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LINKING GREEN URBANISM WITH WALKABILITY: the city of Alor Setar, Malaysia

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Abstract

The rapidity of urbanisation due to global capitalisation has caused lopsided and uneven development in many types of cities the world over. The uncontrol and unbalance development habitually initiated tribulations of environmental, social-cultural and economic problems. In Malaysia, this phenomenon has become apparent, especially in medium-sized cities. The concentration on vertical-physical development, roads and highways, and extensive business districts often disregard the human factors – the residents, workers and visitors. These cities failed to provide the quality urban environment for the urban living; poor accessibility and walkability for pedestrian mobility and lack of greeneries for a pleasant urban environment; and often disregard historical and cultural significance for monetary gains. The concept of Green Urbanism and its principals is a catalyst in solving the problems. This research focus on the overlapping of green urbanism with walkability at the Medium-sized City of Alor Setar is essential to sustain the long existence of Malaysian's medium-sized cities.

This research adopted a mixed-method research strategy to achieve the research aim and objectives. The research examines through literature investigations, the concepts of walkability and green urbanism for probable associations between the two concepts – the research strategy engaged in developing two indices for the appraisal of association. First, the Alor Setar Walkability Index (ASWI)– a walkability index to measure the extent of urban walkability, was modelled from the previous studies of walkability indices ranging from global, Asian and Malaysian indices. Second, the Alor Setar Green Urbanism Index (ASGUI)– an index to measure the level Green Urbanism quality that encourages urban walkability. ASWI was developed by examining the previous walkability indices. Dissimilarly, ASGUI required extended stages of Three-stages of Delphi Survey and validation process involving built environment experts. The final list of the index was subjected to a validation process to determine its robustness for application in the Medium-sized city in Malaysia. The purposive sampling of Semi-structured interviews was carried out among the built environment professionals and practitioners. Data gathered has helped in the identification of the themes of association between both concepts via thematic analysis. The validated indices were used on-site by chosen focus groups along designated routes at the city centre of the Medium-sized City of Alor Setar.

Statistical analysis was used in analysing all the obtained to identify factors of associations between walkability and Green Urbanism. The statistical analysis performed on both ASWI and ASGUI generated significant similarities. The research resolved that route with a high walkability score was also found to score the highest Green Urbanism Quality. A highly walkable city has a positive chain reaction; it stimulates lively street-level activities, thus increase public policing and security. Landscape, greeneries and shades are the encouraging factors to promote walkability. To build a town is to develop a culture. A town endowed with lush landscape, beautiful gardens, and bountiful biodiversity would encourage an outdoor lifestyle and a walking culture. People would be persuaded to walk when the pedestrian network is conveniently and efficiently integrated with the urban transportation system. Also, when the pedestrian network functions as green links between attractive public spaces.

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List of Abbreviations

Abbreviation	Description
ASWI	Alor Setar Walkability Index
ASGUI	Alor Setar Green Urbanism Index
MC	Medium-sized City
GUP	Green Urbanism Principles
GU	Green Urbanism
GUQ	Green Urbanism Quality
LDA	Lebuhraya Darul Aman
JTI	Jalan Tunku Ibrahim
JSB	Jalan Sultan Badlishah
JL	Jalan Langgar

Chapter 1

INTRODUCTION

1.0 Introduction

This research identifies the notion of linking Green Urbanism Principles (GUP) with Urban Walkability (UW) and was conducted in the context of Medium-sized City (MC) in Malaysia. The chosen city is Bandaraya Alor Setar, which is the state capital of Kedah Darul Aman. Although Alor Setar is the state capital, conferred the city title and function as the administrative centre, it is still considered as a medium-sized city due to the number of its populations, economic growths, developments and income (Ku Ismail, 2016; Ministry of Urban Wellbeing Housing and Local Government, 2017) as detailed under sub section 4.3.2 (pg. 78).

This chapter presents an introduction to the research, and it is divided into five sections, namely, first is the Introduction of the chapter and background of the study, the second section is Agenda of the Research, third is Scope and Limitation of the Research, the fourth section is Research Methodology, and the last section is the (Sanyal, 2013) Structure of the Thesis.

1.1 Background of the Study

The speed of urbanisation in developing countries is a major spatial outcome of global capitalism (Chen, Zhang, Liu, & Zhang, 2014; Peng, Chen, & Cheng, 2011; World Economic Forum, 2018). This uneven process leading to rural-urban imbalance, lopsided city hierarchy and housing segregation, degenerating social and economic inequalities across cities and towns (Chen & Parish, 1996; Findley, 1993; Kundu & Gupta, 2010; Linn, 1982; Moses Lomoro, Guogping, & John Ladu, 2017; Smith & London, 1990; Todaro, 1989, 1997). According to Datta (2006), lopsided development can be interpreted as uneven development, uncontrolled urbanisation, degradation of both environmental and the quality of urban life.

In Malaysia, medium-sized cities have always been to offer local goods and services to their usually small population and their respective neighbourhoods, as well as performing simple educational and administrative functions serving as collection points for agricultural produce from the villages (referring to small-scale vegetable plots/vegetable gardens) for distribution (Spasic & Petric, 2006). Recent development and expansion have, however, led to insufficient pedestrian networking and facilities – or what can be called 'walkability' - people are shunning away from these activities (Rhodes, Courneya, Blanchard, & Plotnikoff, 2007).

The increasing urbanisation displays the push and pulls factors associated with economic opportunities in big cities[1] in Malaysian (Phang & Tan, 2013). Young inhabitants of Malaysia's small towns and villages[2] are attracting to these fast-developed areas for job opportunities and the potential of improving their lives, thus out-migration from these places (Ang & Ang, 2018). Another reason for the out-migration was due to the dismissed of workers by employers that showed the increasing trend in Alor Setar (Table 1.1). Tables below (Table 1.1 - Table 1.4) exhibit the statistics of migrations and detailed classification from rural and small towns to urban/cities in Malaysia. Urban migration in Malaysia from 2009 to 2016 shows an increasing trend of more than 50% involving intra-state migration (Department of Statistics Malaysia, 2017).

Table 1.1 Number of Dismissed Workers Year 2012 – 2015

District	2012	2013	2014	2015
Alor Setar	74	286	185	904
Kulim	412	45	-	415

Note: The stated figures refer to the number of persons
Source: Department of Statistics Malaysia-Kedah (2015, pg.51)

In the case of Alor Setar, the intra-state migration involved two other towns, Sungai Petani and Kulim (refer Figure 1.1). These two towns are known for new township developments, hotels and resorts, and manufacturing and services industries which Alor

[1] Malaysia's big cities: The city population exceeds 500,000 and annual council income of RM100 millions and above (PLANMalaysia - Department of Town and Regional Planning Malaysia., 2011).
[2] Malaysia's Small towns and villages: The town population not exceeding 10,000 accommodating small scale commercial activities, public facilities and weekly activities - morning/agriculture markets, day/night markets (PLANMalaysia - Department of Town and Regional Planning Malaysia., 2011).

Setar lacks as displays in Figure 1.1. These two towns are well known for their industrial zones offering low tax and attracting many large international manufacturers on electronics, computers, solar energy, to name a few. Among the largest are Intel Corporation, SilTerra Semiconductors, Osram Opto Semiconductors, Showa Denko Corporation, First Solar Inc and many others (Kulim Technology Park Corporation, 2018). Other pulling factors for intra-state migration to Sungai Petani and Kulim are, both towns are closer to Penang International Airport and Penang Port which handles international cargo and shipping. The percentage of urban migration is shown in Table 1.2 below.

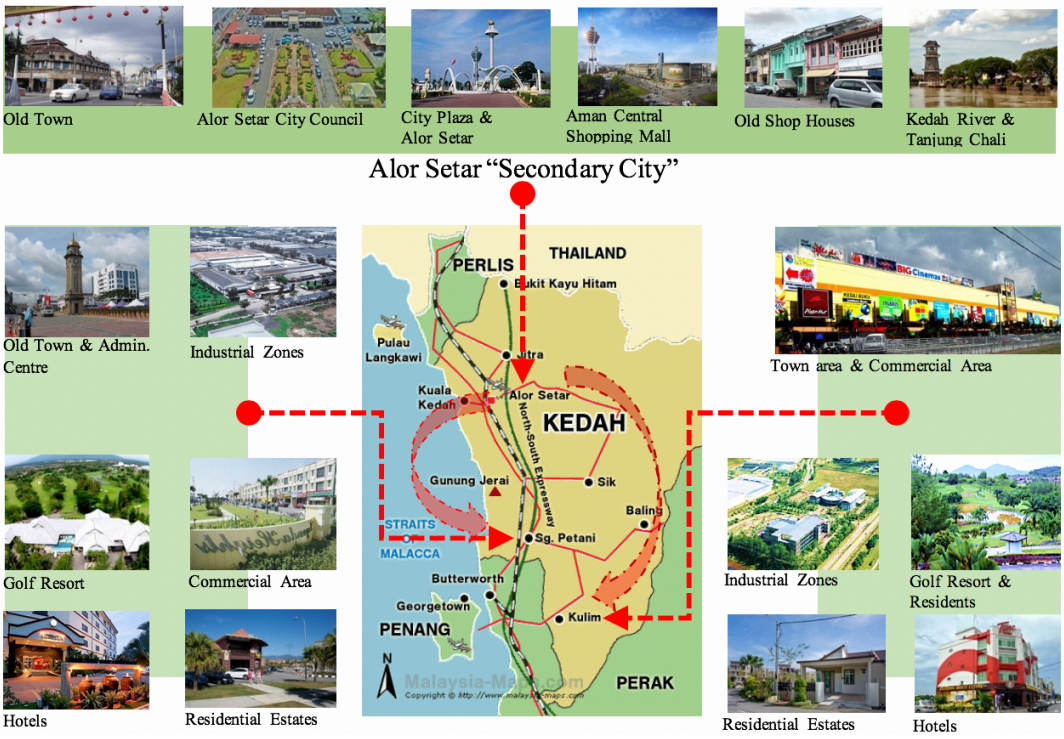

Figure 1.1 Sungai Petani and Kulim Towns: intra-state migrant towns

Table 1.2 Percentage of Urban Migration 2015-16

Year	2009-10	2010-2011	2015-16	Trend
Migrants Percentage	84.7%	86.6%	88.8%	Increase

Source: Department of Statistics Malaysia (2011, 2017)

Also, another pattern of migration in Malaysia from small town to major urban areas is influenced by decision-selectivity factors involving young generations to attain comfort and contentment in life (Rashid, 2019). Table 1.3 indicates the age group of 25-34 as the highest as this group often migrated for reasons of economic opportunities and carrier

advancement. Age group 1-14 and 15-24 with the percentage of migration 21% and 26.1% respectively were education-related migration. In Malaysia, pupils advance to secondary schools at the age of 13-18, and most of the excel students were offered a placement at public boarding schools throughout Malaysia. At the age of 19-25, most of them are in tertiary education in public and private universities away from their place of origin.

Table 1.3 Percentage of Migrants' Age Groups 2015-16

Age Range	1 - 14	15 - 24	25 - 34	35 - 44	45 - 64	< 65
Percentage	21%	26.1%	34.8%	10.9%	6.1%	1.0%

Source: Department of Statistics Malaysia (2017)

Malaysia was once reputable as an agriculture-based country, exporting rubber and palm oil. However, with the nation's aspiration into becoming a developed country with Vision 2020 and the latest Vision 2030, the agricultural industry is now being replaced with manufacturing, construction and services as stated in Table 1.4. Thus, explained the higher percentage of migrants associated in these industries.

Table 1.4 Percentage of Migrants' Industrial Classifications 2015-16

Industry	Agriculture	Mining & Quarrying	Manufacturing	Construction	Services
Percentage	6.6%	1.1%	17.1%	12.0%	63.3%

Source: Department of Statistics Malaysia (2017)

These MC may not be attractive enough to retain stable populations. However, they still have their unique characters and have the potential to encourage the economic development of stable communities. These towns also offer a platform for urbanisation with increasing economic activities (Mardiansjah, 2016; Spasic & Petric, 2006) plus as a pointer of modernization from as little as the advertisement of modern technology and offering IT-based services (McGill, 2018), the availability of modern infrastructure or even green infrastructure within the city (Shackleton et al., 2017; Tang & Lee, 2016) to a more prominent role as a window to modern trade of national and international level (Roberts, 2014).

A town, in general, must be made safe, comfortable and pleasant for its inhabitants and visitors alike to frequent and experience the cities' unique characters, values and assets at street level. The concept of the walkable city is beyond the idea of connecting the origin to destination, but it has enveloped the whole premise of 'the environment where the

journey is taking place'. The subjects of safety, comfort and pleasantness are variables which according to (Krambeck & Shah, 2006) are inclusive in the three parameters of a walkability index: 1) Safety and Security; 2) Convenience and Attractiveness, and 3) Policy Support. Simultaneously these parameters need to be studied further in order to determine the magnitude of accessibility and the application of GUP in creating a sustainable, safe and comfortable and high quality of life for the city's inhabitants.

Apart from small towns and villages, medium-size cities are experiencing population decline due to economic migration (Cox & Longlands, 2016), while the absence of walkable streets creates an unsustainable urban setting for daily economic, social and environmental performance (Sanyal, 2013). The opportunity exists to manage and design the streets of the MC to encourage the economic prosperity of these towns. Simultaneously, promotes the healthy lifestyles to existing and new inhabitants as part of a broader programme of sustainable development/smart growth. Henceforth, there are potentials of solving or minimising the hollow-effect of the MC due to out-migration.

The concentration for development in big cities have had reached the saturation point, thus the need of expanding to neighbouring towns, to what popularly known as satellite towns (Pojani & Stead, 2015; Samutina & Zaporozhets, 2015). Transportation planning, urban design, and pedestrians design and planning have evolved over the past century along distinctly different tracks. According to Southworth (2005), the current urban design trends are focusing on creating distinct experiential qualities of the built environment at small to medium scale. However, transportation planning is seen focusing on more abstract functionality and efficiency, specifically for the motorist, at the cities and regions' scale (Southworth, 2005).

1.1.1 Statement of Issues

a) Global Context

The notion of Green Urbanism first arose in the 1990s. It conceptualises a model for smart urban design with zero-waste and zero-emissions while promoting compact, energy-efficient urban development to improve the existing city (Nassar, 2013). Also, Green Urbanism promotes sustainable development and the expansion of social and

environmental resources in the city. Beatley (2000) defines Green Urbanism as a concept capturing both urban and environmental sustainability through a holistic vision that includes the programmes, policies and creative design ideas for urban renewal and environmental sustainability. Beatley (2000) also emphasises that cities and towns should epitomise the unique and important design qualities and characteristics that employed GUP (Table 1.5).

Table 1.5 Design characteristics of Green Urbanism in cities (Beatley, 2000)

Green Urbanism in the city	1	Strive to live within their ecological limits, reduce their ecological footprints, and acknowledge their connections with and impacts on other cities.
	2	Green and that are designed for and function in ways analogous to nature.
	3	Achieve a circular rather that a linear metabolism, which nurtures and develops positive symbiotic relationships with and between its hinterland.
	4	Strive toward local and regional self-sufficiency and take full advantage of and nurture local/regional food production, economy, power production.
	5	Facilitate and encourage more sustainable, healthful lifestyles.
	6	Emphasize a high quality of life, pedestrian network and connectivity; and the creation of highly liveable neighbourhoods and communities.

b) The Malaysian Context

The research will specifically focus on linking the urban walkability with GUP according to the result established from Delphi Survey among built environment professionals and experts. The identified principles emphasised on social, cultural, economic and environmental attributes for urban walkability. According to (Mansor, Said, & Mohamad, 2012), walkability is strongly influenced by street connectivity, which is one of the Seven (7) attributes of urban dimension for creating a Smart Green City as Figure 1.2 below.

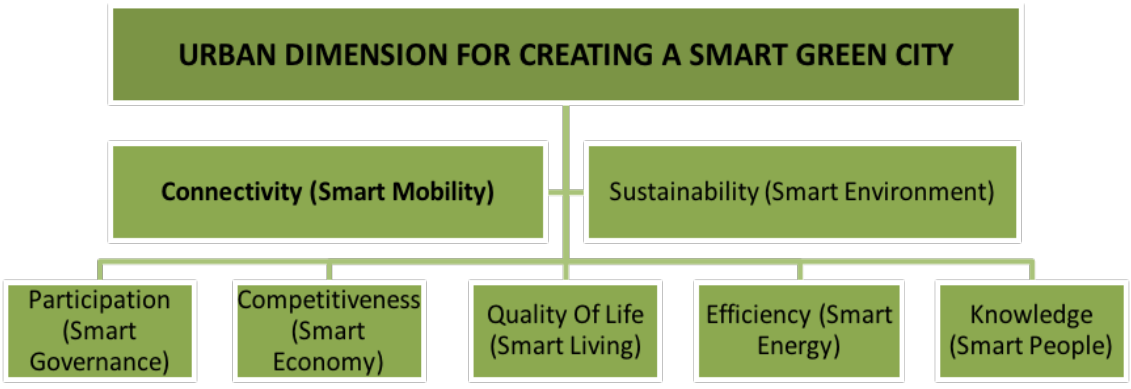

Figure 1.2 Main Urban Dimensions for Creating a Smart Green City
Source: Adapted from Nassar (2013, p 340)

A town's inhabitants spend most of their time in and within built-up areas while performing their daily activities and tasks. The travelling distances and times within the town areas are often significantly long and very high. For example, between 25 and 50%

of trips in major Indian cities and about 50% of all trips in major African cities are made entirely on foot. Significantly, in developing cities in South East Asia, the portion of all-walking trips can be as high as 60 to 70% (Bandara, 2013; Gwilliam, 2002, 2013; Sanyal, 2013).

Unfortunately, pedestrian amenities, infrastructure and services are mostly neglected in town planning and budgets, even though a large number of trips are made by foot (Bandara, 2013; Sanyal, 2013). Indeed, we have reached a point whereby and large, the pedestrian network fails to provide a shortest, comfortable, safe and pleasant route in our towns (Bahari, Arshad & Yahya, 2012, 2013). As a result, a town's residents opportunity to be in contact either visual or experiential with greenery are less frequent (Mansor & Said, 2008) due to improper planning and failure to incorporate GUP with a town's accessibility and walkability qualities.

Good accessibility and walkability in and around our towns are critical in ensuring the livelihood of these MC. These issues were first highlighted at the national level in the Malaysia's National Urban Policy in 2006; focussing on the inefficiency of pedestrian network, lack of public transport system and the integration among their services, and minimal emphasis on the provision of pedestrian infrastructure for comfort and safety in Malaysia's MC (Federal Department of Town and Country Planning Peninsular Malaysia & Ministry of Housing and Local Government, 2006). These cities are typically characterised as MC with a population of not greater than 500,000 (Harun, Mansor, & Said, 2013; Ismail, 1996). A thriving city must have good accessibility and promote walkability. Therefore, the Green Urbanism and walkability index are elements that interweaved, and of a significance in order to make a town or city thrive by promoting walking and other related physical activities, and sustainability. From an urban planning perspective, the study of the overlapping of green urbanism with walkability in the MC is essential to sustain the livelihood and long existence of our MC.

In the case of Malaysia's towns and cities, the concern for pedestrian facilities and connectivity is not a new phenomenon. There are problems associated with walkability and connectivity in our towns and cities. Bahari et al. (2013) stated that more than 90 per cent of pedestrians in Malaysia aged between 19 – 49 years old are dissatisfied with pedestrian facilities and connectivity in urban areas, and the percentage is much lower

amongst pedestrians aged 50 years old and above. Also, the National Key Economic Area (NKEA) under the Economic Transformation Plan (ETP) has identified the need to create a comprehensive pedestrian network. The pedestrian network targets explicitly the provision of proper planning to link pedestrian walkways with the public transport system (The Economic Planning Unit (Malaysia), 2015).

There is a practical need for this study in the Malaysian context. The local and municipal governments of Malaysia have made numerous efforts to provide walkable neighbourhoods and paths. South Johor Economic Region (SJER) established a strategy to implement walkability requirements by facilitating neighbourhood areas (Iskandar Regional Development Authority (IRDA), 2016; Ramli & Akmal, 2006). Conversely, there is still a lot to be desired to provide a walking environment with a high level of walkability. Referring to Energy, the urban transportation sector is one of largest energy consumers in Malaysia (Chong, Ni, Liu, Li, & Centre, 2015); within which the motor vehicles remain one of the highest contributor of CO_2 which is 22.9% of total urban CO_2 pollution (Brohi, Pillai, Asirvatham, Ludlow, & Bushell, 2018; Ghadimzadeh et al., 2015). World Energy Market Observatory (WEMO) 2017 projected that Malaysia's energy usage that includes urban transportation would increase by 4.8% until the year 2030 (Yunus, 2017).

Hence, urban walkability is seen as able to provide a solution to the constant increment of pollution in urban areas as a result of a large number of private transport (Brohi et al., 2018). This is in line with the 11th Malaysian Plan that included green angle as the central strategic trust 'Pursuing green growth for sustainability and resilience', which is seen as a significant improvement from the 10th Malaysian Plan that did not include environment in the strategic standpoint (Zainal, Kong, Kasinathan, & Zakaria, 2015). Malaysia's green growth strategy can lead to a better quality of growth, strengthening food, water and energy security, reduce environmental threats and ecological catastrophe, and eventually improve well-being and quality of life (The Economic Planning Unit (Malaysia), 2015).

Public Work Department's (JKR) strategic plan is to increase sidewalks length by 70% (Lamit et al., 2013). According to Ministry of Health published a report in Al Mahmood, Shamsuddin, Mohd Saufi, Othman, & Ibrahim (2018), the obesity among adults in Malaysia in 2011 was 15.1% which was an increase of 300% as compared to 1996. In

2016, obesity in children was 11.9%, an increase of 5.8% from 2011 (Al Mahmood et al., 2018). Therefore, to address problems associated with these pieces of evidence, it is timely for the government, policymakers and local authorities in Malaysia to support more walking and urban walkability (Lamit et al., 2013).

Shah, da Silva, & Nélson (2010) in their recent research, stated the Malaysian approach to pedestrianisation differs from that of Brazil. In Malaysia, the pedestrianisation approach views the pathways as infrastructure for pedestrians, choosing to focus more on the 'hard' components of a pedestrian path. On the contrary, the Brazilian opt for both 'hard' and 'soft' aspects of the pedestrian path to determine the desirability to walk and lay emphasis on walkability. In addition, Malaysian towns and cities are not pedestrian-friendly (Bahari et al., 2012; Mansouri & Ujang, 2017; Wong, 2011) as it currently has inefficient design (Keat, Yaacob, & Hashim, 2016; Shamsuddin, Abu Hassan, & Bilyamin, 2018), inadequate maintenance (Keat et al., 2016; Zakaria & Ujang, 2015) and poor accessibility and linkages (Bahari et al., 2012; Moayedi et al., 2013). The attraction areas are also not easily accessible, inadequate pedestrian facilities and segmented (Zakaria & Ujang, 2015).

There is also a need to enhance the attractiveness of building and spaces in the city centre for visual fulfilment for pedestrian for cultural, commercial and recreational activities that they can actively participate. As stated by Ujang & Muslim(2013), currently, it lacks in connectivity, quality of pedestrian walkways and interaction with the built environment and in need for more landscape and greenery for physical and visual comfort. It is evident that there are very weak linkages between places an urban tourism district, despite the fact many potential places of interest for pedestrians around and within the city centre in Malaysia. According to Wong (2011) in Ujang & Muslim (2013), places of attractions are segregated from each other and not appropriately connected, and their specific functions or uses welcomed only specific groups of people.

The lack of walkable element has also affected the behaviour of walking among the citizens. A stern measure is needed to force a change in attitude, and perhaps it can only be changed by the design of the city centre's environment itself. The consideration of creating a walkable environment is essential so that it can help to create a comfortable place to live. The research shows that transportation has become an issue that needs to be

addressed (Shamsuddin, Hassan, & Bilyamin, 2012). Most of the contemporary design and planning in cities in Malaysia have been criticised for their inhumanity and insufficient amenities to meet the movement purposes of urban users. It seems that to satisfy the need for vehicular flows has become the dominant idea adopted by our planners and designers (Yaakub & Hashim, 2009).

The current state of pedestrian infrastructure in Malaysian towns is not pedestrian-friendly due to several factors such as inefficient design to attract users (Bahari et al., 2012). Besides, it fails to encourage and promote walkability among town's residents and Malaysians in general (Abidin, 2016; Bahari et al., 2012; Ujang & Muslim, 2013; Wong, 2011; Zakaria & Ujang, 2015). Inadequate and poor maintenance of pedestrian walkways also contributes to discouraging people from walking. It is a common sight to see walkways with soil, sand, rubbish and water puddle due to an uneven surface (Zakaria & Ujang, 2015).

According to Wong (2011), there are many places of interest for pedestrians around, and within the city, however pedestrian connectivity and linkages to these places are very weak (The Economic Planning Unit (Malaysia), 2010; Ujang & Muslim, 2013). Also, places of attractions are not easily accessible, inadequate of pedestrian facilities, segmented and isolated from each other, and their functions serve exclusive for a restricted group of people due to poor connectivity and attractiveness of walking environment (Ujang & Muslim, 2013; Wong, 2011; Zakaria & Ujang, 2015).

There is a need to enhance the attractiveness of building and spaces in Malaysian cities and towns for visual fulfilment for pedestrian for cultural, commercial and recreational activities that they can actively participate. Ujang & Muslim (2013) revealed that the quality of pedestrian walkways and interaction with the built environment are two important attributes in promoting walkability in Malaysian towns. Currently, these qualities are lacking and in need for adequate green infrastructure, more attractive landscape and urban greenery quality to contribute for physical and visual comfort of users (Mansor et al., 2012). Furthermore, the potential benefits of green infrastructure on the well-being of urban residents are yet to be unequivocally integrated into policy-making and are considered as luxury elements instead of as necessities for urban residents (Mansor et al., 2012).

According to (Shamsuddin, Hassan, et al., 2012) currently, transportation in Malaysian towns and cities is one of the factors that dissuade walkability, and have become much talk about an issue that needs to be addressed. This issue adds up to the lack of walkable element that has affected the walking behaviour of Malaysian towns' citizens. A sound and rational measure are needed to drive a change in attitude, and perhaps it can only be changed by the design of the towns and cities environment itself. The consideration of creating a walkable environment, integrated development of green areas in urban centres and planning the layout of cities for a more vibrant and walkable are important so that it can help to create a comfortable place to live in and a healthy neighbourhood (Department of Environment Malaysia, 2011; Shamsuddin, Hassan, et al., 2012).

Another issue of the insolvency of urban walkability in Malaysia is the lack of proper Green Infrastructure (GI), an essential component of Green Urbanism, as seen in many European countries and Australia. GI is the physical environment in the form of public and private spaces, such as parks, community spaces and gardens, allotments, cemeteries, trees, green roofs, green facades and rain gardens – often referred to as small-scale GI and natural landscape features such as woodland, grassland, moors and wetlands – often referred to as large-scale GI (Benton-Short, Keeley, & Rowland, 2017; Cheshmehzangi & Griffiths, 2014; Willems, Molenveld, Voorberg, & Brinkman, 2020). For this research, the author will only focus on GI in the small-scale GI types. As against the large-scale GI such as wetlands development or green parkways system, as small-scale GI is integrated within the urban fabric, interacts with other forms of city's infrastructure and has more significant potential to engage with urban residents and business owners (Benton-Short et al., 2017).

Given the hot climate in Malaysia, GI in the form of a multi-functional green network of open spaces, tree-lined walkways, which reinforce healthy urban living and promote urban ecology should be long-established. The issue remains, and not many researches were carried out concerning the matter. There are only two published research papers on GI in Malaysia by the same authors (Harun et al., 2012; Harun et al., 2013) however, not explicitly tackling the issue of urban walkability and none on Green Urbanism (GU).

1.2 Agenda of the Research

1.2.1 Research Question

This research revolves around one key research question:

"How can a Medium-sized City embody the qualities of Green Urbanism Principles that are related to the built environment, community, landscape and urban sustainability?"

This will involve focusing upon how towns and cities can embrace a high quality of life, pedestrian network and connectivity, and the creation of highly liveable neighbourhoods and communities of an urban area.
There will be two subsidiary research questions in the research:

a) How does urban walkability relate to Green Urbanism Principles?

b) How can urban walkability be measured in terms of Green Urbanism Principles?

1.2.2 Aim of the Research

This research aims to investigate the link between Green Urbanism Principles and walkability indices (the level of 'routes of accessibility' and 'networks of walkability') for a Medium-sized City as part of the comprehensive establishment of walkable town.

1.2.3 Objectives of the Research

To achieve the main goal of conducting this study, three objectives have been identified as follows:

1. To understand the concept of Green Urbanism and its principles (GUP) and identify its qualities for the revitalisation of a Medium-sized City);

2. To distinguish the determinant elements in Green Urbanism Principles that promote walkability in Medium-sized City;
3. To establish the link between Green Urbanism Principles and urban walkability, and their potential impacts in improving the environment in Medium-sized City.

1.3 Scope and Limitation of the Study

The scope of this research is limited to the Medium-sized City of Alor Setar Town Centre, Kedah, Malaysia. The list below detailed the scope of the study. The detail of the site selection is explained in Chapter 4 – INTRODUCTION OF THE CASE STUDY AREA.

1. This research will only focus on a selected site which is an old city with a rich local history and culture. Thus, not all the fifteen Green Urbanism Principle (refer to Appendix: GU-1) can be applied due to existing conditions and limitations. A group of local academics who are expert in the built environment will involve in identifying the relevant principles that are suitable and practical for implementation at the selected study site, which is to emphasise on the high quality of life and the creation of highly liveable neighbourhoods and communities of a town.

2. Limited to the accessibility and walkability index from and within the town's boundary.

3. The study concentrated at the Alor Setar town centre areas as stipulated by the Local Planning Authority. Not covering the areas beyond its peripheral boundaries.

1.4 Research Methodology

This exploratory research employed a mixed-method research strategy. In this research, several unique aspects and approaches of qualitative research methods are combined to contribute to rich, insightful results in a case study, both qualitative and quantitative methods for data collection and analysis. Each of which has its own approaches in data collection, the procedure of analysis and interpretation. The sequential stage of research

begins with identifying identification of indicators to develop two indices for; 1) measuring urban walkability modelled from the established Global Walkability Index, 2) measuring Green Urbanism Quality generated from the concept of Green Urbanism Principles. The second stage involves the testing of the indices to measure the level of urban walkability in association with Green Urbanism Principles.

1.5 Structure of the Thesis

The thesis will consist of nine chapters, the structure of which is described below:

Chapter 1 – INTRODUCTION

The first chapter presents the overall structure of the research. It covers the background of the study, statement of issues and research questions, research aim and objectives, research scope and limitations, and the introductory of the research methodology. Conclusively, this chapter highlights the significance of the research and its contribution to knowledge.

Chapter 2 – SUSTAINABLE ENVIRONMENT, THE CONCEPT OF GREEN URBANISM AND ITS PRINCIPLES

The second chapter exhibits literature reviews relating to the research topic. The literature assist in establishing the concept of a 'Green Urbanism, Walkable Street and Environment (in medium-sized cities)', as well as the general theories concerning *Green Urbanism, Walkable Street and Index, Suitable (good) Street Design, Responsive Environments and Sustainable Urban Design* in order to outline the theoretical foundation and scope of the research.

Chapter 3 – RESEARCH DESIGN AND METHODOLOGY

The third chapter describes the methodology and procedure to be adopted to assess and measure *the level of application of GUP* in a Medium-sized City *that promotes walkability*. It also discusses the approach of the methodology, the scope of research, the process that determines an appropriate research design and the way the investigation is structured.

Chapter 4 – INTRODUCTION TO THE CASE STUDY AREA

The fourth chapter presents an introduction to the area of study. The exploration in this chapter includes the social and physical contexts, the urban design policies associated with the context, the physical characteristics, the users, the uses and activities as well as changes and improvement of the places.

Chapter 5 – WALKABILITY AND THE DEVELOPMENT OF ALOR SETAR WALKABILITY INDEX (ASWI)

The fifth chapter presents a review of urban walkability theories and indices developed by previous researchers. It covers theories, practices and indices at the global, Asian and Malaysian context. The literature and indices in this chapter formed the foundation in developing *the 'site-specific' Walkability Index* for use during site survey and observation.

Chapter 6 – GREEN URBANISM AND THE DEVELOPMENT ALOR SETAR GREEN URBANISM INDEX (ASGUI)

The sixth chapter presents a review of the parameter and criteria for 'Green Urbanism, Walkable Street and Environment (in the Medium-sized City)' and the current body of knowledge concerning the main attributes that determine *the level of application of GU (Principle No. 6)* in Medium-sized City *that promotes walkability*.

Chapter 7 – URBAN WALKABILITY AND THE INFLUENCING FACTORS

The seventh chapter focuses on the analysis of data collected in Alor Setar. The first part (of the two parts) of the analysis centres in the domain of walkability and the influencing factors.

Chapter 8 - GREEN URBANISM PRINCIPLES (GUP) ASSOCIATED TO QUALITIES OF URBAN WALKABILITY

The eighth chapter concentrates on the analysis of data collected in Alor Setar. The second part (of the two parts) of the analysis centres in the domain of Green Urbanism Principles (GUP) that are associated with the qualities of urban walkability.

Chapter 9 – DISCUSSION OF THE FINDINGS

The ninth chapter discusses the influencing factors for urban walkability based on the analysed results of ASWI in Chapter 7 and ASGUI in Chapter 8. The purpose of this chapter is to provide construct comparisons in order to establish associated physical characteristics, features and factors between ASWI and ASGUI that promote urban walkability in the Medium-sized City of Alor Setar. The result from the most walkable and the highest GUQ will be used in the discussions.

Chapter 10 - CONCLUSION AND RECOMMENDATIONS

The tenth chapter concludes the research finding and discussions of the outcome. Discussions on the limitation, issues and problem arise during the course of the research are also highlighted. Ending with recommendations and suggestions on areas that the researcher finds pertinent and in need of further investigation.

Chapter 2

SUSTAINABLE ENVIRONMENT, THE CONCEPT OF GREEN URBANISM AND ITS PRINCIPLES

2.0 Introduction

The second chapter will exhibit the literature review relating to the research topic. The literature will assist in establishing the concept of a '**Green Urbanism, Walkable Street and Environment (**in MC**)**', as well as the general theories concerning *Green Urbanism, Walkable Street and Index, Suitable (good) Street Design, Responsive Environments and Sustainable Urban Design* in order to outline the theoretical foundation and scope of the research.

This chapter is divided into eight sections, including the Introduction. The second section is The Domain of Sustainability and Green Urbanism. The third section covering the Definition and Understanding Sustainability and fourth is the Origin of Sustainability – Sustainable Development. The discussion on Green Urbanism is covered in the subsequent sections beginning with the fifth section that is the concept of Green Urbanism, sixth Theories in Green Urbanism and seventh, the Principles of Green Urbanism. Section eight summarises the discussion of this chapter.

2.1 The Domain of Sustainability

Urban greenery is one of the key components of green urbanism for a town to develop with benefits for both human and the environment (Beatley, 2001; Lehmann, 2012). It is natural and preserved as resources for the ecosystem and social services in the city for the benefit of urban dwellers and its inhabitants. It also promotes healthy living, economic activities and social cohesion; and with proper planning, contributes significantly to city image and identity. In addition, a green urbanism approach also helps in reducing air pollution, producing oxygen, promoting recreational activities and improves the aesthetic environment. It also directly encourages less private car use and promotes walking

amongst a town's dwellers (Nassar, 2013; Rafiee, Mahiny, Khorasani, Darvishsefat, & Danekar, 2009).

Lindfield & Steinberg (2012) stated that the urban dimensions signify different overlapping layers essential to establish a smart urban structure. The smart cities model requires a systemic approach, encircling various dimensions of 'smartness' and accentuating the importance of integration and interaction across many areas. Linfield also accentuated that connectivity (smart mobility) and sustainability (smart environment) play important roles in achieving smart green cities due to their direct relationship between humans and their environment as shown (see Figure 1.2, on pg. 6).

2.2 Definition and Understanding of Sustainability

The notion of sustainability hails from the concept of sustainable development. The idea is widespread and became fashionable after the world's first Earth Summit in Rio in 1992. There are many opinions and ideas on what sustainability means but up to now, and there is no one definition that is collectively agreed. The divergence of ideas stems from the extensiveness of fields and areas under its belt. The fundamental insight of the term is instigated from the Brundtland Report in 1987 (Drexhage & Murphy, 2010).

The concept of sustainable development was developed upon, in the height of awareness of the critical ecological destruction (Carley & Kirk, 1998). Ever since, the term has shifted in meanings and has been used interchangeably by policy-makers, built environment professionals, authorities, developers, businesses, and the general public (DuPuis & Ball, 2013; Hotten, 2004; Jacques, 2014; Kuhlman & Farrington, 2010; Lehmann, 2011; Markard, Raven, & Truffer, 2012).

Undoubtedly, the 'Brundtland Report', marked an important moment in connecting bio-physical environmental, social and economic policy goals. Since it was published, there has been a large amount of literature and discussions focusing on the broad topic of sustainable development (Vallance, Perkins, & Dixon, 2011). The causal conflict concerning the related bearings of sustainability, particularly the environmental, social, economic and the broad interpretation of what sustainability is have led to a generality of

use, to label an array of urban forms as being ‘sustainable’ (Dempsey, Bramley, Power, & Brown, 2011; Giddings, Hopwood, & O’Brien, 2002; Jenks & Dempsey, 2005).

Nowadays, it has become prevalent in policy-oriented research to use the term sustainability as an expression of what public policies should attain and accomplish. The term sustainability mostly makes a greater appearance in the world of the built environment - urban development and in particular, the greening of the urban core (DuPuis & Ball, 2013; Jacques, 2014). Indeed, the sustainable city movement or green city movement has currently admired the world over. Various concepts and ideas stem from it ranging from Landscape Urbanism, Eco-city, Climate Responsive Urbanism, Ecological Urbanism, Biophilic Urbanism and Isobenefit, among others. The aforementioned sustainable cities movement is a complex process, all of which addressing the fundamental areas of economic, environmental and socially equitable sustainability which leads to the concept of Green Infrastructure of the cities (Ahern, 2007).

In the current literature on urban planning and design reflects a convergence of study and case applications focussing on sustainable cities and sustainable urbanism (Beatley, 2000; Low, 2005; Moughtin & Shirley, 2005; Steiner, 2011; Van der Ryn & Stuart Cowan, 2007; Woolley, 2005). This emerging focus reflects a broader international awareness of sustainability across its basic tripartite dimensions: economy, environment and (social) equity – often known as the ‘three E’ of sustainability (Beatley,2000). Thenceforward, Beatley (2000) introduced Green Urbanism, which is a concept that offers innovative approaches to dealing with rapid urban growth (Pinnegar, Marceau, & Randolph, 2008; Wells, 2010b). Lehmann (2010a), in his book, extends the concept further by detailing the concept by proposing the fifteen core principles of Green Urbanism, which will be the basis of this research.

On the whole, most literature blurs the focus with debates occurring within and between each range of perceptions (Vallance et al., 2011). The generality of perceptions ranging from urban sustainability, sustainable management, environmental sustainability, weak and strong sustainability, or just ‘sustainability’ (Bramley & Power, 2009; Littig & Griessler, 2005; Vallance et al., 2011). One of the vaguest and often ignored in the wide definition and practice of sustainable development is social sustainability. It connects

with the extensive range of bio-physical environmental and economic issues and challenges, particularly concerning the social dimensions and their implications (Dempsey et al., 2011; Vallance et al., 2011). One of the definitions that are possibly able to capture all aspects of sustainability is by U.K. Forum for the Future (2018);

> "...a dynamic process which enables all people to realize their potential and improve their quality of life in ways which simultaneously protect and enhance the Earth's life support systems."
> Source: (Forum for the Future (U.K.), 2018)

2.3 The History and Evolution of Sustainable Development

The idea of sustainability was conceived initially in forestry, where it was realised that it is important not to harvest more than what the forest yields in new growth (Wiersum, 1995). Parallel to the meaning as mentioned by Wiersum, the German's *Nachhaltigkeit* (sustainability) was first used in 1713 (Wilderer, 2007). This, followed by Thomas Malthus famous work in 1798, concerning alarming mass starvation due to the demand to feed the ever-growing population against the diminishing availability of agricultural lands (Kuhlman & Farrington, 2010).

It is important to note that in 1931, an American economist, Harold Hotelling, developed his optimal rate of exploitation of non-renewable resources (Hotelling, 1931). It was, however, the Club of Rome' report in 1972 that succeeded in garnering the attention of public policy-makers globally. The report projected that in one or two generations, many natural resources crucial to our survival would be exhausted. Such negativity in forecasting the future is incongruous in public policy which is in all generality inferred to be about improving things (Meadows et al.,1972).

Such shifts in emphasis between 1713 -1978 provide the rationale for global concern on the vulnerability of our environment. The concern has led to the birth of the report of the UN World Commission on Environment and Development, known as the Brundtland Report in 1987. The report highlights the question: 'how can the aspirations of the world's nations for a better life be reconciled with limited natural resources and the dangers of environmental degradation? The answer to the question by the Commission is in 'the

application of sustainable development' (Brundtland, 1987; Drexhage & Murphy, 2010; Kuhlman & Farrington, 2010).

Many intellectual discussions have occurred on sustainable development ever since its debut in Our Common Future (Banerjee, 2007; Luke, 2005; Redclift, 2005). However, it was due to the Rio Earth Summit with its Agenda 21 in 1992 that sustainable development has found its most prominent 'landmark achievement', even though some may argue that it only gained the attention of the media and political bodies around the issue of climate change (Doyle, 1998; Lehmann, 2015a). Rio's landmark achievement included the three seminal instruments of environmental governance that were established at the summit:

1. the UN Framework Convention on Climate Change (UNFCCC);
2. the Convention on Biological Diversity (CBD); and
3. the non-legally binding Statement of Forest Principles.

The Rio Summit was a success and had the world's attention, and significantly included active engagement and attendance by most national leaders. In addition to the success, there were claims of deficiency in two areas namely, excessively emphasises on the 'environment pillar' in the negotiations and inadequate implementation of goals established under Agenda 21 (Drexhage & Murphy, 2010; Kelly, 2003).

Both sustainability and sustainable development carry the parallel meaning of championing the needs and desires of people and the environment (Hotten, 2004). By and large, sustainability can be described as people's responsibility to proceed their course of living and to fulfil their need by way of that will sustain life and that will allow their future generations to live and fulfil their own need (Drexhage & Murphy, 2010). The Thomas Jefferson Sustainability Council's (Charlottesville, Virginia) definition adopted by is that:

> 'Sustainability may be described as our responsibility to proceed in a way that will sustain life that will allow our children, grandchildren and great-grandchildren to live comfortably in a friendly, clean, and healthy world, that people:
>
> i. Take responsibility for life in all its forms as well as respect human work and aspirations;

ii. Respect individual rights and community responsibilities;
iii. Recognize social, environmental, economic, and political systems to be inter-dependent;
iv. Weigh costs and benefits of decisions fully, including long-term costs and benefits to future generations;
v. Acknowledge that resources are finite and that there are limits to growth;
vi. Assume control of their destinies;
vii. Recognize that our ability to see the needs of the future is limited, and any attempt to define sustainability should remain as open and flexible as possible.'

Source: Thomas Jefferson Planning Commission (retrieved from http://www.tjpdc.org/)

Sustainable development to achieve economic prosperity simultaneously, environmental quality and social equity (Howarth, 2012; James, 2015; Ritchie, 2008; Wessells, 2014). It is related to social, economic and environmental orderliness that impact a community with a system that continuously supports and providing healthy, productive, meaningful and the quality of life. Sustainable development is envisioned to embrace the three pillars of sustainability; however, over the last 20 years, it has often been categorised primarily as an environmental issue (Drexhage and Murphy & Drexhage, 2010).

The 1987 Brundtland Report very much displayed great concern to the conflict between humankind's desire for a better life against the restrictions of the natural environment. As generally enveloped in the extensive literature, the three dimensions embodying sustainability are identified as social, economic and environmental (Dempsey et al., 2011; Giddings et al., 2002; Jenks & Dempsey, 2005; Kuhlman & Farrington, 2010; Vallance et al., 2011). Disputes arise with some scholars on the interpretation of the meaning of sustainability (Azami, Mirzaee, & Mohammadi, 2015; Guidotti, 2018; O'Riordan, 1985; Redclift, 1987; Tanguay, Rajaonson, Lefebvre, & Lanoie, 2010). As accordance to Lele (1991) who are of the opinion that the change of meaning in sustainability, sustainable development and its variants complicate the genuine ambiguity between the aims of benefit for all and environmental conservation or weak and strong sustainability. Instead, to refer back to the earlier meaning that the primary concern of sustainability is the welfare of future generations and the excessive exploitation of natural resources (Kuhlman & Farrington, 2010).

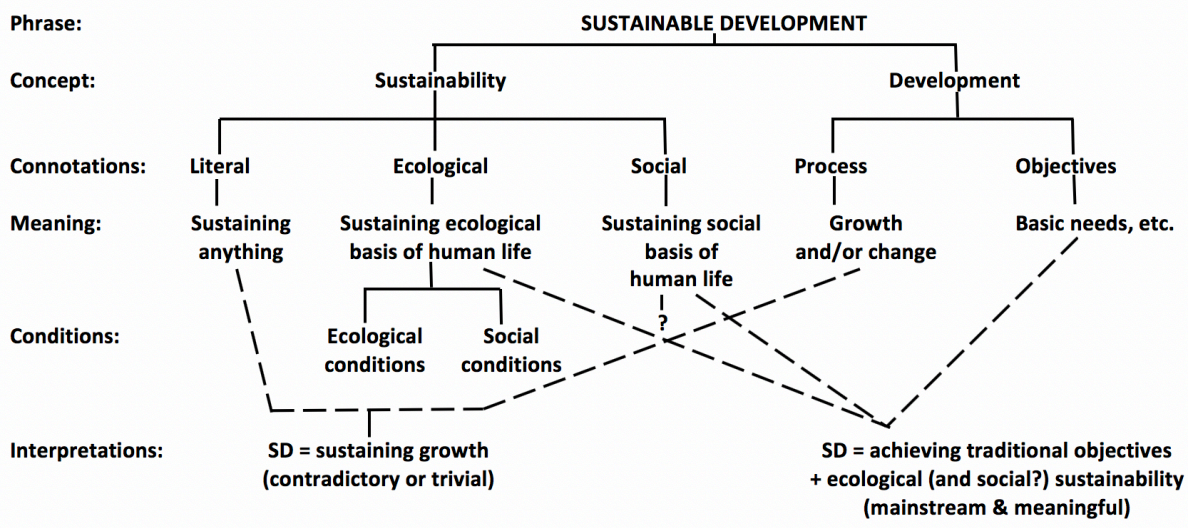

Figure 2.1 The Semantics of Sustainable Development
Source: Lele (1991, Pg. 608)

The broad concept of sustainability was deciphered into different contexts generating more than 70 different definitions across various subjects and disciplines (Momoh, Buta, & Medjdoub, 2018). Generally, all definition of Sustainability area related to and around :

- Living within the ecological limits
- Understanding the interconnections among economy, society, and environment (and culture)
- Equitable distribution of resources and opportunities

2.4 The Pillars of Sustainability

It is widely recognised that sustainable development encompasses a merger of broad issues are known as the three pillars of sustainability, that are economic development, social equity and environmental protection. Sustainable development is an idealist development template that has for over the past 20 years, been accepted globally as a guiding principle. The idea of the Three Pillars of Sustainability evolves from the Triple Bottom Line concept that originates from the world of management science established by Elkington (1994). In his article, he calls for the inclusion of organisations' profit partly as the corporate social responsibility for the care of the environment as well as supporting those with disabilities and hiring minorities (the social dimension) (Elkington, 1994; Kuhlman & Farrington, 2010).

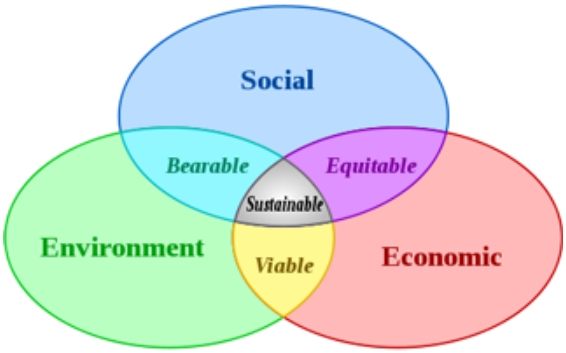

Figure 2.2 'Sustainable Venn Diagram'
Source: Weisser (2017, Retrieved: 3rd April 2018)

Based on the sustainable Venn Diagram (Figure 2.2), in order to achieve sustainability, it is essential to balance the social, environmental and economic factors in equal harmony. If we only achieve two out of three pillars, then we end up with: 1) Social + Economic Sustainability = Equitable; 2) Social + Environmental Sustainability = Bearable and 3) Economic + Environmental Sustainability = Viable. Only through balancing economic, social and environmental can we achieve true sustainability.

This idea of three pillars was further strengthened in 2005 during the World Summit of Social Development when it was emphasised that the three core areas impact the philosophy and social science of sustainable development (United Nations General Assembly, 2005). These three overlapping ellipses indicating that the three pillars of sustainability are not mutually exclusive but can be mutually reinforcing (Forestry Commission of Great Britain, 2015). The three pillars are interdependent, and in the long run, none can exist without the others (Morelli, 2011) as popularly signified in the diagram of the three pillars of sustainability

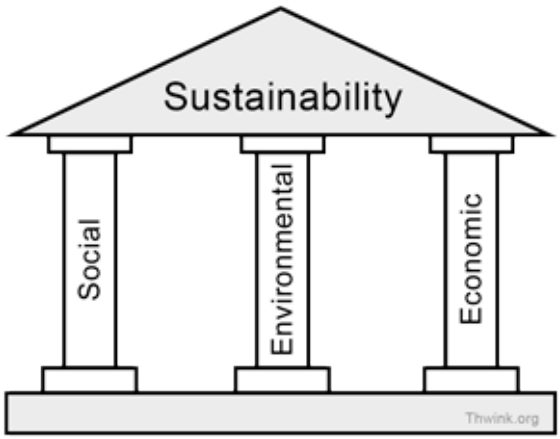

Figure 2.3: The Three Pillars of Sustainability
Source: thwink.org/sustain/glossary/Sustainability.htm.
(Retrieved: 18th February 2016)

2.4.1 Social Sustainability

Despite less attention having been given to the definition of social sustainability in built environment discipline, the generally accepted definition of social sustainability is the ability of a social system, such as a country, to indefinitely function at a defined level of social well-being. This level of social well-being should be defined concerning the purpose of *people*, which is to heighten their quality of life and those of their descendants. The core dimension of social sustainability is characterised as social equity and the sustainability of a community given that a balance between the distinct dimensions of sustainability is required to ensure that social sustainability does not jeopardise the economic or ecological sustainability (Dempsey et al., 2011).

It is important to note the definition outlined by McKenzie (2004, pg 12) that social sustainability is generally a favourable condition within communities and a process within communities that can achieve that condition. He supplemented the definition with a list of corresponding principles, including;

- equity of access to key service;
- equity between generations;
- a system of relations valuing disparate cultures;
- political participation of citizens, particularly at a local level;
- a sense of community ownership;
- a system for transmitting awareness of social sustainability from one generation to the next;
- mechanisms for a community to fulfil its own needs where possible; and
- political advocacy to meet needs that cannot be met by community action.

Subsequently, there is universal disagreement on what quality of life goals should be. Not only do nations disagree, so do their political parties, religions, cultures, activists, and organisations, among others. Thus many claims that it is the weakest pillar of them all because of its vagueness and the fact that most people disagree upon most of the laid definitions (Dempsey et al., 2011). This research is not attempting to define what quality of life goals should be, even in the broadest sense. Additionally, the ubiquitous references to social sustainability have created a rather messy conceptual field in which there are many uncertainties about the term's numerous meanings and applications (Vallance et al., 2011).

