ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8

International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

http://TuEngr.com

The Spatial Pattern Analysis for the Los Angeles US Courthouse

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Paper ID: 15A2C

Volume 15 Issue 2

Received 09 January 2024
Received in revised form 14 March 2024
Accepted 05 April 2024
Available online 23 April 2024

Keywords:
Public building; Court facilities; LA courthouse; Space syntax; Courthouse design; Level of permeability; Level of wayfinding; Sustainability; Connecting space.

Abstract

The study analyses the spatial configuration of the courthouse building by looking into the level of permeability and level of wayfinding. This study aims to analyze the spatial relationship between the spaces by different users through the space syntax technique. The selected case study for this paper is the U.S. Courthouse in Los Angeles, that the courthouse falls under the building typology of the public building category. The research adopts a qualitative approach by generating a justified graph based on the floor plan of the selected case study and producing a comprehensive analysis of the building's spatial configuration. The result has shown that the courthouse has a systematic and proper spatial configuration to segregate different users. In conclusion, the findings allow the readers to have a thorough understanding of the spatial configuration of the courthouse design in terms of permeability level and wayfinding level, and it contributes to the designer's design of more efficient spatial planning for the future courthouse building.

Discipline: Architectural Engineering.

Cite This Article:

Chan, L.H., Arab, Y., Hassan, A.S., Onubi, H, O., and Witchayangkoon, B. (2024). The Spatial Pattern Analysis for the Los Angeles US Courthouse. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 15*(2), 15A2C, 1-16. http://TUENGR.COM/V15/15A2C.pdf DOI: 10.14456/ITJEMAST.2024.9

1 Introduction

Legal Architecture is the meeting point between architecture and law, and it is the study of architecture composed of the courtroom, the court buildings, and the court premises that carry out the judiciary system in a functional manner (Blumetti, 2020; Kumar, 2017). The courthouse is

categorized as a public building typology, specifically a public government institutional building. Such building typology is mainly to serve the public community as well as an office for the public servants.

Courthouse facilities normally have a clear and direct functional program as well as distinct circulation patterns to define the functional zones (Goussous & Dahabreh, 2014). Space syntax is applied to study the accessibility and the spatial relationship of the courthouse. Space syntax is a technique for analyzing and describing spatial formation in various forms such as buildings, interior spaces, cities, and many more (Hillier, 1999). Therefore, we could study how the spatial arrangement of the buildings could influence human activity and the way the users use it (Hassan, 2004).

The case study chosen for this paper is the U.S. Courthouse, designed by Skidmore, Owings & Merrill (SOM) located in Los Angeles, United States. The project has won numerous awards such as the 2019 American Institute of Architects (AIA) Institute Honour Award, the 2018 AIA/COTE Top Ten Green Projects Award, the 2018 Institute Honour Awards for Architecture, the Environmental Award from AIA, the 2017 Best of the Best Project by Engineering News-Record (ENR), and 2016 GSA Design Award (SOM, 2016). With sustainability as a driving factor for the courthouse design, the building has received the highest award – LEED Platinum by the US Green Building Council.

The objective of conducting this study is to study the level of permeability and wayfinding of courthouse buildings by different building users as well as to analyze the spatial relationship between different spaces; therefore improvements could be made in designing such building typology to be more efficient in terms of spatial planning in the future.

2 Literature Review

Space syntax is a set of theories and techniques that originated with Bill Hillier in the early seventies to describe and analyze the configurations of urban space and building space in relation to the patterns of human activity (Hillier, 1999; Hillier & Vaughan, 2007). From there, space syntax then being used as a tool to be applied on a broad scale level in the research on the built environment (Nes, 2014). It is used to describe and analyze the spatial pattern of a place or a tool to simulate spatial design proposals by predicting how the spaces would work and relate to each other therefore creating a more effective building circulation (Hillier & Hanson, 1997). The idea of space syntax is based on the analysis of permeability level and way-finding level (Abdul Halim et al., 2019). The level of permeability is defined as the level of accessibility of the space, therefore, to determine whether it is a public, semi-public, or private building. Meanwhile, wayfinding is the users' experience and their understanding of the space (Abdul Rahaman et al., 2019).

3 The U.S. Courthouse

The project was initiated by the General Services Administration (GSA) in the 1990s but halted due to financial constraints, and later re-scoped in 2012, the new courthouse intends to centralize the courts' functions within one building and serves as an iconic and symbolic form for

the Central District of California. According to the architect's statement, 'Light' is at the very core of the design concept for this courthouse building in Los Angeles (McGuigan, 2017). Light also as a metaphor for judicial fairness and to generate an atmosphere of equanimity and calm. The architect has taken a contemporary approach to design the new courthouse that resembles the value of justice- fairness and transparency, instead of taking the classical, eclectic Western styles which were deemed to be a symbol of democracy during the past (Hassan & Abdul Nasir, 2018).

3.1 The LA U.S. Courthouse Building Typology

The U.S. Courthouse is categorized as a public institutional building typology, a building that is designed for the public to attend the court or seek legal services. Such building often requires high security to protect the inside from any interference as well as the integrity of the judicial process (NCJRS, n.d.; Sarre & Prenzler, 2012).

3.2 Location of the LA U.S. Courthouse

The building is situated at a sloped site in Downtown Los Angeles, within the prominent city's Civic Centre neighborhood, a few blocks away from the Walt Disney Concert Hall designed by the famous architect Frank Gehry (Risen, 2018). The architect intends to create a major civic presence while engaging with a rapidly changing neighborhood and increasing the walkability around the site.

