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LEVELS OF PERMEABILITY AND WAYFINDING IN AUTISM INSTITUTION

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ABSTRACT

Autism Institute is an organisation that helps autistic students who need legal and special education with appropriate programs and services. This study is to identify the level of permeability and wayfinding which determines the quality of the building's spatial configuration. This research evaluates the space planning through the floor layout plans which will discover and understand the quality of spatial configuration for Autism Institute. To achieve the research objective, the research study investigates educational and autism institutions with reference to space syntax analysis. The case studies selected for analysis were Flower with Kindergarten in South Korea and Pacific Autism Family Center in Canada. A justified graph and numbering indication system for each case study are conducted, and the resulting graph is compared and summarised based on the level of permeability, wayfinding and spatial configuration in relation to space syntax.

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental disorder. Usually, they have difficulties in social communication and interaction, repetitive patterns of behaviours and interests (Nelson et al., 2016). According to the Ministry of Health (MOH, 2004), reported that one in every 600 children in Malaysia has autism. Hence, Autism Institute is a place that can help students who need legal and special education with appropriate programs and services. This paper aims to study the space planning through the floor plans layout which will discover and understand the quality of spatial configuration for Autism Institute. Quality of the spatial configuration of the building is important and determined by two elements which are the level of permeability and wayfinding. The objective of the research is to study the level of permeability and wayfinding with reference to space syntax analysis.

The case studies selected for analysis were the Flower + Kindergarten, South Korea and Pacific

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Autism Family Center (PAFC), Canada. Each case study is conducted with a justified graph and numbering indication system and summarised based on the spatial configuration, level of permeability and wayfinding in relation to space syntax. The limitation of the study is the limited choices and insufficient sets of layout drawings for the Autism Institute from local.

2. LITERATURE REVIEW

2.1 DEFINITION OF SPACE SYNTAX

According to Hillier and Hanson (1984), Hillier (1996), space syntax is a theory for space and to analyse the spatial configuration in several elements such as township, cities, buildings or landscapes. Meanwhile, in architecture approach, space syntax is to determine the expression between spatial configurations with a social or cultural meaning (Nourian, Rezvani, & Sariyildiz, 2013). In other words, space syntax is to generate social interactions in the built environment by analysing the spatial configuration (Ackerson & Straty, 1978). Wayfinding and place-learning, where individuals and space interact are the spatial cognition aspects that usually will be used to analyse in space syntax theory (Beck & Turkienicz, 2009).

There are few space syntax analysis graphs that can be implemented for easier to read and analyse such as a graph, syntactic step, depth and justified graph (Hillier, Hanson, Bartlett, & Benedikt, 2016). A justified graph will be used and analyse the depth and level of permeability of the case studies. Basically, these graphs help to understand the overall depth from the most bottom until the highest floor of a building. The levels of depth or steps will directly affect how the justified graph looks at the end, is either deep or shallow (Natapov et al., 2015). Each connection in a building is connected to the justified graphs which indicate the level of the depth. Space syntax consists of two measurable factors which are ‘Level of Permeability' and ‘Wayfinding'. In architectural design, level of permeability is the level of movement or circulation of people inside the building. It can be categories into three zonings which are a public area, semi-public or semi-private, and private area (Alonso de Andrade, Berghauser Pont, & Amorim, 2018; Siegel, 1975).

On the other hand, wayfinding is an architectural design that gives guidance to people based on a physical environment and improves their understanding and experience of the space (Mohd Yasin, Hassan, Al-Ashwal, 2017). Also, it is a spatial space problem solving as well. It will let you know where your desired location is, and lead to get there from your present location when you are in a building or an environment (Natapov et al., 2015; Montello, 2001). Based on the study from Emo, Holscher, Wiener, & Conroy-Dalton, (2012), environment affected the wayfinding behaviour. There are four environmental variables that have been identified that will affect wayfinding behaviours such as visual access, layout plan configuration, architectural differentiation, and signage.

2.2 AUTISM INSTITUTION

Children with autism need to look after and extra caring especially in education. A good institution should have provided special education base on the social and mental ability of every autistic child because every child with autism has their own characteristics and learning skills (Peterson, 2012). In other research studies from Gindis (2008), Institute for autism requires adequate training and specialist or professionals with mental health background supported such as diagnosis and therapy for neurodevelopmental disorders. Autism Institution can be defined as an educational

environment that can operate and provide clinical and educational knowledge at the same time for autism (Brown, 2012). In short, autistic students require special education in legally and educationally with appropriate programs and services.

3. CASE STUDY

3.1 FLOWER + KINDERGARTEN, SOUTH KOREA

Flower Kindergarten is located in the Seocho District of South Korea. The kindergarten was designed by Jungmin Nam from OA Lab architectural firm while Yewon Kindergarten was the client of this building. Flower Kindergarten completely constructed in 2015 and has a total 2165 m^2 of gross floor area. The specialty of this kindergarten came with built-in flowerpots on the façade design, an interesting interior design that plays with colours and a versatile staircase that acts as a play and study area. The building consists of a total seven floors which including two stories of basement. Basically, the canteen, teacher's room and admin, and car parking was located in the basement area while the four house classrooms were located above ground vertically. A rooftop garden was located at the topmost level for the children. Besides, several sustainable elements and eco-friendly designs were applied in this kindergarten such as a rainwater harvesting system for irrigation purposes and solar panels located at the rooftop that collects solar energy.

3.2 PACIFIC AUTISM FAMILY CENTER (PAFC), CANADA

The Pacific Autism Family or known as PAFC, "The Hub" is located at Richmond, approximately 500 m from the Vancouver International Airport, Canada. The centre was designed by a local architectural firm – NSDA Architects and consists of three levels which covered approximately 5500 square meters of floor area. The PAFC is a centre that supports and helping the needs of individuals with Autism Spectrum Disorder (ASD) and their parents by integrates with several resources such as research, information, assessment, treatment, education, learning, etc. Basically, this building mostly caters to children, teenagers and young adults, together provide support to families of children with ASD as well. Besides, four main spaces have been categorised and provided in this centre are educational spaces, healthcare spaces, life skill spaces, and research spaces. There are also several spaces specifically provided for the people with ASD such as a calm room or meeting room which allows children to escape or stay if they become overstimulated.

