©2025 International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8

TuEngr Group

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

http://TuEngr.com

Permeability and Wayfinding on the Layout Plan's Design of Storstrom Prison for the Users' Mobility

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Paper ID: 16A2F

Volume 16 Issue 2

Received 14 February 2025
Received in revised form 24 May 2025
Accepted 02 June 2025
Available online 11 June 2025

Keywords:
Spatial configuration; Justified graph; VGA Analysis; Permeability; Space syntax analysis; Prison design; Wayfinding; Private space; Building space; Prison security control; Spatial arrangement; Spatial design; Correction facility.

Abstract

Space Syntax is a tool that investigates architectural and surrounding spaces, identifying linkages between spatial configurations and user movement. This paper focuses on Space Syntax analysis of Correctional Facility spatial configurations. Grounded in the understanding that spatial layouts influence human interactions and activities, this research aims to unravel the nuanced dynamics shaping the lived experience of individuals within correctional settings. The case study is Storstrom Prison in Denmark. This study analyses the space syntax of the case study building with quantitative analysis. Analytical justified graph and visibility graph analysis (VGA) are applied to provide quantitative references and assess the degree of permeability and wayfinding that create the comprehensive spatial network. The overall space syntax performance of the Storstrom Prison is dominated by private spaces with intermediate wayfinding, making up 42.8% of the total building spaces. The findings of this study hold potential implications for improving correctional facility design, focusing on enhancing security measures, promoting rehabilitation, and fostering a more humane and effective environment within the criminal justice system.

Discipline: Architecture.

Cite This Article:

Lee, Y. L., Hassan, A. S., Witchayangkoon, B., Abdul Nasir, M.H. & Arab, Y. (2025). Permeability and Wayfinding on the Layout Plan's Design of Storstrom Prison for the Users' Mobility. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 16*(2), 16A2F, 1-18. http://TUENGR.COM/V16/16A2F.pdf DOI: 10.14456/ITJEMAST.2022.13

1 Introduction

Buildings and spaces encompass space-functional settings for human activity, which characterize an individual's mental issues like memories, connections, and shared experiences (Butterworth, 2009). The study utilizes space syntax analysis to evaluate users' accessibility to the building typology of the Correctional Facility. It aims to comprehensively understand this specialized facility's spatial organization, connectivity, and design within correctional environments. Space syntax encompasses a spatial theory and a collection of analytical, quantitative, and descriptive tools used to scrutinize spatial configurations in diverse contexts (Hillier, 1996). The spatial configuration in the layout plan design affected how the users utilize them (Hassan, 2004).

Storstrom Prison is selected as the focal point of this case study due to its notable contributions to the correctional facility building typology. This design aimed to be visually familiar, allowing inmates to relate to it personally through recognizable sensations. It enables mobility for prisoners, resembling individuals outside incarceration while maintaining a controlled and informal atmosphere. The primary focus was on constructing a sense of normalcy closely tied to the external world, providing an environment within the prison that reflects aspects of everyday life beyond its boundaries (Merrick, 2018).

The decision to study this facility is motivated by several factors, including identifying issues or problems within this building typology that warrant investigation for improvement. Storstrom Prison has explicitly been selected as a prominent case study, standing out for its remarkable accomplishments, notably securing the first prize in a 2010 architectural competition that recognized its innovative design. Moreover, it has received acknowledgement from fellow journal writers and architects, rendering it a captivating subject for a comprehensive examination.

This research aims to analyze the layout plans of the case study's building and enhance the permeability and wayfinding of users' mobility within the building typology of correctional facilities.

2 Literature Review

The theory of space syntax and its methodologies have found extensive application in examining aspects of spatial cognition, specifically in processes such as wayfinding and permeability, wherein the interaction between individuals and their spatial surroundings is crucial (Beck & Turkienicz,2009). It involves comprehending and assessing the spatial structures inherent in a social way of life (Munir et al., 2019; Peponis, 2024a, 2024b). Fundamentally, space syntax is the interconnections and relationships between users and the habitable spaces in a relative context (Fuad et al., 2022). It encompasses exploring how designated spaces are planned and utilized in a manner that integrates social or cultural importance (Dursun, 2007). According to Ephes (2006), permeability is characterized as the movement of spaces from one to another. It is also articulated as people's satisfaction with spaces, influenced by the environmental qualities of a location (Yavus et al., 2012). Abrams and Brandom (2010) stated that wayfinding pertains to user encounters with the context. It examines how individuals navigate through a spatial configuration. As a result, space syntax analysis can demonstrate the circulation patterns and navigational ease within that building (Natapov et al., 2015). The study of permeability and wayfinding within a space, as facilitated by Space Syntax, contributes valuable insights to the fields of architectural design, aiding in optimizing spatial layouts for improved functionality and user experience.

3 Case Study: Storstrom Prison in Denmark

The location of Storstrom Prison is on Falster Island, Denmark, designed by C.F. Moller. Construction of Storstrom Prison was completed in 2017. Its rural location brings unique environmental contexts that influence a community-oriented approach to social interaction inside the facility. Additionally, the rural setting may affect how the prisoners interact with their community. A significant architectural challenge in this project involves mitigating the institutional context of a high-security prison to house approximately 250 inmates.

Storstrom Prison falls under a building typology of correctional facilities or prisons. However, access to the facility is restricted to private areas, and it is not a public space in the traditional sense. It is designed to accommodate individuals within the criminal justice system. The closed Storstrom Prison aims to create the world's most humane high-security prison with architectural measures that promote the social rehabilitation of inmates, fostering their mental and physical well-being and providing a decent workplace for the administrative and security staff (urbanNext, 2024). The intention is to create social interactions within the correctional facility. The architects characterize the spatial arrangement of the new prison by likening it to a compact urban community. The design features volumes organized as petite centres encircling a central core, essentially a covered plaza represented by a sports building. Each centre is enveloped by landscaped gardens, streets, and small squares visible from within. This diverse horizon provides inmates with varying perspectives in their daily experiences (Moller, 2024).

The architectural style of Storstrom Prison is best described as a brutalism style. It embraces a fortress design that prioritizes functionality and a human-centric approach. The prison design differs from conventional institutional models in integrating open spaces and natural lighting (Merrick, 2018). The fortress image of Storstrom Prison aligns with a progressive approach to correctional facility design, focusing on rehabilitation and the well-being of inmates within a secure environment.

4 Method

This study utilized qualitative research techniques, including online research, articles, journals, and books, to conduct initial research on the background and project details of the chosen case study. A quantitative analysis uses justified graphics and visibility graph analysis (VGA) to analyze the permeability levels and wayfinding in examining spatial networking. The most effective method of implementing wayfinding analysis is to identify each space's hierarchical order based on the movement levelling scheme (Yusoff et al., 2019).