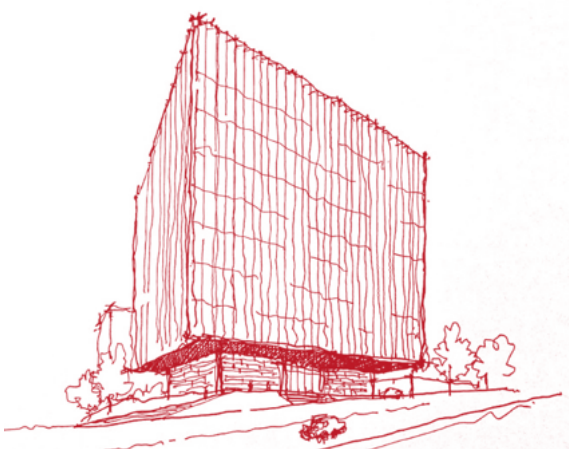


Figure 1: Exterior Perspective of the U.S. Courthouse, Los Angeles

3.3 Detail of the U.S. Courthouse

The courthouse's design reflects the quality of calm, fairness, and transparency of the U.S. judiciary system, and it is modern in spirit and rooted in classic principles of federal architecture. The courthouse has a friendly urbanity on the street, an expansive public plaza with a cantilevered and transparent entrance statement, and wide steps to achieve a strong civic identity (McGuigan, 2017; SOM, 2016). With sustainability as a driving factor for the courthouse design, the building has received the highest award – LEED Platinum by US Green Building Council (Volner, 2018). The courthouse has incorporated several sustainable design features, such as onsite photovoltaic power generations, radiant hydronic systems, demand control ventilation systems, displacement air delivery systems, and extensive uses of daylighting systems (AIA, 2018).

4 Research Method

A preliminary study is conducted to study the theory of space syntax and the background of the selected case study from architectural websites. Secondly, space syntax is the method for the spatial analysis of the case study through the quantitative approach with the aid of the graph. The reason for using space syntax is because it provides a set of theories and methods to allow the researchers to study different kinds and scales of spatial configurations. It has been widely used not only in research areas but also in practical applications such as urban and human geography, anthropology, cognitive science, archaeology, and information technology (Stonor, 2011).

Table 1: Likert Scale for Space Syntax Analysis

Level of Depth	Level of Permeability	Level of Wayfinding
1-4	Public	Very Easy
5-8	Semi-Public	Easy
9-12	Semi-Private	Hard
13-16	Private	Very Hard

There are four levels of measurement in the Likert Scale shown in Table 1, which are used to identify the level of permeability and wayfinding. The measurement will be translated into the axes of the justified graph to study the spatial relationship of the selected case study. The higher the number in the depth level of space, the more private the space, which means it is more difficult to access into the space and vice versa (Mariana et al., 2017).

To collect the data and measure the space, each room with the floor plan of the selected building will be assigned with alphabets and numbers. The alphanumeric system will help the readers to have a better understanding of the different types of spaces, for the labeling of which number comes first indicates the primary space of the building, for example, 1, 2a, 2b, 3, etc. Meanwhile, the labeling in which the alphabet comes first is the transitional space, for example, alphabet E indicates the entrance of the building (E1, E2, E3, etc.); S indicates the staircase (S1, S2, S3, etc.); L for lift (L1, L2, L3, etc.).

The labels will then be translated into a justified graph as the example shown in Figure 2 after the analysis that has been done on the floor plans. In the discussion part, the data will be converted into numbers and percentages to determine the hierarchical order for the permeability level and wayfinding level of space.

5 Results of the Analysis

5.1 Users' Category

The study will focus on two main groups of users – the public and court staff (private) in terms of their permeability level and wayfinding level through space syntax using the justified graph. The user groups are indicated with colors to distinguish the public access and authorized access.