Table 2.1 Various definition of Sustainability: Social

Theme	Urban Sustainability	References
Social	• Should address the perpetuity of social values, identities, relationships and institutions	• Black, 2004; Moldan et al. (2012)
	• Common goals and social cohesion	• Gilbert et al. (1996)
	• Health, education, food, water, housing should be sustained for each individual	• Gilbert et al. (1996; Longoni and Cagliano (2015); Moldan et al. (2012)
	• Actively support the maintenance and creation of skills as well as the capabilities of future generations	• Longoni and Cagliano (2015)

Source: Adapted from Verma & Raghubanshi (2018, pg. 283)

2.4.2 Environmental Sustainability

Environmental sustainability is the capability of the environment to indefinitely support a defined level of environmental quality and natural resource extraction rates. The issue of environmental sustainability is the world's biggest problem, though since the consequences of not solving the problem now are delayed, the problem receives too low a priority to solve. Sustainability is the indefinite ability to continuously defined behaviour (Morelli, 2011). Herman Daly, one of the forerunners of ecological sustainability, looked at the problem from the maintenance of natural capital viewpoint. He proposed that Environmental sustainability is the rate of harvesting for a renewable resource, pollution creation, and depletion of the non-renewable resource that can be continued indefinitely (Daly, 1990).

Daly (1990) highlighted three fundamental areas of issues:

- renewable resources - the rate of harvest should not exceed the rate of regeneration (sustainable yield);
- pollution - the rates of waste generation from projects should not exceed the assimilative capacity of the environment (sustainable waste disposal); and
- the depletion of the non-renewable resources should require comparable development of renewable substitutes for that resource (Daly, 1990).

Table 2.2 Various definition of Sustainability: Environmental

Theme	Urban Sustainability	References
Environmental	• Social and economic development should have sound environmental foundation	• Moldan et al. (2012)
	• Natural resource management should have high priority	
	• Tipping points, thresholds (air, water pollution levels), sudden changes should be well understood	• Moldan et al. (2012); Booth et al. (2016)

Source: Adapted from Verma & Raghubanshi (2018, pg. 283)

2.4.3 Economic Sustainability

Economic sustainability is defined as the capability of an economy to upkeep a defined level of economic production indefinitely. Since the global recession of 2008, economic sustainability is the world's biggest noticeable problem, which threatens the progression regarding overcoming the issues and problems of environmental sustainability (Das & Guchhait, 2013). From an economic perspective, sustainability requires that current economic activity does not inexplicably afflict the next generations. Morelli (2011) mentioned that economists would assign environmental assets as a friction of the natural and human-made capital value, and their preservation becomes a function of overall financial analysis, and their preservation serves a function of overall financial analysis. A sustainable system that economically sounds must be able to continuously produce goods and services to government, and external debt must be kept at the manageable level, and to avoid extreme sectoral imbalances which damage agricultural or industrial production (Das & Guchhait, 2013; Foy, 1990; Morelli, 2011).

In contrast, according to Foy (1990), the ecologist will seek to preserve minimum levels of environmental assets in physical terms. He suggests that since an ecological approach will better characterise the present situation, it should serve to limit conventional economic reasoning to ensure sustainability. Economic sustainability should involve analysis to minimise the social costs of meeting standards for protecting environmental assets but not for determining what those standards should be (Foy, 1990).

Table 2.3 Various definition of Sustainability: Economic

Theme	Urban Sustainability	References
Economic	• It should focus on man-made, natural, human and social capital • Resource utilisation should not affect future income • Intergenerational equity for resources • Economic activity should consider ecological basis • Intergenerational equity, distributional equity, optimal growth	• Hamilton (2006) • Moldan et al. (2012) • Anand and Sen (2000)

Source: Adapted from Verma & Raghubanshi (2018, pg. 283)

2.4.4 The Fourth Pillar of Sustainability – Culture

Hawkes (2001) in his book, *The Fourth Pillar of Sustainability: Culture's Essential Role in Public Planning,* depicts that culture is an essential core dimension in addition to the existing three dimensions of sustainability. According to Hawkes, ecologically sustainable development (ESD) with its three dimensions – economic, social and environmental (as stated in the Ecologically Sustainable Development and Local Agenda 21) - has become the mantra of contemporary planning with culture hardly in the scene (Institut de Cultura Barcelona, 2010). We often encounter the rhetoric jargon like *'profound cultural shift'* and *'value of cultural diversity'* that envelops sustainable development and most of the other new paradigms. However, even though the meaning of culture exhibited in these phrases sounds uplifting and profound, when it comes to practical matters, culture tends to revert to its traditional designation of the finer and more refined artefacts of civilisation. The things that one may appreciate after the food is gathered, the roof mended, the road sealed, the workers paid, the children vaccinated, the criminals apprehended and the water purifier, among others (Hawkes, 2001).

Culture as the fourth pillar of sustainability propagated during the first World Public Meeting on Culture, held in Porto Alegre in September 2002. After the meeting, guidelines that accentuate local cultural policies were drawn up and finalised on the 8th May 2004 in Barcelona, a document comparable to what the Agenda 21 meant in 1992 for the environment. The guidelines then, submitted to the UN-HABITAT and UNESCO on the 15th September 2004, and from October 2004, the world organisation United Cities and Local Governments, and United Nation (UCLG) assumed the coordination of the Agenda 21 for culture (South-East Europe Transnational Cooperation Programme, 2012).

2.4.5 Culture and development

The Agenda 21 for culture is a medium to heighten the position of culture in urban policies and accordingly to make cultural issues the fourth pillar of sustainable development. Accordingly, Agenda 21 for Culture put forward two requirements:

i. Strengthening local policies, asserting the importance of solid and, autonomous cultural policies, and establishing bridges with other areas of local governance; and
ii. Advocating the integration of culture as a fundamental element of our development model and adopting as its own the idea proposed by the Australian researcher and activist Jon Hawkes.

Source: Hawkes, n.d., 2001; Institut de Cultura Barcelona, 2010; South East Europe Transnational Cooperation Programme, 2012.

Wessells (2014) has provided an adapted version of the 'pillars' diagram to illustrate The Four Pillars of Sustainability, with the addition of Tribal Justice column representing Culture (Figure 2.4).



Figure 2.4: The Four Pillars of Sustainability
Source: Wessells (2014, Retrieved: 3rd March 2016)

Culture, as the Fourth Pillar of sustainability, not only focusing on developing a robust cultural policy and advocating a cultural dimension in all public policies (Hawkes, 2001). However, it also bridges the gap of the importance of people's mobility in their environment, the stability of community values and safety in an urban environment, rather than merely being financially prosperous (Institut de Cultura Barcelona, 2010). Under the

fourth pillar, cultural sustainability as core domain covers seven subdomains - the engagement & identity, recreation and creativity, memory & projection, believe & meaning, gender & generations, enquiry & learning and health & wellbeing (James, 2015, pg. 24).

Currently, the idea of sustainability is dominated by more significant focus on smart technological innovations agendas (Hemani & Das, 2016), e.g. green building, green roof and smart transportation, instead of a more people-oriented city, community building, human-scale city, landscape and greenery; and conservation and restoration of nature and ecology (Hemani & Das, 2016). Oktay (2012) suggest that a more holistic solution protect the sense of place, community, social values, history and cultural distinctiveness due to uncontrol globalisation. Culture, community and social sustainability are interrelated, although they are very much independent as one of sustainability's dimensions. Albeit the inclusion of the social aspect in sustainable development, nonetheless, the attention to the human dimension has been overlooked for over twenty years, and most debates and discourses either focussed on bio-physical environmental issues or the fusion with development and economic growth (Dempsey et al., 2011; Littig & Griessler, 2005; Vallance et al., 2011).

2.5 Redefining Sustainable Urbanism

Sustainable development is currently focussing on the economic and development but lacking in social-cultural sustainability as it is currently unclear and under-represented (Hemani & Das, 2016). The ideology of sustainable development throughout history was focusing on the betterment of the environment and the people (Bourke, 2004; Redclift, 2005; Ritchie, 2008). However, the noble ideology was defeated due to the rapid development and the demand of material wealth & consumerism (economic and industry) and power (political) that put pressure on the environment with the consequences of polluted and inadequate living space, poverty and illness in the 1920s to late 30s. However, in the 1960s, the environmental consciousness re-emerged and becoming popular in western culture (Bourke, 2004).

The way forward is to humanise the urban development and approach the issues of urban sustainability holistically (Klarin, 2018; Oktay, 2012) instead of selective practices to

portray sustainable image (Klarin, 2018). Unfortunately, many countries are yet to fully achieve the truly sustainable development (Klarin, 2018); and selective sustainable development is the current practices the world over (Hodson & Marvin, 2010; Rosol, Béal, & Mössner, 2017). This approach is replicated in Malaysia (Ahmad, Kadir, & Shafie, 2011; Ghee, 2016) where the authorities and developer are selling the symbolic 'green cities title' by only funding selected sectors, e.g. construction of 'green building' (Rosol, Béal, & Mössner, 2017). The development championing environmental issue and benefits such as mega eco-city plan and substantial investment on green infrastructure and landscapes are few examples of the current trend as selling point or marketing strategy (Chang, 2017; Lang & Rothenberg, 2017; Rosol et al., 2017).

2.6 The Endeavour of Green City Movement

Due to many issues related to the failure of urban developments, urbanists are struggling to find the perfect solution that can holistically solve the ever-rising urban development setback (Klarin, 2018). The endeavour started during the problematic industrial cities of the nineteenth century America, that plagued with congested, poor urban dwellers with epidemic hazard and horrid environment; thus, the emergence of 'aesthetics of order' concept by then urbanists (Aryal, 2010). It has been well documented of the damaging consequences of rapid urbanisation resulting in environmental degradation, urban sprawl and social inequalities (Joss, 2010). Various attempts by urbanists to remedy the detrimental effects of urbanisation with new urban development models aiming at solving issues from environmental & nature-based; social, communities & neighbourhood and new towns, urban forms & technology related (Hemani, Das, & Chowdhury, 2016; Klarin, 2018; Larco, 2016; Nowotny et al., 2018).

Aryal (2010) highlighted that there are seven modalities under the domain of sustainability, Occupational Groups, Government, Community, Economy, Culture, Environment and Physiology to which the modern urban sustainable development concepts revolves around. These modern urban sustainable development concepts as displayed in Figure 2.5, can be categorised into five, Nature-Based Urbanism, Technology-Based Urbanism, Studies of City Form, Physical Planning Urbanism and Comprehensive Urbanism.

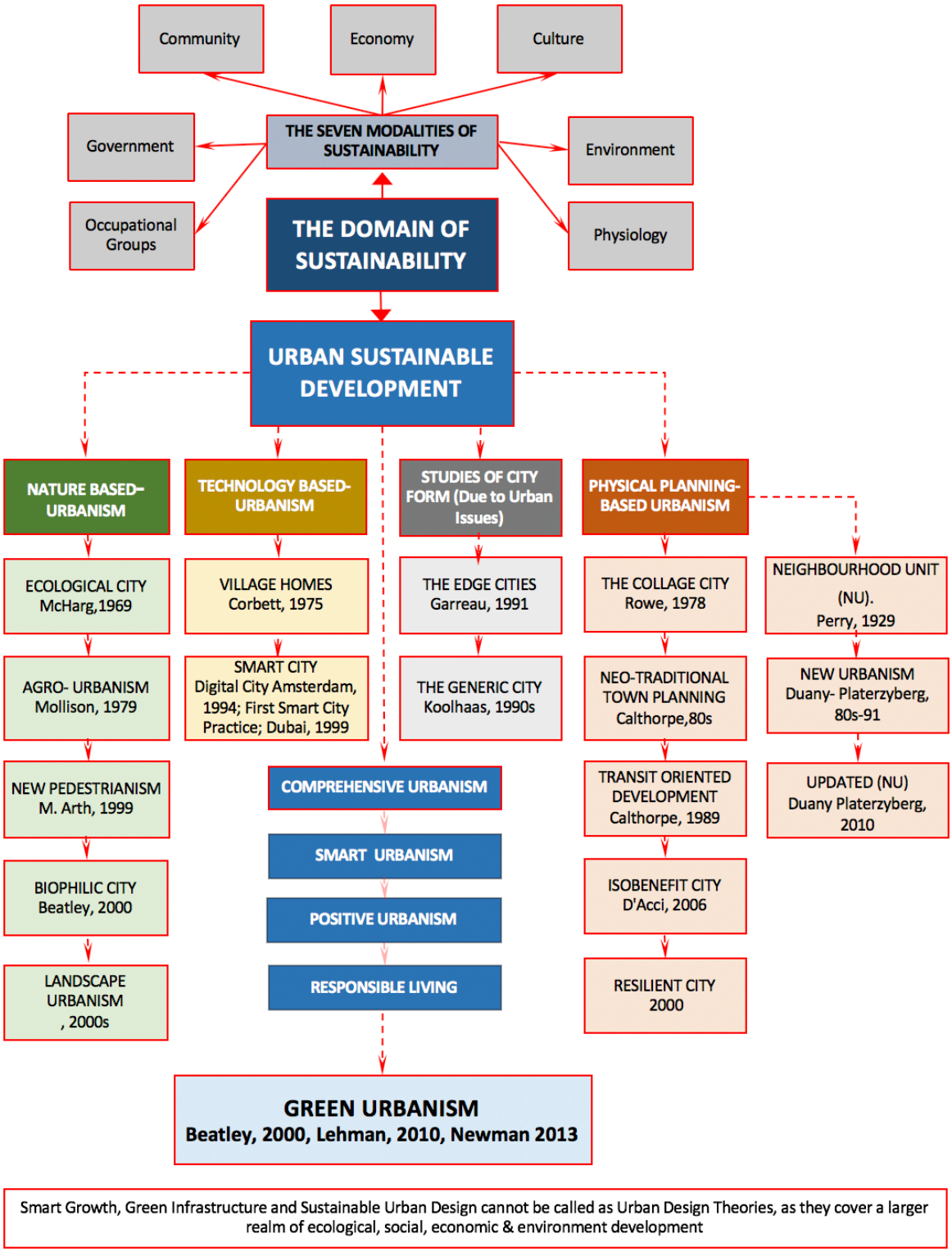

Figure 2.5 The Classification of Modern Urban Planning Concepts
Source: The Author (based from Anthopoulos (2017); Aryal (2010); Beatley (2000); Lehmann (2010b)

2.7 Summary of the Chapter

While the domain of sustainable development often orbits around the three pillars or themes; Social, Environment and Economic, in recent years, Culture has been accepted as the fourth pillar of sustainability due to its ability to bridge the gap of the importance of people's mobility in their environment. It also assisted in the stability of community values and safety in an urban environment, instead of merely being financially prosperous. The inclusion of culture also brings into picture the important contributions of local history and identity. This research focuses on urban walkability because of its profound impact on urban sustainability. Not only does it act as a mere means of connectivity and distribution of people's mobility, but it also acts as the backbone of an urban area that has environmental, social, economic and cultural implications.

The common practices of sustainable urban development often utilise the Nature-Based Urbanism, Technology-Based Urbanism, Studies of City Form for Urban Issues and the most widespread Physical Planning-Based Urbanism. The literature searches on the potential means and the way forward to humanise the urban development and approach the urban issues of urban sustainability holistically. The search has led to the new approach of sustainable urban development – Comprehensive Urbanism utilising the concept of Green Urbanism. The following chapter discusses the research design and methodology employed in this research in uncovering the association between urban walkability and urban sustainability.

Chapter 3

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter justifies the research methodology adopted in order to achieve the research aim and objectives. The study aims to investigate the link between GUP and walkability indices (the level of 'routes of accessibility' and 'networks of walkability') for a town as part of the comprehensive establishment of 'walkable' town in Malaysia. The objectives of the research are to examine the role of GUP for the revitalisation of towns, to identify the determinant elements in GUP that promote walkability in towns, to establish the link between GUP and a walkability index and their potential impacts in improving the environment in towns, and, finally, to ascertain the presence and suitability of application of GUP in Malaysia's towns.

This chapter is divided into seven sections. After the introduction, the second section discussed the research design and justifications for adopting the selected strategy for this study. The third section clarifies the research design for the study to answer the research objectives, that includes research instrument design and sampling selection procedures. The fourth and fifth sections describe the collection of data for walkability and the data for green urbanism application, respectively. The sixth section outlines the procedure for analysing the data to answer each research objectives and the identification of attributes that link walkability and green urbanism in the studied site. The final section concludes with a summary of the chapter.

3.1 Research Agenda

The research agenda intend to guide the direction of this study. This research aims to investigate the link between GUP and walkability indices (the level of 'routes of accessibility' and 'networks of walkability') for a Medium-sized City as part of the comprehensive establishment of 'walkable' city in Malaysia.

3.1.1 Mixed-Method Research

This exploratory research will adopt a *mixed-method research design* approach. In this research, several unique aspects and approaches of qualitative research methods are combined to contribute to rich, insightful results in a case study, both qualitative and quantitative methods for data collection and analysis. Each of which has its approaches in data collection, the procedure of analysis and interpretation. The combined qualities of both methods are exhibit in Table 3.1 below.

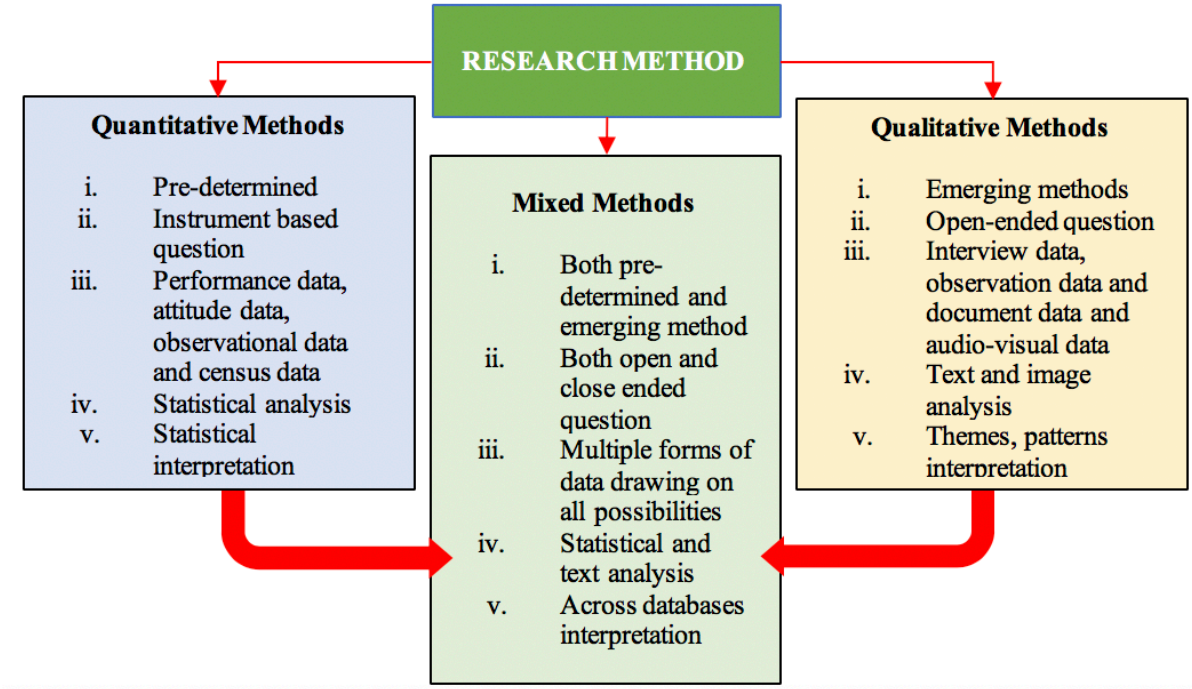

Figure 3.1 Research Method Diagram
Source: Creswell (2018, pg. 21)

The mixed method of research as employed in this study allows for data triangulation between methods and able to strengthen the data outcome, thus providing the most comprehensive approach in solving a research problem (Kelle, Kühberger, & Bernhard, 2019; Morse, 1991). The Mixed method also helps improved data validity and procedures to explain the research topic comprehensively (Johnson & Walsh, 2019; Kelle et al., 2019).

Data gathering comprised of two urban sustainability domains, Green Urbanism and Walkability. Each domain required different approaches in data acquisition due to the nature of the domain, data availability and practicality of data collection approach.

a. Green Urbanism

The domain of Green urbanism involved both approaches, qualitative and quantitative in its data acquisition. Firstly, an extensive literature review on sustainable development, urban sustainability and green urbanism were carried out to identify relevant principles and parameters. Secondly, the identified principles and parameters were then finalised to be validated by a panel of experts in the Delphi survey. Thirdly, the result from Delphi survey formed the checklist of Green Urbanism Quality and was then verified by two senior academicians from two different public universities in Malaysia to form the final site-specific Green Urbanism index to be used on-site. Fourthly, Semi-structured Interviews were carried out with practising experts to explore the practitioners' thoughts on Green Urbanism Principles and its association with urban walkability. To get their insight on current applications, benefits and main theme/character of association between GUP and urban walkability before finalising the Green Urbanism index and Walkability Index to be tested on-site. The experts' commentaries and statements were also used in the discussion of the result findings.

b. Walkability

As for Walkability domain, data acquisition involved a rigorous examination of established indices based on two categories. Firstly, literature investigations on walkability indices from established urban planning agencies and private organisation. Secondly, examinations on walkability indices from the urban design based from renown authors, and finally, thorough investigations on established walkability indices from three classifications, Global, Asian and Malaysian indices before establishing the site-specific walkability index to be used on-site.

Since the basis of the research develops from the concept of GUP and linking it with a walkability index. Therefore a deductive operationalisation approach will be adopted in formulating the data gathering process (Ewing et al., 2006). Domains explains the research approach for both urban design domains involved.

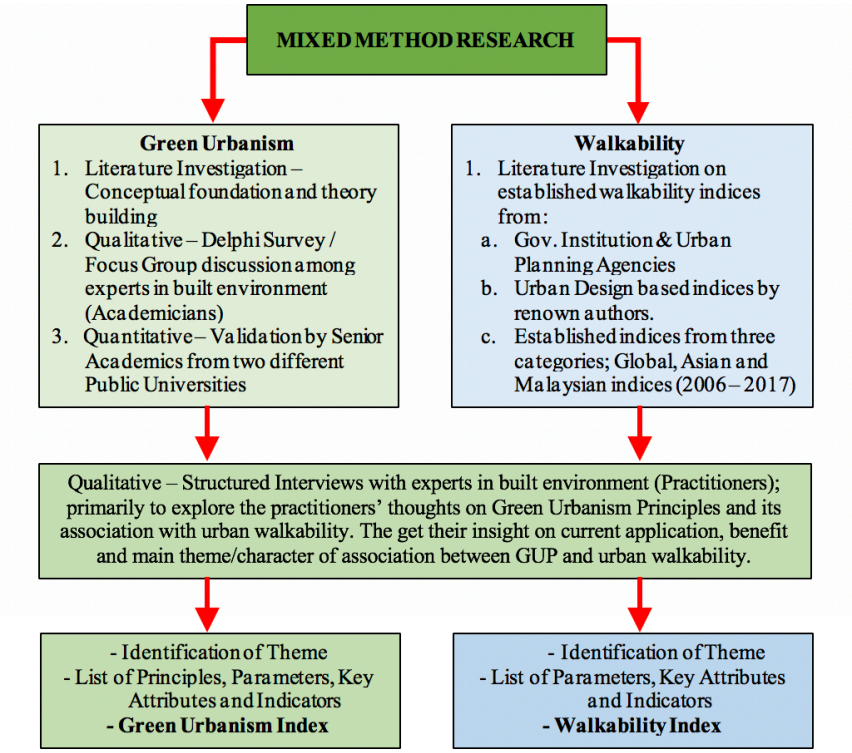

Figure 3.2 Mixed-method Research approach in data acquisition for both Green Urbanism and Walkability Domains

It is essential to study the built environment quality in order to determine the level of application of GUP, as stated in the research objective. Appleyard & Lintell (1972) used field interviews and observations (survey) on their research on streets to determine how traffic conditions affected the liveability and the quality of the street environment. They used in-depth interviews and systematic observations to obtain environmental concerns of pedestrians and traffic activity on the streets. Xerez & Fonseca (2011) employed mixed-method research involving Semi-structured Interview and observation. The Semi-structured Interview has helped in understanding the community and city forms of the neighbourhood, and the structure of social networks. Site observation contributed to the ethnographic understanding, neighbours' interactions and ways of urban living, and the use of urban public spaces.

Lang, Chen, Chan, Yung, & Lee (2019); Smith, Nelischer, & Perkins (1997); Stessens, Canters, Huysmans, & Khan (2020) in their research project, investigated the physical environment that contributes to the quality of a community, and that meets the needs and desires of its visitors and inhabitants. The methods involved descriptive research, matrix development and case study applications. Sulaiman (2000) and Xerez & Fonseca (2011) used observations and interviews in their field survey method to evaluate the comfort

condition people experience and their perception of the environment. Individuals' characteristics and behavioural patterns were also considered. Eliasson, Knez, Westerberg, Thorsson, & Lindberg (2007) used four urban spaces, Tan, Chung, Roberts, & Lau (2019) used various type of urban density as case studies in investigating how weather and microclimate affect people in urban outdoor environments. Observations and site survey by focus group were conducted simultaneously during the studies.

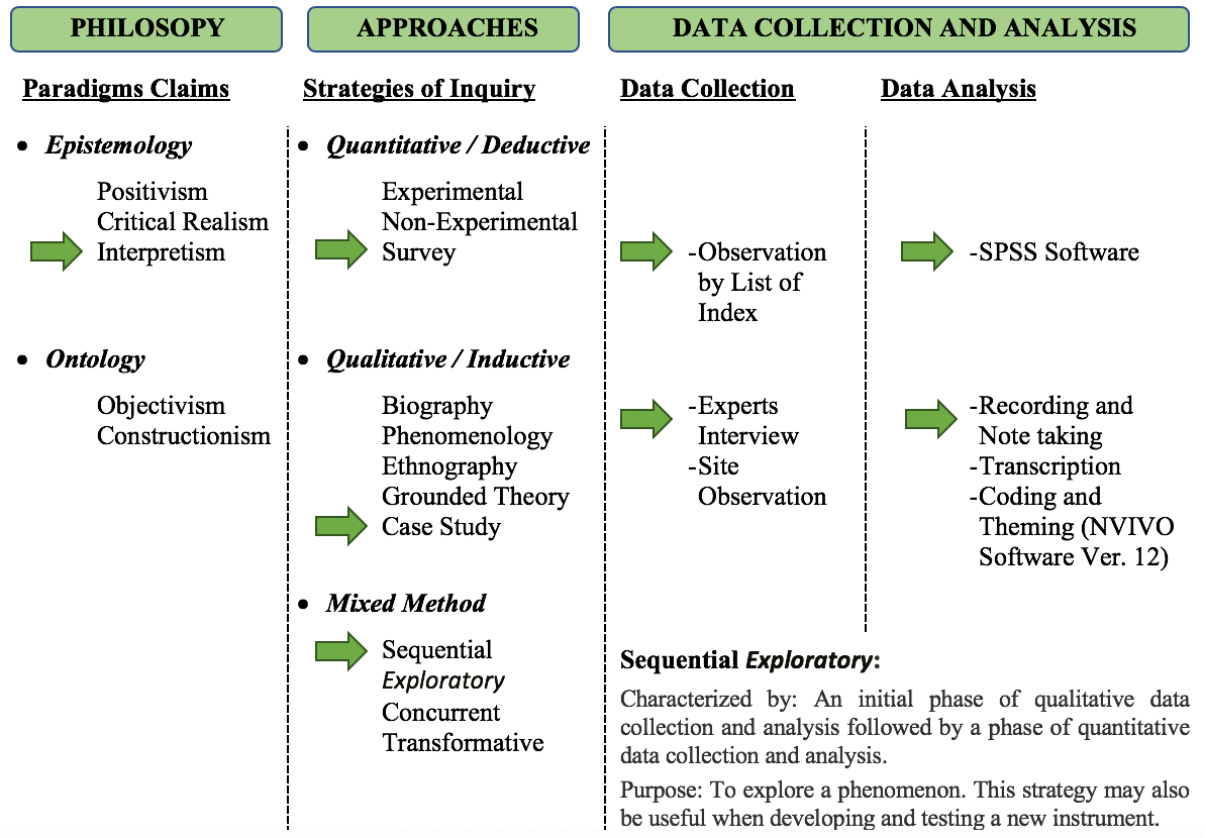

Figure 3.3 Research design strategies adapted from Miles et al. (1994); Bryman, (2012); Creswell (2018)

The following research questions guided the final decisions in adopting the methodological approach:

- How can a Medium-sized City embody the qualities of Green Urbanism Principles?
- How does urban walkability relate to Green Urbanism Principles (GUP)?
- How can urban walkability be measured in terms of Green Urbanism Principles (GUP)?

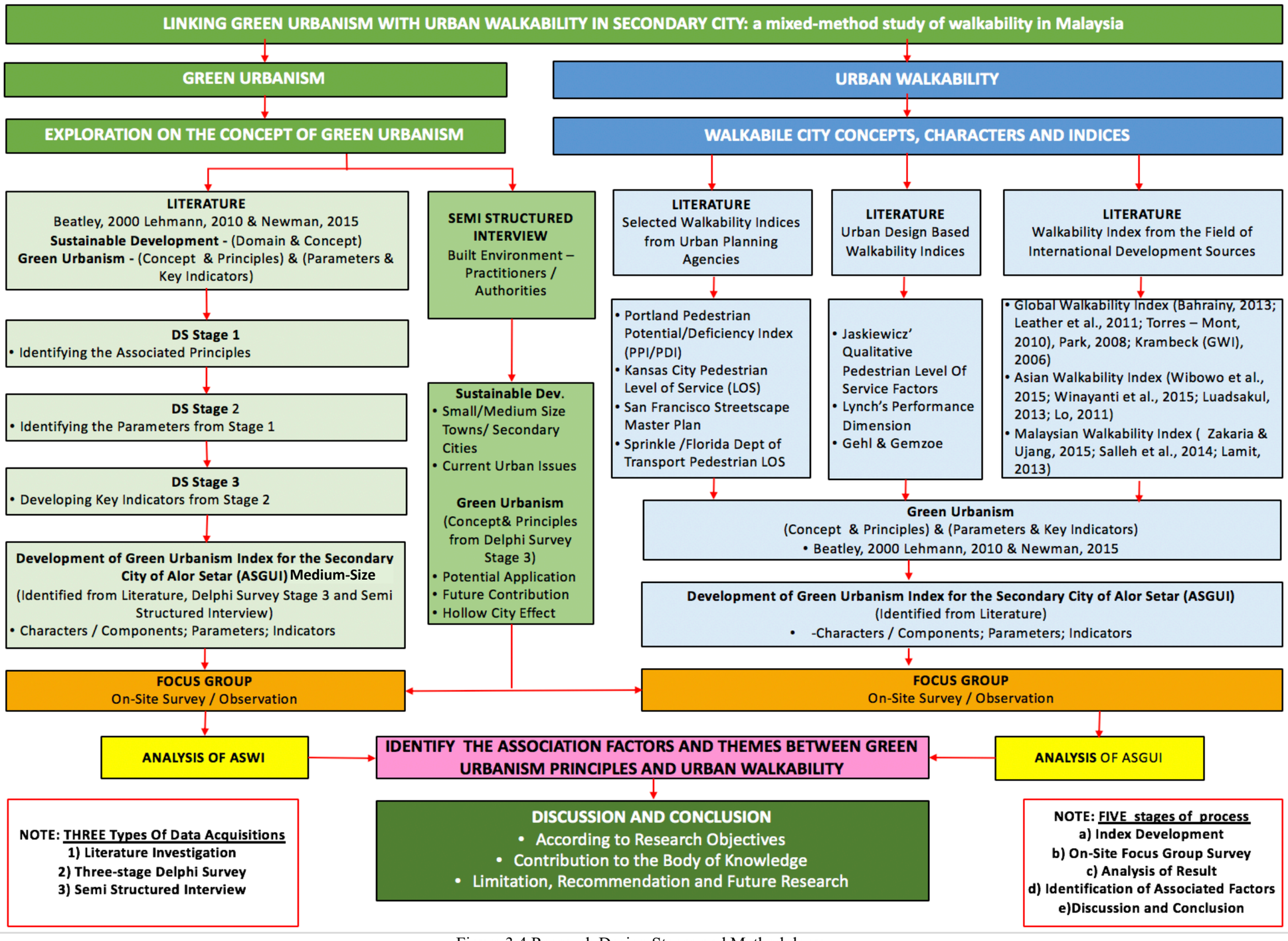

Figure 3.4 Research Design Stages and Methodology

The above Figure 3.4 illustrates the research design stages and methodology employed in this research. It involves THREE types of data acquisitions, 1) Literature investigation, 2) Three-Stage Delphi Survey, and 3) Semi-structured Interview. The process was divided into FIVE stages, a) development of indices (ASWI and ASGUI), b) On-Site Survey using ASWI and ASGUI by Focus Group, c) Analysis of Result, and d) Identifying the Factors of Association, and e) Discussion and Conclusion.

3.2 Research Strategy: Case Study

The developed Green Urbanism Index and Walkability Index were then tested at the selected site. One of the critical issues is the selection of the appropriate scale of the case study site for the study to be conducted (Thomas, 2011). The walkability of a town can be measured either Regional (macro-scale) or Local / Neighbourhood (micro-scale) (Lathey, Guhathakurta, & Aggarwal, 2009; Leach, Lee, Hunt, & Rogers, 2017).

3.2.1 Case Study Site Selection

Sustainability and liveability are often neglected in city planning and development in small and medium-size city (Cox & Longlands, 2016; Rainis, Shariff, & Masron, 2006; Samian, Jahi & Awang, 2014; Way, 2016). Alor Setar was chosen as a case study site due to its best-suited city character and unique historical values. Being the most extensive displays of royal characters, buildings and relics of the nine main Malay Royal Towns in Malaysia (Mohmad Shukri, Manteghi, Wahab, Che Amat, & Hick Ming, 2018), Alor Setar is a perfect exemplar for this precedent study. The study of Green urbanism application works best in places with strong history and local identity as accorded to Luccarelli & Røe (2012, pg. 5), and Alor Setar is known for its strong historical background and identity. Figure 3.5 showcases the typical characters of five of Malaysia's largest Traditional Malay Royal Towns.

Physical Characteristics	ALOR SETAR	KLANG	SERI MENANTI	KUALA TERENGGANU	KOTA BAHRU
Royal palace Complex	Istana Pelamin	Istana Alam Shah	Seri Menanti Complex	Istana Maziah	Istana Balai Besar
Fortress	Kuala Bahang Fortress	Raja Mahdi Fortress	Natural Hill and Palace Fortress	Bukit Puteri Fortress	Along Kelantan River
Mosque	Zahir Mosque	Sultan Sulaiman Mosque	Tanjung Sembeling Mosque	Zainal Abidin Mosque	Muhammadi Mosque
Public Open Space	Medan Bandar	Padanag Sultan Sulaiman	Padang Diraja Seri Menanti	Padang Maziah	Padang Merdeka
Marketplace	Pekan Rabu	Pasar Besar	Pasar Seri Menanti	Pasar paying	Pasar Siti Khadijah
River & Jetty	Kedah River	Klang River	Seri Menanti River	Terengganu River	Kelantan River
Settlement	Kampung Melayu & Cina	Kampung Sungai Udang	Kampung Buyau	Kampung Keling	Buluh Kubu
Gateway	Istana Kota Tengah Gateway	Raja Mahdi Gateway	Seri Menanti Gateway	Istana Maziah Gateway	Istana Balai Inner Gateway

Figure 3.5 Comparison of physical characteristics of Traditional Malay Royal Towns: Kota Setar, Klang, Seri Menanti, Kuala Terengganu and Kota Bharu.
Source: Mohmad Shukri et al. (2018, pg. 854)

a. Mission and Vision of the City Manager

According to the mission and vision statements, Majlis Bandaraya Alor Setar – MBAS (Alor Setar City Council) is committed to achieving sustainable development, and aiming towards transforming the city into a liveable township by 2035 (MBAS, 2018).

b. Strong Local Identity and History

GU best works in places with a strong local identity and history (Luccarelli & Røe, 2012). The state of Kedah has a strong and rich historical background – starting from being one of the oldest ancient Hindu empire in South East Asia to the Malay Muslim Sultanate lineage, from the Siamese empire occupation, the western colonialization to a state of an independence country (Abdullah, 2003; Ayob, Harun, & Mat Akhir, 2013; Moore, 2011). The strong identity and rich history of the Malay Sultanates and their legacies are still perceptible in and around Alor Setar especially at the Heritage Zone as shown in Figure 3.6 below, showcasing the old city Gateway, Masjid Zahir (State Mosque), the Yellow Palace, the Great Audience Hall and other physical structures and artefacts - refer chapter

4, sub-section 4.6.1 for details description and images (Arkib Negara Malaysia, 2017; Chen, 2007; Harun & Abdul Jalil, 2012, 2014).



Figure 3.6 The Heritage Zone - Showcasing the Strong Identity of the Malay Sultanate and the Rich Architectural Artefacts

c. Unique Urban Setting

Alor Setar urban setting is unique and surrounded by greeneries of peri-landscape, paddy fields and residential areas. Water bodies are running through the city, the Sungai Kedah (Kedah River) and the man-made canal from the city centre connecting the Kedah River as a form of flood control measure in the city centre during the rainy season. The residential areas surrounding the city centre is approximately 1.5 km radius, making walkability possible and practicable. There are also inner-city residential areas, namely Pekan Cina and Pekan Melayu in the form of double storey shophouses, where the ground floor of the premise is for business, and the top floor functioned as a residential.



Figure 3.7 Aerial View of Alor Setar City

d. Geographical and Topographical Condition of the City

Approximately 85% of Alor Setar is flat land, and the overall area of the city centre is generally flat, making it suitable for walking (MBAS, 2018). The city manager is currently active in promoting landscape quality as one of its identity. The whole of Alor Setar will be planted with more flowering shade trees from the species of Tabebuia rosea or Tecoma tree or fondly known as 'Malaysian Sakura' among the locals due to the pinkish colour of the flowers. According to Alor Setar City Council, Tecoma has been endorsed as the landscape identity for Alor Setar and Kedah. Thus, developers must plant

the tree in all new developments. Currently, there are about 1,136 Tecoma trees all over the city (refer to Figure 3.8).



Figure 3.8 The blooming of Tabebuia *rosea* in Alor Setar.
Source: utusan.com.my/rencana/utama/musim-sakura-dan-masa-depan-kxp-di-kedah-1.304415, (Retrieved: 2nd March 2016)

e. State Government Policy

The aspiration for city development is parallel with the National Development Policy (2014-2017) that focus on:

i. Efficient and sustainable development.
ii. Strong, dynamic and competitive city's economic development.
iii. Integrated and efficient transportation system.
iv. Provision of quality city services, infrastructure and utility.
v. Creation of prosperous environment for city living with local identity.
vi. Effective city management.

Source: MBAS (2018); Md Daud (2014)

3.2.2 Case Study Protocol

The case study protocol is an essential way of increasing the case study research reliability (Barbour, 2008). It is intended to guide the researcher in carrying out the data collection exercise in the case study. The protocol contains procedures, relevant instruments and general rules to be strictly followed during data collection (Sholihah, 2016; Yin, 2018). There are six sources of evidence that might be used in case studies as suggested by Yin

(2018) and employed in this research, documentation, archival records, interviews, direct observations, participant observations and physical artefacts.

3.2.3 Pilot Study

The pilot studies for this research were done in two separate categories namely, Walkability and Green Urbanism Indices;

a. Walkability and Green Urbanism Indices

The completed indices were tested at Sungai Petani city centre (the second-largest city in Kedah) with one focus group consisting of four members to identify and act upon of the followings:

i) The ability of the group members to understand the indices: It was found that all group members have no issues with both indices. The wording and phrases in both indices were easily understood and no amendment required.

ii) The ability of the group members to identify listed items in both indices on study site and scoring process: All group members were able to perform as explained, and the scoring process was completed without any issues.

iii) Time spent to complete the task: The timings to complete both indices were within the time range as estimated and comfortable for all group members even under the heat and busy urban environment. The 5-point Likert scale proven to be uncomplicated and straight forward for the scoring process. Group members were able to quickly discuss the items for scoring before the final scores were recorded.

b. Semi-structured Interview

Two pilot interviews were carried out involving one PhD student of the same background at the University of Nottingham and an architect who was at the time a member of Nottingham Malaysian Community (NMC) to identify and act upon of the followings:

i) Time spent on the task and the number of questions: The initial interview questions were found to be too many and consumed too much of interviewees' time. Therefore, the list of questions was reduced and rephrased, to shorten the time and at the same time allowing rooms for interviewees to expand their views.

ii) Generality and specificity of the questions: It was proven that the list of questions was general enough that allow interviewees to share their ideas and at the same time specific enough to cover and envelop the main issue.
iii) Another point raised during the interview was to include questions or suggestions on related 'themes or classifications' to relate, associate or compare between urban walkability and green urbanism quality.

3.3 Green Urbanism: Data Collection Stages and Method of Analysis

The research on the domain of Green Urbanism employed qualitative data acquisition and a mixed of qualitative and quantitative approaches in data analysis. The data acquisitions processes were divided into two categories;

- Developing ASGUI and
- Measuring urban walkability using ASGUI.

3.3.1 Procedures of Developing Alor Setar Green Urbanism Index (ASGUI)

There are three categories in the procedure, namely a) Literature Investigations, b) Delphi Survey and c) Semi-structured Interviews. Figure 6.10 (in Chapter 6) showcase the detail process and procedure for Green Urbanism data acquisition. The processes were as follows:

a. Literature Investigations – Qualitative Method Data Acquisition and Analysis

The first stage of data generation was through exploration on the Domain of Green Urbanism. The process of literature review focused primarily on the contribution of Green Urbanism towards enhancing a pleasant urban physical environment and urban walkability. The literature investigation also helped deepen the understanding of the research topic and formed the research background. Literature investigation generated the first stage of data that is a list of general components of Green Urbanism (from Beatley, 2000; Newman 2010) that can be associated with urban walkability. The general list of components was then explored further and merged with the proposed Principles of Green Urbanism as proposed by Lehman, 2010b. Based on the literature, a list of Green

Urbanism's components and principles that can be associated with urban walkability was established and to be triangulated with the finding from the Three-Stage Delphi Survey.

This investigation as summarised in Table 3.1, the literature investigation also fulfils Research Objective 1, that is "To understand the concept of Green Urbanism and its principles (GUP) and identify its qualities for the revitalisation of a Medium-sized City)" which answers the Main Research Question, "How can a Medium-sized City embody the qualities of Green Urbanism Principles that are related to the built environment, community, landscape and urban sustainability?.

Table 3.1 Literature Investigation on Green Urbanism Components

	Description
Method	Thorough exploration on the Domain of Green Urbanism with categorisation focussing on the contribution of Green Urbanism towards; • Enhancing pleasant urban physical environment • Encouraging urban walkability • Background of research
Sources / Participants	1) Key Authors: ; Lehmann, 2010b; P. Newman, 2010 etc. 2) Journal Papers and Books
Analysis	Document and Content Analysis
Outcome	Identified the general Green Urbanism Components associated with urban walkability.
Validation	Comparison to the result of Stage 1 and 2 of Delphi Survey
Research Question	Answering main Research Question; How can a Secondary City embody the qualities of Green Urbanism Principles that are related to the built environment, community, landscape and urban sustainability? Subsidiary research question;
Research Objective	Research Objective No. 1: To examine the role of Green Urbanism principles (GUP) for the revitalisation of Secondary City

b. Delphi Survey – Qualitative Method Data Acquisition and Quantitative Data Analysis

The second type of data collection is a three-stage adapted Delphi Survey technique. This method helped in obtaining consensus notion from a selected group of expert academics in the built environment. Delphi survey is a qualitative method (Creswell, 2014, 2018) and a form of judgment or forecasting techniques proven appropriate in developing indicators or ranking of evaluation criteria (Arvan, Fahimnia, Reisi, & Siemsen, 2019; Grisham, 2009; Landeta, Barrutia, & Lertxundi, 2011; Mitchell, 1991; Rowe & Wright,

1999; Rowe, Wright, & Bolger, 1991; Skulmoski, Hartman, & Krahn, 2007; Teriman, 2012; Winkler & Moser, 2016).

There are four frequently used Delphi approaches in research, namely Classical, Policy, Decision and Tanking-type Delphi, which details presented in Figure 3.9. However, there are criticisms on the use of Delphi technique such as the biases in expert selection (Mushonga et al., 2018; Winkler and Moser, 2016; Mitchell, 1991), lack of selection of rigorous experts (Gupta & Clarke, 1996; Landeta, 2006; Winkler and Moser, 2016; Mushonga et al., 2018) and its inability to garner numeric result accuracy of clinical testing-type (Grisham, 2009, pg. 125; Teriman, 2012).

	Classical Delphi	**Policy Delphi**	**Decision Delphi**	**Ranking-type Delphi**
Focus	Facts	Ideas	Decisions that influence future directions	Rankings
Goal	Create consensus	Define and differentiate views	Prepare and support decisions	Identify and rank key issues
Panelists	Unbiased experts	Lobbyists	Decision makers	Experts
Participation	Need many panelists (in relation to the complexity of the questions being asked)	Consider all relevant groups	Cover a high percentage of the relevant decision makers	Number of panelists should not be too large (in order to facilitate consensus)
Common uses	In the natural sciences and engineering where underlying physical ''laws of nature'' guide experts' answers	In social and political contexts to analyze policy issues	In contexts where a small, well-defined group have decision making power	In business to guide future management action or research agendas

Figure 3.9 Comparison of Delphi Types
Source: Paré, Cameron, Poba-Nzaou, & Templier (2013, Pg 208)

However, the Delphi technique is beneficial when other methods are not adequate or appropriate for data collection (Linstone & Turoff, 1975, p.4-6). Besides, this established technique of harnessing judgement from a selected group of experts has the flexibility as a decision-aiding tool when there lacking or even unknown evident or knowledge concerning to issues of interest (Mitchell, 1991; Murphy et al., 1998; Pandor et al., 2019; Rowe & Wright, 1999; Teriman, 2012). Furthermore, Delphi survey is the most appropriate technique in attaining consensus of agreement involving complex and new concepts (Kleemann, Baysal, Bulley, & Fürst, 2017, pg.412; Zarghami et al., 2018, pg. 113) and it also advantageous when dealing with cross-field research (Hasson, Keeney, & McKenna, 2000; Olawumi & Chan, 2018).

Table 3.2 The Strength and Weaknesses of Delphi Survey

Strengths	Weaknesses
1. The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis. 2. The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience and expertise. 3. More individuals are needed than can effectively interact in a face-to-face exchange. 4. Time and cost make frequent group meetings infeasible. 5. The efficiency of face-to-face meetings can be increased by a supplemental group communication process. 6. Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured. 7. The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality ("bandwagon effect").	1. Imposing monitor views and preconceptions of a problem upon the respondent group by over specifying the structure of the Delphi and not allowing for contribution of other perspectives related to the problem. 2. Assuming that Delphi can be a surrogate for all other human communications in a given situation. 3. Poor techniques of summarizing and presenting the group response and ensuring common interpretations of the evaluation scales utilized in the exercise. 4. Ignoring and not exploring disagreement so that discouraged dissenters drop out and an artificial consensus is generated 5. Understanding the demanding nature of a Delphi and the fact that the respondents should be recognized as consultants and properly compensated for their time if the Delphi is not an integral part of their job function.

Source: Adapted from Linstone & Turoff (1975, p.4-6)

Consequently, weighting the strengths and weaknesses of the Delphi Survey as shown in

Table 3.2, the Author concluded that Delphi Survey was the perfect method to obtain the data required for this research for reasons: 1) Green Urbanism is relatively a new concept in Malaysia, and urban planning in Malaysia are still following the conventional approaches, 2) Preliminary review on the topic in Malaysia (prior to the approval of PhD study) showed that the knowledge on the topic is limited to academics and a small number practitioners, and 3) it facilitates the process of procuring consensus of agreement among cross-field professionals (Urban Planners, Landscape Architects, Architects, Engineers and Academics).

i. Selection of Experts

The selection of experts were drawn from built environment academics from Malaysia's public universities with a minimum of five years of teaching in built environment courses. The criteria of experts for this survey was determined following the set conditions as listed in Table 3.3. A minimum of five years of experience was set following the standard

ruling for 'Confirmation Guidelines in the Service' for public universities academics. According to the guidelines, a minimum qualification is Masters degree in any built environment field, serving a maximum of three years under probation period, additional two years as subject matter expert with a minimum of one academic research, and successfully completed compulsory related courses set by the university (Civil Service Commission Malaysia, 2008; The Office of Registrar UiTM, 2014).

The criteria for validator was set as senior academic (Associate Professor/Professor) who are an active researcher/post graduate supervisor with vast experiences and knowledge in sustainable development in Malaysia. Nineteen participants participated during the main Delphi Survey, and two senior academics from two other universities participated in the validation survey. The initial planning was to get 30 built environment experts from several public universities, but it was immaterialized due to time constraints, availability, travelling and logistic issues.

Table 3.3 Selection of Experts for Delphi Survey

No.	Category	Description
	Eligible Criteria (Main Delphi Survey)	
1	Gender	Male and Female
2	Back Ground	Built environment academicians/experts
3	Academic Qualification	• 10 – 20 participants • Senior Academicians • PhD / Masters in Built Environment fields -Landscape Architecture -Architecture -Urban Design -Town and regional Planning
4	Years of Experience	Minimum of five years
5	Availability	Able to participate in all Three Stages of Delphi Survey - Stage 1: Individual - Stage 2: Group Discourse - Stage 3: Group Discourse
	Eligible Criteria (Final Validation of Delphi Survey)	
6	Academic Qualification	• Two participants • Senior Academicians/Assoc. Prof./Prof. • Active Researchers • PhD in Built Environment fields
	Availability	One off survey

ii. Number of Experts

There are no specific rules on the ideal number of the panel of experts in Delphi survey as it can range between 4 to 3000, although Linston & Turoff (1975) suggested seven (Thangaratinam & Redman, 2005). Johnson (1976) in Paliwoda (1983, pg 36) stated that:

> "...it has been found that average group error drops rapidly as the number in the Delphi group is increased to about eight to twelve. After reaching a number of about thirteen to fifteen, the average group error decreases very little with each additional member. Thus, a Delphi user could feel fairly safe in choosing a group size of ten to twelve."

Okoli & Pawlowski (2004) are in the opinion that 10-18 expert is sufficient and further highlight that the number of experts in Delphi group size does not depend on statistical power, but instead on group dynamics for attaining at a consensus among experts. Paliwoda (1983) suggested 18 panel of experts is appropriate as it caused fewer conflicts and manageable however Zarghami, Azemati, Fatourehchi, & Karamloo (2018) were in the opinion that the ideal range is 10 – 50 experts. In this research, the panel of experts involved are 19, and it is worth to note that these experts made an excellent range of expertise, experience and qualifications with some being active researchers.

iii. Delphi Survey Stage 1: Identification of Green Urbanism Principles (GUP) that are related to urban walkability

Stage 1 of data collection via Delphi Survey was to investigate the association of GUP with urban walkability. Each expert was given a set of GUP with a sufficient description of the objective and purpose of the principles. Each expert was then asked to indicate (according to their knowledge, expertise and understanding) which principles from the list are RELEVANT or NOT RELEVANT with urban walkability. All Principles with Percentage of Agreement equal to or higher than **a Cut-off Point Percentage of 66.7%** (refer 6.9.4 (b) Establishing Consensus of Agreement in Delphi Survey) were then included in the Delphi Survey Stage 2. The detail discussion is in Chapter 8, sub-heading 8.2.

iv. Delphi Survey Stage 2: Examining and discussing the selected principles (from Stage 1) together with its detail content for relevancy to walkability.