4.1 Likert Scale

This study uses the Likert Scale to assess permeability and conduct a wayfinding analysis. According to Yusoff et al. (2019), the Likert Scale divides spaces into five levels of privacy: public, semi-public, semi-private, private, and highly private. The higher the depth level on the Likert Scale, the more difficult wayfinding becomes for the users.

The level of permeability and wayfinding for the site layout plan and internal spatial planning are examined in this study using a justified graph. According to Klarqvist (1993), a justified graph is a spatial configuration summary where all spaces are arranged starting from a single space at various reference levels. The spatial layout was analyzed using the measurable scale graph (Mustafa et al., 2010; Yavuz et al., 2012). According to Lee (2020), the deeper the space from reach, the higher the numbering. The network graph begins at 'Root', which will serve as the building's entry. From there, it expands into nodes with more profound levels of depth and finally connects to the building's final node. The linkage illustrates the interaction between the spaces in a building (McLane, 2013). The Likert scale will be used to assess the degree of permeability and wayfinding based on the tabulated results of the justified graph, as illustrated in Figure 1.

4.2 Alphanumeric System

An alphanumeric system is used to classify each space in the building layout using alphabets, numbers, and colours according to their functions. The space hierarchy is determined by the numbering sequence (1,2,3, etc.). Numerical numbering (1, 2, 3, etc.) specifies the common spaces, while alphanumerical numbering (E1, E2, E3, etc.) indicates entrances and access to the building. Furthermore, alphanumeric numberings such as C1, C2, C3, etc., are used to label corridors. Staircases and lifts are vertical access marked with S1, S2, S3, etc., and L1 & L2, respectively. Colour labelling helps the analysis distinguish between different user types. For instance, the common spaces are differentiated into two colours based on the type of users: orange for the public and purple for spaces restricted to staff and inmates. The staircases are indicated in green, and the lift is labelled yellow.

Table 1: Categorization of Alphanumeric and Colour Based on Building Function.

Function	Alphanumeric	Colour
Primary Ingress	G (G1)	Orange
Building Access	E (E1, E2, E3, etc)	Purple
Common Spaces	(1,2,3, etc)	Purple
Corridors	C (C1, C2, C3, etc)	Blue
Staircases	S (S1, S2, S3, etc)	Green
Lifts	L (L1 & L2)	Yellow
Different Blocks of Buildings	B (B1, B2, B3, etc)	Orange/ Purple
Open Space	A (A1, A2, A3, etc)	Purple

Meanwhile, corridor spaces are highlighted in blue. On the site plan, the primary ingress is indicated as G1 (orange colour), and different blocks of buildings are labelled as B1, B2, B3, etc.

Open space on the site plan is indicated as A1, A2, A3, etc. Different blocks of buildings are indicated in different colours: orange for the public and purple for staff and inmates. The labelling from the plans is then transferred into the justified graph to analyze the depth level of permeability and wayfinding. The Likert scale validates the assessment scales for public-private zoning and user-friendliness.

4.3 Justified Graph

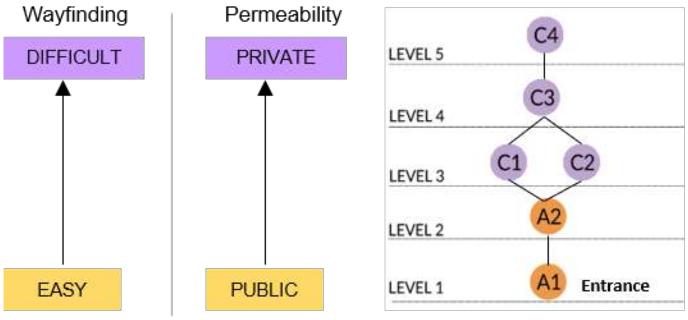


Figure 1: Example of Justified Graph.

The permeability and wayfinding at each level are examined based on the justified graph, as shown in Figure 1. Depth levels of permeability are classified into four categorical scales: public, semi-public, semi-private, and private. Private space has the highest permeability depth level. Meanwhile, depth levels of wayfinding are identified into four measurable scales. For instance, it is very easy, easy, difficult, and very difficult, whereas the lower the depth level, the better the wayfinding.

