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Space Syntax Analysis on Indoor Anaheim Regional Transportation Intermodal Center

Ahmad Afiq Md Noor[1], Yasser Arab[2*], Ahmad Sanusi Hassan[1], Hilary Omatule Onubi[1], Joesron Alie Syahbana[3], Bhattraradej Witchayangkoon[4], Maryam Saeed[2]

[1] *School of Housing, Building & Planning, Universities Sains Malaysia, MALAYSIA.*
[2] *Department of Architectural Engineering, Dhofar University, Salalah, SULTANATE of OMAN.*
[3] *Department of Urban and Regional Planning, Faculty of Engineering, Diponegoro University, Semarang, INDONESIA.*
[4] *Department of Civil Engineering, Thammasat School of Engineering, Thammasat University, THAILAND.*
**Corresponding Author (Tel: +968 9987 2907, Email: yarab@ du.edu.om).*

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Abstract

Space syntax is a human-focused approach that supports humans in identifying the relationship between human activities and the spaces within a habited area. This paper mainly focuses on the space syntax defined from the existing case study the Anaheim Regional Transportation Intermodal Center (ARTIC), USA. Method of utilizing information found from resources like the internet and interviewing the respective parties involved in the building renovation. The Likert scale method is used to present the research finalist, which justifies the wayfinding and permeability of the ARTIC. This paper's finding shows that wayfinding in the ARTIC is instead of a dilemma. Based on the outcome, the ARTIC round spatial arrangement is somewhat supportive for the visitors to seek wayfinding. However, some areas are narrow and dense, which are not suitable to cater to the large volume of visitors. Hence, the finding of this paper hopes to aid in building the designer in future terminal design.

Disciplinary: Architectural Engineering.

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1 Introduction

In 1984, after publishing "The Social Logic of Space" by Bill Hillier (1984), architectural theory related to spatial nature had been improving fast. 'Space syntax' is a social theory of space and a method of analysing the spaces in buildings and urban environment using the analytical and

descriptive tool to represent the spatial formation (Hillier and Hanson, 1984, Hillier, 1996). The research objective is to analyse the flow of spaces or permeability (Ephes, 2006) of the selected case study building. This paper uses space syntax and applies it to achieve the research objective and finally determines how the spaces are configured will relate to the way humans perceive and move through the spatial system (Penn et al. 1998). The analysis also includes using a graph to understand and predict user movements (Ratti, 2003).

The case study, Anaheim Regional Transportation Intermodal Center (ARTIC), designed by HOK Architect, The design team used building information modelling (BIM) to develop ARTIC's complex form, geometry and functions, to navigate the complexities of the building systems, and to study the building's tolerances and environmental performance. This gives way to multiple types of user, and each will have a different level of permeability access and wayfinding according to the spatial building formations (Rahaman, 2019). This iconic facility symbolised a new public transit era and was only made possible because of city leaders' unwavering commitment to a contemporary and bold design. The Anaheim Regional Transportation Intermodal Center (ARTIC) in Anaheim, Calif., has earned national recognition in the 2015 Innovative Design in Engineering and Architecture with Structural Steel awards program (IDEAS2). In honour of this achievement, the project team members were presented with awards from the American Institute of Steel Construction (AISC) during a ceremony at the facility. The analysis also includes graphs to understand and predict user movements (Ratti, 2003).

2 Literature Review

The syntax of space is a method for defining the relationships between human activities and space Within an inhabited area (Bafna, 2003). Investigation of human movement's spatial change The primary goal of space syntax is from one field to another. Spaces and connectivity for transform during the analysis method, space syntax analysis also occurs, often represented by the Permeability degree that lies in constructing buildings. However, the building architecture is focused on The intention and functions that were to be represented by the designer. It is possible to consider space syntax as an accessibility analysis of graphs to derive wayfinding results (Yusoff, 2019). And Kevin A. The phrase for his book "The Picture of the City" was, used by Lynch (1960), where he described wayfinding as wayfinding. “Consistent use of definite sensory inputs from the natural world to be coordinated.” In another “The syntax of term, space enables individuals to examine the connection between human activities and Spaces in all distinct ways from the populated area's structure” (Penn, 2003). The normal to coordinate themselves, communities also use space as the keyword and the necessary details.