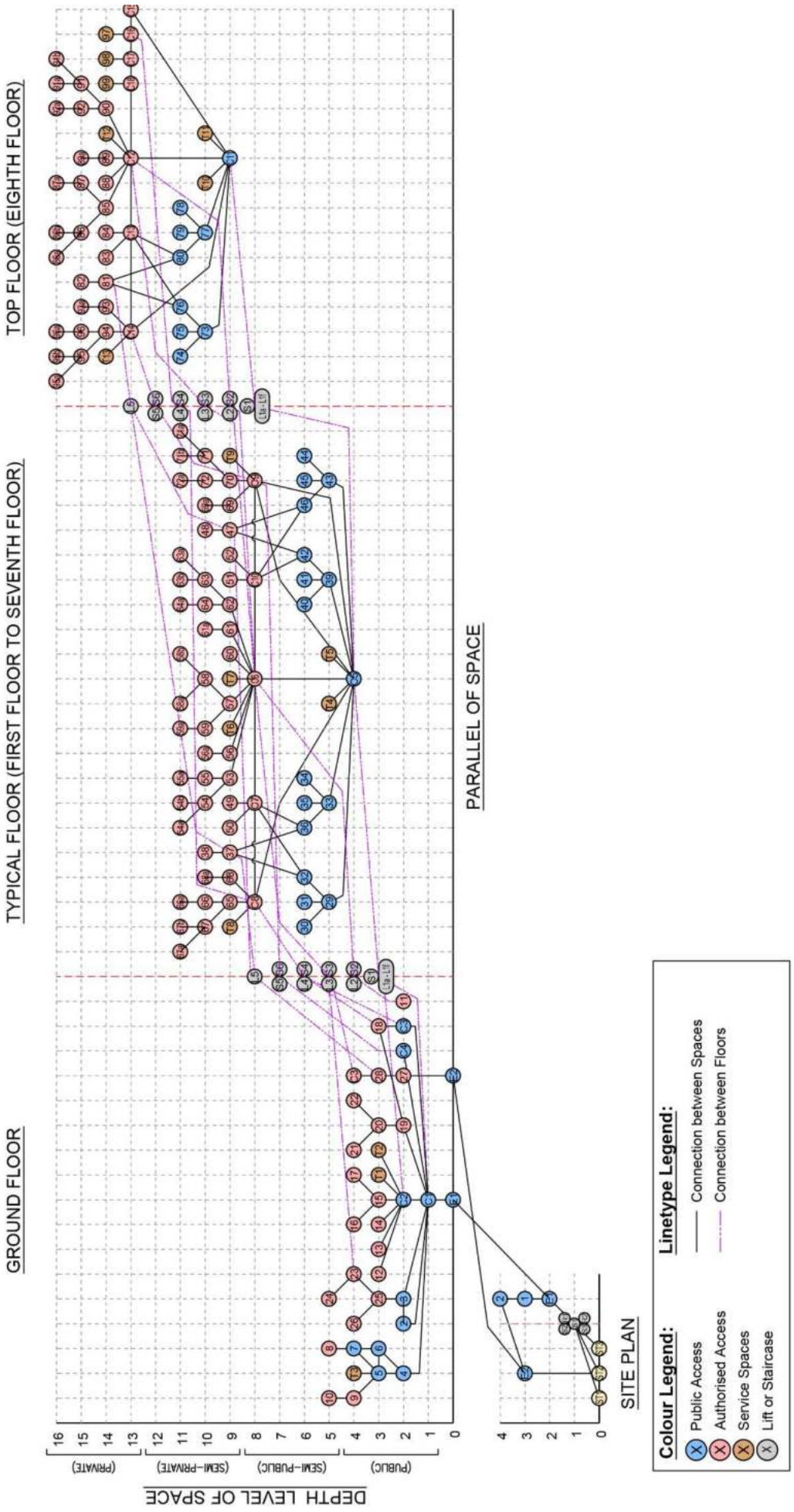


Figure 2: Overall Justified Graph for U.S. Courthouse, Los Angeles

5.2 Site Plan

Figure 4 shows the site plan of the U.S. Courthouse. Due to the strategic location of the courthouse, which sited in the middle of downtown Los Angeles, it promotes walkability and connection with the surrounding urban context and therefore, it shows that the permeability level of the site plan is predominantly public and the level of wayfinding for the users to locate the main entrance is easy. Based on the justified graph (Figure 5) and the space syntax analysis (Table 2), there are a total of four (4) levels of depth, from 1 as the most public space to 4 as the most private space.

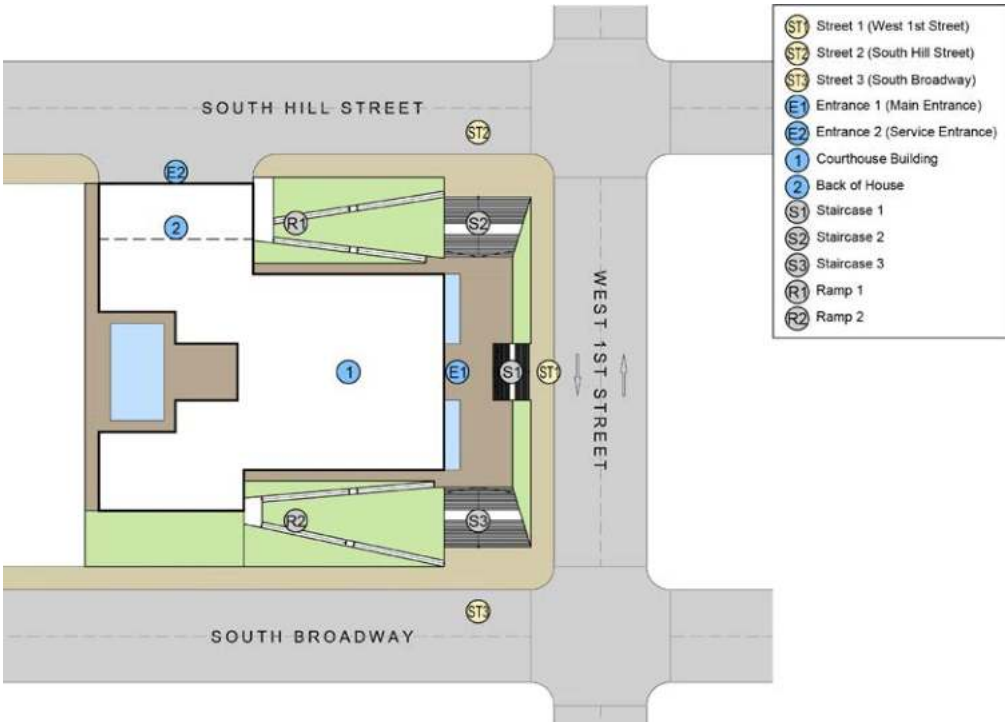


Figure 3: Site Plan of U.S. Courthouse, Los Angeles

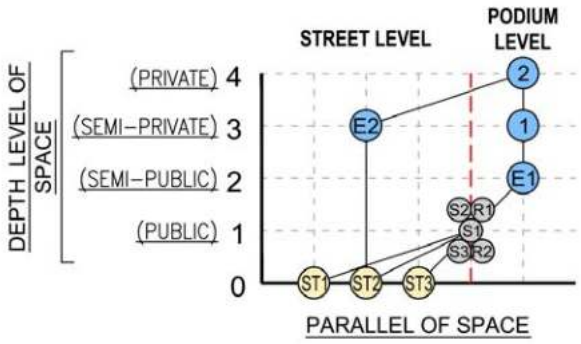


Figure 4: Justified graph of Site Plan

Table 2: Space Syntax Analysis for Site Plan

Level of Permeability	Level of Wayfinding	Depth Level of Space	Code of Space
Public	Very Easy	1	ST1, ST2, ST3
Semi-Public	Easy	2	E1, S1, S2, S3, R1, R2
Semi-Private	Hard	3	E2, 1
Private	Very Hard	4	2

5.3 Ground Floor Plan

Main Spaces:

2 Courtyard	10 Office Storage	18 Lift Lobby	26 Kitchen
3 Cafeteria	11 Lift Lobby	19 Archive Waiting	27 Back of House
4 Jury Assembly Reception	12 Court Office	20 Archive Reception	28 Holding Office
5 Jury Assembly Lounge	13 Office Storage	21 Archive Room	T1 Toilet 1
6 Jury Assembly Hall	14 Meeting Room	22 Archive Office	T2 Toilet 2
7 Pantry	15 Court Office	23 Private Dining	T3 Toilet 3
8 Storage	16 Meeting Room	24 Private Pantry	
9 Jury Assembly Office	17 Office Storage	25 Preparation Area	