4. METHODOLOGY

There are two types of method conducted for the space syntax methodology. Firstly, both case studies of the floor plans are indicated with alphabets and numbers. Furthermore, all the plans combined with different colours to differentiate the level of depth. For the alphanumeric, the alphabet E shows the mean of access into the building (E1, E2, E3, etc.). For building services part, the alphabet B is used for services compartments such as fire, water or electrical (B1, B2, B3, etc.) while alphabet D indicates the storage or storeroom (D1, D2, D3, etc.). Toilets or washrooms (T1, T2, T3, etc.), corridors (C1, C2, C3, etc.), staircases (ST1, ST2, ST3, etc.) and elevators (L1, L2, L3, etc.). Meanwhile, Numerical labelling (1, 2, 3, etc.) indicates the main usable spaces. The second type of method was to transfer all the labelling from the floor plans and translated them into a justified graph

respectively. The level of permeability and wayfinding are the primary key to develop the space syntax of justified graphs. At last, a comparative analysis is done for both case studies. There are three levels of measurement for the Likert Scale was used to justify the level of permeability. Below show the defined scale:

Depth from 0 to 2 = Public
Depth from 3 to 8 = Semi-Public or Semi-Private
Depth from >9 = Private

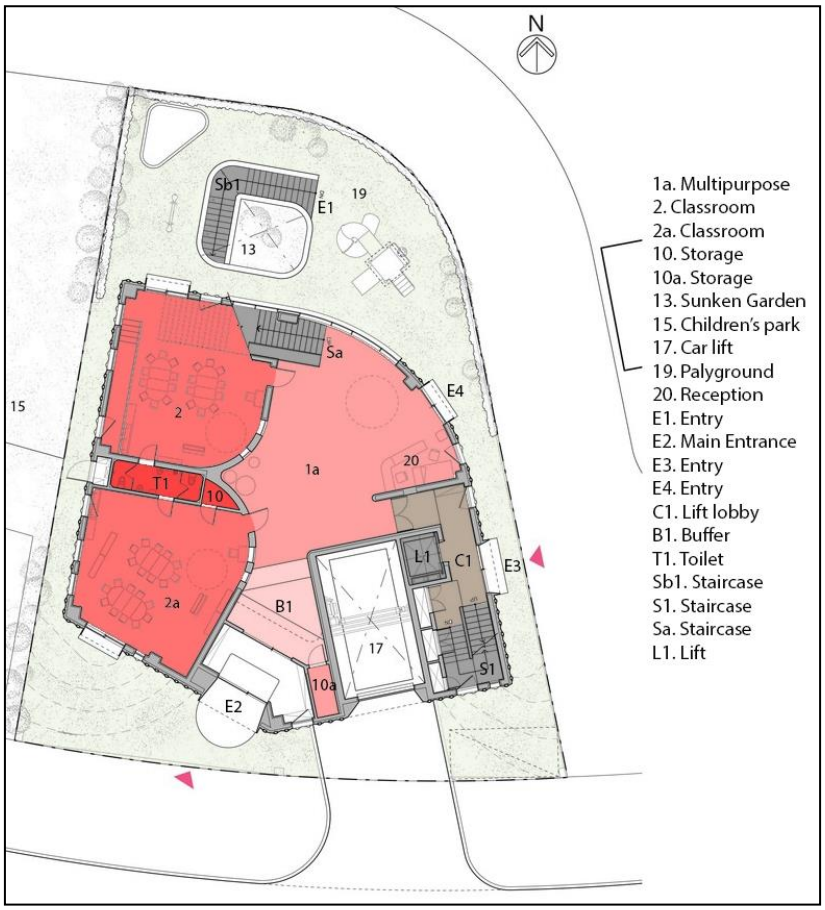

Figure 1: Site Plan and Ground Floor Plan

5. ANALYSIS, RESULT, AND DISCUSSION

5.1 FLOWER + KINDERGARTEN

5.1.1 SPATIAL CONFIGURATION

Figures 1-6 show the site plan for each floor of the Flower + Kindergarten. Legends for each space are given.

