



Analysis of Permeability & Wayfinding Using Space Syntax Theory in Public Aquarium: Case Study on Antalya Aquarium in Turkey

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Abstract

The aquarium building aims to be a recreational, research and education centre that showcases marine life and creates memories for people while exploring the underwater world. This study reviews the space syntax network of Antalya Aquarium in Turkey, focusing on the wayfinding and permeability level of spaces to explain the spatial configuration in detail. The study focuses on interpreting public visitors' exploration routes (individual or group) and private personnel. The research is conducted by the Likert Scale, justified graph, and the alphanumeric system to contextualise the overall space syntax findings and results. Due to limited access for paid visitors only, the study has shown that 33% of the whole building spaces are semi-private and average in wayfinding. The designated 'one-way route' for visitors is straightforward and clear for first-time visitors. The study concludes that the level of permeability and wayfinding in Antalya Aquarium is a considerably clear distinction between public and private spaces, it segregates most of the heavy-duty services from visitors' paths. Besides, making the starting point of exhibitions on the first floor and exit hall on the ground floor seemingly uncommon for visitors' mental images. Still, it is undeniably a thoughtful design to avoid large crowds during peak hours.

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1 Introduction

Public aquarium typically houses numerous aquatic life species designed for public viewing. It is usually accommodated with large and thick acrylic glass aquarium tanks, which can hold millions of litres of water for myriads of marine life. Besides exhibiting marine life, some aquariums contribute as a vital source of public information on marine life conservation and education purposes (Worldwide Aquariums & Marine Life Centers, 2019; Aram & Suman, 2023).

As one of the largest oceanariums globally, Antalya Aquarium is meticulously sculpted with a façade of fluid's nature with undulating waves to ensure a natural transition from the surrounding site context, blending itself seamlessly to the site topography (Stevens, 2014). It accommodates the larger size of aquariums, to mimic the natural ocean ecosystem, where marine life could be kept for entertainment and study. Antalya Aquarium is located in the heart of Antalya, and it has become the most vibrant attraction in Turkey's tourist centre, a must-visit symbolic aquarium in Turkey (Alkan, 2015)

Today, the public aquarium has come a long way to become an active partner and leadership role in wildlife conservation while demonstrating the commitment to fight extinction and protect marine species (Barongi, 2015). Many aquariums have practised partnerships with universities, foundations and government organisation to develop toward research and education focus, transitioned from mere entertainment to a conservation and education model (Gang, 2016). Hence, Antalya Aquarium has in every respect become the representative of the blue planet, celebrating the blue world, using architecture to foster inspiration, education and frame experience for all (Baldwin, 2020).

Antalya Aquarium ranks as an award-winning attraction for its architecture and entertainment for the city's growing population. It is a leading attraction in Turkey and the world's prominent destinations such as Hagia Sophia and Topkapı Palace. Besides, it has won the QM AWARDS 2013 for Turkey's Best Managed Alternative Tourism Area (Antalya Aquarium, 2024). The aquarium architecture is often discussed and recognised by various renowned architecture websites, such as ArchDaily, Archello, Arch2O, DesignBoom and Architizer. TripAdvisor also awarded Traveller's Choice Awards 2014 and 2015 (Alkan, 2015).

This research analyses the permeability and wayfinding of the exhibition and aquaria spaces through space syntax with its spatial configuration. The spatial arrangement enables us to identify the impact of innovative conservation and education through the depth of permeability and wayfinding. Thus, the level of permeability and wayfinding become an architectural tool that offers directional guidance to people and enhances their spatial experience understanding (Yasin, et al., 2017). The spatial configuration and layout of buildings influence the way how an individual uses them (Hassan, 2004).

2 Literature Review

2.1 Space Syntax

Space syntax circumscribes a set of techniques and theories as a tool for spatial configuration analysis, such as interior spaces, buildings, cities and landscapes (Hillier & Hanson, 1984). Numerous researches have proved that spatial layout configuration influences human spatial cognition (Tzamir, 1975; Lynch, 1960; 1981). Space syntax offers an excellent emphasis on the networking between spaces rather than the characteristics of a room or building (Nes, 2014). The space syntax examines the space connectivity through analysis graphs such as a justified graph, depth, syntactic step and graph (Klarqvist, 1993).

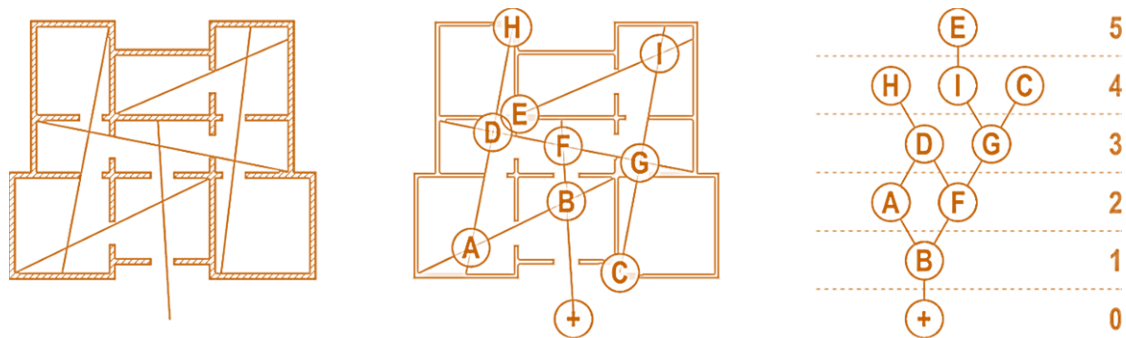


Figure 1: Level of Depth in Space Syntax (after Dawes & Ostwald (2018)).