Circulation Spaces:

E1 Entrance 1 (Main Entrance)	C3 Corridor 3	L1b Public Lift 2	L1f Public Lift 6	L5 Private Lift
E2 Entrance 2 (Service Entrance)	C4 Corridor 4	L1c Public Lift 3	L2 Private Lift	S1 Staircase 1
C1 Corridor 1	C5 Corridor 5	L1d Public Lift 4	L3 Private Lift	S2 Staircase 2
C2 Corridor 2	L1a Public Lift 1	L1e Public Lift 5	L4 Private Lift	S3 Staircase 3

Figure 5: Ground Floor Plan of U.S. Courthouse, Los Angeles

Figure 5 shows the ground floor plan of the U.S. Courthouse. The public enters the courthouse building through the main entrance E1. Upon entering the main building, the users will be welcomed by the expansive and huge atrium lobby C1, which is the most public space for people to gather and linger around, it also connects to spaces such as the cafeteria and jury assembly area as well as few private spaces that placed along the sides of the building.

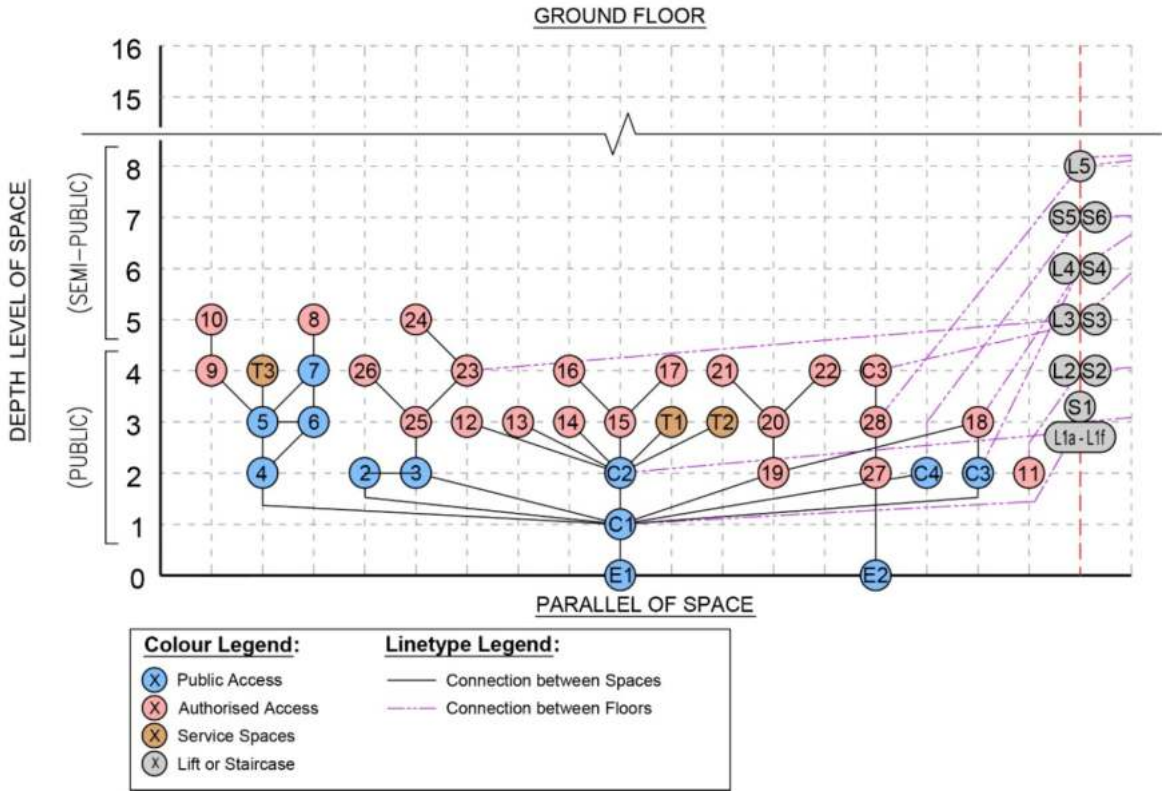


Figure 6: Justified graph of Ground Floor Plan

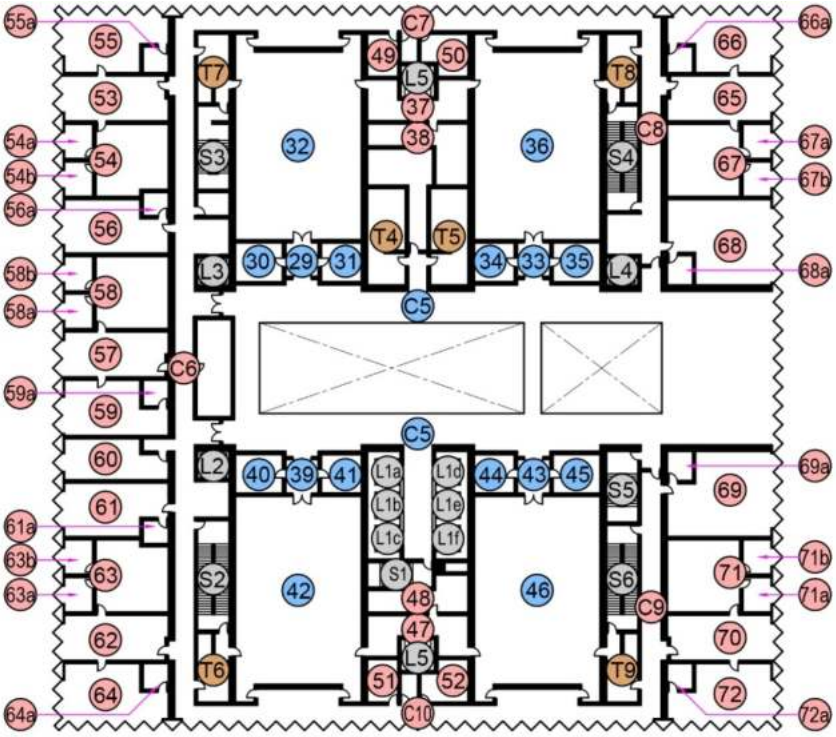
Table 3: Space Syntax Analysis for Ground Floor Plan

