



Using Space Syntax in Spatial Cognition: A Case Study of Orlando Police Department Headquarters

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Abstract

Community engagement has become a central focus in modern policing. Apart from being the ground for law enforcement, a police premise is also a platform to build relationships between police and the community. A well-designed policy premise not only improves employee efficiency but can also strengthen the department's presence and the community's trust in the agency. This research evaluates the spatial configuration of a selected police premise through space syntax with the aid of justified graphs. Focus is given to the level of permeability and wayfinding for the building's primary user, namely police personnel. This study also highlighted the importance of studying the spatial relationship of each space in a police premise to enhance the safety and workflow efficiency of police personnel. The analysis presented in this paper has implications for the architectural designs of community-friendly police premises, specifically on the spatial configuration and user's cognition.

Discipline: Architectural Engineering.

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1 Introduction

A police force plays a prominent role in the country's national economic growth and social development (Tengpongsthorn, 2017). Police are the front line in law enforcement, crime control, and peacekeeping. Their daily jobs include keeping the peace and order, maintaining public security and safety, and fighting against violence, crime, and other harmful acts (PDRM, 2012).

Due to the plurality and complexity of a police force's duty, work effectiveness has become a key to successful policing operations. In fact, the spatial design of a police premise is also one of the factors that could affect the performance of the police on duty in terms of efficiency (Zaharin et al., 2019). A police premise is not only made up of a workspace and administration area; it also consists of some areas with higher security control such as a lockup room, armoury, and evidence storage. According to Hillier and Penn (2004), a study on space syntax can reduce the complexity and translate spatial planning into a simple language that can be easily understood by others. Therefore, a space syntax study is vital to streamline the workflow and retain a police premise's security.

Kalayci and Bilir (2016) discussed the facade of a building acting as a media that can potentially motivate or deter direct contact between the user and the building. Back in the day, police headquarters were usually highly secured buildings with a fortress-like design that was usually perceived as intimidating (Millie, 2012). However, the trend has shown that the design concept of OTI - open, transparent, and inclusive (Blount-Hill et al., 2020) has started to apply in public safety facilities, transforming them into a more inclusive public building. It shows that establishing a strong relationship between police and the community has never been more crucial than before. Therefore, OTI design has become part of a comprehensive strategy that helps to rebuild the public's trust and improve their confidence in law enforcement (Moser, 2016).

Orlando Police Department Headquarters located in Orlando, Florida, has been chosen as the case study in this paper to illuminate the discussion. It won the Award of Excellence in 2015 from the AIA Orlando Chapter as a recognition of the outstanding quality of its design (Architects Design Group, 2020). This new headquarters has shown a contradictory design approach of being open and transparent compared to existing police premises in Malaysia which are usually fortified with high fencing and solid walls. A study on this community-friendly police premise is believed to be helpful in the implementation of such a novel approach in Malaysia's police premises.

This paper seeks to study the logical planning of a newly designed police headquarters by understanding and analyzing the spatial configuration, level of permeability, and wayfinding in relation to space syntax. The involvement of spatial planning at the initial design stage can ensure that the facility elements and sub-elements are in tune with each other all the time. The findings from this research can also help the designer to improve transparency and security in the future policing premise. Also, the requirement for the level of permeability and wayfinding varies from

one user to another (Rahaman et al., 2019), depending on their work and duty. In this case, the focus will be given to the police premise's primary user, namely police staff.

2 LITERATURE REVIEW

2.1 Space Syntax

Space syntax is being increasingly used as a tool for space planning and design in architecture and urban planning (Turner, 2007), forming a social logic language between a designer and a designed space. It is a combination of mathematical and computational techniques used by an architect to study and analyze the spatial configuration of an inhabited space (Matejcek et al., 2020), from buildings to cities. According to Hillier and Hanson (1984), space can be analyzed by breaking it down into smaller segments. It is believed that the relational characteristic of space can form human behaviour (Dursun, 2007; Hassan, 2004). Further, space syntax is always discussed together with the level of permeability and wayfinding. According to Stamps (2003), permeability is defined as “the ability of something to move through another thing”. Other than that, plurality is also another measurement of the level of permeability (Yavuz et al., 2012). A permeable space should provide a variety of paths and connections. Meanwhile, as most discussed by Lynch (1960), wayfinding is the process of determining and following a path or route between a starting point and an ending point. Both permeability and wayfinding levels are the measurable factors of space syntax (Lim, 2019).

2.2 Building Typology: Public Safety Building

Police headquarters is a public safety facility where law enforcement's contact between police personnel and the public happens. Most of the spaces are mainly for private use with high access control, but certain areas such as service counters are open to the public. It provides the necessary structural and operational resiliency in fighting crime and offering public safety services in the city.

In general, a well-designed public safety facility should fulfill five design features, namely functionality, accessibility, navigability, security, and social facility (Blount-Hill et al., 2020). A functional police headquarters not only can improve the police effectiveness and efficiency but can also increase satisfaction among other users inside the building. Secondly, a police headquarters' location is of equal importance and it should be easily seen and accessible by the public in case of an emergency (Zaharin et al., 2019). Once inside a police headquarters, one who is not familiar with the building should not find it challenging to recognize where to lodge a crime report, pay a fine, or seek other police services.