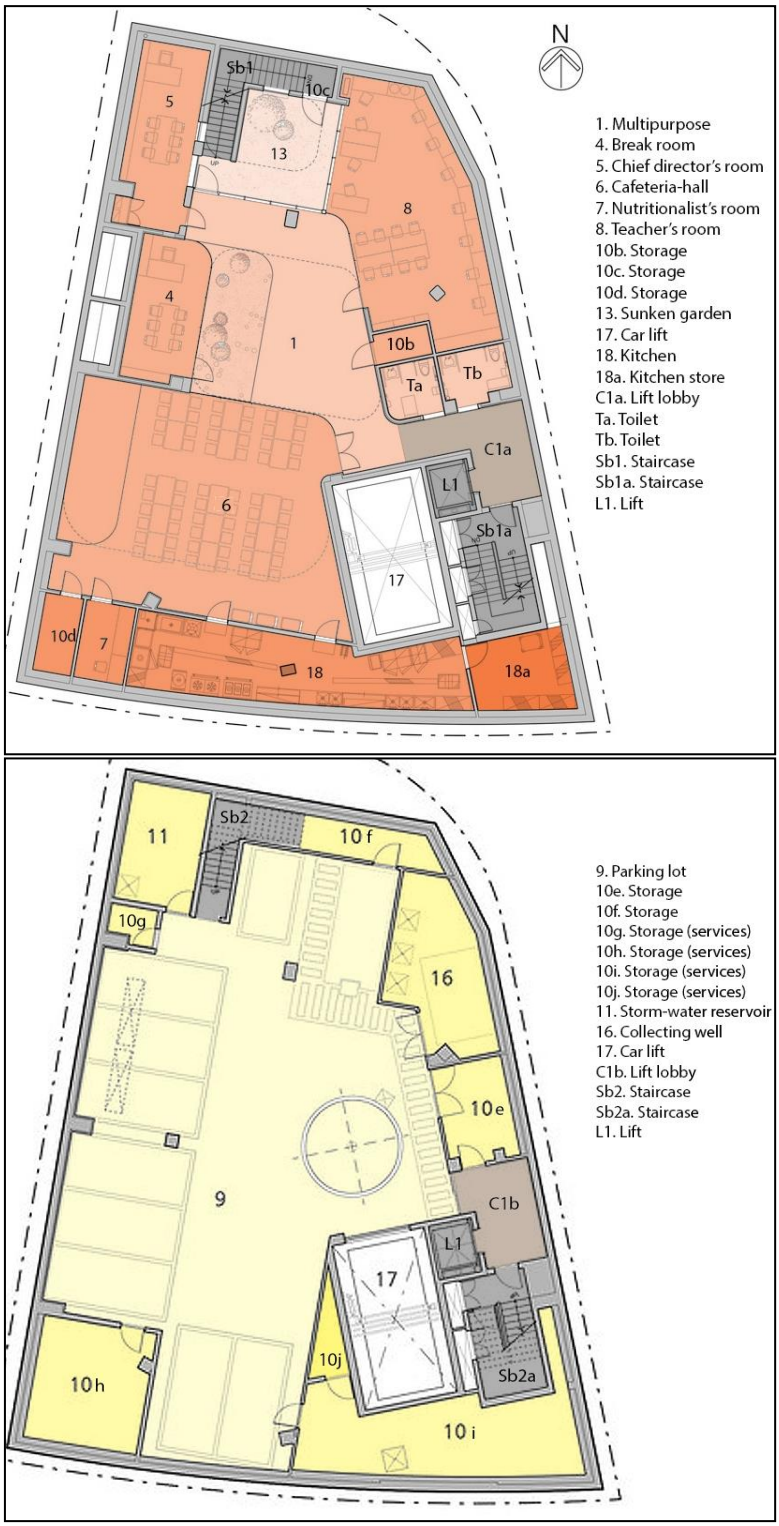

Figure 2: Basement 1 (top) and Basement 2 (bottom) Floor Plan

5.1.2 SPACE SYNTAX ANALYSIS

Referring to the ground floor plan (Figure 1) and justified graph (Figure 7), there is three entrance (E2, E3, and E4) that access into the building. Another entry (E1) will lead to basement one by using the staircase (Sb1) from the outdoor playground area. The first level of permeability falls on the corridor (C1) and buffer (B1) that leads to the multipurpose space (1a). For the vertical circulation, two staircases (Sa, S1) is the primary connection that leads you up to the first floor from the corridor (C1) and multipurpose area (1a) meanwhile another two staircases (Sb1, Sb1a) will guide

you down to the first basement floor. Move to the third level of permeability, two classrooms (2, 2a) are connected by the multipurpose area and shared by a toilet (T1). Lastly, storage (10) and bathroom (T1) located between 2 classrooms will be the highest permeability at ground floor (fourth level of permeability).

