ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8

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

http://TuEngr.com

A Study on Kevin Lynch's Urban Design Elements with a Case Study at Taman Seri Juru in Simpang Ampat Town of Penang

Zhin Yang Lau[1], Xian Yi Tan[1], Yasser Arab[1*], Ahmad Sanusi Hassan[1], Puttipol Dumrongchai[2], and Anita Ratnasari Rakhmatulloh[3]

[1] *School of Housing, Building & Planning, Universiti Sains MALAYSIA.*

[2] *Department of Civil Engineering, Faculty of Engineering, Chiang Mai University, 50200, THAILAND.*

[3] *Department of Urban and Regional Planning, Faculty of Engineering, Diponegoro University, INDONESIA.*

**Corresponding Author (Tel: +60-14242-6181, Email: yasserarab2005@yahoo.com).*

Paper ID: 12A6A

Volume 12 Issue 6

Received 01 October 2020
Received in revised form 09 March 2021
Accepted 15 March 2021
Available online 24 March 2021

Keywords:
Garden City; City path; Urban planning; Landmark element; Lynch's elements; Mental image; Edge element; Mind mapping; Urban development; Residential development; Urban elements.

Abstract

This study discusses and identifies urban design elements at Taman Seri Juru, Simpang Ampat, Penang. This study is to comply with the five approaches which were proposed by Kevin A. Lynch, i.e. paths, nodes, edges, landmarks, and districts by using Mental mapping. The qualitative method was applied to collect the information and data from the book and online resources, site visits, simulation, and interviews to ensure that the data is accurate and valuable. The study's analysis shows that all the urban design elements are essential for shaping this township's image. In contrast, the 'Garden City' concept is expressed through the buildings' arrangement on almost every district with a path. The path is the essential urban element in gridding the districts, while edges and landmarks complement each other well in the planning. Nodes do not play an essential role as the plan of the site is lacking nodes. The urban design elements are organised with urban planning development in shaping the mental image of Taman Seri Juru, Simpang Ampat in Penang.

Disciplinary: Urban Design, Architectural Science.

Cite This Article:

Lau, Z. Y., Tan, X. Y., Arab, Y., Hassan, A. S., Dumrongchai, P., and Rakhmatulloh, A. R. (2021). A Study on Kevin Lynch's Urban Design Elements with a Case Study at Taman Seri Juru in Simpang Ampat Town of Penang. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 12*(6), 12A6A, 1-13. http://TUENGR.COM/V12/12A6A.pdf DOI: 10.14456/ITJEMAST.2021.106

1 Introduction

This paper aims to study the urban design elements of a case study in Taman Seri Juru, Simpang Ampat, Penang (see Figure 1). Urban design is the design of cities and towns, streets, and

spaces for the built environment. The urban design also includes urban planning to create form, shape, and character in the built environment.

The study will identify the five urban design elements: paths, districts, nodes, landmarks, and edges stated by Kevin Lynch. "The Image of the City" by Kevin Lynch had studied well on urban design principles. The study used the method of mind mapping to analyses how people are orienting themselves in the city. People recognise and organise urban design elements into coherent ways of wayfinding (de Lange, 2009). A good layout plan will help the user be more direct and precise whenever they move toward a destination (Yasin et al., 2017). Besides that, Howard (1902) started the concept of the garden city in the United Kingdom. Garden city is an urban planning method. A self-sustained community is surrounded by green belts, aiming to capture the primary benefits from the rural environment and urban environment (Howard,1902). Hence, this paper determined the urban design elements in Taman Seri Juru, Simpang Ampat, Penang and measured the efficiency of urban planning elements used in urban planning.

This work evaluates urban design elements' quality depending on urban design elements to make the urban areas functional, lively, and attractive by connecting people and spots. The study aims to identify whether the site fully utilised the urban design elements on its usage and spaces' urbanity. The study also measures the quality of urban design fabrics with their space characteristics.

2 Literature Review

The urban space is one of the qualities concerns. It generates the opportunity to ease the people to use and understand the built environment and extensively adapted to finding a way to go through. The urban space can be enhanced through the implementation of townscape elements and landscapes. The sense of the urban design elements from Lynch (1981) describes five physical elements to form a city image: the criteria of edges, nodes, paths districts, and landmarks. Appealing value, purposeful, and structural is vital for the leading urban design principal for planned a city (Moughtin, 1999). The development of urban patterns allocated different ethnic groups into partial settlements according to the divide and rule concept (Hassan 2017).