4.4 Visibility Graph Analysis (VGA)

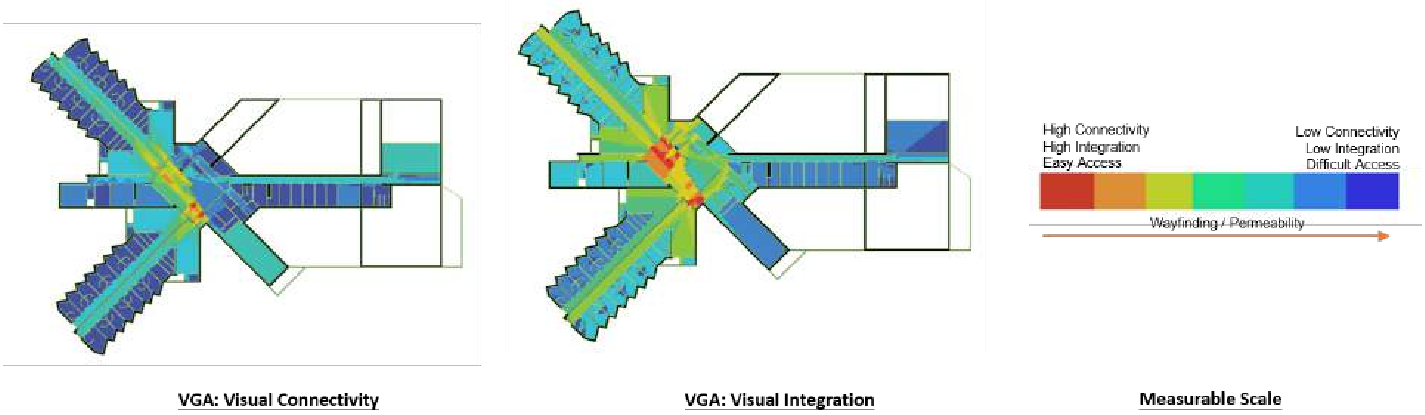


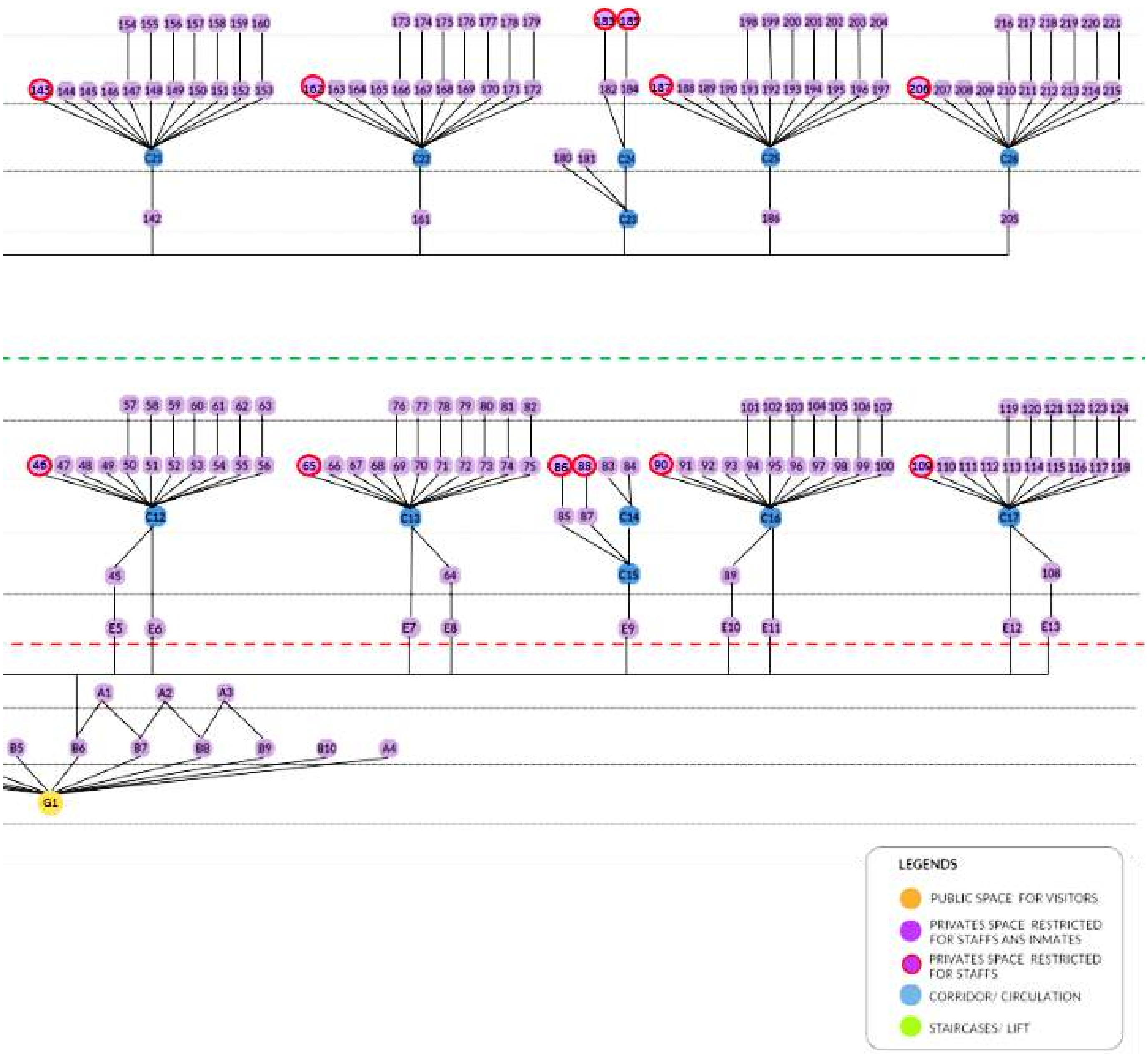
Figure 2: Example of Visibility Graph Analysis (VGA) and Measurable Scale for VGA.

The colour scale in Figure 2 shows the colour indication on the VGA produced by the depthmapX software, which identified the level of connectivity and integration. Blue represents the lowest connectivity and integration level, indicating difficult access. The level of wayfinding grows from red to blue, representing the highest connectivity and integration level, indicating easy access.

4.5 Data Synthesis

The VGA Connectivity Graph and VGA Integration Graph assess permeability and wayfinding quality at different levels. Permeability levels can be classed into four categories: public, private, semi-private, and very private. The very private space has the highest depth level. Wayfinding quality is categorized into five levels: easy, intermediate, difficult, very difficult, and most difficult. Lower depth levels indicate better wayfinding. The percentages of public and private spaces in each floor plan are calculated using a Hierarchical Order from high to low percentages. VGA analysis identifies and compares locations with varying spatial connectivity and integration degrees to assess wayfinding effectiveness. The justified graph illustrates the usage of asymmetric and symmetric spatial systems to validate wayfinding quality, including user navigability and spatial complexity.