Meanwhile, the security of a public safety facility like this is of utmost importance because this is where dangerous individuals like lawbreakers are transferred. Lastly, incorporating some social facilities like public plazas and lobbies can make the public feel more welcome. It can also provide a platform to strengthen the bond between the public and the police. The concepts of being secure and being open to the public are quite contradicting, and this would be the main challenge

of designing a community-oriented public safety facility like this. However, this can be overcome by studying the spatial configuration and degree of segregation of each user group (Munir, 2019).

3 Case Study: Orlando Police Department Headquarters

Design by Architects Design Group, Orlando Police Department Headquarters showcases the concept of openness and transparency which aims to serve as a major catalyst for rebuilding the relationship between the community and police (Reeves, 2018). Owned by the City of Orlando, this new state-of-the-art police headquarters is located at downtown in the historic Parramore District.

This police headquarters consists of three stories, which can accommodate 450 sworn officers to carry out their duties in different departments. The zoning of spaces includes general administration, investigative, patrol, and special services. With a floor area of around 9,290 SQM, it houses plenty of office space for every bureau within the Police Department and common areas such as community meeting rooms and gymnasiums (Architects Design Group, 2020).

The idea of openness and transparency is showcased on both the exterior and interior of this headquarters. The entrance is located at the most prominent corner and welcomes public visitors through the north public entrance atrium, leading to the public lobby on the ground floor.

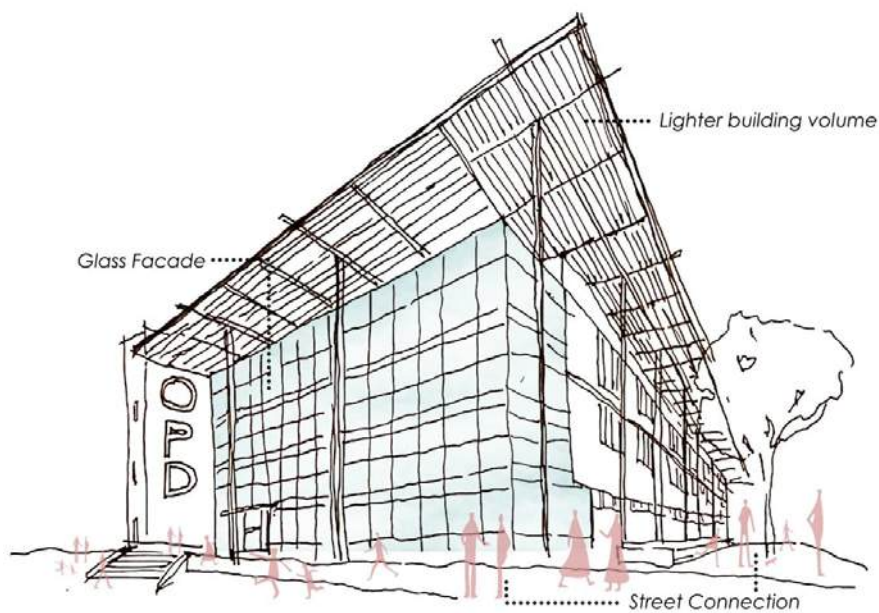


Figure 1: Exterior View of Orlando Police Department Headquarters.

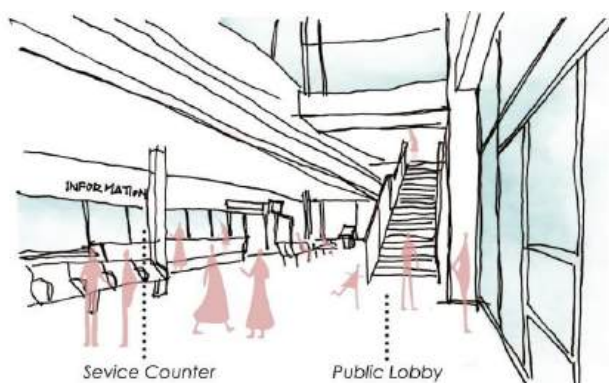


Figure 2: Public Lobby

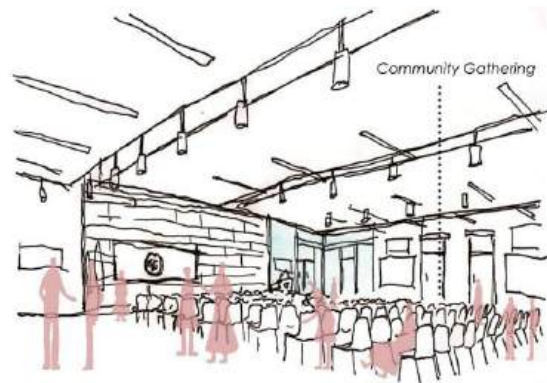


Figure 3: Community Hall

4 Method

The study is carried out by utilizing a quantitative analysis of a case study building via a justified graph. A justified graph is presented in the form of data graphs, which discuss the spatial configurations from the point of view of topological relations, instead of relying solely on the metric measurements of spaces and distances between them (Hillier & Hanson, 1984; Rohloff, 2009). To give a quantitative value to the level of permeability and wayfinding, the Likert Scale has been introduced to identify both measurements of the users in a building. The measurement of the Likert Scale is explained in Table 1.