The Stage 2 of Delphi Survey involved the same group of experts were asked to discuss together in a group to extract Parameters and list as many as possible Key Attributes from

the detail content of the selected principles. Participants were asked to decide on the relevancy of each Principle and its key attributes by indicating 'Yes' for agreeing of its relevancy or 'No' for disagreeing in a provided checklist. The result was calculated using statistical analysis of Intraclass Correlation Coefficient (ICC) and frequency of agreement. The List of Parameters and Key Attributes were then finalised and included in Delphi Survey Stage 3.

v. Delphi Survey Stage 3: Assessing the selected indicators (from Stage 2) to finally create a list of Key Indicators that associate Green Urbanism with urban walkability.

In Stage 3, All experts as a group were to discuss and list the potential indicators that can be derived from the list of key attributes as in Stage 3. The identified indicators and its description were then finalised based on their theme/classification of association and contribution to urban walkability. At the end of the group discussion, a complete list of Green Urbanism Component, Parameters, Key Attributes and Indicators were produced. To test the validity of the list developed, further verification was carried out in the form of linear validity and relevancy by two other senior academicians from different public universities to determine the Level of Agreement. Results of the validity test were analysed using SPSS ver. 24 by calculating the Kappa value and Significance value. Finally, the outcome from the Three-Stage Delphi Survey was then compared with the finding from Literature Investigation. Consequently, a final List of Green Urbanism index was created for use in Alor Setar.

The research seeks to identify the link between GUP and walkability and does not seek to evaluate the hierarchical impact of each key attributes. Additionally, due to the time constrained on the part of Delphi survey's participants, only issues concerning the aim and objectives of the research were covered. As displays in Table 3.4, the Delphi Survey data helps to accomplish Research Objective 2, that is 'To distinguish the determinant elements in Green Urbanism principles (GUP) that promote walkability in Medium-sized City', and answered the subsidiary research question 1) How does urban walkability relate to Green Urbanism Principles (GUP)?

Table 3.4 Delphi Survey Method - to Establish the Association of Green Urbanism Principles (GUP) with Urban Walkability

	Description
Method	Three stages of Delphi Survey: 1) Stage 1: Individual identification of GUP that are related to urban walkability 2) Stage 2: Group examination and discussion of the MOST selected principles (from Stage 1) together with its detail content for relevancy. To extract and list as many as possible indicators from the detail content of the selected principles. 3) Stage 3: Assessing the selected indicators (from Stage 2) to finally create a list of Indicators that associate Green Urbanism with urban walkability. : The list of Indicators was validated by other two senior academics.
Sources / Participants	Involving nineteen (19) Academic experts in Built Environment from local universities plus two (2) senior academics from other universities for final validation; • 14 Senior Academics (3 - Architecture, 5 - Landscape Architecture and 6 - Urban Design) • 5 Academics (4 - Landscape Architecture and 1 - Urban Design) • 2 Senior Academics (1 - Landscape Architecture, 1 – Urban Design)
Analysis	Stage 1: Descriptive analysis using Percentage of Consensus of Agreement Analysis to identify; • GUP associated with urban walkability Stage 2: Group discourse involving the process of addition and omission using majority of agreement. • Green Urbanism Parameters, Key Attributes and potential Indicators for urban walkability measures Stage 3: Finalising the agreed list involving the process of addition and omission using majority of agreement • Green Urbanism Parameters, Key Attributes and Indicators for urban walkability measures • Final list was analysed using Cohen's Kappa Inter-rater Correlation Coefficient analysis.
Outcome	A complete list of Green Urbanism Parameters, Key Attributes and Indicators that are associated with urban walkability. (Development of ASGUI)
Validation	Triangulation from findings in Literature Investigation and Cohen's Kappa Inter-rater Correlation Coefficient analysis value
Research Question	Answering Subsidiary Research Question; 1) How does urban walkability relate to Green Urbanism Principles (GUP)?
Research Objective	Research Objective No. 2. "To identify the determinant elements in Green Urbanism principles (GUP) that promote walkability in Secondary City"

c. Semi-structured Interviews – Qualitative Data Acquisition and Analysis

The third type of data collection involved the Semi-structured Interview. The sampling technique employed in this research was purposive sampling that is relatively common in mixed methods research (Hall, McDonald, & Peleg, 2018; Teddlie & Yu, 2007). It can be defined as a selection of units of a group of individuals, individuals or groups according to a specific purpose to answer research questions (Palinkas et al., 2015; Teddlie & Yu, 2007). Additionally, the purposive sampling technique is best for small

sampling size (Palinkas et al., 2015), targeting on specific phenomena which information only the selected samples can provide (Maxwell, 2008; Teddlie & Yu, 2007). The Semi-structured Interviews involved 16 local professionals, practitioners and authorities in Built Environment.

The letter of intent for an interview session were sent to 40 various local professionals, practitioners and authorities in Built Environment. A total of 25 professionals replied and agreed to participate in the semi-structured interview sessions. However, due to the narrow time frame, last minutes cancellations and busy schedule, only 16 participants were able to participate during the span of three months data gathering period in Malaysia as approved by the researcher's sponsor. Nonetheless, the available participants is still in the range of minimum number as accorded by Guest, Bunce, & Johnson (2006) and Morse (2000), a focus content in semi-structured interview requires a small number of participants; of which Cresswell (2007) and Saunders (2012) suggested between 5-25 participants.

The Semi-structured Interview was designed with a list of questions and key points to be covered and methodically work through them. The guided questionnaire helps to explore themes of research as developed earlier from the Content Analysis in Literature Investigation and findings from Descriptive analysis in Delphi Survey. This process of Semi-structured Interview gave freedom to the interviewees to articulate their opinion on other subject matter pertinent to the research. The interviews were carried out at interviewees office and other places convenience to interviewees. Interviews were recorded mostly using Olympus Audio Recorder (model: WS-853) with the informed consent by interviewees and by note-taking when the interviewees declined for the conversations to be digitally recorded. The digital recorded data and manual notes were then compiled and transcribed using Computer Assisted/Aided Qualitative Data Analysis Software (CAQDAS), NVIVO Version 12. Once completed, all transcribed data were classified using a coding system based on Themes and Sub-themes for thematic analysis. Table 3.5 below summarises what can be coded as pointed out by Gibbs & Taylor (2010).

Table 3.5 Types of Phenomena That Can Be Coded (In Gibbs & Taylor, 2010; adapted from Bogdan and Biklen, 1992; Strauss, 1987; Gibbs, 2006)

	What can be coded	Example
1	Behaviours, specific acts	Seeking reassurance, bragging
2	Events – short once in a lifetime events or things people have done that are often told as a story	Wedding day, day moved out of home for university, starting first job
3	Activities – these are of a longer duration, involve other people within a particular setting	Going clubbing, attending a night course, conservation work
4	Strategies, practices or tactics	Being nasty to get dumped, staying late at work to get promotion
5	States – general conditions experienced by people or found in organisations	Hopeless "I'll never meet anyone better at my age" settling for someone who is not really suitable
6	Meanings – a wide range of phenomena at the core of much qualitative analysis. Meanings and interpretations are important parts of what directs participants' actions a. What concepts do participants use to understand their world? What norms, values and rules guide their actions b. What meaning or significance it has for participants, how do they construe events, what are the feelings c. What symbols do people use to understand their situation? What names do they use for objects, events, persons, roles, setting and equipment?	The term 'chilling out' is used by young people to mean relaxing and not doing very much Jealousy "I just felt why did she get him" A PhD is referred to as 'a test of endurance' (because finishing a PhD is a challenge)
7	Participants' adaptation to a new setting or involvement	About new neighbours "In my new house I have to keep my music down at night as the neighbours have young children"
8	Relationships or interaction	Seeing family "Now my sister lives in the next road she visits more, and we've become much closer"
9	Conditions and constraints	Loss of job (before financial difficulties), moving away (before lost contact with old friends)
10	Consequences	Confidence gets dates, positive attitude attracts opportunities
11	Settings – the entire context of the events under study	University, workplace, housing estate
12	Reflexive – researcher's role in the process, how intervention generated the data	Probing question "How did you feel when he said that?"

Source: Gibbs and Taylor (2010, onlineqda.hud.ac.uk/Intro QDA/how_what_to_code.php. Retrieved: 26th June 2016)

The thematic analysis helped in attaining a meaning that is pertinent to the research by the identification of themes (Willig, 2014) and patterns (Braun & Clarke, 2006) in the data sets. There are many approaches in the coding process (Corbin & Strauss, 2015;

Saldana & Omasta, 2016; Willig, 2014) and the coding process was performed at three levels as follows;

i) Initial Coding – the data reduction process which involved the organisation of transcribed data, identification of distinct concept and categorisation of themes related to research questions. The identification of themes and codes were made as suggested by Saldaña (2016) and Gibbs & Taylor (2010) as Table 3.6 below:

Table 3.6 Technique to Identify Themes and Codes

Technique	Description
Word repetitions	look for commonly used words and words whose close repetition may indicated emotions
Indigenous categories (grounded theorists refer to as 'In vivo coding')	terms used by respondents with a particular meaning and significance in their setting.
Key-words-in-context	look for the range of uses of key terms in the phrases and sentences in which they occur.
Social science queries	introduce social science explanations and theories, for example, to explain the conditions, actions, interaction and consequences of phenomena. Searching
Searching for missing information	essentially try to get an idea of what is not being done or talked out, but which you would have expected to find.
Metaphors and analogies	people often use metaphor to indicate something about their key, central beliefs about things and these may indicate the way they feel about things too.

Source: Adapted from Saldana (2016); Gibbs & Taylor (2010); Ryan & Bernard (2003); Corbin & Strauss (2010)

ii) Axial Coding – the process of repetitive reading of the qualitative (transcribed) data to finalise the ideal categories or themes, related and comparable data were categorised and compiled together under one theme, and

iii) the interpretation of coded data – all coded themes were analytically categorised and compiled following their content and context. Next, identification of trends, patterns and explanation in the codes were carried out using the content analysis method. All data set were to be presented in the form of descriptive text, quotes, table and charts. Table 3.7 below summarises the process of Semi-structured Interview.

Table 3.7 Semi-structured Interview with Local Experts – to Identify Association of Green Urbanism Principles (GUP) with Urban Walkability and Its Applicability in the Malaysian Context

	Description
Method	Semi structured interview with guided questionnaire helps to explore themes of research as developed earlier from the Content Analysis in Literature Investigation and findings from Descriptive analysis in Delphi Survey. Interviews were recorded mostly using Olympus Audio Recorder (model: WS-853) with the informed consent by interviewees and by note taking when the interviewees declined the conversations to be digitally recorded.
Sources / Participants	Structured interview involving 16 local professionals, practitioners and authorities in Built Environment. • 3 Policy Makers • 2 Landscape Architects • 2 Architects • 3 Town and Regional Planners • 2 Urban Planner • 1 Professional Body • 2 Professors of Landscape Architecture and Urban Design • 1 Environmental Engineer
Analysis	Content Analysis; research method that provides a systematic and objective means to make valid inferences from verbal data in order to describe and quantify specific phenomena. Utilising NVIVO Software Version 12 to; i) transcribed interviews data into table of conversation (together with Microsoft Words) ii) Categorising information from the interviews into Themes. iii) Coding the Themes into Sub-themes for detail analysis. iv) Qualitative analysis and Quantitative analysis based from NVIVO coding system
Outcome	A set of codes of themes and sub-themes generated from the semi structured interviews data. All Data set were to be presented in in both qualitative and quantitative in the form of descriptive text, quotes, table and charts.
Validation	Data gathered were triangulated with finding from Literature investigation and findings from the three-stage of Delphi Survey.
Research Question	Answering Subsidiary Research Question; 1. How does urban walkability relate to Green Urbanism Principles (GUP)? 2. How can urban walkability be measured in terms of Green Urbanism Principles (GUP)?
Research Objective	Research Objective No. 2. To distinguish the determinant elements in Green Urbanism principles (GUP) that promote walkability in Secondary City No. 3. "To establish the link between green urbanism principles (GUP) and urban walkability and their potential impacts in improving the environment in Secondary City)"

3.3.2 Procedures of Measuring Urban Walkability Using Alor Setar Green Urbanism Index (ASGUI)

The process of measuring urban walkability using ASGUI involves:

a. Focus Group – Quantitative Method Data Acquisition and Quantitative Data Analysis

The fourth type of data collection (as summarises in Table 3.8) involved the Focus Group Field Survey comprising of 21 participants in four groups. The process started with the selection of group members consisting local volunteers, from the age of 18 – 40 years of age, physically fit to walk the selected routes and committed to participating in the field survey for four and a half days (refer to sub-section 3.4.2 for selected age range). Once the groups of volunteers were confirmed, they were required to attend a half-day workshop before the actual field survey took place. During the workshop, participants were informed on the purpose of the research, the objective of the field survey, and their roles and responsibility. They were also introduced to the study routes, materials tools to be used; and explained the detail procedures of ranking and recording using the checklist in the index.

All recorded data rankings during the field survey were brought back to the station, and all four groups were asked to discuss (with their group member) and finalised their ranking based from their observations, experiences and findings. The results from the Focus Group surveys were analysed utilising SPSS version 24. The analysis employed the Three-steps validation process, which the objective is to test the validity of each indicator in measuring its latent variables (Parameters).

Table 3.8 Focus Group Field Survey Method Using ASWI and ASGUI

	Description
Method	Focus Group Field Survey: Using ASWI and ASGUI
Sources / Participants	Focus group comprised of 21 local residents; • 11 - university/college students (18-22 years old) • 6 – business owner/self-employed & unemployed (22-36 years old) • 2 – part-time teacher (35-40 years old)
Analysis	ASWI – Statistical Analysis using Standard Global Walkability Index Ranking ASGUI – Statistical Analysis: Statistical Analysis using POMP Score and Categorical Ranking
Outcome	ASWI – Urban walkability value for each routes and route ranking. ASGUI – GUQ value for each routes and route ranking
Validation	Triangulation between ASWI and ASGUI to establish the most walkable route in the SC of Alor Setar and identified the determinant factors.
Research Question	Answering Subsidiary Research Question; 1. How does urban walkability relate to Green Urbanism Principles (GUP)? 2. How can urban walkability be measured in terms of Green Urbanism Principles (GUP)?
Research Objective	Research Objective No. 2. To distinguish the determinant elements in Green Urbanism principles (GUP) that promote walkability in Secondary City No. 3. "To establish the link between green urbanism principles (GUP) and urban walkability and their potential impacts in improving the environment in Secondary City)"

3.4 Field Survey and Observation Procedures for ASWI and ASGUI

The process of data acquisition from the Focus Group site survey involved stages as follows;

3.4.1 Selection and Tasks of the Focus Group

The recruitment fliers for focus group participants (refer Appendix: RF-8) were displayed at several public notice board and public places in Alor Setar as detailed in Table 3.9 below.

Table 3.9 Premise and Location of Recruitment Fliers for Focus Group Participants

No.	Premise	Location
1	7-Eleven 24 hours Marts	Aman Central, Alor Setar
2	7-Eleven 24 hours Marts	Jalan Putra
3	Tesco Supermarket	Mergong, Alor Setar
4	Tesco Supermarket	Setar Gate, Alor Setar
5	Giant Supermarket	Jalan Langgar, Alor Setar
6	Bus Stop	Pekan Rabu, Alor Setar
7	Public Notice Board	Majlis Bandaraya Alor Setar

3.4.2 Criteria of Participants

Initially, the intended criteria for focus group participants, as in Table 3.10, based on their age group range and work status was seen as advantageous and feasible. However, the planning was not materialised because of no volunteers from age group (i) 13 – 18 years old and only two volunteers from the elderly group (iv) 61 – 75 years old. However, after explaining the nature of works involved and the distance participants need to walk, both volunteers from the age group (iv) 61 – 75 years old decided to withdraw from participating (refer Table 3.10).

Table 3.10 The Initial Criteria for Focus Group Participants

No.	Category	Description
	Eligible Criteria	
1	Gender	Male and Female
2	Resident	Local Resident of Alor Setar, Kedah
3	Age	13 – 75 years • (category 1) 13 – 18yrs. (secondary school pupils) • (category 2) 19 – 25 yrs. (college students / working adults) • (category 3) 26 – 60yrs. (working adults) • (category 4) 61 – 75yrs. (pensioners / senior citizens)
4	Duration of Study	4 days (½ day Introduction and workshop)
5	Time of Survey	6.45am – 7.00pm
6	Remuneration	RM 25/day
	Task	Participants are required to walk in a group along selected routes within Bandar Alor Setar city centre to identify: • Walkable routes and green urbanism qualities based on a provided checklist and map. • To participate in group discussions and idea sharing at a workshop
7	Note	Good health and able to walk along selected routes in Bandar Alor Setar. Able to work a group and can contribute in group discussion and idea sharing.

Most volunteers (Table 3.11) were among college students who were on semester holiday (age group ranging from 18 – 22 yrs. old), young self-employed individuals (age group ranging from 22 – 32 yrs. old) and part-time teachers (age group ranging from 35– 40 yrs. old).

Table 3.11 Focus Group Participants: Age Group and Status

Age Group	Status	Detail Age	No. of Participants
18 – 22 years	University / College Student	18yo – 1 19yo – 4 20yo – 2 21yo – 3 22yo – 1	11
22 – 36 years	Business Owner / Self Employed	22yo – 1 26yo – 2 30yo – 1 35yo – 1 36yo – 1	6
	Unemployed	28yo – 1 32yo – 1	2
35 – 40 years	Part Time Teacher	35yo – 1 40yo – 1	2
	Total Participants		**21**

3.4.3 Workshop for the Survey and Duration of Survey

Before the field survey, all participants were required to attend a half-day briefing session place at Dewan Mini Taman Muhibah, Alor Setar on 9/2/2017 at 2.30 – 5.20 pm. During the briefing, all participants were made aware of the task and scope of work needed to be performed, security and safety issues and conformity of participation. Next, participants were being explained in detail the process of data collection, the area of coverage, materials and tools required for the data collection. Discussion and explanation on the content of both the Walkability Index list and Green urbanism list were done in detail to avoid confusion that would jeopardise data validity.

Participants were then divided into four groups (Group A, B and C – five members; Group D – 6 members) comprises of mix gender, age and status with intending to minimise biases in data ranking. Each group select their group leader to lead the team. All

participants were made aware of the importance of acquiring valid data; thus, each member needed to be a proactive, responsible and committed participant.

3.4.4 Instruction to Participants

Group members were given specific instructions inmaking sure the the smooth and efficient survey process. The instruction given were as follows;

a. Instruction to Group Leaders

The four group leaders were given an 'Instruction to Group Leaders' (refer Appendix IGL-9) sheet followed by verbal explanation and discussion to ensure absolute understanding of their scope of work and responsibility as the person in charge of their team members, all materials and tools; and to communicate with the researcher during the field survey.

b. Instruction to the Focus Group Members

Each group members were informed of the tasks and roles to be carried out during data acquisition as in Table 3.12;

Table 3.12 Role and Responsibility of Group Member

Role	Responsibility
Group Leader	person in-charge of their team members, all materials and tools; and to communicate with the researcher during field survey. Lead the discussion of the arising issues, ranking value in the index sheet and looking after the safety and welfare of group members.
Photographer	to take photos of the paths, the environment and event along the surveyed route.
Measurer	to measure the width of walking path
Data Register	to record measurement details and to register ranking value in index sheet with the agreement of tall group members.
Pedestrian Counting	To count the number of pedestrians at specific time and at selected stations.

The group members were asked to discuss and decide on the roles and responsibility of each group member according to their ability and confidence.

3.4.5 Equipment for Field Survey

Each group was equipped with essential materials and tools to assist them in data acquisition on the field, as detailed below;

- Compact Camera
- Map of Alor Setar City Centre
- Detail Map of Marked Survey Route
- List of ASWI
- List of ASGUI
- A 10 Metre (30ft.) Measuring tape
- Stationery Set (Clip file, pencil colours, colouring markers, highlighters, pens and pencils, white papers, Sticky Notes and erasers)

3.4.6 Data Acquisition Procedure during the Field Survey

The field surveys were carried out in four days following the availability of all participants Table 3.13. Sequentially, data acquisition during the field survey was divided into two phases as follows;

Table 3.13 Phases in Data Acquisition during Field Survey

Phase	Date	Time
Focus Group Introduction, Briefing and Workshop	9 Feb. 2017 Thursday (Weekday)	2.30 – 5.30 pm
Phase I		
Field survey for urban walkability using ASWI	10 Feb. 2017 Friday (Weekday)	6.45 am – 7.00 pm
	12 Feb. 2017 Sunday (Weekend)	6.45 am – 7.00 pm
Phase II		
Field survey for Green urbanism using ASGUI	11 Feb. 2017 Saturday (Weekend)	6.45 am – 7.00 pm
	13 Feb. 2017 Monday (Weekday)	6.45 am – 7.00 pm

The process of data gathering for both ASWI and ASGUI started as early as 6.45 am and ended at 7.00 pm for four days. It was intended for each ASWI and ASGUI field survey to be carried out in two days, one on a weekday and another on the weekend to better capture both working and non-working condition of the city. It is important to note that

unlike other states in Malaysia, the weekend in the state of Kedah (together with Kelantan, Terengganu and Johor) is on Friday and Saturday.

Data collection is a vital part of research; therefore, thorough planning must be done to ensure the field survey runs efficiently and generating reliable data. For that reason, the field survey by focus group was divided into two phases; however, the processes were the same for both as follows;

a. Fieldworks Survey

- The survey was done in four days, starting at 6.45 am and finished at 7.00 pm every day.
- The four groups were assigned to start the survey at four different routes (i.e. Group A at Route 1, Group B at Route 2, Group C at Route 3 and Group D at Route 4) and all four groups covered all routes at the end of the day (refer Chapter 4, section 4.6 for detail routes).
- Group members were asked to look for the items, conditions or situations listed in the index (both ASWI and ASGUI) and ranked the value from '1 to 5' with '1' being Very Poor and '5' being Very Good.
- There were at least three pedestrian counting stations as detailed in

- Table 3.14 for each route (depending on the length of the route). The selection of the counting points was based on the strategic location, main pedestrian routes and easily accessible.

Table 3.14 List of Route and Pedestrian Counting Point

No	Route	Location
1	Jalan Tunku Ibrahim	• City Plaza/Holiday Villa Hotel • Setar Walk • Central Bus Stop/Pekan Rabu • Jln Sultan M'mad Jiwa/Jln Tk. Ibrahim
2	Jalan Sultan Badlishah	• Wisma PKNK • Ukir Mall/Pekan Rabu • Sultan Abd Halim Building • Intersection Jln Sul. Badlishah/Jln Tk. Ibrahim • Jalan Mahsuri/Jln Kota • Jalan Kolam Air/UTC Bldg
3	Jalan Langgar	• Intersection Jln Langgar/Jln Raja/Shell • Intersection Jln Langgar/Jln Selamat/ Bank Islam • Intersection Jln Kolam Air/Jln Stesen
4	Lebuhraya Darul Aman	• Aman Central • Balai Besar/Masjid Zahir • Pekan Cina/River • Jln Sultan M. Jiwa

- Pedestrian counting process required additional volunteers apart from the existing Focus Group participants to take part due to the number of routes and counting points and duration for counting. For that reason, the researcher invited five colleagues for assistance. Two persons were assigned to do the pedestrian counting at each route except for Jalan Sultan Badlishah which required three persons. This is due to the many important road branches, hence the need for six counting points. The pedestrian counting times were scheduled as detailed in Table 3.15.

Table 3.15 Pedestrian Counting Time Intervals

	Time	Duration	Note
	Morning		
1		07.00am – 08.00am	Peak hour – to work
2		08.00am – 09.00am	Peak hour – to work
3		10.00am – 11.00am	Morning break
	Afternoon		
4		12.30pm – 01.30pm	Peak hour – Lunch break
5		01.30pm – 02.30pm	Peak hour – Lunch break
	Evening		
6		04.30pm – 05.30pm	Peak hour – off work
		05.30pm – 06.30pm	Peak hour – off work

b. Discussion and Finalising the Ranking Value: 8.30 pm – 10.30 pm

- After completing the survey for the day, group members were asked to meet up and discuss the whole process, finalising the ranking value in the index sheet and updating the progress to the researcher.
- Routes taken were marked on the map, notes of the survey were tidied up and the routes, notes were taken during the interview with pedestrians were refined for easy recording and reference.
- Discussions were made on the issues encountered and ways to resolve, and at the same time briefing for the next day survey works.

c. Discussion the Focus Group Survey

- On the fourth evening of the survey, each group completed all the data-entry process into a survey sheet, indication and marking on the survey map.
- Group leader updated the interview sheets and completed the issues/problem form.

3.5 Data Analysis Procedure

All data collected were analysed using both qualitative and quantitative approaches corresponding the purpose of the data for this research.

3.5.1 Quantitative Data Analysis

There are two types of quantitative data obtained in this research, first is Delphi Survey data, and the second is Focus Group Field Survey data.

a. Three-Stage Delphi Survey Data Analysis

The association of GUP with urban walkability were identified in stage 1 of the Delphi Survey. Expert participants were provided with an envelope containing i) Invitation to participate in the Delphi Survey, ii) Information Sheet briefing on the purpose and objective of the survey and Data Protection Act 1998, and iii) a checklist of 15 GUP together with the description of the principles extracted from Lehman (2010b).

Participants were asked to individually identify and rate the potential principles concerning the relevancy with urban walkability. The level of relevancy ratings ranged on a five-point Likert scale from '1 = Very Low, 2 = Low, 3 = Medium, 4 = High, and 5 = Very High'.

i. Stage 1: Descriptive analysis using Percentage of Consensus of Agreement Analysis to identify GUP associated with urban walkability. The data gathered from Stage 1 of Delphi Survey was analysed using Percentage of Consensus of Agreement method with cut-off points at 66.7% as discussed in ***6.9.4 (b) Establishing Consensus of Agreement in Delphi Survey.*** The selected principles exceeded the cut-off points of 66.7% were selected for stage 2 of the survey.

ii. Stage 2: Group discourse involving the process of addition and omission using the Percentage of Consensus of Agreement to develop Green Urbanism Parameters, Key Attributes and potential Indicators for urban walkability measures. Data gathered from Stage 2 of the Delphi Survey was in the listing format of GUP associated with urban walkability. The associated principles were scrutinised to extract the Parameters and Key Attributes before any indicators for the measurement of urban walkability can be established (which is in Stage 3). The identified analysed and selected based on the majority of agreement during the expert's group discourse. Subsequently,

iii. Stage 3: Finalising the agreed list involving the process of addition and omission using Percentage of Consensus of Agreement for the final listing of Green Urbanism's Main Themes or Classifications, Parameters, Key Attributes and Indicators for urban walkability measures. All the listed indicators were tabled and discussed its validity, association and significant by considering the Malaysian context and local factors. During the discussions, the potential key indicators were scrutinised in detail involving a series of omissions, additions and alterations to the list for any redundancy, repetition and out of context indicators.

The two senior academics from other universities were asked to rate the final list according to the 5-point Likert scale to identify the relevance and level of importance. The outcomes from the rating process were analysed using SPSS software ver. 24 for Cohen's Kappa value of Inter-rater Correlation Coefficient. Subsequently, the final

validated Alor Setar Green Urbanism Indicator (ASGUI) was developed for the in the field works.

b. Semi-structured Interview

The interview sessions with 16 built environment professionals were recorded mostly using Olympus Audio Recorder (model: WS-853) with the informed consent by interviewees and by note-taking when the interviewees declined for the conversations to be digitally recorded. The digital recorded data and manual notes were then compiled and transcribed using a Computer-Aided Qualitative Data Analysis (CAQDAS) software called NVIVO Version 12. Once completed, all transcribed data were classified using a coding system based on Themes and Sub-themes. The Content Analysis method was used to systematically analyse using Coding Query Technique by identifying all nodes related to this study, which data set was presented in the form of descriptive text, quotes, table and charts to support descriptions and arguments. The elaborated predetermined themes, together with the emerging themes, were then integrated to help in developing the final Green Urbanism Index for Alor Setar (ASGUI). The identified main themes were used to determine the association of Green Urbanism principles with urban walkability.

c. Focus Group Field Survey Data Analysis

The data obtained from the field survey were processed using SPSS software version 24 for both ASWI and ASGUI. The three-step analysis was to determine the significant correlation between indicator with its latent variables.

Phase 1: Analysis for Dimension Reduction Factor using Kaiser-Meyer-Olkin (KMO) and Bartlett's test.

Phase 2: Analysis of Correlation Between Indicators using Measures of Sampling Adequacy (MSA)

Phase 3: Analysis to Determine the Correlation between Indicator and its Latent variable using Component Matrix Analysis.

The result from both ASGUI and ASWI were;

i. First, triangulated to identify the level of significant correlation between both Green Urbanism and Urban Walkability concepts to answer the research questions.
ii. Second, compared both ASWI and ASGUI analysed results from fieldworks findings with the professionals' standpoint on determinant elements associating Green Urbanism and urban walkability.
iii. Third, using descriptive analysis result of ASGUI to determine the link between green urbanism principles (GUP) and urban walkability and their potential impacts in improving the environment in Medium-sized City.

3.6 Summary of the Chapter

This chapter discusses and justifies the research methodology and strategies adopted in this study. The study resolved into adopting a mixed-method research strategy as the most appropriate to accomplish the aim and objectives of the study. The selected research design required the collection of data of two parts:

1) Green Urbanism – which involved the literature investigation in identifying relevant principles and parameters. Next is the qualitative 'exploratory sequential' three-stage Delphi Survey to develop the ASGUI for on-site survey and observations. Concurrently, Semi-structured Interviews with local experts in the built environment were carried out to explore their thoughts and insight on the association between Green Urbanism Principles with urban walkability, before the final ASGUI can be utilised on-site.
2) Walkability – it involves a straight-forward literature investigation on various walkability indices from established urban planning agencies and private organisation, walkability indices from urban design based from renown authors and walkability indices from three classifications, Global, Asian and Malaysian indices, before establishing the site-specific ASWI to be used on-site.

The two validated indices were then used on-site by Focus Groups following specific guidelines and procedures set, to establish urban walkability score (ASWI) and Green Urbanism Quality score (ASGUI). A different method of calculation required for both

indices due to the different nature of measurement and function, thus the need for standardising Adjusted Value for parallel comparison. The following chapter introduces the case study site, the Medium-sized City of Alor Setar, Kedah, Malaysia.

Chapter 4

INTRODUCTION TO THE CASE STUDY AREA

4.0 Introduction

This chapter introduces Alor Setar as the case study area. The intent of this chapter is to provide an insight into the physical characteristics and features of the city; and the uses and activities that ensue. This chapter also provides background information to the analysis that follows.

This chapter is divided into eight sections. The first section provides the introduction to the chapter, and the second section highlights an overview of Malaysia. The third section introduces the State of Kedah with an overview of its location, history and background. The fourth section focusses on the Medium-sized city of Alor Setar as the Capital State of Kedah, the city manager's vision statement, the reasons it is categorised as Medium-sized City and its potential. The Fifth section is the introduction to the case study site, which is the city centre of the Medium-sized City of Alor Setar and the sixth section discussion on the physical context of Alor Setar.

The chapter continues in the seventh section with the introduction of the study routes in the city centre comprising the four selected routes, namely Jalan Tunku Ibrahim, Jalan Sultan Badlishah, Jalan Langar and Lebuhraya Darul Aman. This section highlights the street characters, land uses, distance and coverage. Details for places/elements of interest are also highlighted in the Appendix section for better understanding of the site context . Lastly, the conclusion of the chapter is in the eight sections.

4.1 Malaysia in Brief

It is essential to first introduce Malaysia before progressing to the introduction of the case study site. It is located at the latitudes 2 and 7 degrees north of the Equator covering a

total area of 330,345 km^2. As shown in Malaysia Peninsular Malaysia is neighbouring Thailand to the north and Singapore to the south; and separated from the states of Sabah and Sarawak by the South China Sea. Indonesia bounds Sabah and Sarawak to the north, and Sarawak also shares a border with Brunei (Cohen, Cohen, Aiken, & West, 2010). Malaysia has warm and humid tropical weather throughout the year. As of 2010 census, the population of Malaysia is 28.3 million consisting of three main ethnic groups, Malays/Bumiputera (67.4%), Chinese (24.6%), Indians (7.3%) and 0.7% others (Department of Statistics Malaysia, 2018).

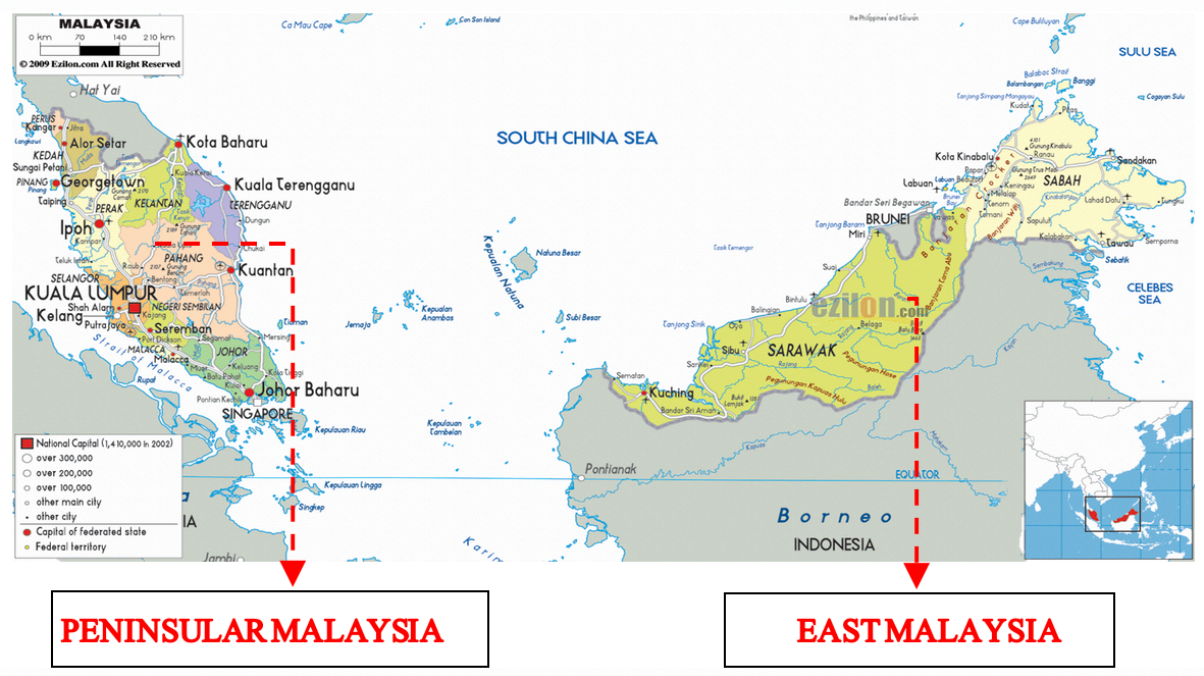

Figure 4.1 The map of Malaysia showing both Peninsular Malaysia and East Malaysia
Source: Dept. of Statistics Malaysia, 2018)

4.2 The State of Kedah, A Brief History

The State of Kedah also known as 'Jelapang Padi Malaysia' or 'The Rice Bowl of Malaysia' is located at the northern part of Peninsular Malaysia neighbouring Perlis to the North, Thailand to the North-East, Pulau Pinang to the south and Perak to the South-East (refer figure 4.2). The Ancient Kedah Kingdom was acknowledged as one of the world's oldest civilisation and was developed in two stages of progression. The first was known as Sungai Mas Stage during the 5th – 10th AD and the second is Lembah Bujang Stage in the 11th – 14th AD (Department of Statistics Malaysia, 2018). Due to its location at the north end of Malacca Strait, this old kingdom was a popular entrepot for gold, tin,

peppers and forest products; and was a transit port for shipping merchants from Arabs, Persia, India and Ceylon sailing to Malacca port (Abdullah, 2003; Ihsan et al., 2015). Kedah has endured a series of subjugation and colonization by the British from 1786 to 1797, by The Kingdom of Siam in 1821 to 1842, the Japanese in 1942 to 1945 and back under the colonization of the British until 1957 (Othman & Abdul Aziz, 2012).

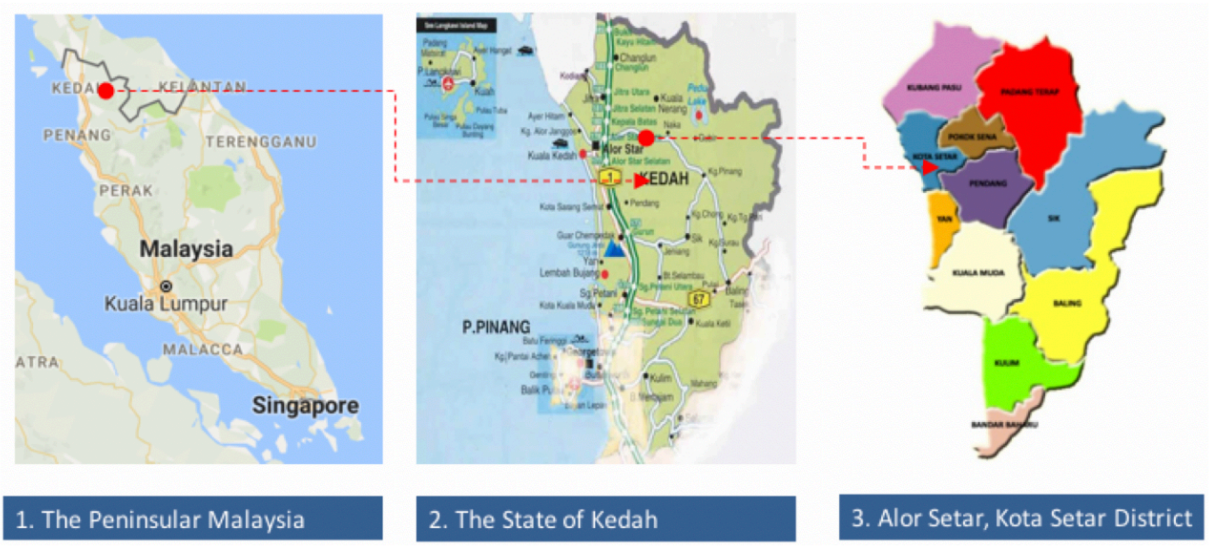

Figure 4.2 Map of the State of Kedah Darul Aman (Kedah2U, 2018)

After independence in 1957 from the British, Kedah commenced its development programs under the Ruling of the Sultan (Ismail, 2008; Md Daud, 2014; Moore, 2011).

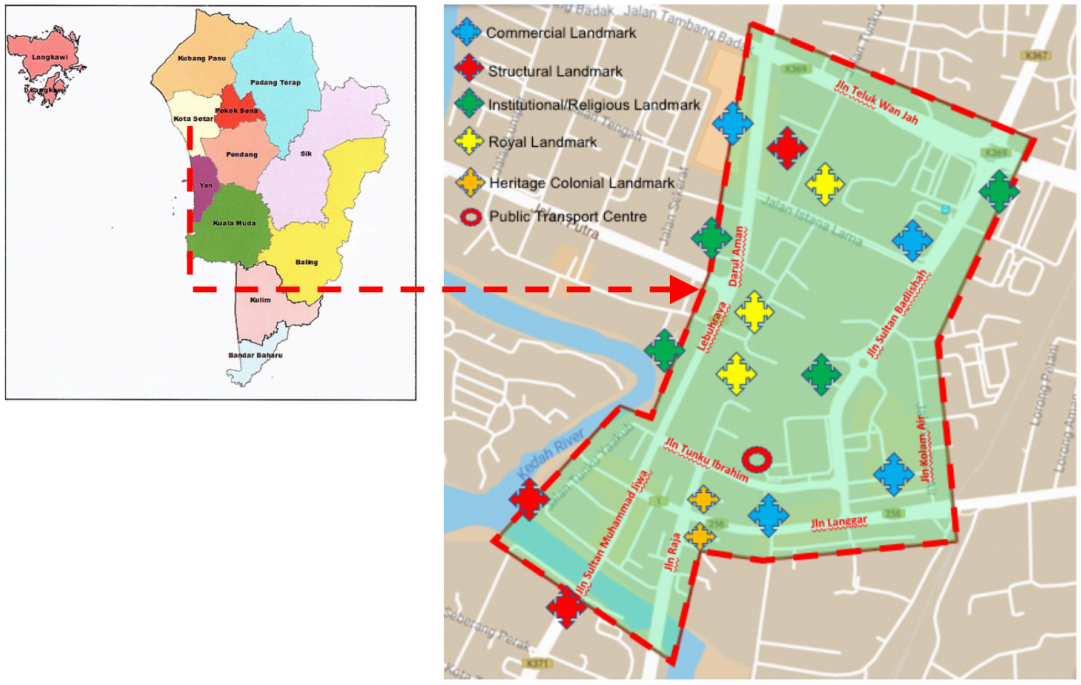

Figure 4.3 (L) Map of Kedah administration area (MBAS, 2018), (R) Map of Alor Setar city centre with landmarks and public transport centre (Author, 2018)

Being a rich and fertile land, Kedah main economic activities (in 1967-1978) is agriculture focussing in producing rice for the nation. Hence in 1967, the nick of 'The Rice Bowl of Malaysia' was introduced (Yusoff, Talib, & Pon, 2011). In addition to agriculture, Kedah also ventures into industrial activities beginning in 1978-1986 with the development of industrial zones around the state. Tourism also plays an essential role in Kedah's economy offering nature, history and shopping with several places of attractions like Langkawi Island, Alor Setar and Bukit Kayu Hitam among others (Yusoff et al. 2011). There are five big towns in Kedah namely, Sungai Petani, Alor Setar, Kulim, Jitra and Langkawi town.

4.3 Alor Setar the State Capital

As the state capital and administration centre for Kedah Darul Aman, Alor Setar has become the centre of development planning and monitoring, city cleaning and beautification, infrastructure and traffic management and public facilities. Majlis Bandaraya Alor Setar (MBAS), the city manager, is responsible for city programs and projects implementation and management of infrastructure, among others.



Figure 4.4 The Medan Bandar (City Plaza) and Alor Setar Tower - A horizontal and vertical landmarks of Alor Setar

The mission statement of the organisation:

> "*Driving the Excellence of Alor Setar City Council as an Efficient, Innovative, Responsive Organisation that is Committed to Achieve Sustainable Development towards Aiming for Liveable Township by 2035*".

The vision statement of the organisation:

> "*Transforming the City of Alor Setar as Liveable City*"

From the Mission and Vision statements above, the city is aiming to develop its city sustainably comprehensively, and at the same time aspire to become a liveable city. The liveable city was mentioned in the recent 10th Malaysia Plan under the topic 'Building Vibrant and Liveable Cities' and in the Government Transformation Program 2010 objectives (The Economic Planning Unit (Malaysia), 2010). It was further highlighted in the National Key Result Areas (NKRA's) and National Key Performance Indicator (NKPI), which state exactly the criteria of the liveability, e.g. reducing crime, fighting corruption, raising the standard of living, fostering innovation and stronger communities, providing populations with the most liveable environments and improving the efficiency urban public transport (Shamsuddin & Abu Hassan, 2013).

At the same time, based on a personal interview with city officials responsible for formulating the policy and city planning (AR1 and PLR1), there are eight other apparitions set by the organisation. The first being the economic centre for the state by providing business opportunities for small, medium and large business scales. Second is transforming the Pension City label into a more current and relevant city by providing activities, programs and spaces attracting younger generations back to the city (Author Interviews, 2018).

The third and fourth is to initiate the Safe City and Liveable City Concepts in all its development and programs by following the liveable city criteria as stipulated by NKPI. It is hoped by commissioning these two concepts will help generate the city's economic and population. The Fifth aspiration is to make Alor Setar as Education Hub by providing sufficient infrastructure and services to welcome the opening of more education centres alongside its current two international universities and three private colleges (Author Interviews, 2018).

The sixth is to make Alor Setar as tourism city attracting both local and foreign tourists. The city can take advantage of its nature, tradition and heritage assets, and to aggressively promote Alor Setar as a tourism centre. In line with the city's tourism initiatives, the seventh aspiration is to make the Royal City (Bandar Muadzam Shah and Bandar Anak Bukit) as part of Alor Setar image and identity. Lastly, the Heritage Conservation of all royal artefacts, structure and palaces together with the historical buildings to be conserved and maintained as part of city image and tourist attractions (Author Interviews, 2018).

4.3.1 The Medium-Sized City (MC)

The term Medium-sized city (MC) also known as Secondary City, Intermediate City or Second-tiered City as accorded by Professor Dennis Rondinelli of the University of North Carolina in 1982 through his research publication on 'Intermediate Cities in Developing Countries'.

The definition of a Medium-sized City:
There is no consensus in the definition of an MC due to its various characters throughout regions and national context (Department of Statistics Malaysia-Kedah, 2015; Yusoff et al., 2011). However, according to Ulama (2017), the MC (Secondary or Intermediate City) can be defined primarily by the city's population of larger than 100,000 inhabitants but smaller than the largest city in the country of reference. The MC often has a particular combination of urban-rural characteristics (Rondinelli, 1982, 1983), that the urban characters are diffusing a place where the rural characters were once dominating the physical, social and economy (Bolay & Rabinovich, 2004; Contardo, Boano, & Wirsching, 2018; Estrella, 2018; Rondinelli, 1982). This city often selected as regional, provincial, or district centres or as other types of local administrative or political nodes (Mardiansjah, 2016). Figure 4.5 below displayed Estrella (2018) summarises the general characters of MC.

Author	Recommended Criteria	Observed Characteristics	Growth Factors
Rondinelli 1982	• Population size and density • Physical area and characteristics • Proportion of labor force in non-agricultural occupations • Mix and diversity of economic activities • Relationships with others around. • Services for rural and urban areas	• Combination of urban dan rural social, economic and physical characteristics. Both functions. • Economies of commercial and service activities in the small-scale industrial sector. • National small share of manufacturing activities and employment • Diversity and quality of social services and facilities.	• Favourable physical location and natural resources • Defensive position and military basis • Administrative and political centers • Colonization and foreign investments • Commerce, trade, and services
	Recommended Criteria	**Fundamental Dimensions**	**Types**
Bolay and Rabinovich 2004	• Surface size and population • Location • Spatial integration • Social and economic structures • Relations with other cities • Urbanization process • Scale: local, regional, national and international	• Demographic • Economic • Political and institutional • Services and equipment • Environmental and territorial management • Social and cultural	• Regional • Service center • Regional capital • Economic location • Tourist center • Communication hub • Metropolitan periphery • National/international interface • Cities in conurban area • Association of a group of towns • Urban region
	Main Elements	**Functions and Attributes**	**Types**
Roberts 2014	• Scope • Scale • Functions • Networks • Market/business orientation • Social and cultural capital	Typology of urban functions • Regional market • Service center • Regional capital • Tourist center • Communication hub • Economic location Functional Attributes • Economic • Administrative • Logistics • Knowledge & learning • Cultural & sports	• Subnational urban centers of administration, manufacturing, agriculture or resource development • Metropolitan clustered secondary cities, which develop in the periphery of metropolitan or urban regions • Corridor secondary cities, which develop as growth poles along major transportation corridors.

Figure 4.5 Characteristics of Medium-sized (Secondary/Intermediate) City by Author
Source: Estrella, 2018; Rondinelli, 1982, 1983)

There needs to be more study of the characters and issues pertaining to an MC (Ulama, 2017) due to severely limited data, outdated information (e.g. national census and primary data), inadequate social and economic information beyond population characteristics (Rondinelli, 1982). The character of an MC varies globally, hence contributed to the lacking in consensus in its definition. Table 4.1 defined the three broad characteristics linked to MC's economic development.

Table 4.1 Characteristics of the economies of the Medium-sized Cities

Group	Character	Example
Medium-size Cities with Strong Economic Growth	• Strong growth paths and dynamic local economy. • Well-connected in national and international in system of competitive trade, development and investment. • Strong export focus and outward orientation. • Star tourist destination • Resource and manufacturing cities	• Denpasar, Bali, Indonesia • Belo Horizonte (Brazil) • Cusco (Peru) • Toulouse (France) • Seattle (USA)
Medium-size Cities with Moderate Economic Growth	• Moderate and boomtown economies due to migration. • Diverse range of economic activities servicing local and national markets. • Larger agricultural and manufacturing cities. • Located at the peri-urban fringe of large metropolitan cities. • Rapid growth due to deindustrialization and the development of export-processing zones. • Hard to manageable urban development and environmental issues.	• Cities in China - Tianjin • Cities in Brazil - • Cities in India - Bangalore
Medium-size Cities with Slow Economic Growth	• comprises highly depressed cities that contain large numbers of urban poor people. • There are two types: - the first are cities experiencing increasing urbanization, rising poverty, little investment and scant formal-sector job creation - the second are cities in economic decline as they move into a post-industrial and declining-population phase. • Some cities are increasingly disadvantaged, disconnected and less able to compete for trade and investment within the national system of cities. • Worse case, becoming the forgotten cities. • Struggling to make any headway in lifting their economies, overcoming poverty and improving the liveability of the environment	- Most African Cities are type two. - Europe, North America and Asia

Source: Adopted from Rondinelli (1982, 1983); Estrella (2018)

Comparing the above table with data census of Alor Setar 2015 and findings from Roberts (2014), Alor Setar is one of the 24 medium-size cities in Malaysia (Department of Statistics Malaysia-Kedah, 2015) which can easily fit the criteria of MC based on Table 4.2 below.

Table 4.2 Alor Setar as Medium-sized City

Item	Criteria	Actual
Population size	<100,000< the largest city	405, 500
Coverage/Size	Not Measured	666 km^2
Character	Urban-rural character	Surrounded by villages
	Agriculture	Surrounded by Paddy fields
	Administrative and political nodes	State capital
	Industrial zones	Adjacent to Mergong Industrial zone
Rate of economic development (Robert, 2014)	Group 3: 2nd type:	- Less able to compete for trade and investment within the national system of cities. - the second are cities in economic decline as they move into a post-industrial and declining- population phase.

Source: Author, 2018

4.3.2 The City's Potentials

There is significant potential for Alor Setar to be able to achieve its mission and visions. This MC has been conferred as the Top Six Medium/Small Asian Cities of the Future for 2007/08 based on seven broad categories, as displayed in Table 4.3. The judging categories are 1. Economic Potential, 2. Cost-Effectiveness, 3. Human Resources, 4. Quality of Life, 5. Infrastructure, 6, Business Friendliness, and 7. Promotion Strategy.

Table 4.3 Alor Setar ranked as the top medium/small city of the future

TOP 6 MEDIUM/SMALL ASIAN CITIES: OVERALL		
RANK	CITIES	COUNYTRIES
1	Alor Setar	Malaysia
2	New Castle	Australia
3	Jeju City	South Korea
4	Taoyuan City	Taiwan
5	Gifu	Japan
6	Ipswich	Australia

Source: (fDi Intelligence, 2007, pg. 34)

4.4 Introduction to the Case Study Site: The Medium-sized City of Alor Setar

Alor Setar is the capital of Kedah Darul Aman. According to the estimation of Mid-Year Population based on the adjusted Population and Housing Census of Malaysia 2010 indicated that Alor Setar (under the district of Kota Setar) has a total land area of 666 km^2 with 2018 estimated population of 405,500 as in Table 4.4 (Department of Statistics Malaysia-Kedah, 2015). Majority of its population are dwelling at the fringe of the city's boundary, leaving a very small number of residents are residing within the city centre (Department of Statistics Malaysia-Kedah, 2015). Greater Alor Setar area is 118.603 km^2 while Alor Setar city centre area coverage is only 6.523 KM^2, with a total population in the city area of 22, 364 (Department of Statistics Malaysia-Kedah, 2015). Unlike the city of Georgetown in Pulau Pinang, Alor Setar is known as MC due to its smaller population, medium economic growth; with moderate infrastructure, facilities and city income (Amir, 2014; Department of Statistics Malaysia-Kedah, 2015).