5 Result of Analysis



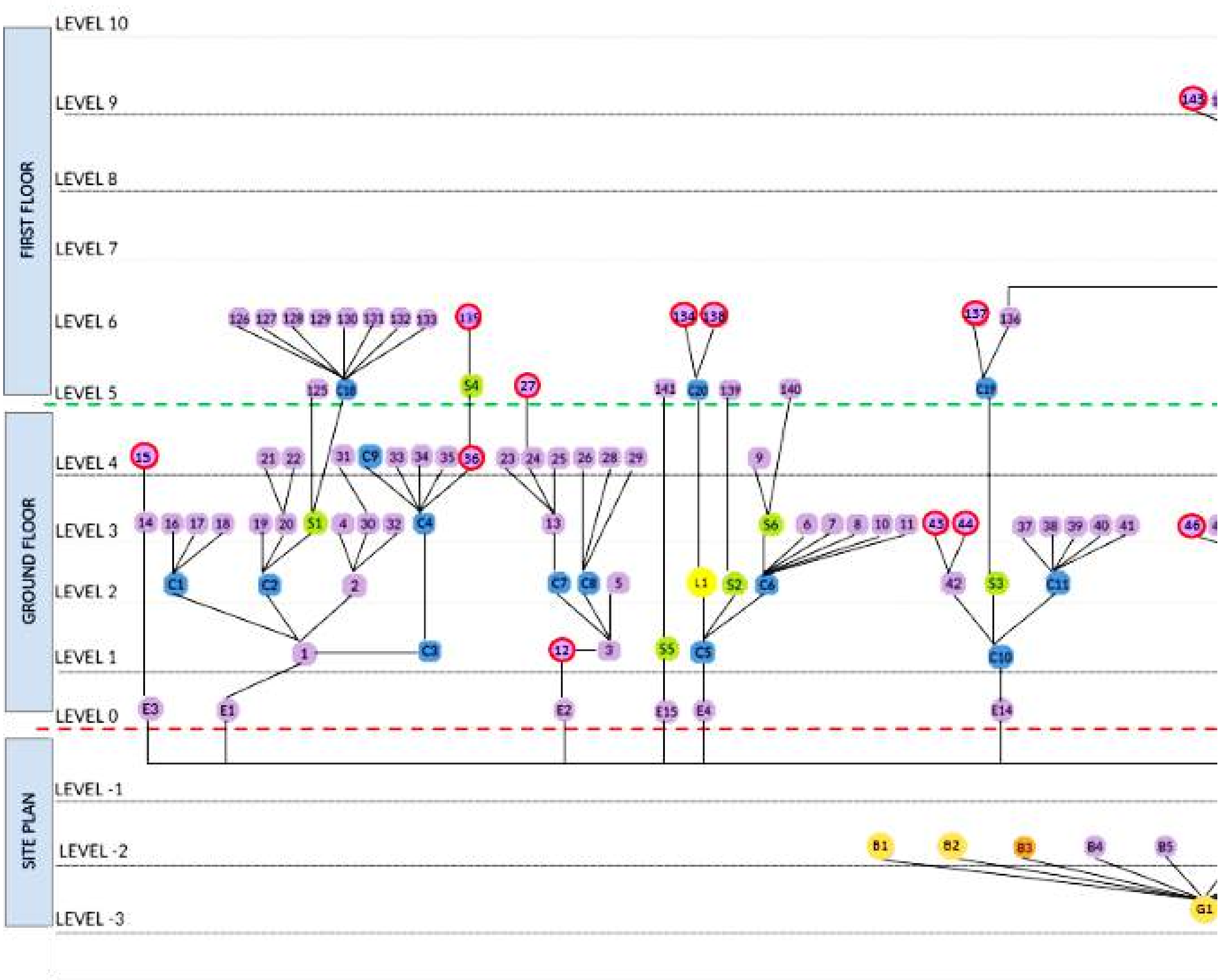


Figure 3: Overall Justified Graph for Storstrom Prison.

In this case study analysis, there are two user categories. The primary user category is the visitors, identified in orange numbering labelling. The other users are the staff and inmates, labelled in the purple numbering system. However, private places restricted for staff are labelled in the purple numbering system with a red circle.

5.1 Site Plan Spatial Configuration

The justified graph in Figure 3 shows the four depth levels in the site plan, ranging from level -3 to level 0. The depth levels of wayfinding and the accessibility to different building blocks are very straightforward. Since this case study is a correctional facility, it limits access to the public. Only one building block, B3 (Visitors' Department), is allowed public access, as shown in Figure 4. The standard wing of the case study (B6) is analyzed in both justified and VGA graphs, as shown in Figures 5 and 6. All spaces are integrated with high connectivity, contributing to an easy wayfinding for users.

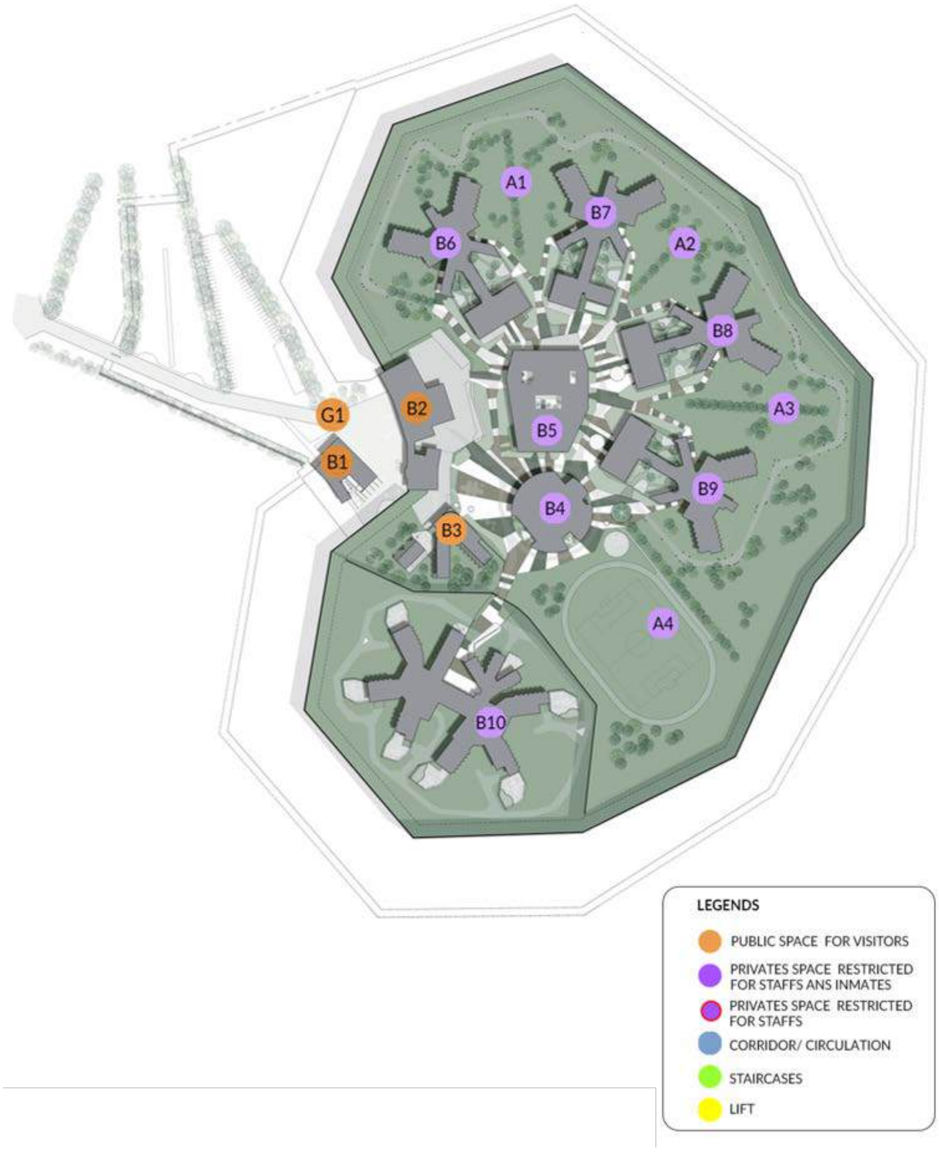
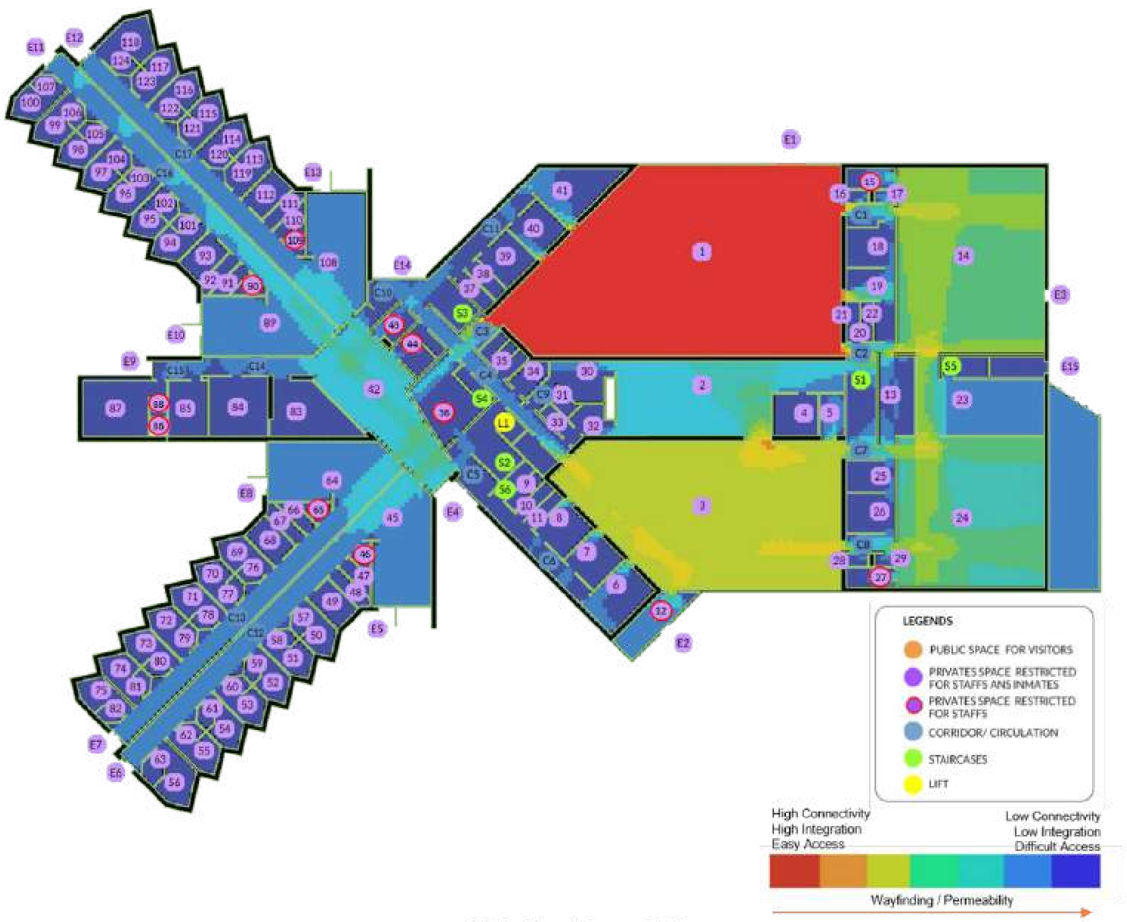