Figure 1, the permeability level refers to the spatial layout’s connectivity, which determines the accessibility of spaces within a building (McLane, 2013). The rooms can be differentiated based on the degree of privacy and the ability to regulate privacy (Mustafa, et al., 2010). Besides, wayfinding is a design tool to help humans understand the spaces and guide them through the spatial unit within a building (Yasin, et al., 2017). Therefore, good building circulation and wayfinding are supported by space syntax analysis. (Khairdzir et al., 2020)

2.2 Building Typology

A public aquarium is usually designed with a large lobby to receive the public, leading them to the aquarium’s display in a ‘one-way route’. The exhibition place will showcase preserved specimens and outcomes of conservation efforts. An auditorium and small lecture theatre are vital for research and education purposes. The visit eventually comes to an end with the aquarium’s souvenir shop. (Karydis, 2011) Besides, there would be semi-private or private spaces catering for staff, services, and maintenance (Curnock & Moss, 2023).

2.3 The Case Study: Antalya Aquarium

From Figure 2, Antalya Aquarium is a public aquarium designed by a local Turkish Architect firm, Bahadir Kul Architects in 2012. The exhibitions and aquaria in Antalya Aquarium boast myriads of cohesive themes and concepts in thematic aquariums, as well as the longest tunnel aquarium in the world with the length of 131 metres and a width of 3 metres. It offers glimpses into both above water and underwater aquatic life. (Antalya Aquarium, 2024)

The total built-up area of the building is about 12,000 m² on 30,000 m² of land. The aquarium complex has approximately 10 thousand animals in the aquarium complex, and it accommodated a sizeable main tank of 5 million litres and 27 other tanks with extra 2 million litres (Oceana

Manufacturing, 2014). There are a total of 64 aquariums with 40 various themes are exhibited, including (Antalya Aquarium, 2013):

1. Aquarium (Asia, Africa and Amazon)
2. Thematic Sections (The Indian Ocean, Red Sea, Atlantic Ocean and the Pacific Ocean)
3. Main Tank and Tunnel (Tropical Reef, Sunken City Atlantis and the Mediterranean)
4. Snow World and Ice Museum (Igloos, House of St. Nicholas and Cafes)
5. Wild Park (Reptiles, Snakes or Bugs)
6. Oceanride XD Cinema

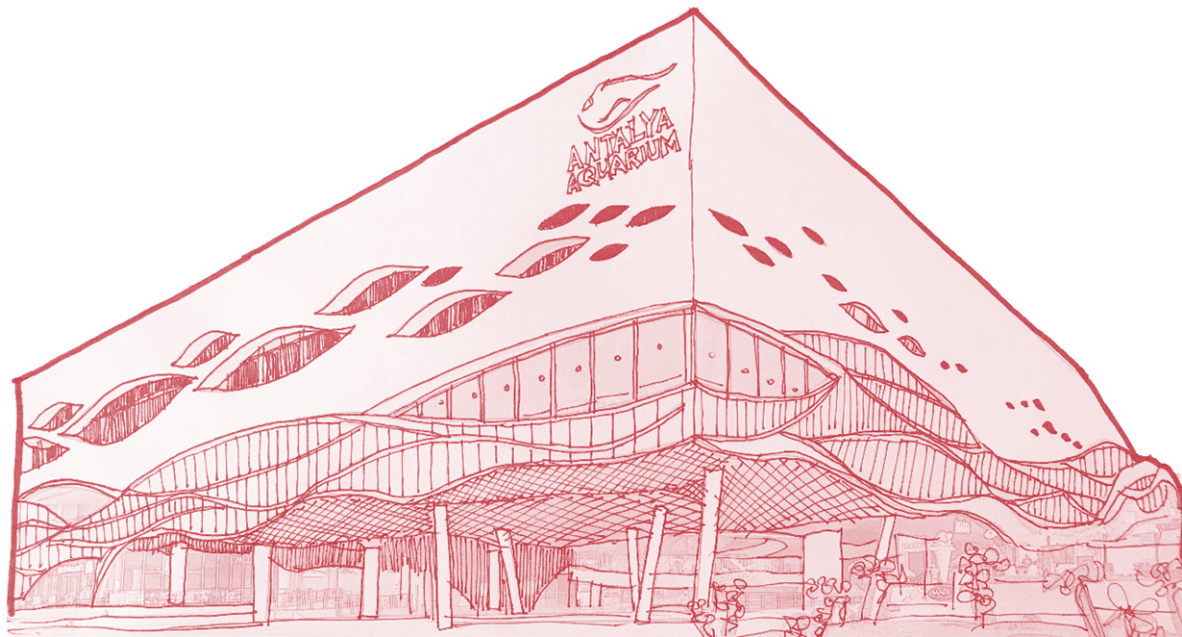


Figure 2: Exterior perspective of Antalya Aquarium

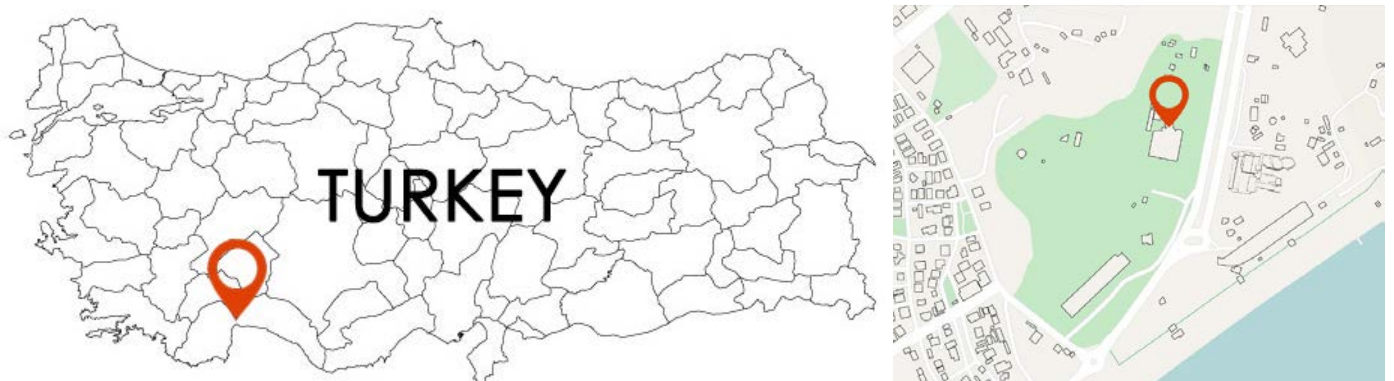


Figure 3: Key Plan and Location Plan of Antalya Aquarium in Turkey

The Antalya Aquarium is located in the Konyaalti region of Antalya, a tourism region of Turkey (Figure 3). On 15 August 2012, Antalya Aquarium hosted a grand opening under Antalya Metropolitan Municipality's efforts with an 80 million TRY investment fund. It receives a vast amount of domestic and foreign tourists every year. As a result, Antalya Aquarium also has an enormous visitor portfolio as the number of visitors reached 1 million during the first year of opening and achieved 5 million audiences within seven years. (Çelik & Ülger, 2020)

