



# Analysis of Permeability and Wayfinding of University Library: Case Study on SCCC Learning Resource Center

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## **Abstract**

Learning centers are very common in higher education institutions, and this case study analysed SCCC Learning Resource Center. The study aims to identify the level of permeability and wayfinding using space syntax. Space syntax technique able to discover the spaces as social forms. The building is located in New York, the United States, accommodating dynamic social learning and conventional peaceful single-scholar studying. This case study identifies the level of permeability and wayfinding through a numbering system to study the space syntax of the SCCC Learning Resource Center. The overall level of permeability determined is semi-public, which is 51% of overall spaces. In addition, the level of wayfinding is average which is identified as 38% of overall spaces. Finally, the permeability levels are appropriate to the building typology of this building. The wayfinding level is average because there is a limitation of access to the first floor level for the building user. The ground-floor level is more complex and has a higher number of private spaces compared to the first-floor level.

**Discipline:** Architecture, Space syntax.

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# 1 Introduction

Learning centres at higher education institutions are becoming more common and taking on more critical roles. While learning centres have grown commonplace in higher education institutions across North America, the word "learning centre" refers to various educational ideas and occurrences. As a result, researchers have urged a deeper understanding of learning centres. Based on the concept that the meaning of a term is determined by its usage in language, an assessment or study of the literature and research relevant to learning centres was conducted to provide criteria for more accurate descriptions and observations of learning centres (Thum, 1980). The primary goal of the learning resource centre is to construct libraries to support academics' educational, social, and cultural activities and contribute to their information requirements (Jange, 2009).

This study examined SCCC Learning Resource Center using space syntax. The resource center is unique by its architecture and the idea of inviting daylight into the building. The specific link between the user and space is investigated, exposing varying degrees of accessibility and movement options inside a structure (Munir, 2019). However, the enhanced dependence on the spatial arrangement was invariant across various global orientations. This interaction pattern may be involved in grouping collinear line segments into smooth curves (Polat & Sagi, 1994).

This study aims to analyse the permeability and wayfinding of the SCCC Learning Resource Center spaces using space syntax with its spatial configuration. It allows us to assess the impact of new conservation and education initiatives on permeability and wayfinding. As a result, the level of permeability and wayfinding become an architectural instrument that provides people with directional assistance and improves their spatial awareness. In addition, the spatial organisation and layout of buildings give an impact on how people use them (Koch, 2010).

## 2 Literature Review

### 2.1 Space Syntax

Based on Hillier (2011), the space syntax technique gives some instruments for penetrating the mechanics of architectural spaces and seeing these spaces as social forms manifested in architectural formation (Hillier & Iida, 2005). The author concluded that utilising connection graph representation and space syntax describes the spatial arrangement of spaces (Hillier et al., 1987).

Analysis of spatial attributes utilising syntactic space approaches revealed that spatial configuration, level of permeability, and wayfinding are all connected (Halim et al., 2019). Permeability is defined as the movement of spaces from one another (Yusoff et al., 2019). It may also be represented by physical attributes and how places are used (Keisling & Fox Jr, 2021). According to Kevin Lynch's study, wayfinding is described as "an organisation of specific sensory clues from the external world (Abd Rahaman et al., 2019). "Wayfinding is more than considered as signage where it is a collection of components that work together to create an environment for us to travel through (Fattahi & Kobayashi, 2009).

## 2.2 Case Study

Suffolk Country Community College is located in multi-location, Brentwood, Riverhead, Long Island and Selden, New York. In the United States, community colleges are seen as critical in developing qualified science professionals (Sasway & Kelly, 2021). The college primarily supports students who lead extraordinarily complicated lifestyles and have various commitments (Hoofman, 2015). The college was constructed with a minimalist building style where the exterior is designed with minimal elements and white in colour. The programme rooms grow more private, less collaborative, and more quiet and contemplative as one goes out from the heart of the building. Public access programme areas, such as the auditorium and gallery, are placed outside of library security, allowing them to be used outside of library hours.

The Learning Resource Center at Suffolk County Community College glows as a lantern light. The structure serves as both a prism for illuminating the internal areas during the day and a beacon for illuminating the campus at night. Parts of the cube are removed to allow natural light to permeate deep into the structure, allowing most areas to have access to natural light and views (Welch, 2021). The college's collaborative learning area, a central lantern housing information common, rises over the library's roofline to create a conspicuous cupola. The lantern is visible from anywhere on the academic mall and from the east and west commuter parking lots.