Table 1: Likert Scale for Space Syntax Analysis of Measurable Scale Graph Figure

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

First and foremost, floor plans such as site plan (SP), ground floor plan (GF), first-floor plan (1F), and second-floor plan (2F) of the case study are mapped out with AutoCAD and Photoshop. By observing the floor plans, information such as topological position and the relationship between each space can be then translated into a justified graph. A justified graph (Figure 4) consists of a series of nodes spread on the x-axis and y-axis. The first placed nodes indicate depth level 0, the next set of nodes, linked to the previous, represent depth level 1, and so on. These spaces are defined in numeric and alphanumeric labels as 1, 2, S1, S2, L1, L3, etc (Table 2).

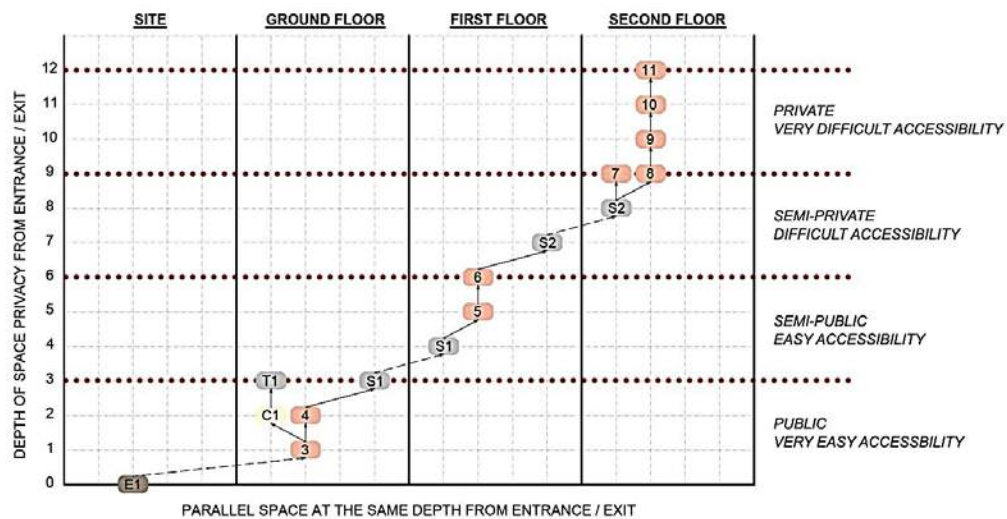


Figure 4: Example of Justified Graph.

Table 2: Numerical and Alphanumeric Labeling on the floor plans

Space	Label
Main Spaces	1,2,3,4,etc
Site Access	A1,A2,A3,A3, etc
Parking Area	P1,P2,P3,P4, etc
Entrances	E1,E2,E3,E4,etc
Staircases	S1,S2,S3,S4,etc
Lifts	L1,L2,L3,L4,etc
Corridors	C1,C2,C3,C4,etc
Toilets	T1,T2,T3,T4,etc

The method of analyzing the level of permeability and wayfinding is illustrated in Figures 5 and 6, respectively. The greater the number, the higher the level of permeability, and the higher the degree of privacy. The same measurement goes to the level of wayfinding as well, the greater the number, the higher the level of wayfinding, making it harder for the user to access.

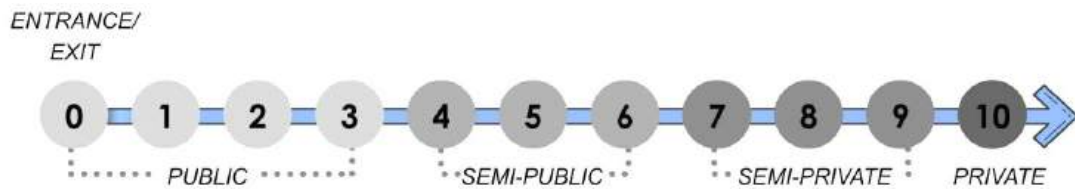


Figure 5: Depth of level of permeability.

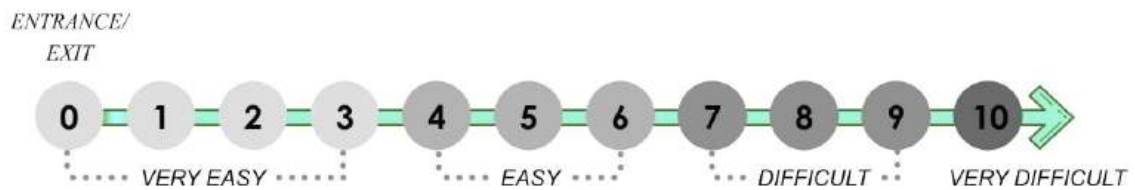


Figure 6: Depth of level of wayfinding.

In the discussion, the depth of the level of permeability and wayfinding will then be translated into a percentage to determine the overall building's degree of accessibility. The total number of spaces (I) will first be identified based on the floor level (GF, 1F and 2F). These findings are arranged in a table (Table 3) in hierarchical order, from a high percentage to a low percentage. In the end, the results retrieved from Table 3 will then determine which level of permeability and wayfinding is the most dominant one in this study.

Table 3: Summary of Level of Permeability and Level of Wayfinding (Example)

Depth of Space	Level of Permeability	Level of Wayfinding	Number of Space			Total	%
			GF	1F	2F		
0-3	Public	Very Easy	a	e	i	E (a+e+i)	E/I x 100
4-6	Semi-Public	Easy	b	f	j	F (b+f+j)	F/I x 100
7-9	Semi-Private	Difficult	c	g	k	G (c+g+k)	G/I x 100
10 and above	Private	Very Difficult	d	h	l	H (d+h+l)	H/I x 100
Total			A (a+b+c+d)	B (e+f+g+h)	C (i+j+k+l)	I (A+B+C) (E+F+G+H)	100

5 Result

First and foremost, the users' category of a police premise is identified, namely police staff, public, and lawbreakers. Due to the limitation of study time, this study focuses only on the primary user of this building - police staff.