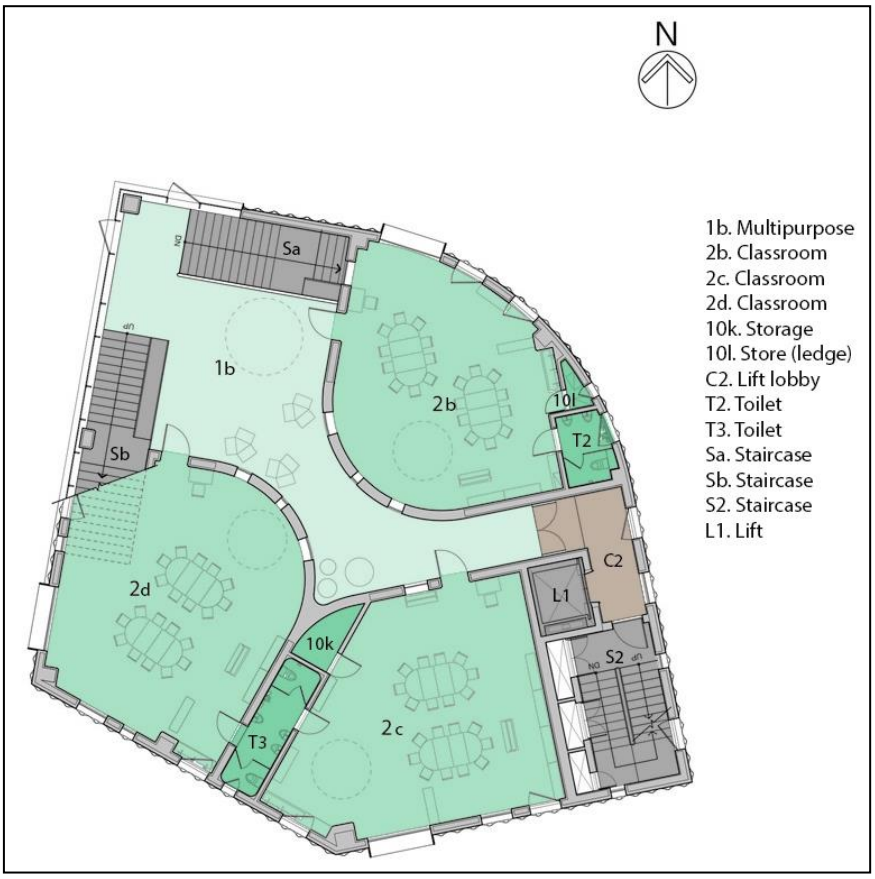

Figure 3: First Floor Plan

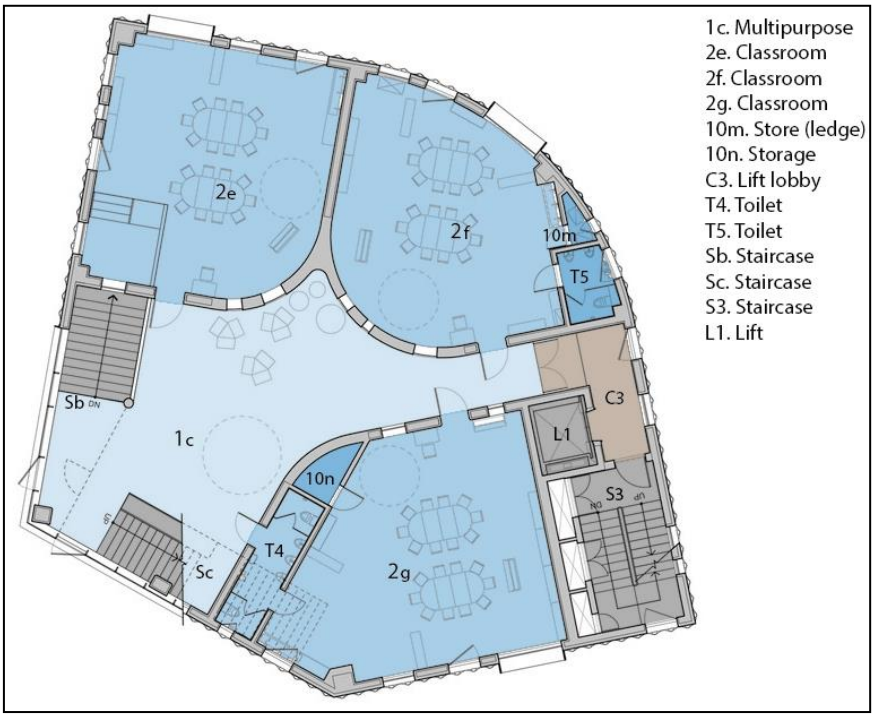

Figure 4: Second Floor Plan

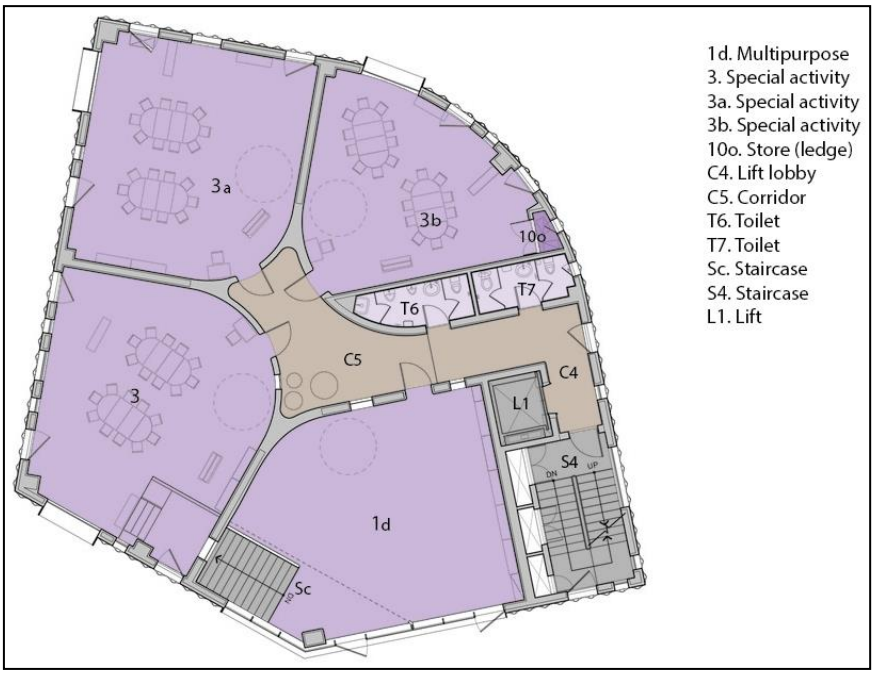

Figure 5: Third Floor Plan

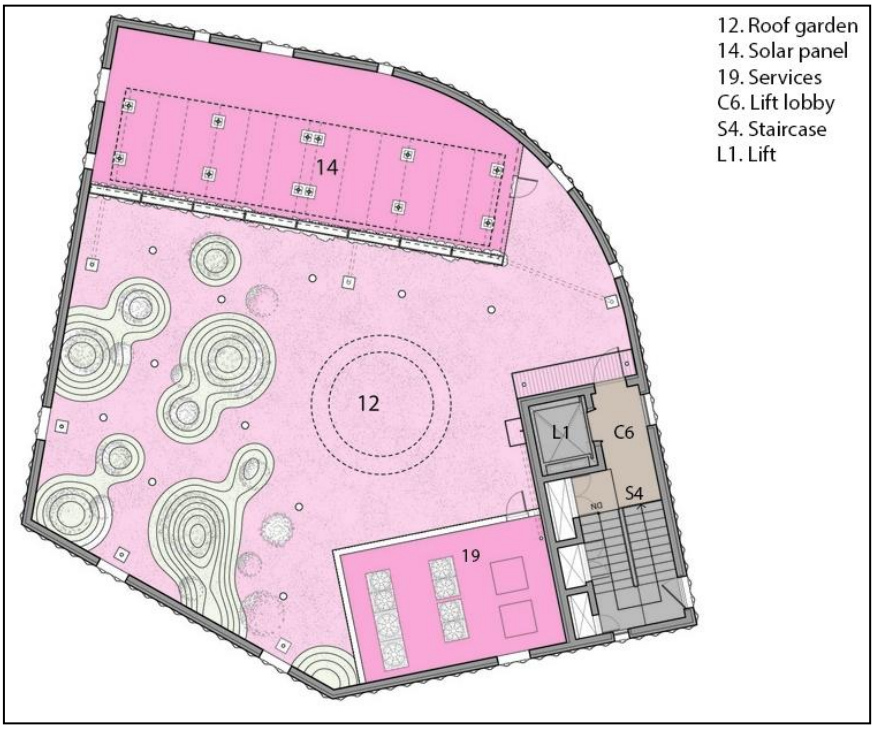

Figure 6: Fourth Floor Plan

At the first basement floor plan (Figure 2) with its justified graph (Figure 7), the multipurpose room (1) is the centre point that connected all the significant spaces at basement one such as director's room, break room, cafeteria and teacher's room (fourth level of permeability). Two staircases (Sb2, Sb2a) is the primary connection that leads you down to basement two from a sunken garden (13) and corridor (C1a). Move to the fifth level of permeability; you have to pass through the cafeteria then it will lead you to these spaces such as cafeteria storage, nutritionist's room and kitchen. Kitchen store is the highest permeability space at basement 1 (sixth level of permeability). The next level is the

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second basement floor plan (Figure 2). Basically, basement two are located for car parking by using the car lift to transfer it (17). The car park area surrounds all the storeroom and services room. Two staircases (Sb2, Sb2a) is the primary connection that leads you up to basement 1. Storage/services are the highest permeability spaces at basement 2 (seventh level of permeability).