2.1 Urban Design Elements

2.1.1 Paths

According to Kevin Lynch (1960), the path is the most important urban design element as it formed a cohesive network arrangement of people and a city's environment. The city paths meant not to be confused or disorder people to achieve a vibrant city image. The internal part that appeared by the path pattern is grating. It includes the connection of arterial roads, highway, and collector roads that may consist of few access or entrances within the sites in place according to the British colonial rule planning divide (Hassan, 2014). While paths can be considered the utmost vital elements in urban design, they formed the urban flexibility for people to transport from one to another (de Lange, 2009). The path appearances to support the image of settlements, such as directional quality, continuity, and identifiable.

2.1.2 Nodes

The significant spots in a city are where planned foci are known as elements of nodes. It is identified as the gathering point or attention point in a town. Nodes are separated into two physical elements: junctions of a path or plaza and point to the town people with planned foci. (Hassan, 2010). Well identifiable nodes, formed by continuous and remarkable architectural elements. Nodes on the main roads create better efficiency movement compared to the nodes located away from main roads.

2.1.3 Districts

District characteristics are similar to discrete visual identities from urban design components: material, texture, and building form. (Lynch, 1960). The observers on the parts of districts can ensure thematic continuity. Unique features in identical regions are represented as a well-design city. Numerous regions are connected by the edges, such as shoreline, roads, or seamless boundaries between various regions by public users about the continuity, improving the urban design city image.

2.1.4 Edges

Based on Dalton and Bafina (2003), the edges as an element in the topological boundaries allow a spectator to locate themselves in this area. The definition of borders is segregated into two zones or districts by a sharp distinction in a linear way. Simultaneously, the zone's compactness can create a diverse sense of place on a massive scale for a particular area. The category of edges is in natural forms and physically.

2.1.5 Landmarks

The sense of the place in an area possibly will be enhanced through landmarks. The definition of understanding of the site also has belonging senses that within a particular environment or location, conceivably due to social relatives (Low and Altman,1992). A point for reference while physical elements guide and orient people, is known as landmarks, and from the exterior, it has outstanding visual features. Foltz (1998) stated the characteristics of dominance, important, significant, and vivid location. Based on Lynch (1960), the essential cues of the landmarks act in the wayfinding method in the city is its legibility. The determination of a decent milestone is their outstanding ability towards the surroundings by strengthening the sense of place, elements of the location, and its characteristics, including size, visibility, height, and colour in a city.

2.2 Background of the Case Study: Taman Seri Juru, Simpang Ampat

Taman Seri Juru is a residential neighbourhood strategically located within the established township of Juru and next to Bukit Minyak Industrial Park, about 15 minutes driving to Penang 1st Bridge. Juru is within the Simpang Ampat postal area. It is a Chinese new Village and includes industrialised areas in Bukit Tengah and Bukit Minyak and Kampung Bagan Nyior, Kuala Juru, Kampung Sungai Semilang, Kampung Bukit Kecil and Kampung Tok Kangar. At the same time, the other neighbourhood housing estates are Taman Cendana and Taman Desa Juru. The Case Study in Taman Seri Juru is a housing scheme that moved into its third phase of development, including 200

units of 2-story terrace houses. Besides, rural urbanisation is another strategy applied in Taman Seri Juru, aiming to reduce congestion in metropolitan areas by channelling migration to these new towns. The environment of a new town, services, and facilities are introduced into rural areas to eliminate the social and economic inequalities between urban and rural inhabitants (Ngah et al., 2015). Figure 1 shows the critical plan and location plan of Taman Seri Juru, Simpang Ampat; the building is one of the complete developed garden cities in Penang mainland due to its strategic location. Figure 2 shows the ground plan of Taman Seri Juru, Simpang Ampat. It is mainly developed 2-story terrace houses within the residential district and eateries and mini markets in the commercial district. Also, the land-use patterns are changed inclined by the industrial decentralisation strategy (Hassan 2005). It provides the amenities and facilities for residents as well; Juru Sports Gymnasium Centre and Outdoor Playground are provided in the neighbourhood.