Level of Permeability	Level of Wayfinding	Depth Level of Space	Code of Space
Public	Very Easy	1-4	E1, E2, C1, 2, 3, 4, 5, 6, 11, 12, 15, 18, 19, 20, 25, 27, 28, T1, T2, C2, C3, C4
Semi-Public	Easy	5-8	7, 8, 9, 13, 14, 16, 17, 21, 22, 23, 26, T3
Semi-Private	Hard	9-12	10, 24
Private	Very Hard	13-16	-

Based on the justified graph of the ground floor plan (Figure 6), most of the main spaces such as the cafeteria, courtyard, the jury assembly hall are easily accessible by the public through a public atrium corridor (C1). According to Table 3 showing the space syntax analysis for the ground floor plan, the overall level of permeability is predominantly public, and the level of wayfinding is straightforward to access by the public.

5.4 Typical Floor Plan (First To Seventh Floor Plan)

Figure 7 shows the typical floors to be accessed through the public lifts (L1a, L1b, L1c, L1d, L1e, and L1f) from the ground level. Upon arriving at the floor, the public will be led towards a huge lofty atrium with corridors (C5) on both sides, which eventually bring people into the courtrooms. The offices and judge chambers are arranged along the perimeter of the building connected by secured corridors (C6, C7, C8, C9, and C10) so that the route will not be interrupted by the public.



Main Spaces:

29 Sound-lock Lobby	46 Courtroom	58b Law Clerk's Room 2	67b Law Clerk's Room 2
30 Attorney's Waiting Room	47 Detention Corridor	59 Judge Chamber	68 Trial Jury Room
31 Attorney's Waiting Room	48 Courtroom Holding Cell	59a Judge Ensuite	68a Trial Jury Ensuite
32 Courtroom	49 Courtroom Storage	60 Storage	69 Trial Jury Room
33 Sound-lock Lobby	50 Courtroom Storage	61 Trial Jury Room	69a Trial Jury Ensuite
34 Attorney's Waiting Room	51 Courtroom Storage	61a Trial Jury Ensuite	70 Judge Chamber Reception
35 Attorney's Waiting Room	52 Courtroom Storage	62 Judge Chamber Reception	71 Law Clerk's Office
36 Courtroom	53 Judge Chamber Reception	63 Law Clerk's Office	72 Judge Chamber
37 Detention Corridor	54 Law Clerk's Office	63a Law Clerk's Room 1	72a Judge Ensuite
38 Courtroom Holding Cell	54a Law Clerk's Room 1	63b Law Clerk's Room 2	T4 Toilet 4
39 Sound-lock Lobby	54b Law Clerk's Room 2	64 Judge Chamber	T5 Toilet 5
40 Attorney's Waiting Room	55 Judge Chamber	64a Judge Ensuite	T6 Toilet 6
41 Attorney's Waiting Room	56 Trial Jury Room	65 Judge Chamber Reception	T7 Toilet 7
42 Courtroom	56a Trial Jury Ensuite	66 Judge Chamber	T8 Toilet 8
43 Sound-lock Lobby	57 Judge Chamber Reception	66a Judge Ensuite	
44 Attorney's Waiting Room	58 Law Clerk's Office	67 Law Clerk's Office	
45 Attorney's Waiting Room	58a Law Clerk's Room 1	67a Law Clerk's Room 1	

Circulation Spaces:

C5 Corridor 5	C9 Corridor 9	L1b Public Lift 2	L1f Public Lift 6	L5 Private Lift	S4 Staircase 4
C6 Corridor 6	C10 Corridor 10	L1c Public Lift 3	L2 Private Lift	S1 Staircase 1	S5 Staircase 5
C7 Corridor 7		L1d Public Lift 4	L3 Private Lift	S2 Staircase 2	S6 Staircase 6
C8 Corridor 8	L1a Public Lift 1	L1e Public Lift 5	L4 Private Lift	S3 Staircase 3	

Figure 7: Typical Floor Plan (First to Seventh Floor)