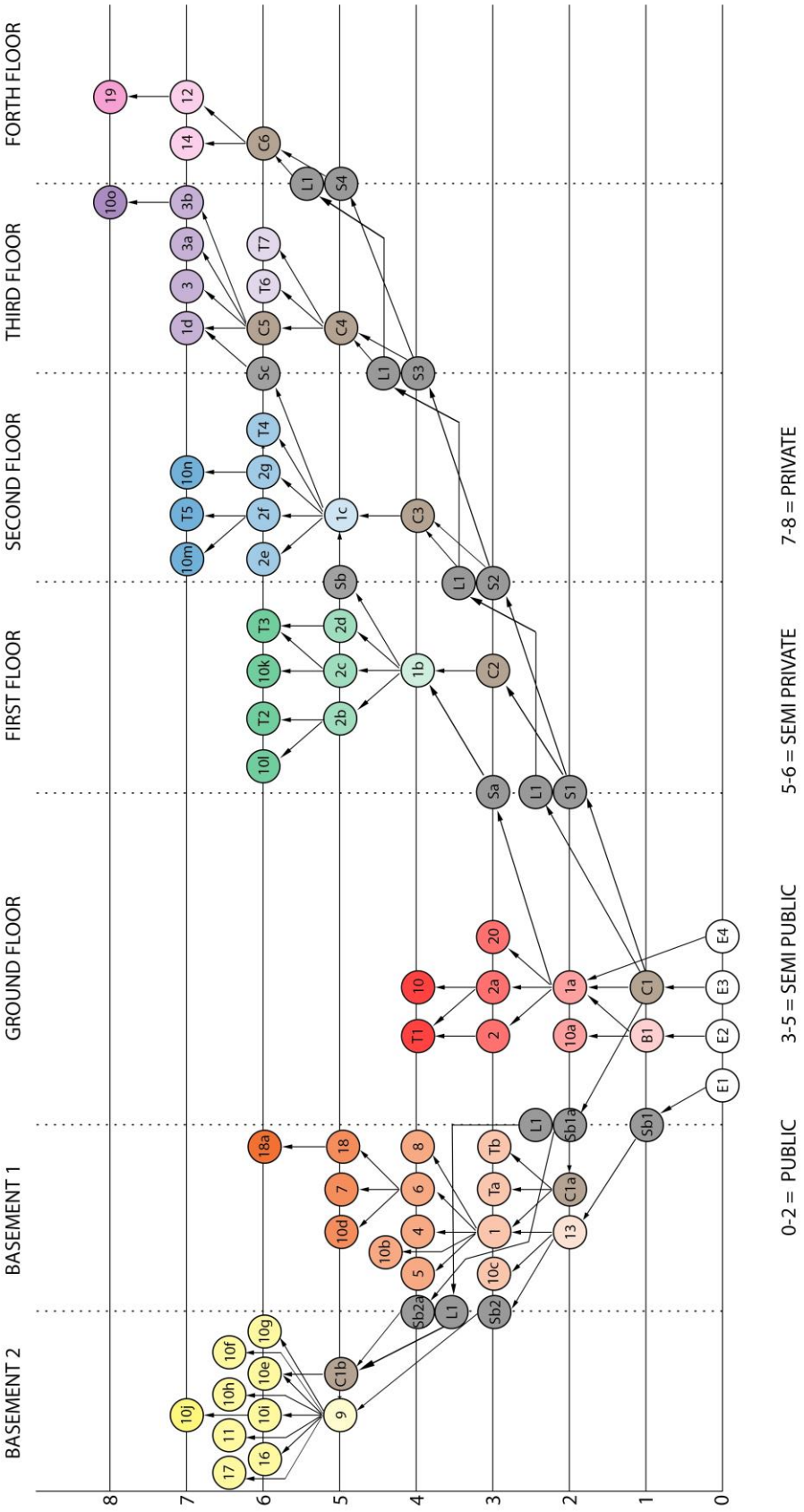

Figure 7: Overall Justified Graph of Flower Kindergarten.

At the first floor plan (Figure 3) with its justified graph (Figure 7), the majority all the spaces are considered as semi-private spaces on the first floor (fifth and sixth level of permeability). A spiral staircase concept connected from (Sa to Sb), while another fire staircase (S2) which also can lead you up to the second floor as well. The multipurpose room (1b) is the primary space that leads you to go to all the classrooms and staircases on first floor while (T3) is a shared washroom for the two classrooms (2c and 2d) while classroom (2b) has its private toilet. The second-floor plan (Figure 4) has similar permeability level of its justified graph (Figure 7), to the first floor, a spiral staircase continues connected from (Sb to Sc), while another fire staircase (S3) which also can lead you up to the third floor as well. The multipurpose room (1c) is the primary space link to all the classrooms and (T4) is a shared bathroom for the two classrooms (2g and 2e), but classroom 2e have to pass through multipurpose (1c) while classroom (2f) has its private toilet (T5).

Referring to the third-floor plan (Figure 5) and justified graph (Figure 7), the majority of all the spaces are considered as private spaces on the third floor and only will be used when there is a particular activity or function happen (seventh level of permeability). The spiral staircase ended at this floor and located inside the multipurpose room (1d), and you have to use the fire staircase (S4) which only can lead you up to the topmost floor. Two toilets are located outside of the rooms, and all the users have to come out from the places and pass through the corridor (C5) to use it. Lastly is the fourth-floor plan (Figure 6), the most private spaces which are located on the topmost floor – Services (eighth level of permeability). A private rooftop garden that only can be used by kinder children and staffs. The only staircase (S4) that connected to the topmost floor due to privacy setting and design, to control the public go up.

5.1.3 DISCUSSION

According to the results and analysis from the justified graph (Figure 7), a strong concept of the spiral staircase is the central circulation of the building and bring all the children to reach their classroom respective accordingly; this has helped all the children easily to achieve its potential in navigating the direction and wayfinding vertically. For all the classrooms on every floor, a multipurpose area that acts as a corridor, an open playscape area or a quiet area that connects surrounding to each of the classes respectively, it creates more fun and exciting area for the children rather than just a standard linear corridor.

For the cafeteria hall from the basement one floor, it might be more convenient if the spaces relocate to the ground floor, this could ease the children for finding the cafeteria either from the classroom or from the outdoor playground. Besides, it could ease the loading and unloading services of the kitchen from the road as well. Based on the justified graph, usually, toilets, office, storage rooms, and services ledge usually are designed as the last and most private area to reach on each floor of the kindergarten which won't use by the public. Lastly, the symmetric spatial system has shown in the space syntax justified graph which the spaces between each other are directly connected to the root space. Hence, a minimum depth and straightforward spatial configuration have applied in the Flower Kindergarten which can assist the children in navigation and wayfinding efficiently.

5.2 PACIFIC AUTISM FAMILY CENTER (PAFC)

5.2.1 SPATIAL CONFIGURATION

Figures 8-10 show the site plan for each floor of the PAFC for visual inspection of the building. Legends for each space are given.