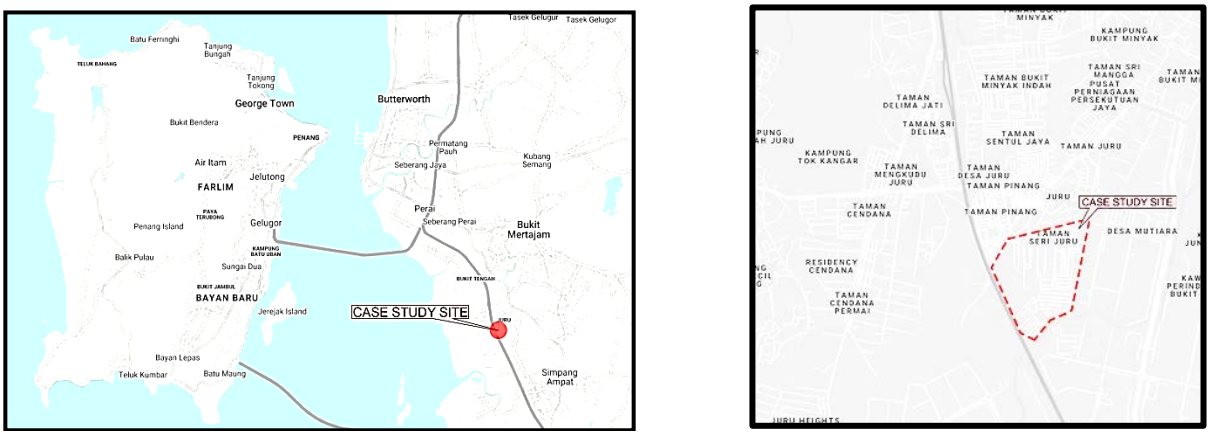

Figure 1. Key Plan of Pulau Pinang (Left) and Location Plan of Taman Seri Juru (Right), Penang, Malaysia. (Courtesy of Google map).

Figure 2. Layout Plan (Figure-Ground) of Taman Seri Juru, Simpang Ampat

3 Methodology

This research study uses qualitative research to study all the five urban elements in a township by referring to Kevin A. Lynch (1960) proposed, i.e. paths, nodes, edges, landmarks, and districts, using mental mapping analyses the Taman Seri Juru, Simpang Ampat township. The figure-ground plan (Figure 3) is used for site identification and data comparison towards the urban design elements of its quality. The aggregate information and data will attach with the related photos captured on-site by mapping the paths, edge, district, nodes, and landmarks by using Adobe Photoshop and AutoCAD software to generate a figure-ground plan section demarcate on all the

elements. Simultaneously, observation through visiting the site and google map ensures the information collects and identifies more precise and applied to the final results.

3.1 Path

The paths compare with identity on their width, accessibility, the length along the road, and popularity of usage. The width of the road will indicate the usage of the road with the hierarchy of the network. Besides, the number of entrances or access for the path will clearly show the density of traffic. The precise information can be collected to categorise the roads for analysis purposes through the observations on the path and interviews towards the residents. To gather the information in this site can identify the path through the map, figure-ground plan, and a site visit to categorise the type of roads, entrance to the site, and the access path. The category of arterial roads, collector roads, local roads cul-de-sac, and end roads, cycling lanes, pedestrian walks, waterways, or railway is applicable. With that, the identity in a hierarchical order of path includes widths and lengths.

3.2 Nodes

Based on Lynch (1960), nodes are connected with junctions or intersections of space. Nodes in Taman Seri Juru, Simpang Ampat, are determined based on their function, attraction, uniqueness, and popularity. It is often placed where people gather and meet, such as road or street junction. Thus, identifying the nodes by interviewing the locals or the pedestrians nearby would be the best alternative to identify the nodes. Identify in a hierarchical order of nodes with size, area, percentage, and activity types.

3.3 Districts

Each zone of the building usage can identify districts. According to the commercial district, small industrial district, and residential district, few classifications need to be identified. By doing observation through the map, the figure-ground plan a site visit to determine the area. The district quality and the building numbers can also define by following the further indication of existing zoning in the site coverage boundary consisting of residential Semi-D, Bungalow, two Storey Terrace, Industry Building, and Commercial Shophouses. With that, identity in a hierarchical order of districts with the area.

3.4 Edges

Edges are determined with a distinct edge, edge typologies, overlapping edge, and amorphous edge. Next, edges essential characteristics are differentiated with opaque, permeable, and transparent, also act as an essential role for edges quality evaluation and identification township formation. The method to identify edges is to observe and identify the edges and number of edges available in the site with hierarchical order, including height, width, and length, where information is subject to relevant results.