5.1 Site Plan

Figure 8 shows the result of the level of permeability and wayfinding for the site of Orlando Police Department Headquarters (Figure 7), covering the range from 0 to 2. There are three access points (A1, A2, and A3) to this site which can be found along W South St., Woods Ave, and W

Anderson St. respectively. They are all placed at the zeroth level of depth of permeability and wayfinding, indicating the entrance or exit for this building.

The functionality of parking can be separated into two, parking P1 serves for the public, whereas parking P2 is private parking for the police personnel. Hence, parking P1 directs the public to the public entrance (E1, E3, and E4) while parking P2 leads to the private entrance (E5, E6, and E7). Among the seven entrances (E1 - E7) of the main building, the entrance facing Orange Blossom Trail (E2) is the most public with the highest accessibility, especially for pedestrians coming from the north and west. There is a clear separation between the public entrance and the private entrance.

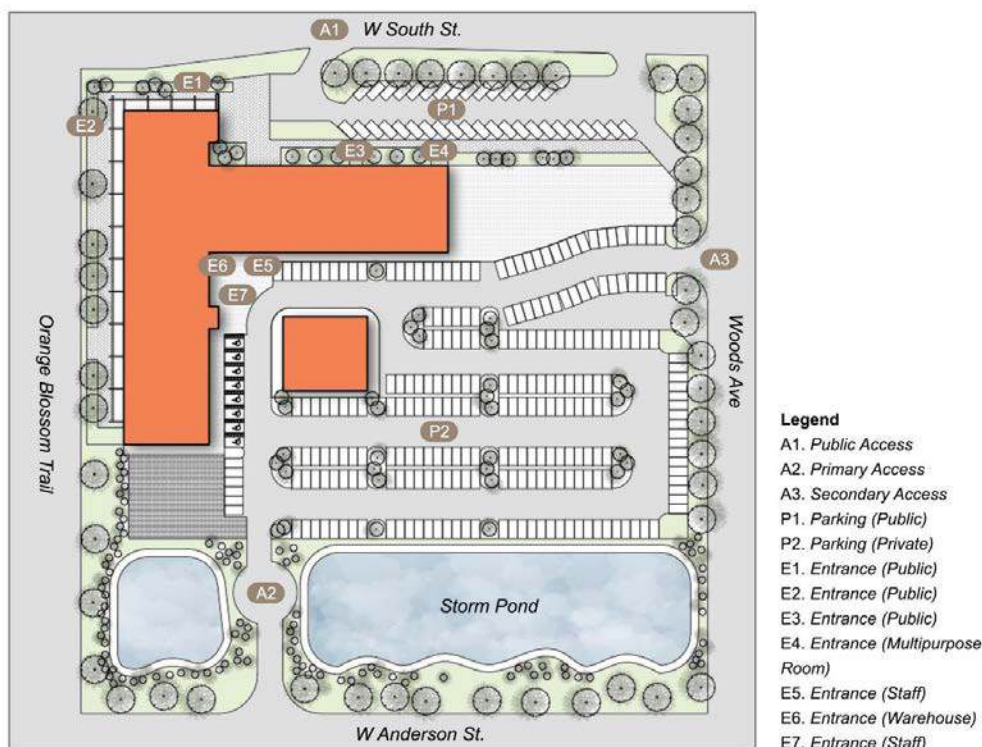


Figure 7: Site plan

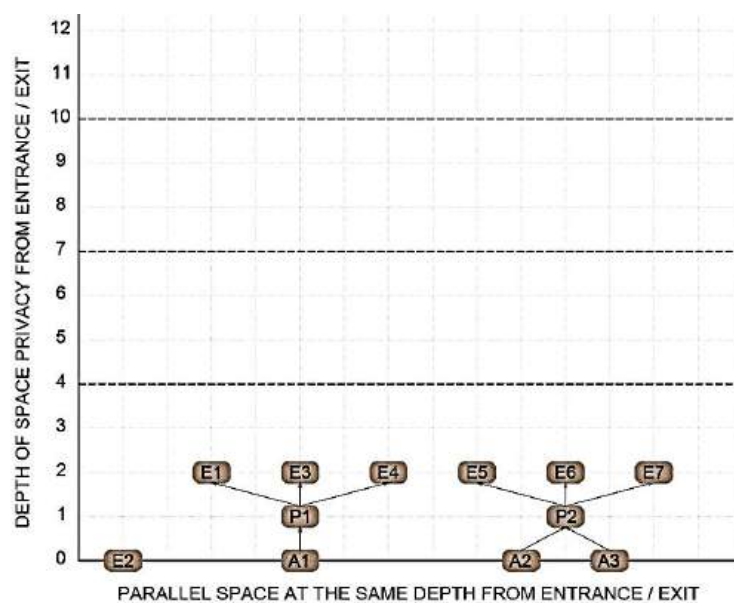


Figure 8: Justified Graph of Site.