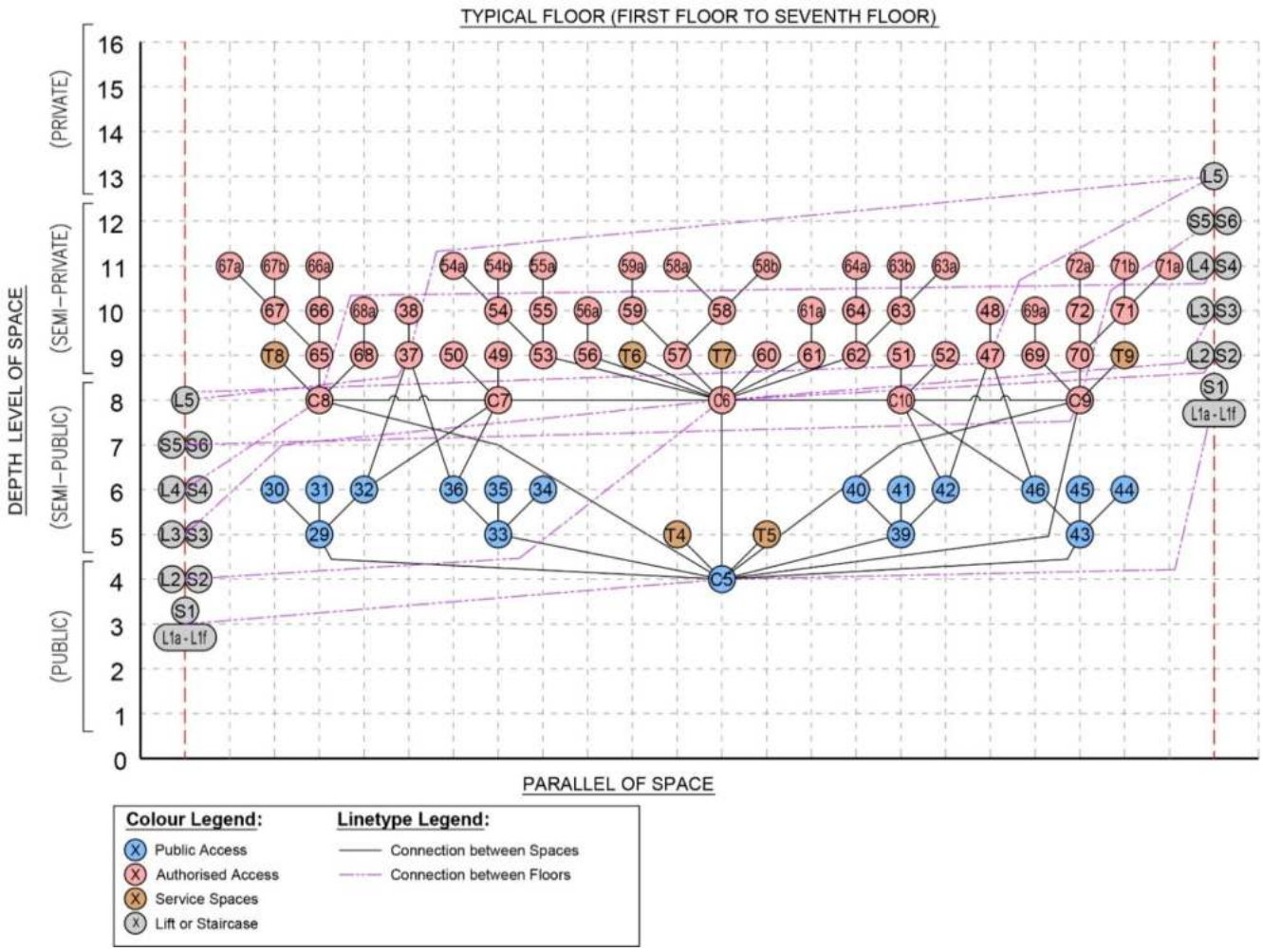


Figure 8: Justified graph of Typical Floor Plan (First to Seventh Floor)

Table 4: Space Syntax Analysis for Typical Floor Plan.

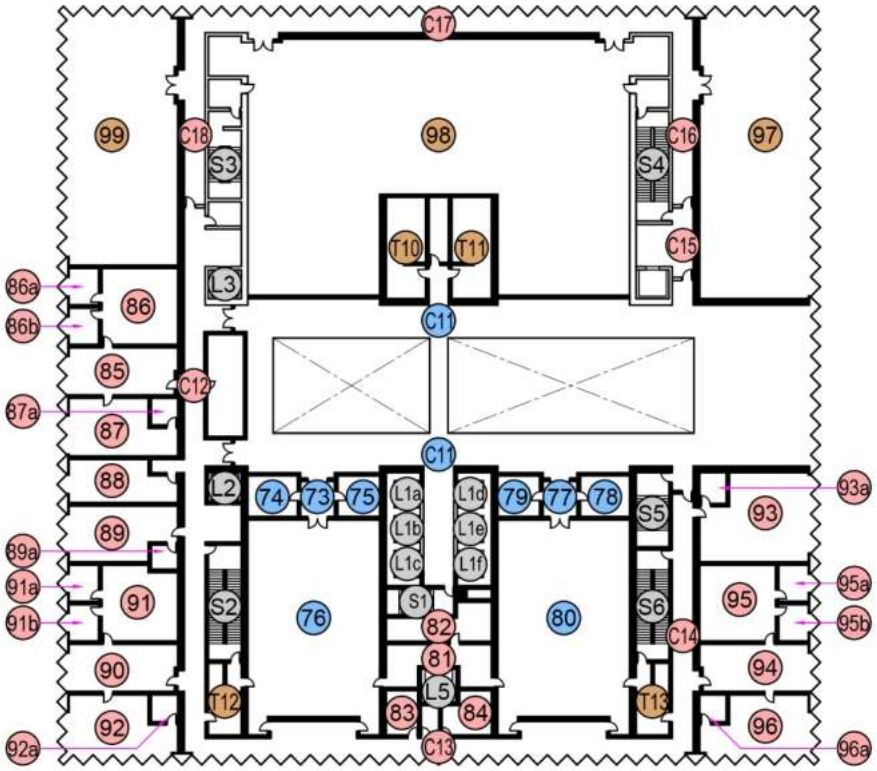
Level of Permeability	Level of Wayfinding	Depth Level of Space	Code of Space
Public	Very Easy	1-4	C5
Semi-Public	Easy	5-8	29, 30, 31, 32, 33, 34, 35, 36, 39, 40, 41, 42, 43, 44, 45, 46, T4, T5, C6, C7, C8, C9, C10
Semi-Private	Hard	9-12	37, 38, 47, 48, 49, 50, 51, 52, 53, 54, 54a, 54b, 55, 55a, 56, 56a, 57, 58, 58a, 58b, 59, 59a, 60, 61, 61a, 62, 63, 63a, 63b, 64, 64a, 65, 66, 66a, 67, 67a, 67b, 68, 68a, 69, 69a, 70, 71, 71a, 71b, 72, 72a, T6, T7, T8, T9
Private	Very Hard	13-16	--

Based on the justified graph (Figure 8) and space syntax analysis (Table 4) of the typical floor, the permeability level of this floor is considered to be both semi-public and semi-private, whereas the wayfinding level is in an average value as the scale of depth level falls on 5 to 12. Most of the public spaces such as courtrooms and public corridors are semi-public spaces, and the wayfinding is straightforward. Some spaces such as judges' chambers, court offices, and trial jury rooms are semi-private spaces that only can be accessed through secured and protected corridors that are segregated from public circulation; therefore, the wayfinding level is hard.