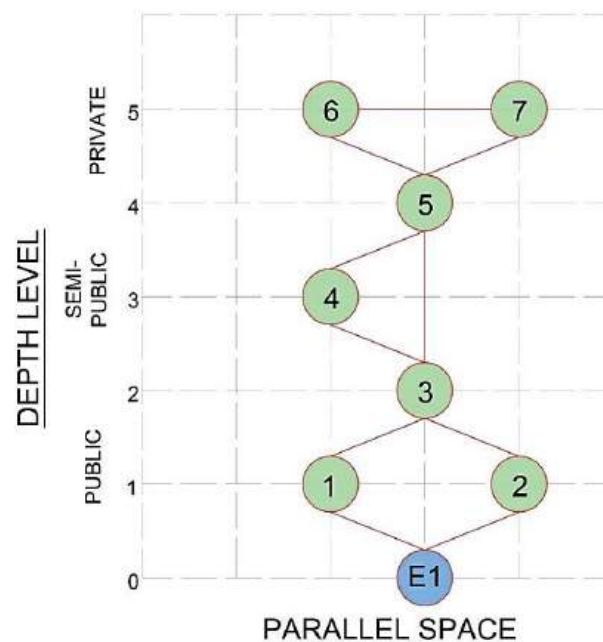
The Learning Resource Center programme accommodates both the dynamic social learning given by the Information Commons' collaborative programme activities and the conventional peaceful single scholar studying in the collection and reading room spaces. Individual and team computer workstations, technology and reference support desks, group study rooms, and informal reading areas are all located in the Information Commons. In addition, it serves as a core dynamo for promoting fruitful interactions between students and professors (Cabellero, 2021).

## 3 Method

Through the qualitative technique, preliminary research is carried out with the space syntax theory, background, and project information of the case study. (Suchon & Olesiak, 2021) The spatial arrangements on the floor plans were redrawn based on the images obtained from reputable sources used to identify the permeability and wayfinding analysis, which is then contextualised with space syntax theory. As a result, the approach to do this wayfinding study is to investigate the spatial hierarchies in the numbering graph using justified graphs.

The analysis of permeability and wayfinding was measured through a numbering system to study the space syntax theory of the building. (Osman & Suliman, 1994) First, the layout plan of Suffolk Country Community College was mapped out with images using software such as Autodesk Autocad and Photoshop to conduct the analysis. Then, observation was done to analyse the quality of the spatial arrangement of the building. The numbering system was applied to each space to label the numbering and colour to identify the spatial configuration of the building. For instance, the entrances are labelled as E, Services = S and other spaces are labelled as 1, 2, 3 etc. The colour of the numbering is defined as the permeability level of the spaces in the building.

The justified graph will explain the depth of the spaces within the building in a numeric way which mean as the higher the depth level, the more privacy the space in the building and the less depth level, which means the building is less privacy (Sailer & Koutsolampros, 2021). It also showcases the level of wayfinding or access to a specific space through the depth level in the justified graph. For example, the space identified at a lower depth level means the wayfinding of the space is very easy to easy, and space at a higher depth level can be difficult to very difficult to access to the space (Ab Majid et al., 2021). The level of permeability by hierarchical order is measured from the overall percentages, which categorise the primary, secondary, and tertiary levels.