Figure 4: Site Plan.

Table 2: Schedule of Accommodation for Site Plan.

Code	Space
G1	Public Ingress to Site
B1	Personnel Building
B2	Gateway Building
B3	Visitors' Department
B4	Activity Building
B5	Workshop Building
B6-B9	Standard Wing
B10	Special Secured Building
A1-A3	Open Space
A4	Outdoor Sport Court

5.2 Ground Floor Plan Spatial Configuration



VGA: Visual Connectivity

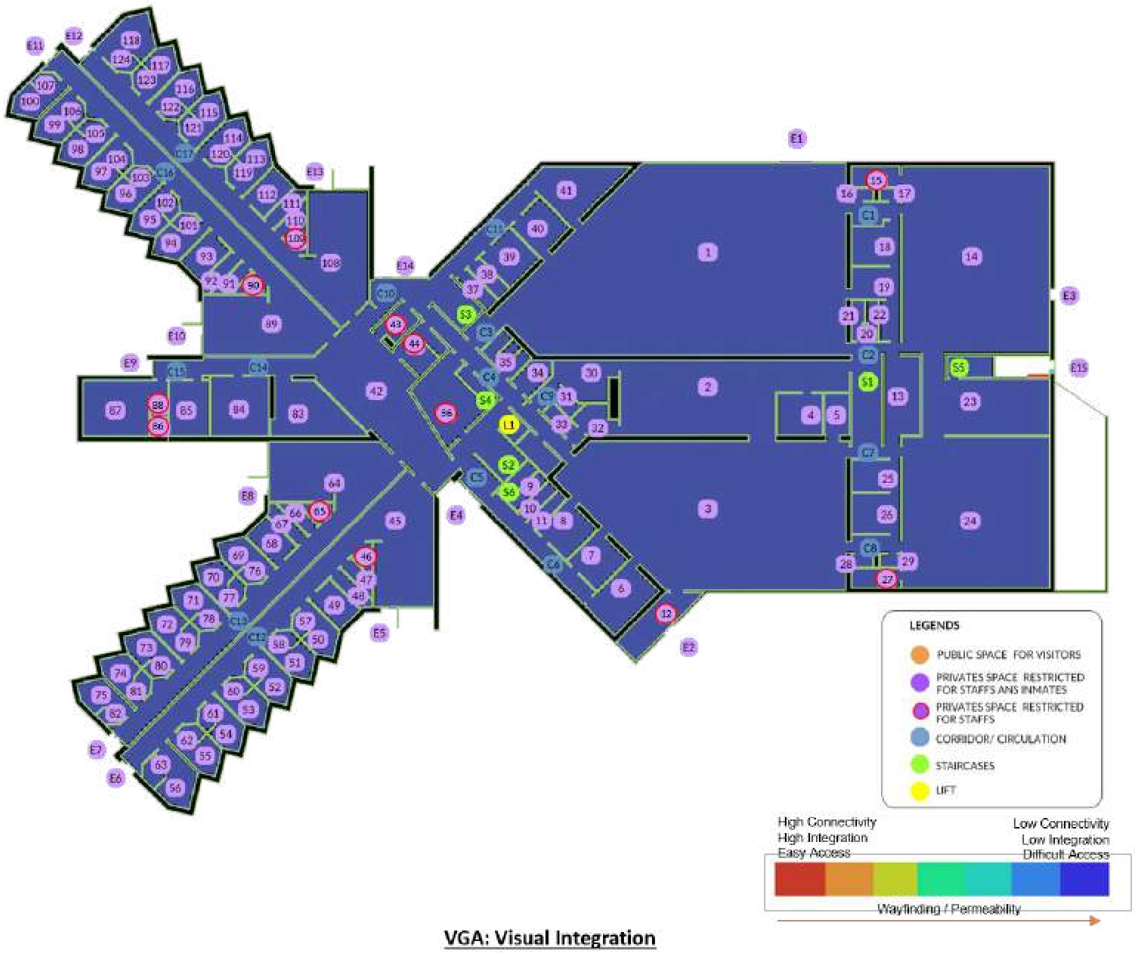


Figure 5: Ground Floor Plan and Visibility Graph Analysis of Standard Wing.