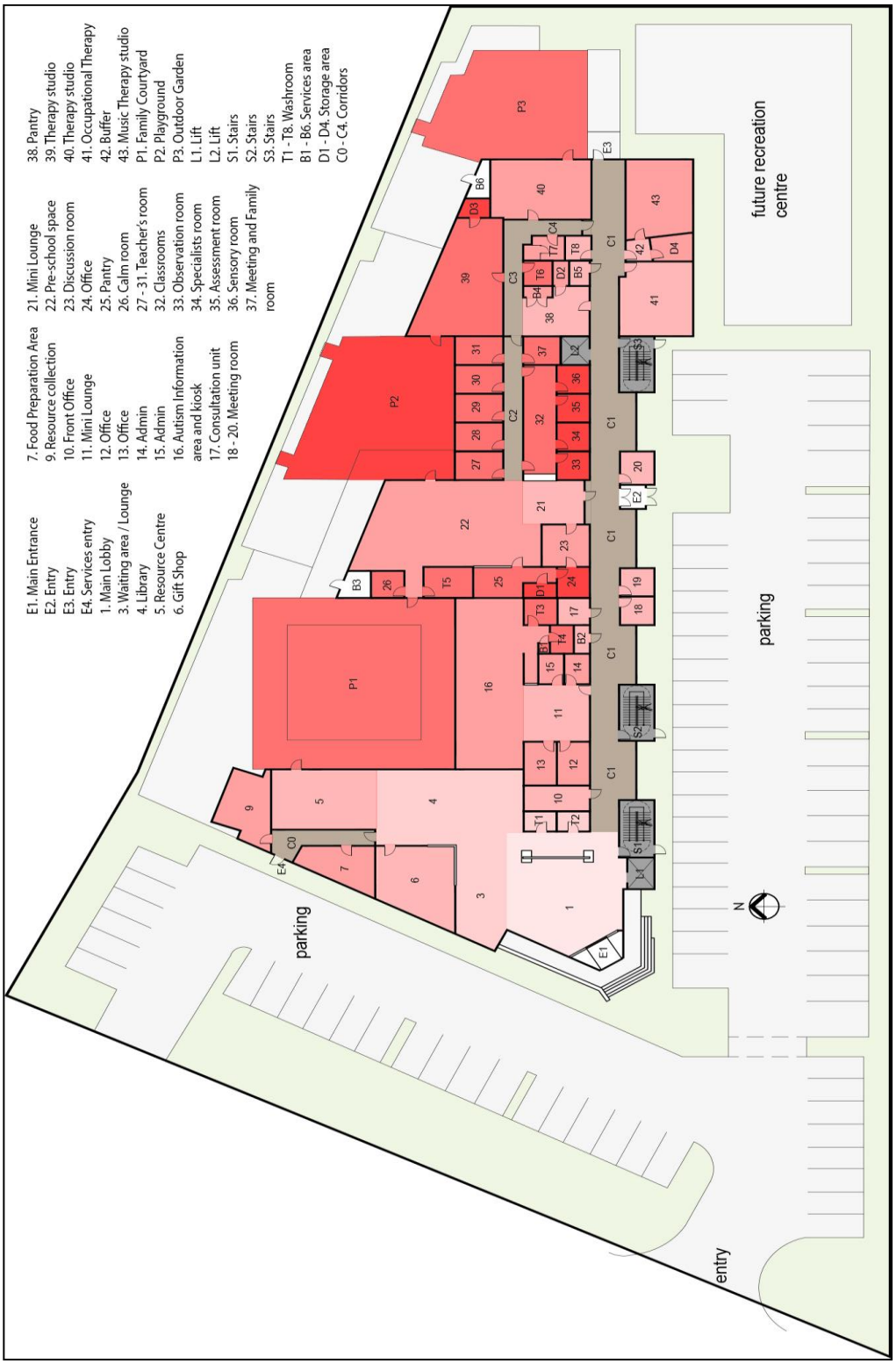

Figure 8: Site Plan and Ground Floor Plan (PAFC)