Table 4.4 Population of Kedah by district 2012-2018 (Population and Housing Census of Malaysia 2010)

Num.	District	2012 [P]	2014 [P]	2016 [P]	2018 [P]
1	Alor Setar/Kota Setar	372, 100	379, 700	401, 200	405,500
2	Kulim	307, 600	308, 700	317, 000	325,600
3	Sungai Petani/Kuala Muda	475, 900	488, 300	500, 900	514,400

Note: [P] - Preliminary

Source: Department of Statistics Malaysia-Kedah (2015, pg. 19)

Repute as one of the oldest traditional Malay Royal Town, Alor Setar was founded 283 years ago by Sultan Muhammad Jiwa Zainal Abidin Mu'azzam Shah, Kedah's 19th. Ruler in 1735 (Department of Statistics Malaysia, 2018; The Economic Planning Unit (Malaysia), 2015). As the state capital, Alor Setar was the first town to have proper planning and became the identity of the states ruled by the Malay Rulers (Moore, 2011). The two main features of these early towns were the royal courts, and the trading centres of merchants (Moore, 2011).

Being one of the oldest city in Malaysia, the city has its uniqueness and strengths in terms of culture, history and agricultural productions; and Kedah is popularly known as 'Jelapang Padi' of Malaysia or The Rice bowl of Malaysia (Yusoff et al., 2011). Alor Setar has been conferred with city status on 21st December 2013, due to political and

administrative reasons despite the then population was only 374,300 (Yusoff et al., 2011) that is below 500,000 and the municipal council income is less than Ringgit Malaysia 100 million as per city status guidelines (Department of Statistics Malaysia-Kedah, 2015).

Alor Setar is now the second-largest city in Kedah after Sungai Petani/Kuala Muda with the population of 456,605, which took the crown in 2010 as the most populated with highest income city (Ministry of Urban Wellbeing Housing and Local Government, 2017). This is due to Sungai Petani's development envisaged as an industrial city and considered a newly planned modern city with many new residential areas. Contradictorily, the old city of Alor Setar has always maintained its traditional and historical values makes it challenging for expansion and new development (Department of Statistics Malaysia-Kedah, 2015).

4.5 The Physical Context

Alor Setar is generally flat, with mixed land uses in the city centre that is dominated by business premises, government offices and institutions, and residential. Table 4.5 showcase the type of land uses in the city centre.

Table 4.5 Land uses in Greater Alor Setar

Type of Land Use	Area	Hectare	Percentage
Commercial / Business area	Concentrating at the city centre to the southern part of the city with Pekan Rabu as nodal (business area along Jalan Pekan Cina, Pekan Melayu, Jalan Langgar, Jalan Putra, Jalan Tengku Ibrahim (2-3 storey shop lots), area surrounding Pekan Rabu, MBAS Complex and UTC building, Star Parade Complex and area surrounding Sentosa Hotel.	309.475	2.608%
Mixed-land use Residential and Business	Shop houses in Pekan Cina and Pekan Melayu where the ground floor is operating as shop, retail or café and the second floor is a residential.	123.214	1.039%
Residential area	The largest land use component in overall Alor Setar area. Covering mostly the northern part of the city centre (Taman Tunku Habsah, Kampong Pisang, Kampong Titi Siam and government quarters), and the south (Kampong Seberang Perak).	2511.250	21.174%
Government offices, Institutions and Facilities	Majlis Bandaraya Alor Setar (MBAS), Kedah Royal Museum, Kedah State Art Gallery, Darul Aman Stadium, Swimming pool, Kedah Police Contingent Building, Cultural centre (Gelanggang Budaya), Education Complex, Masjid Zahir, Tokong Poh Aun Keong, Wisma Negeri Building, Sultan Abdul Halim Building, Federal and State Government Complex and Wan Mat Saman Building.	871.390	7.347%
Recreation and open spaces	Alor Setar Tower Park, Waterfront & Tanjung Chali Sungai Kedah, Pocket parks.	163.596	1.379%
Agricultural Land	Located at the fringe of the city centre, to the west and mostly on the east.	5077.210	42.808%
Vacant Land	Scattered around the city mostly at the city fringe	700.668	5.906%
Infrastructure & Utility	Facilities within the city e.g. public toilets, pedestrian walkways etc	186.165	1.570%
Forest	Vegetation at the peripheral of the city and agricultural land	38.041	0.321%
Water Body	Sungai Kedah (Kedah River), Mat Saman Canal	217.821	1.837%
Transportation	Covering Roads, Rail Tract, Express Highway etc.	1355.620	11.430%
Light Industry	Covering light industrial areas	305.888	2.579%

Note: Areas warrant as Green Spaces in the city include recreation parks, garden and open spaces, riverbanks, all vegetated areas natural/planted, recreation fields, landscaped pedestrian ways, green roofs, roadside reserves and agricultural land or plot land.
Source: (Department of Town and Regional Planning (Kedah), 2017)

4.5.1 Public Transportation

Most visitors and residents of Alor Setar are dependent on private transport of either cars or motorcycles because the public transportation as accorded by the locals are not reliable and inefficient (Department of Town and Regional Planning (Kedah), 2017). Centralise parking, roadside parking, and multi-storey car parks for both cars and motorcycles are available all over the city although the number is insufficient. There are two types of public transportation in Alor Setar,

a. Intracity transportation: including the local buses and taxis transporting the locals from the nearby residential areas, adjacent districts and feeder buses from centralising bus station (Shahab Perdana Bus Terminal – located at the city's outskirt).

   The demand for intracity or known as local bus service are declining (Figure 4.6), and the number of passengers using the local bus service dropped 23.4% in 2015 as compared to 2014.

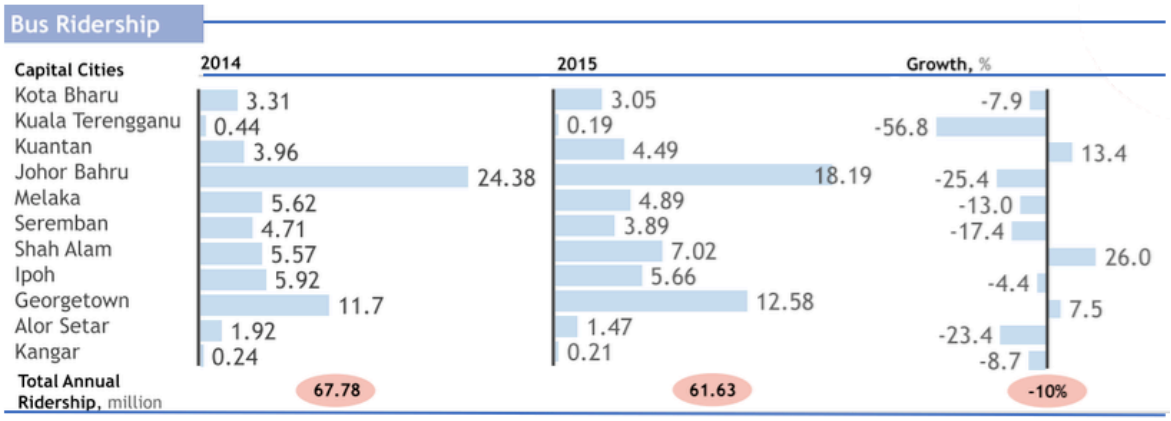

Figure 4.6 The number of bus passengers in selected cities in Malaysia
Source: (Md Daud, 2014)

b. Inter-city transportation comprises buses, commuter trains, Electric Train Service and International Train Service.

   i. Bus services operating from adjacent states (Penang and Perlis) – drop and pick passenger at the city centre, serving those from adjacent cities who work in Alor.

   ii. Bus Service from other states in Malaysian – drop and pick passengers at Shahab Perdana Bus Terminal.

   iii. Commuter Trains are operating from Penang, Kedah and Perlis – serving those from adjacent cities who work in Alor (stopping at all stations). There are 14 services to and from Alor Setar to 12 other stations covering three states (Penang,

Kedah and Perlis). The service started from Butterworth, Penang at 5.25 am and reached Alor Setar in approximately one hour at 6.33 am and continue to reach Padang Besar, Perlis at 7.16 am.

iv. Electric Train Service (ETS)- express trains are operating from Kuala Lumpur city to Perlis (stopping at main stations only). There are five services from Alor Setar to Kuala Lumpur at every three-hour starting at 8.29 am – 6.47 pm with the exception of the last ETS train leaving Alor Setar one hour after the fourth service (Figure 4.7).

v. International Train Service – operating from Singapore, Kuala Lumpur, Butterworth, Alor Setar, Padang Besar to Thailand.



Figure 4.7 Electric Train Service (ETS) at Alor Setar Train Station

4.5.2 Pedestrian Space and Pedestrian Way

According to MBAS, the issues of pedestrian's safety and security is of great concern. Thus, MBAS spent Ringgit Malaysia 1 million to improve safety and security in the city centre by constructing railings along pedestrian walkways, street lighting and convex road safety mirrors at crime-prone areas along Jalan Sultan Badlishah, Jalan Tunku Ibrahim, Jalan Kota and Persiaran Sultan Abdul Hamid. Another Ringgit Malaysia 3.3 million were spent on improving roads, sidewalks, covered drainage to improve users' safety. The rate of fatal accidents involving pedestrian death is still very high(Figure 4.8), which is of great concern.

KEMATIAN MENGIKUT KATEGORI PENGGUNA JALAN RAYA BAGI TEMPOH 10 TAHUN (2008 HINGGA 2017)

KATEGORI	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	JUMLAH
MOTOKAR	1,335	1,405	1,421	1,389	1,435	1,399	1,258	1,358	1,489	1,269	13,758
MOTOSIKAL	3,898	4,067	4,036	4,169	4,178	4,294	4,179	4,203	4,485	4,348	41,857
PEJALAN KAKI	598	589	626	530	530	455	515	482	511	441	5,277
BASIKAL	203	224	192	172	156	159	124	107	123	162	1,622
BAS	48	31	77	29	32	60	29	20	29	23	378
LORI	195	213	202	247	194	210	221	223	186	199	2,090
VAN	96	91	97	93	86	80	73	71	65	62	814
4x4	106	78	154	151	159	158	129	130	142	113	1,320
LAIN-LAIN	48	47	67	97	147	100	146	112	122	123	1,009
JUMLAH	6,527	6,745	6,872	6,877	6,917	6,915	6,674	6,706	7,152	**6,740**	68,125

Figure 4.8 Fatal accident (Death) based on the category of road users from 2008 - 2017
Source: Nun (2016)

According to MBAS's Planning officer, the coverage and distance of walking also limited to the core areas of the city. The city centre is also lacking on pedestrian facilities, narrow at numerous areas, not properly linked and not disabled friendly with high road kerbs; making walking less comfortable.

4.6 Study Routes

The selected study site is at the MC of Alor Setar city centre, comprising the four main streets (refer Figure 4.9) namely; 1. Lebuhraya Darul Aman – Pekan Cina (1.8 km), 2. Jalan Tunku Ibrahim (0.7 km), 3. Jalan Langgar (1.1 km), and 4. Jalan Sultan Badlishah – Jalan Kolam Air (1.0 km).



Figure 4.9 Alor Setar City Centre – The Study Route

ROUTE 1 _ Lebuhraya Darul Aman

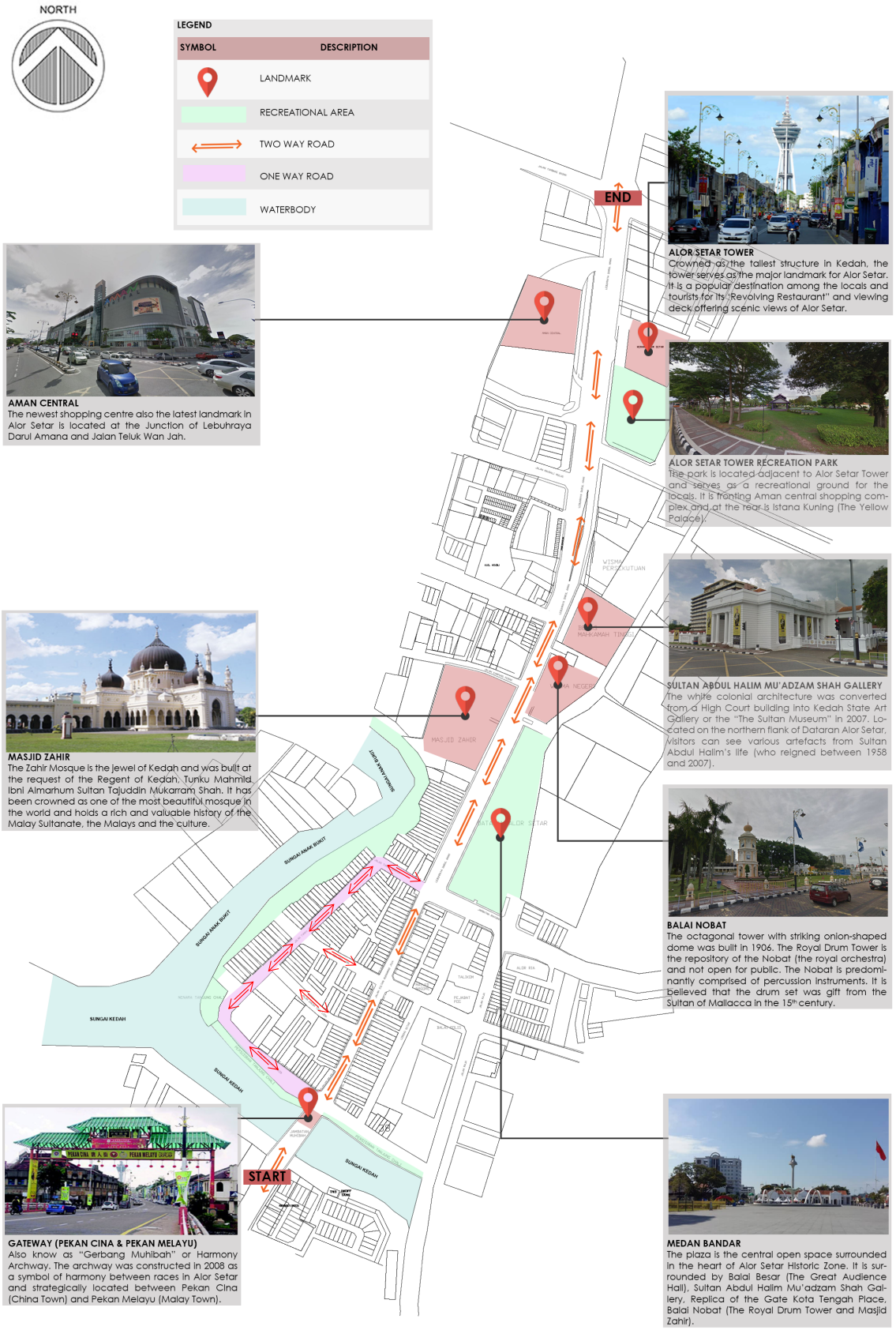

Figure 4.10 Route 1- Lebuhraya Darul Aman - Pekan Cina

4.6.1 Lebuhraya Darul Aman

The study concentrated along with a total of 2.18 km road length (a) the first part is 1.314 km along Lebuhraya Darul Aman and (b) the second part is 0.866 km along smaller roads of Jalan Sultan Muhammad Jiwa, Jalan Tunku Yaakob and Jalan Penjara Lama (refer Figure 4.10 Route 1- Lebuhraya Darul Aman - Pekan Cina). Lebuhraya Darul Aman is well known for its historical image of Traditional Malay Sultanate with structures and monuments are visible on both sides of the road. The area of Jalan Sultan Muhammad Jiwa, Jalan Tunku Yaakob and Jalan Penjara Lama is known as Pekan Cina (China Town) reflecting Chinese descends residents, a mixed-land use of businesses at the ground floor and residential at the back or on the upper floor of old colonial shophouses. Table 4.6 below presented LDA street characters and pedestrian ways condition.

Table 4.6 Route 1 - Lebuhraya Darul Aman street characters and pedestrian ways condition

Route 1	**Lebuhraya Darul Aman**
Area of Coverage	Starting from Teluk Wan Jah and Lebuhraya Darul Aman Junction to Jambatan Muhibah (Harmony Bridge)
Total Length	1.8 km
Street Character	i. A shopping street starting from the junction with modern buildings of shopping complex, shop lots and offices. ii. Heritage Zone of Alor Setar with series of traditional Malay architecture of the Palace, Moorish architecture and Post-colonial architecture along both sides of the road. iii. Pekan Cina & Pekan Melayu with mixture colonial influence shop houses of Southern Chinese Eclectic, Straits Eclectic and Art Deco. The Sungai Kedah promenade with wide recreation space for the locals and Pekan Cina residents. iv. Mixed land uses of retails and residentials
Pedestrian	Along Lebuhraya Darul Aman and Heritage Zone i. Pedestrian sidewalks of varies widths ranging from 1.5 -3.0 M at certain areas on both sides of the road. ii. Shaded at certain areas (with trees and buildings) iii. High road kerbs of 300 mm (without pedestrian ramp) iv. Mostly interlocking pavers with metal railings at certain intervals v. Clean and well maintain Pekan Cina and Pekan Melayu i. Mostly five-foot walkway (1.525 M) attached to the shophouses ii. Mostly shaded by buildings and covered walkways iii. High road kerbs of 300 mm with series of elevated and sunken levels, with 1-2 steps (riser <250 mm) at certain areas iv. Sidewalk of interlocking pavers along the main road varies in size and mostly narrow of less than 1.2 m with obstacles (street lighting and road signposts, garbage bins and irregular surface/missing pavers) v. Generally clean but not well maintain



Figure 4.11 Route 2 - Jalan Tunku Ibrahim

4.6.2 Jalan Tunku Ibrahim

The Second study route is Jalan Tunku Ibrahim which runs 0.7 km. This road is popular with shophouses selling textiles and 'Star Walk' - a pedestrian plaza with cafes and resting areas (refer
Figure 4.11). There are many of nodes acting as the source of human movements namely, Holiday Villa Hotel, Star Walk, Main Public Transport Stop (Bus and Taxi), Alor Setar City Council and Pekan Rabu Complex. Table 4.7 below shows the street characters of the route.

Table 4.7 Route 2 - Jalan Tunku Ibrahim street characters and pedestrian ways condition

Route 2	**Jalan Tunku Ibrahim**
Area of Coverage	Starting from Jalan Kolam Air and Jalan Tunku Ibrahim junction to Lebuhraya Darul Aman junction
Total Length	0.7 km
Street Character	i. A shopping street with modern buildings of shopping complex, shop lots of Southern Chinese Eclectic, Straits Eclectic and Art Deco styles and offices. ii. Setar Walk pedestrian plaza with resting area and outdoor cafes
Pedestrian	Along Jalan Tunku Ibrahim i. Pedestrian sidewalks of varies widths ranging from 1.5 -3.0 M at certain areas on both sides of the road. ii. Shaded at certain areas (with trees and buildings) iii. High road kerbs of 300 mm (without pedestrian ramp) iv. Mostly interlocking pavers with metal railings at certain intervals v. Clean and well maintain Shophouses opposite Setar Walk i. Mostly five-foot walkway attached to the shophouses ii. Mostly shaded by buildings and covered walkways iii. Generally clean and well maintain

ROUTE 3 _ Jalan Langgar


NORTH
END
START
JALAN LANGGAR
JALAN LANGGAR
PERNIAGAAN/PEKAN RABU
JALAN RAJA
JALAN SELAMAT
JALAN KAH
JALAN LORONG TAHIR
JALAN TEMENGGUNG ABDUL RAHMAN PUTRA

4.6.3 Jalan Langgar

The Third study route is Jalan Tunku Ibrahim which runs 1.1 km, as shown in Figure 4.12. This road is popular with shophouses selling textiles of Indian descends known as 'Little India' and modern shophouses, offices and eating outlets. There two prominent landmarks towards the end of the road in the form of colonial buildings (Post Office and Police station). Table 4.8 shows the street character of the route.

Table 4.8 Route 3 - Jalan Langgar street characters and pedestrian ways condition

Route 3	**Jalan Langgar**
Area of Coverage	Starting from Jalan Kolam Air junction to and Jalan Penjara Lama
Total Length	1.1 km
Street Character	i. A street with modern buildings of shopping complex, shop lots of Southern Chinese Eclectic, Straits Eclectic, Art Deco styles ii. A street with modern building of offices and shops.
Pedestrian	Along Jalan Langgar to KFC Restaurant i. Mostly five-foot walkway (1.525 M) attached to the shophouses ii. Mostly shaded (with trees and buildings) iii. Generally clean and well maintain From KFC Restaurant to Jalan Penjara Lama i. Pedestrian sidewalks or irregular sizes at both sides of the road. The narrow pedestrian walkway ranging from 0.8 – 1.0 M and the wide pedestrian walkway ranging from 1.2 – 2.5 M. ii. Shaded at certain areas (with trees and buildings) iii. High road kerbs of 300 mm with some obstacles (lighting and road signposts) iv. Mostly interlocking pavers with metal railings at certain intervals v. Clean but not well maintain with surface breakage and missing pavers

ROUTE 4 _ Jalan Sultan Badlishah



Figure 4.13 Route 4 - Jalan Sultan Badlishah and Jalan Kolam Air

4.6.5 Jalan Sultan Badlishah

The fourth study route is Jalan Sultan Badlishah which runs 1.0 km. This road is known for public offices and government buildings, as shown in Figure 4.13. One of the better-landscaped roads in Alor Setar with pedestrian walkways at both sides of the road and several resting areas as well.

One of the most frequented building is the Urban Transformation Centre building (UTC) which houses government-related services. Holiday Villa Hotel is located adjacent to UTC, which is another landmark in this area. Fronting the hotel is the single storey old white building which is one of the city council offices. There are many restaurants, food court, cafes and street vendors along Jalan Raja, Lorong Padi and Jalan Mahsuri serving local foods and desserts. Table 4.9 shows the street character of the route.

Table 4.9 Route 4 - Jalan Sultan Badlishah street characters and pedestrian ways condition

Route 4	**Jalan Sultan Badlishah**
Area of Coverage	Starting from Teluk Wan Jah Roundabout to Jalan Tunku Ibrahim junction and from Jalan Kolam Air to Jalan Langgar junction
Total Length	1.0 km
Street Character	i. A government offices and institutions dominated street ii. Interestingly landscaped pedestrian walkways at both sides of the road with five pocket parks/rest area along the road iii. Modern buildings, shop lots, banks and offices generating pedestrians
Pedestrian	i. Pedestrian walkways with varies width ranging from 1.2 – 3.0 M at both sides of the road, generally using interlocking pavers with metal railing along the walkways. ii. Mostly shaded with trees and buildings, with gazebos/pergolas at landscape and resting areas iii. Generally clean and well maintain except at several areas with broken walkways by roots of big trees.

vi. Food court and cafes

There are several eating places at Jalan Kolam Air and Jalan Raja that contributed to the number of pedestrians in this area.



Figure 4.14 Food court at Jalan Raja, Jalan Kolam Air


Figure 4.15 Pedestrian walkway not continuous causing pedestrian-vehicular conflicts

vii. Jalan Mahsuri and Lorong Padi

There are provisions for motorcycles and car park at both roads and illegal parking always a problem causing a blockage.



Figure 4.16 Motorcycle parking at congested Lorong Padi



Figure 4.17 Roadside eatery at the junction of Jalan Sultan Badlishah and Jalan Mahsuri

4.7 Summary of the Chapter

The Medium-sized City of Alor Setar is the State Capitol, the centre of administration centre and second economic hub for the State of Kedah; and repute as one of the oldest traditional Malay Royal Town in Malaysia. Although being conferred with a 'City' status, the city is still considered as the Medium-sized City due to its lesser economic accomplishments and development growth. Nonetheless, the city has many potentials as it was ranked as one of the top small cities of the future in 2007.

The study site is located at the core area of the city centre and comprises of four of the city's main routes. The first route is Lebuhraya Darul Aman covering the area starting from Teluk Wan Jah and Lebuhraya Darul Aman Junction to Jambatan Muhibah (Harmony Bridge). The second route is Jalan Tengku Ibrahim starting from Jalan Kolam Air and Jalan Tunku Ibrahim junction to Lebuhraya Darul Aman junction. The third route is Jalan Langgar starting from Jalan Kolam Air junction to and Jalan Penjara Lama, and finally, route four is Jalan Sultan Badlishah starting from Teluk Wan Jah Roundabout to Jalan Tunku Ibrahim junction and from Jalan Kolam Air to Jalan Langgar junction.

This chapter only serves as introductory to the case study site with some highlights on the location, street characters, the physical features of the surrounding environment and some of the distinct qualities of the city. The following chapter 5 discusses in detail literature investigations, the formulation and development of urban walkability index, method of calculations and the method of analysis employed.

Chapter 5

WALKABILITY AND THE DEVELOPMENT OF ALOR SETAR WALKABILITY INDEX (ASWI)

5.0 Introduction

This chapter discusses the overall concept of walkability, beginning with the history of walkability. The earlier part of the chapter also reviews theories pertinent to urban walkability and the various indices used globally. The reviews of global indices lead to the identification of Components, Parameters, Key Attributes and Indicators of Walkability. Subsequently, the site-specific walkability indicator known as ASWI was developed for the use of on-site survey and observation by a selected focus group in Alor Setar, Kedah, Malaysia.

Chapter 5 is divided into three parts of discussions with 11 sections as follows; **Part On**e is covering the Literature Review on the concept of walkability: starting with the first section as the Introduction of this chapter. The second section discusses Accessibility and Walkability and the third section covering the History of Walkability. The fourth is Understanding and Definition of Walkability, followed by the fifth, Theories in Walkability. The investigation on Urban walkability set off with the discussion on Pedestrian Level of Service in section sixth and seventh, the Previous Study on Walkable City. **Part Two** covers the investigation of Walkability components, parameters and key attributes in section eight, the Development of Walkability Index and Assessment; ninth, the Walkability Index – The Identification of Indicators; and **Part Three** covers the development of walkability index in the tenth section that is ASWI. Finally, section eleventh summarises the discussion of this chapter.

----- PART ONE -----

5.1 Accessibility and walkability

The intricate spatial connections that characterise our towns and cities often instigate significant problems for urban designers, planners and policymakers globally. Often these urban spatial connectors are being left out and treated as insignificant whether this is new development or the regeneration of existing areas. Hence, the integration of urban spatial connectors at all levels with a sensible method is indeed eminent (Dempsey et al., 2011; Manley & Rose, 2014; Pinnegar et al., 2008). Linking all urban spaces at all levels in a sustainable way is never an easy task; and it has to be done comprehensively covering all aspects of urban development (Dempsey et al., 2011; Lehmann, 2010a, 2015a; Zavrl & Zeren, 2010).

The concept of accessibility involves convenience and the hierarchies of opportunity with which people access goods and services. Such a concept aims to establish an environment where the process of creative identification and urban resources exploitation can be revealed in its entirety (Landry & Bianchini, 1995). Cervero (2002) suggests that accessibility is an indicator of the ability to efficiently reach oft-visited places. It is a product of mobility and proximity (moving faster from point A to point B (mobility) or by bringing points A and B closer together (proximity), or some combination thereof, minimising the time travelling so that more time is available at the destination. Travelling occurs because of 'derive demand' or the need to get to place other than occasional pleasure trips. Apart from cycling, walking is one of the most sustainable modes of transportation (Forsyth & Southworth, 2008).

Benefit of walking have been identified as improving public and private health, interaction between neighbours, feelings of community and positive sense of place, and contributes to reductions in traffic congestion, air pollution and emissions, and resource use (Ewing & Handy, 2009; Forsyth, 2015; Forsyth & Southworth, 2008; Southworth, 2005; Wang & Wen, 2017; Wang, Chau, Ng, & Leung, 2016). Neighbourhood walkability and pedestrian accessibility are very important as it helps increases individual and collective social capital, better community health, decreased crime rates and even

increased economic activity. In pedestrian-oriented communities that are highly walkable, people are likely to walk to places such as corner markets, restaurants, schools, places of worship, public parks and other establishments necessary for life (Leyden, 2003). People become less dependent on motorised transportation, mainly private vehicles as pedestrian access escalates. Moreover, the primary objective of providing eminence pedestrian ways that are safe with adequate facilities is that the network has to direct users to their destination (Torres et al., 2010).

5.2 The History of Walkability

Pedestrian mobility is now being embraced by many communities who adopted it as an alternative to automobiles. According to many, their reason for this shift is due to the awareness that dependency on automobiles is ecologically unsustainable. Automobile-oriented environments are causing hazardous surroundings to both motorists and pedestrians while destroying the beauty and aesthetics of the environment (Ozzie, 2012). According to the Oxford English Dictionary (2014) , the term ‘walkable’ was used since the eighteenth century. Forsyth (2015) stated that the term ‘walkability’ often carried the same meaning and used interchangeably as ‘walkable’. However, both carry different definition when it comes to creating walkable places, measuring environmental walkability and assessing the cost and benefits involved in creating walkable environments (Forsyth, 2015).

Although the term ‘walkable’ is not exclusively referring to mere pedestrian walkway or pedestrianisation, it is somehow significantly related to the condition and infrastructure to walk. According to McKean (1982), among of the earliest purposed design and built pedestrian street in Europe was the Lijnbaa in Rotterdam which opened in 1953; and pedestrianised shopping centre in Stevenage, United Kingdom which was built in 1959. These indicated the beginning of a significant awarenenss on the need for pedestrian infrastructure. McKean also state that since the 1960s, many European towns and cities have created part of their centres as car-free zones (McKean, 1982).

5.3 Understanding and the Definition of Walkability

There are many definitions of 'walkability', and the term is growing in popularity (Lo, 2011; Park, Choi, & Lee, 2015; Southworth, 2005). Walkability and walkable are often discussed together, but the real definition and distinction are not clear. According to Oxford English Dictionary (2014), the term 'walkable' is defined as 'of an area or route suitable or safe for walking', and 'ability' is defined as 'the fact that somebody or something is able to do something'. Krambeck (2006) defined walkability in its most basic sense - the safety, security, economy, and convenience of travelling by foot. She further indicated that in developing cities, walking is considered as mobility for the poorest residents.

The concept of walkability is multi-dimensional that can be generally defined as an environment; typically the built environment facilitates walking and pedestrian-friendly (Hall & Ram, 2018a; Moura, Cambra, & Gonçalves, 2017). Shamsuddin, Hassan et al., (2012) suggest that walkability and walkable is also considered as a measure that something is 'Walking-Friendly'. Walkability is how friendly the built environment is (Ariffin, Hamzah, & Jawi, 2018; Bandara, 2013; Darmoyono & Tanan, 2015; Ferrer, Ruiz, & Mars, 2015; Government of Western Australia, 2016; Livi & Clifton, 2004), and correspondingly refers to the ease pedestrians can travel through this space (Abley, 2005; Barker, 2012; City of Portland, 1998; D'Arcy, 2013; Hernandez & Monzon, 2016; Koh & Wong, 2013).

Most definition of walkability pointed to the level of conduciveness of built environment to walking (Lo, 2009). Correspondingly, Bandara (2013) who states that walkability can be defined as the degree of the built environment is friendly to welcoming of people living, shopping, visiting, enjoying or spending time in an area. Of late, walkability deliberations in most developed cities, encouraging mode change for short trips from motorized to non-motorized vehicles (Ferrer et al., 2015; Government of Western Australia, 2016; Park, 2008; Zuniga-Teran, Orr, Gimblett, Chalfoun, Marsh, et al., 2017), or on encouraging walking as a healthy leisure activity (Bandara, 2013).

Walkability can be measured qualitatively and quantitatively (Abdulla, Abdelmonem, & Selim, 2017; Eisenberg, Vanderbom, & Vasudevan, 2017; Riggs, 2017) based on the

degree of inviting or un-inviting a particular area is to pedestrians (Kaczynski & Glover, 2012). The linking of walking and socially vibrant areas is becoming more evident in towns and cities with walkability qualities (Evans, Kropf, Saxena, & Waite, 2007; Pancholi, Yigitcanlar, & Guaralda, 2018). Consequently, these qualities that facilitate and stimulate the utilitarian type of walking create better social cohesion, healthier lifestyles, have higher property values and promote better liveability (Forsyth, 2015). Table 5.1 below detailed the three typical classifications of the theme in defining walkability (Forsyth, 2015).

Table 5.1 Cluster of the Definition of Walkability

Key Theme	Factor	Description
Conditions or means definition	• Traversable • Compact • Safety and security • Physically enticing environment	• Getting from point A to B. • Provide short distance. • Perceive and actual safety and security from crime and traffic. • Pedestrian facilities (sidewalks, ped. crossing, lighting, street furniture etc).
Perceived outcome of walking definition	• Walkable environment often attractive because … • Environmental preservation and social equity components • Transportation or exercise	• Lively and sociable, pleasant, clean (often in shopping areas and mixed neighbourhood). • Provide sustainable transportation option, save energy, options for those who cannot use car due to age, income or disability. • Environment that allow fast- pace mobility and able to induce exercise or transportation.
Proxy definition	• Multidimensional & measurable by indicators • Holistic solution to improving urban areas	• Creates indicators of the condition of walkability. • slower paced, more human scaled, healthier, and happier – a generally a good place to be.

Source: Adapted from Forsyth (2015, pg. 276)

Accordingly, it is beneficial to define walkability, focusing on its micro-level design attributes narrowly, and to measure walkability on a smaller scale [i.e. at the urban core instead of the overall cities or looking walkability at the street level rather than at the neighbourhood level] (Park, 2008). Further to this, Ujang & Muslim (2013, pg. 55) define walkability as 'the extent to which walking is readily available as a safe, connected, accessible and pleasant mode of transport'. This research follows the three walkability classification of themes and factors as defined by Forsyth (2015) in Table 5.1 above in finding the association with GUP. Therefore, walkability is defined as "the condition" of

which facilitate the construct of “multidimensional” “ideal environment” of “universal quality” for a “holistic solution” of urban issues;

i. “The condition” is referred to the principles of Green Urbanism associated with urban walkability.
ii. “Multidimensional” is the ability of it to be measured by a set of developed indicators (ASGUI & ASWI).
iii. “Ideal environment” is the milieu of the desired volume of space in accordance with purpose and function.
iv. “universal quality” is the characteristic of condition that is beneficial to both environment and human of social equity.
v. “Holistic solution” is the ability to provide answers and way of solving issues pertaining to an urban condition of site-specific.

5.4 Purpose of Walking

Travelling behaviour, specifically walking, is very complex as it is very much dependent on the purpose of walking (Choi, 2013; Forsyth, 2015). There are different types of walking, as established by previous researchers (Table 5.2).

The first is Utilitarian type of walking trips (Brownson, Hoehner, Day, Forsyth & Sallis, 2009; Choi, 2013; Dadpour, Pakzad & Khankeh, 2016; Feuillet et al., 2018; Park et al., 2015; Stewart et al., 2016) involving daily routines as going to work, school, shopping for grocery, and other types of walking with ‘necessary’ purposes. This type of walking often directed to the shortest to medium distance from origin to destination or vice versa and with a quick or fast speed of walking. The origins and destination are fixed but sometimes open for adaptations and changes based on needs and environmental conditions (Choi, 2013; Feuillet et al., 2018; Hajrasouliha & Yin, 2015; Park et al., 2015; Stewart et al., 2016). Although many researchers include walking for transportation as part of Utilitarian type of walking, some researchers (Feuillet et al., 2018; Forsyth, 2015;

Zuniga-Teran, Orr, Gimblett, Chalfoun, Marsh, et al., 2017) categorised it separately as the act of walking is explicitly going to public transit for a continuing trip, with fixed destination, fast speed, choosing the shortest route possible and low environmental influence.

The second type is Recreational/Social (or Pleasure) type of walking, which showed different behaviour and less purposeful attitudes as compared to the first type (Choi, 2013; Stewart et al., 2016; Zuniga-Teran, Orr, Gimblett, Chalfoun, Guertin, et al., 2017). This type showed more flexibility between moving from a destination, stopping and arriving at the destination (Choi, 2013). In addition, the choice of route to destinations were less fixed and not necessarily directed based on the shortest direction (Brownson et al., 2009; Choi, 2013; Dadpour et al., 2016; Forsyth, 2015; Frank et al., 2010; Park et al., 2015; Stewart et al., 2016; Wang et al., 2016; Zuniga-Teran et al., 2017).

The Third type of walking purpose is Health/Exercise which is driven by motivation such as losing weight, reducing stress, increasing fitness among others (Forsyth, 2015) – walking in this category generally purposeful and fast pace (Choi, 2013). Dog walking for some is considered as part of exercise for healthy living (Kabisch & Haase, 2014; Maguire, Miller, & Weston, 2018; Ribeiro et al., 2018) and benefiting general health (Maguire et al., 2018; NHS, 2011), which sometimes involves medium speed of walking, active mobility with frequent stops and mostly covering green areas.

Table 5.2 The Three Types of Purpose of Walking

TYPE	DESCRIPTION	FACTORS	ENVIRON-MENTAL INFLUENCE	AUTHOR
Utilitarian	Walking trips involving daily routines as going to work, school, shopping for grocery, and other types of walking with 'necessary' purposes.	- Directed by shortest to medium distance - Quick/fast speed - Fixed origin & destination/s but sometimes less fixed	- Low to medium influence	- Choi (2013) - Park et al. (2015) - Feuillet et al. (2018) - Stewart et al. (2016) - Hajrasouliha & Yin (2015) - Jensen et al. (2017)
	Walking for Transport - going to public transit for a continuing trip	- Directed by shortest distance - Quick/fast speed - Fixed origin & destination/s	- Low influence	- Feuillet et al. (2018) - Forsyth (2015) - Zuniga-Teran et al. (2017) - Dadpour et al. (2016) - Brownson et al. (2009a) - Frank et al. (2010) - Wang et al. (2016)
Pleasure / Social / Recreational	Also known as recreational walking other than that of exercises. Window shopping, sight-seeing and strolling (either in the park or city centre – generally in retail areas). Generally, observing people, shops and surrounding while walking.	- Less purposeful - Slower speed - Flexibility between moving & stopping - Destination less fixed - Not always directed by the shortest distance	- Strong influence	- Choi (2013) - Park et al. (2015) - Dadpour et al. (2016) - Brownson et al. (2009a) - Frank et al. (2010) - Forsyth (2015) - Stewart et al. (2016) - Zuniga-Teran et al. (2017) - Wang et al. (2016)
Exercise / Health	Generally purposeful and fast pace (except for dog walking which involve many stops and covering green area)	- Purposeful - Destination less fixed - Not always directed by the shortest distance	- Moderate Influence	- Choi (2013) - Park et al. (2015) - Dadpour et al. (2016) - Jensen et al. (2017) - Forsyth (2015) - Zuniga-Teran et al. (2017)

Source: The Author (2016)

5.5 Pedestrian Level of Service (PLoS)

A dedicated pedestrian sidewalk and pathway is vital to ensure the security, safety, comfort and the best route possible for walking. Various studies were carried out concerning serving the best interest of pedestrian. Fruin (1971) developed the concept of Pedestrian Level of Service or 'PLoS' for walking in 1971, which was derived from the walking density, speed and flow relationship. Subsequently, the concept was developed based on the freedom to select walking speed, the ability to assist slow-moving pedestrians, and relative ease of reverse and crossing movements under various pedestrian volumes.

The standard walking pace for average person (generally in good health and normal built), in normal whether condition, on generally flat route without carrying baggage is within

the range of 1.2 – 1.4 metre/second or about 72 – 84 km/hr (Cronkleton, 2019; Fruin, 1971; Mohler, Thompson, Creem-Regehr, Pick, & Warren, 2007; Young, 1999). Walking pace below the standard range tend to cause others to slow down, is considered as slow walking and walking pace above the standard range is considered as fast walking (Azmi & Karim, 2012). Figure 3.1 below shows the Level of Service for pedestrian with LOS 'A' indicated the best condition, LOF 'F', for the worse condition (Figure 5.1). It is noted that this concept was seemingly good for walkways.

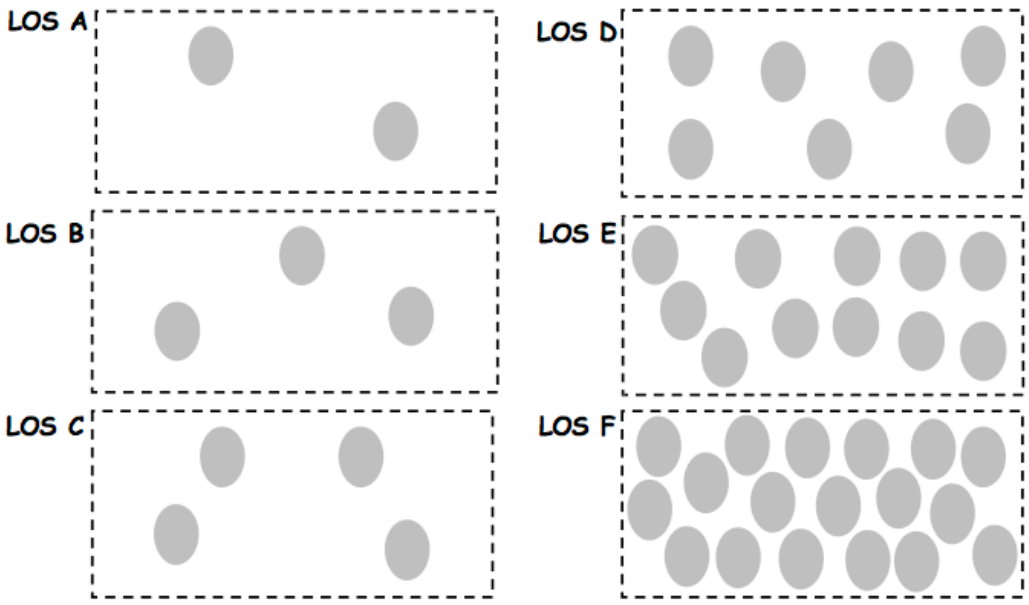

Figure 5.1: Illustration of Pedestrian Level of Service for Walkways
Source: Fruin (1971, pg. 7)

5.6 The Study of Walkability

There are many studies conducted on walkability with more attention on its wide-ranging benefits (Park et al., 2015) associated to public health (Eisenberg et al., 2017; Gehrke & Welch, 2017; Maguire et al., 2018; Ribeiro et al., 2018), social (Alidoust, Bosman, & Holden, 2018; Cheshmehzangi, 2015; Jun & Hur, 2015; Rogers, Gardner, & Carlson, 2013), economic (Cheshmehzangi, 2015; Gilderbloom, Riggs, & Meares, 2015; Knight, Weaver, & Jones, 2018; Shamsuddin et al., 2018) and urban sustainability (Abdulla et al., 2017; Ariffin & Zahari, 2013; Azmi & Karim, 2012; Scoppa, Bawazir, & Alawadi, 2018). Table 5.3 summarises the benefit of walkability comprising the economic, social, environmental sustainability as well as the general health. The contribution of built

environment quality to walkability is continuously researched - to expand knowledge (Choi, 2013) for its application for the betterment of the urban environment (Park et al., 2015).

Table 5.3 Walkability Benefits on Land Use and Urban Populace

Economic Sustainability	Social Sustainability	Environmental Sustainability	General Health
- Improved accessibility, particularly for non-drivers. - Reduced transportation costs. - Increased parking efficiency (parking facilities can serve more destinations). - Can increase local business activity and employment. - Support for transit and other alternative modes. - Special support for some businesses, such as walking tourism. - Health cost savings from improved exercise.	- Improved accessibility for people who are transport disadvantaged. - Reduced external transportation costs (crash risk, pollution, etc.). - Increased neighbourhood interaction and community cohesion. - Improved opportunities to preserve cultural resources (e.g., historic buildings). - Increased exercise.	- Reduced land needed for roads and parking facilities. - Open space preservation. - Reduced energy consumption and pollution emissions. - Improved aesthetics. Reduced water pollution. - Reduced "heat island" effects.	- Weight management (Body fat, overweight and obesity). - Improved quality of life, sense of wellbeing and long-term health. - Helped in reducing health services demand. - Fitness, stamina and energy. - Healthy ageing, mobility, independence, and quality of life in older adults. - Mental health and wellbeing.

Source: Adapted from Coffee, Howard, Paquet, Hugo, & Daniel (2013, pg. 163-164); Litman (2003, pg. 10)

The oppression of our environment has been continuous ever since the second Waves of Innovation. However, the general public is becoming environmentally conscious and protective in the era of the Sixth Wave with the innovation of clean technology (Figure 5.2), renewable energy, green transport, green development among others (Hargroves, Paten, Palousis, & Smith, 2005).

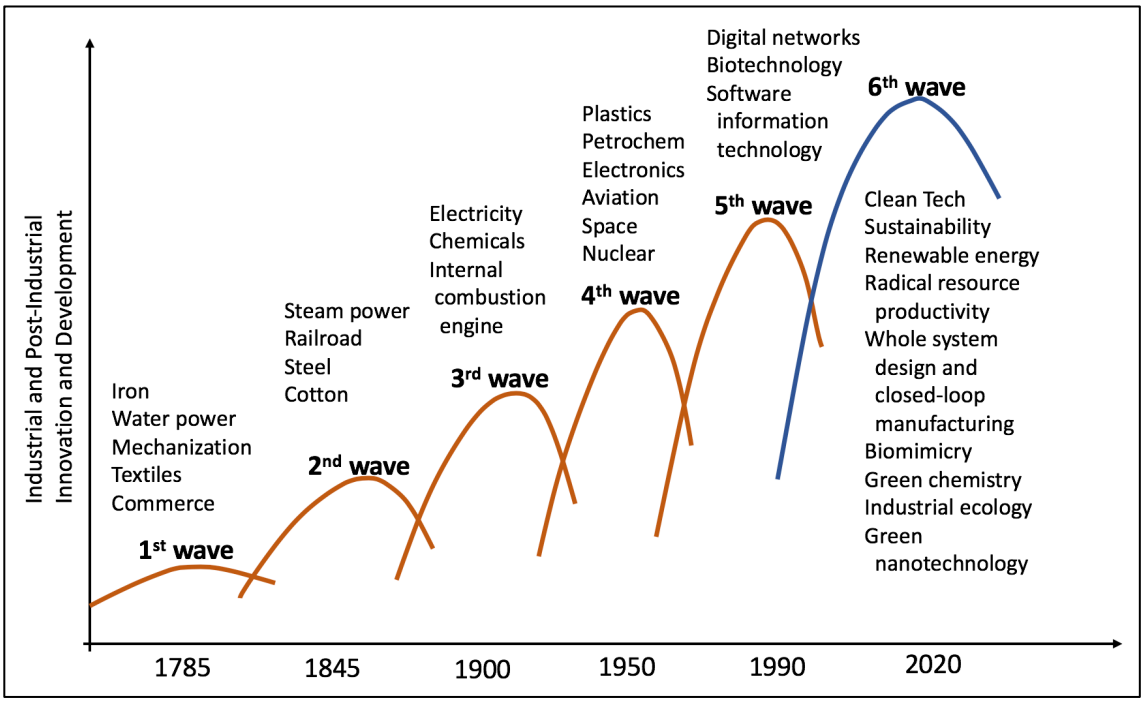

Figure 5.2 Waves of Innovation - the Era of Sustainability
Source: The Natural Edge Project (2004) in Hargroves et al. (2005)

As evident in literature investigations, walking being a multidisciplinary activity (Choi, 2013; Frank, Devlin, Johnstone, & Loon, 2010) are being measured with a variety of walkability metrics of different fields. Thus, to effectively identified factors that persuade walking in urban areas, it is necessary to have a multidisciplinary method of measurement that incorporate all the different fields (Yin & Wang, 2016), various point of views (Rafiemanzelat, Emadi, & Kamali, 2017) and relevant disciplines (Lo, 2011). Wolf (2008), highlights that there are two categories of determinant in city walkability being, 1) Physical Environment and 2) Psycho-Social Environment as detailed in Figure 5.3.

The Western walkability indices are unrealistic and unsuitable for it to be used in the context of Asian countries due to numerous differences such as locality, climate and culture (Salleh, Zainol, Ahmad, & Noor, 2014) A successful walkability measure must be realistically based on site-specific and well suited to the site conditions. However, it should also permit a certain degree of modification for it to be replicated in other places (Lo, 2011).

	Positive Elements
Physical Environment	higher population density (city core rather than suburbs) higher housing density mix of land uses (such as residential and retail) street design with more connectivity (rather than cul-de-sacs) availability of public transit walking and biking infrastructure (such as sidewalks and bike lanes)
Psycho-Social Environment	safety from crime safety from traffic absence of social disorder aesthetics (including trees and landscape) educational campaigns (such as Walk-to-School) incentive programs (such as work place reimbursement for transit use)

Figure 5.3 Determinants of City Walkability
Source: Wolf (2008, https://depts.washington.edu/hhwb/Thm_ActiveLiving.html;

Retrieved: 20th March 2016)

----- PART TWO -----

5.7 Development of Alor Setar Walkability Index (ASWI) – The Identification of Indicators and Assessment

In general, the development of the walkability index involved a series of a systematic process of consideration from identifying Components, General Parameters, Parameters, Key Attributes and finally to the Indicators. Indicators are the direct mean of assessment linking the objective of the research and the perceived values for assessment. The assessment method either single or integrated, using quantitative or qualitative, employ some form of indicator to measure output (Becker, 2005; Drexhage & Murphy, 2010; Hart, 2014; Olalla-Tárraga, 2006).

5.7.1 Definition of Indicators

There are various definitions of indicators used in works of literature and researches (Hák, Janoušková, Moldan, & Dahl, 2018), which according to Heink & Kowarik (2010, pg. 585) as 'a measure or component from which conclusions on the phenomenon of interest (the indicandum) can be inferred'. USEPA (2008, pg. 1-3) defined that an environmental indicator as a measure of change in the state of the environment (environmental), or in human activities that affect the state of the environment or ecosystem (cultural/social), if at all possible, in relation to a standard value, objective, or goal. An environmental indicator is not a sole environmental premise from which a data is generated but refers to environmental change attributes (Zhang et al., 2018, pg. 191), an instrument to relay the meaning of data (Olalla-Tárraga, 2006, pg. 3) or as an 'indication of a measure[ment]…to indicate a condition' (Becker, 2005, pg. 88; Teriman, 2012, pg. 50). Consequently, it expands beyond the associated value of a specific environmental parameter (Zhang et al., 2018).

In general, there are three types of indicators, descriptive measures, normative measures and as hybrid measures (Heink & Kowarik, 2010, pg. 585) as in Table 5.4 - Table 5.6 below;

a. Descriptive Indicators: a measurement using indicators at a descriptive level, describe the state of a system or analyse environmental changes (Heink & Kowarik, 2010).

Table 5.4 Varies Definition of Descriptive Indicators

Varies Definitions	Author
1. 'environmental indicators provide information about phenomena that are regarded typical for and/or critical to environmental quality'.	Smeets & Weterings, 1999, pg. 5
2. 'Measurable indication of changes in vital sign for assessment'.	Erden, Demir, Ugras, Arslan, & Arslan, 2018, pg. 5
3. 'Indicators reflect measurable and calculated direct effect contributions of various factors'.	Sun, Ma, & Xu, 2018, pg. 644
4. 'An indicator is a variable that describes the state of a system'.	Walz, 2000, pg. 613

Source: Adapted from Heink & Kowarik (2010, pg. 585-588)

b. Normative Indicators: a measurement using indicators to stipulate the future (environmental) condition or phenomenon (prescriptive indicators) and to test whether a desired (environmental) condition was ultimately achieved (evaluative indicators) (Heink & Kowarik, 2010).

Table 5.5 Varies Definition of Normative Indicators

Varies Definitions	Author
1. Empirical and quantitative characteristics for effective evaluation.	Semenov, 2018, pg. 1276
2. 'Indicator: Index or measurement endpoint to evaluate health of a system (economic, physical, biological, human)'.	Burger, 2006, pg. 142
3. 'An indicator is ... a function of variables. It provides an indication, i.e., an entity that can be used as an argument of a function used to take a decision'.	Riley, 2001, pg. 123 - 126

Source: Adapted from Heink & Kowarik (2010, pg. 585-588)

c. Hybrid Indicators: a measurement using both descriptive and normative indicators, either in a clearly distinguished sense in the form of separate indicator system (Yang et al., 2018) or ambiguously intermingled (Alfsen & Sæbø, 1993; Heink & Kowarik, 2010; Zhang et al., 2018).