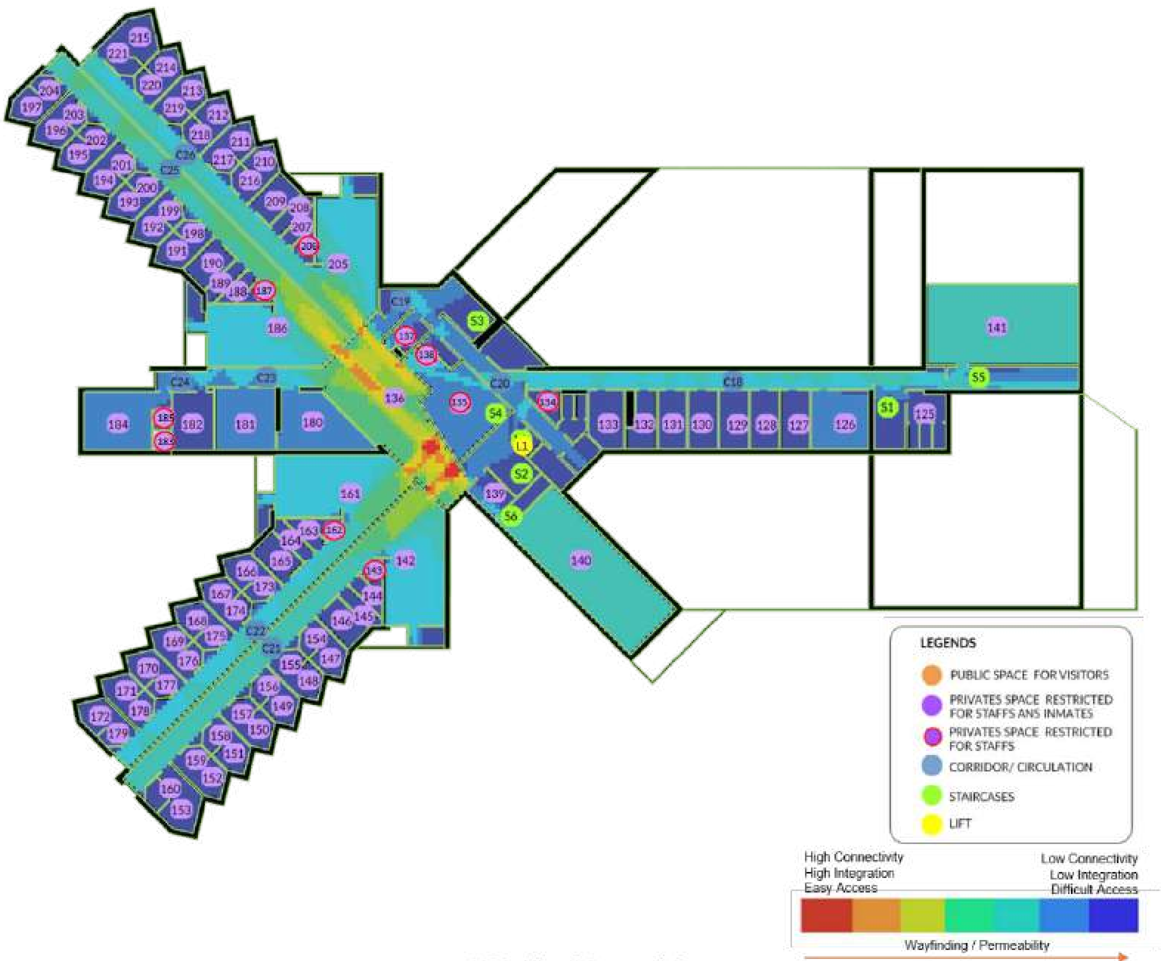
The ground floor plan has four depth levels from level 0 to level 4, as shown in the justified graph in Figure 3. Based on the results from both the justified graph and the VGA graphs, it is shown that inmates' public spaces are well segregated from private spaces on the ground floor. Regarding the justified graph in Figure 3, depth levels 0 to 2 are considered public spaces for inmates. Corridors 1 (C1) to 17 (C17) are located at depth levels 1 and 2, which serve as the private access point to all semi-private or private spaces, such as inmates' cells, staff rooms, and service areas. The spatial configuration on the ground floor is complex. As shown in Figure 3, depth levels 0 to 2 are classified as effortless wayfinding qualities with low differentiation in the spatial environment, as illustrated by the asymmetrical spatial system. Figure 5 shows that Prisoners' Courtyard (1 and 3) and Workshop (2,14, and 24) have the highest connectivity and integration level. Meanwhile, depth levels 3 and 4 are identified as difficult and very difficult to access, with their higher degree of spatial complexity and high cell security for easy security control.

Table 3: Schedule of Accommodation for the Ground Floor Plan of Standard Wing.

Code	Space
E1	Courtyard Entrance
E2	Stores Entrance
E3	Workshop Entrance
E4, E14, E15	Fire Exit - Staircase
E5, E8, E10, E13	Prisoners' Main Entrance
E6, E7, E11, E12	Fire Exit - Cell
E9	Fire Exit – Study Room
L1	Lift 1
S1	Fire Staircase 1
S2	Fire Staircase 2
S3	Fire Staircase 3
S4	Staff Staircase
S5	Fire Staircase 5
S6	Fire Staircase 6
C1-C17	Corridor
1, 3, 83	Prisoners' Courtyard
2, 14, 24	Workshop
4, 5, 18, 19, 25, 26,	Multipurpose Room
6, 7, 8, 39, 40, 41	Education Room
9, 47, 66, 91, 110	Cleaning Room
10, 11, 16, 17, 20, 21, 22, 28, 29, 31, 33, 35, 37, 38	Standard Toilets
12,15, 27, 88, 86	Store Room
13,42	Guard Area
23	Prisoners' Waiting Area
30, 32, 34	Prisoners' Common Room
36	Staff Room
43	Staff Pantry
44	Officer Room
45, 64, 89, 108	Communal Kitchen/ Living Room
46, 65, 90, 109	Mechanical Room/ Electrical Room
48, 67, 92, 111	Yard
49, 68, 93, 112	Laundry Room
50-56, 69-75, 94-100, 113-118	Cell
57-63, 76-82, 101-107, 119-124	Cells' Toilet
84	Gym
85, 87	Study Room

There are five depth levels from level 5 to level 10 for the first floor in the justified graph, as shown in Figure 3. Based on Figure 6, Staircase (S1 to S6) and lift (L1) are vertical access to the upper floor. Staircase (S4) is the private vertical access mainly for staff. Guard Area (137) is the public assembly point for staff and inmates. From level 7 to level 10, cells for the inmates indicate the lowest connectivity and stipulate the most private spaces. The spaces form a symmetrical spatial system with a corridor (C18 - C26) as the root space. The VGA further validates this with the corridor's moderately high visual connectivity and ease of movement path due to the high integration of human movement. The layout of the first floor is considered easy wayfinding for the inmates and staff since it is designed to serve as all the private spaces, such as the accommodation of inmates, holding cells, and isolation cells. The layout of the first floor is considered very difficult to access since visitors are only accessible to the visitors' department (B3), as shown in Figure 4.