3 Research Method

This research is carried out with the space syntax theory, background and project information of the case study through qualitative research methods, such as internet research, articles, journals, books and websites. The analysis of permeability and wayfinding is identified based on the spatial arrangements on floor plans and then contextualised with space syntax theory. Hence, the best way to carry out this wayfinding analysis is to examine the spatial hierarchies through the levelling system in numbering graph. (Yusoff et al., 2019) Overall, the wayfinding and permeability analysis is broken down into two major groups: public (individual or group) and staff administration (service and maintenance), to identify and analyse different user destinations.

3.1 Likert Scale

The Likert Scale is utilised by categorising five types of spaces, such as public, semi-public, semi-private, private and extremely private. Each type of space is rated on the Likert Scale. The levels of permeability & wayfinding are categorised into five ranges of the Likert Scale's rating. The higher the rating, the deeper the level and depth of permeability and wayfinding based on Table 1.

Table 1: Likert Scale of Measurement for Space Syntax Analysis

Rating of Likert Scale	Depth of Permeability	Level of Wayfinding
0-2	Public	Very Easy
3-5	Semi-Public	Easy
6-8	Semi-Private	Average
9-11	Private	Difficult
12-13	Extremely Private	Very Difficult

Generally, the hierarchical order of permeability and wayfinding is ranked as primary, secondary and tertiary levels. The highest level of the hierarchy is always deemed as a primary destination of users as it would be the essential space with the easiest accessibility and increased visibility of location in the building.

3.2 Justified Graph

From Figure 4, the justified graph will showcase numerically the depth of spaces within the building, for instance, the higher the numbers, the deeper the spaces (Lee, 2020). Justified graphs start with the 'Root' at the base, spreading the nodes vertically and horizontally, placing them respectively into different depth levels while connecting to previously linked spaces. (McLane, 2013)

3.3 Alphanumeric System

Table 2: Categorisation of Alphanumeric and Colour Based on Building Function

Function	Alphanumeric	Colour
Building Access	E (E1, E2, E3, etc.)	Yellow
Aquarium/Exhibition	A (A1, A2, A3, etc.)	Blue
Transportation	T (T1, T2, T3, etc.)	Red
Services	S (S1, S2, S3, etc.)	Grey
Amenities	R (R1, R2, R3, etc.)	Brown
Administration/Control	C (C1, C2, C3, etc.)	Orange

Table 2 shows that the analysis uses labelling numbers and alphabets on the floor plan spaces incorporated with different colours. Meanwhile, each category's hierarchy of spaces is indicated by from sequence of numbering (1,2,3, etc).