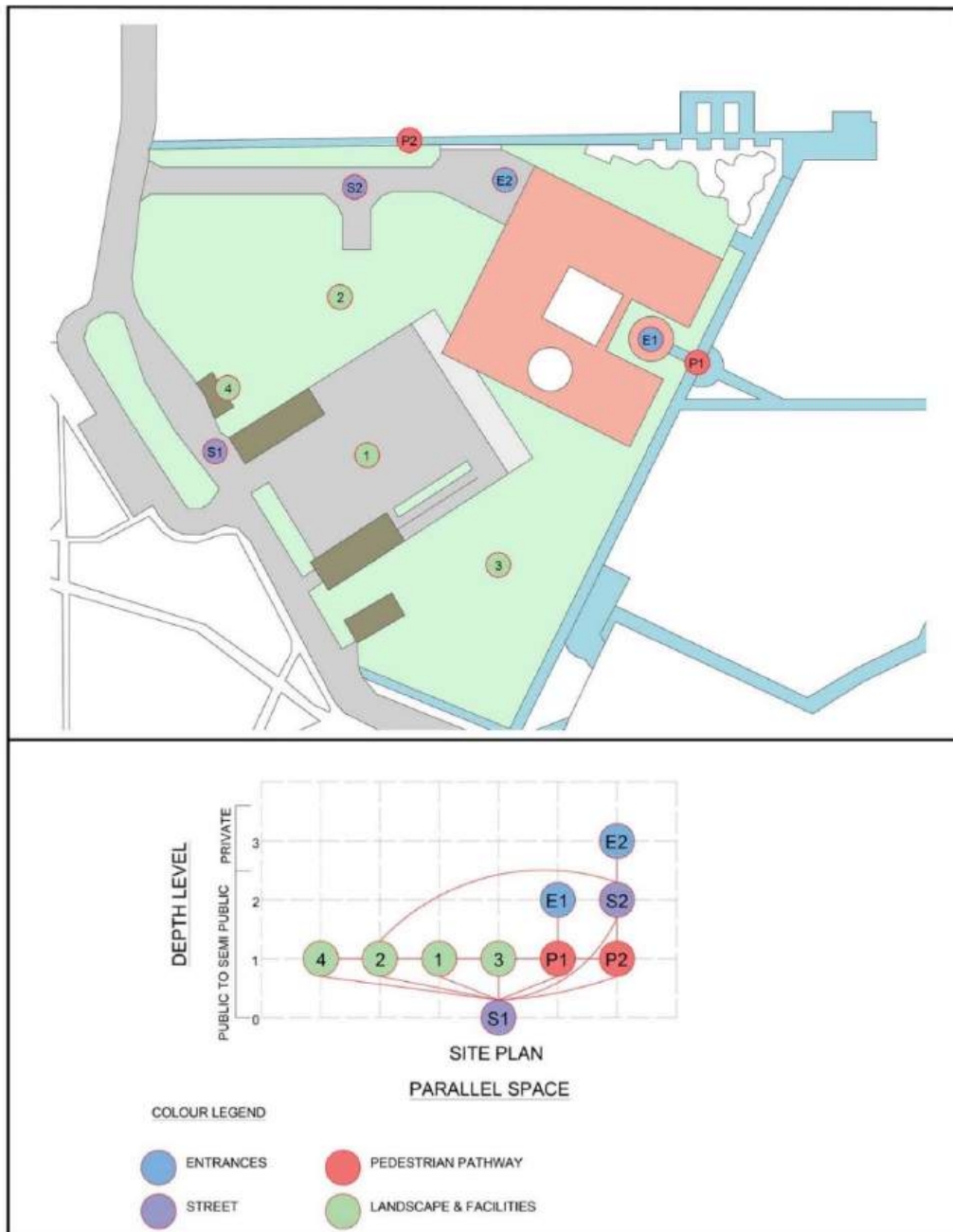
**Figure 1:** Example of Justified Graph

## 4 Result

### 4.1 Site Plan

The SCCC Learning Resource Center has two-level which consist of the ground floor and the first floor analysed for level and wayfinding and level of permeability. The justified graph below shows the circulation of space in the building to identify the depth level of spaces. Three categories of users have access to the building, which are the public, SCCC students and the university staff.

Figure 2 shows the justified graph for the site plan, which explains the level of permeability is public because the highest depth level identified is 3. All categories of users can access the building entrance (E1) except (E2), accessible to the staff. In addition, public and private users can access the building through the parking lot (1). The public will go through landscape and pathway (3) and linked to the (P1). The private user will go through landscape and path (2) and be directly accessible to E2. The main entrance is directly accessible from the pedestrian pathway (P1) linked to the (P2).



**Figure 2:** Redrawn Site Plan and Justified Graph of Site Plan for SCCC Learning Resource Center

Based on Figure 2, the level wayfinding is straightforward because the building is in the university, and all direction is accessible. Table 1 shows the Likert scale for the site plan and space indication based on the numbering in Figure 2.