Table 5.6 Varies Definition of Hybrid Indicators

Varies Definitions	Author
1. 'An indicator is a measurable characteristic of a current state or quality of an area, and able to demonstrate trend if performed repeatedly'	Ferris & Humphrey, 1999, pg. 313
2. 'An environmental indicator is usually defined as a number indicating the state and development of the environment or conditions affecting the environment. (...) The indicator is meant to give information in excess of what is directly measured or observed, i.e., the parameter value or statistical information. Thus, an indicator is seldom presented as a single datum, but it should be put in some context from which it is possible to infer what is indicated'	Alfsen & Sæbø, 1993, pg. 416

Source: Adapted from Heink & Kowarik (2010, pg. 585-588)

This research descriptively utilised indicators to measure the level of environmental condition or phenomenon and should be linked to issues and goals specific that promote urban walkability.

5.7.2 Indicators Development

The research intended to ascertain the association of two urban design concepts, that are Walkability and Green Urbanism in revitalising Malaysian MC (medium-sized city) of Alor Setar. Systematically, the development of indicators was divided into two categories of urban sustainability domains. The first is walkability indicators, and the second category is Green Urbanism.

5.7.3 The Stages of Indicators Development

The development of final indicators used on-site during fieldworks follows six (6) stages of investigations as illustrated in Figure 5.4 below.

- The first stage:

  - Investigated global walkability index, which uses Kramback & Shah (2006) indices as the basis due to its universality and applicability of walkability components for comparison on the next stage.

- The second stage:

-Investigated walkability themes and parameters from established urban planning agencies and private organisation to identify wide-ranging walkability themes and parameters.

- The third stage:

  - Investigated the latest established walkability indices by researchers from the Western countries, Asian and Malaysian. Identified recurrent and substantial walkability parameters, key attributes and indicators for the development of index related to the topic and area of study.

- The fourth stage:

  - Examined and identified the relevant parameters, key attributes and indicators significant to the local context. List of potential walkability indicators for Malaysia/Alor Setar.

- The fifth stage:

  - Developed a list of walkability indicators suitable for the Malaysian Context and Alor Setar. List of walkability indicators for Malaysia/Alor Setar - ready for the pilot survey in Sungai Petani (ranking no. 2 after Alor Setar).

- The sixth stage

  - Tailored the Parameters, Key Attributes and Indicators identified and developed the site-specific index for use in Alor Setar.

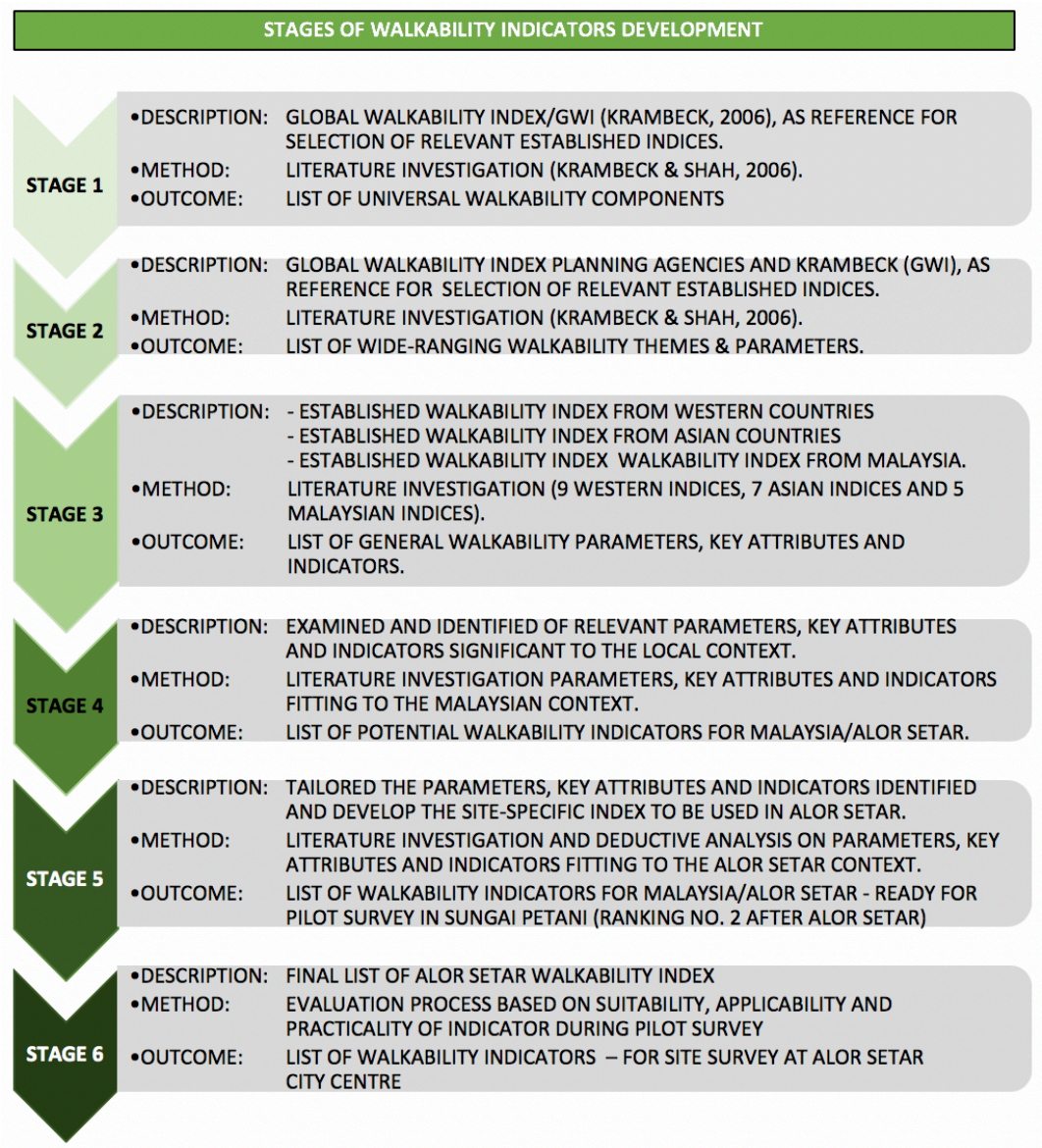

Figure 5.4 Stages of Walkability Indicators Development

The World Bank has done and funded extensive works on developing Walkability Indices, for example, Krambeck & Shah (2006). Asian Development Bank also funded research for the development of Asian Walkability Index in 13 cities of 10 Asian countries (unfortunately, Malaysian cities were not included in the research) by Gota et al. in 2010. A total of 21 indices examined, nine were from Global indices, seven were from Asian countries indices, and five were from the Malaysian indices. The selection of the indices for the study was based on six criteria as follows;

- Applicable to Secondary (including small and medium-sized) towns/cities
- Area of research covering city centres, urban neighbourhoods
- Urban liveability and city living

- Involving urban qualities, environmental quality measurements, landscapes and biodiversity
- Mixed land uses and developments
- Considering local cultures and histories

5.7.4. Walkability Measurement

The physical aspects of built environment influenced significantly in the measurement of urban walkability (Adkins et al., 2012; Appleyard, 2016; Ewing & Cervero, 2001; Ewing, Hajrasouliha, Neckerman, Purciel-Hill, & Greene, 2016; Guo & Loo, 2013). Thus, it is imperative to measure the effectiveness of physical variables of the built environment on urban walkability (Koh & Wong, 2013; Sugiyama et al., 2015; Wang et al., 2016). The measuring of walkability based on physical environmental attributes significantly associated with environmental measurements (Carr, Dunsiger, & Marcus, 2011; Duncan, Aldstadt, Whalen, & Melly, 2013; Ewing et al., 2006; Hall & Ram, 2018a; Kang, Xiong, & Mannering, 2013; Yin & Wang, 2016).

Walkability measures based on the physical environmental attributes involve objective, subjective, or a mix of objective and subjective data. Objective measures include direct field observation also known as walkability audit, or indirect evaluation of secondary data using geographic information system (GIS) techniques. Subjective measurements comprise of interviews or surveys with pedestrians / potential pedestrians in a study area, or indirect methods comprise of evaluation of built environment attributes associated with perceptual response (such as design qualities). Table 5.7 synthesises the walkability measurements adopted from Ewing et al. (2006). However, according to (Besser et al., 2018; Ellis et al., 2016; Jensen et al., 2017; Koohsari et al., 2015; Van Lenthe & Kamphuis, 2011) there can be mismatches between subjective and objective measures of walkability.

Table 5.7 Measuring Walkability

Walkability measurement	Direct method	Indirect method
Objective measurement	Direct field observations, called a walkability audit.	Evaluation of secondary data using GIS information technique.
Subjective measurement	Interviews or surveys with pedestrians or potential pedestrians in a study area.	Evaluation of built environment attributes related to perceptual response, such as design qualities.

Source: Adapted from Ewing et al. (2006); Rafiemanzelat, Emadi, & Kamali (2017)

Apart from the commonly employed measurement systems, many scholars who employed a unique and site-specific measurement system for evaluations. Diverse methods and tools such as perceived measures from interviews and self-report questionnaires, observational measures from audits and archival datasets were developed for the measurement of the built environment in accordance with the research purpose, existing variables and the scale of contextual measurement (Brownson et al., 2009; Rafiemanzelat et al., 2017). This research employed both walkability measurements comprised direct and indirect method as it will improve the accuracy of the index measurements (Ellis et al., 2016).

The researcher is in the opinion that mixed-measurement approach produced reliable walkability measurement result to be associated with GUP as highlighted in Table 5.8 below.

Table 5.8 Walkability Measurement Employed in the Research

Walkability measurement	Direct method	Indirect method
Objective measurement	Direct field observations: -Field observation by researcher -Walkability audit by focus groups -Focus groups discussions	Evaluation of secondary data using information, maps and statistical input.
Subjective measurement	Interviews with pedestrians, residents and business operators in a study area on walkability issues	Evaluation of physical built environment attributes based from existing condition, such as design qualities, implementation, policies and programs.

5.8 The Components and General Parameters of Walkability Measurements

The progression of establishing general parameters for walkability measurement involving global walkability indices was divided into two categories, Krambeck and Shah (GWI) and International urban planning agencies.

5.8.1 Establishing Walkability Measure Components: Global Walkability Index (GWI)

As a point of departure, the researcher used Krambeck's Global Walkability Index as the basis of investigations and for the development of the final index (Table 5.9). This is due to several factors, such as:

i. The broad and generality of the index.

The generality of Krambeck's index gave room for modification to better suit different purpose, locality and approach which specific metrics fail to provide. For example, Jaskiewicz (2000) inclusion of specific aesthetic metrics for walkability (Building Articulation and Overhangs and Rooflines) as part of qualitative index proving bias and not satisfactory because design criteria are subjective by definition (Lo, 2009).

ii. Inclusive of all components suitable for Asian countries.

Not all walkability components used in the western and even Asian countries are suitable for the Malaysian context. Thus, the selection of main/relevant components that are befitted the climate, cultures and conditions of the locality is essential. Krambeck's index was seen as able to competently covers these requirements, concomitantly with some alteration for it to perfectly works and parallel with Asian Green City framework to measure pedestrian environment (Wibowo et al., 2015).

iii. Practicality and applicability of the index to the study.

Due to its generality and consideration of Asian culture/conditions, the index is practical and easily applicable using the listed components as guidelines. Although being simplified and included only elements deemed the most important, the index maintains as plausible indicators to measure walkability (Krambeck & Shah, 2006). It is applicable for all cities regardless of context and purpose with some modification to fit specific detail of indicators in the existing parameters (Leather, Fabian, Gota, & Mejia, 2011; Wibowo et al., 2015).

Table 5.9 Krambeck's Global Walkability Index - Summary of Components (2006)

Component	Description
Safety and Security	Safety component covers the conflict between pedestrian and motor vehicles, the safety of pedestrians against road/traffic accidents, provision of safe crossing points and perception of safety along the walking route. Security component regards pedestrian's perception of their protection against crime along the walking route, level of environmental condition that promotes pedestrian's security and also covers the degree of motorist behaviour and respects towards pedestrians.
Convenience and Attractiveness	Convenient dealt with the availability of pedestrian crossings along major roads, the possibility of the pedestrian to choose walking direction and interconnectivity of pathways with other modes of transportations. It also stressed the existence and quality of facilities for blinds, handicapped and people with limited ability. Another point of measure is the presence of any obstacles on walking paths either permanent and temporary. Attractiveness encases the maintenance and cleanliness, the materials used and the overall surrounding environment along the walking paths. Additionally, it also highlights the provision of amenities for pedestrian along the walking paths such as coverage of walking routes, covered walkways and shades, benches, shelters, public toilets etc.
Policy Support	Policy Support component circumscribes the allocation of government's funding and resources devoted to pedestrian planning and the availability of relevant urban design guidelines. It also accentuates on the enforcement of relevant pedestrian safety laws and regulations. The component also emphasises the degree of public outreach for pedestrian and, driving safety and etiquette among motorists.

Source: Krambeck & Shah (2006, pg. 19)

The three components as listed by Krambeck (refer Table 5.9) were then investigated further to identify general parameters (as a basis) before the final parameters can be established. Due to the generality of Krambeck's walkability components (which is necessary for global use), some of the initial findings were not included in the final index but covered in the literature.

5.8.2 Establishing the Walkability Measure Parameters: Urban Planning Walkability Index - International Urban Planning Agencies and Reputable Organisation

Apart from Krambeck and Shah (2006), eight other global walkability indices and guidelines from the public and private agencies were also investigated. All of the urban planning agencies indices were carried out employing a heuristic approach instead of scientific. The heuristic approach has been shown to provide generally accurate assessments of walkability (Carr et al., 2011; Duncan, Aldstadt, Whalen, Melly, & Gortmaker, 2011; Schlossberg, Johnson-Shelton, Evers, & Moreno-Black, 2015; Weinberger & Sweet, 2012). Besides, it is best to employ heuristic approach when dealing with the perception of the environmental attributes and identification of practical

problems at the actual routes (Ceder & Wilson, 1986; Chen, 2012), which parallel with this research approach. Most of these indices provide themes components and general parameters for walkability measure instead of specific indicators to maintain its generality for easy replication.

Expanding from the three Components as proposed by Krambeck, the investigation on indices by International Urban Planning Agencies and Reputable Organisations established the emergence of five General Parameters as follows; Safety and Security, Convenience and Universal Design, Environment Effect, Uses and Activities and Policy Support. Table 5.10 detailed out the emergence of the general parameters.

Table 5.10 Summary of General Parameters (Urban Planning Agencies and Reputable Organisations)

COMPO-NENT (GWI)	GENERAL PARAMETER (URBAN PLANNING AGENCIES)		DESCRIPTION
SAFETY AND SECURITY	Safety and Security	Separation of walkway from traffic & Traffic speed; Pedestrian safety and security	Walking path modal conflict – the extend pedestrians mix with other modes, such as bicycles, motorcycles, or cars.
		Pedestrian crossings, Safety & Security	Crossing safety & availability; Pedestrian safety and security concern; Pedestrian road accidents; Perceptions of security from crime; Quality of motorist behaviour
CONVENIENCE AND ATTRACTIVENESS	Convenience and Universal Design	Walkways directness, Continuity & Connectivity	(Not covered in Krambeck's) Direct routes from origins to destinations; The extent of pedestrian network links to key trip origins and destinations; The continuity and connectivity of pedestrian network to transit services.
		Universal accessibility & Disabled friendly	The Availability and quality of facilities for blind & disabled persons; Effective width of paths, and curb ramps to accommodate wheelchairs and strollers.
		Availability, Condition & Maintenance of walkways	Maintenance and cleanliness of walking paths; Presence of permanent or temporary obstacles on walking paths
	Environmental Effect	Visual quality, Interest & Sense of place	Presence of streetscapes and amenities (cover, benches, streetlight, public toilets)
		Landscapes & Street trees	Presence of street trees (Trees provide a natural barrier from traffic, improve air quality, provide some degree of shelter from the elements, and improve the attractiveness of the pedestrian environment)
	Uses and Activities	Mixed-Land use, Density & Diversity along walkways	(Not covered in Krambeck's) The presence of mixed land uses/ building uses in the city instead of mono functional land use; The level of density (of population and occupied spaces) and diversity (of uses and activities) along the pedestrian routes.
POLICY SUPPORT	Policy Support	Relevant policy, guidelines and laws related to pedestrian planning and safety	Funding and resources devoted to pedestrian planning; Enforcement & outreach for pedestrian & traffic safety Presence of relevant urban design guidelines; Existence and enforcement of relevant pedestrian safety laws and regulations; Degree of public outreach for pedestrian and driving safety and etiquette

Walkability measurements for the fields of urban and transportation planning undertaken by planning agencies and influential non- governmental organisations depict pedestrian space as networks, with walkability measured concerning buffered pedestrian networks. Walkability measurements from these agencies accentuate variables that measure pedestrian walkways continuity; street connectivity or route directness; land use density and diversity; buffering from heavy or highspeed traffic; crossing safety; and human-scale design (City and County of San Francisco, 2015b; City of Portland, 1998; Dowling, Reinke, Flannery, Ryus, & Vandehey, 2010; Institute for Transportation and Development Policy New York, 2018; Montgomery & Roberts, 2008; Ng et al., 2016).

The components and parameters used in the walkability measurement metrics by planning agencies and influential non- governmental organisations are diverse. This is due to the various reasoning such as geographical locations, cultural background, specific and localise issues and availability of data and sources (BRE Group, 2012; Institute for Transportation and Development Policy New York, 2018; Jaskiewicz, 2000; L. Kang et al., 2013; Knight et al., 2018; Lo, 2009; M. Z. Shah et al., 2010). However, the most prevalent emerging parameters from all eight indices and walkability guidelines investigated can be systematically categorised in four components of the general parameter according to their measuring factors. These four general parameters are;

i. Safety and Security

- Separation of the walkway from traffic & Traffic speed
- Pedestrian crossings, Safety & Security)

Prominent focus was given on pedestrian safety and security especially on the issues of separating pedestrian walkways from the road by most of the walkability indices - New York's Pedestrian First (**NYPF**), Hong Kong's walkability Index (**HKWI**), World Bank's Walk Urban (**WBWU**)**,** Kansas' Pedestrian Level of Service (**KPLoS**) and, Danish & USA's Multimodal Level of Service Analysis for Urban Streets (**MLoS**). Portland's PPI/PDI (**PPPI**), BREEAM Communities (**BREEAM**) and San Francisco's PEQI (**SFPEQI**) were both highlighted the concerns on limiting the vehicular volume, controlling vehicular speed limit and traffic calming, clear marking of on-street parking and separating bicycle lanes as measures for buffered pedestrian walkways.

The provision of proper, signalised, marked and raised pedestrian crossing is vital to protect the legal right of pedestrian safety as evident in all the indices. Also, waiting time for crossing too was deemed an important safety factor to avoid people crossing recklessly as evident in NYPF and SFPEQI. The availability of pedestrian crossing at short intervals (NYPF; KPLoS; SFPEQI), crossing at minimum road width (PPPDI; KPLoS; SFPEQI) and raised road median for pedestrian refuge for a pedestrian crossing at the wider road is essential in protecting pedestrian. Street lighting at the crossing is important for pedestrian safety and security, and as to increase visibility to the in-coming car of the pedestrian (WBWU; FPEQI).

ii. Convenience and Universal Design

- Availability, Condition & Maintenance of walkways
- Universal accessibility & Disabled friendly
- Walkways directness, Continuity & Connectivity

All indices indicated the need of a dedicated pedestrian walkway or sidewalks that are continuous, unobstructed and separated from vehicular; and it must be made clean and well maintained (NYPF; HKWI; KPLoS; BREEAM). Walkways also must be wide enough (1.8-2.5m) for pedestrians, wheelchairs and bicycles (NYPF; MLoS) as part of ensuring the practicality of having multi-modal transport planning. As for busy road in urban areas, it is best to have pedestrian walkways on both sides of the road (SFPEQI).

Universal accessibility in the form of wider sidewalks, low road kerbs, and ramps connecting sidewalks and roads is another key factor for walkability measuring metrics (NYPF; HKWI; WBWU; PPPDI; BREEAM; SFPEQI). Additionally, all indices but NYPF include walkway directness, continuity and connectivity as an important parameter to measure walkability.

iii. Environmental Effects

- Visual quality, Interest & Sense of place
- Landscapes & Street trees

Landscape and Street Trees were considered as an important environmental effect in softening the urban street scene (HKWI; BREEAM) and helped in enhancing the sense of comfort along pedestrian walkways (HKWI, KPLoS). Apart from creating visual and sensory interest, it also provides a habitat for urban wildlife (HKWI; BREEAM). The

landscape and tree lines provided shades for pedestrians (KPLoS) and formed as part of the streetscape in an urban environment with seating and resting area (HKWI; SFPEQI). The higher number and shorter distance of street trees can contribute to maximising environmental comfort and acting as a buffer zone for pedestrians in urban areas (MLoS).

Active activities along paths with street vendors contributed to creating good Visual quality, Interest & Sense of place (NYPF) as it is a vital element for walkability (HKWI). A city displaying its local character gives a place a unique identity with senses of attachment, quality of the public realm and sense of place (HKWI; SFPEQI; BREEAM). Active and diverse activities along pedestrian walkways also insinuated the human scale in the vast urban environment (PPPDI; KPLoS). Street vendors, lighting, street signs and poles and planting interposed the quality of urban character and public realm (NYPF; HKWI; SFPEQI; MLoS), in which essential in urban walkability.

iv. Uses and Activities

- Mixed-Land use, Density & Diversity along walkways
- Image, Heritage & Culture

Areas with mixed-land uses attract more pedestrians as compared to a single uses area as manifest in most indices examined (NYPF; HKWI; PPPI; KPLoS; SFPEQI; BREEAM; MLoS). Mixed-land uses areas often associated with liveable neighbourhood offer a higher density of buildings, population and high diversity of activities (HKWI; WBWI; PPPI; BREEAM; MLoS). A pedestrian route with active and attractive land use activities, adjacent and along walking route encourages walkability as it could impart positive experiences (NYPF; KPLoS; SFPEQI) to pedestrians walking along those routes. Another key factor is the distance of walking to and from daily routines such as a workplace, schools, parks, transport transit and shops, among others (HKWI; PPPI; BREEAM) encourage walkability.

v. Policy Support

Laws, guidelines and policies are important factor in ensuring the applicability, workability and enforcement for any walkable environments or pedestrianisation programmes (City of Kansas City, 2003; Institute for Transportation and Development Policy New York, 2018; Leather et al., 2011; Litman et al., 2016; Salleh et al., 2014; Wibowo et al., 2015). Most of the policies covering the safety and security of users (City

of Kansas City, 2003; City of Portland, 1998; Dowling et al., 2010; Institute for Transportation and Development Policy New York, 2018; Leather et al., 2011; Ng et al., 2016; Y. Wang et al., 2016), expansion of pedestrian infrastructure (Ng et al., 2016; City of Portland, 1998; Dowling et al., 2010; City of Kansas City, 2003), connecting and joining of the pedestrian network (Ng et al., 2016; Dowling et al., 2010) and coverage of historical and cultural places (Ng et al., 2016; City of Kansas City, 2003; Dowling et al., 2010).

vi. Image, Heritage and Culture

- The Image projection and contribution of heritage and culture by walkable environment were not pronounced in most urban planning agencies and organisations' walkability measurement. HKWI and KPLoS marginally touched on the contribution of street culture and old building at a shopping street in either old districts of the city. BREEAM clearly includes Heritage, Culture and Identity and distinctiveness in its list, however, MLoS had ambiguously mentioned areas of historical landmarks and tourist attractions. KPLoS, on the other hand, highlighted the importance of mixed-land use areas with historical elements included to increase walkability.

Generally, the walkability measurements from these sources can be divided into two categories, a) Provision of walking infrastructure and Safety: ALL parameters under this category were emphasised in all walkability metrics by urban planning agencies and influential non-governmental organisations examined, and b) Design functionality, Comfort and Beautification: NOT ALL parameters under this category were accentuated in all walkability metrics by urban planning agencies and influential non-governmental organisations examined; as indicated in Table 5.11 below. Correspondingly, Table 5.12 summarises all the general walkability parameters by selected urban planning agencies and influential nongovernmental organizations.

Table 5.11 Categories of Walkability Measures by Parameters as Identified in All Urban Planning Agencies and Influential Nongovernmental Organizations.

Parameters measured by ALL urban planning agencies and influential nongovernmental organisations.	**Parameters measured by NOT ALL urban planning agencies and influential nongovernmental organisations.**
a) Provision of Walking Infrastructure and Safety & Security	**b) Design functionality and Comfort & Beautification**
1) Walking Infrastructure	1) Design functionality
Availability of sidewalk	Universal accessibility & Disabled friendly
Condition of sidewalk	Walkways directness
Maintenance of walkways	Continuity & Connectivity
2) Safety and Security	2) Comfort and Beautification
Walkway at Mixed-Land use area	Visual quality
Density & Diversity along walkways	Visual Interest
Separation of the walkway from traffic	Sense of place
Traffic speed	Landscapes
Pedestrian crossings,	Street trees
Safety & Security from crime	

Table 5.12 Urban Planning/Private Agencies - Walkability General Parameters.

General Parameter / Agency		1. New York (Pedestrian First, 2018) (NYPF)	2. Hong Kong (Hong Kong Walkability Index, 2016) (HKWI)	3. World Bank - Demand, Constraints and Measurement of the Urban Pedestrian Environment (Walk Urban, 2008) (WBWU)	4. Portland (Pedestrian Potential or Deficiency Index [PPI/PDI], 1998) (PPPI)	5. Kansas City (Pedestrian Level of Service [LOS], 2003) (KPLoS)	6. San Francisco (The Pedestrian Environmental Quality Index [PEQI], 2008) (SFPEQI)	7. BREEAM Communities (2012)	8. USA & Denmark Transportation Research Board (TRB), (Multimodal Level of Service Analysis for Urban Streets, 2010) (MLoS)
Safety and Security	Separation of walkway from traffic & Traffic speed; Pedestrian safety and security	Dedicated pedestrian walkways separated from traffic. Clear indication of speed limit and traffic calming. Allocation of well managed on-street, off-street and underground paid parking.	Dedicated pedestrian walkways. Provide a safe walking environment, separate pedestrians from vehicular traffic as much as possible. Traffic calming measures help maintaining a safe walking environment.	Separate motorised vehicles for pedestrian safety and security.	Clear indication of traffic speed limit & not excessive in volume	Pedestrian ways are separated from vehicles, Allocation parking lanes, Clear indication of speed limit.	Clear indication of on-street parking & bike lanes; Traffic calming to slow traffic speeds	Enhance security through improving the walkability of the neighbourhood, Lighting along pedestrian walkway,	Sidewalk width; Pedestrian ways are separated from vehicles with buffers or barriers; Clear indication of on-street parking not encroaching travel lane; Indication of bike lane; Limit motor vehicle speed, volume, frequency & volume in the city
	Pedestrian crossings, Safety & Security	Proper crossings with signalised crosswalk, not excessive waiting time, crossing at short intervals.	Provide widened sidewalks and prioritized pedestrian crossings.	Indication of pedestrian crossing, lighting and safety & security	Availability of safe and comfortable pedestrian crossing & limit traffic speed, volume, road width to avoid pedestrian crashes	Availability of pedestrian crossing, minimal lane width & number of crossing along pedestrian ways	Clear indication of crossing; street lighting for increased visibility & corner parking restrictions; Minimise crossing distance & time	Safe crossing points are provided at appropriate locations and intervals. At the point of crossing, the road must also be well-lit and there should be a clear line of sight for at least 300m in each direction.	Marked, raised and properly designed pedestrian crossing for safety. Pedestrian refuge at raised median for wide roads.
Convenience and Universal Design	Walkways directness, Continuity & Connectivity	-	Directness of routes to main destinations in the neighbourhood. Accessibility and connectivity to nearby destinations	Foot-network to connect the entire urban area.	Connected street network and depending on the block length	Ratio of actual to minimum grid distance	Integrated with street connectivity	Direct connectivity; reduce automobile dependence, provides a mix of uses in a walkable distance	Pedestrian network connecting rural network or neighbourhood street.
	Universal accessibility & Disabled friendly	Universal accessible, Wide and unobstructed for wheelchair users	Universally Accessible - and for pedestrian with luggage	Pedestrian right: standard for universal access to all pedestrians.	Universally Accessible	-	Universally accessible with pedestrian Facilities. Presence of median refuges	Universal design is aimed at improving the environment in order to enable a broad spectrum of people, regardless of their age and physical ability, to participate in community life	-
	Availability, Condition & Maintenance of walkways	Footpaths in good condition and sufficiently wide. Dedicated and clean	Properly maintain and clean walkways create comfortable environment for walking	Separating street and walkways for pedestrian safety	Continuous sidewalks. Unobstructed walkways (temporary or permanent)	Complete walkways system with design and maintenance	Dedicated pedestrian walkways assigned on both sides of the street	Continuous walkways system with design and maintenance	Availability of walkways with sufficient width. Wide enough for cyclist
Environmental Effect	Visual quality, Interest & Sense of place	Active activities along paths with street vendors, seating facilities	Visual quality and interest are vital for walkability. Local character gives a place a unique identity and senses of attachment and place.	-	Human scale in a city	Pedestrian comfort & attractive, design and human scale	Character & quality of the public realm; intersections as important public space; consolidated utilities, parking meters, street signs and poles	Create safe and appealing streets and spaces that encourage human interaction and a positive sense of place.	Street trees for pedestrian friendly and quality environment
	Landscapes & Street trees	-	Landscapes enhances the sense of comfort along the streets, softening the urban street-scene, creating visual and sensory interest, and providing streets with habitats for wildlife. Provision of comfort facilities, particularly seating,	-	-	Pedestrian comfort with shade from street lined trees	Streetscape elements along pedestrian ways with proper seating, trees & plantings.	Provision of appropriate shaded green space and tree cover, open water and fountains in public spaces, shaded public spaces and footpaths, and green roofs, vegetated walls and attractive landscaping.	Roadside landscaping considered. Number and distance of street trees. Trees used as buffer zone.

Agency / General Parameter		1. New York (Pedestrian First, 2018) (NYPF)	2. Hong Kong (Hong Kong Walkability Index, 2016) (HKWI)	3. World Bank - Demand, Constraints and Measurement of the Urban Pedestrian Environment (Walk Urban, 2008) (WBWU)	4. Portland (Pedestrian Potential or Deficiency Index [PPI/PDI], 1998) (PPPI)	5. Kansas City (Pedestrian Level of Service [LOS], 2003) (KPLoS)	6. San Francisco (The Pedestrian Environmental Quality Index [PEQI], 2008) (SFPEQI)	7. BREEAM Communities (2012)	8. USA & Denmark Transportation Research Board (TRB), (Multimodal Level of Service Analysis for Urban Streets, 2010) (MLoS)
Uses and Activities	Mixed-Land use, Density & Diversity along walkways	Mixed uses, lively and active	Scale & Density of Building, Population and location. The use of space and connection with public transport is important due to excessive population density.	Demand for quality pedestrian network increases when land use density and diversity are high.	Mixed land use and density; walking distance to daily routines and destinations, schools, parks, transit & shops; average zoning size	Mixed land use adjacent/along the pedestrian network attractive and inviting such that they encourage pedestrian activities or are they unappealing.	Adjacent uses attractive or unappealing & land use – mixed, retail uses, public places and public seating.	Mixed land use and density; walking distance to daily routines, green spaces and destinations. Design to allow multiple uses for different users.	Mixed-land use, high density. Demand for Pedestrian Level of Service more in urban areas as compared to transition and rural areas.
Policy Support	Relevant policy, guidelines and laws related to pedestrian planning and safety	Series of policies recommendations pertaining to pedestrian safety, provision and improvement of infrastructure and expansion.	Hong Kong Planning Standards and Guidelines (2011). - Promotion of pedestrian planning, Strengthening of pedestrian planning and Development of pedestrian network at local level, in particular, the linkages with public transport.	-	- Arterial Streets Classification Policy (1977) - Regional Policy for Pedestrian Transportation Series of Statutes and Codes for pedestrian planning, provision of infrastructure, rights and safety. -Funding for pedestrian elements upgrading.	The City of Kansas City's Plans, Standards, Codes, Policies, and Capital Improvement Program provide FOCUS Kansas City Plan: -Pedestrian mobility and walking community -Pedestrian Environment -Pedestrian infra and safety.	-	-Promotes community involvement in decisions affecting the design, construction, operation -Long-term stewardship of the development.	- Vision 2030: City Plan (the Walkable City) and Guidelines for pedestrian planning, safety, linkage and connectivity - Disability Policy Programme – most accessible capital city by 2010 - Built City Inward, outer city nodes and effective public transport location.
Image, Heritage & Culture	Image, History and Culture were not pronounced in all indices								
	Image, Heritage & Culture	-	High place value streets with unique recreational facilities such as museums, theatres, and large urban parks, buildings along the street, or the street itself (insignificant)	-	-	Riverfront Trail - Highlight and emphasis historic and cultural locations and structures (insignificant)	-	Refurbished, re-used, recycled or maintained and those of significant value – culture, heritage and local identity	- All city centre regeneration projects must consider the historic assets of the inner city, (insignificant)
Approach	Note	Road not too wide and has max of 2 lanes. Suitable for application at small and medium size town/city. Landscape and greeneries excluded - Heuristic Approach	Street management as public space due to limited availability of open space. - Heuristic Approach	Focus on safety, infrastructure and policy. Landscape and greeneries excluded - Heuristic Approach	Topography or slope; Landscape and greeneries excluded Pedestrian-related street classification; Regional land use area. -Heuristic Approach	Focus on street level context of pedestrian analysis. Landscape and greeneries excluded -Heuristic Approach	Focus on pedestrian perception towards environmental quality and comfort. -Heuristic Approach	Focus on broad development of sustainable communities. -Heuristic Approach	Focus on providing safety for pedestrian. Street trees considered -Heuristic Approach

Source: 1. Institute for Transportation and Development Policy (2018); 2. Ng et al. (2016); 3. Montgomery & Roberts (2008); 4. City of Portland (1998); 5. City of Kansas City (2003); 6. City and County of San Francisco (2008); 7. BREEAM Communities (2012); 8. Dowling et al., (2010); Stockholm City Planning Administration, (2010); Lo (2009); Krambeck & Shah (2006).

5.9 The Parameters, Key attributes and Measured Indicators of Walkability Measurements

Further, from Walkability Components and General Parameters extracted (from the previous section 5.8.2), investigations on walkability measures performed in the Western countries and Asian countries were thoroughly investigated to establish prevalent Parameters, Key Attributes and Measured Indicators to be used for the development of ASWI.

5.9.1 Western Countries Walkability Indices

The established general components from GWI and international urban planning walkability indices were examined in order to determine the most prevalent parameter in measuring urban walkability. Henceforward, in authenticating the prevalent parameters, 11 walkability indices of both heuristic and scientific approach from the western countries were examined. As a result, eight prevalent parameters were established, as displayed in Table 5.13. These parameters were then used in the subsequent process to identify indicators for walkability measurement.

Table 5.13 Prevalent Parameters and Key Attributes from Western Countries Walkability Indices

General Parameter (extracted from Krambeck and 7 Intl. urban planning agencies)		**Prevalent Parameter** (extracted from 11 Western walkability indices)	
1	Safety & Security	1	Sense of Safety
		2	Sense of Security
2	Convenient and Universal Design	3	Convenience
3	Environmental Effects	4	Visual Interest & Attractiveness
		5	Comfort
4	Uses and Activities	6	Uses & Activities
5	Policy Support	7	Policy Support
6	Image, Heritage and Culture (insignificant)	8	Image, Heritage, History and Culture (insignificant)

Source: Ruiz-Padillo et al.,2018; Zuniga-Teran et al., 2017; Eisenberg et al., 2017; Riggs, 2017; Appleyard, 2016; Wang, Chau, Ng & Leung, 2016; Bahrainy, 2013; Leather et al., 2011; Torres-Montoya et al., 2010; Park, 2008; Krambeck & Shah, 2006

The most prevalent emerging parameters from all seven Western countries indices and walkability guidelines investigated can be systematically categorised in eight parameters and 26 key attributes according to their measuring factors as follows;

i. Sense of Safety

All the examined indices covered extensively on the parameters of the sense of safety, as it is critical to the perception of pedestrians while walking and produced positive effects to walking experience (Torres-Montoya et al., 2010; Wang et al., 2016). Excessive traffic speed often made walking less feasible, less convenient, and more dangerous (Ferrer et al., 2015; Wey & Chiu, 2013).

Crossing wide roads is no panacea for pedestrians even at marked pedestrian crossing (Ewing & Cervero, 2001; Southworth, 2005), thus rightsizing the road (Ewing & Cervero, 2001) and providing pedestrian refuge island at road median will make it more pedestrian-friendly (Dowling et al., 2010; Government of Western Australia, 2016; Kent & PPS, 2005; Millington et al., 2009; Southworth, 2005). Pedestrian facilities such as buffered pathways, marked and signalised crossings, railings and street trees can instil the sense of safety against traffic-related accidents (Corazza, Di Mascio, & Moretti, 2016; Leather et al., 2011; Russo, James, Aguilar, & Smaglik, 2018).

Recurring Key Attributes: Traffic Speed and Pedestrian Crossing, Crossing Facilities and Facility for Paths.

ii. Sense of Security

Riggs (2017), whose themes on walkability measurements encompasses four broad themes of Experimentations; Leadership; People Power and Informality suggests that two-way streets are much safer for pedestrian against crime instead of a one-way street. He argues that a two-way street may become busier in traffic volumes, but it helps to slow the traffic down, escalate people awareness, safer from crime and increase in property value. Riggs also mentioned that 'unwalkable' areas are crime-prone areas; therefore the environmental quality of the areas need to be improved to make it walkable and to solve crime issues (Karlenzig, 2008; Tiwari, 2015; Zuniga-Teran, Orr, Gimblett, Chalfoun, Guertin, et al., 2017).

Recurring Key Attributes: Safety Rules and Law, Pedestrian Safety Education, Street Crime, Security at Day and Security at Night.

iii. Convenience

The availability of pedestrian walkways as a mean of connectivity among communities in urban neighbourhoods (Ruiz-Padillo et al.,2018; Zuniga et al.,2017) is an essential element of walkability (Appleyard, 2016; Park, 2008). It must be kept clean and adequately maintained for the convenience and safety of users (Ruiz-Padillo et al.,2018; Zuniga et al.,2017; Eisenberg et al., 2017; Appleyard, 2016; Bahrainy, 2013; Leather et al., 2011; Krambeck & Shah, 2005); and portraying the positive image of the city with the quality of maintenance, path surface and materials used (Ruiz-Padillo et al.,2018; Zuniga et al.,2017; Leather et al., 2011; Torres-Montoya et al., 2010; European Commission, 2004).

Providing infrastructure for universal accessibility is imperative (Eisenberg et al., 2017; Leather et al., 2011; Torres-Montoya et al., 2010; Krambeck & Shah, 2006) in order to establish a disabled-friendly environment with elements such as low road kerbs, access ramps, seating at short intervals, wide pavements and tactile ground surface indicators (braille blocks). This will ensure the comfort and convenience for all users. The provision of continuous walking paths will also foster continuity of diverse activities and directness of route from the origin to destination (Zuniga-Teran et al., 2017; Eisenberg et al., 2017; Appleyard, 2016; Bahrainy, 2013; Torres-Montoya et al., 2010; Park, 2008).

Recurring Key Attributes: Availability, Condition & Maintenance of walkways, Universal accessibility & Disabled-friendly and Walkways directness, Continuity & Connectivity.

iv. Visual Interest and Attractiveness

Attractive and pleasant land use, i.e. active open space, busy shops, transparent building façade instead of a run-down and hard brick walls (Zuniga-Teran et al., 2017; Eisenberg et al., 2017; Riggs, 2017; Appleyard, 2016; Wang, Chau, Ng & Leung, 2016; Bahrainy, 2013) adjacent to pedestrian ways are more likely to attract walking and cycling activities. Nature and natural environment along walkways give unique character, and sense of place to the route and often attract walking activities (Dadpour et al., 2016; Hall & Ram, 2018b; Riggs, 2017; Wang et al., 2016; Wilker, 2012).

Overarching canopy formed by trees on both side of the road create outstanding visual frame, provide comforting shades and present sense of place (Jivén & Larkham, 2003; Koh & Wong, 2013; Mohamad & Ayob, 2013; Schlossberg et al., 2015; Wang et al., 2016; Wilker, 2012).

Tress and greeneries along pedestrian ways gives positive environmental effects (Park, 2008; Sarkar et al., 2015) to user; series of trees separating pedestrian ways acts as buffer that creates sense of security (Sarkar et al., 2015; Schlossberg, Johnson-Shelton, Evers, & Moreno, 2015; Wang et al., 2016), and at the same time provides comfort zone for pedestrians (Zuniga-Teran et al., 2017; Bahrainy, 2013; Leather et al., 2011; Torres-Montoya et al., 2010) interest more users to use that route. Benton-Short et al. (2017) in their research found that one of the benefits of landscape, greeneries and tree canopies is their ability to enhance city image, promote tourism and create a walkable environment (Ujang & Muslim, 2013).

Recurring Key Attributes: Visual quality, Interest & Sense of place and Landscapes & Street trees.

v. Comfort

The comfort and sensory pleasure offered by the surrounding environment make walking enjoyable (Mehta, 2008). The quality of comfort may be determined by a myriad of factors including weather, perceived safety levels, the familiarity of the place, setting and people, convenience, physical conditions of the area and so forth (Mehta, 2008; Southworth, 2005).

Environmental factors and qualities are often a focused in walkability research, especially thermal comfort, shades and shadows from trees and climatic condition (Bahrainy & Khosravi, 2013; Riggs, 2017; Wang et al., 2016; Zuniga-Teran, Orr, Gimblett, Chalfoun, Marsh, et al., 2017). The presence of shades along pathways provides thermal comfort (Hwang, Lin, & Matzarakis, 2011; Rosheidat, 2014) and encourages people to walk (Taleai & Taheri Amiri, 2017).

Recurring Key Attributes: Physical Comfort, Environment Effects, Coolness and Presence of shades.

vi. Uses and Activities

Mixed land use along pedestrian walkways is thought to provide more visual variety and interest for pedestrians (Forsyth et al., 2008; Frank et al., 2010; Koh & Wong, 2013), thus promote urban walkability. Variety of land uses also arouse the interests of their urban residents and visitors to walk more by providing variability of destinations, e.g. public spaces, parks, streets and public transport (Ferrer et al., 2015) and variety of recreational objective such as shopping malls and cinemas (Wang et al., 2016).

Many researches have proven that walkability increases in areas of mixed-land uses (Ferrer, Ruiz, & Mars, 2015; Ruiz-padillo et al., 2018; Eisenberg et al., 2017; Appleyard, 2016; Wang, Chau, Ng & Leung, 2016; Bahrainy, 2013; Torres-Montoya et al., 2010; Park, 2008;), and areas where good connectivity promotes high density of land use, population and activity (Hajrasouliha & Yin, 2015; Schlossberg et al., 2015). Diversity of land use also along the route at street level encourage walkability such as active shopfronts on both sides of the road, transparent building façades and the number of intersections (Zuniga-Teran et al., 2017; Eisenberg et al., 2017; Riggs, 2017; Wang et al., 2016).

Recurring Key Attributes: Mixed-Land use and Density & Diversity along walkways.

vii. Policy Support

Funding and resources for pedestrian planning were considered vital and to be included in planning policy in order to champion pedestrian mobility including the rights of people with disabilities (Eisenberg, Vanderbom, & Vasudevan, 2017). The lack of specific and relevant policies and political support that accommodate the needs of pedestrians is proven to be lacking (Leather et al., 2011). The issues of sheltering pedestrian safety and the deficiency of facilities were not covered effectively making pedestrians victimised by the existing policy and guidelines (Leather et al., 2011), especially in dense areas.

Wang et al. (2016) highlighted that critical built environmental attributes should be incorporated into design and planning guidelines for effective cost and design for pedestrians and neighbourhood planning. Hence, there is a need to overhaul existing

pedestrian policies and guidelines which are often ambiguous or inequitable and rarely enforced (Leather et al., 2011).

Recurring Key Attributes: Planning for Pedestrian and Relevant Design Guidelines

viii. Image, Heritage, History and Culture

One of the walkable town's trait is the ability of visitors to perceive the image portrayed by the built environment, the public realm and the way of life of its residents (City of Kansas City, 2003; Meetiyagoda, 2018; Sepe, 2009; Zubir & Sulaiman, 2004). Astoundingly, Image, Heritage, Sense of Place and Sense of Identity were NOT explicitly covered in all global indices examined.

The probability of not having this parameter in any of the examined global indices may be due to all the indices were carried out generally in modern areas of a city with either none or minimal values of cultural, image and sense of place. Riggs (2017) quoted the writing of Jacobs (1961) on her views concerning the importance of considering the Sense of Place in a city while Kramback (2006) mentioned the importance of culture in a city for the city to benefit in tourism industries. Additionally, the older small building gives aesthetic and charm to the city environment and contribute to walkability (Appleyard, 2016).

Recurring Key Attributes: City Image and Heritage and Culture

Further investigation on the established parameters from Western countries walkability indices stemmed 26 indicators for walkability measurement as exhibited in Table 5.14. These indicators were then compared with the Asian and Malaysian indicators for walkability.

Table 5.14 Western Countries Walkability Indices – Components of Parameter, Key Attributes and Measured Indicator.

Component		Key Attributes	Measured Indicator	Author
General Parameter	**Parameter**			
Safety and Security	Sense of Safety	• Traffic Speed and Pedestrian Crossing • Crossing Facilities • Facility for Paths	• Motorist Behaviour • Walking Path Modal Conflict • Pedestrian Crossing ○ Availability of Crossing, Distance from One Crossing to Another • Traffic Speed	Ruiz-Padillo et al. (2018) Zuniga-Teran et al. (2017) Eisenberg, Vanderbom, & Vasudevan (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016) Bahrainy (2013) Leather et al. (2011) Torres-Mont (2010) Park (2008) Krambeck & Shah (GWI) (2005)
	Sense of Security	• Safety Rules and Law • Pedestrian Safety Education • Street Crime • Security at Day • Security at Night	• Traffic Light Signal/Traffic Management at Crossings • Having Pedestrian Crossing Line / Crossing Safety • Crossing Exposure • Street and Path Lighting • Pedestrian Safety ○ Traffic Management at crossing, Design Treatment at Crossing • Security from Crime	
Convenience and Universal Design	Convenience	• Legibility & Functionality of Sidewalk with Diverse Activities	• Width of Sidewalk • Length of Sidewalk • Street Lighting • Sidewalk Lighting • Interference of Drivers Activities Along Sidewalk • Limited Access (Boulevard, Planting, Drainage)	Ruiz-Padillo et al. (2018) Zuniga-Teran et al. (2017) Eisenberg, Vanderbom, & Vasudevan (2017) Appleyard (2016) Bahrainy (2013) Leather et. al. (2011) Torres-Mont (2010) Park (2008) Krambeck & Shah (GWI) (2005)

		• Accessibility & Linkages	• Distance of Route
			• Walking Comfort (Pedestrian Congestion)
			• Pedestrian Amenities
			• Availability of Walking Path
			  ○ Availability, Maintenance (Breakage and Ruin), Cleanliness
			• Path/Walkway
			  ○ Area of Coverage, Width, Safe for use, Obstruction (Permanent/Temporary)
			• Disability Infrastructure Availability, Quality
				Ruiz-Padillo et al. (2018)
				Zuniga-Teran et al. (2017)
				Eisenberg, Vanderbom, & Vasudevan (2017)
				Riggs (2017)
				Appleyard (2016)
				Wang, Chau, Ng & Leung (2016)
				Bahrainy (2013)
				Leather et al. (2011)
				Torres-Mont (2010)
				Park (2008)
				Krambeck & Shah (GWI) (2005)

Environmental Effects	Visual Interest, Attractiveness & Sense of Place	• Street Scale and Enclosure • Variety • Landscape and Street trees	• Streetscape • Pedestrian facilities • Walking Path ○ Quality of Design, Quality of Material • Tress and Vegetation • Diverse of Activities Along the Path	Ruiz-Padillo et al. (2018) Zuniga-Teran et al. (2017) Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016) Bahrainy (2013) Leather et al. (2011) Torres-Mont (2010) Park (2008) Krambeck & Shah (GWI) (2005)

	Comfort	• Physical Comfort • Environment Effects, Coolness and Presence of shades	• Street Lighting • Resting Amenities • Smell, Air Quality and Cleanliness of surrounding • Shelter • Shadow ○ Trees, Buildings / Other structures	Ruiz-Padillo et al. (2018) Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016) Bahrainy (2013) Torres-Mont (2010) Park (2008) Krambeck & Shah (GWI) (2005)
		• Public Space and Greenery	• Public Space and Recreation/ Parks and Greenery • Urban Open Space / Plaza	Zuniga-Teran et al. (2017) Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016) Bahrainy (2013) Leather et al. (2011) Torres-Mont (2010)
Uses & Activities	Uses & Activities	• Shared Street • Urban Compactness	• Active Traditional Shop Houses • Active Commercial Modern Buildings • Active Commercial Street • Mix of Residential and Commercial Street • Slopes and Topographic Factors	Ruiz-Padillo et al. (2018) Zuniga-Teran et al. (2017) Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Wang, Chau, Ng & Leung (2016) Park (2008) Krambeck & Shah (GWI) (2005)
		• Multi-disciplinary of land use and activities	• Mixed-Land Use • Land Use Density	Ruiz-Padillo et al. (2018) Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016) Bahrainy (2013) Torres-Mont (2010) Park (2008)
		• Sociability	• Society and Community	Zuniga-Teran et al. (2017) Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016)
		• Multi-modal Performance	• Availability of Mix Public Transport • Accessibility to Public Transport	Eisenberg, Vanderbom, & Vasudevan (2017) Riggs (2017) Appleyard (2016) Wang, Chau, Ng & Leung (2016) Leather et al. (2011)
Policy Support	Pedestrian Planning, Design and Guidelines	• Planning for Pedestrian • Relevant Design Guidelines	• Government support for pedestrian related infrastructure • Budget allocation for pedestrian planning and master plan • Relevant guidelines and law on pedestrian safety	Eisenberg, Vanderbom, & Vasudevan (2017) Appleyard (2016) Leather et al. (2011 Krambeck & Shah (GWI) (2005)
Image, Heritage & Culture	Image, History and Culture were not pronounced in all indices			
	Image, Heritage & Culture	• Local Heritage • Ethnography • Local Culture	• Active Heritage and Historic Area • Cultural Street & Buildings	Riggs (2017) Appleyard (2016) Krambeck & Shah (GWI) (2005)

Source: 1. Zuniga-Teran et al. (2017); 2. Eisenberg, Vanderbom, & Vasudevan (2017); 3. Riggs (2017); 4. Appleyard (2016); 5. Wang, Chau, Ng, & Leung (2016); 6. Bahrainy & Khosravi (2013); 7. Leather et al. (2011); 8. Torres-Montoya et al. (2010); 9. Park (2008); 10. Krambeck & Shah (2006)

5.9.2 Asian Countries and Malaysian Walkability Indices

A thorough investigation of and comparison between the South East Asian and Western countries walkability indices displayed significant similarities of the prevalent indicators used for walkability measurement. This was due to three factors;

- the source of most indices can be traced back to Krambeck and Shah 2006
- the indices orbited around the environmental quality as stimuli for walkability
- the indices focus on the provision of pedestrian infrastructure in the homogenous global city with no or little emphasis on image, heritage and character.