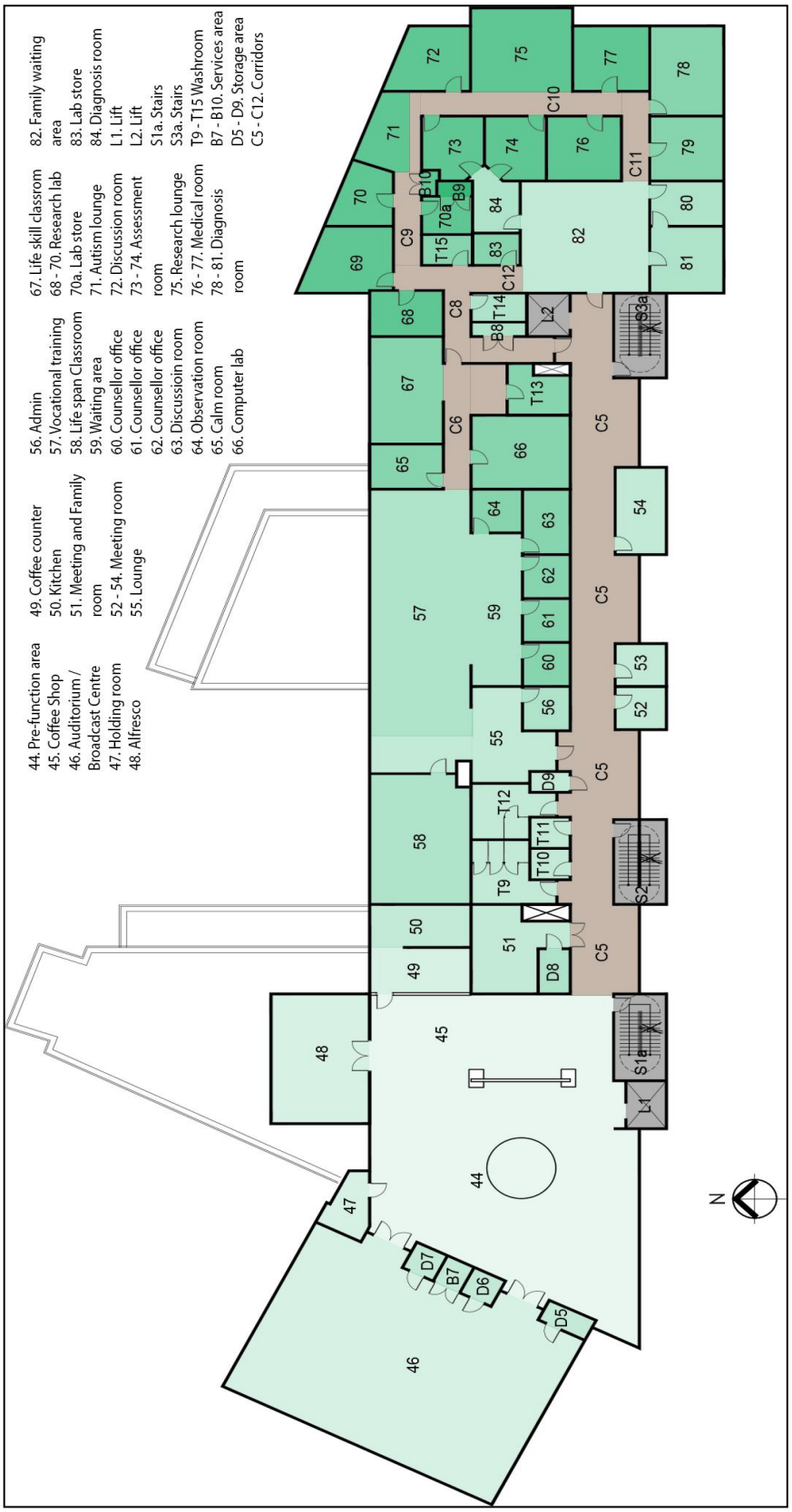

Figure 9: First Floor Plan (PAFC)

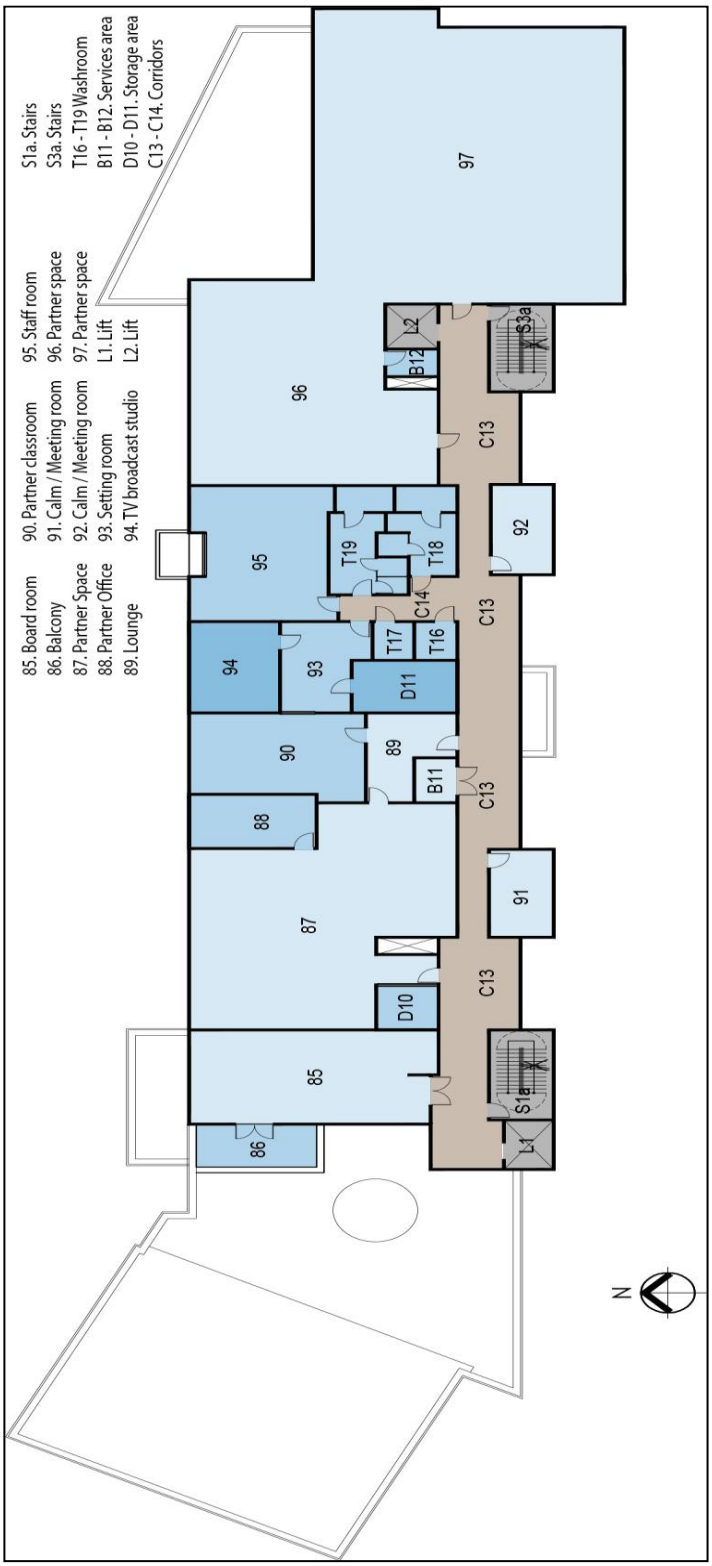

Figure 10: Second Floor Plan (PAFC)

5.2.2 SPACE SYNTAX ANALYSIS

Firstly start from the ground floor plan in Figure 8 and its justified graph (Figure 11), (E1) is the main entrance that enters the building. There is two side entrance that can come as well (E2, E3). While the last entry (E4) is mainly for loading and services purposes, basically ground floor can be divided into two spaces which are public and semi-public spaces. Library, resource centre, gift shop, family courtyard, etc. (4, 5, 6, P1) are more to public area that can shared with families, while admin,

classrooms, teacher's room, therapy studio, etc. (16, 22, 30, 39) are considered as semi-public area. For the circulation, the corridor (C1) is the primary connection that links all the spaces together with the lift and staircases (L1, L2, S1, S2, and S3).