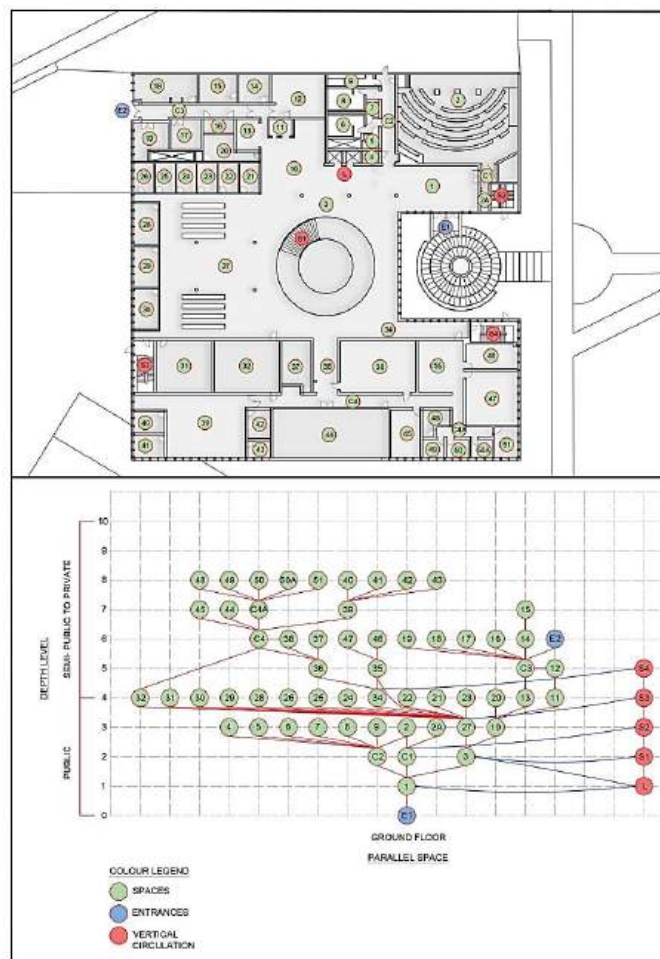
**Table 1:** Likert Scale on Space Analysis for Site Plan

Code of Space	Area	Level of Permeability	Depth Level	Level of Wayfinding
P1	Pedestrian 1	Public	1	Easy
P2	Pedestrian 2	Public	1	Easy
2	Plaza 1	Public	1	Easy
3	Plaza 2	Public	1	Easy
4	Bus Stop	Public	1	Easy
1	Parking	Public	1	Easy
S1	Street 1	Public	0	Easy
S2	Street 2	Semi-Public	1	Easy
E1	Entrance 1	Public	2	Easy
E2	Entrance 2	Private	3	Average



## 4.2 Ground Floor Plan

Figure 3 shows ground floor plan while Table 2 details Likert scale analysis.



**Figure 3:** Redrawn Ground Floor Plan and Justified Graph of Ground Floor Floor for SCCC Learning Resource Center

**Table 2:** Likert Scale on Space Analysis for Ground Floor Plan

Code of Space	Area	Level of Permeability	Depth Level	Level of Wayfinding
E1	Entrance	Public	0	Easy
E2	Entrance 2	Public	6	Difficult
S1	Staircase 1	Public	-	Easy
S2	Staircase 2	Public	-	Easy
S3	Staircase 3	Public	-	Easy
S4	Staircase 4	Public	-	Easy
C1	Corridor 1	Public	2	Easy
C2	Corridor 2	Public	2	Easy
C3	Corridor 3	Semi-Public	5	Easy
C4	Corridor 4	Semi-Public	6	Average
C4A	Corridor 5	Private	7	Difficult
L	Lift	Public	-	Easy
1	Entrance Lobby	Public	1	Easy
2	Auditorium	Public	3	Average
2A	Utility	Public	3	Easy
3	Library Lobby	Public	2	Easy
4	Utility	Public	3	Easy
5	OKU Toilet	Public	3	Easy
6	Men Toilet	Public	3	Easy
7	Cleaner's Room	Public	3	Easy