4 Result and Analysis

4.1 Overall Justified Graph in Users' Category

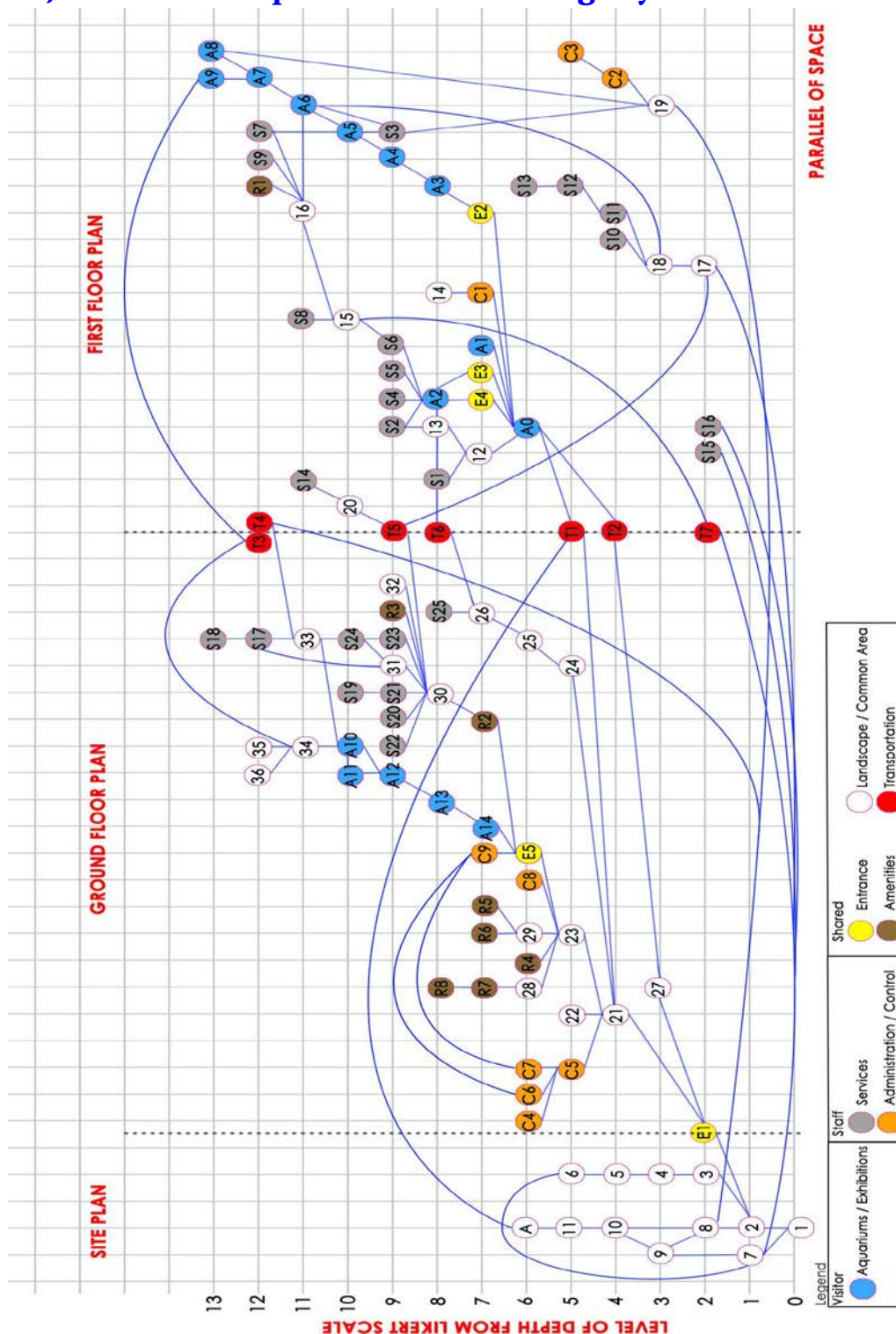


Figure 4: Overall Justified Graph for Antalya Aquarium

As shown in Figure 4, the overall justified graph has three plans to examine, such as the site plan, the ground floor plan and the first-floor plan. The shape of the justified graph is exceptional due to existing topography, where some of the rooms and spaces on the first floor can be entered

from the site landscape. There is only a positive axis of depth level as there is no basement level in the building. The overall space syntax analysis shows that public visitors usually follow the aquarium exhibitions path, while the staff mainly work in services and administration rooms. Common spaces such as entrances, amenities, landscapes and transportation are shared by both types of users.