5.5 Top Floor Plan (Eighth Floor Plan)

Figure 9 shows the top floor layout of the courthouse. It has almost a similar spatial layout

as the typical floors, having a huge atrium with a corridor (C11) linking to the courtrooms and private judges' offices placed along the building perimeter. The Judge's chambers are accessed through the private corridors (C12, C13, and C14), and the corridors also link to the courtrooms. The difference is that the service spaces occupy half of the floor area, which used to be another two courtrooms on the typical floors.



Main Spaces:

73 Sound-lock Lobby	84 Courtroom Storage	91a Law Clerk's Room 1	96a Judge Ensuite
74 Attorney's Waiting Room	85 Judge Chamber Reception	91b Law Clerk's Room 2	97 M&E
75 Attorney's Waiting Room	86 Law Clerk's Office	92 Judge Chamber	98 M&E
76 Courtroom	86a Law Clerk's Room 1	92a Judge Ensuite	99 M&E
77 Sound-lock Lobby	86b Law Clerk's Room 2	93 Trial Jury Room	T10 Toilet 10
78 Attorney's Waiting Room	87 Judge Chamber	93a Trial Jury Ensuite	T11 Toilet 11
79 Attorney's Waiting Room	88 Storage	94 Judge Chamber Reception	T12 Toilet 12
80 Courtroom	89 Trial Jury Room	95 Law Clerk's Office	T13 Toilet 13
81 Detention Corridor	89a Trial Jury Ensuite	95a Law Clerk's Room 1	
82 Courtroom Holding Cell	90 Judge Chamber Reception	95b Law Clerk's Room 2	
83 Courtroom Storage	91 Law Clerk's Office	96 Judge Chamber	

Circulation Spaces:

C11 Corridor 11	C15 Corridor 15	L1a Public Lift 1	L1e Public Lift 5	L4 Private Lift	S3 Staircase 3
C12 Corridor 12	C16 Corridor 16	L1b Public Lift 2	L1f Public Lift 6	L5 Private Lift	S4 Staircase 4
C13 Corridor 13	C17 Corridor 17	L1c Public Lift 3	L2 Private Lift	S1 Staircase 1	S5 Staircase 5
C14 Corridor 14	C18 Corridor 18	L1d Public Lift 4	L3 Private Lift	S2 Staircase 2	S6 Staircase 6

Figure 9: Top Floor Plan (Eighth Floor)

Based on the justified graph (Figure 10) and space syntax analysis (Table 5) of the top floor, it is considered that the floor is private in terms of permeability level, mainly due to its location on

the highest floor. The wayfinding level is considered to be very hard as the scale of depth level falls from 10 to 15. Few spaces such as the courtrooms and waiting rooms are semi-private spaces, and the wayfinding level is hard. Other spaces such as the Judge's chambers are extremely private spaces, and the wayfinding level is very hard as it only allows authorized personnel to enter.

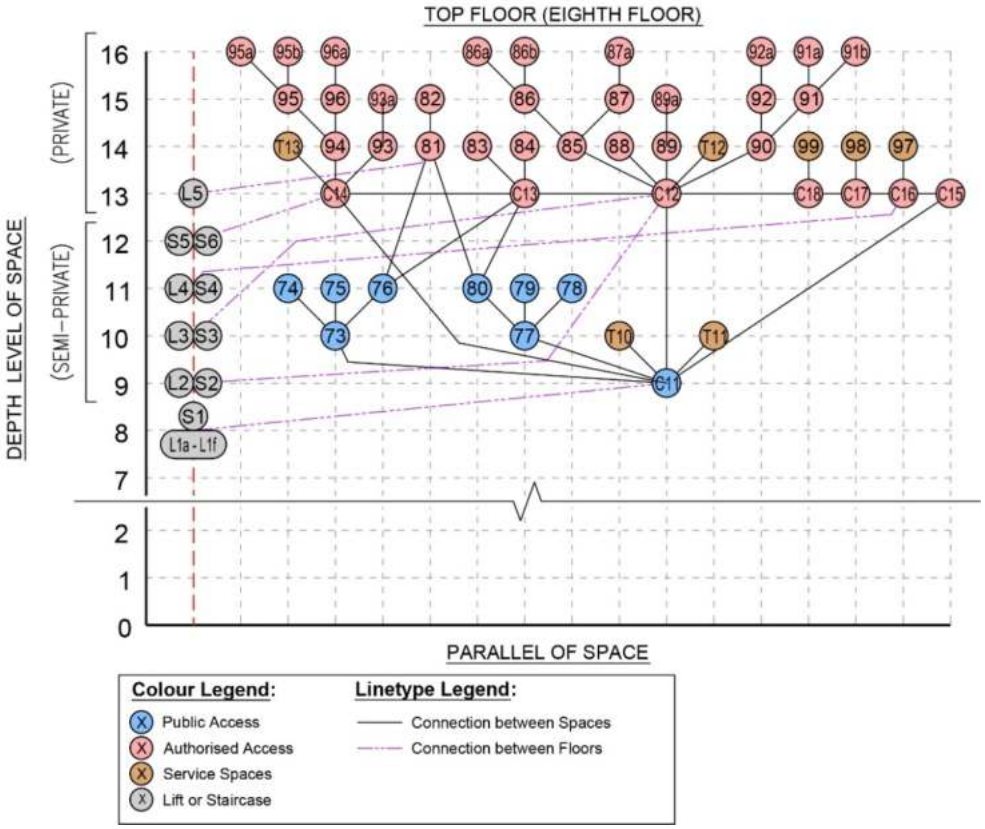


Figure 10: Justified graph of Top Floor Plan (Eighth Floor)

Table 5: Space Syntax Analysis for Top Floor Plan

Level of Permeability	Level of Wayfinding	Depth Level of Space	Code of Space
Public	Very Easy	1-4	-
Semi-Public	Easy	5-8	-
Semi-Private	Hard	9-12	C11, 73, 74, 75, 76, 77, 78, 79, 80, T6, T7
Private	Very Hard	13-16	81, 82, 83, 84, 85, 86, 86a, 86b, 87, 87a, 88, 89, 89a, 90, 91, 91a, 91b, 92, 92a, 93, 93a, 94, 95, 95a, 95b, 96, 96a, 97, 98, 99, T12, T13, C12, C13, C14, C15, C16, C17, C18

6 Discussion

6.1 Shape of Justified Graph

Based on the result of the justified graph analysis of the courthouse, the scheme has shown the characteristics of the shallow tree-formed graph model. There are a total of 16 steps of depth level of space being identified in the justified graph, the level of permeability and level of wayfinding is then determined and categorized according to its hierarchical order.