3.5 Landmarks

Landmarks can be done by built masses in the town and recognised objects through determination. Site observation identifies the building types by attached case study site images towards a place recognised and supervisory. The type of building's landmarks can be identified through interviews with the local's citizen within the case study area; this is to identify the landmarks' criteria of its length, width, height, area, and volume of the building.

4 Results and Analysis

4.1 Path

4.1.1 Arterial Roads

There is the main freeway to access Taman Seri Juru arterial road, Jalan Perindustrian Bkt Minyak 1, which connects to a few hallways, Lorong Seri Juru 1, Jalan 6 and Jalan Seri Juru. Taman Seri Juru can be reached by the north-south express (toll road), head to Jalan Kebun Nenas and continue to Jalan Bukit Tengah, follow by Jalan Perindustrian Bukit Minyak to enter the main arterial roads of Taman Seri Juru, Jalan Seri Juru The main entrance to the site from Jalan Perindustrian Bkt Minyak is an only one of the arterial road with width 12m, length 640m.

4.1.2 Collector Roads

There are four collector roads within the site where the main collector road is Jalan Seri Juru, width 12m, length 780m. The secondary collector road, which is Jalan Enam width 12m, length 241m. Tertiary collector road, which is Jalan 6 width 12m, length 528m. While Quaternary collector road which is Lorong Seri Juru 1. width 12m, length 187m.

4.1.3 Local Roads

There are 30 local roads in this site where the hierarchical order is sequence follows from the Lorong Seri Juru 1 until Lorong Seri Juru 30. At the same time, all the local road is served with width 12m and has a varied length to each local road according to the number of units along each local road.

4.1.4 End Roads

There are four end roads on this site. The hierarchical order is the End road#1 is Jalan Seri Juru with width 12m, length 780m. Next, End road#2 is Lorong Seri Juru 1 width 12m, length 31m, and End road#3 is Lorong Seri Juru 4, width 12m, length 421m. Lastly, End road#4 is Lorong Seri Juru 5, width 12m, length 52m.

4.1.5 Pedestrian Walks

All the units surround the pedestrian walk. The comparative ratio on all pedestrian walkway width is about 0.5m to 1m, and the length measurement is by following along the lot unit or path.

4.1.6 Waterways/Canals/Rivers

There is a river on the south side of the side where is the end of the site. The river flows from east to west direction while the width is roughly 12-19m and the length of the river within site is 438m. The river's broad measure ratio varies as its organic flow and distances are continuous across the site. Table 1 and Figure 4 show the types of paths in the selected case study.

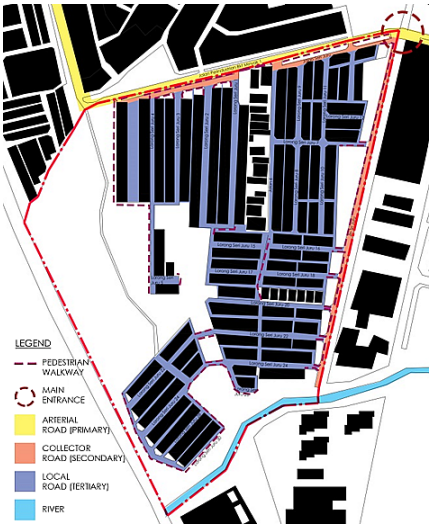

Figure 3: Ground plan for a case study of Taman Seri Juru each path

Table 1: Path detail in the study area.

Path	Number of paths	Width	Percentage	Length	Percentage
Arterial Roads	1	12m	2.37%	640m	6.14%
Collector Roads	4	12m	9.50%	1736m	16.67%
Local Roads	30	12m	71.27%	5268m	50.57%
End Roads	4	12m	9.50%	1284m	12.33%
Pedestrian Walks	30	0.75m	4.46%	1268m	17.17%
Waterways Boats	1	15.5m	3.07%	438m	4.2%

Figure 4: Captured images from google street map showing Taman Seri Juru paths.

4.2 Edges

There are three edges in this site: highway edges as the edges between the highway and the place, zoning edges as the road segregate the residential zone and the factory zone, and river edges are the edge that split the electric sub-station and the study site. The main boundary edge is highway edges shown in Table 2, height 1.5m between the two roads, 30m of buffer between two roads, length 708m. The secondary boundary edge is zoning edges, 18m of buffer between zone area, length 815m. Tertiary boundary edges are river edges, height roughly 9m, the 30m-40m buffer between river and site units, length 434 m (Figure 5).