4.2 Space Syntax Analysis on-Site Plan

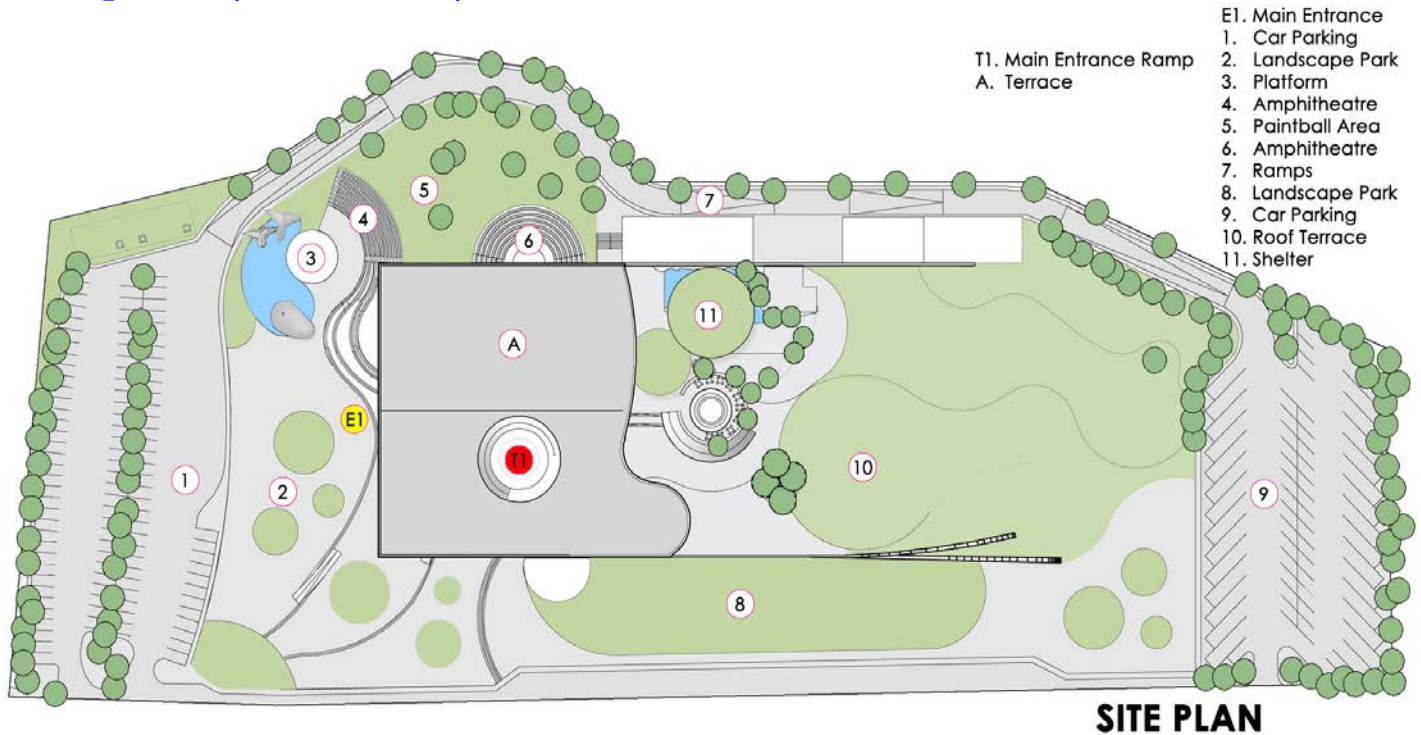


Figure 5: Site Plan with SOA

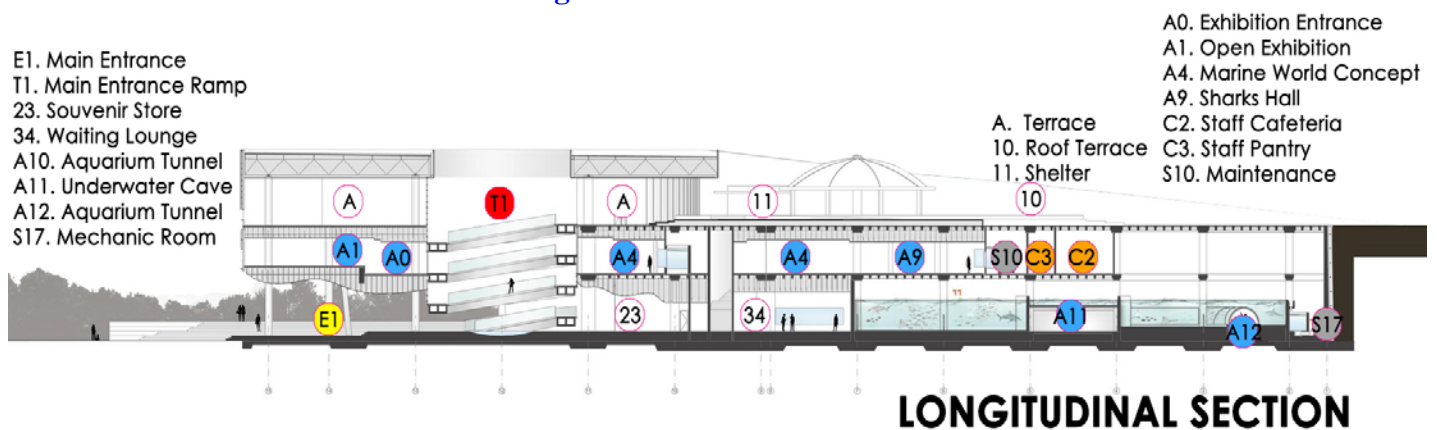


Figure 6: Longitudinal Section with SOA

From Figures 5 and 6, the Antalya Aquarium is designed in line with the topography, where the higher ground creates an accessible roof at the back of the car parking area. Then, the lower floor serves as the main entrance of the aquarium building.

Referring to the overall justified graph (Figure 4) and Likert Scale table (Table 3), there is one main entrance (E1) connecting from the surrounding landscape, ranging from public to semi-public level of permeability. E1 leads the public access into the main lobby of the building, with the high permeable network and easy for wayfinding. However, the terrace (A) is rated as semi-private due to its accessibility being average in wayfinding, it can be reached from the shelter (11) or the main

entrance ramp (T1) from the first floor.

Table 3: Likert Scale on Space Analysis for Site Plan

Area	Category	Depth Level	Level of Permeability	Level of Wayfinding
1	Landscape	0	Public	Very Easy
2,7	Landscape	1	Public	Very Easy
E1	Building Access	2	Public	Very Easy
3,8	Landscape	2	Public	Very Easy
4,9	Landscape	3	Semi-Public	Easy
5,10	Landscape	4	Semi-Public	Easy
6,11	Landscape	5	Semi-Public	Easy
A	Landscape	6	Semi-Private	Average