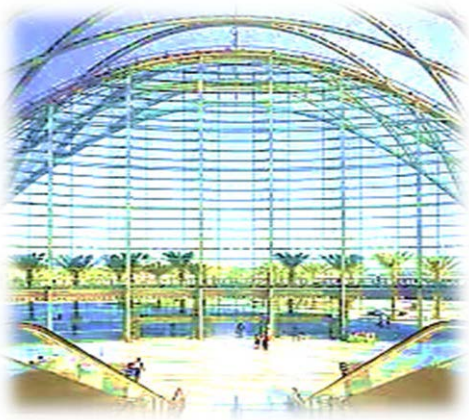
Van Nes & Yamu (2021) discussed basic concepts, complex theories, and applications underlying space syntax. Rashid (2019) explained the fundamental concepts, methods, and measures of space syntax configurational approach, highlighting on the axial and segment map analyses, and combining space syntax with GIS.

Mohamed (2012) explored wayfinding ability in city. The results showed that, of an environment, spatial configuration and spatial cognition are highly related giving that space syntax technique provides good predictions of wayfinding ability. Also the study showed that visual form and spatial configuration are highly connected.

3 Anaheim Transportation Intermodal Centre

Anaheim Transportation (Figure 1) is known as the new pulse of the United States, where the transportation capable of that would become an icon for public transit. It needed to encourage Orange County's three million residents with annual visitors more than 50 million, think toward future of sustainable smart travels. The Anaheim Regional Transportation Intermodal Center (ARTIC) serves southern California with a flexible, futuristic terminal for rail, bus and auto passengers in addition to bicyclists and pedestrians. The parabolic design concept of diamond-shaped steel arches infilled with translucent ETFE (ethylene tetrafluoroethylene) creates a grand, light-filled atrium space reminiscent of the world's great passenger terminals.

(a) Anaheim transportation (ARTIC) from the opposite road view.



(b) The interior entrance of the Anaheim transportation

(c) The main sheltered entrance of Anaheim transportation from the construction

Figure 1: Anaheim Regional Transportation Intermodal Center (ARTIC), Anaheim, CA, USA (continued). (public domain images with re-digital master enhancement).

Strategically located in Anaheim's "Platinum Triangle," an area that includes Angel Stadium and the Honda Center, ARTIC is near multiple points of interest including the Anaheim Convention Center and Disneyland. A connection to an adjacent pedestrian and cycling trail along the Santa

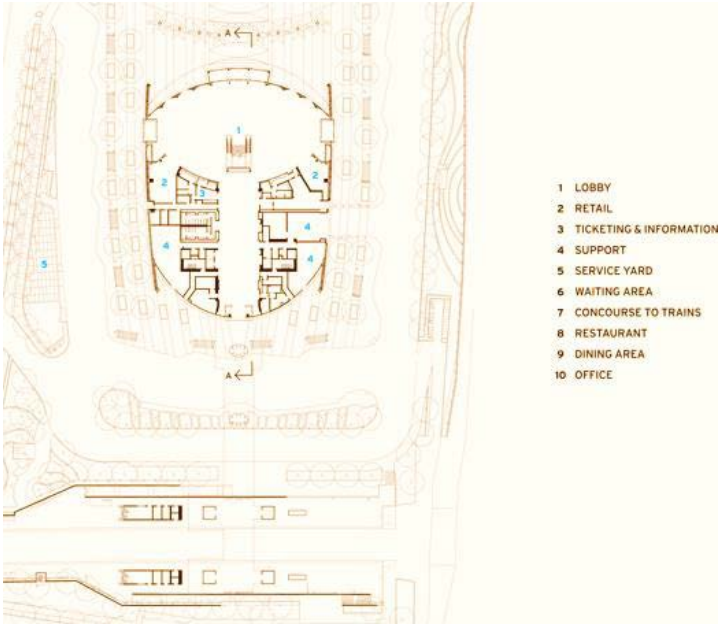
Ana River opens ARTIC to non-vehicular traffic. Its master plan establishes a clear pedestrian pathway to future mixed-use development. The building's landscape architecture complements both its operations and surroundings. Date palms and olive trees within ARTIC's outdoor plaza create shaded seating areas for riders while succulent gardens add vibrant colours and texture. These drought-tolerant plantings are irrigated entirely from rainwater and greywater, contributing to the building's 80 per cent reduction in potable water consumption.