Generally, the most prevalent emerging parameters from all seven indices and walkability guidelines investigated can be systematically categorised in eight parameters according to their measuring factors as follows;

i. Sense of Safety

The motorist's behaviour and respect towards pedestrians were being inflicted significantly concerned in Asian walkability indices as in the findings of Wibowo et al. (2015); Winayanti et al. (2015); Darmoyono & Tanan (2015); Luadsakul (2013) and Koh & Wong (2013). This concerned is incongruent with a report entitled '*Road Safety in Asia and the Pacific and The Updated Regional Road Safety Goals and Targets for Asia and the Pacific 2017-2020'* by UNESCAP Transport Division (2017) highlighted the gruesome fact that 'one person is being killed on the road in every 40 seconds, more than 2000 lives a day and more than 15,000 lives a week'. This figure is on the rise attributable to some common characteristics of urban areas in South East Asian countries such as; i) Rapid increase in population and motorization, ii) Densely populated, iii) Road users compete for limited space and iv) Traffic mix, and often causing frequent and close interaction between the vulnerable pedestrians and motorised road users as displayed in Figure 5.5 below (UNESCAP Transport Division, 2017).

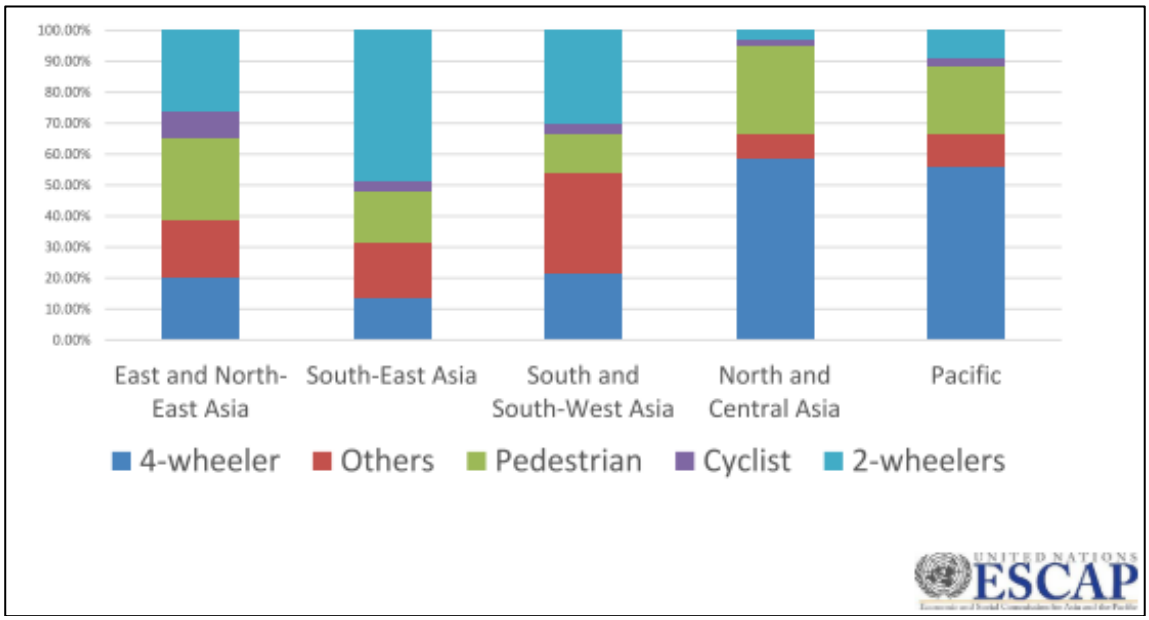

Figure 5.5 Road Safety Situation in the Asia Pacific: Distribution of road traffic death by type of road users ESCAP sub-regions 2013
Source: UNESCAP Transport Division (2017, pg. 16); King (2016)

The findings from Asian walkability indices explicitly showcased that the issues of excessive traffic speed in Asian cities were of major concern (Sholihah, 2016; Wibowo et al., 2015; Winayanti et al., 2015; Koh & Wong, 2013). King (2016) stated that the Asia Pacific region contributed almost 64% of the world's road fatalities and in South East Asia alone, almost 20,000 pedestrians were killed in traffic accidents. In addition, conflicts ensued at pedestrian crossings and along/on pathways (Sholihah, 2016; Wibowo et al., 2015; Winayanti et al., 2015; Darmoyono & Tanan, 2015; Luadsakul, 2013).

Unlike the Western countries, another major concerned as highlighted in most Asian walkability indices findings were inadequate marked and signalised pedestrian crossings and long distances between crossings (Leather et al., 2011; Lo, 2011; UNESCAP Transport Division, 2017; Winayanti et al., 2015), on-street parking and parking on sidewalks that caused complications for pedestrians (Gota et al., 2010; Lo, 2011; Winayanti et al., 2015). The presence of bollards, railings, path and street lightings and street trees were amongst features perceived as able to create buffered walking space and instil the sense of safety (Lo, 2011).

Recurring Key Attributes: Traffic Speed and Pedestrian Crossing, Crossing Facilities and Facility for Paths.

ii. Sense of Security

One of the primary emphasis on Asian Walkability indices was the feeling of security while walking or using walking spaces. Perception of security from crime top the inventory, indicating the need of facilities and features that able to promote that presentiment of being in a safe place (Sholihah, 2016; Wibowo et al., 2015; Winayanti et al., 2015; Darmoyono & Tanan, 2015; Luadsakul, 2013; Koh & Wong, 2013; Lo, 2011). The provision of road signs and notices, low shrubberies and sidewalk lighting made pedestrians aware of their surroundings and the presence street lighting able to increase the visibility of drivers of pedestrians (Sholihah, 2016; Wibowo et al., 2015; Winayanti et al., 2015; Darmoyono & Tanan, 2015).

Wide sidewalk permits various street activities along walking paths and the same time increase the degree sidewalk occupancies, which in turn increase the sense of security (Sholihah, 2016; Wibowo et al., 2015; Winayanti et al., 2015; Darmoyono & Tanan, 2015). Double or active building frontage (Adkins et al., 2012; Tiwari, 2015) and transparent building facades permit pedestrians to seek assistance in case of urgent situation, thus, giving the impression of security (Lamit et al., 2013; Leather et al., 2011; Llewelyn Davies Yeang, 2000; Park, 2008).

Recurring Key Attributes: Safety Rules and Law, Pedestrian Safety Education, Street Crime, Security at Day and Security at Night.

iii. Convenience

The legibility and functionality of walkways play important roles in urban walkability as it implicates the spatial construct of a city (Ewing et al., 2006; Koohsari et al., 2014). The provision of walkways (Centre for Liveable Cities Singapore & The Seoul Institute, 2016), its condition and maintenance, and the availability of pedestrian crossing along major roads is one of the key factors in urban walkability. Asian perception on convenience often associated in relevance with the distance of walkable amenities, predominantly walkable retail facilities; also directness, continuity and connectivity of pedestrian walkways in the urban areas (Leather et al., 2011).

In addition, the availability of pedestrian amenities as such as street lightings, shelters, benches, public toilets, among others was being indicated by all Asian countries indices as significant for pedestrian convenience. Thus, implies that Convenience is one of the main parameters for walkability measure in Asia (Sholihah, 2016; Wibowo et al., 2015; Winayanti et al., 2015; Darmoyono & Tanan, 2015; Luadsakul, 2013; Koh & Wong, 2013; Lo, 2011). Differ to the developed countries walkable indices, the attention to universal accessibility as highlighted by Gota et al. (2010) remains lacking. This has resulted in high recurrence of this attribute in Asian indices.

Recurring Key Attributes: Availability, Condition & Maintenance of walkways, Universal accessibility & Disabled-friendly and Walkways directness, Continuity & Connectivity.

iv. Visual Interest and Attractiveness

One of the motivations for pedestrians to walk from an origin to destination/s often associated with the appealing quality of the environment in pedestrian's visual frame (Fitzsimons, Nelson, Leyden, Wickham, & Woods, 2010; Forsyth, 2015; Mohareb, Derrible, & Peiravian, 2014; Rafiemanzelat et al., 2017). For that reason, visual interest/quality (Koh & Wong, 2013; Lo, 2011; Moayedi et al., 2013; Sholihah, 2016) and attractiveness of surrounding environment (Centre for Liveable Cities Singapore & The Seoul Institute, 2016) akin to landscape and street trees (Darmoyono & Tanan, 2015; Koh & Wong, 2013; Luadsakul & Ratanvaraha, 2013) appeared in all Asian indices.

The unique qualities of the surrounding environment typically become memorable and were seen as able to unveil the Sense of Place (Lo, 2011; Sholihah, 2016). The emotional attachment people have with their environment or within a place can project to familiarity with the environment as community places or neighbourhood landmarks (Mehta, 2008). This leads to a positive response and attachment (Brown & Raymond, 2007), thus helps encouraging neighbourhood walkability (Mehta, 2008).

The pleasure of walking is derived through the sensory experience presented via various stimuli perceived from the environment that include natural elements, landscape features and trees (Mehta, 2008). Landscape and street trees often seen as important attribute and mediator in creating public spaces for more significant interaction between people and the environment, where people are willing to opt for walking instead of a car (City and County of San Francisco, 2015a; Sanyal, 2013).

Recurring Key Attributes: Visual quality, Interest & Sense of place and Landscapes & Street trees.

v. Comfort

The weather condition in Asian countries only suitable for short-distance of walking trips (Koh & Wong, 2013). There are many barriers to walkability in Asian cities, as highlighted in literature and comfort is one of the most mentioned. Generally, there are two types of factors associating the comfort level of the pedestrian in Asian cities, the physical (Zhao, 2011) and the environmental effects (Wang et al., 2016). The physical comfort is dealing with the provision of infrastructure and amenities supporting walking, e.g. walking surface and linkages, pedestrian crossing, street lighting, seating and shelters; and public toilet (Kang, 2015; Moayedi et al., 2013; Shamsuddin et al., 2018).

The environmental conditions that persuade walking are, e.g. cool atmosphere with shade trees, shadow corridors, appealing surrounding environment; and general cleanliness, good air quality and smell (Keat et al., 2016; Koh & Wong, 2013; Lin & Chang, 2010; Litman, 2011; Ng et al., 2016). One of the most published issues is the tropical weather which is hot with high humidity and high rainfall. These conditions are significantly affecting the comfort level among pedestrian while walking along the urban street (Centre for Liveable Cities Singapore & The Seoul Institute, 2016; Leather et al., 2011; Lo, 2011).

Recurring Key Attributes: Physical Comfort and Environment Effects, Coolness and Presence of shades.

vi. Uses and Activities

Mixed land uses and activities along the walking routes play a significant role (Mushonga et al., 2018) in making walking appealing (Koh & Wong, 2013). Single land use of offices and corporate complexes are less walkable as it developed a homogeneity of activity from a generally typical user. As compared to a street that has multi-land uses like commercial streets, downtown street (USA) or retails streets which offers a heterogeneity of activities due to the atypical and diversifies users (to cite).

Researches in Asian cities have shown a strong relationship between mixed uses development and density (Salleh et al., 2014). In addition, vertical mixed land uses where the ground floor is retail, second floor for office space and the third is as residential will help increase density and diversity (Arshad, 2012). Vertical mixed development is seen as able to increase diversity in both physical land uses and at the same time the inclusion of human diversity (by having residential) in urban centres (Stafford & Baldwin, 2018). Diversity and density of activities along pedestrian walkways often regard as compelling attributes and ability to attract users (Sholihah, 2016).

Recurring Key Attributes: Mixed-Land use and Density & Diversity along walkways.

vii. Policy Support

It is imperative to have enough funding to support walkability and pedestrian planning; however, Asian countries may not have as much attention and funding as their Western counterparts (Centre for Liveable Cities Singapore & The Seoul Institute, 2016; Lo, 2010). Except for Singapore and Japan, although there is the awareness of sustainability, Asian countries are still behind in term of pedestrian planning, pedestrian facilities and the application of universal design (Lo, 2011). There are numerous policies and guidelines concerning sustainable development and environmental protection. However, there is a great deficiency on the part of implementations and enforcement (Darmoyono & Tanan, 2015).

Recurring Key Attributes: Planning for Pedestrian and Relevant Design Guidelines.

viii. Image, Heritage and Culture

Asian indices include Image (Heritage & Culture) as an important parameter and attribute for walkability. Cities or towns with the distinctive and unique image often increase the imageability and possess a 'pulling effect' to pedestrians (Ujang & Muslim, 2013) to partake in recreational walking (Centre for Liveable Cities Singapore & The Seoul Institute, 2016; Ewing & Handy, 2009; Lindfield & Steinberg, 2012). This is due to a distinct environment it created that compelled visitors to be in close range and walking at a slower pace (recreational walking) (Stewart et al., 2016; Sugiyama et al., 2014) in order to intimately experience the special milieu that these towns offer (Centre for Liveable Cities Singapore & The Seoul Institute, 2016).

Besides, historic sites and heritage areas incite local and foreign visitors to patronise the area for attentive walking with the appealing value it represents, and the layers of archaic stories it unfolds (Gorrini & Bertini, 2018; Jacks, 2004; Overall, 2017). Time and again, the unique and memorable image of a city or a town are depicted via history, heritage and culture in both tangible and intangible assets (Jacobs, 1961; Rasoolimanesh, Jaafar, Ahmad, & Barghi, 2017; Sasaki, 2010).

Tangibly, the local culture of a place in the form of the built environment such as heritage buildings, religious buildings, structures, ethnic quarters and areas habitually excite tourists to explore (Sepe, 2009; Shamsuddin, Sulaiman, & Amat, 2012; Ujang & Muslim, 2013). Contrariwise, the practising culture of the people as displayed in the languages, costumes, rituals and religious festivals, arts and crafts, cuisines, music and the daily lives; and the indiscernibly local folklores, spirit of the place or genius loci often intrigue outsiders to observe and sometimes participate for personal experiences (Anderson, 2009; Sepe, 2009; Shamsuddin, Sulaiman, et al., 2012; Ujang & Muslim, 2013); hence increases walkability of the place by attracting visitors to walk the street to observe, to experience and to feel (Gorrini & Bertini, 2018; Jacks, 2004; Meetiyagoda, 2018; Ujang & Muslim, 2013).

Recurring Key Attributes: City Image and Heritage and Culture.

Table 5.15 below summarises the recurrence attributes from both Asian countries and Malaysian indices.

Table 5.15 Asian and Malaysian Walkability Indices – Components of Parameter, Key Attributes and Measured Indicator.

Component		Key Attributes	Measured Indicator	Author (Asian Countries)	Author (Malaysian)
General Parameter	Parameter				
Safety and Security	Sense of Safety	• Traffic Speed and Pedestrian Crossing • Crossing Facilities • Facility for Paths	• Motorist Behaviour • Walking Path Modal Conflict • Pedestrian Crossing ○ Availability of Crossing, Distance from One Crossing to Another • Traffic Speed	Sholihah, 2016 Wibowo et al., 2015 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Luadsakul, 2013 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013 Shamsuddin et. al., 2012
	Sense of Security	• Safety Rules and Law • Pedestrian Safety Education • Street Crime • Security at Day • Security at Night	• Traffic Light Signal/Traffic Management at Crossings • Having Pedestrian Crossing Line / Crossing Safety • Crossing Exposure • Street and Path Lighting • Pedestrian Safety ○ Traffic Management at crossing, Design Treatment at Crossing • Security from Crime	Sholihah, 2016 Wibowo et al., 2015 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Luadsakul, 2013 Koh & Wong, 2013	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013 Shamsuddin et. al., 2012
Convenience and Universal Design	Convenience	• Legibility & Functionality of Sidewalk with Diverse Activities	• Width of Sidewalk • Length of Sidewalk • Street Lighting • Sidewalk Lighting • Interference of Drivers Activities Along Sidewalk • Limited Access (Boulevard, Planting, Drainage)	Sholihah, 2016 Wibowo et al., 2015 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Luadsakul, 2013 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013 Shamsuddin et. al., 2012

		• Accessibility & Linkages	• Distance of Route
			• Walking Comfort (Pedestrian Congestion)
			• Pedestrian Amenities
			• Availability of Walking Path
			  ○ Availability, Maintenance (Breakage and Ruin), Cleanliness
			• Path/Walkway
			  ○ Area of Coverage, Width, Safe for use, Obstruction (Permanent/Temporary)
			• Disability Infrastructure Availability, Quality
				Sholihah, 2016
				Wibowo et al., 2015
				Winayanti et. al., 2015
				Darmoyono & Tanan, 2015
				Luadsakul, 2013
				Koh & Wong, 2013
				Lo, 2011
					Zakaria & Ujang, 2015
					Azmi & Ahmad, 2015
					Salleh et. al., 2014
					Lamit, 2013
					Shamsuddin et. al., 2012

Environmental Effects	Visual Interest, Attractiveness & Sense of Place	• Street Scale and Enclosure • Variety	• Streetscape • Pedestrian facilities • Walking Path ○ Quality of Design, Quality of Material • Tress and Vegetation	Sholihah, 2016 Darmoyono & Tanan, 2015 Luadsakul, 2013	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014

		• Landscape and Street trees	• Diverse of Activities Along the Path	Koh & Wong, 2013	Lamit, 2013 Shamsuddin et. al., 2012
	Comfort	• Physical Comfort • Environment Effects, Coolness and Presence of shades	• Street Lighting • Resting Amenities • Smell, Air Quality and Cleanliness of surrounding • Shelter • Shadow ○ Trees, Buildings / Other structures	Sholihah, 2016 Wibowo et al., 2015 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Luadsakul, 2013 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013 Shamsuddin et. al., 2012
		• Public Space and Greenery	• Public Space and Recreation/ Parks and Greenery • Urban Open Space / Plaza	Sholihah, 2016 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013
Uses & Activities	Uses & Activities	• Shared Street	• Active Traditional Shop Houses • Active Commercial Modern Buildings • Active Commercial Street • Mix of Residential and Commercial Street	Sholihah, 2016 Darmoyono & Tanan, 2015 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013 Shamsuddin et. al., 2012
		• Multi-disciplinary of land use and activities	• Mixed-Land Use • Land Use Density	Sholihah, 2016 Wibowo et al., 2015 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Lamit, 2013 Shamsuddin et. al., 2012
		• Sociability	• Society and Community	Sholihah, 2016 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Luadsakul, 2013 Koh & Wong, 2013 Lo, 2011	Azmi & Ahmad, 2015
		• Multi-modal Performance	• Availability of Mix Public Transport • Accessibility to Public Transport	Sholihah, 2016 Wibowo et al., 2015 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Azmi & Ahmad, 2015 Salleh et. al., 2014 Shamsuddin et. al., 2012

		• Urban Compactness	• Urban skyline, buildings' height and proximity • Road Network Design	Sholihah, 2016 Koh & Wong, 2013 Lo, 2011	Azmi & Ahmad, 2015 Lamit, 2013 Shamsuddin et. al., 2012
	Image. Heritage & Culture	• Local Heritage • Ethnography • Local Culture	• Active Heritage and Historic Area • Cultural Street & Buildings	Sholihah, 2016 Winayanti et. al., 2015 Koh & Wong, 2013 Lo, 2011	Zakaria & Ujang, 2015 Salleh et. al., 2014 Shamsuddin et. al., 2012
Policy Support	Pedestrian Planning, Design and Guidelines	• Planning for Pedestrian • Relevant Design Guidelines	• Government support for pedestrian related infrastructure • Budget allocation for pedestrian planning and master plan • Relevant guidelines and law on pedestrian safety	Sholihah, 2016 Wibowo et al., 2015 Winayanti et. al., 2015 Darmoyono & Tanan, 2015 Lo, 2011	

Source A: 1. Sholihah, 2016; 2. Wibowo et al., 2015; 3. Winayanti et al., 2015; 4. Darmoyono & Tanan, 2015, 5. Luadsakul, 2013; 6. Koh & Wong, 2013; 7. Lo, 2011

Source B: 1. Zakaria & Ujang, 2015; 2.Azmi & Ahmad, 2015; 3. Salleh et. al., 2014; 4. Lamit, 2013; 5. Shamsuddin et. al., 2012

Note

1- Winayanti (2015) - Stressed that the local Government must consider the social and cultural conditions in the National Guidelines for the Planning, Delivery and Utilization of Pedestrian Infrastructure.
2- Sholihah (2016) - Highlighted the local Culture, Heritage Values, the Historic Image and Sense of Place as important of elements to promote urban walkability
3- Lo (2011) - Discussed on the benefit of the Local Image, Cultural Values, Heritage of the locals and Sense of Place as Key Attributes in Walkability

----- PART THREE -----

5.10 Alor Setar Walkability Index (ASWI)

Based from the extensive investigation of literature from different fields that dealt with pedestrian performance and preferences, there appears to be some convergence of opinion and research on land use and streetscape factors that influence the quality of the pedestrian environment and the number of pedestrians using the space. Thorough investigations of components, indices and walkability measured themes from Krambeck & Shah (2006), and all the international urban planning agencies & reputable private organisations established General Parameters used for walkability measures (refer Table 5.10 and Table 5.12). Subsequently, through the assessments of the walkability indices of 10 Western countries, have established the recurrence parameters to facilitate the construct of Specific Parameters for ASWI (refer Table 5.13). The parameters are a) Safety and Security, b) Convenience and Universal Design, c) Environmental Effects; and d) Uses and Activities.

The established Parameters were then investigated further to identify relevant Key Attributes and Indicator for walkability measures. In doing so, the researcher analysed and compared walkability indices from Western countries (ten indices), Asian countries (seven indices) and Malaysian (five indices). Factors that often appear in many different walkability measures or metrics include the following:

i. Presence of continuous and well-maintained sidewalks.
ii. Universal access characteristics.
iii. Path directness and street network connectivity.
iv. Safety of at-grade crossing treatments.
v. Absence of heavy and high-speed traffic.
vi. Pedestrian separation or buffering from traffic.
vii. Land-use density.
viii. Building and land-use diversity or mix.
ix. Street trees and landscaping.
x. Visual interest and a sense of place as defined under local conditions.
xi. Perceived or actual security.

5.10.1 Parameters for Alor Setar Walkability Index (ASWI)

In order to apply the parameter and walkability measures indicator at a specific site as in Alor Setar, some modifications were necessary as to ensure its applicability and practicality based on location and context (Corazza et al., 2016), culture and specific values (Dridi, 2015), availability of data (Chow et al., 2014; Giles-Corti et al., 2014), and purpose (Leslie et al., 2005; Shishebori, Jabalameli, & Jabbarzadeh, 2014) of conducting research (Hajna, Dasgupta, Halparin, & Ross, 2013; Lee & Talen, 2014; Sepe, 2009; Terzano & Gross, 2016). Literature investigations also denoting 'Image, Heritage and Culture' were insignificant in all indices examined. Although it emerges in seven indices (four Asian and three Malaysian), it is not substantial enough as a Parameter but only captured under Uses and Activities. Description of parameters was made specific to ensure categorisation of indicators were accurate as displayed in Table 5.16 below.

Table 5.16 Description of Selected Parameters for ASWI

Recurring Parameter (from all indices)	Site Specific Parameter	Description
Safety and Security	Safety and Security	The general feeling of safe and secure in the environment. Sense of safety from accidents, using facilities and from crime. Sense of security
Convenience and Universal Design	Convenience	Universal design and facilities that provide ease and comfort for physically challenge users (low kerbs, ramp, tactile pavers, hand railing, seating, uniform and smooth surfaces etc.)
Environmental Effects	Visual Interest and Attractiveness	The aesthetic value surrounding environment along pathways and attractiveness of pedestrian facilities (street furniture, lighting, pathway material, greeneries etc.) that provide or improve the quality of surrounding.
Environmental Effects	Comfort	Condition of pedestrian facilities that raise sense of comfo convenience or pleasure as well as promoting sense of impartiali among users.
Uses and Activities	Uses and Activities	Spaces along the pathways that promote activities and inviting users to participate in activities both singles of groups (street art, street vendors, seating, observing, passive or active activities). The display and presence of place or cultural image, history and heritage of the place in both tangible and intangible form.
Uses and Activities	Image, Heritage and Culture	Insignificant as main Parameters but integrated under Uses and Activities considering site specific special characters.

5.10.2 Indicator for Alor Setar Walkability Index (ASWI)

This has resulted in the formation of a complete set of ASWI. Table 5.17 displays the final indicators based on a combination of all researchers, modified indicators, combined indicators and improved or extended descriptions from the originals.

Table 5.17 The Site-Specific Parameter and Measured Indicators for ASWI

No	Site Specific Parameter	Measured Indicator
A	SENSE OF SAFETY AND SECURITY	1. Motorist Behaviour and Respect to Pedestrian
		2. Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)
		3. Availability of Crossings
		4. Crossing Safety (Traffic Light / Traffic Management at Crossing)
		5. Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing
		6. Perception of Security from Crime
B	CONVENIENCE	7. Distance of The Route to Where They Were Going
		8. Walking Comfort Due to Pedestrian Congestion
		9. Pedestrian Amenities (Cover, Public Toilets, Street Lights)
		10. Maintenance and Cleanliness of Walking Path
		11. Availability of Walking Paths
		12. Distance from One Pedestrian Crossing Point to Another
		13. Path Coverage (Area of Coverage)
		14. Shared Street Network and Connectivity/Alternative Routes
		15. Obstructions Free Walking Path (Permanent/Temporary–to Note)
		16. Existence and Quality of Facilities for Blind and Disabled Persons/Disability Infrastructure
		17. Walking Path (Width and Safety)
C	VISUAL INTEREST & ATTRACTIVENESS	18. Streetscape and Pedestrian Facilities
		19. Walking Path (Quality of Design and Materials)
		20. Trees and Vegetation
		21. Diverse of Activities Along Path
D	COMFORT	22. Street Lighting
		23. Resting Amenities
		24. Smell, Air Quality & Cleanliness
		25. Shelter
		26. Shadow of Trees/Buildings/Elements
E	USES AND ACTIVITIES	27. Land Use Mix
		28. Active Traditional Shop Houses
		29. Active Commercial Modern Building
		30. Active Heritage and Cultural Street
		31. Active Commercial Street
		32. Mix of Residential and Commercial Street
		33. Availability of Mix Public Transport
		34. Public Space and Recreation/ Parks and Greenery
		35. Urban Open Space/Plaza

5.10.3 Measured Scale for Indicator

This research adopted the 5-point Likert scale method for its indicator to measure urban walkability in Alor Setar. Although some researchers (Covin & Slevin, 1989; Wittink & Bayer, 1994; Churchill & Peter, 1984; Coelho & Esteves, 2007; Ribe et al., 2018) accentuated that the response would be more accurate when using the larger scale. The 5-point Likert scale was seen as effective as it helped increased response quality and reducing respondent frustration level (Babakus & Mangold, 1992; Wittink & Bayer, 1994). The 5-point scale offers simpler variance than a smaller Likert scale, e.g. 10-point

or 7-point Likert scales with fewer complications and easy response during fieldworks; and provide better opportunity to detect changes and more power to explain a point of view (Krosnick & Presser, 2010).

In the case of this research, there are three specific reasons for opting a 5-point Likert scale:

i. it involved Focus Group who are well aware of the scope of works and the amount of data needed to complete the survey
ii. all participants were being informed and trained during a workshop before the start of the survey.
iii. The works were being carried out as a group, thus minimising the discussion time on deciding the score using a smaller Likert scale.

5.10.4 Data Collection Form and Calculations

Data collection form should be filled in with measurement of indicator (Likert scale of 1 to 5, according to the principles, qualities and categories as explained and demonstrated during the 4 hours of workshop and survey exercise. The measured Likert scale rankings were filled in boxes provided for each indicator. The surveyed road of up to 10 stretches was surveyed (this number was derived based on the length of the roads surveyed). Each group recorded ranking/measurement into each square. To normalise the data input, each input rank was multiplied by the length of the surveyed road and the pedestrian count (x10) (Krambeck & Shah, 2006). The results are then summed up across rows 1-35 and averaged by the number of stretches surveyed. The resulting number is divided by 10 for simplicity. A final average is then calculated and used in the derivation of the index. This calculation was done using the formula;

$$\boldsymbol{\left(\Sigma(x * length * 10 * count)/\#/10\right)}$$

(Note: $\boldsymbol{x}$ = the measured indicator, ***length*** = each surveyed stretch length, ***count*** = pedestrian count for each stretch, **#** = total number of stretches in a surveyed route)

This index is a stand-alone mean of calculation based from Focus groups survey, without any additional data as in Krambeck's (data from public agency survey and cross-country survey. Thus, the calculated average was a direct representation value of walkability measured on-site (Luadsakul & Ratanvaraha, 2013; Minhas & Poddar, 2017). The

calculated averages were translated into a rating system from 0 (lowest score) to 100 (highest score) known as adjusted value and therefore can be directly ranked with the standard range of walkability measure (Winayanti et al., 2015) as Table 5.18 below to :

Table 5.18 Adjusted Value for Standard Range of Walkability and Green Urbanism Measure

Range	Walkability Status
0 - 20	Very Poor Condition and Walkability
21 – 40	Poor Condition and Walkability
41 – 60	Moderate Condition and Walkability
61 – 80	Good Condition and Walkability
81 – 100	Very Good Condition and Walkability

5.11 Summary of the Chapter

The chapter is divided into three parts, and the first part presents the literature study on the concept of walkability. From the history, the study understands that the term walkability carries varied meaning if it involves the creation of walkable places in practice, measure environmental walkability, and assess the costs and benefits of creating walkable environments. Therefore, the research construed a working definition best represent the research aim as walkability is the condition of which facilitate the construct of multidimensional ideal environment of universal quality for a holistic solution of urban issues;

- The condition is referred to the principles of Green Urbanism associated with urban walkability.
- Multidimensional is the ability of it to be measured by a set of developed indicators.

The second part of the chapter deals with the development of Alor Setar Walkability Index (ASWI), the identification of indicator and the assessment process. The third part of the chapter presents the deductive analysis performed and has revealed a total of five Parameters and 35 Indicators. The collected data and detail analysis for ASWI were presented in Chapter 7. The following chapter discusses literature investigation, the formulation and development of Green Urbanism Quality index, and method of calculation and analysis of the concept.

Chapter 6

GREEN URBANISM AND THE DEVELOPMENT ALOR SETAR GREEN URBANISM INDEX (ASGUI)

6.0 Introduction

This chapter discusses the overall concept of Green Urbanism, beginning with the history of Green Urbanism. The earlier part of the chapter also reviews theories concerning the concept of Green Urbanism and its applications globally. The literature investigation of the topic pilot the direction of the research towards the understanding of history, definitions, principles and approaches in Green Urbanism as part of approaches in Sustainable Urban Development (SUD). Subsequently, the site-specific Green Urbanism Quality measure known as Alor Setar Green Urbanism Index (ASGUI) was developed for the use of on-site survey and observation by a selected focus group in Alor Setar, Kedah, Malaysia.

Chapter 6 is divided into three parts of discussions with 12 sections as follows; **Part On**e is covering the Literature Review on the concept of Green Urbanism: starting with the first section as the Introduction of this chapter. The second section discusses the Concept of Green Urbanism and the third section covering the History of Green Urbanism. The fourth is the Plethora Definition of Green Urbanism, followed by the fifth, the Green urbanism: Urban Design Qualities and Characters.

Part Two covers the investigation and the process of developing Green Urbanism index starting in section sixth, the Development of the Principles; seventh, the Application Green Urbanism in the global context; eighth is covering the Green City Index, and section ninth is the discussion of the Green Infrastructure, Liveability and walkability. **Part Three** covers the development of Green Urbanism Index in the tenth section that is ASGUI – the Development of Indicators. Section eleventh highlights the process of Semi-structured Interviews in finding the Association of Green Urbanism and Walkability, and the final section concludes with the summary of Chapter 6.

----- PART ONE -----

6.1 The Concept of Green Urbanism

Over the years, sustainable urban development initiates theories and concepts in urban development initiatives for the betterment of urban townships, urban neighbourhoods and urban communities, among others. There are numerous labelling of these sustainable urban development concepts either genuine, or the eco-labels are just simply marketing gimmicks (Hamid & Isa, 2018; Martínez García de Leaniz, Herrero Crespo, & Gómez López, 2018; Nas, 2018; Pow & Neo, 2015) to lure the general public. Among the popular concepts are 'Sustainable Cities', 'Liveable Cities', 'Smart Cities', 'Green Cities', 'Compact Cities', 'Transit-Oriented Cities', 'Healthy Cities', 'Low-Carbon Cities', 'Safe Cities', Eco-cities', 'Urban Ecology', 'Resilient Cities', 'Green Urbanism' and many others (Tang & Lee, 2016). All of these sustainable concepts maybe with different taglines, but the central purpose and goal are to minimise environmental impact in development for the betterment of human-kind while protecting the wellbeing of the environment (Ram, 2009; Tang & Lee, 2016).

Green Urbanism, in general, is the practice of establishing communities that are equally advantageous to people and their environment (Beatley & Newman, 2009b; Wells, 2010b). The fight to champion the plight of people's needs and desires in the built environment, the plight to remedy problems people create within the environment and the quandary to balance the dominion of people and their environment continues by the formulation of various theories and concepts. The evolution of theories and the chronology of events about the establishment of the concept of Green Urbanism dates back as early as 1898 with the book by Ebenezer Howard, To-morrow: A Peaceful Path to Real Reform. Later in 1902, the book was reissued as the Garden Cities of Tomorrow (Lehmann, 2010a). However, some argue that the idea of the concept originated earlier since Howard's works were instigated by Edward Bellamy's 1887 utopian science fiction novel Looking Backward and Henry George's Progress and Poverty in 1879 (Almandoz, 2004; Darley, 2007; Fishman, 2002; Parham, 2013; Rosenau, 2007; Schuyler, 2002). Saitta (2016) for instance, in the opinion that Green Urbanism concept evolved far back during Mohenjo-Daro civilisation in 2300 BC. The ancient city was known as the first systematically planned urbanism integrating greeneries (in the form of agricultural land)

with the rest of the city structure, also the first to develop sophisticated infrastructural innovations in water management that serves sanitation and human health for city dwellers (Davis, 1955; France, 2008; Nichols, Covey, & Abdi, 2008; Saitta, 2016).

6.2 The History of Green Urbanism

The term Green Urbanism has been recognised by several authors including, Timothy Beatley (2000), Stephen Lehmann (2010b) and Peter Newman (2010); and since then became accustomed in the world of built environment (Dempsey et al., 2011; DuPuis & Ball, 2013; Giddings et al., 2002; Jacques, 2014; Jenks & Dempsey, 2005; Lehmann, 2010b, 2010a, 2013, 2015a; Manley & Rose, 2014; Pinnegar et al., 2008; Taylor Buck & Taylor, 2014; Wells, 2010b; Zavrl & Zeren, 2010). Historically, the long-established idea and concept of Green Urbanism were not termed as it is popularly known now. Various names appellations and labels used to identify it, but the idea and concept (Table 6.1) in general, remained consistent (Lehmann, 2010a, 2010b; Taylor Buck & Taylor, 2014).

Chronologically, the literature can be classified into three stages, namely; the early writings of the idea interpretations were predominantly related to people-nature conflict and the grandiose solution for a utopian ecosphere (Beatley, 2003). The early writing on ‘green urbanism’ was by Ebenezer Howard, in the 1902 book ‘Garden City of Tomorrow’, which recently made a comeback through social and political agenda. Much later, in 1969, Reyner Banham in his book ‘The Architecture of Well-Tempered Environment’ suggesting that technology, human needs and environmental concerns part and parcel of architecture. Significantly, Lehmann (2010b) suggests that Barnham had significantly contributed to the systematic approach to the environmental impact on the design of buildings.

The second stage of literature mainly focused on the specific sustainability concept of how people/built environment/nature should symbiotically co-exist and significant solutions to the widespread environmental degradation caused by people. Some other early significant writings on green urbanism in this period of the environmental movement / cultural turn of the 1960s, came from Lewis Mumford and Jane Jacobs – although they didn’t call it green urbanism – and in ‘Silent Spring’ by Rachel Carson in 1962, and ‘Design with Climate’ by Victor Olgyay in 1963. Later, Reyner Banham’s

'Architecture of the Well-tempered Environment' and Ian McHarg's 'Design with Nature' in 1969, were pivotal alongside other publications that link with the climatic condition, e.g. Koenigsberger, Drew and Fry, Szokolay, in publications in the 1970s and 80s, to the 'Brundtland Report' (Lehmann, 2010b). Besides, there were essential contributions from Robert and Brenda Vale in 'Green Architecture: Design for an Energy-conscious Future' (1991) (Lehmann, 2010b).

Thirdly, there is the concept of living where people need to accept the fact that the right way of living requires the protection of our environment. More recent theories for the 'Solar City Charter' (Herzog et al., 1995/2007 in Lehmann 2010b), and the sphere of sustainable city theories and climate-responsive urbanism has continuously been expanded. Also, 'Compact Cities' and 'Solar Cities' (Burton, 1997; Jenks and Burgess, 2000; Lehmann, 2015b) capture the visions that belief compact city – using well-formulated sustainable urban design principles is the way forward to urban revitalisation and protecting the future of the city (Lehmann, 2010b). The role and importance of greenery, urban greening and urban forests, social sustainability and culture have increasingly become public concerns. Indeed, green urbanism has emerged championing the approach of creating communities that are equally beneficial to people and their environment (Beatley & Newman, 2013; Beatley, 2011; Lehmann, 2015a; Newman, 2014).

Table 6.1 The Evolution of Green Urbanism in Association with Recent Theories

Publications	Authors (date of publication)
Garden Cities of Tomorrow	Ebenezer Howard (1902)
Image of the City	Kevin Lynch (1960)
Technology, human needs and environmental concerns	Reyner Banham (1969)
Silent Spring	Rachel Carson (1962)
Design with Climate	Victor Olgyay (1963)
Architecture of the Well-Tempered Environment	Reyner Banham (1969)
Biogeochemical systems	Koenigsberger et al. (1980); Drew and Fry (1979); Szokolay (1973, 1981)
The Limits to Growth	Meadows et al. (1972)
The Brundtland Report	Brundtland (1987)
Ecotopia	Ernest Callenbach (1975)
Green Architecture	Robert and Brenda Vale (1991)
Solar City Charter	Herzog et al. (1995)
Urbanisation and climate change	Register (1987); Moewes (1995); Von Weizaecker, Lovins and Lovins (1997); Satterthwaite (1999); Lovelock (2009)
Compact Cities, Solar Cities	Burton (1997); Jenks and Burgees (2000); Lehmann (2005)

Source: Lehmann (2015b), Low Carbon Cities: Transforming Urban Systems, pg. 15

6.3 Plethora Definition of Green Urbanism

The term Green Urbanism has surfaced persistently in newspapers, conferences, electronic and social media, and has become common parlance. Even though the actual meaning is elusive and vague, there is an intrinsic, natural and instinctual common sense of foretelling the meaning. However, the definition of Green Urbanism diverges between authors and professionals' practices in the field. The following definitions by some of the authors indicated the broad and diverse range of definitions of green urbanism.

Beatley & Newman (2009a) and Newman (2010) use six points to define green urbanism. A city embodies green urbanism by (1) living within its ecological limits; (2) function in ways corresponding to nature; (3) strives to achieve a circular rather than a linear metabolism; (4) strives toward local and regional self-sufficiency; (5) facilitates more sustainable lifestyles; and (6) emphasizes a high quality of neighbourhood and community life.

Martinez (2007) describes green urbanism as ways of building our future with a radical shifting of perspective and finding new ways of thinking, rewarding inhabitants' wishes, participative processes, long-term decisions and inclusive design-thinking. Also, learning about real green cities involves analysing the small, local experiences of cities and neighbourhood, must incorporate a more personal perspective, based on experience. They should not be based solely on hi-tech factors such as GIS but should also consider individual concerns.

On a more physical development approach, Newman et al. (2009) advocate that green urbanism greening our cities by reducing hard surface area by replacing surface parking with pocket parks and community gardens. Newman (2010) also highlighted that Green Urbanism is related to renewable energy from solar and wind, as well as biofuels created from organic waste and wastewater sludge insulation, triple-glazed windows, air-tight. Cervero and Sullivan (2011) discuss how green urbanism reduces energy use, emissions, water pollution and waste from a stationary source standpoint in the form of green architecture and sustainable community designs.

Wells (2010a) was in the opinion that Green urbanism should centre on the practice of creating communities, and any development should be mutually beneficial to humans and the environment. Newman (2010) discussed settlements that are: smart, secure and sustainable. These smart settlements are adaptable to 21st. century technologies, secure in that they have built-in systems that enable them to respond to extreme events as well as being built to last, and sustainable in that they are part of the solution to the big questions of sustainability, such as climate change, peak oil, and biodiversity.

Lehmann (2010b) states that green urbanism is interdisciplinary in nature and requires the collaboration of landscape architects, urban planners, architects and urban designers; and ecologists, engineers, transport planners, economists, physicists, psychologists, sociologists and other specialists. Green urbanism strive to minimise the use of energy, water and materials at each stage of the city's or district's life-cycle, including the embodied energy in the extraction and transportation of materials, their fabrication, their assembly into the buildings and, ultimately, the ease and value of their recycling when an individual building's life is over.

Lehmann (2012, 2013) identifies green urbanism as being a holistic concept of urban systems that exist and change (grow or shrink) without negatively impacting the ecosystem. It is a particular form of urbanism that is concerned with a healthy balance between the city and its surrounding hinterland. It underpins practical action in order to shape the urban environment sustainably.

Lindfield & Steinberg (2012) suggest that green urbanism refers to the ability of an urban system to exist, grow, or shrink without negatively impacting the ecosystem in which it resides, thus maintaining a healthy balance between the urban environment concerned and its surrounding hinterlands. Parallel to Lindfield & Steinberg (2012), Nassar (2014) discusses green urbanism as a holistic approach that requires a combination of intelligent planning, efficient design and the cooperation of both the urban population and government. Without the collaboration of all actors, the best plans to build a regenerative city will fail.

Yehia (2015) suggests, to understand Green Urbanism implies understanding Green Design and the whole idea of the 'Green Revolution' is that individuals are encouraged

to feel responsible not only for they fate, by that of others but also for other life forms like plants, animals or insect life. The author also stresses the importance of including culture in sustainable development in order 'to minimise the adverse impacts of attitude and lifestyle' and reduced the negative impact on the environment. Neema, Maniruzzaman and Ohgai (2013) noted that green urbanism indicates a pollution-free future, using public transport, renewable energies, good climatic condition, energy-efficient building designs. All these issues can be achieved only by the provision of greeneries. Green Urbanism is about Sustainability, Healthy and Liveable attainable via Urban Greeneries.

Ionescu (2013) state that green urbanism is derived from high densities, mixed land uses and solar power generators, with an emphasis laid on community gardens and open space. It relates directly to community building is the presence of the 'third place', defined by sociologist Ray Oldenburg. Third places – cafes, bars, bookshops – are community incubators, places situated at the confluence of two social environments: the workplace and the living place. The 'third place' is the generator of social sustainability and urban vitality.

6.4 Green urbanism: Urban Design Qualities and Characters

All of the above definitions highlight some general ideas on urban planning, design and human-environment affiliation; governance, management and policies; and the domain of social, cultural and political aspects of sustainable urbanism. Based on detailed analysis of definitions from various authors (Table 6.2), the definition of green urbanism for this study revolves around four pivotal themes:

a. Nature – refers to the fundamental or integral aspects, characters and the qualities of the environment, attentive to 'human-nature' synergetic relationships with smart management of energy and materials.
b. Urbanism – refers to the imprint and consequences of economic, geographic, political and physical development of the built environment.

c. Culture and Identity – includes the issues on the social, cultural and historical aspects of the built environment.
d. Liveability - the factors that add up to a community's quality of life including the built and natural environments, accessibility and connectivity, economic prosperity, social stability and equity, educational opportunity, entertainment and recreation possibilities.

The four themes arose in response to the disperse locus of understanding of the researcher, the undefined practices as observed by the local authorities and the universal perception of the topic by contemporary society in Malaysia. Additionally, the conventional way of thinking and handling of urban developments must be transformed to reflect on and adapt to the four qualities along with cultural processes that will reframe urban development proposals for the change of circumstances and conditions. To do this requires moving beyond sustainability to 'green urbanism' (Luccarelli & Røe, 2012).

It is not the intention to evaluate the usefulness of other concepts that sprung from the root of sustainability. The researcher chose to focus on Green Urbanism as proposed by Beatley (2005) with the consequential sample of developments and as advocated by Lehmann (2010b) with his important principles. Consequently, the concept of Green Urbanism is seen to contain wide-ranging perspectives and policies and thereby permits global replications. Moreover, Green Urbanism concept dealt not only with the physical consequence of urban design and planning but recognised the weighty relationship between humans and their environments.

Another important quality of Green urbanism as highlighted by (Luccarelli & Røe, 2012)) and Luccarelli & Røe (2012) is the inclusion of social and anthropocentric standpoint in the domain of 'urbanism' when reflecting social, cultural and political sides of sustainability. Subsequently, the term 'green' incites the understanding of urbanism sphere in association with the natural realm, which very much differs from the current understandings, guidelines and policies and urban development practices in Malaysia.

The fundamental idea of this research is to identify the distinct contribution of GUP to urban walkability. Thus, it requires an investigation of the relation between urbanism and nature. The four pivotal Green Urbanism qualities as inferred from the plethora of definitions are in line with the six urban design qualities and characteristics by Beatley (2000, pg. 6-8);

i. Cities that live within the ecological limits, essentially reduce the ecological footprints, and recognise the connections with (and also the impacts on) other cities and communities and the larger planet.
ii. Cities that are green and designed for and act in ways corresponding to nature.
iii. Cities that strive to achieve a circular metabolism, that nurtures/develops symbiotically positive relationships with and between its hinterland (whether that be regional, national, or international).
iv. Cities that strive toward local and regional self-sufficiency and take full advantage of and nurture local/regional food production, economy, power production, and many other activities that sustain and support their populations.
v. Cities that facilitate (and encourage) more sustainable, healthful lifestyles.
vi. Cities that emphasize the high quality of life and the creation of highly liveable neighbourhoods and communities.

Which showcased their interrelation are constructive starting points for the identification of the association of GUP with urban walkability in the context of Malaysia.

Table 6.2 Working Definition of Green Urbanism by Various Author

	AUTHOR	YEAR	PUBLICATION	RESEARCH APPROACH	AREA OR RESEARCH	LEVEL / LOCATION	WORKING DEFINITION OF GREEN URBANISM				
							NATURE	URBANISM	LIVEABILITY	CULTURE & IDENTITY	SOCIO-CULTURE & IDENTITY-IMAGE
1	Adiukwu, Adedeji, & Adiukwu (2018)	2017	Journal: European Academic Research	Urban Sustainability	Smart City Ideas for Africa's Urban Development	Africa	√	√	√	√	CU, SO, ID
2	Rosol, Béal, & Mössner, (2017)	2017	Journal: Environment and Planning A, UK Q1	Sustainable Development -Trend and Policy	-Sustainability Trend -Characteristics of Green Cities	Global	√	√	√	√	SO, IM
3	McCann (2017)	2017	Journal: Environment and Planning A, UK Q1	Sustainable City -Ideology and Concept Transfer and Governance (Europe to China)	-Policy mobilities, -Urban Development -Profit-Oriented Dev. in the Name of Green Urbanism	Global	X	√	√	√	SO
4	Zuberi (2017)	2017	Procedia Environmental Sciences (Green Urbanism Conference)	Green Urbanism Concept	Growth and Sustenance of the Concept of Green Urbanism in the Settlements of Medieval India.	Agra Fort, India	√	√	√	X	X
5	Saitta (2016)	2016	Journal: City Green, Singapore	Sustainable Living -Archaeological & Cross Cultural	Evolution of Green Urbanism from the ancient civilisation	Global	√	√	√	√	CU, ID
6	Holz & Sigler (2016)	2016	Conference: State of Australian Cities Conference, Australia	Urban Sustainability -Technology Based	Green Building Rating	Australia	X	√	√	√	SO, IM
7	Rae (2016)	2016	Journal: Open House International, Netherland Q3	Architecture and Ecology	Arcology: Integrates architecture with ecology towards Green urbanism -Prototype City of Arcosanti, Arizona.	USA	√	√	√	X	X
8	Zaręba, Krzemińska, & Widawski (2016)	2016	Conference: IOP Conference Series: Earth and Environmental Science, UK -Scopus Index	Green Urbanism Practices (Policy, Guidelines and Implementation)	-Green Infrastructure (Community) -Transport Oriented Development (Transport) -Green Belt (Urban Sprawl)	Global -3 Countries -Mueller community, USA -Curitiba BRT, Brazil -Metropolitan Green Belt, UK	X	√	√	√	CU, SO, ID
9	Pow & Neo (2015)	2015	Journal: Area Q1	Concept and Mobile Policy Networks and 'quick fix' Urban Policy Solutions	Green City Model, ecological urban "Imagineering" and socio ecological. -1 good natural environment -2 healthy balance in the man-made environment -3 good lifestyle habits --4 developing a dynamic and efficient economy	China Eco-city Development-The Sino-Singapore Tianjin eco-city (SSTE) project.	√	√	√	√	CU, SO, ID
10	Matan & Newman (2015)	2015	Journal: Journal of the Indian Ocean Region, USA Q3	Green Urbanism City Types. Green urbanism Innovations	cities to reduce their resource footprint, especially carbon, improve biodiversity and at the same time continue to create economic opportunities and liveable places	Indian Ocean region	√	√	√	√	CU, ID
11	Stanislow, Anna, & Marius (2015)	2015	Journal: City, UK Q1	Ideology and Concept of Sustainable Urbanism	Planning and Management of Eco-city	Global	√	√	√	√	CU, SO, ID
12	Yehia (2015)	2015	Book: Global Climate Change, Biodiversity and Sustainability: Challenges and Opportunities (Conference Based)	Sustainable Urban Planning and Development	Planning Methods and Decision-Making Tools That Promote Green Urbanism	Alexandria, Egypt	√	√	√	√	CU, SO, ID
13	Manley & Rose (2014)	2014	Conference: World Sustainable Building 14 (SB14) Barcelona, 28th-30th October 2014	Urban Sustainability -Technology Based	Conceptual: -Smart Building -Information technology and mobile communication systems - Construction Product System	Australia	X	√	√	√	SO
14	Salleh, Zainol, Ahmad, & Noor (2014)	2014	Journal: International Journal of Property Sciences, Malaysia	Urban Design Process and Design Guidelines	Factors Contributing to Green Neighbourhood	Malaysia	√	√	√	√	SO
15	Spirn (2014)	2014	Book Section: The Ecological Design and Planning Reader	Ecological urbanism	Concept and Principles of Sustainable Urban Design and Planning	Global	√	√	√	√	CU, SO, ID

	AUTHOR	YEAR	PUBLICATION	RESEARCH APPROACH	AREA OR RESEARCH	LEVEL / LOCATION	WORKING DEFINITION OF GREEN URBANISM				
							NATURE	URBANISM	LIVEABILITY	CULTURE & IDENTITY	SOCIO-CULTURE & IDENTITY-IMAGE
16	Anastasiadis & Metaxas (2013)	2013	Journal: Journal of World Transactions on Engineering and Technology Education, Australia Q3	Urban Planning Model	Formulating the Principles of An Eco-city	Global	√	√	√	√	SO
17	Ionescu (2013)	2013	Journal: Acta Technica Napocensis: Civil Engineering & Architecture	Social and Urban Ecology	Community Design for Sustainable Urbanism	Post-socialist City, Romania	√	√	√	√	SO, ID
18	Kerr (2013)	2013	Book: Is the Planet Earth Green?	Ecology and Community	Community Resistance towards Ecological Threats by Property Developers	Fremantle, Western Australia	√		√	√	SO
19	Neema, Maniruzzaman, & Ohgai (2013)	2013	Journal: Current Urban Studies -Web of Science Index	Urban Greenery	Develop a greenery-based conceptual model (GBCM) towards attaining a sustainable healthy liveable (SHL) environment.	Megacity of Dhaka, Bangladesh	√	√	√	√	SO, ID
20	Nassar (2013)	2013	International Journal of Social Science and Humanity, Turkey	Urban Design Process and Design Guidelines	Intelligent Planning and Efficient Design	Megacity of Cairo, Egypt	√	√	√	√	CU, SO, ID,
21	Hemmersam (2013)	2013	Le Journal Speciale Z., France	Sustainable Urbanism Model	Compact City, Eco-city People Oriented City (not Technology based)	Oslo	√	√	√	√	SO, IM
22	Peter Newman & Matan (2013)		Book: Green Urbanism in Asia: The Emerging Green Tigers	Sustainable Urbanism Model	Green Urbanism Model in Asian Cities	Asia & Singapore	√	√	√	√	CU, SO
23	Lehmann (2012)	2012	Book: Green Cities for Asia and the Pacific	Sustainable Urbanism	Green Urbanism and Zero Waste City -Sustainable Design and Behavioural Change	Global	√	√	√	√	CU, SO, ID
24	Lindfield & Steinberg (2012)	2012	Book: Green Cities for Asia and the Pacific	Sustainable Urbanism	Green Urbanism and Green Cities Concept	Global	√	√	√	√	CU, SO
25	Luccarelli & Røe (2012)	2012	Book: Green Oslo - Visions, Planning and Discourse	Sustainable Urbanism	Green Urbanism, Ideology and Concept	Global	√	√	√	√	CU, SO, ID, IM
26	Swilling (2011)	2011	Journal: Social Dynamics, UK Q2	Sustainable Urbanism	Socio-metabolism, Ecology and Urban Infrastructure	Global	√	√	X	√	CU, SO, IM
27	Cervero & Sullivan (2011)	2011	Journal: International Journal of Sustainable Development & World Ecology, UK Q2	Sustainable Urbanism and Sub-urban Development	Merging TOD and Green urbanism for neighbourhood design. Referring to Sweden, Germany and Australia	Global	√	√	√	√	SO
28	Asgarzadeh, Koga, Yoshizawa, Munakata, & Hirate (2010)	2010	Journal of Asian Architecture and Building Engineering, Japan Q1	Green urbanism	Sustainable Urban Environment -Green Building Façade and Street Trees	Tokyo, Japan	√	√	√	√	SO
29	Lehmann (2010a)	2010	Book: The principles of green urbanism: Transforming the city for sustainability	Principles of Sustainable City	Developing a Holistic Principles for a Sustainable City	Global	√	√	√	√	CU, SO
30	Lehmann (2010b)	2010	Journal: Survey and Perspectives Integrating Environment & Society (SAPIENS), France Q3	Ideology and Principles of Sustainable City	Green Urbanism: Principles	Global	√	√	√	√	CU, SO
31	Newman (2010)	2010	Environment and Urbanization Asia, USA Q3	Sustainable Urbanism - Key Themes of Sustainable Urbanism	Green Urbanism and the Seven Characteristics	Singapore	√		√	√	CU, SO, ID
32	Newman, Beatley, & Boyer (2009)	2009	Journal: Australian Planner, UK Q2	Resilient City - Key Themes of Sustainable Urbanism	Way to Respond to the Threat of Depleting Resources, Peak Oil and Climate Change.	Global	√	√	√	X	X

	AUTHOR	YEAR	PUBLICATION	RESEARCH APPROACH	AREA OR RESEARCH	LEVEL / LOCATION	WORKING DEFINITION OF GREEN URBANISM				
							NATURE	URBANISM	LIVEABILITY	CULTURE & IDENTITY	SOCIO-CULTURE & IDENTITY-IMAGE
33	Weller (2008)	2008	Journal: Landscape Journal, USA Q4	Landscape Urbanism -Theory and Practice	Master Plan Development of The Wungong Urban Water (WUW) and Landscape Structure Plan (LSP)	Perth, Australia	√	X	X	√	CU, SO, ID
34	Johnson (2008)	2008	Conference: 44th ISOCARP Congress (International Society of City and Regional Planners), Dalian, China, 19-23 September 2008	Concept and Ideology	Green Urbanism as Image Projection	Asian Cities: Malaysia and Singapore	√	√	X	√	CU, SO, IM
35	Karlenzig (2008)	2008	Book: Growing Greener Cities: Urban Sustainability in The Twenty-First Century	Green Cities	Ranking Measuring tools and Indices of Green Cities	US Cities	√	√	√	√	CU, SO, ID, IM
36	Karlenzig (2007)	2007	Book Section: How Green is Your City?				√	√	√		CU, SO, ID, IM
37	Van Den Berg, Hartig, & Staats (2007)	2007	Journal of Social Issues, UK Q1	Urban Sustainability	Urban Nature for Communities	Global	√	√	√	√	SO
38	Martinez (2007)	2007	Urban Forum	People Oriented and Community Building	-Small Scale and localise -Community Participation -Exploratory and Intangible	Neighbourhood area of Can Ricart - Barcelona	√	√	√	√	SO, IM
39	Bogunovich (2002)	2002	Book Series from Conference Proceeding: The Sustainable City II: Urban Regeneration and Sustainability	Urban Sustainability -Technology Based	Merging Ecology with Technology to achieve Smart Metabolism for a Green Urbanism	Global	√	√	√	√	CU, SO
							35 / 39	**36 / 39**	**36 / 39**	**36/39**	

6.5 The Development of the Principles

As stated by Lehmann (2010b), the concept of green urbanism if adequately planned and applied should be able to reduce energy consumptions for the running operations of cities or towns, including lighting, heating and cooling. It should also lessen the use of water in the whole city's district and at the same time managing the ecosystem, biodiversity and urban landscape, as well as nurturing urban farming. The application of the concept should also minimise the use of materials at every stage of their lifecycle. These, according to Lehmann, formed the first and second part of the formulation of the concept.