5.3 First Floor Plan Spatial Configuration



VGA: Visual Connectivity

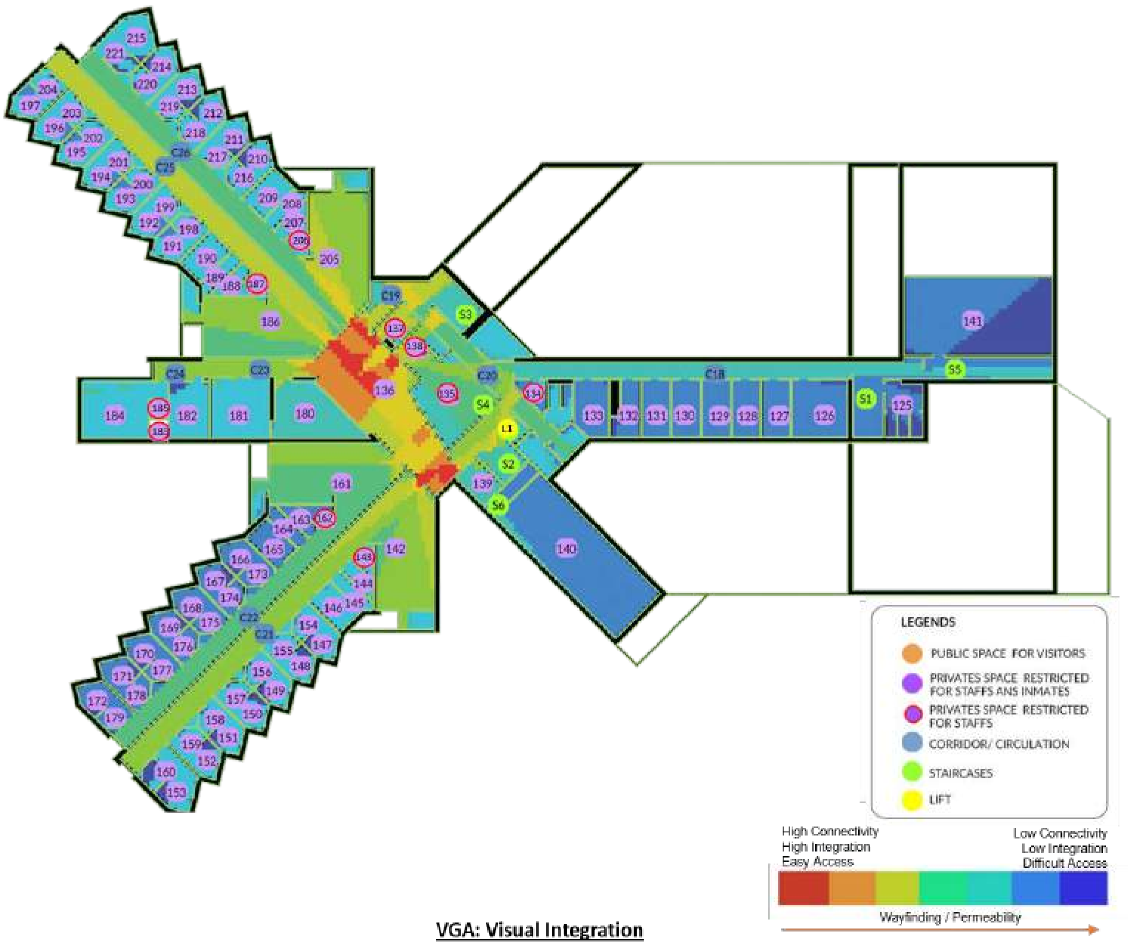


Figure 6: First Floor Plan and Visibility Graph Analysis of Standard Wing.

Table 4: Schedule of Accommodation for First Floor Plan of Standard Wing.

Code	Space
L1	Lift 1
S1	Fire Staircase 1
S2	Fire Staircase 2
S3	Fire Staircase 3
S4	Staff Staircase
S5	Fire Staircase 5
S6	Fire Staircase 6
C18-C26	Corridor
125	Standard Toilets
126-133	Interview/ Counselling Room
134, 143, 162, 187, 206	Mechanical Room/ Electrical Room
135	Staff Room
136	Guard Area
137	Staff Pantry
138	Officer Room
139	Holding Cell
140, 141	Isolation Cell
142, 161, 186, 205	Communal Kitchen/ Living Room
144, 163, 188, 207	Cleaning Room
145, 164, 189, 208	Yard
146, 165, 190, 209	Laundry Room
147-153, 166-172, 191-191, 210-215	Cell
154-160, 173-179, 198-204, 216-221	Cells' Toilet
180	Prisoners' Waiting Area
181	Gym
182, 184	Study Room
183, 185	Store Room

6 Discussion

As illustrated by the justified graph in Figure 3, the public route for the correctional facility presents a uniform spreading, where the public entrance (G1) connects to various buildings (B1-B10). The justified graph indicates an asymmetric pattern with many different entrances (E1-E15) for the inmates to their cells in the building blocks ranging from B6 to B10. Each block accommodates the inmates with restricted access. Only one building block, B3 (Visitors' Department), is allowed public access, as shown in Figure 4. This concept of spatial design maximizes the efficiency of users' circulation. The higher depth level has low spatial integration and connectivity, indicating spatial complexity. The asymmetrical structures that lead to various symmetrical structures in the spatial arrangement have created a comparatively private building typology in a correctional facility. Most spaces are private, such as accommodation for inmates, holding, and isolation cells.

Different cultures have distinct approaches to justice, punishment, and rehabilitation in correctional facilities. Storstrom Prison prioritizes rehabilitation and reintegration into society, influencing the design to focus on educational and vocational programs. Based on Figure 4, activity building (B4) and workshop building (B5) are designed for inmates' rehabilitation. Next, considerations such as the design of communal spaces, cell arrangements, and the overall flow of movement within the standard wing building (B6) can affect social relationships among inmates and between inmates and staff, as illustrated in Figures 5 and 6.

6.1 Level of Permeability

Private spaces account for the most significant portion (42.75%) of the entire schedule of accommodations, as shown in Table 5. Those spaces are located on the ground floor. For example, the staff rooms, inmates' cells, and the services area. 30.11% of the spaces are very private, with the lowest integration in the correctional facility. Those spaces consist of inmates' cells and cells' toilets on the building's first floor, which stipulate the most private spaces. 17.10% of the building is a public space with high permeability. There are prisoners' courtyards, guard areas, workshops, multipurpose rooms, and study rooms. However, the most minor, semi-private spaces accommodate 10.04% of the total spaces. For instance, interview or counselling rooms, staff areas, guard areas, and communal kitchens or living rooms are on the first floor.