5.2 Ground Floor Plan

The range of depth of permeability and wayfinding covers from 0 to 7; ranging from the public to semi-private by referring to the Likert Scale of space syntax illustrated in Table 1.

On the ground floor (Figure 9), the public lobby (1) where the public lodges a report is highly accessible by the public and visitors through entrances E1 and E2. Corridor (C1) leading the people from the lobby (1) to the multipurpose hall (22) is comparatively public, as compared to corridors C2 and C3, which are mainly used by police personnel. Corridors C2 and C3 are protected with higher depth of the level of permeability and wayfinding, making them difficult to access by the public. Furthermore, staircase S1 and lift L1 serving the public are lower in the level of depth of permeability and wayfinding compared to S2 and L2.

Police's common areas like the central break (31) and gymnasium (36), which fall on the fifth and sixth level of depth of space privacy, are more private. However, both of them are highly accessible by the police personnel through corridor C2 from entrance E7. High accessibility and very easy wayfinding can ease and encourage police personnel to use these public areas.

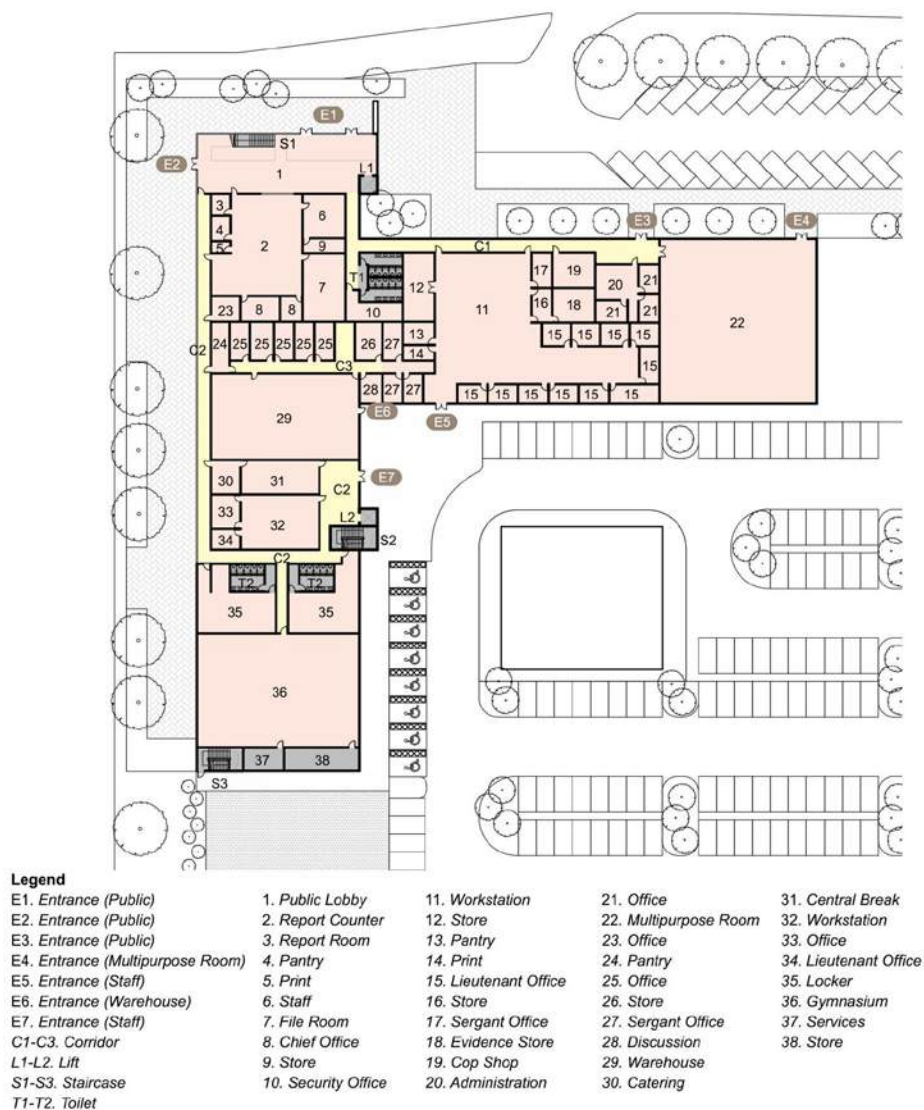


Figure 9: Ground Floor Plan.

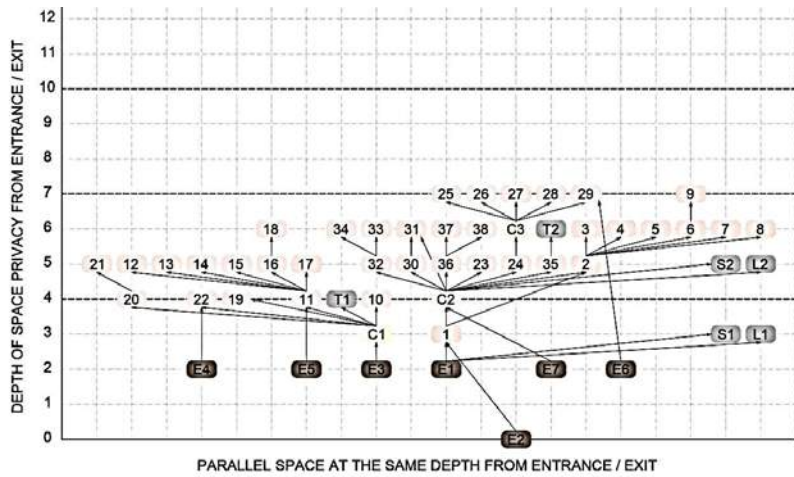


Figure 10: Justified Graph of Ground Floor.