The first two parts of the concept of green urbanism merely involve the technical matter of eco-friendly city, enlighten the solutions on energy saving and reducing the city's carbon footprint. The technological advancement alone does not ensure of any society's sustainability, which is one of the key parameters of a holistic social and environmental sustainability that promotes a healthy community (Dempsey et al., 2011; Lehmann, 2010a, 2012; Oktay, 2012, 2013). Social sustainability and a healthy community are, in turn, form the third and final part of the concept that complete the Three Pillars of Green Urbanism (Figure 6.1).

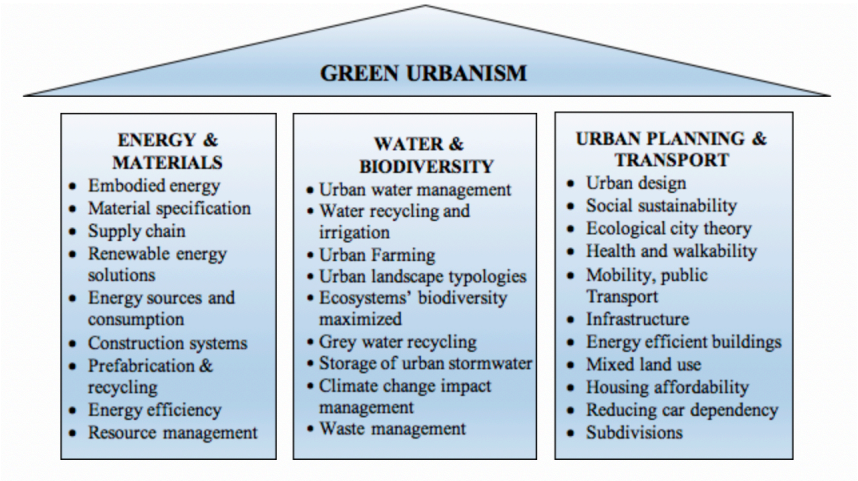

Figure 6.1: The Three Pillars of Green Urbanism.
Source: Dempsey et al. (2011); Lehmann (2010a, 2012); Oktay (2012)

In addition to The Three Pillars of Green Urbanism, Lehmann later includes Socio-Cultural features which parallel to the fourth pillar of sustainability (Figure 6.2).

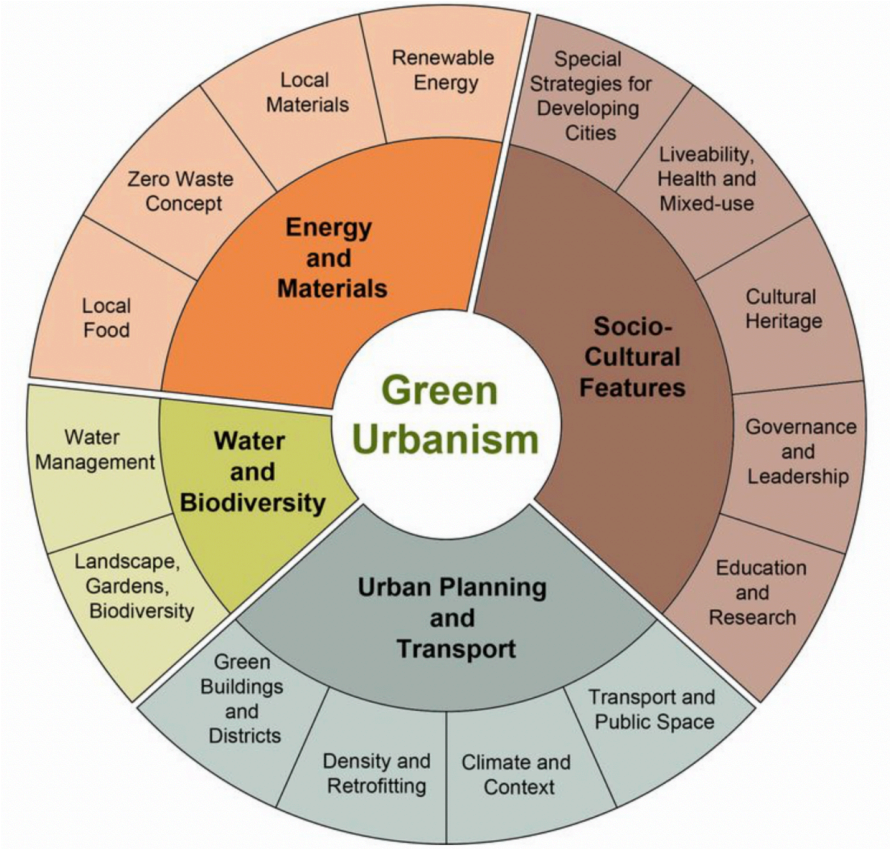

Figure 6.2: Green Urbanism wheel with indicators to measure sustainable design
Source: Lehmann (2013, pg. 2, Retrieved: 18th February 2016)

Lehmann (2013) advocates that apart from the proactive vision of what might be our zero-carbon, fossil-fuel-free future, overlapping mixed-use activities, living and working, infrastructures systems, public transport and natural environment might give a good idea in predicting future development. Cities that exemplify green urbanism are those that have unique and important design qualities and characteristics. According to Lehmann (2010a, p.3), there are sixteen qualities and characteristics a city should achieve if fully comply with the principles of green urbanism. The qualities and characteristics ranging from responding to the climate, renewal energy, solving issues of pollutions.

'The districts and cities where the Principles of Green Urbanism have been applied and integrated in every aspect of urban environments that:

i) respond well to their climate, location, orientation and context, optimizing natural assets such as sunlight and wind flow;

ii) are quiet, clean and effective, with a healthy microclimate;

iii) have reduced or have no CO2 emissions, as they are self-sufficient energy producers, powered by renewable energy sources;

iv) eliminate the concept of waste, as they are based on a closed-loop ecosystem with significant recycling, reusing, remanufacturing and composting;

v) have high water quality, practising sensitive urban water management;

vi) integrate landscape, gardens and green roofs to maximize urban biodiversity and mitigate the urban heat island effect;

vii) take only their fair share of the earth's resources, using principles of urban ecology;

viii) apply new technologies such as co-generation, solar cooling and electric mobility;

ix) provide easy accessibility and mobility, are well interconnected, and provide an efficient low-impact public transport system;

x) use regional and local materials and apply prefabricated modular construction systems;

xi) create a vibrant sense of place and authentic cultural identity, where existing districts are densified and make use of urban mixed-use infill projects;

xii) are generally more compact communities around transport nodes ('green Transit-Oriented Developments, TODs'), with a special concern for affordable housing and mixed-use programs;

xiii) use deep green passive design strategies and solar architecture concepts for all buildings, with compact massing for reduced heat gain in summer;

xiv) are laid-out and oriented in a way that keeps the buildings cool in summer, but which catches the sun in winter,

xv) have a local food supply through community gardens and urban farming and which achieve high food security and reduced “food miles”; and

xvi) use multi-disciplinary approach, best practice for urban governance and sustainable procurement methods.’

However, in view of the fact that this research attempts to link the principles of green urbanism and walkability – before the main principles of green urbanism are being selected, all of the attributes included in the ‘URBAN PLANNING & TRANSPORT’s pillar’ and selective design qualities and characteristics in other pillars pertinent to the study will be discussed, scrutinised and developed as part of the walkability index in the Methodology chapter for use in the field works. The aforementioned design qualities and characteristics extracted from (Lehmann, 2010a) are:

i) respond well to their climate, location, orientation and context, optimizing natural assets such as sunlight and wind flow;
ii) are quiet, clean and effective, with a healthy microclimate;
iii) have reduced or have no CO2 emissions, as they are self-sufficient energy producers, powered by renewable energy sources;
iv) integrate landscape, gardens and green roofs to maximize urban biodiversity and mitigate the urban heat island effect,
v) take only their fair share of the earth’s resources, using principles of urban ecology,
vi) provide easy accessibility and mobility, are well inter- connected, and provide an efficient low-impact public transport system,
vii) create a vibrant sense of place and authentic cultural identity, where current districts are densified and make use of urban mixed-use infill projects,
viii) are generally more compact communities around transport nodes (‘green Transit-Oriented Developments, TODs’), with a special concern for affordable housing and mixed-use programs,

6.6 Green Urbanism: Application in Global Context

Beatley established Green Urbanism concept through his influential publication 'Green Urbanism: Learning from European Cities' in 2000, using 32 case studies in the European exemplar cities. These European cities are well known for their advancement concerning sustainability policies, planning and implementation, which, according to Beatley (2000) parallel with that of the United States of America. He further reiterated, although the physical marks of success are more substantiate in the European cities, the basis of pedestrian malls in the US have influent significantly. At the same time, the Australian too evolved their sustainability policy, planning and implementation at around the same period, due to the influences from Great Britain through their common roots in the legal system, social and cultural legacies (Lehmann, 2010a). Table 6.3 shows leading cities in the US, Europe, Asia and Australia that implemented the GUP.

Table 6.3 Leading Global Cities that Implemented Green Urbanism Principles (GUP): Low Carbon City policy and planning

Cities	Strategies Implemented
Adelaide (AUS) & San Francisco (US)	Zero-waste Concepts
Melbourne (AUS) & Berlin (GER)	Urban renewal, energy efficient buildings
Sydney (AUS) & Malmo (SWE)	Water management, energy co-generation
Stockholm Hammarby-Sjostad (SWE)	Waterfront development, renewal energy
Freiburg Vauban (GER)	A holistic policy promoting low energy consumption
Hannover Kronsberg (GER)	A district with a very high ecological standard
Nanjing & Hangzhou (PRC)	Public transport and free bike schemes
Songdo (S. KOR)	Smart city concept, intelligent buildings with sensors and meters
Singapore	Integration of urban biodiversity, low carbon mobility, water management, good public housing
Helsinki (FIN), Leipzig (GER) & Curitiba (BRA)	Affordable mobility, waste recycling
London (UK)	Holistic strategies, providing community spaces
Munich (GER)	Public transport integration, low energy consumption
Copenhagen (DEN)	Safe cycling and air quality
New York City (US)	Urban green spaces and public space, urban blocks
Vancouver (CAN) & Portland (US)	Quality urban density and public transport, green construction

Source: Lehmann (2015b, pg. 28)

6.6.1 Green Urbanism: the Asian Context

According to Newman (2010), the idea of Green Urbanism is yet to be implemented in the Asian, since Asian cities are still attached with the general 'sustainability concept' and Green Urbanism is yet to thrive. However, Singapore development is seen as the model among Asian countries that employ GUP in its city-state (Lehmann, 2015b; Newman, 2010) although some argue of it being an eco-disaster (Lehmann, 2015b; Newman, 2010). The city-state of Singapore, being unique cannot be compared with other cities in big countries. Singapore is radically unsustainable with its 'gardenesque' city image that often linked to superficial beautification (Terry, 2013).

Singapore lost 50% of its rainforest due to rapid urbanisation which modified its local climate condition causing urban heat island. However, with its current planning and development, it is slowly transforming itself into a more believable green city (Barnard & Heng, 2014; Han, 2018). Singapore is now focussing on transforming the city-state into a committed green city by developing five focal areas following GUP:

- **'Eco-Smart' Towns** – implementing smart technology, more green spaces and eco-friendly features in towns and homes
- **'Car-Lite'** – improvements to rail and bus networks while promoting cycling and walking
- **Zero Waste Nation** – initiative to decrease food and energy wastage
- **Leading Green Economy** – Green Building Masterplan to lead the development of green buildings and invest in solar power
- **Active and Gracious Community** – all areas of society are called to come together and contribute to initiatives

By way of the new policy and vision, Singapore is now a primary test site for the Asian model of Green Urbanism (Table 6.4) with projects ranging from regional planning to urban design and park.

Table 6.4 Projects undertaken in Singapore following Green Urbanism Concept

Project	Description
Tempines New Town	a satellite new town of the city-state is one example that fore- shadows a more structured application of the idea of the garden in relation to urbanism. This new town was being awarded as "an outstanding contribution towards human settlement and development" by the United Nations Building and Social Housing Foundation (BSHF).
The ABC Waterways Project	the Active, Beautiful, Clean Waterways programme (ABC) launched by the Public Utilities Board (PUB) in 2006 is a nationwide attempt to re-convert an engineered system of 14 reservoirs and 32 rivers into a biodiverse social amenity.
One-North	a 200-hectare bio medical hub in central Singapore with aim to integrate all building entities into one landscape formation. Zaha Hadid's design ensembles "complex urban ecology" into one artificial landscape. Critics verdict the project as only works at that particular urban quarter of artificial landscape formation but failed to integrate with existing landform, traffic issues persist (Lim, 2016; Velegrinis & Weller, 2007)
University of New South Wales Asia Campus –	a previously flat 22-hectare greenfield site was transformed into a campus identity through creation of an ecologically functioning urban landscape. The intention of the whole design is to establish the landscape as the main object and buildings are placed within it. The introduced landscapes help as environmental filters in the campus, with hope it will also fulfil the ecological function.
The Gardens by the Bay	This project is said the ultimate transformation of Singapore's Garden City to a City in a Garden. The series of gardens here encompasses 101 hectares of reclaimed land present ecological ambition, scale and beauty of artificial landscapes. The critics argued that these gardens at the bay that cost SD1.035 billions were built on a reclaimed land with massive amount of concrete is not at all ecological. The superficial beauty incorporates large hard surfaces, imported flora, artificial and spotlighting at nights on its giant trees and annual maintenance of SD53 millions were too costly (Terry, 2013)

Source: Adopted from Velegrinis & Weller (2007)

6.6.2 Green Urbanism: the Malaysia Context

Green Cities and Green Developments are currently for selective areas and privileged few (Hodson & Marvin, 2010; Rosol et al., 2017). This especially true in the case of Malaysia, where sustainable development and /or Green projects that aimed to create high quality of life in a liveable town are common and concentrated in big cities of Kuala Lumpur, Johor Bahru, Georgetown among others (Hodson & Marvin, 2010; Rosol, Béal, & Mössner, 2017). The programmes, funding and implementations of 'green' development that include pedestrianisation, public transportation and other facilities for sustainable living in small/medium size town are limited at the core area of the city or town (Table 6.5).

Table 6.5 Distribution of 'Sustainable Living' Facilities between big cities and small/medium size cities in Malaysia

SECTOR	BIG CITY (Greater Kuala Lumpur / Klang Valley, Johor Bahru)	SMALL / MEDIUM CITY	SOURCE
Public Transport	40%	20% (By the Year 2020)	(Ministry of Energy Green Technology and Water (Kettha)., 2017)
Green Technology / Green Township Projects	Greater KL / Klang Valley • Putrajaya • Cyberjaya • Subang Jaya • Petaling Jaya Johor Bahru • Iskandar Malaysia	Ayer Keroh, Melaka • Hang Tuah Jaya	(Ministry of Energy Green Technology and Water (Malaysia), 2015)
Pedestrianisation	Focus on major cities • Kuala Lumpur • Johor Bahru • Kuching • Kota Kinabalu	Data Not Available	Data Not Available

An additional issue in Malaysia is that the residential neighbourhoods are being developed in a piecemeal approach and lacking in neighbourhood planning that supports the idea of sustainability (Ahmad, Kadir, & Shafie, 2011; Ghee, 2016; Teriman, 2012). Green urbanism attempts to establish cities that emphasise the high quality of life and the creation of highly liveable neighbourhoods and communities with its 15 principles. These principles focus on the association of human and their environment with strategies to bring into effect again the landscape in urban areas and maximising the establishment of urban biodiversity. It also championed the notion of a pedestrian-friendly environment with non-motorised transport such as walking and cycling dominating the urban areas (Figure 6.3). The principles also recognise the importance of creating a liveable city and community building in order to achieve a multi-functional city with a vibrant city environment. Finally, a city will only be as mere space without its unique characters and identity. The principles highlighted that interchangeable design makes a city soporific; hence it is crucial for a city to maintain its heritage and culture, with a strong sense of identity.

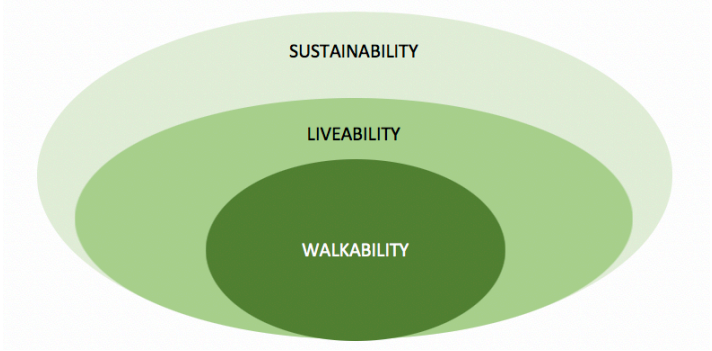

Figure 6.3: The Connection of Sustainability, Liveability and Walkability
Source: Lehmann (2010b)

The initiation of the National Green Technology Policy in 2009 (NGTP2009) that marked the important move at driving Malaysia's green development (Chua & Oh, 2011). The NGTP2009 is built on four pillars;

a) Energy: Seek to attain energy independence and promote efficient utilisation;
b) Environment: Conserve and minimize the impact on the environment;
c) Economy: Enhance the national economic development through the use of technology; and
d) Social: Improve the quality of life for all (Chua & Oh, 2011).

According to NGTP2009, there are three stages of implementing sustainable development in Malaysia (Table 6.6). First, the short-term goals to be implemented in the 10th Malaysian Plan (2011 – 2015), which is to increase public awareness of the sustainable development and green technology; and expanding related research at local research institutes and institutions of higher learning. Second, the medium-term to be implemented in the 11th Malaysian Plan (2016 – 2020) by making green technology as preferred ways in developments, procurements of products and services; and increase research, development and innovation of green technology by research institutions and local universities. Third, long term in the 12th Malaysian Plan (2021 – 2025) inculcating green technology in Malaysian culture and widespread adoption of sustainable development strategies to reduce energy consumption and footprint; and expansion of international research collaborations between local universities and research institutions with green technology industries.

Table 6.6 National Green Technology Goals in the Span of Three Malaysian Plans

Malaysian Plan (MP)	Goals	Key Sector to Urban Sustainability
10th MP (2011-2015)	• Increase public awareness and commitment for the adoption and application of GT Widespread availability and recognition of GT in local market • Increase foreign and domestic direct investments in GT • Expansion of local research institutes and institutions of higher learning	• Energy Sector • Buildings Sector • Water and Waste management Sector • Transportation Sector
11th MP (2016-2020)	• GT to be the preferred choice in procurement of products and services • Increase production of local GT products • Larger local market shares in GT • Expansion of local small medium enterprises and small medium industries on GT into global market • Increase research, development and innovation of GT by local universities and research institutions • Expansion of GT applications to most economic sectors	• Energy Sector • Buildings Sector • Water and Waste management Sector • Transportation Sector • Environmental Sector
12th MP (2021-2025)	• Inculcation of GT in Malaysian culture • Widespread adoption of GT to reduce overall resource consumption while sustaining national economic growth • Significant reduction in national energy consumption • Improvement of Malaysia's ranking in environmental ratings • Malaysia as a major producer of GT in the global market • Expansion of international collaborations between local universities and research institutions with GT industries	Yet to be detailed

Source:(Ministry of Energy Green Technology and Water (Malaysia), 2009, 2015)

Currently, there are not many significant projects in Malaysia that implemented the concept, however there two projects that are worth mentioning i) Putrajaya and ii) Iskandar Malaysia (refer Appendix: PIM-10 for images of both developments) that implemented to a certain extent the principle of Green urbanism as described in Table 6.7;

Table 6.7 Projects of sustainable development values in Malaysia

Project	Description
Putrajaya	this new administration township houses numerous government institutions, residential areas, parks and gardens, and shopping centre. Putrajaya provides insights into current directions in Malaysian and Southeast Asian urbanism continuing a tradition of postcolonial masterplan cities built on a *tabula rasa*. With the utopian belief, Putrajaya was developed as a possible ideal city that engineering society and nation through design (Moser, 2010) This is the first development that see landscape as the one of the agendas if not the main, with 12 large parks and numerous pocket gardens throughout the township. Residential areas are connected to the parks with proper walkways system connected to all of other parks. Although the green area covered is at 37.5%, a massive wetland and man lake (11.9%), critics exclaimed that Putrajaya development is not in line with ecological principles due to lack of green building initiatives and materials used.
Iskandar Malaysia	the development of Iskandar Malaysia was included in the 9th Malaysian Plan as main corridor for Malaysia's future economic development (Rizzo & Glasson, 2012). The development incorporates financial district, Johor new administrative centre, residential areas, shopping centres, creative park, education city, medical hub, harbour port, free trade zones etc. Iskandar Malaysia also pledged in contributing the Malaysia's pledge to reduce 40% of carbon release and in 2015 launched Low Carbon Society in the five local authorities within Iskandar development area. Greener city and home, urban farming, resilient development and inclusive society are key objectives in the development plan (Iskandar Regional Development Authority (IRDA), 2015).

Various measures were taken to accelerate the property market by developers including the promotion of eco-friendly and environmentally oriented development scheme, lush greenery, provision of gardens, parks and recreation spaces (Alias, Ali, & Wai, 2011). Consequently, the current marketing trend of residential properties in Malaysia often tagged their development as 'green', 'eco' and 'environmentally friendly'. According to (Alias, Ali, & Wai, 2011), 83% of the Greenfields Housing Development (GHD) claims were deceptive of the environmental benefits than it existed in their developments. Similarly, there is no worth mentioned green development in the MC in Malaysian that manifests any implementation of sustainable principle in their development and planning due to context and location (Tateishi, 2018).

6.7 Green City Index

The Green City Index survey was conducted in 2012 by the Economist Intelligence Unit which based in London and was sponsored by Siemens. The Green City Index series have evaluated the performance of more than 120 cities around the globe. The selected cities for evaluation were based on its size and importance; mostly capital cities, large

population hubs and business centres. Cities were divided into seven regions, the US and Canada, German, European, Asian, Latin American, African and Australia and New Zealand (Alias et al., 2011).

The index measures cities on about 30 indicators under eight to nine categories, depending on the region and availability of data. It covers CO2 emissions, energy, buildings, land use, transport, water and sanitation, waste management, air quality and environmental governance. The measurement involved both quantitative and qualitative data and was based on current environmental performance as well as the intentions of the city to become greener. The specific indicators for certain index were befittingly altered due to the unique challenges in each region and the availability of data (The Economist Intelligence Unit, 2012b).

6.7.1 European / Global Green City Index

The European Green City Index assessment differs from one of the Asian cities due to the advance achievement of most of the European cities in sustainable development and green cities initiatives (The Economist Intelligence Unit, 2012b). For example, the European cities are well developed in terms of the sanitary system, unlike most of the Asian cities. Thus, the exclusion of Sanitation scores from the European Green City Index. The issue with the European cities were the political and economic gaps between Eastern and Western Europe even after 20 years of bridging programmes, the indication of environmental divide remains (Choon et al., 2011; Lemes, 2011; The Green City, 2017). In addition, other differences between the two indices are the scoring technique to assess each city, Asian Index uses performance level (well below average – well above average), but the European's were scored using a point system.

The survey on European cities focuses on 30 indicators under eight Categories; environmental governance CO2, air quality, energy, water, buildings, waste and land use and transport (Figure 6.4) Generally, the European cities are well ahead in having good public participation, policies support and excellent environmental governance. Hence, many of the cities have excellent environmental quality (The Economist Intelligence Unit, 2012b). Moreover, apart from having good policies and strong governmental support, economic strength and wealth play an important role in making green city

initiatives a success; it takes considerable effort and huge monetary capacity to improve the quality of the environment. (Beatley, 2001). The European Green City Index evaluates 16 quantitative and 14 qualitative indicators. The methodology for Europe was adapted for the other regional indices.

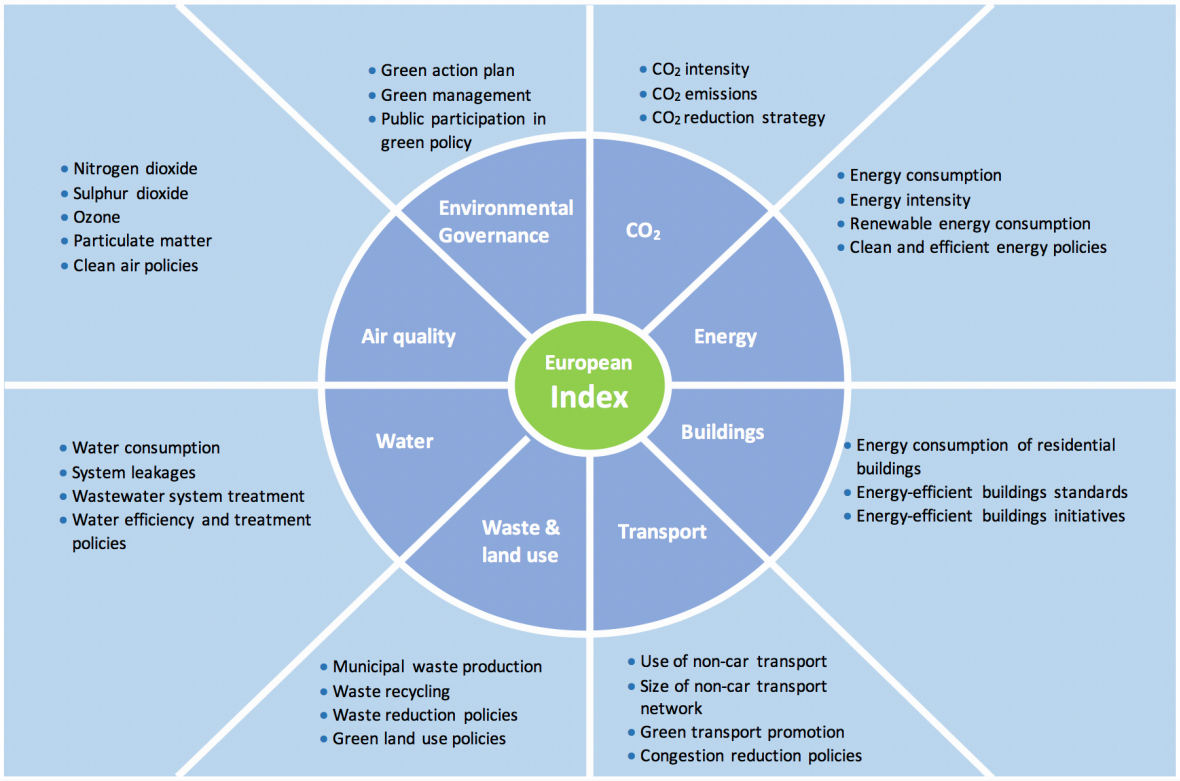

Figure 6.4 The European Green City Index
Source: (Darmoyono & Tanan, 2015; The Economist Intelligence Unit, 2012a).

6.7.2 Asian Green City Index

The Survey for Asian Green City focuses on CO2, transport, land use and buildings, waste, water, air quality, sanitation, and environmental governance. The study involved 22 cities that includes most major Asian urban areas, evaluates the level of green awareness, practices and governance. The study components in the methodology were developed based on the European Green City Index (2009) and Latin America Green City Index (2010) due to different practices and availability of data. The Asian Green City Index (Figure 6.5) includes 29 indicators from Eight Categories, ranked with five levels of assessment namely, well below average, below average, average, above average and well above average (Darmoyono & Tanan, 2015; The Economist Intelligence Unit, 2012a).

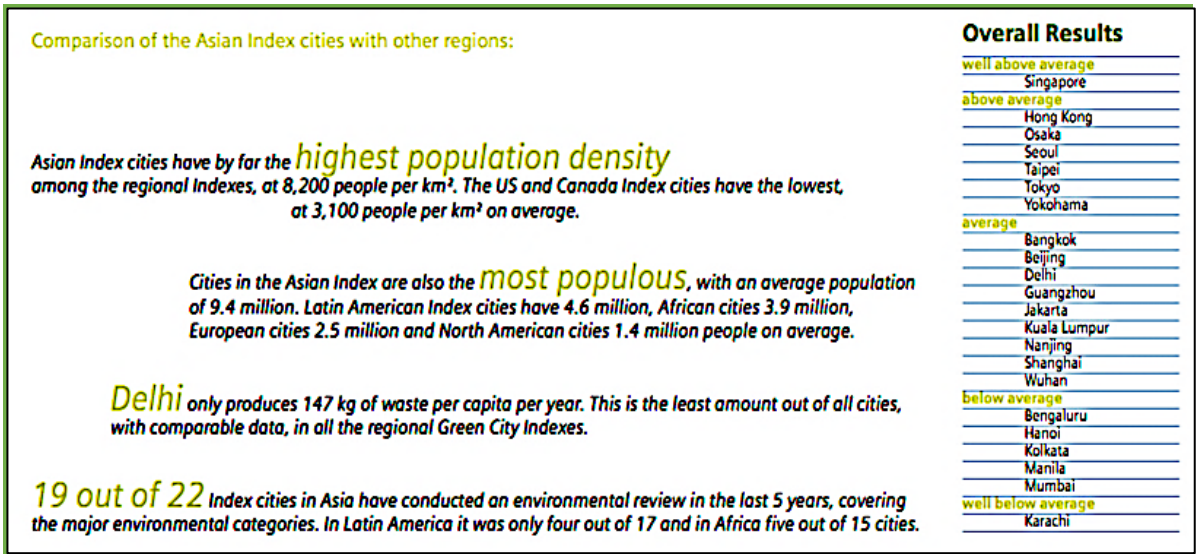

Figure 6.5 Asian Green City Index- Overall Result
Source: The Green City Index, a research project conducted by the Economist Intelligence Unit, London; Sponsored by Siemens (2012), Pg. 25

The result of the survey reports that Singapore topped the chart by being ranked as 'well above average' leaving other Asian cities such as Hongkong, Osaka, Tokyo, Yokohama, Soul and Taipei at the 'above average' level. Kuala Lumpur, Jakarta, Bangkok, Delhi and five other cities in the People Republic of China ranked as 'average'. The result also indicated that Asian cities that were ranked as 'below average' and 'well below average' share several common issues such as being the most populous cities and economically weak such as Karachi, Kolkata, Bengaluru, Mumbai, Manila and Hanoi. Each of these low-ranking cities has specific problems that need to be solved to improve the environmental condition such as Public Transportation, Air Quality, Sanitation, Waste, and Land use and Buildings (Figure 6.6). (Darmoyono & Tanan, 2015; The Economist Intelligence Unit, 2012a)

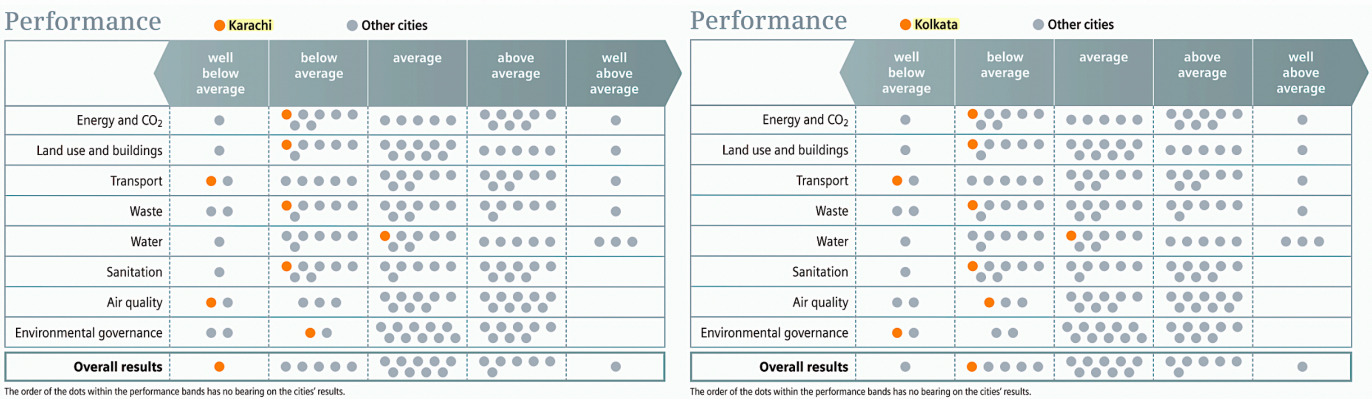

Figure 6.6 Asian Green City Index - Low Ranking Cities (Karachi as 'well below average' and Kolkata as 'below average')

6.7.3 Malaysian Green City Index

Kuala Lumpur, Malaysian was ranked as 'average' in the overall result of Asian Green City Index (Figure 6.7). Kuala Lumpur scored 'above average' in Transport and Air Quality, 'average' in Land use and Buildings and Environmental Governance; and 'below average' for Energy & CO2 and Sanitation. However, Kuala Lumpur scored below average for its Waste and Water categories (Darmoyono & Tanan, 2015; The Economist Intelligence Unit, 2012a).

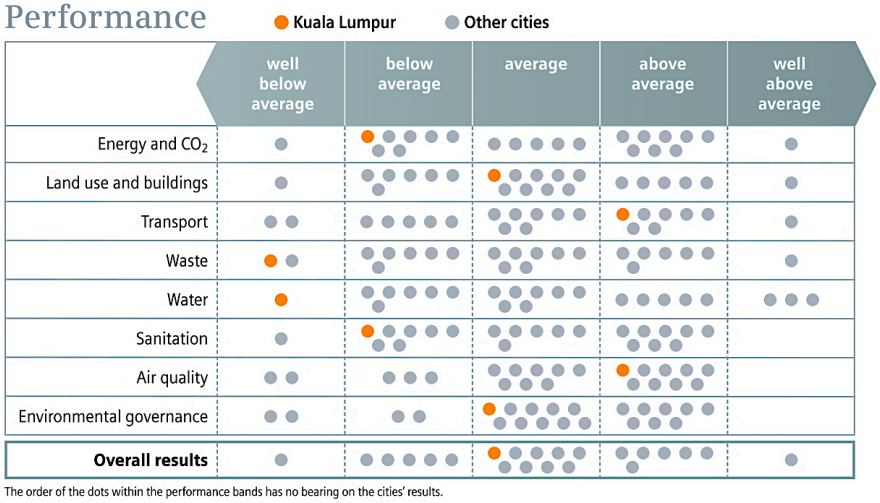

Figure 6.7 Kuala Lumpur Green City Index - Overall Performance

6.8 Green urbanism: Green Infrastructure, Liveability and Walkability

Lehmann (2010a) include green infrastructure as part of key components of Green Urbanism by mean of re-conceptualising the existing cities and the system of infrastructure in the three-pillar of Green Urbanism, Energy and Materials, Water and Biodiversity and Urban Planning and Transport (Figure 6.8). The assessment of a green city environment is often dependant on the quality of its infrastructure. The availability of vivid green infrastructure every so often inviting users to be in the space (The Economist Intelligence Unit, 2012a). This is particularly true, as people use green infrastructure such as park as their recreational space and at the same time a habitat for wildlife, it is their habitat (Salleh et al., 2014). Currently, many cities are in great efforts to restore elements of green infrastructures in their territories as the awareness of its importance increases (Benton-Short et al., 2017; Cheshmehzangi & Griffiths, 2014; Solecki & Welch, 1995; Swilling, 2011).

The approach in green infrastructure aims to maximise the connectivity of physical and functional spaces and at the same time heightening diverse function in terms of economic, social and social benefits (Beatley, 2009). In addition, green infrastructure is seen as able to solve many urban challenges and contributes substantially as the foundation of liveable cities that support biodiversity, human well-being (Mell, 2013) and strive for resilience through landscape diversity (Balzan, 2017; Mell, 2017). Lehmann (2010b) suggests that by reconceptualising urban infrastructure following GUP may encourage urban liveability.

In green infrastructure, greenways play significant roles as a means of connecting people and places (Ahern, 2007; Zulian, Thijssen, Gunther, & Maes, 2018). Often good connectivity between physical and functional places invited concentration of mobility (Benton-Short et al., 2017; Lennon & Scott, 2014; Mansor et al., 2012; Porse, 2018; Walmsley, 1995), in turn, encourage urban liveability (Lehmann, 2014; Lennon & Scott, 2014; Mansor et al., 2012).

Meanwhile, recent studies indicated that green infrastructure could promote urban walkability significantly (Ahern, 2007; Kuller, Farrelly, Deletic, & Bach, 2018; Lehmann, 2014; Simpson & Parker, 2018). It was discovered that resident of an urban neighbourhood within close vicinity to green space, parks and recreation places have a tendency to walk more and maintain good health as compared to those living in areas without these green spaces (Robert L. Ryan, 2018).

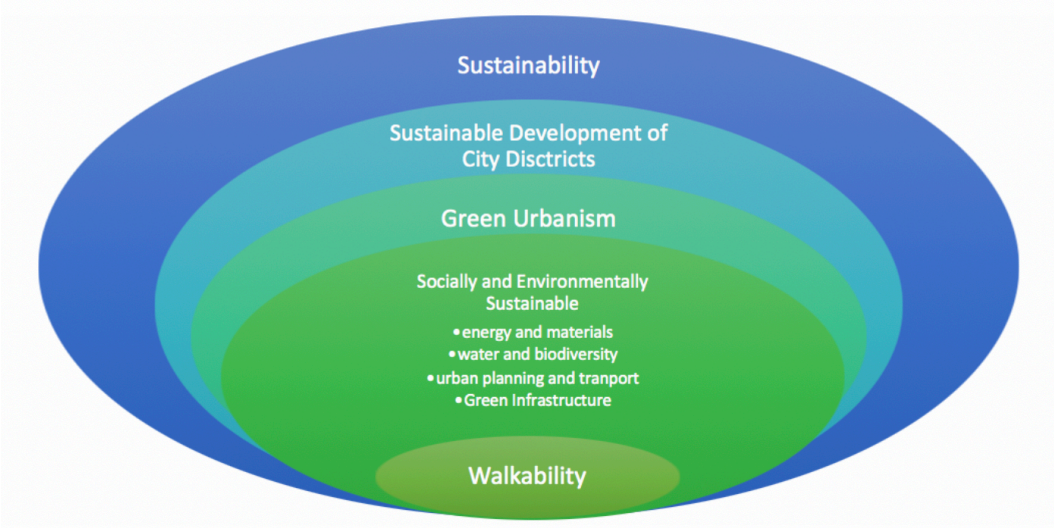

Figure 6.8 The Context of Sustainability, Green Urbanism and Walkability in Built Environment. Source: Extracted from Lehmann (2010a), pg. 1.

----- PART THREE -----

6.9 Development of Alor Setar Green Urbanism Index (ASGUI) – The Identification of Indicators

This section is divided into five (5) stages of progression as the diagram in Figure 6.9 below:

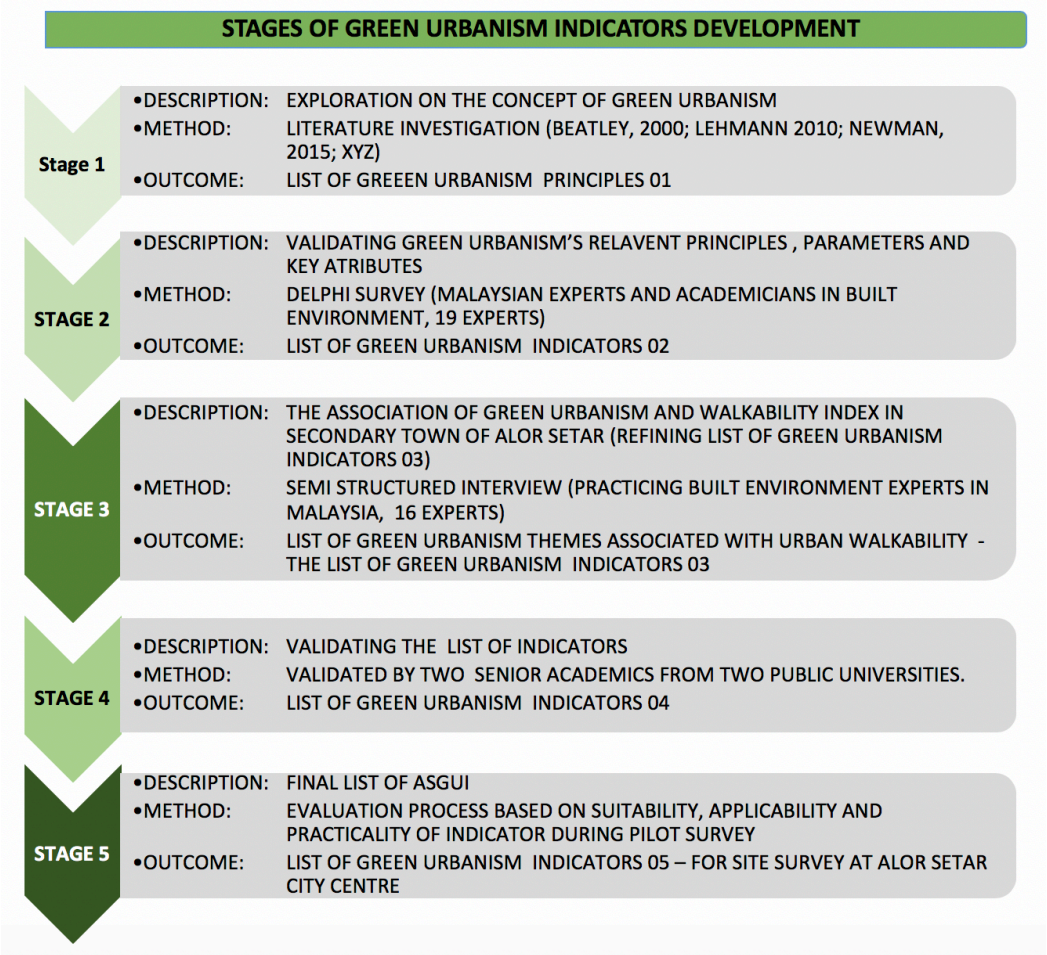

Figure 6.9 The Development of Green Urbanism Index

6.9.1 Strategy in Developing Green Urbanism index

Data acquisition for Green Urbanism employed both quantitative and qualitative approach. Figure 6.10 below summarises the data acquisition process for Green Urbanism Domain.

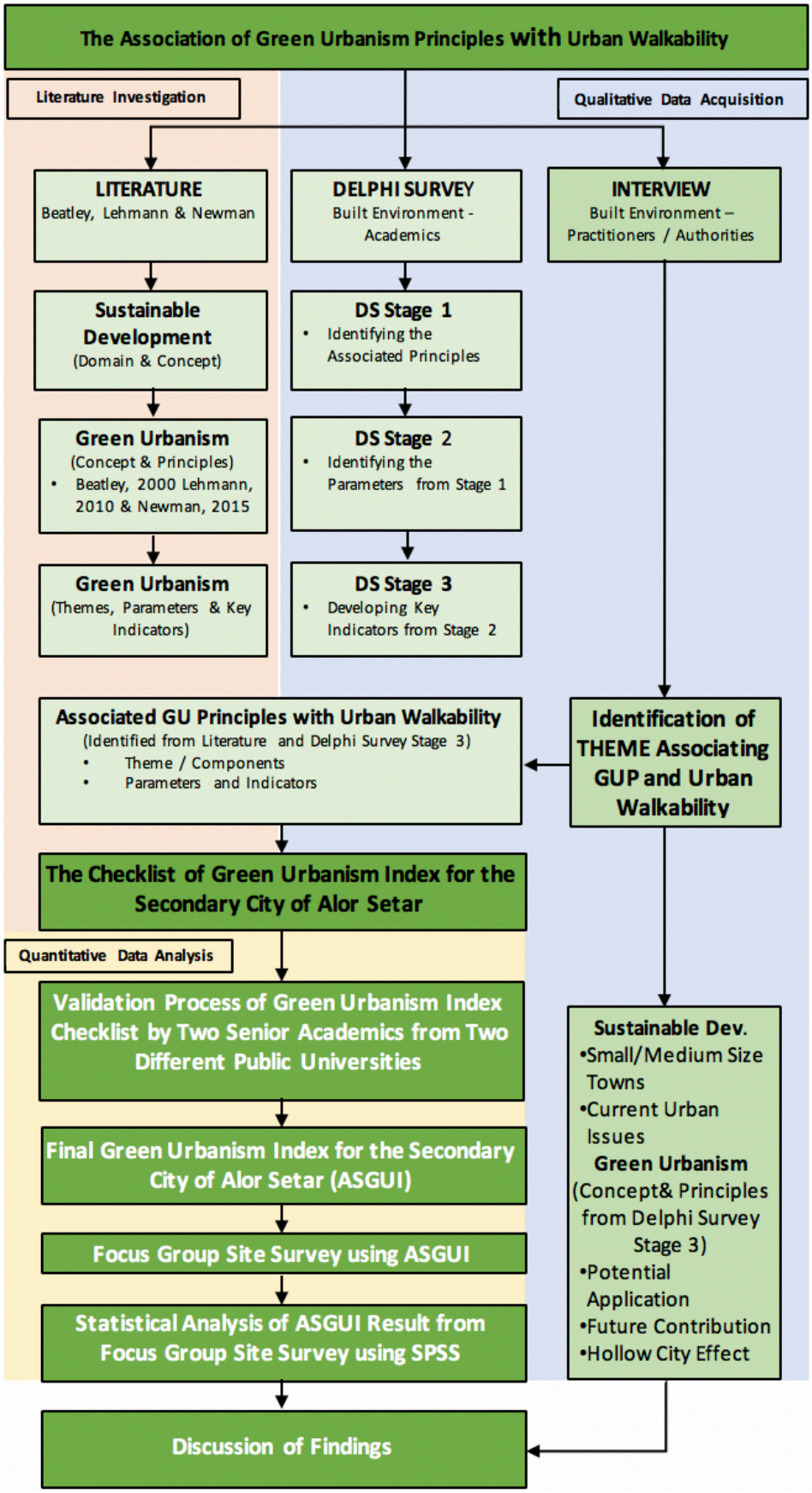

Figure 6.10 Data collection process for Green Urbanism Domain using both Qualitative and Quantitative approach

6.9.2 Literature investigation: The General Component of Green Urbanism

The initial process involved literature review consists of substantial studies from journals, articles, books and the internet for secondary data sources — the primary references as the basis of this research on GUP grounds on two publications. The first is '*Green Urbanism: Learning from European Cities*' by Timothy Beatley in 2000. Beatley expresses that concepts of sustainable development and new urbanism are inadequate on their own. Thus, he proposed a Green Urbanism concept for circular metabolism for cities along with balancing eco-cycles of cities to harmonised urban ecosystem's inputs and outputs.

Beatley also coined Green urbanism as a 'new, new urbanism' that stresses the role that cities can play with the incorporation of four urbanism components namely, *Land Use and Communities*, *Transportation and Mobility in Green-Urban Cities*, *Green and Organic Cities,* and *Governance and Economy* (as shown in Table 6.8). Beatley's purpose is to identify and describe the types of green city initiatives undertook by the European cities have undertaken through the seven case studies:

i. Sustainable land use and mobility: Paris, Freiburg, Copenhagen, Helsinki, Vitoria-Gasteiz, London;
ii. Energy and climate protection: Paris, Freiburg, Copenhagen, Helsinki, London;
iii. Climate adaptation: Paris, Venice, London;
iv. Pollution remediation: Copenhagen, Venice, Vitoria-Gasteiz, London; and
v. Green infrastructure: Paris, Copenhagen, Helsinki, Vitoria-Gasteiz, London.