Table 5: Number and Percentage of Spaces Based on Level of Permeability.

Hierarchical Order	Level of Permeability	VGA Integration	Corresponding Justified Graph Depth Level	Number of Spaces	Percentage (%)
Primary Level	Public	High	0, 1, 2	46	17.10
Secondary Level	Private	Low	3,4	115	42.75
Tertiary Level	Semi-Private	Very Low	5, 6,7	27	10.04
Quaternary Level	Very Private	Lowest	8,9,10	81	30.11
			Total	269	100

6.2 Level of Wayfinding

Based on Table 6, 42.75% of the spaces in the correctional facility have intermediate wayfinding and moderate connectivity. For instance, those places are on the ground floor: staff rooms, inmates' cells, and the services area. Next, 27.51% of spaces have the most challenging level of wayfinding. Those places are inmates' cells and cell toilets on the first floor, which have the lowest connectivity due to the robust security in the correctional facility setting. Meanwhile, 17.10% of spaces in the building are accessible to wayfinding and have high connectivity. This result shows inmates are well segregated on the ground floor, such as in prisoners' courtyards, guard areas, workshops, multipurpose rooms, and study rooms. 8.18% of the building spaces on the first floor are difficult to find and need higher connectivity. For example, the first floor contains the staff areas, the guard area, and the interview or therapy rooms. Lastly, only 4.46% of building spaces are categorized under the quaternary level, making wayfinding difficult. For instance, staff areas, a gym, a communal kitchen, or a living room on the first floor must improve connectivity.

Table 6: Number and Percentage of Spaces Based on Level of Wayfinding.

Hierarchical Order	Level of Wayfinding	VGA Connectivity	Corresponding Justified Graph Depth Level	Number of Spaces	Percentage (%)
Primary Level	Easy	High	0, 1, 2	46	17.10
Secondary Level	Intermediate	Moderate	3, 4	115	42.75
Tertiary Level	Difficult	Low	5, 6	22	8.18
Quaternary Level	Very Difficult	Very Low	7, 8	12	4.46
Quinary Level	Most Difficult	Lowest	9, 10	74	27.51
			Total	269	100

6.3 Spatial Design

Table 7: Number and Percentage of Spaces Based on Connecting Spaces.

Connecting Spaces	Spaces	Number	Percentage (%)
End Room	4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 18, 19, 21, 22, 23, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 43, 44, 46, 47, 48, 49, 57, 58, 59, 60, 61, 62, 63, 65, 66, 67, 68, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 88, 90, 91, 92, 93, 101, 102, 103, 104, 105, 106, 107, 109, 110, 111,112, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 137, 138, 139, 140, 141, 143, 144, 145, 146, 154, 155, 156, 157, 158, 159, 160, 162, 163, 164, 165, 173, 174, 175, 176, 177, 178, 179, 180, 181, 183, 185, 187, 188, 189, 190, 198, 199, 200, 201, 202, 203, 204, 206, 207, 208, 209, 216, 217, 218, 219, 220, 221	143	53.16
Single Connecting Space	12, 14, 24, 30, 36, 45, 64, 85, 87, 89, 108, 50, 51, 52, 53, 54, 55, 56, 69, 70, 71, 72, 73, 74, 75, 94, 95, 96, 97, 98, 99, 100, 113, 114, 115, 116, 117, 118, 142, 147, 148, 149, 150, 151, 152, 153, 161, 166, 167, 168, 169, 170, 171, 172, 182, 184, 186, 191, 192, 193, 194, 195, 196, 197, 205, 210, 211, 212, 213, 214, 215	71	26.39
Double Connecting Space	20, 42	2	0.74
Triple Connecting Space	2, 3, 13	3	1.12
Multiple Connecting Spaces	1, 136	2	0.74
Staircases	S1, S2, S3, S4, S5, S6	6	2.23
Lift	L1	1	0.37
Corridors	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26	26	9.67
Entrance/ Lobby	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15	15	5.58
	Total	269	100

Based on Table 7, 53.16% of prisoner building blocks have dead-end cells (rooms), totalling 143 spaces to enhance inmate security. 26.39% of the spaces are single connecting, facilitating a direct transition between areas. Corridors contribute 9.67% of the weightage, while the entrance or lobby comprises 5.58% of the total building percentage. Lifts and staircases that provide vertical access are arranged at varying depth levels in the justified graph, accounting for 0.37% and 2.23% of the building access nodes, respectively. Nevertheless, double-connecting spaces and multiple-connecting spaces are limited to 0.74% of the entire building, with triple-connecting spaces accounting for only 1.12%, primarily influenced by the robust security measures implemented in the correctional facility.

7 Conclusion

Storstrom Prison is a well-organized correctional facility that includes straightforward spatial navigation. This case study restricts public access because it is a correctional facility. As shown in Figure 4, just one building block, B3 (Visitors' Department), is open to the public. Public and private spaces are well segregated on the ground floor at the standard wing blocks B6-B10. On the first floor, the accessibility has straightforward wayfinding for inmates and staff, as it is specifically structured to accommodate various private spaces, including inmate housing, holding cells, and isolation cells. Hence, most of the spaces in the building are categorized under end rooms.

The spatial configuration of the correctional facility in the case study effectively aligns with the desired permeability and wayfinding quality level, as evidenced by the justified graph and VGA analysis. Private spaces with intermediate wayfinding dominate the overall space syntax performance of the correctional facility at 42.75%. The building functions as a private space with a relatively low level of permeability in the spatial configuration. The purpose is to heighten privacy and security levels, requiring authorization for the staff and inmates' access. The level of wayfinding is intermediate in the justified graph and a moderate level of integration in VGA, creating restrictions for the staff and inmates' accessibility for efficient security control. Meanwhile, accessing inmates' cells is difficult due to their arrangement in the layout plan design for stringent security.

A well-designed correctional facility improves safety and security, fostering controlled security for inmates and staff. The case study exposes the spaces that encourage positive social interactions among inmates, such as communal areas on the ground floor for recreation activities to promote a rehabilitative environment for the inmates. Besides, a thoughtful spatial design allows for better surveillance, aiding staff in monitoring activities within the facility and leading to a safer and more secure atmosphere. Meanwhile, design features that contribute to the isolation of inmates can lead to feelings of segregation that harm the inmates' psychology.

8 Availability of Data and Materials

All information is included in this work.

9 Acknowledgement

This research is under financial support from ITJEMAST publisher for a joint research study with Universiti Sains Malaysia from the industrial grant No 304 /PPBGN /6501356 /I158 titled 'A Study on Social Contexts of Building Space Syntax'.

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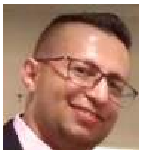

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