The Phantom, transportation has been deliberately built to fill several usable spaces inside and enable immense spectator capacities to be held in a period per event. People with the same intent are social, educational, recreational, service, and other purposes, using a public or private. External preparation, wayfinding & permeability levels must cater to the high degree of permeability—the sum of human movement to prevent all forms of needless trouble. Specific sentences and control of the Securities and entry egress are also the most crucial obstacles in transportation architecture. This research examines the positive and negative implications of the picked case study and provides data to strengthen future design of transportation center and facilities.

The Anaheim Regional Transit Intermodal Hub (ARTIC) is an optimistic showcase of the future mass transport in southern California.

(a) Critical Plan Anaheim

(b) location plan Anaheim



(c) The site plan Anaheim

Figure 2: Plan Anaheim

4 Method

The selection of a proper case study for space syntax is crucial to start for this research. The case study selection must have comparative typology with the design thesis topic. However, the circular space syntax graph is being introduced in this case due to the circular space syntax graph able to fulfil the placement and circulation of the Anaheim Transportation Intermodal Centre. The circular space syntax graph with permeability will be differentiated by the colour zone growing from the outermost line toward the Centre point. Meantime, building levelling will be indicated based on the mainline's position. Spaces relationship can be presented in the more natural form due to all the labelling and symbols able to place accordingly. As the research proceeds further, different kinds of presentation graph methods will need to be introduced. Due to the circulation design of the Anaheim Transportation Intermodal Centre are in the form of a loop. All the spaces within able to be connected through a continuous walking corridor. Besides that, multiple entrances are situated around the terminal, allowing the ingress and egress to be happening all around. Conventional vertical and horizontal space syntax graphs challenge the flow of connectivity and the level of permeability.

5 Results

This analysis will start from the ground floor plan. This result will be carried out specific to each user category. Their circulation to go through all space will be translated into a graph format from which the depth permeability may be understood. The three user categories are Tourists and Staff Terminal. Figures 3, 4 and 5 are the floor plan for the transit terminal with a code that corresponds to the provided list of spaces with code and space name, accommodation schedule for the ground floor, first-floor plan, and mezzanine floor plan. The images were also redrawn to illustrate based on the images provided by the pinterest.com.