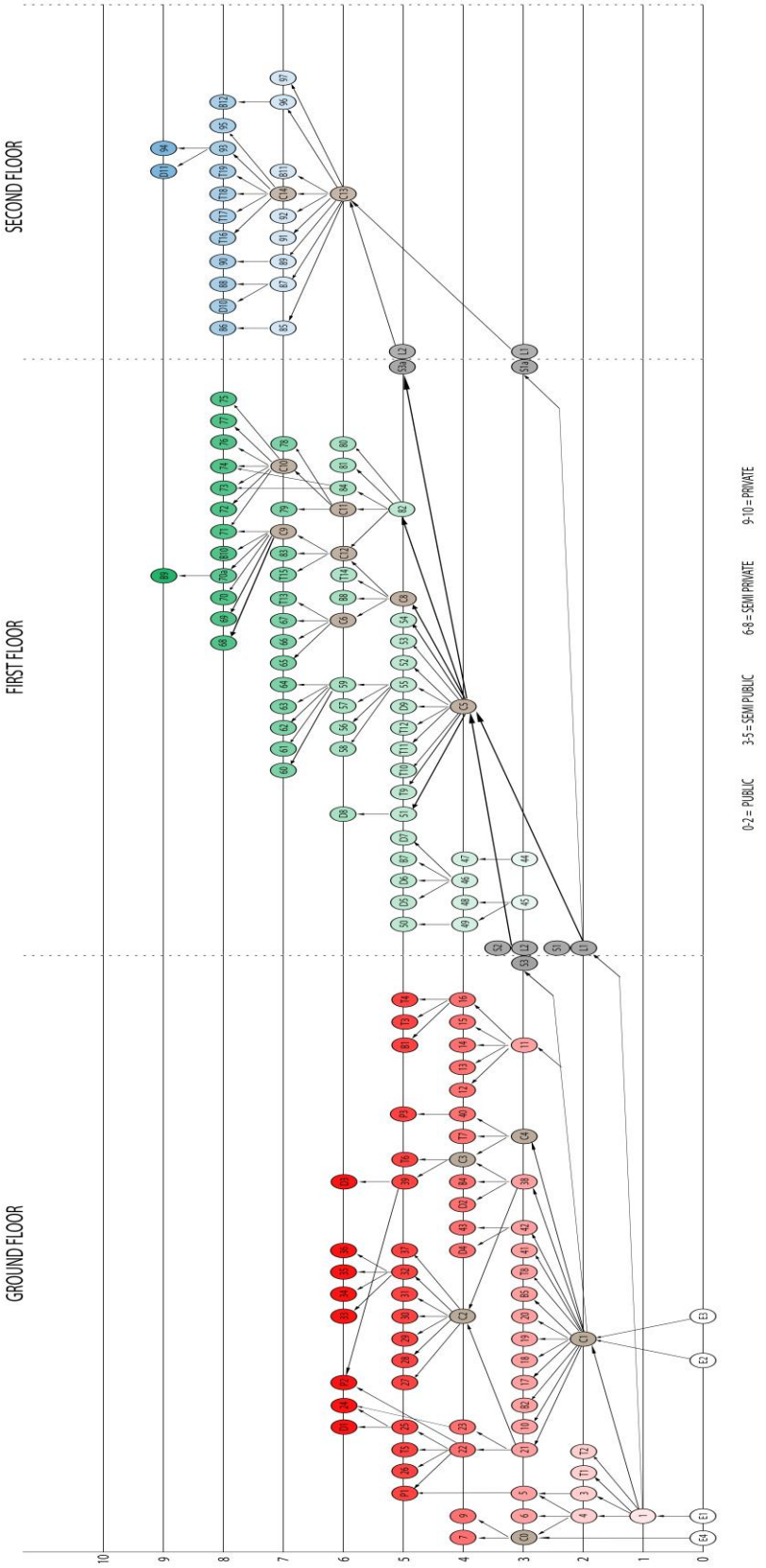

Figure 11: Overall Justified Graph of PAFC.

The simple concept of the corridor design is to ease the direction and wayfinding for the individuals with ASD. There is a semi-public playground (P2) provided for the children that connected between pre-school space and therapy studio (22, 39). Lastly, (T1, T2) washrooms are mainly provided for the public while from T4 until T6 are provided for the staff, children and teachers.

Moved on to the first-floor plan (Figure 9) and its justified graph (Figure 11), there will be an auditorium with a pre-function area and a coffee shop with alfresco (44, 45, 46, 48) at the left side when coming out from the lift and stairs (L1, S1a). Same as the ground floor, a corridor (C5) is the primary connection that links all the spaces together with the lift and staircases (L1, L2, S1a, S2, and S3a). Basically, second-floor spaces can be divided into two which are semi-public and semi-private. Semi-public consists of coffee shop, broadcast centre, auditorium, family waiting area, etc. while semi-private consists of life skill apartment, clinical assessment, research lab, etc. (67, 69, 75). Lastly, (T9, T10, T11, T12) washrooms are catered for public and (T13, T14, T15) individual washrooms are provided for the children and staffs.

Finally, at the topmost floor which is a second-floor plan (Figure 10) with its justified graph (Figure 11), all the spaces mostly are considered as private spaces such as boardroom, partner office, TV broadcast studio, staff room, etc. (85, 88, 94, 95). The long corridor (C13) is the primary connection that links all the spaces together with the lift and staircases (L1, L2, S1a, and S3a). Lastly, (T16, T17, T18, T19) all the washrooms are gathered next to TV broadcast studio; hence all the users on third floor need to come out from their spaces and pass through the corridor to reach those washrooms.

5.2.3 DISCUSSION

Based on the results from the justified graph (Figure 11), the long corridor design (C1, C5, and C13) play an essential role on connecting all the different function of spaces with all the vertical circulation such as staircases and two lifts from ground floor until the highest level which is the third floor. Due to the difficulties of behaviour on wayfinding for the individuals of ASD, it is designed such a way that a long and straightforward corridor that easy to find and navigate to each space that they want to enter. The spaces located on the second floor are considered the private area, the exchange and relocation of the boardroom with TV broadcast centre might let the user of the boardroom more convenient when located next to the staff room and the washrooms. Hence, all the staff will have a shorter distance when they are having a meeting in the boardroom. As shown in the graph, the clinical assessment room and the research lab on the first floor are designed as the last and semi-private areas. The centre which partially allows the public to access such as families with children of ASD while the most private sector of this building was located on the topmost floor which is on the second floor considers the boardroom, staff room, etc. At last, a minimum depth and symmetric spatial configuration and minimum depth have implemented in the PAFC which can assist the children with ASD in navigation and wayfinding.

6. CONCLUSION

Although both of the case studies are slightly different in components and purposes of the user,

there has similarity way of design and circulation either in a vertical or horizontal form. For education typology, the most important consideration is to help all the children easily to achieve its potential in navigating the direction and wayfinding neither in mainstream or ASD. Hence,

Learning area, therapy studio, and classrooms are the leading spaces in both buildings for the children. Children need to navigate to those spaces by themselves easily and in a straightforward direction. In conclusion, symmetric spatial configuration system, which has minimum depth have shown in both of the justified, graphs (Figure 7 and 11). That means either public or private areas; both areas could navigate the spaces with ease. Through this study, the principal of wayfinding showed that a good design of circulation between the public and private sector is to let the public access to the spaces easily without disturbing the private areas.

7. AVAILABILITY OF DATA AND MATERIAL

Information related to this work is already presented in this article.

8. ACKNOWLEDGEMENT

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