4.3 Space Syntax Analysis On Ground Floor Plan

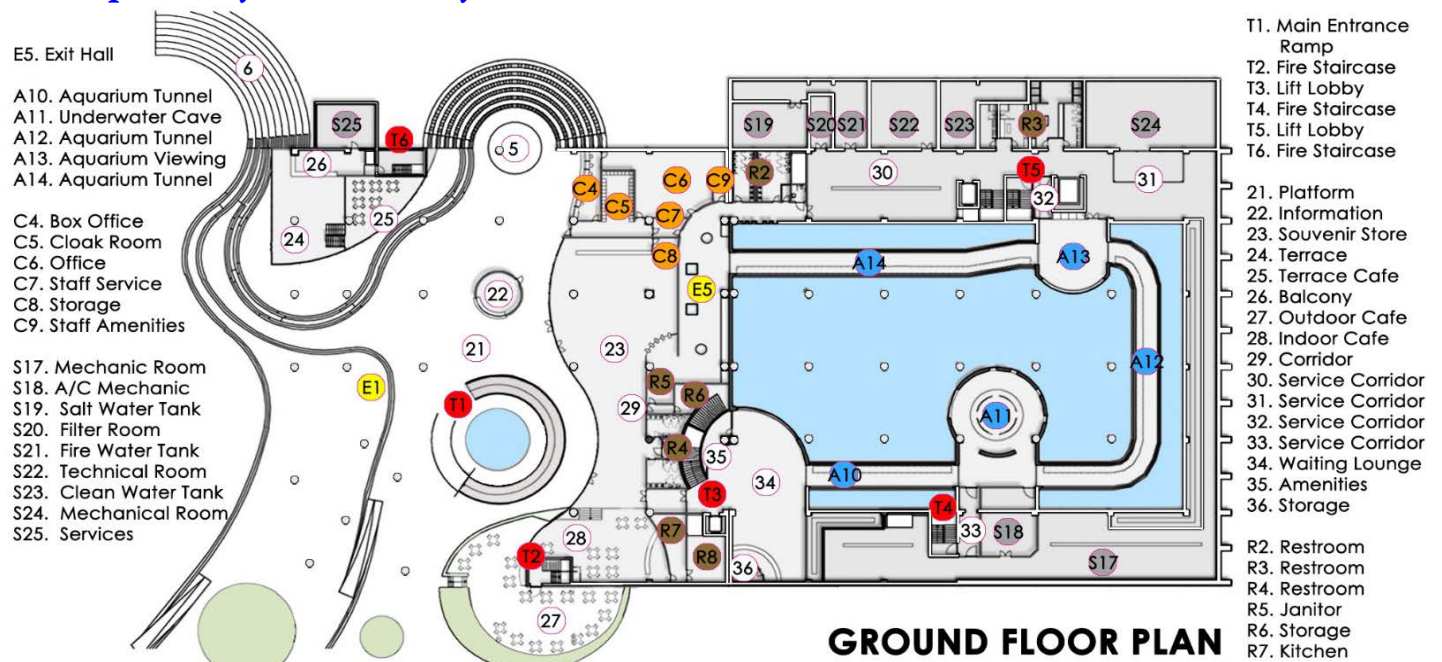


Figure 7: Ground Floor Plan with SOA

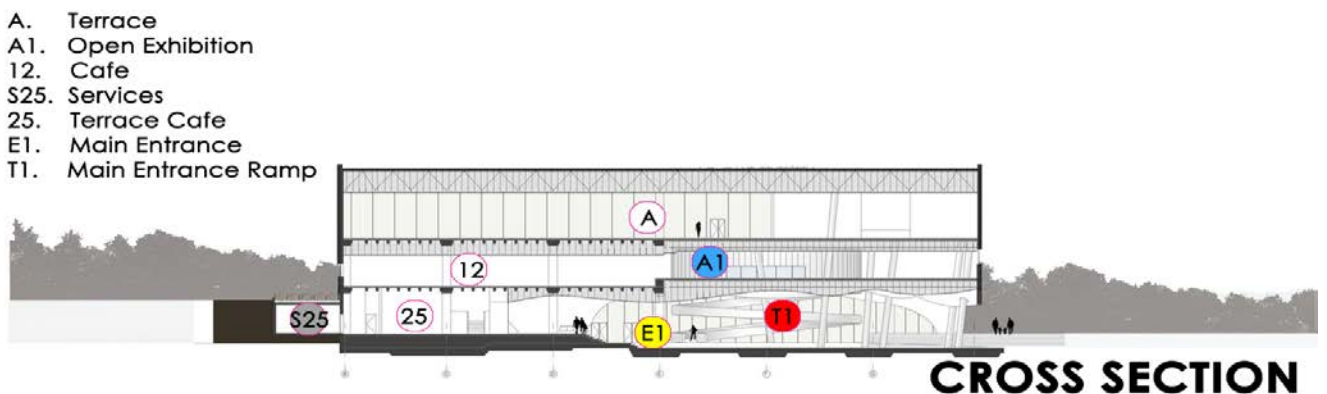


Figure 8: Ground Floor Plan with SOA

In correspondence of Figures 7 and 8, the journey for public visitors starts from travelling up the main entrance ramp (T1) after purchasing tickets from the box office (C4) to begin the tour for exhibition and education, as the first exhibition of the aquarium building starts from the first floor. The lift lobby (T3) acts as the vertical transportation to connect the first-floor aquarium exhibition

to ground floor aquarium exhibition such as the aquarium tunnel (A10), underwater cave (A11), aquarium tunnel (A12), aquarium viewing (A13) and aquarium tunnel (A14), which leads to the exit hall (E5), ending the journey of the visit.

Box office (C4), cloakroom (C5), office (C6) and staff service (C7) serve as the administration and management of the building. Services lift lobbies such as T4 and T5 are used for maintenance and services, to enter spaces such as the mechanic room (S17), A/C mechanic (S18), saltwater tank (S19), filter room (S20), fire water tank (S21), technical room (S22), clean water tank (S23) and mechanical room (S24).

Table 4: Likert Scale on Space Analysis for Ground Floor Plan

Area	Category	Depth Level	Level of Permeability	Level of Wayfinding
27	Common Area	3	Semi-Public	Easy
21	Common Area	4	Semi-Public	Easy
T2	Transportation	4	Semi-Public	Easy
22, 23, 24	Common Area	5	Semi-Public	Easy
C5	Administration/Control	5	Semi-Public	Easy
T1	Transportation	5	Semi-Public	Easy
C4, C6, C7, C8	Administration/Control	6	Semi-Private	Average
E5	Building Access	6	Semi-Private	Average
R4	Amenities	6	Semi-Private	Average
25,28,29	Common Area	6	Semi-Private	Average
R2, R5, R6, R7	Amenities	7	Semi-Private	Average
C9	Administration/Control	7	Semi-Private	Average
A14	Aquarium/Exhibition	7	Semi-Private	Average
26	Common Area	7	Semi-Private	Average
T6	Transportation	8	Semi-Private	Average
R8	Amenities	8	Semi-Private	Average
A13	Aquarium/Exhibition	8	Semi-Private	Average
30	Common Area	8	Semi-Private	Average
S25	Services	8	Semi-Private	Average
A12	Aquarium/Exhibition	9	Private	Difficult
S20, S21, S22, S23	Services	9	Private	Difficult
R3	Amenities	9	Private	Difficult
31, 32	Common Area	9	Private	Difficult
T5	Transportation	9	Private	Difficult
A10, A11	Aquarium/Exhibition	10	Private	Difficult
S19, S24	Services	10	Private	Difficult
33, 34	Common Area	11	Private	Difficult
35, 36	Common Area	12	Extremely Private	Very Difficult
S17	Services	12	Extremely Private	Very Difficult
T3, T4	Transportation	12	Extremely Private	Very Difficult
S18	Services	13	Extremely Private	Very Difficult

According to the overall justified graph (Figure 5) and the Likert Scale (Table 4), the level of permeability for public users ranges from semi-public to private. The wayfinding of the spaces varies from easy to difficult wayfinding. Although the public circulation for aquarium exhibitions starts from the first floor, the aquarium and exhibition spaces on the ground floor (A10, A11, A12, A13, A14) remain a more public space with easy wayfinding compared to the first-floor exhibition spaces.

Meanwhile, most of the service spaces such as S20, S21, S22, S23, S19, S24, S17, S18 are placed from private to extremely private in the building, where they have their service lift lobby (T4, T5) to hide away from public users. Moreover, for staff and administration areas (C1, C3, C4, C5) which do not require much heavy-duty and technical maintenance, can be permitted from the public entrance, making them substantially public and easy to wayfinding.

4.4 Space Syntax Analysis On First Floor Plan

On the first floor (Figure 9), the open exhibition (A1), café (12), aquarium entrance hall (E2) and snow room entrance (E3) can be accessed straightaway from the exhibition entrance (A0). For aquarium exhibition and education, E2 is the only access to the introduction hall (A3), marine world concept (A4), cave concept (A5), special aquarium (A6), tropical reef ecosystem (A7), sharks concept (A8) and sharks hall (A9). Then, the lift lobby (T3) continues the journey by going down to the ground-floor aquarium exhibition. The snow hall (A2) has to be accessed from the entrance (E2) after paying for tickets at the box office (C1), then exit thru the egress hall (E4).