6.2 Levels of Permeability

Based on the table of results (Table 6), it has shown that the case study has its level of permeability falls in the semi-private category, comprising 64 spaces among a total of 161 spaces

and contributing 39.8%, which is the highest number of space and percentage among other spatial categories. Followed by private and semi-public spaces at 24.2% and 21.7% respectively. The public spaces only cover 14.3% of the spaces in the building, whereby the spaces are mostly located on the ground floor. The table of summary above with a total of 161 spaces does not include the lifts and staircases in the building.

Table 6: Summary of Space Syntax Results

Floors		Ground Floor		Typical Floor (First Floor to Seventh Floor)		Top Floor (Eighth Floor)		**Overall Result** (Based on the category of space)	
Level of Permeability	Level of Wayfinding	No.	Percentage	No.	Percentage	No.	Percentage	**No.**	**Percentage**
Public	Very Easy	22	61.1%	1	1.3%	0	0%	**23**	**14.3%**
Semi-Public	Easy	12	33.3%	23	30.7%	0	0%	**35**	**21.7%**
Semi-Private	Hard	2	5.6%	51	68.0%	11	22.0%	**64**	**39.8%**
Private	Very Hard	0	0%	0	0%	39	78.0%	**39**	**24.2%**
Total number of spaces		36	100%	75	100%	50	100%	**161**	**100%**

6.3 Level of Wayfinding

The wayfinding level is proportional to the level of permeability. According to Table 6, the overall wayfinding level of the selected case study is hard at 39.8%, mainly due to the high-security design needed for the courthouse. Accessibility to spaces within a courthouse building is typically found through multiple routes and access points, therefore increasing the depth level of space eventually. The highly accessible and straightforward spaces have the lowest percentage at 14.3%, in other words, the public circulation is limited within a certain area of the building and most of the spaces are not easily found or not opened to public access.

6.4 Connecting Spaces

Table 7: Summary of Connecting Spaces

Connecting Spaces	Code	Number of Space	Percentage
Single	4, 11, 12, 13, 14, 15, 49, 50, 51, 52, 60, 83, 84, 88, 97, 99, T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13	29	16.4%
Double	2, 9, 18, 19, 20, 26, 55, 56, 59, 61, 64, 66, 68, 69, 72, 81, 87, 89, 92, 93, 96, 98	22	12.4%
Triple	3, 6, 7, 23, 25, 27, 28, 37, 47, 53, 54, 57, 58, 62, 63, 65, 67, 70, 71, 85, 86, 90, 91, 94, 95	25	14.1%
Multiple	5, 29, 32, 33, 36, 39, 42, 43, 46, 73, 76, 77, 80	13	7.3%
End Room	8, 10, 16, 17, 21, 22, 24, 30, 31, 34, 35, 38, 40, 41, 44, 45, 48, 54a, 54b, 55a, 56a, 58a, 58b, 59a, 61a, 63a, 63b, 64a, 66a, 67a, 67b, 68a, 69a, 71a, 71b, 72a, 74, 75, 78, 79, 82, 86a, 86b, 87a, 89a, 91a, 91b, 92a, 93a, 95a, 95b, 96a	52	29.4%
Staircase	S1, S2, S3, S4, S5	5	2.8%
Lift	L1a, L1b, L1c, L1d, L1e, L1f, L2, L3, L4, L5, L6	11	6.3%
Lobby / Corridor / Entrance	E1, E2, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18	20	10.3%
	Total	177	100.0%

Based on the summary of connecting spaces (Table 7), it has shown that the end room has the highest percentage (29.4%), represents a number of 52 rooms among all the 177 spaces. The end room is considered a very private space where it usually locates within the inner part of the spaces, and the wayfinding level is very hard. Followed by single connecting spaces, triple connecting spaces and double connecting spaces at 16.4%, 14.1% and 12.4% respectively. For service and circulation spaces such as staircase, lift, lobby and corridor cover a total of 19.4% of the overall building spaces.

7 Conclusion

Through this paper, the level of permeability and wayfinding of the courthouse building is studied. The overall result has shown that even though the building typology of the courthouse is categorized as a public building, however, it has a more semi-private context because it does not permit people to move freely inside the building due to its nature of being a high-security building and therefore the users have to pass through few depth levels of space to reach their destination in the building.

The significance of this study contributes to the readers or designers having a better and more thorough understanding of the spatial configurations of the courthouse building. The findings could be used as a guideline or a design template to enhance the future courthouse design and spatial planning to increase the permeability and wayfinding of space while not compromising the security needed for such building typology. The drawback of the results is that the schedule of accommodation could not be applied for all the courthouse designs, mainly because of some factors such as scale, culture, and surrounding context, and different countries will have different design guidelines and requirements.

The limitation while conducting this study is that the labeling of space in floor plan from the online source is limited and general, the author has to observe and analyze the furniture arrangement of the space and therefore provide a more concise and acute labeled floor plan for the use of this paper. Furthermore, the analysis and results being obtained through the qualitative approach are subjective, and therefore, one case study of the selected building typology is not sufficient to represent the nature of the building typology, few more studies should be done to obtain a more comprehensive spatial analysis of the selected building typology.

8 Availability of Data and Material

All data and materials are included in this article.

9 References

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