5.3 First Floor and Second Floor Plan

Accessible by either staircase S1 and lift L1 or staircase S2 and lift L2, all spaces on the first floor (Figure 11) cater to police personnel such as inspectors, lieutenants, sergeants, and police chiefs. They are most likely to be semi-private and private in terms of level of permeability, ranging from 7 to 10, see Figure 13. Corridor (C5) acts as the main connector between each space and floor, leading to workstations (39,43, and 58) of different departments. Toilet T3 and electrical room (57) are directly accessible through corridor C5 to ease the process of services and maintenance.



Legend	39. Workstation	53. File Room	67. Workstation	81. Computer Room	95. File
C4-C9. Corridor	40. Store	54. Store	68. Services	82. Lounge	96. Support
L1. Lift	41. Lieutenant Office	55. Office	69. Lockers	83. Rest	97. Patrol
S1-S3. Staircase	42. Sergeant Office	56. Store	70. Store	84. Attendant Room	98. Vault
T3-T4. Toilet	43. Workstation	57. Electrical Room	71. Office	85. Store	99. Gallery
	44. Store	58. Workstation	72. Management	86. File Store	100. CCTV Room
	45. Lieutenant Office	59. Store	73. Office	87. Support	101. Computer Room
	46. Sergeant Office	60. Discussion Room	74. Computer Room	88. Pantry	102. Store
	47. Workstation	61. Sergeant Office	75. Workstation	89. Kitchen	103. Lounge
	48. Supply Room	62. Lieutenant Office	76. Inspector Room	90. Work	104. Deputy Chief Office
	49. Store	63. War Room	77. Lieutenant Office	91. Janitor	105. Chief Office
	50. Crime Intake	64. File Store	78. Sergeant Office	92. Store	106. Admin
	51. Vault	65. Meeting	79. Chief Office	93. Office	107. File
	52. Sergeant Office	66. Store	80. Office	94. Lieutenant Office	108. Electrical Room

Figure 11 (Left) & Figure 12 (Right): First Floor and Second Floor Plan.

In general, spaces on the second floor (Figure 12) are relatively higher in the depth of permeability and wayfinding compared to the first floor. Most of them are placed at the ninth and above level except the management office (72). Management office (72), which serves a nucleus function to the operation of this headquarters is easy to access by the police personnel at this level. On the other extreme, the Deputy Chief's Office (104) and Chief's Office (105) have the highest privacy level and are very difficult in wayfinding among the spaces, making them the most secure space in this building.

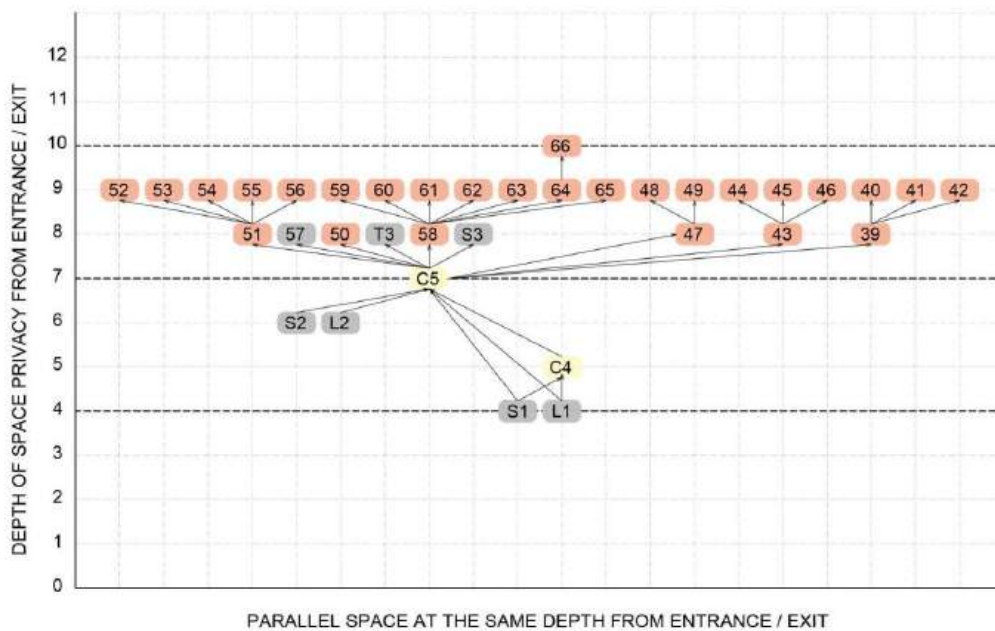


Figure 13: Justified Graph of Mid-floor (First Floor).