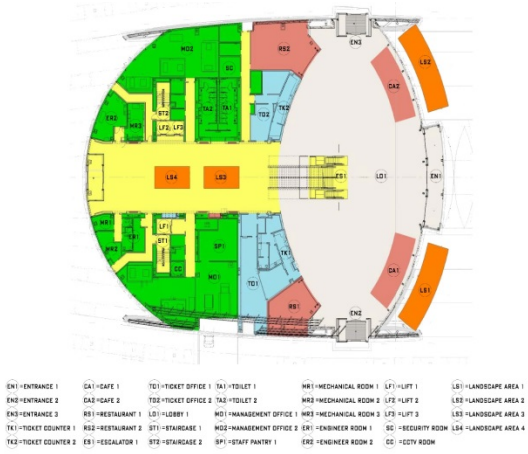
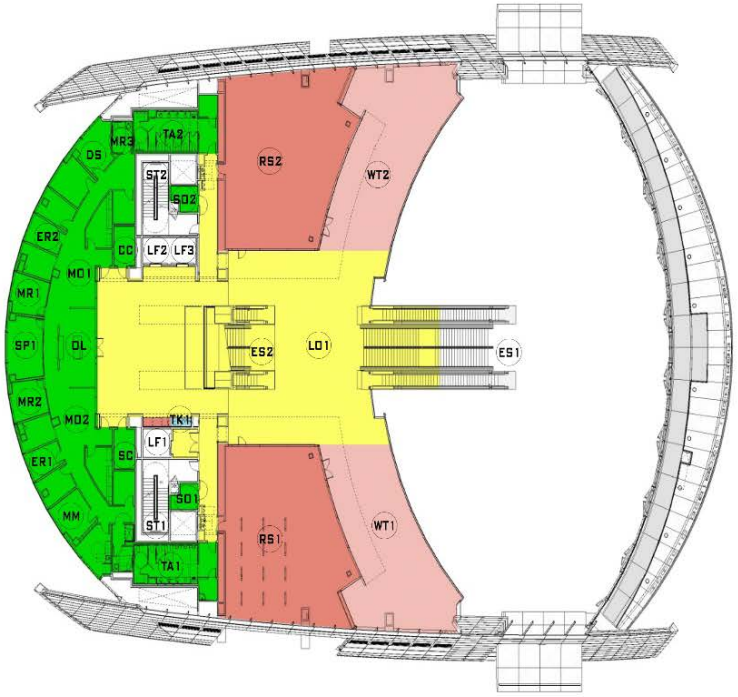


Figure 3: Ground Floor Plan Indication,

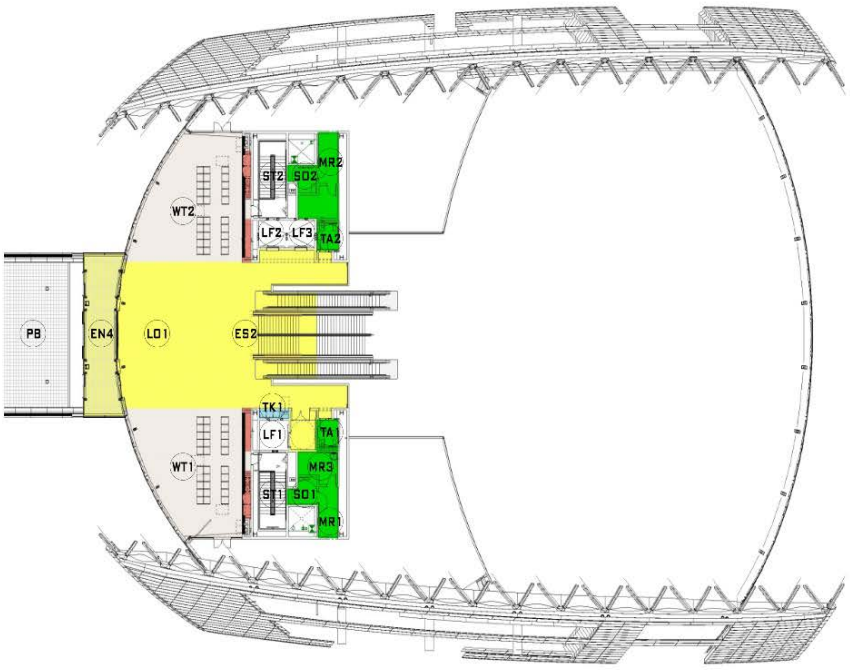
There are three main entrances (grey colour indication) on the ground floor that mainly serve the vehicular ingress and egress. The current ground floor plan contains six colour indication for part of the transit terminal. For the yellow colour indication that for the circulation in the transit terminal, red colour indicates that for the commercial tenant space, the orange color

indication of the landscaping area, the grey color indication of the lobby and waiting area, the blue color indication for ticket counter, and last is the green color transportation operation.