Figure 5. Figure-ground plan for a case study of Taman Seri Juru each edge.

Table 2: Edge types and details in the study area.

Edge	Number of edges	Width	Percentage	Length	Percentage
Main Edge	1	30m	39%	708m	36.2%
Secondary Edge	1	18m	23.4%	815m	41.57%
Tertiary Edge	1	29m	37.7%	434m	22.23%

4.3 Districts

There are three main districts in this site, as shown in figure 6 and 7: residential district, commercial district, and small industry district. The most dominant district is a residential district, followed by commercial and small industrial districts because of its district area. The residential district consists of 61.6 acres of land size. It is the primary district of the site. The residential district can further separate into Bungalow, one-story Semi-D, two-story Sem-D, one-story terrace, and two-story terraces. The buildings' height is not more than 10m, and the majority of the residents are Chinese since Taman Seri Juru is near the Juru New Chinese Village. While the secondary district is a commercial district, it consists of 4.6 acres of land size. The building types of the commercial district is two-story shophouses with 10m height. The shophouses' majority is a restaurant and mini-market.

Further, the small industry district is the tertiary district of the site; it only consists of 3.8 acres of land size (Table 3). A few small industrial buildings are located in the small industry district since the site is nearby the Industrialised area of Bukit Minyak. The height of the industry building is 12m.

Table 3: District detail in the study area.

Districts	Residential District	Commercial District	Small Industry District	Total
Area (acres)	61.6	4.6	3.8	70
Percentage (%) to the total land size	88	6.6	5.4	100

Figure 6: Ground plan for a case study of Taman Seri Juru in each district.

Figure 7: Images captured from google street map to show Taman Seri Juru district.

4.4 Nodes

There is only one node on the site, the outdoor playground of Taman Seri Juru (Figure 8); it functions as an outdoor leisure place and public park for residents of Taman Seri Juru (Figure 9). There is provided with outdoor exercise facilities and a sitting area for the public. Based on the resident's interview, Taman Seri Juru usually has exercise at the playground during morning and evening, lacking covered and shaded by the tree. The site lacks nodes where people meet and gather, such as open areas, plazas, and markets. Although the site's design planning is well planning in a grid system, the street junction and road cannot be considered nodes of the site since there are not happening on the site (Table 4).

Figure 8: Ground plan for a case study of Taman Seri Juru each node.

Table 4: Node information

Node	Size (W x L)	Area	Percentage	Activity Type	Level of Socio-Activity
Node 1	70m x 56m	3900m^2	-	Outdoor Playground	Satisfactory

Figure 9: Taman Seri Juru Node

4.5 Landmarks

The hierarchical order of landmarks is Restaurant Xing Seong Yuan and the Corrupet Packaging Sdn Bhd and Juru Sports Gymnasium Center (Table 5). Restaurant Xing Seong Yuan is considered a primary landmark. Restaurant Xing Seong Yuan started its business in 2001, provide around 20 food stalls. Restaurant Xing Seong Yuan is also considered a well-known restaurant to the locals due to its strategic location and delicious food. The majority of their customer are Chinese residents and non-Muslim workers of industry nearby during lunchtime. It consists of 2 units of shophouses and 496m^2.

Moreover, it is located at the main entrance of Taman Seri Juru; it is also easy to find by outsiders. Simultaneously, Corrupet Packaging Sdn Bhd is an industrial building in Taman Seri Juru since 2002 and is considered the site's secondary landmark. It has an 18years history on the site and is easy to recognise since it is the highest building with 12m height among the residential housing. Every day more than five lorries are delivering the stuff from the industry and more than 30 workers. Juru Sports Gymnasium Centers is a tertiary landmark of the site. It is located at the main entrance of Taman Seri Juru, and its building type is an industrial building with 12m in height. It is easy to recognise by outsiders due to its strategic location (Figures 10 & 11).

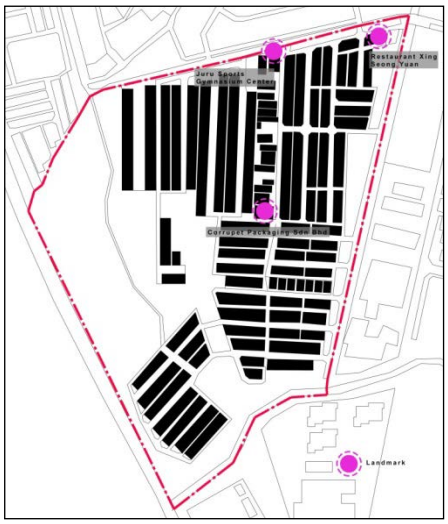

Figure 10. Figure-ground plan for a case study of Taman Seri Juru each landmark.