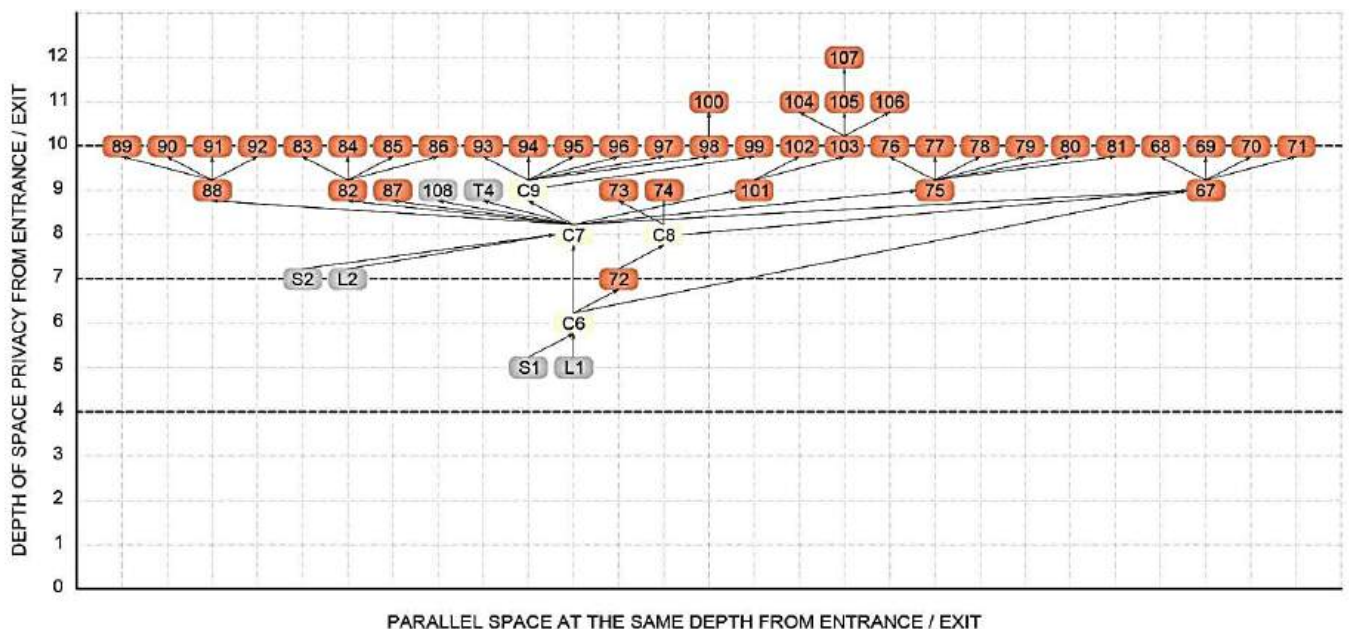


Figure 14: Justified Graph of Top Floor (Second Floor).

6 Discussion

From the space syntax results for this case study, an overall justified graph (Figure 15) was produced by combining every floor's justified graphs (Figures 8,10,13, and 14). Regardless of the user's category, the overall justified graph shows that the spaces are getting more private and difficult in wayfinding as they go higher. Overall, the ground floor has the lowest permeability and wayfinding level, whereas the second floor is the opposite. This is due to the purpose of the building itself being a police premise with high security and access control; only certain areas on the ground floor are open to the public. It is also to be noted that a police premise's spatial configuration is always influenced by the hierarchy in the class titles of a sworn police officer and their job descriptions. In the United States, rankings of the police officer can be arranged as follows: (1) Chief, (2) Commander, (3) Captain, (4) Lieutenant, (5) Sergeant, (6) Detective, and (7) General Officer (LAPD, 2015). Hence, this police headquarters reflects such a hierarchy in terms of space planning as well. For instance, the office room for the Deputy Police Chief (104) and Police Chief (105) is placed on the topmost floor, above all the rest to highlight the head of the police department's status and authority. Meanwhile, shared spaces for both the public and police are placed on the ground floor, to ease the wayfinding and access control of users in this building. The segregation of public space and private space is obvious in this building by means of vertical segregation.

Referring to Table 4, among the 143 identified spaces, the majority of spaces (36.4%) are semi-private, followed by semi-public spaces (32.2%). Most of them are spaces where police perform their duty, such as an office room, workstation, and computer room which can be found on the first floor and second floor. Public spaces only consist of 8.3% of space in total, mainly placed on the ground floor. As a whole, the building's spatial configuration is more favorable to the police personnel in terms of the degree of permeability and wayfinding.

Table 4: Summary of Level of Permeability and Level of Wayfinding in Hierarchical Order

Depth of Space	Level of Permeability	Level of Wayfinding	Number of Space			Total	%
			Ground Floor	First Floor	Second Floor		
7-9	Semi-Private	Difficult	6	29	17	52	36.4
4-6	Semi-Public	Easy	37	6	3	46	32.2
10 and above	Private	Very Difficult	0	1	32	33	23.1
0-3	Public	Very Easy	12	0	0	12	8.3
Total			55	36	52	143	100

Lastly, the type of space in the Orlando Police Department Office is identified and tabulated in Table 5. It shows that this building has optimized the space efficiency by having a high percentage of main space (end room, multiple connection space, single connecting space, and lobby) compared to auxiliary space (staircases, corridors, entrances, lifts, and toilets). In this building, 75.5% of the space is usable while the rest functions as space connectors and services. End

rooms usually dedicated office rooms for police officers have the highest percentage (55.9%) among all types of space. It is noteworthy that this police headquarters has only one lobby which is designated for public use. There is no open space for the staff to mingle around. Perhaps a dedicated foyer or lobby for police can encourage spontaneous social collision between the staff, and strengthen the inter-department relationship.

