D
a	Working Space
b	Handwashing area
c	Toilet
d	Store

Figure 14: Drawing of typical office plan unit of Tamarind Square and Measurable Scale Graph of the typical retail plan.

Figure 14 shows the detailed, measurable scale graph of typical office plan at Block D (BD). Each typical office plan unit has an open plan with only one depth level of permeability and wayfinding, private and can only be accessed by authorized users like office staff. Most offices inside Tamarind Square are located on a higher level to separate the public spaces.

6 Discussion

From the analysis, it can be found that the average shape of the justified graph for the plans at Tamarind Square has a combination of both linear and symmetric sequences. The wayfinding pattern of the Tamarind Square was evaluated by analysing its user accessibility from pedestrians' point of view and drivers' point of view. The public can access not all the spaces inside the building. Authorised users can only access specific spaces.

At the Site Plan, the highest depth of spaces is at level 5, showing that the visitor's depth of accessibility is moderate. Based on the graph, it is justified that the degree of permeability and wayfinding at the site plan area is easily accessible by the public with only 10% semi-public. At Level 3, the highest depth of spaces is at Level 9 for Block D. The lowest level of spaces is at Level 4 for Block F, indicating that the depth of the accessibility and visibility for public visitors is different for different blocks. This concludes that different blocks at Level 3 are designed accessible for specific users. Although the spaces at Block F on Level 3 are offices, the low level of permeability and wayfinding indicate that these offices are designed for tenants who wish to have clear visibility from their potential clients public view who can come from the public.

At Level 3M, the shape of connectivity of the justified graph is more complicated, especially at Block E. Block B has the highest depth of spaces compared to Block F at Level 3M even though the deepest space at Block F is office type compared to Block B which is retail type. At Level 4, Figure 12 shows that Block B and Block C are still connected through a corridor walkway, whereas Block A, B and C are no longer connected through corridor walkways. There are also more staircases and escalators added to the plan, making the vertical circulations consume 40% of the justified

graph. These vertical circulations also have different permeability levels and wayfinding depending on the type of spaces they are connected to.

7 Conclusion

In conclusion, although Tamarind Square was designed mainly to serve the public, some of the building spaces can be quite confusing to read by first-time public users. However, the spaces' complexity can give the users the experience to enjoy the walkability inside the site and explore the design concept of the building. Successful wayfinding systems in the Tamarind Square layout can provide the user with adequate wayfinding and encourage the public spaces to be accessed by the public, which can help bring potential customers to the retail stores. The level of depth of permeability plays an important role when designing the retail areas as these areas require a lower level of permeability so that users will hesitate or mistake these spaces as private spaces and therefore can increase engagement between the sellers and potential customers. This study also shows that although retail and office fall on the same type of typology, commercial typology, both types of spaces require different spatial arrangements with varying permeability and wayfinding levels.

8 Availability of Data And Material

All information is included in this article.

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