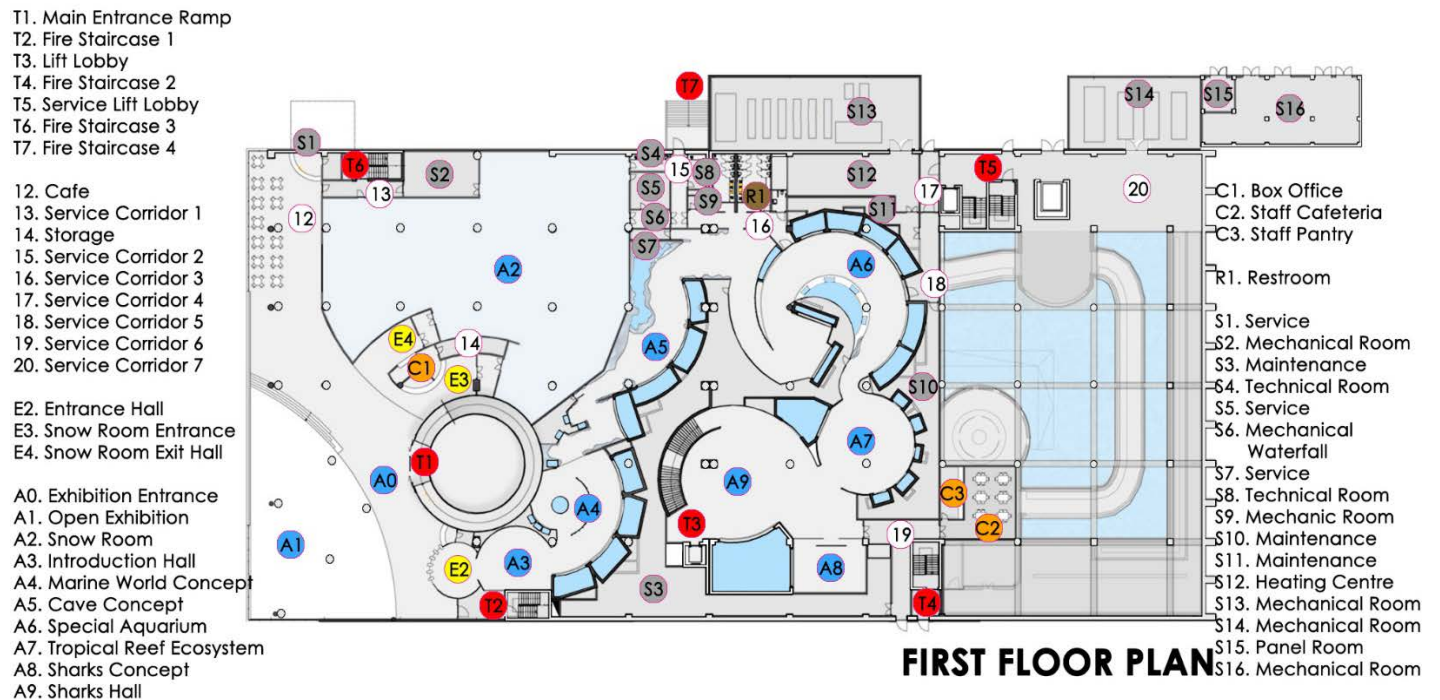


Figure 9: First Floor Plan with SOA

As the back of the building is connected seamlessly with higher ground, the services lift lobbies such as T4, T5 and T7 can be entered directly from the outside. They segregate the maintenance route from the public route to the spaces such as maintenance (S3), mechanical waterfall (S6), technical room (S8), mechanic room (S9), maintenance (S10 and S11), heating centre (S12), mechanical room (S14 and S16) and panel room (S15).

According to the overall justified graph (Figure 4) and the Likert Scale table (Table 5), the level of permeability for public users varies from public to extremely private with simple to very difficult wayfinding in a one-way route. As the exhibition goes deeper within the aquarium, exhibitions on the first floor (A3, A4, A5, A6, A7, A8, A9) are found to be harder in wayfinding than

the ground floor exhibition spaces.

Table 5: Likert Scale on Space Analysis for First Floor Plan

Area	Category	Depth Level	Level of Permeability	Level of Wayfinding
T7	Transportation	2	Public	Very Easy
S15, S16	Services	2	Public	Very Easy
17	Common Area	2	Public	Very Easy
18, 19	Common Area	3	Semi-Public	Easy
T2	Transportation	4	Semi-Public	Easy
S10, S11	Services	4	Semi-Public	Easy
C2	Administration/Control	4	Semi-Public	Easy
T1	Transportation	5	Semi-Public	Easy
S12	Services	5	Semi-Public	Easy
C3	Administration/Control	5	Semi-Public	Easy
A0	Aquarium/Exhibition	6	Semi-Private	Average
S13	Services	6	Semi-Private	Average
E2, E3, E4	Building Access	7	Semi-Private	Average
A1	Aquarium/Exhibition	7	Semi-Private	Average
C1	Administration/Control	7	Semi-Private	Average
12	Common Area	7	Semi-Private	Average
T6	Transportation	8	Semi-Private	Average
A2,A3	Aquarium/Exhibition	8	Semi-Private	Average
13,14	Common Area	8	Semi-Private	Average
S1	Services	8	Semi-Private	Average
T5	Transportation	9	Private	Difficult
S2,S3,S4,S5,S6	Services	9	Private	Difficult
A4	Aquarium/Exhibition	9	Private	Difficult
15,20	Common Area	10	Private	Difficult
A5	Aquarium/Exhibition	10	Private	Difficult
S8,S14	Services	11	Private	Difficult
A6	Aquarium/Exhibition	11	Private	Difficult
16	Common Area	11	Private	Difficult
T3,T4	Transportation	12	Extremely Private	Very Difficult
S7,S9	Services	12	Extremely Private	Very Difficult
R1	Amenities	12	Extremely Private	Very Difficult
A7	Aquarium/Exhibition	12	Extremely Private	Very Difficult
A8,A9	Aquarium/Exhibition	13	Extremely Private	Very Difficult

Maintenance and services are mostly positioned in the areas of semi-private to extremely private zones in the building. However, exceptional cases like the services room (S15, S16) can be entered directly from the back of the house of the aquarium building, which is deemed very public and very easy in wayfinding. Besides, in the snow hall exhibition (A2), the services (S2, S4, S5, S6) are attached to the exhibition spaces. Therefore it is accessible from both service lobbies and public exhibition areas.