Code of Space	Area	Level of Permeability	Depth Level	Level of Wayfinding
8	Women Toilet	Public	3	Easy
9	Storage	Public	3	Easy
10	Information Counter	Public	3	Easy
11	Book Shelve	Semi-Public	4	Easy
12	Sorting Room	Private	5	Difficult
13	Printing Area	Semi-Public	4	Easy
14	Office	Private	6	Difficult
15	Office	Private	7	Difficult
16	Toilet	Private	6	Difficult
17	Office	Private	6	Difficult
18	Pantry	Private	6	Difficult
19	Office	Private	6	Difficult
20	Librarians Room	Semi-Public	4	Average
21-26	Reference Librarians	Semi-Public	4	Average
27	Book Reference	Public	3	Easy
28	Group Reading	Public	4	Easy
29	Group Reading	Public	4	Easy
30	Group Reading	Public	4	Easy
31	Lecture Room	Public	4	Easy
32	Lecture Room	Public	4	Easy
34	Casual Reading	Public	4	Easy
35	Tutoring Class	Semi-Public	5	Average
36	Academic Learning Centre Entrance	Semi-Public	5	Average
37	Group Study	Semi-Public	6	Average
38	Tutor Classroom	Semi-Public	6	Average
39	Writing Center	Private	7	Difficult
40-43	Study Room	Private	8	Difficult
44	Computer Lab	Semi-Public	7	Difficult
45	Group Study	Semi-Public	7	Difficult
46	Computer Lab	Semi-Public	6	Difficult
47	Classroom	Semi-Public	6	Difficult
48 -50A, 51	Study Room	Private	8	Difficult

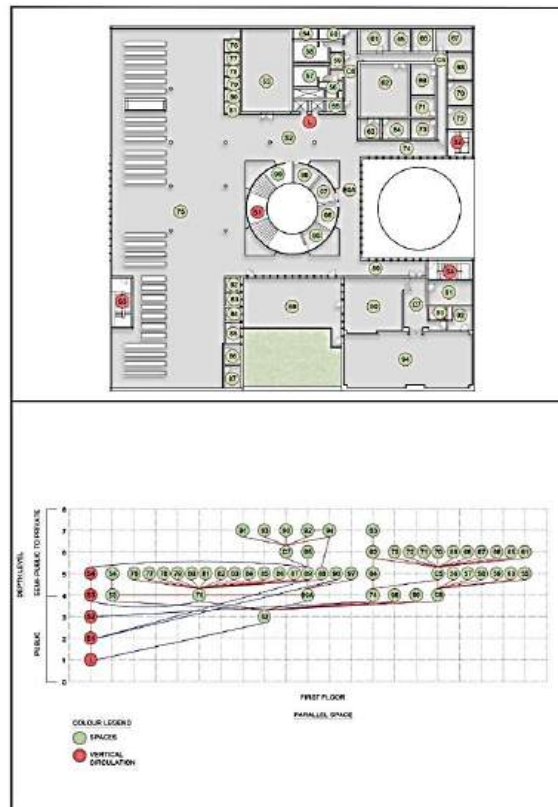
Figure 3 shows the ground floor plan, and justified graph, which identified the depth level is from 0, and the highest level is 8. The graph also indicates the level of permeability is public. Even though the depth level is 8, most of the building spaces are public spaces. The user can access the building through E1 and directly accessible to the public spaces through the lobby (1), as shown in figure 3. The user has a choice of using a lift or staircase to reach the first floor. The most accessible staircase to access is S1, which is in the middle of the building, and it is most visible from the entrance lobby. E2 is private access to the office area for the building staff. Based on table 2, the level of wayfinding is easy on the ground floor except for private spaces. The public spaces are primarily designed in an open-plan concept, which is straightforward. The wayfinding will gradually increase from easy to difficult based on the function of spaces.

### 4.3 First Floor Plan

Figure 4 shows the depth level is seven which is identified from the ground floor plan and justified graph. The level of permeability indicates in figure 4 is semi-public. However, there are private spaces such as a board room, meeting room and pantry on the first floor. The user will reach

(52) or (75) directed to lift (L) or staircase (S1). The corridors (C5), (C6), (C7) is the space that diverges the semi-public spaces and private spaces.

The level of wayfinding is easy to average on the first floor, as shown in Table 3. Most semi-public spaces are designed in the open-plan concept, but the open space on the first floor is more spacious and more prominent than the ground floor. It also influences the wayfinding to be easier than the ground floor level. The wayfinding of spaces will be more difficult as the spaces are deeper and private such as the spaces identified on the highest depth level, (90), (91), (92), (93), (94) and (63).