WT1 =WAITING AREA 1	RS1 =RESTAURANT 1	MO1 =MANAGEMENT OFFICE 1	TA1 =TOILET 1	MR1 =MECHANICAL ROOM 1	DL =OFFICE LOBBY
WT2 =WAITING AREA 2	RS2 =RESTAURANT 2	MO2 =MANAGEMENT OFFICE 2	TA2 =TOILET 2	MR2 =MECHANICAL ROOM 2	DS =DISCUSSION ROOM
EN3 =ENTRANCE 3	ES1 =ESCALATOR 1	SP1 =STAFF PANTRY 1	LF1 =LIFT 1	MR3 =MECHANICAL ROOM 3	MM =MEETING ROOM
SO1 =STORE 1	ES2 =ESCALATOR 2	ST1 =STAIRCASE 1	LF2 =LIFT 2	ER1 =ENGINEER ROOM 1	SC =SECURITY ROOM
SO2 =STORE 2	LO1 =LOBBY 1	ST2 =STAIRCASE 2	LF3 =LIFT 3	ER2 =ENGINEER ROOM 2	CC =CCTV ROOM

Figure 4: First Floor Plan Indication,



WT1 =WAITING AREA 1	MR1 =MECHANICAL ROOM 1	TA1 =TOILET 1		
WT2 =WAITING AREA 2	MR2 =MECHANICAL ROOM 2	TA2 =TOILET 2	PB =PASSANGER BRIDGE	
EN4 =ENTRANCE 4	MR3 =MECHANICAL ROOM 3	LF1 =LIFT 1	TK1 =TICKET COUNTER 1	
SO1 =STORE 1	ES2 =ESCALATOR 2	LF2 =LIFT 2	ST1 =STAIRCASE 1	
SO2 =STORE 2	LO1 =LOBBY 1	LF3 =LIFT 3	ST2 =STAIRCASE 2	

Figure 5: Mezzanine Floor Plan Indication,

5.1 Tourist Circulation

Figure 6, tourists have a generally straightforward flow that begins from the car drop off or bus terminal. Their access to the transit terminal has three entrance (EN1-EN3). The terminal lobby (LO1), fluidly linked to the ticket counter (TK1-TK2), cafe (CA1-CA2), restaurant (RS1-RS2) and access way to the first-floor level that lifts (LF1-LF2), escalator (ES1) and staircase (ST1-ST2).

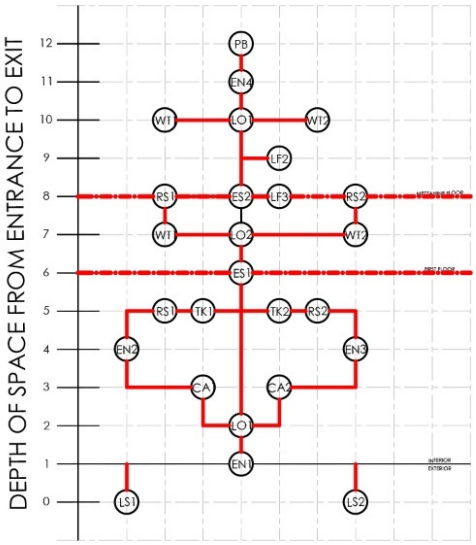


Figure 6: Measurable scale graph for tourist circulation

At the first floor level the tourist needs to through by lobby 2 (LO2) and their can to waiting area at (WT1-WT2) and restaurant (RS1-RS2) also can get the ticket at the counter ticket (TK1). After getting the confirmation for a travel document, the tourist will go through the escalator 2 (ES2) to go mezzanine floor to departure. That have lobby (LO1) or waiting for the area (WT1-WT2). Some tourists can use the lift (LF1-LF2) facilities to shorten the walking step distance.

5.2 Terminal Staff Circulation

Through Figure 7, the terminal staff work at the first-floor level. Only the specific staff like a receptionist who works at the ticket counter (TK) located at the terminal lobby 1 (TL1). They will enter via the entrance through by escalator 1(ES1) it is connected to terminal lobby (TL1) or management office (MO1-MO2) where the staff that duty at ground floor level.