5 Discussion

The public route for aquarium exhibitions has shown a deep tree-formed graph model. One-way route exhibition and education have been set up for public visitors to follow, regardless of single or in-group visitors. The one-way route is clear and straightforward, then branches out with spaces for vertical building transportation and amenities like restrooms. The one-way route characteristic makes the wayfinding considerably easy for first-time visitors to follow. However, as

the exhibition route goes inward, the permeability of public users' spaces is covered from public to extremely private zones.

While the services route for maintenance has exhibited a shallow tree-formed graph model, most of the service area can be accessed through the same service corridor. Furthermore, certain service areas on the first floor can be accessed from the landscape from the site plan. Therefore the overall justified graph shape is uncommon for most of the building.

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

Level of Permeability and Wayfinding	Level	Spaces	Number	Percentage (%)
Public/Very Easy (0-2)	Site Plan	1,2,3,7,8	5	
	Ground Floor Plan	E1	1	
	First Floor Plan	T7,S15,S16,S17	4	
			10	9.5
Semi-Public/Easy (3-5)	Site Plan	4,5,6,9,10,11	6	
	Ground Floor Plan	21,22,23,24,27,T1,T2,C5	8	
	First Floor Plan	18,19,S10,S11,S12,C2,C3	7	
			21	19.8
Semi-Private/Average (6-8)	Site Plan	A	1	
	Ground Floor Plan	C4,C6,C7,28,R4,29,C8,E5,25,R7,R6,R5,C9,A14,R2,26,R8,A13,30,S25,T6	21	
	First Floor Plan	A0,S13,12,E3,E4,A1,C1,E2,S1,13,A2,14,A3	13	
			35	33.0
Private/Difficult (9-11)	Ground Floor Plan	A12,S22,S20,S21,31,S23,R3,32,T5,A11,A10,S19,S24,34,33	15	
	First Floor Plan	S2,S4,S5,S6,A4,S3,20,15,A5,S14,S8,16,A6	13	
			28	26.4
Extremely Private/Very Difficult (12-13)	Ground Floor Plan	35,36,S17,T3,T4,S18	6	
	First Floor Plan	R1,S9,S7,A7,A8,A9	6	
			12	11.3
Total			106	100

*Note: Percentage = $\frac{\text{Number of Spaces}}{\text{Total Number of Spaces}} \times 100\%$

In Table 6, 33% of the aquarium building is semi-private and average in wayfinding. Those spaces are mostly located on the ground floor plan such as the aquarium exhibitions, staff offices, public amenities and some service rooms. 9.5% of the building consists of public spaces with a primary level of permeability, where the main building entrance, landscape park and some service rooms are placed in this category with very easy wayfinding. Besides, 19.8% of the building are categorised in semi-public spaces with a secondary level of permeability. While 26.4% of the rooms are made up of most of the service areas which are private and difficult in wayfinding, restricted from public visitors. Around 11.3% of the spaces are deemed as extremely confidential with extremely difficult wayfinding. Those spaces are services and aquarium exhibitions that are situated deep in the building.

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

Connecting Space	Spaces	Number	Percentage (%)
End Room	C4,R5,R6,R8,S19,S18,S25,S4,14,S10,S13,C3	12	11.3
Single	11,22,C8,C9,35,36,S22,S20,S23,R3,32,S24,S14,S15,S16,A1,S8,R1,S9,R4	20	18.9
Double	1,3,4,5,6,C6,C7,27,28,R7,A14,A13,A11,R2,S21,S5,T7,T2,T1,T6,T3,T4,20,S2,S6,E4,E3,C1,S11,S12,E2,A3,A4,A8,A9,C2,S7,24,25,A	40	37.7
Triple	2,E1,29,A12,31,33,S17,26,T5,S1,12,17,A7,S3,19	15	14.2
Multiple	7,8,9,10,C5,21,23,E5,A10,34,30,13,A0,A2,15,18,A5,A6,16	19	17.9
Total		106	100

***Note:** Percentage = $\frac{\text{Number of Spaces}}{\text{Total Number of Spaces}} \cdot 100\%$

According to Table 7, most of the Antalya Aquarium spaces are double connecting spaces, made up of 40 rooms with 37.7% of the building. The spaces are mostly comprised of aquarium exhibitions which possess the characteristics of the one-way route for paid visitors. There are approximately 12 end rooms with 11.3% of the total spaces in the building and 20 single connecting areas (18.9%). These spaces are mostly taken up for services and staff rooms for maintenance and administration purposes.

Furthermore, there are approximately 15 triple-connecting spaces (14.2%) and around 19 multi-connecting spaces with 17.9% in Antalya Aquarium. These spaces branch out and link most of the rooms together, mainly consisting of building entrances, transportation, site landscape and common areas shared by both visitors and service staff. Out of six sets of staircases and lifts have been found, only two sets have their foyer and lobbies.

6 Conclusion

Antalya Aquarium is designed with a very straightforward one-way route for paid visitors to follow the path, while services are hidden behind aquarium exhibitions mostly, which is satisfactory for separating both public and service routes. As seen in the overall justified graph (Figure 5), the overall space syntax performance in Antalya Aquarium is mostly semi-private and average in wayfinding, taking up 33.0% of the whole building space. Most aquarium exhibitions are placed in semi-private spaces due to their limited access to paid visitors, while service and maintenance areas are located, ranging from semi-private to extremely private, to allow related personnel to carry out their work. Besides, aquarium exhibitions are mostly double connecting spaces, while service and administration spaces are mainly end rooms or single connecting spaces.

This study focuses on the relationship between each area based on space syntax analysis. Antalya Aquarium is designed thoughtfully for two primary users: the public (individuals or groups) and private personnel, regarding the spatial arrangement and privacy level. The justified graph's shape is noteworthy due to existing topography, where some service spaces on the first floor can be accessed directly from the site landscape. Moreover, starting the exhibition on the first floor does not seem familiar to public visitors mental images, which the box office is located on the ground floor but the aquarium exhibitions start from the first-floor level. It is assumed that the aquarium exhibition is intended to end on the ground floor so that the entrance and exit hall are segregated

on the first floor and ground floor respectively, to avoid congestion during peak hours.

7 Availability of Data and Material

All information is included in this article.

8 References

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