Table 5: Summary of Type of Space in Hierarchical Order

Type of Space	Number of Space			Total	%
	Ground Floor	First Floor	Second Floor		
End Room	25	22	33	80	55.9
Multiple Connecting Space	6	5	6	17	11.9
Single Connecting Space	6	1	3	10	7.0
Staircases (S)	3	3	3	9	6.3
Corridors (C)	3	2	4	9	6.3
Entrances (E)	7	0	0	7	4.9
Lifts (L)	2	2	2	6	4.2
Toilets (T)	2	1	1	4	2.8
Lobby	1	0	0	1	0.7
Total	55	36	52	143	100

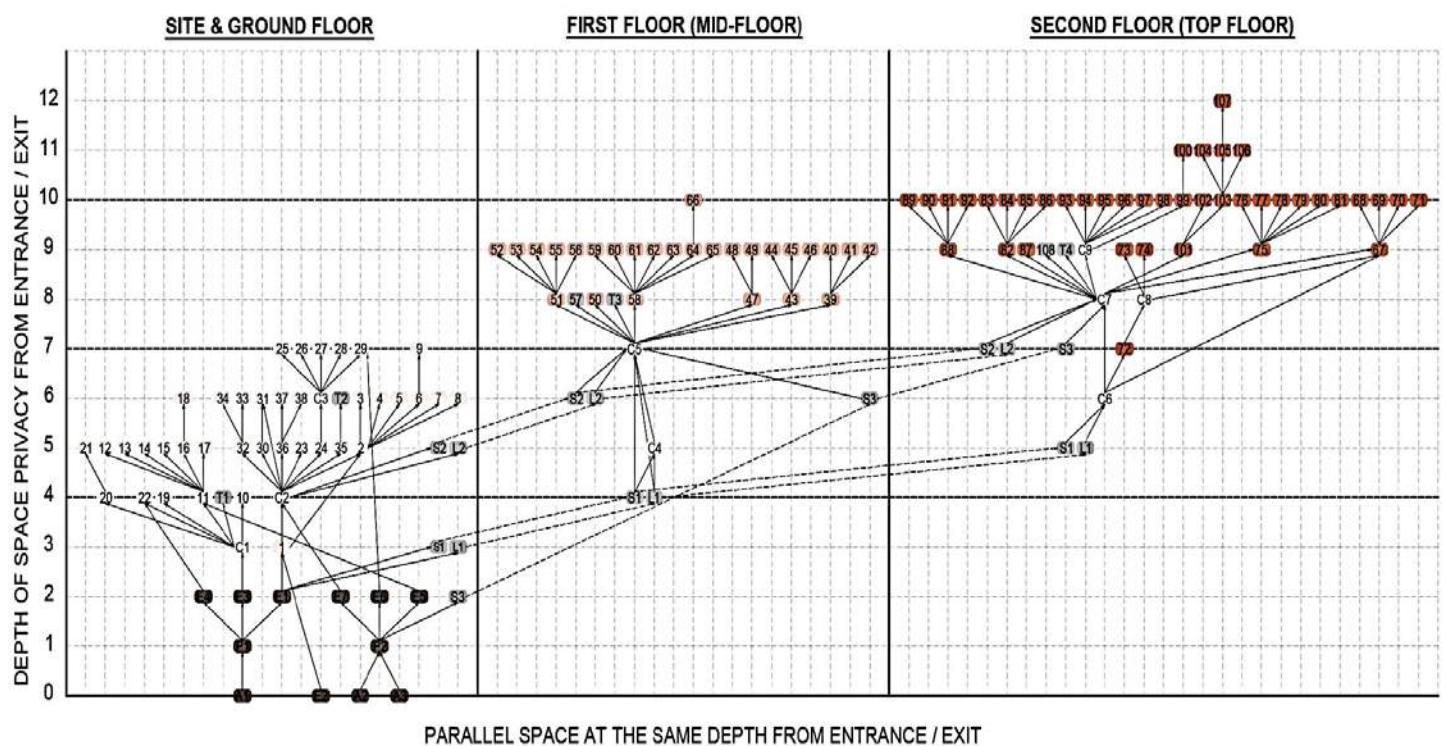


Figure 15: Overall Justified Graph.

7 Conclusion

Police headquarters is usually a police premise with a high degree of security and privacy, keeping unauthorized personnel out of the compound. The result of the study shows that the Orlando Police Department has a majority of semi-private spaces (36.4%) with difficult wayfinding. It is mainly a private building, but efforts have been made to transform this police premise into spaces for public safety and community benefits, forming a dynamic relationship between police

and the community. Being open and secure at the same time is a challenge to the designer. Still, Orlando Police Department Headquarters has shown that it can be achieved by having a thoughtful study of spatial structure in the building.

The level of permeability and wayfinding is strongly related to the floor level and depth of space. Public spaces like the service counter and community hall shall be placed close to the public access with very easy wayfinding, mostly on the ground floor. On the other hand, spaces that require higher security like the police chief's office should be placed far from public areas, making them inaccessible to the public but only to authorized personnel. Segregation between public space and private space can help to retain the privacy and safety of police premises. Still, it is to note that semi-public and semi-private spaces shall be introduced to ensure a smooth transition from public space to private space. The future study shall include the level of permeability and wayfinding for a different group of building users, making a more comprehensive spatial configuration study for a police premise.

8 Availability of Data and Material

All information is included in this article.

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