Table 5: Landmark comparisons.

Landmark	Length (m)	Width(m)	Height(m)	Area(m^2)	Volume(m^3)	Level of Dominance
Restaurant Xing Seong Yuan	22.5	22.2	10	496	4960	Very Good
Corrupet Packaging Sdn Bhd	40.4	28	12	1130	13560	Good
Juru Sports Gymnasium Center	41	24	12	972	11664	Satisfactory
Total	103.9	74.2	34	2598	30184	Good

Figure 11: Captured images from google street map showing Taman Seri Juru landmarks.

5 Discussion

The path element is the best category by comparison with other elements. The highest percentage in the table metrics among the path is local roads, and the lowest percentage is waterways boats. The result shows that most road width is 12m and the length of the road is within 438m and 5268m. While the road is a good plan that consists of most road types and lacks the same pedestrian-friendly road as the pedestrian is not connected in every path.

The overall result by analysis, the edges' element is the medium category. The highest percentage in comparisons of edges is a secondary edge known as zoning edge, which the length is 81 m in 41.57%. Simultaneously, the lowest percentage of the edge is the tertiary edge known as the river edge, which is only 434m in 22.23%. While the benefit is there having water elements, although there is a highway beside which creates noise to residents.

According to the overall result, the element of the district is the satisfactory category. The highest percentage in comparison of districts is Residential District, and it consists of 61.6 acres of land size. It is the site's primary district, and the residential district can further separate into Bungalow, one-story Semi-D, two-story Sem-D, one-story terrace, and two-story terrace. Moreover, they are followed by the commercial district, which is the second district and consists of 4.6 acres of land size. The building types of the commercial district are two-story shop houses with 10m height. While the lowest percentage in comparing districts is the Small Industry District, it only consists of 3.8 acres of land size.

Based on the overall result, it shows that the element of nodes is the weakest category. There is only one node on the site, which is the outdoor playground of Taman Seri Juru. The site lacks nodes where people meet and gather, such as open areas, plazas, and markets. Although the site's design planning is well planning in the grid system, the street junction and road cannot be considered nodes of the site since there are not happening in the place. The site is encouraged to enhance and create the nodes to make the site livelier and celebrating.

As can be seen from the overall result, the element of landmarks is the medium category. The hierarchical order of landmarks is Restaurant Xing Seong Yuan and the CorruPET Packaging

Sdn Bhd and Juru Sports Gymnasium Center. Each landmark has a strategic location in the site and history to make them easy to recognise by outsiders and residents.

6 Conclusion

Urban design elements in Taman Seri Juru, Simpang Ampat has been analysed after the qualitative method and analysis. This study finds that the five urban design elements - paths, nodes, districts, landmarks, and edges are essential in shaping this township's image. The hierarchical order of urban design elements in Taman Seri Juru is paths, districts, edges, landmarks, nodes. Overall, the outcome result of urban design elements shows that the highest percentages element is the path. The total ratio of paths within the site is the most use. The path is the most important element in planning the township into a grid system in which buildings are separated into different districts in high clarity. While the lowest percentages of the urban design elements are nodes as the study that the nodes in the site coverage are very minimum and not dominant throughout the site. The site is lacking nodes where people to meet and gather. Using a drone to capture site photos can generate 3D to show the height and multilayer elements. An online survey form may help understand the local culture, history, and latest changes of the site. It is possible to do a simulation with traffic software to understand each element's density and depth.

7 Data Availability Statement

The data for this study can be available upon a request made to the corresponding author.

8 Acknowledgment

This study is financially supported by Bridging Grant, Number 304.PPBGN.6316521.

9 References

Altman. I., Low. S. (1992). Human behavior and environments. *Advances in theory and research, V.12, Place attachment*, Plenum Press, New York.

Dalton, R, Bafna, S. (2003). The syntactical image of the city: A reciprocal definition of spatial elements and spatial syntaxes. In *Proceedings of the 4th International Space Syntax Symposium London.*

de Lange, M. (2009). Review: Kevin Lynch – The Image of the City. http://themobilecity.nl/2009/05/08/review-kevin-lynch-the-image-of-the-city Retrieved May 2017.