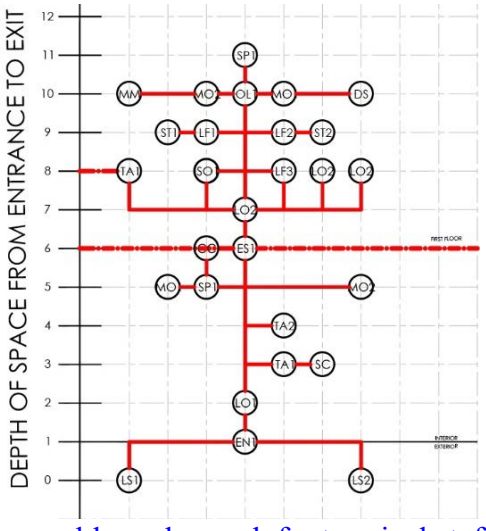


Figure 7. Measurable scale graph for terminal staff circulation

The staff can use the lift (LF1) or staircase (ST1-ST2) to going to the office space upstairs. The terminal staff like administration have their own office space at this first-floor level. At the first-floor terminal lobby (LO2), there are three branches directly to the office space (MO). The office lobby (OL) located at the end of the building was also located the high management office (MO1-MO2), discussion room (DS) and meeting room (MM).

The architect-designed the management office must have a high depth permeability space where the high-ranking officers work there and the staff that deals with tourists or passengers must have a low-depth permeability and be close to the terminal lobby. The primary circulation, especially for the international gate where the foreign enter and out of the country, must be through the standard operating procedure.

6 Discussion

There are categories of visitors and users (Purpose of Visit) who visiting Anaheim Transportation. Method for categorising them will relate to the function of Anaheim itself closely. First, Anaheim Transportation is mainly designed to cater to "Transportation". Transportation can be closely linked to the bus, LRT, taxi, and monorail, which involve public space. Visitors who come for such a transit often have a specific direction while walking in Anaheim. They will direct themselves toward the transit area based on the entrance indication after entering the building. However, wayfinding is very different for the transit such as organising a transit for a particular transit.

Such transit often encourages the visitor to move around Anaheim's internal layout. The level of permeability is often hardly able to apply due to different motives having. Commonly terminal will maximise the functional spaces as much as possible. It is tough to control the visitor movement while there are multiple entrances around Anaheim. High visitor volume usually will affect human change also. Most visitors often like to find the shortest travel distance to travels within the building. However, the third phenomenon often happens to the visitor who travels to Anaheim Transportation to visit the offices or the office workers. We can find multiple organisation office within Anaheim such as Terminal Lrt and office are located around the first floor. The visitor often moves from one to another due to all circulation on the ground floor. Ground floor plan circulation often makes the visitors confuse for the direction.

6.1 Wayfinding in the Ground Floor

Ground floor layout presented in a high ceiling and big space designs. The visitor must go through many tiers of the compartment to reach their destination. The overall experience of the ground floor given for the visitor is very appropriate due to the reasons mentioned. The circulation will lead to the back of the house quickly.

6.2 Wayfinding in the First Floor

The visitor who settles their activity on the ground floor can get ES1 to go straight to the first floor. The first floor has a direct and straightforward wayfinding for office and waiting area. However, a visitor who came for the counter ticket and entrance can relax and chill on the first floor. The overall user experience for the first floor is slightly better, and it has felt welcoming in the way of the design approach.

6.3 Wayfinding in the Mezzanine Floor

The mezzanine floor has straightforward wayfinding for waiting area because from the first floor, and the visitor goes straight to entrance(EN4) to get the LRT, monorail, and bus. However, a visitor who came from the first floor has nothing to do the mezzanine floor just only for departure.

Having studied space syntax analysis on the indoor arena of the Anaheim Transportation, California, the summarised result is given in Table 1.