**Figure 4:** Redrawn First Floor Plan and Justified Graph of First Floor Floor for SCCC Learning Resource Center

**Table 3:** Likert Scale on Space Analysis for First Floor Plan

Code of Space	Area	Level of Permeability	Depth Level	Level of Wayfinding
C5	Corridor 5	Semi-Public	5	Difficult
C6	Corridor 6	Semi-Public	4	Average
C7	Corridor 7	Private	6	Difficult
52	Lobby	Semi-Public	3	Easy
53	Classroom	Semi-Public	4	Average
54	Storage	Semi-Public	5	Average
55	Utility	Semi-Public	5	Average
56	OKU Toilet	Semi-Public	5	Average
57	Men Toilet	Semi-Public	5	Average
58	Women Toilet	Semi-Public	5	Average
59	Cleaner's room	Semi-Public	5	Average
60	Storage	Semi-Public	5	Average
61	Computer Room	Semi-Public	6	Difficult
62	Media Center	Private	6	Difficult
63	IT Room	Private	7	Difficult
64	Information Room	Semi-Public	5	Average
65-73	Computer Room	Semi-Public	6	Difficult
74	Casual Seating	Semi-Public	4	Easy



75	Reading Area	Semi-Public	4	Easy
76 -87	Individual Study	Semi-Public	5	Easy
88	Roof Terrace	Semi-Public	5	Easy
89	Casual Seating	Semi-Public	5	Easy
89A	Casual Seating	Semi-Public	4	Easy
90	Meeting Room	Private	7	Difficult
91	Classroom	Private	7	Difficult
92	Pantry	Private	7	Difficult
93	Toilet	Private	7	Difficult
94	Board Room	Private	7	Difficult
95	Group Study	Semi-Public	6	Average
96	Group Study	Semi-Public	5	Average
97	Group Study	Semi-Public	5	Average
98	Group Study	Semi-Public	4	Easy
99	Group Study	Semi-Public	4	Easy

## 5 Discussion

The overall shape of the justified graph of the SCCC Learning Resource Center is a more horizontal shape based on Figures 2, 3 and 4. The overall result shows that the primary level of permeability is 51% in semi-public spaces, which has the highest percentage. This is because most of the public spaces in the building have separated small spaces such as individual study and group study rooms which results in a semi-public overall percentage. The secondary level of permeability is 28% on public spaces where all spaces are on the ground floor level. It is because there is a checkpoint to limit the user on the first-floor level. The tertiary level of permeability is 21% in private spaces. The private spaces are mostly connected through corridors that separate the public and semi-public spaces from private spaces.

Moreover, the result shows that the highest percentage on level of wayfinding is 38% of spaces are average to access. It is because of the highest number of semi-public spaces on the first floor level. The level of wayfinding on the second-highest level is 33% of easy access spaces. The public is mostly very easy to access and visible. The overall result shows the lowest percentage is 29% of spaces are difficult to access. The building user can access the building vertically through a lift (L) and staircase (S1). However, there is a staircase (S2), (S3) and (S4) for emergency escape and specific functions. Overall, there are two lifts and four staircases provided for this building.

## 6 Conclusion

The permeability and wayfinding of the SCCC Learning Resource Center were analysed and observed through the research method, as shown in the methodology. The building typology of this building is a library and learning centre open for the public, students, and university staff. Based on the overall result, the space syntax performance of this case study building is public and semi-public. The result shows the highest percentage of the level of permeability in semi-public and public spaces. It is also appropriate to a building typology, but there are more semi-public spaces than public spaces. Some of the semi-public spaces are public spaces, but the function of the spaces requires a little privacy, such as individual study room, which changes from public to semi-public space.

The result shows the highest percentage of the level of wayfinding is average and easy to access. The higher number of spaces is averagely accessible compared to easy access because there is a limitation of access to the first floor of the building. Overall, the spatial layout of this building is generally straightforward, but the layout ground floor level is more complex than the first floor level. Moreover, the private spaces on the ground floor level are higher than the first-floor level. There is a limitation on information and review papers during the case study conducted.

## 7 Availability of Data And Material

Data can be made available by contacting the corresponding author.

## 8 Acknowledgement

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