Foltz, M. A, (1998*). Designing Navigable Information Spaces*. M.S. Thesis, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology.

Hassan, A. S. (2005). Konsep Rekabentuk Bandar di Semenanjung Malaysia: *Kuala Lumpur dan Bandar-Bandar di Sekitarnya*. Penang: USM Press.AWG Publishing.

Hassan, A. S. (2010). *Fishing Villages: Resemblance of Pre-colonial City Landscape at the Straits of Malacca in Peninsular Malaysia*. The Arab World Geographer, 13(2), 93-107.

Hassan, A. S. (2014). *Siri Syarahan Umum: Ke Manakah Hala Tuju Reka Bentuk Bandar dan Seni Bina Kita?* Penang, Universiti Sains Malaysia.

Hassan, A. S. (2017). *Amalan Tebusguna Tanah, Reka Bentuk Bandar dan Seni Bina di Malaysia*. Penang: USM Press.

Howard, E. (1902). *Garden cities of to-morrow*. London: *Swan Sonnenschein & Co.*

Lynch, K. (1960). *The Image of the City*. Massachusetts: The MIT Press.

Lynch, K. (1986). The Image of the City. Boston: MIT Press.

Moughtin, C. (1999). Urban Design: *Method and Technique. Massachusetts: Architectural Press.*

Ngah, K., Rahman, M.F.A., Zan, Z.M., Zakaria, Z. (2015). Development pressure in south west district of Penang: Issues and implications. *Procedia-Social and Behavioral Sciences, 211,* 429-436. DOI: 10.1016/j.sbspro.2015.11.056

Yasin, N.M., Hassan, A.S. & Al-Ashwal, N.T. (2017). Investigation of mental mapping in urban design: Case of Queensbay, Penang. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 8*(4), 261-273.

Lau Zhin Yang is a postgraduate student of Master of Architecture in University Sains Malaysia. He received his Bachelor of Architecture from theUniversity of Malaya. Zhin Yang's interests include housing development design and urban planning design.

Tan Xian Yi is a postgraduate student of Master of Architecture in University Sains Malaysia. He received his Bachelor of Architecture from the University of Malaya. Xian Yi's interests include housing development design and urban planning design.

Dr. Yasser Arab is a Senior Lecturer at Universiti Sains Malaysia. He obtained his Bachelor of Architecture from Ittihad Private University, Aleppo, Syria. He obtained a PhD in Sustainable Architecture from Universiti Sains Malaysia (USM), Penang, Malaysia. His research focused on the Environment Performance of Residential High-Rise Buildings' Façade in Malaysia.

Professor Dr.Ahmad Sanusi Hassan teaches at Architecture Programme, the School of Housing, Building and Planning, Universiti Sains Malaysia (USM), Penang, Malaysia. He obtained a Bachelor and Master of Architecture degrees from the University of Houston, Texas, the USA, and a Doctor of Philosophy (PhD) degree from the University of Nottingham, UK. His research focuses on Sustainable Architecture and Urban Design Development for Southeast Asia, history and theory of Architecture, Computer-Aided Design (CAD), and Computer Animation.

Dr.Puttipol Dumrongchai is an Associate Professor at the Department of Civil Engineering, Chiang Mai University. He received his B.Eng. from Chulalongkorn University, and an MS degree in Spatial Information Science and Engineering from the University of Maine, USA. He continued his PhD study at the Ohio State University USA, where he obtained his Ph.D. in Geodetic Science and Surveying. Dr. Dumrongchai's interests involve Local Geoid Determination, Terrestrial and Airborne Gravimetry, Physical Geodesy, and Geodetic Applications.

Dr.Anita Ratnasari Rakhmatulloh is an Assistant Professor and Researcher at the Department of Urban and Regional Planning, Faculty of Engineering, Diponegoro University Jl. Prof. Soedarto, SH, Tembalang, Semarang, Jawa Tengah, Indonesia. Her research is Spatial and Transportation Planning.

Note: The origin of this article was reviewed, accepted, and presented at the 5th International Conference on Sustainable Architecture and Urban Design (ICWSAUD 2020) (Virtual Conference), a Joint Conference with the 5th International Conference on Engineering, Innovation, & Technology (ICEIT 2020) held by the School of Housing Building and Planning, Universiti Sains Malaysia, Pinang, Malaysia during 22-23 September 2020.