Table 1: Summarised permeability result of Anaheim Regional Transportation Intermodal Centre, California

Element	Very easy	Easy	Neutral	Hard	Very hard
Ground Floor	✓				
First Floor		✓			
Mezzanine Floor			✓		

7 Conclusion

This paper mainly focuses on the space syntax for the case study the Anaheim Regional Transportation Intermodal Center (ARTIC), USA. Method of utilizing information to form color zone for each floor. The Likert scale method is used to present the research finalist, which justifies the wayfinding and permeability of the ARTIC. This paper's finding shows that wayfinding in the ARTIC is very easy for the ground floor, easy for the first floor, and neutral for the mezzanine floor. Based on the outcome, the ARTIC round spatial arrangement is somewhat supportive for the visitors to seek wayfinding, even though some areas are narrow and dense not suitable to cater to the large volume of visitors.

8 Availability of Data And Material

All information is incorporated in this article.

9 Acknowledgement

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Ahmad Afiq Md Noor is a postgraduate student from the Master of Architecture Programme at the School of Housing, Building and Planning, Universiti Sains Malaysia (USM), Penang, Malaysia.He obtainedhis degree in Bachelor of science(Hons) in Architecture at School of Housing Building And Planning (HBP),Universiti Sains Malaysia(USM),Penang,Malaysia, and Diploma in Architecture at Politeknik Merlimau Melaka (PMM),Melaka.

Dr.Yasser Arab is an assistant professor at the Department of Architectural Engineering, College of Engineering, Dhofar University, Oman. He obtained his Bachelor of Architecture from Ittihad Private University, Aleppo, Syria. He obtained his Master's and PhD in Sustainable Architecture from Universiti Sains Malaysia (USM), Penang, Malaysia. His research focused on the environmental performance of Residential High-Rise Buildings' Façade in Malaysia. He is a Registered Architect in the Syrian Engineers Union. He is very active in research and publication, he published about 70 journal papers, book chapters, and conference proceedings.

Professor Dr. Ahmad Sanusi Hassan is a Professor in Architecture Programme at the School of Housing, Building and Planning, Universiti Sains Malaysia, Penang, Malaysia. He obtained a Bachelor and Master of Architecture degrees from University of Houston, Texas, USA, and Doctor of Philosophy (PhD) degree focusing on Sustainable Architecture and Urban Design Development for Southeast Asia from University of Nottingham, United Kingdom.

Dr.Hilary Omatule Onubi is a Post-doctoral research fellow in Housing, Building and Planning of the Universiti Sains Malaysia, Penang, Malaysia. He obtained his PhD and MSc. degrees in Construction Management from the Universiti Sains Malaysia and Ahmadu Bello University Zaria, Nigeria respectively, and a BSc degree in Building from the University of Jos, Nigeria. Research focuses on Sustainable Construction.

Dr. Ir. Joesron Alie Syahbana is an Associate Professor at the Department of Urban and Regional Planning, Faculty of Engineering, Diponegoro University. He got his Engineering degree in Urban and Regional Planning and Master's degree in Industrial Engineering and Management from Bandung Institute of Technology, Bandung, Indonesia, and his Doctorate degree in Architecture and Planning from Gajahmada University, Yogyakarta, Indonesia. His research focuses on urban Development Management, Social Planning and Spatial Planning.

Bhattraradej Witchayangkoon is an Associate Professor of Department of Civil Engineering at Thammasat University. He received his B.Eng. from King Mongkut's University of Technology Thonburi with Honors. He continued his PhD study at University of Maine, USA, where he obtained his PhD in Spatial Information Science & Engineering. Dr. Witchayangkoon interests involve Applications of Emerging Technologies to Engineering.

Maryam Saeed is a practicing architect and lecturer at the Department of Architectural Engineering, Dhofar University, Sultanate of Oman. She obtained her Bachelor of Architecture from the University of Greenwich and her Masters of Fine Arts in Design from Sheffield Hallam University, the United Kingdom. She is a researcher in Architecture, design and computation, centering her studies and professional practice on the Digitalization of Heritage and Generative Design Methodologies.