Although not perfect, the European examples have incorporated strategic policies into land uses, transportations planning and development practices that lessen the ecological footprint. The European example is considered advanced as compared to the rest of the world's regions (Beatley, 2000; Lehmann, 2010b; Newman & Matan, 2013; Newman, 2010)

Table 6.8 Green Urbanism Components Extracted from Beatley, 2000

Green Urbanism Components	Description
Land use and Communities (Liveability)	Sustainable land use strategies are presented as compact urban forms with mixed-use as model by Helsinki and Stockholm. Some plans include a 'strategy of urban form that allows large blocks of open space or green wedges to come very close to urban neighbourhood' (p. 35) for instance those in Copenhagen and Amsterdam.
Transportation and Mobility in Green-Urban Cities (Urbanism)	Committed to the provision of sustainable transportation and mobility which include public transport, such as trams and high speed-rails; more `ecological' auto- mobiles; car-free cities; and biking transport with an emphasis 'building a bike-riding culture' (p. 183)
Green and Organic Cities (Nature)	Establishing ecological networks 'at the municipal level potentially comprise of ecological waterways, tree corridors, and connections between parks and open space system' (p. 200). Then, recycling and renewable energy are described with attention given to the probable circular cycling of resources and emitting wastes of the urban ecosystem. There are examples of organic buildings, eco-bridges, and practices to improve the local climate as well as conservation habitat systems as in Bologna (Italy).
Governance and Economy (Policy)	focuses on economy policies that support sustainable business, green offices, and non-government initiatives. Indicators and targets of sustainability are also presented with examples of cities that have established sustainability indicators, such as Leicester (Great Britain).

6.9.3 Literature investigation: The Principles of Green Urbanism

The second literature investigation involved the fundamental publication '*The principles of green urbanism: Transforming the city for sustainability*' by Steffen Lehmann in 2010a. In this book, Lehmann put forward the idea of creating a zero-carbon city with the implementation of responsible and smart urban developments that parallel with the ideology of the environment protection. Hence, the naissance of a systematic urban development planning called GUP that comprises 15 guiding principles and guidelines for urban development.

In addition to the two key references by Beatley and Lehmann, Newman's *'Green Urbanism Down Under: Learning from Sustainable Communities in Australia, 2012'* and *'Green Urbanism in Asia: The Emerging Green Tiger, 2013'* along with other literature. The examination of both fundamental references and literature, forms the basis for the identification of relevant GUP that can be associated with urban walkability based on Malaysian context and Alor Setar as site-specific.

Table 6.9 The Principles of Green Urbanism Extracted from Lehmann 2010b (pg. 231-240)

Green Urbanism Principles	Description
Principle 1: Climate and context	Respond well to their climate, location, orientation and context, optimizing natural assets such as sunlight and wind flow; are quiet, clean and effective, with a healthy microclimate.
Principle 2: Renewable energy for zero co2	Have reduced or have no CO2 emissions, as they are self-sufficient energy producers, powered by renewable energy sources.
Principle 3: Zero-waste city	Eliminate the concept of waste, as they are based on a closed-loop ecosystem with significant recycling, reusing, remanufacturing and composting.
Principle 4: Water	The various aspects of this principle include, in general, reducing water consumption, finding more efficient uses for water resources, ensuring good water quality and the protection of aquatic habitats. Have high water quality, practicing sensitive urban water management.
Principle 5: Landscape, gardens and urban biodiversity	Integrate landscape, gardens and green roofs to maximize urban biodiversity and mitigate the urban heat island effect. Preserves and maximizes its open spaces, natural landscapes and recreational opportunities is a more healthy and resilient city.
Principle 6: Sustainable transport and good public space: compact and poly-centric cities	Provide easy accessibility and mobility, are well inter- connected, and provide an efficient low-impact public transport system. Integrated non-motorized transport, such as cycling or walking, and, consequently, bicycle/pedestrian- friendly environments, with safe bicycle ways, free rental bike schemes and pleasant public spaces. It is important to identify the optimal transport mix that offers inter-connections for public transport and the integration of private and public transport systems.
Principle 7: Local and sustainable materials with less embodied energy	Take only their fair share of the earth's resources, using principles of urban ecology. Use regional and local materials and apply prefabricated modular construction systems.
Principle 8: Density and retrofitting of existing districts	Mixed-use urban infill projects, building the 'city above the city' by converting low density districts into higher density communities; and by revitalizing underutilized land for community benefit and affordable housing. In the compact city, every neighbourhood is sustainable and self- sufficient; and uses Energy Services Company principles for self-financing energy efficiency and in all retrofitting programs.
Principle 9: Green buildings and districts, using passive design principles	Apply new technologies such as co-generation, solar cooling and electric mobility. Use deep green passive design strategies and solar architecture concepts for all buildings, with compact massing for reduced heat gain in summer, and are laid-out and oriented in a way that keeps the buildings cool in summer, but which catches the sun in winter.
Principle 10: Liveability, healthy communities and mixed-use programs	A mixed-use (and mixed income) city delivers more social sustainability and social inclusion and helps to repopulate the city centre. Mixed land uses are particularly important as it helps reduce traffic and by integrating a diverse range of economic and cultural activities will avoid mono-functional projects, which generate a higher demand for people movement and mobility.
Principle 11: Local food and short supply chains	Have a local food supply through community gardens and urban farming and which achieve high food security and reduced 'food miles'.
Principle 12: Cultural heritages, identity and sense of place	Create a vibrant sense of place and authentic cultural identity, where existing districts are densified and make use of urban mixed-use infill projects. Balances heritage with conservation and development; fostering distinctive places with a strong sense of place, where densities are high enough to support basic public transit and walk-to retail services. Developments should create details and unique qualities of localities, demographic qualities of the populace and the creativity of the authorities and citizens; and to support the health, the activities and the safety of its residents. Cities to aim for air quality, health and pollution reduction, to foster resilient communities, to have strong public space networks and community facilities.
Principle 13: Urban governance, leadership and best practice	Applying best practice for urban governance and sustainable procurement methods. Networks and skills can be activated and utilized through engaging the local community and key stakeholders, to ensure sustainable outcomes.
Principle 14: Education, research and knowledge	The various aspects of this principle include: technical training and up-skilling, research, exchange of experiences, knowledge dissemination through research publications about ecological city theory and sustainable design.
Principle 15: Strategies for cities in developing countries	Developing and emerging countries have their own needs and require particular strategies, appropriate technology transfers and funding mechanisms to harmonizing the impacts of rapid urbanization and globalization.

Prior to Green Urbanism Index to measure urban walkability can be developed, a set of Parameters, Key Attributes and Indicators need to be extricated from the detail description of each identified principles (from Table 6.9). This process needs to be verified and validated by experts. Hence, the Delphi Survey among experts was conducted for the validating process.

6.9.4 Delphi Survey: Green Urbanism Indicators from the Principles

This method helped in obtaining consensus notion from a selected group of academics who are experts in the built environment. Delphi Survey is a form of judgment techniques proven appropriate in developing indicators or ranking of evaluation criteria (Mitchell, 1991; Rowe, Wright, & Bolger, 1991; Rowe & Wright, 1999; Skulmoski, Hartman, & Krahn, 2007; Grisham, 2009; Landeta, Barrutia, & Lertxundi, 2011, Teriman, 2012).

Although there are criticisms on the use of Delphi technique such as the biases in expert selection (Balzan, 2017; Salleh et al., 2014; Sugiyama, Carver, Koohsari, & Veitch, 2018; Weller, 2008)Winkler and Moser, 2016; Mitchell, 1999), lack of selection of rigorous experts (Gupta & Clarke, 1996; Landeta, 2006; Winkler and Moser, 2016; Mushonga et al., 2018) and its inability to garner result of clinical-type accuracy (Grisham, 2009, pg. 125).

The Delphi technique is beneficial when other methods are not adequate or appropriate for data collection. (Linstone & Turoff, 1975, p.4-6). In addition, this established technique of harnessing judgement from a selected group of experts has the flexibility as a decision-aiding tool when there lacking or even unknown evident or knowledge in regard to issues of interest (Mitchell, 1991; Rowe & Wright, 1999; Adler & Ziglio, 1996; Murphy et al., 1998, Teriman, 2012). Figure 6.11 below highlights the comparison of four types of Delphi technique.

	Classical Delphi	Policy Delphi	Decision Delphi	Ranking-type Delphi
Focus	Facts	Ideas	Decisions that influence future directions	Rankings
Goal	Create consensus	Define & differentiate views	Prepare & support decisions	Identify & rank key issues
Panelists	Unbiased experts	Lobbyists	Decision makers	Experts
Participants	Need many panelists (in relation to the complexity of the questions asked)	Consider all relevant groups with many participants	Cover a high percentage of the relevant decision makers	Number of panelists should not be too large (in order to facilitate consensus)
Common uses	In the natural sciences and engineering where underlying physical "laws of nature" guide experts' answers	In social and political contexts to analyze policy issues	In context where a small, well-defined group have decision making power	In business to guide future management action or research agendas

Figure 6.11 Comparison of Delphi Types
Source: Paré, Cameron, Poba-Nzaou, & Templier (2013, pg.208)

a. Number of experts

There are no specific rules on the ideal number of the panel of experts in the Delphi Survey as it can range between 4 to 3000, although Linstone &Turoff (1975) suggested seven. Johnson (1976) in (Thangaratinam & Redman, 2005) stated that:

> '...it has been found that average group error drops rapidly as the number in the Delphi group is increased to about eight to twelve. After reaching a number of about thirteen to fifteen, the average group error decreases very little with each additional member. Thus, a Delphi user could feel fairly safe in choosing a group size of ten to twelve.'

Okoli & Pawlowski (2004) are in the opinion that 10-18 expert is sufficient and further highlight that the number of experts in Delphi group size does not depend on statistical power, but instead on group dynamics for reaching a consensus among experts. Paliwoda (1983) suggested 18 panel of experts is appropriate as it caused fewer conflicts and manageable however Zarghami, Azemati, Fatourehchi, & Karamloo (2018) were in the opinion that the ideal range is 10 – 50 experts. In this research, the panel of experts involved are 19, and it is worth to note that these experts made a good range of expertise, experience and qualifications with some being active researchers, with consideration of the strengths and weaknesses (Table 6.10) of employing the method.

Table 6.10 The Strength and Weaknesses of Delphi Survey Technique

Strengths	Weaknesses
1. The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis. 2. The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience and expertise. 3. More individuals are needed than can effectively interact in a face-to-face exchange. 4. Time and cost make frequent group meetings infeasible. 5. The efficiency of face-to-face meetings can be increased by a supplemental group communication process. 6. Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured. 7. The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality ("bandwagon effect").	1. Imposing monitor views and preconceptions of a problem upon the respondent group by over specifying the structure of the Delphi and not allowing for contribution of other perspectives related to the problem. 2. Assuming that Delphi can be a surrogate for all other human communications in a given situation. 3. Poor techniques of summarizing and presenting the group response and ensuring common interpretations of the evaluation scales utilized in the exercise. 4. Ignoring and not exploring disagreement so that discouraged dissenters drop out and an artificial consensus is generated 5. Understanding the demanding nature of a Delphi and the fact that the respondents should be recognized as consultants and properly compensated for their time if the Delphi is not an integral part of their job function.

Source: Linstone & Turoff (1975, p.4-6)

b. Establishing Consensus of Agreement in Delphi Survey

The identification of association GUP with urban walkability in the Three-stages of Delphi Survey was based on unanimity of agreement amongst the expert participants. Previous research highlighted that there are several methods in determining the consensus of agreement;

i) Standard Deviation - ordering items that achieved equal composite scores (top two items) on the scales used. For example, an item with a lower standard deviation ranked higher in priority than that with a similar score but with a higher standard deviation (Martin & Manley, 2018; Price, Blacketer, & Brownlee, 2018).

ii) Interquartile Range - to identify the position of the middle half of the scores in the distribution by identifying the difference between the first quartile and the third quartile (Martin & Manley, 2018; Price, Blacketer, & Brownlee, 2018).

iii) Group Mean Score - to identify the mass distribution of data on the ordinal scales, specifically for elements that obtained an IQR = 1 and a $\mu x \approx 3$ (Bordt, 2018; Martin & Manley, 2018).

iv) Cut-off Points – The value of percentage considered as consensus had been reached was arbitrarily set at either 66.7%, 75%, 80% or 100% agreement amongst participants (Lau, 2010; Watson, Watson, Ackerman, & Gronvall, 2017).

In order to verify the indicators for green urbanism and its association with urban walkability, a Delphi Survey was carried out involving professionals and academia. Table 6.11 below indicate the detail of panel of experts participated in the Delphi Survey.

Table 6.11 Panel of Experts Participated in Delphi Survey

	Participant	Background & Expertise	Qualification	Year of experience
1	SRL1	Architecture	PhD	10 – 15yrs
2	SRL2	Landscape Architecture	PhD	< 15yrs
3	SRL3	Architecture	PhD	< 15yrs
4	SRL4	Landscape Architecture	PhD	5 - 10yrs
5	SRL5	Urban Design	PhD	< 15yrs
6	SRL6	Architecture	PhD	10 – 15yrs
7	SRL12	Urban Design	PhD	10 – 15yrs
8	SRL7	Landscape Architecture	MA	10 – 15yrs
9	SRL8	Urban Design	MA	10 – 15yrs
10	SRL9	Urban Design	MA	10 – 15yrs
11	SRL10	Urban Design	MA	10 – 15yrs
12	SRL11	Landscape Architecture	MA	10 – 15yrs
13	SRL13	Urban Design	MA	10 – 15yrs
14	SRL14	Landscape Architecture	MA	10 – 15yrs
15	L1	Landscape Architecture	MA	5 - 10yrs
16	L2	Urban Design	MA	5 - 10yrs
17	L3	Landscape Architecture	MA	5 - 10yrs
18	L4	Landscape Architecture	MA	5 - 10yrs
19	L5	Landscape Architecture	MA	5 - 10yrs

No one method of data gathering is inherently better than another (Akesson & Canavera, 2017; Almeland, Lindford, Berg, & Hansson, 2018; Lerner et al., 2014; Mohile et al., 2015; Molina-Garrido et al., 2018; Teriman, 2012), each data collection method is more effective by triangulation with another method as means of internal data validity, credibility and authenticity (O'Leary, 2017).

c. The Delphi Survey was divided into Three Stages:

i. Stage 1: Individual identification of Green Urbanism Principles (GUP) that are related to urban walkability

The Stage 1 of the survey involved academics in the built environment who are familiar with the city of Alor Setar and agreed to participate in all three stages of the survey, out of 30 nominated academicians suggested by the Faculty of Architecture, Planning and Surveying, UiTM Perak, only 19 academics met the criteria. A checklist survey sheets containing all 15 GUP and basic description explaining each of the principles were sent out to participants (refer Appendix: GU-1). The participants were asked to select any principle/s that to them are related to urban walkability based on their expertise, knowledge and experience. All of the respondent survey forms were then calculated for the Percentage of Consensus of Agreement. This research employed a cut-off point of 66.7% as the minimum percentage of consensus of agreement on how much homogeneity there is in the ratings and were selected for the next stage of the survey. (Refer Chapter 8, section 8.2 for detail calculation)

ii. Stage 2: Group examination and discussion of the MOST selected principles (from Stage 1) together with its detail content for relevancy. To extract and list as many as possible indicators from the detailed content of the selected principles.

In the course of Stage 2, the selected principles were accompanied with detail description and explanation of its content in the form of and articles from selected authors. All participants from stage 1 were to participate in a group discourse to establish the associated theme for each principle, a list of Parameters and Key Attributes as a preliminary stage in formulating the Green Urbanism index for Alor Setar. The suitable themes, parameters and potential indicators were decided and calculated using the Percentage of Consensus of Agreement with a cut-off point of 66.7%. (Refer Chapter 8, section 8.3 for detail calculation)

iii. Stage 3: Assessing the selected indicators (from Stage 2) to finally create a list of Key Indicators that associate Green Urbanism Quality with urban walkability (GUQ).

All the listed indicators were then discussed in Stage 3 of the Delphi Survey. At this point, all the listed indicators were tabled and discussed its validity, association and significant for field works. The final list of *Key Indicators* was produced after a series of omissions,

additions and alterations to the list for any redundancy, repetition and out of context indicators. This process was necessary to ensure the validity and richness of the data (Creswell, 2018; Miles et al., 1994). The final list of identified indicators was then verified two additional senior academics from two different public universities. The two senior academics were asked to rate the final list according to the 5-point Likert scale to identify the relevance and level of importance. The outcome from the rating process was analysed using SPSS software ver. 24 for Cohen's Kappa value of Inter-rater Correlation Coefficient. (Refer Chapter 8, section 8.4 for detail calculation)

6.9.5 Data Collection Form and Calculations

The final list of Green Urbanism Indicators was then developed as per validation from the two senior academicians in Stage 3 Delphi Survey, in the form of a complete checklist. The checklist is labelled as ASGUI which include the four associated principles, relevant parameters, key attributes and the indicators, with 5-point Likert Scale for categories (1 being Very Poor to 5 being Very Good) as means of measures which detailed in Chapter 5, sub-heading 5.10.3. This index was used by members of focus groups used during field works in assessing Green Urbanism quality (GUQ) in Bandaraya Alor Setar (refer Table 8.30).

To normalise the data input, each groups' input ranks of indicators for all stretches, of each route, were calculated for Raw Average Values. These values were then finalised as Fixed Rounded Values. Next, all Fixed Rounded Values (of each indicator) were sum up across row 1-58 to determine the total value known as 'Observed Value'. For ease of interpretation, the Observed Value was then converted using the Percentage Of Maximum Possible (POMP) score, where 0 and 100 represented the lowest and highest possible scale scores, respectively (Teriman, 2012). The final POMP scores of each route were to be compared with the Adjusted Value (Table 6.12) for categories of Green Urbanism Quality. The conversion of observed value (from rank scale to percentage form) permits ease of interpretation (Cohen et al., 2010) and later parallel comparison with ASWI result based on Adjusted Value Standard Range of Walkability and Green Urbanism Measure. The POMP formula for calculation is as follow;

$$\text{ASGUI POMP Score} = \frac{\text{Total Observed value} - \text{Minimum value}}{\text{Maximum possible value} - \text{Minimum value}} \times 100$$

The calculated POMP score were corresponding to a rating percentage system from 0 (lowest score) to 100 (highest score) known as adjusted value (Bourassa, Tackman, Mehl, & Sbarra, 2019; Egilson, Jakobsdóttir, Ólafsson, & Leósdóttir, 2017; Pirrone et al., 2019) as Table 6.12 below.

Table 6.12 Adjusted Value for Standard Range of Green Urbanism Quality (GUQ)

POMP Score Range	Green Urbanism Quality Status
0 - 20	Very Poor Green Urbanism Quality
21 – 40	Poor Green Urbanism Quality
41 – 60	Moderate Green Urbanism Quality
61 – 80	Good Green Urbanism Quality
81 – 100	Very Good Green Urbanism Quality

6.10 Association of Green Urbanism and Urban Walkability – Semi-structured Interview

To further understand and as a form of validation on the potential association of GUP and urban walkability, Semi-structured interviews were carried out involving built environment professionals, practitioners, senior academicians, policymakers, professionals in the local authorities and professional body's representatives. This Semi-structured Interview was designed as a strategy to establish familiarity and understanding of both walkability and Green urbanism concepts. Subsequently, the interview help ascertained the potential benefits of Green Urbanism applications to urban walkability and urban environment.

Initially, 20 professionals have agreed to be interviewed, but the number fell to 16 (Table 6.13) owed to the issues of work commitment, busy schedule and availability during the time frame.

Table 6.13 Participants in the Semi-structured Interview from the Built Environment Professionals and Practitioners.

	REF. CODE	POSITION	DIVISION	YEARS OF EXPERIENCE / AGE	EDUCATION BACKGROUND
1	SM (PB1)	Vice President,	Professional Body 1	20 (15 - 20) / 46	-Dip in Landscape Architecture -BA in Landscape Architecture -MA in Landscape Architecture -PhD. Built Environment -Chartered Landscape Architect
2	ZR (TP1)	Principal Planner,	Town Planner 1	15 (11 - 15) / 44	-BA in Town & Regional Planning -Chartered Town Planner
3	SS (UP1)	Principal Urban Planner & Director,	Urban Planner 2	23 (>20) / 56	-Dip. In Architecture -BA in Town & Regional Planning -Chartered Town Planner
4	MZZ (PM1)	Deputy Director,	Policy Maker 1	23 (>20) / 49	-Dip in Town & Regional Planning, -BA in Landscape Architecture, -MA in Landscape Architecture
5	ZA (LA1)	Director & Head Urban Designer,	Landscape Architect 1	22 (>20) / 48	-Dip in Town & Regional Planning, -BA in Landscape Architecture -Chartered Landscape Architect
6	HKO (PM2)	State Director & Landscape Architect,	Policy Maker 2	20 (15 - 20) / 46	-Dip in Landscape Architecture -BA in Landscape Architecture -Chartered Landscape Architect
7	RSN (UP2)	Deputy Director (Special Project),	Urban Planner 2	15 (11 - 15) / 42	-Dip in Town & Regional Planning, -BA in Town & Regional Planning
8	IZS (AR1)	Head Architect,	Architect 1	28 (>20) / 53	-Dip in Architecture -BA in Architecture
9	PKK (AC1)	Retired Professor & Visiting Professor	Academic 1	38 (>20) / 65	-Dip in Architecture -BA in Architecture -MA in Landscape Architecture
10	PIS (AC2)	Post Graduate Director, Academician / Landscape Architect / Urban Planner,	Academic 2	26 (>20) /56	-Dip in Architecture -BA in Landscape Architecture -MA in Landscape Architecture -PhD. Architecture / Built Environment
11	CRS (TP2)	Senior Researcher & Urban Planner,	Town Planner 2	21 (>20) / 48	-BA in Town & Regional Planning -MA in Town & Regional Planning -PhD. Urban Planning
12	FSM (TP3)	Town Planner Policy Evaluation and International Research Unit,	Town Planner 3	12 (11 – 15) / 38	-Dip in Town & Regional Planning, -BA in Town & Regional Planning -MA in Urban Planning
13	NAI (PM3)	(Retired) Head Department & Town Planner,	Policy Maker 3	36 (>20) / 63	-Dip in Town & Regional Planning, -BA in Town & Regional Planning -MA in Town Planning -Chartered Town Planner
14	AA (EE1)	Sr. Environmental Engineer / Project Manager,	Environmental Engineer 1	20 (15 - 20) / 46	-BA in Civil Engineering -MA in Environmental Science -Professional Engineer (Environmental Assessment & Management))
15	PCE (LA2)	Managing Director / Landscape Architect & Urban Designer,	Landscape Architect 2	23 (>20) / 49	-BA in Architecture -MA in Landscape Architecture -Chartered Landscape Architect
16	MSR (AR2)	Director & Architect, Urban Designer	Architect 2	21 (>20) / 48	-BA in Architecture -Post Grad Dip in Architecture -MA in Urban Design -Chartered Architect

6.10.1 Intended Outcome from the Interviews

During the Semi-structured Interview sessions, interviewees were asked a set of question designed as strategies to established;

i) Current issues in Sustainable Development in Malaysia.
ii) Range of understanding of the term of walkable environment, persuasive elements, attributes of a walkable town and influential environmental attributes.
iii) Range of understanding of Green urbanism concept, its application in Malaysia and contributions towards the urban built environment.
iv) Understanding and familiarity of GUP in general; The associating Themes or classifications with GUP and urban walkability.
v) Understanding and familiarity of the four GUP associated with urban walkability (findings from stage 3 of Delphi Survey; Principles 5, 6, 10 and 12).
vi) Cultural influence o walkability.
vii) The benefit of Green urbanism application in Malaysian towns and cities.
viii) Potential of Green urbanism application to counter hollowing-out problems in Malaysian cities, and
ix) Arising issues and recommendations.

Thematic analysis to identify common topics, ideas and patterns using word frequency and word cloud in NVIVO 12 were employed to distinguish the main theme of GUP that can be associated with urban walkability. The findings also helped in validating the ASGUI and ASWI checklist. The outcome of the interviews is also covered in Chapter 8, under section 8.5, where the findings will be applied as a formed of verification on the conclusion of the survey's findings and discussions.

6.11 Summary of the Chapter

The chapter is divided into three parts; the first part presents the literature study on the concept of Green urbanism. The evolution of Green Urbanism drew back to Sir Ebenezer Howard, the proponent of the Garden City Concept in 1902 and stemmed into various modern concepts at present. The study was made to understand that the term Green Urbanism carries the plethora of definition with wide-ranging meaning. Out of 39

definitions from various authors, this study proposed that the definition of green urbanism for this study revolves around four pivotal themes:

- Nature – refers to the fundamental or integral aspects, characters and the qualities of the environment, attentive to 'human-nature' synergetic relationships with smart management of energy and materials.
- Urbanism – refers to the imprint and consequences of economic, geographic, political and physical development of the built environment.
- Culture and Identity – includes the issues pertaining to the social, cultural and historical aspects of the built environment.
- Liveability - the factors that add up to a community's quality of life including the built and natural environments, accessibility and connectivity, economic prosperity, social stability and equity, educational opportunity, entertainment and recreation possibilities.

The second part of the chapter deals with the development of Alor Setar Green Urbanism index (ASGUI) from the measurement of Green Urbanism Quality (GUQ), the identification of indicator and the assessment process. The third part of the chapter presents the process of developing ASGUI employing the Three-stage Delphi Survey. The method of calculation for Stage 1 and 2 of Delphi was Percentage of Consensus of Agreement with a cut-off point of 66.7%. The Stage 3 Delphi objective is to develop a list of indicators for the purpose of field works. The final list of indicators was to be validated by two senior academics and calculated for Cohen's Kappa value of Inter-rater Correlation Coefficient. The collected data and detail analysis for ASGUI were presented in Chapter 8. The following chapter discusses the urban walkability, the influencing factors and the development of ASGUI.

Chapter 7

URBAN WALKABILITY AND THE INFLUENCING FACTORS

7.0 Introduction

This chapter discusses the influencing factors for urban walkability in accordance with survey findings in Alor Setar as the case study area. The intent of this chapter is to present the collected data from a justifiable process. This chapter is divided into seven sections. The first section provides a brief introduction to the case study area; the second section presents the routes covered and the division of road stretches (the survey routes executed by focus group survey). The third section discusses the procedure of validating each indicator in measuring its latent variables (Parameters) derived from ASWI using Three--steps validation process.

The fourth section presents the result of a statistical test for the validation procedures in justifying urban walkability index assessment. The fifth section explains the purpose of the survey, result presentation stages and the calculation method. The sixth section deliberates the result findings of Alor Setar Walkability Index (ASWI), and the final section is the summary of the chapter and highlights the content of the succeeding chapter.



Figure 7.1 Keymap of ASWI and ASGUI Measuring Routes: Main Routes and Stretches

Legend (for keymap in Figure 7.1)

Stretch	Route	Distance
	Lebuhraya Darul Aman	
1	Jalan Tambang Badak Junction – Jalan Mahdali Junction	0.397 km
2	Jalan Mahdali Junction – Jalan Kampung Perak Junction	0.282 km
3	Jalan Kampung Perak Junction – Jalan Tunku Yaakob Junction	0.300 km
4	Jalan Tunku Yaakob Junction – Sultan Abdul Halim Bridge	0.335 km
5	Jalan Penjara Lama	0.165 km
6	Jalan Dato' Dr Cheah Toon Lok	0.156 km
7	Jalan Tunku Yaakob (from Sultan Abdul Halim Bridge Junction – Jalan Penjara Lama	0.327 km
8	Jalan Tunku Yaakob (from Jalan Penjara Lama– Lebuhraya Darul Aman	0.218 km
	Total Distance	**2.180 km**
	Jalan Tunku Ibrahim	
1	Jalan Kolam Air Junction – Jalan Sultan Badlishah Junction	0.225 km
2	Jalan Sultan Badlishah Junction – Pekan Rabu Complex	0.150 km

3	Pekan Rabu Complex – Jalan Raja Junction	0.215 km
4	Jalan Raja Junction – Lebuhraya Darul Aman Junction	0.150 km
	Total Distance	**0.790 km**
	Jalan Langgar	
1	Jalan Stesen Junction – Jalan Sehala Junction	0.300 km
2	Jalan Sehala Junction – Jalan Limbong Kapal Junction	0.195 km
3	Jalan Limbong Kapal Junction – Jalan Raja Junction	0.200 km
4	Jalan Raja Junction (Jalan Penjara Lama) – Jalan Sultan Muhammad Jiwa Junction	0.150 km
	Total Distance	**0.845 km**
	Jalan Sultan Badlishah	
1	Jalan Teluk Wan Jah Roundabout – Jalan Istana Lama Junction	0.315 km
2	Jalan Istana Lama Junction – Jalan Sultan Badlishah Roundabout	0.270 km
3	Jalan Sultan Badlishah Roundabout – Jalan Mahsuri Junction	0.225 km
4	Jalan Mahsuri Junction (Jalan Selamat) – Jalan Langgar Junction	0.180 km
5	Jalan Sultan Badlishah/Jalan Kolam Air – Jalan Langgar Junction	0.425 km
6	Jalan Kota – Jalan Mahsuri	0.250 km
7	Jalan Mahsuri Junction/Lorong Padi – Jalan Tunku Ibrahim Junction	0.150 km
	Total Distance	**1.815 km**

7.2 The Assessment of Urban Walkability Using ASWI

In order to have a justifiable assessment of urban walkability, the parameters and its indicators must be tested for validity. This research employed the Three-steps validation process, which the objective is to test the validity of each indicator in measuring its latent variables (Parameters) from the developed list in ASWI. Table 7.1 showcase the details steps of each testing.

Table 7.1 Statistical test to validate Parameter and its Indicators

	Objective	Statistical Test	Description
Step 1	Analysis of dimension reduction factor	i) Bartlett Test of Sphericity	To test validity of Parameter (Latent variable) and Indicators. - Very Important for analysis of variance, based from the mixed classification, age, background and profession of Focus Group's volunteer. The Bartlett test is to verify the assumption that variances are equal across all four Focus Groups.
		ii) Kaiser-Meyer-Olkin (KMO)	To Measure of Sampling Adequacy (MSA)
Step 2	Analysis of correlation between indicators.	i) Kaiser-Meyer-Olkin (KMO)	Measure of Sampling Adequacy (MSA) testing is to identify correlation between indicators.
Step 3	Analysis to determine correlation between each indicator and latent variable.	i) Principal Component Analysis: Component Matrix	To identify correlation of indicators and parameters by means of data reduction method.

7.2.1 The Procedure of Validity Test

Sample of detail testing procedures to validate Parameter A and its indicators following the three steps as listed in Table 7.1 is detailed below;

a. Step 1: Analyse-dimension reduction factor

Output 1 SPSS:
Table 7.2 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.741
Bartlett's Test of Sphericity	Approx. Chi-Square	141.413
	df	36
	Sig.	.000

[*The KMO measures the sampling adequacy (which determines if the responses given with the sample are adequate or not) which should be close than 0.5 for a satisfactory factor analysis to proceed. Kaiser (1974) recommend: i) value close to 0.5 (value for KMO) as minimum (barely accepted), ii) values between 0.7-0.8 acceptable, iii) values above 0.9 are superb.*]

Analysis of Output – 1 are as follows:

i) Output 1 shows the correlation test between all indicators and its latent variable using KMO's (*Kaiser-Meyer-Olkin & Bartlett's test*) method. In this case, the correlation value is 0.74 (more than 0.5). In addition, the comparison of the sizes of the observed correlation coefficients to the sizes of the partial correlation coefficients for the sum of analysis variables is 74.1% and proven to be reliable because it is above 70%.
Conclusion: there is a **STRONG CORRELATION** between indicators and its latent variable. It also supported by p-value > 0.05 (0.000 > 0.05).

ii) Also, using the *Null Hypothesis (H_0),* the statistical test is presented as follows:
H_o: There is no correlation between indicators a1, a2, a3, a4, a5 & a6 and its Parameter.
H_1: There is a significant correlation between indicators a1, a2, a3, a4, a5 & a6 and Parameter.
Hypotheses Testing: Since the p-value is 0.000, which is **LESS** than 0.05 (5%), then H_0 can be REJECTED.
Conclusion: There is a **SIGNIFICANT CORRELATION** between indicators and its latent variable.

b. Step 2: Analysis of correlation between indicators.

Output 2 SPSS:

Table 7.3 Anti-image Matrices

		Motorist Behaviour and Respect to Pedestrian	Walking Path Modal Conflict (Pedestrian/ Vehicular Conflict)	Availability of Crossings	Crossing Safety (Traffic Light / Traffic Management at Crossing)	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	Perception of Security from Crime
Anti-image Covariance	Motorist Behaviour and Respect to Pedestrian	.248	-.182	.025	.058	-.069	.002
	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	-.182	.205	-.064	-.031	.037	.009
	Availability of Crossings	.025	-.064	.187	-.064	.005	-.095
	Crossing Safety (Traffic Light / Traffic Management at Crossing)	.058	-.031	-.064	.109	-.087	.029
	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	-.069	.037	.005	-.087	.122	-.074
	Perception of Security from Crime	.002	.009	-.095	.029	-.074	.380
Anti-image Correlation	Motorist Behaviour and Respect to Pedestrian	.577[a]	-.806	.115	.352	-.395	.008
	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	-.806	.686[a]	-.326	-.205	.232	.032
	Availability of Crossings	.115	-.326	.847[a]	-.450	.034	-.358
	Crossing Safety (Traffic Light / Traffic Management at Crossing)	.352	-.205	-.450	.717[a]	-.755	.141
	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	-.395	.232	.034	-.755	.738[a]	-.342
	Perception of Security from Crime	.008	.032	-.358	.141	-.342	.879[a]

a. Measures of Sampling Adequacy (MSA)

Analysis of Output - 2 is as follows:

All green values indicated the correlation test between indicators using MSA (measures of sampling adequacy) method. The result shows a **STRONG CORRELATION** among the majority of the indicators. For example, indicator 6 (a6 - Perception of Security from Crime) has the strongest correlation (0.879) with other indicators.

c. Step 3: determine correlation between each indicator and latent variable.

Output 3 SPSS:

Table 7.4 Component Matrix

Component Matrix	Component	
	1	2
Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	.912	-.235
Availability of Crossings	.912	-.183
Crossing Safety (Traffic Light / Traffic Management at Crossing)	.891	-.327
Perception of Security from Crime	.815	-.274
Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	.778	.556
Motorist Behaviour and Respect to Pedestrian	.640	.723
Extraction Method: Principal Component Analysis.		
a. 2 components extracted.		

Analysis of Output - 3 is as follows:

Based on Output 3, all of the indicators in Component – column 1 show the correlation value of more than 0.5, thus indicating a **VERY STRONG CORRELATION** to the latent variable.

7.3 Validity of Parameter and Its Indicators

7.3.1 Parameter A – SENSE OF SAFETY AND SECURITY

Result for Parameter A:

From SPSS Outputs 1-3, we can determine the validity of each indicator to the latent variable by using correlation values as presented in Table 7.5.

Table 7.5 SPSS data output for Parameter A. SENSE OF SAFETY AND SECURITY

PARA-METER	INDICATOR	BARTLET T TEST	KMO	MSA	COMPONENT MATRIX.
A. SENSE OF SAFETY AND SECURITY	a1 Motorist Behaviour and Respect to Pedestrian	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.577 (Strong, because > 0.5)	0.912 (Strong, because > 0.5)
	a2 Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.686 (Strong, because > 0.5)	0.912 (Strong, because > 0.5)
	a3 Availability of Crossings	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.847 (Strong, because > 0.5)	0.891 (Strong, because > 0.5)
	a4 Crossing Safety (Traffic Light / Traffic Management at Crossing)	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.717 (Strong, because > 0.5)	0.815 (Strong, because > 0.5)
	a5 Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.738 (Strong, because > 0.5)	0.778 (Strong, because > 0.5)
	a6 Perception of Security from Crime	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.879 (Strong, because > 0.5)	0.640 (Strong, because > 0.5)

Based on the three methods of testing, the result for **Parameter A** showed that all indicators are valid and significant to measure the latent variable (parameter).

7.3.2 Parameter B – CONVENIENT

Result for Parameter B:

From Outputs 1-3, we can determine the validity of each indicator to the latent variable by using correlation values as presented in Table 7.6.

Table 7.6 SPSS data output for Parameter B. CONVENIENCE

PARA-METER	INDICATOR	BARTLETT TEST	KMO	MSA	COMPONENT MATRIX.
B. CONVENIENCE	B1 Distance of The Route to Where They Were Going	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.742 (Strong, because > 0.5)	0.870 (Strong, because > 0.5)
	B2 Walking Comfort Due to Pedestrian Congestion	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.794 (Strong, because > 0.5)	0.965 (Strong, because > 0.5)
	B3 Pedestrian Amenities (Cover, Public Toilets, Street Lights)	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.680 (Strong, because > 0.5)	0.860 (Strong, because < 0.5)
	B4 Maintenance and Cleanliness of Walking Path	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.699 (Strong, because > 0.5)	0.883 (Strong, because > 0.5)
	B5 Availability of Walking Paths	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.717 (Strong, because > 0.5)	0.847 (Strong, because > 0.5)
	B6 Distance from One Pedestrian Crossing Point to Another	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.678 (Strong, because > 0.5)	0.726 (Strong, because > 0.5)
	B7 Path Coverage (Area of Coverage)	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.664 (Strong, because > 0.5)	0.802 (Strong, because > 0.5)
	B8 Shared Street Network and Connectivity/Alternative Routes	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.738 (Strong, because > 0.5)	0.664 (Strong, because > 0.5)
	B9 Obstructions Free Walking Path (Permanent/Temporary–to Note)	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.349 (Weak, because < 0.5)	0.169 (Weak, because < 0.5)
	B10 Existence and Quality of Facilities for Blind and Disabled Persons	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.662 (Strong, because > 0.5)	0.660 (Strong, because > 0.5)
	B11 Disability Infrastructure	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.240 (Weak, because < 0.5)	-0.099 (Weak, because < 0.5)
	B12 Walking Path (Width and Safety)	0.000 p < 0.05 (Significant)	0.648 (Strong, because > 0.5)	0.710 (Strong, because > 0.5)	0.907 (Strong, because > 0.5)

Based on the three methods of testing, the result for **Parameter B** showed that all indicators are valid and significant to measure the latent variable (parameter).

7.3.3 Parameter C – VISUAL INTEREST & ATTRACTIVENESS

Result for Parameter C:

From Outputs 1-3, we can determine the validity of each indicator to the latent variable by using correlation values as presented in Table 7.7.

Table 7.7 SPSS data output for Parameter C. VISUAL INTEREST & ATTRACTIVENESS

PARA-METER	INDICATOR	BARTLETT TEST	KMO	MSA	COMPONENT MATRIX.
C. VISUAL INTEREST & ATTRACTIVENESS	C1 Streetscape and Pedestrian Facilities	0.000 p < 0.05 (Significant)	0.844 (Strong, because > 0.5)	0.804 (Strong, because > 0.5)	0.919 (Strong, because > 0.5)
	C2 Walking Path (Quality of Design and Materials)	0.000 p < 0.05 (Significant)	0.844 (Strong, because > 0.5)	0.842 (Strong, because > 0.5)	0.890 (Strong, because > 0.5)
	C3 Trees and Vegetation	0.000 p < 0.05 (Significant)	0.844 (Strong, because > 0.5)	0.853 (Strong, because > 0.5)	0.891 (Strong, because < 0.5)
	C4 Diverse of Activities Along Path	0.000 p < 0.05 (Significant)	0.844 (Strong, because > 0.5)	0.891 (Strong, because > 0.5)	0.839 (Strong, because > 0.5)

Based on the three methods of testing, the result for **Parameter C** showed that all indicators are valid and significant to measure the latent variable (parameter).

7.3.4 Parameter D – COMFORT

Result for Parameter D:

From Outputs 1-3, we can determine the validity of each indicator to the latent variable by using correlation values as presented in Table 7.8.

Table 7.8 SPSS data output for Parameter D. COMFORT

PARA-METER	INDICATOR	BARTLETT TEST	KMO	MSA	COMPONENT MATRIX.
D. COMFORT	D1 Street Lighting	0.000 p < 0.05 (Significant)	0.783 (Strong, because > 0.5)	0.885 (Strong, because > 0.5)	0.860 (Strong, because > 0.5)
	D2 Resting Amenities	0.000 p < 0.05 (Significant)	0. 783 (Strong, because > 0.5)	0.963 (Strong, because > 0.5)	0.688 (Strong, because > 0.5)
	D3 Smell, Air Quality & Cleanliness	0.000 p < 0.05 (Significant)	0. 783 (Strong, because > 0.5)	0.715 (Strong, because > 0.5)	0.824 (Strong, because < 0.5)
	D4 Shelter	0.000 p < 0.05 (Significant)	0. 783 (Strong, because > 0.5)	0.717 (Strong, because > 0.5)	0.944 (Strong, because > 0.5)
	D5 Shadow of Trees/Buildings/ Elements	0.000 p < 0.05 (Significant)	0.783 (Strong, because > 0.5)	0.767 (Strong, because > 0.5)	0.869 (Strong, because > 0.5)

Based on the three methods of testing, the result for **Parameter D** showed that all indicators are valid and significant to measure the latent variable (parameter).

7.3.5 Parameter E – USES AND ACTIVITIES

Result for Parameter E: USES AND ACTIVITIES

From Outputs 1-3, we can determine the validity of each indicator to the latent variable by using correlation values as presented in Table 7.8 below.

Table 7.9 SPSS data output for Parameter E. USES AND ACTIVITIES

PARA-METER	INDICATOR	BARTLETT TEST	KMO	MSA	COMPONENT MATRIX.
E. USES AND ACTIVITIES	E1 Land Use Mix	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.774 (Strong, because > 0.5)	0.796 (Strong, because > 0.5)
	E2 Active Traditional Shop Houses	0.000 p < 0.05 (Significant)	0. 741 (Strong, because > 0.5)	0.857 (Strong, because > 0.5)	0.864 (Strong, because > 0.5)
	E3 Active Commercial Modern Building	0.000 p < 0.05 (Significant)	0. 741 (Strong, because > 0.5)	0.763 (Strong, because > 0.5)	0.847 (Strong, because < 0.5)
	E4 Active Heritage and Cultural Street	0.000 p < 0.05 (Significant)	0. 741 (Strong, because > 0.5)	0.609 (Strong, because > 0.5)	0.706 (Strong, because > 0.5)
	E5 Active Commercial Street	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.654 (Strong, because > 0.5)	0.791 (Strong, because > 0.5)
	E6 Mix of Residential and Commercial Street	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.698 (Strong, because > 0.5)	0.814 (Strong, because > 0.5)
	E7 Availability of Mix Public Transport	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.785 (Strong, because > 0.5)	0.457 (Weak, because < 0.5)
	E8 Public Space and Recreation/ Parks and Greenery	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.736 (Strong, because > 0.5)	0.858 (Strong, because > 0.5)
	E9 Urban Open Space/Plaza	0.000 p < 0.05 (Significant)	0.741 (Strong, because > 0.5)	0.806 (Strong, because > 0.5)	0.916 (Strong, because > 0.5)

Based on the three methods of testing, the result for **Parameter E** showed that all indicators are valid and significant to measure the latent variable (parameter).

7.4 Alor Setar Walkability Index (ASWI) – Measuring Urban Walkability

The parameters and indicators of ASWI were statistically validated, as discussed in section 7.3, which endorsed its reliability. ASWI was used during surveys by the selected focus groups members to measure urban walkability on-site was proven to be comprehensive, applicable and straightforward. The results of ASWI were analysed mainly to a) identify the status of urban walkability in Alor Setar city centre, b) identify the status of urban walkability at all four selected routes, c) to later (during the discussion

of ASGUI) compare and associate the result of urban walkability using ASWI at all four routes with the result of Green Urbanism application using ASGUI. The results of the survey are presented in three stages;

1) The sample of ASWI calculations based on road groups, stretches and routes.

2) Urban Walkability in Alor Setar City Centre - The overall result of ASWI.

3) The contributing factors for urban walkability based on the parameters of the individual route.

7.4.1 The Sample of ASWI Calculations

(*The result used in this sample of calculation is derived from the data by Group 2 at all four stretches along Jalan Tunku Ibrahim*)

The survey involved four focus groups covering four selected routes. Each route was divided into several stretches for easy and systematic index measurement. Thus, the ASWI calculations started with 'each group calculating the index for all stretches in a route' before the final route average index can be derived. Table 7.10 below illustrates the calculation of route average by Focus Group 2 for Jalan Tunku Ibrahim.

Table 7.10 Sample Calculation of Urban Walkability at Jalan Tunku Ibrahim (Group 2: Four Stretches)

Road Name: JALAN TUNKU IBRAHIM Group: 2 Survey Area No.: 4/4(y)

Time: AM Peak Hour: YES Weather Condition: CLEAR SKY

(1 = Poor) → (5 = Good)

	Surveyed Road Stretch (x)	1	2	3	4	5	6	7	8	9	10	(#)	Stretch 1	Stretch 2	Stretch 3	Stretch 4	Avearge
													(Σ(x*length*y*count)/#)/y				
	A. SENSE OF SAFETY AND SECURITY																
1	Motorist Behaviour and Respect to Pedestrian	3	3	3	3								41.85	29.93	41.76	9.68	30.80
2	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	3	4	4	4								41.85	39.90	55.69	12.90	37.58
3	Availability of Crossings	3	3	4	3								41.85	29.93	55.69	9.68	34.28
4	Crossing Safety (Traffic Light / Traffic Management at Crossing)	3	3	3	3								41.85	29.93	41.76	9.68	30.80
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	4	3	4	3								55.80	29.93	55.69	9.68	37.77
6	Perception of Security from Crime	3	3	4	4								41.85	29.93	55.69	12.90	35.09
	B. CONVENIENCE																
7	Distance of The Route to Where They Were Going	3	4	4	4								41.85	39.90	55.69	12.90	37.58
8	Walking Comfort Due to Pedestrian Congestion	4	3	4	4								55.80	29.93	55.69	12.90	38.58
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	4	3	3	3								55.80	29.93	41.76	9.68	34.29
10	Maintenance and Cleanliness of Walking Path	4	4	4	4								55.80	39.90	55.69	12.90	41.07
11	Availability of Walking Paths	5	5	4	4								69.75	49.88	55.69	12.90	47.05
12	Distance from One Pedestrian Crossing Point to Another	3	3	3	3								41.85	29.93	41.76	9.68	30.80
13	Path Coverage (Area of Coverage)	4	4	4	4								55.80	39.90	55.69	12.90	41.07
14	Shared Street Network and Connectivity/Alternative Routes	3	4	3	3								41.85	39.90	41.76	9.68	33.30
15	Obstructions Free Walking Path (Permanent/Temporary -to Note)	3	3	2	3								41.85	29.93	27.84	9.68	27.32
16	Existence and Quality of Facilities for Blind and Disabled Persons/Disability Infrastructure	2	2	2	2								27.90	19.95	27.84	6.45	20.54
17	Walking Path (Width and Safety)	4	4	4	4								55.80	39.90	55.69	12.90	41.07
	C. VISUAL INTEREST & ATTRACTIVENESS																
18	Streetscape and Pedestrian Facilities	4	3	3	3								55.80	29.93	41.76	9.68	34.29
19	Walking Path (Quality of Design and Materials)	4	4	4	4								55.80	39.90	55.69	12.90	41.07
20	Trees and Vegetation	4	4	3	3								55.80	39.90	41.76	9.68	36.78
21	Diverse of Activities Along Path	3	3	3	2								41.85	29.93	41.76	6.45	30.00
	D. COMFORT																
22	Street Lighting	3	3	4	4								41.85	29.93	55.69	12.90	35.09
23	Resting Amenities	3	3	3	2								41.85	29.93	41.76	6.45	30.00
24	Smell, Air Quality & Cleanliness	3	3	3	3								41.85	29.93	41.76	9.68	30.80
25	Shelter	4	3	4	2								55.80	29.93	55.69	6.45	36.97
26	Shadow Of Trees/Buildings/Elements	4	4	3	3								55.80	39.90	41.76	9.68	36.78
	E. USES AND ACTIVITIES																
27	Land Use Mix	3	3	3	3								41.85	29.93	41.76	9.68	30.80
28	Active Traditional Shop Houses	3	3	3	2								41.85	29.93	41.76	6.45	30.00
29	Active Commercial Modern Building	4	3	3	3								55.80	29.93	41.76	9.68	34.29
30	Active Heritage and Cultural Street	2	3	3	4								27.90	29.93	41.76	12.90	28.12
31	Active Commercial Street	4	4	3	3								55.80	39.90	41.76	9.68	36.78
32	Mix of Residential and Commercial Street	2	2	3	2								27.90	19.95	41.76	6.45	24.02
33	Availability of Mix Public Transport	3	3	4	4								41.85	29.93	55.69	12.90	35.09
34	Public Space and Recreation/ Parks and Greenery	3	2	3	3								41.85	19.95	41.76	9.68	28.31
35	Urban Open Space/Plaza	4	2	3	2								55.80	19.95	41.76	6.45	30.99
	Pedestrian *Count*	248	266	259	86								1646.10	1127.18	1628.79	364.75	1189.20
	Length of Surveyed Stretch (km)	0.225	0.150	0.215	0.150								47.03	32.21	46.54	10.14	33.98

Unweighted Average

Next was the measurement of ASWI for each route by calculating the average index from all four groups. Table 7.11 highlights the ASWI unweighted average calculation from all groups for Jalan Tunku Ibrahim. The unweighted value of urban walkability index at Jalan Tunku Ibrahim is **32.86**.

a. Calculation of a Route Unweighted Average

Overall Unweighted Average for each route is calculated by dividing total measured value with the total number of indicators. For example, the Total measured value for Lebuhraya Darul Aman (LDA) is 2660.58, and total numbers of indicators are 35; thus, the calculation is;

$$\text{Unweighted Average} = \frac{\text{total measured value of a route}}{\text{total number of indicators}}$$

$$\text{Unweighted Average} = \frac{2660.58}{35}$$

$$\textbf{Unweighted Average for LDA} = \mathbf{76.02}$$

b. Calculation of a Parameter

Unweighted Average calculation for each parameter of a route is meant for a comparison between parameters only. It helps to indicate the level of contribution of that particular parameter towards urban walkability at a particular route. It is not to be calculated as part of overall Unweighted Average value for a route. For example, the Total measured value for Parameter A. Sense of Safety and Security at Lebuhraya Darul Aman (LDA) is 397.47, and total numbers of indicators under Parameter A are six; thus, the calculation is;

$$\text{Unweighted Average} = \frac{\text{total measured value of a parameter}}{\text{total number of indicators under a parameter}}$$

$$\text{Unweighted Average} = \frac{397.47}{6}$$

$$\textbf{Unweighted Average for Parameter A} = \mathbf{66.25}$$

Table 7.11 Sample Calculation of Urban Walkability at Jalan Tunku Ibrahim (All groups Average)

	PARAMETER AND INDICATOR	Group 1	Group 2	Group 3	Group 4	Total Ave. All Groups
		Average of Four Stretches				
	A. SENSE OF SAFETY AND SECURITY					
1	Motorist Behaviour and Respect to Pedestrian	26.52	30.80	21.34	21.34	25.00
2	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	31.61	37.58	25.63	34.28	32.28
3	Availability of Crossings	20.54	34.28	26.52	30.80	28.03
4	Crossing Safety (Traffic Light / Traffic Management at Crossing)	28.31	30.80	21.34	30.80	27.81
5	Clearly Mark Pedestrian Crossing Line / Zebra Line /Raised Road Level (Flushed) Crossing	41.07	37.77	34.28	30.80	35.98
6	Perception of Security from Crime	41.07	35.09	43.49	33.30	38.24
	B. CONVENIENCE					
7	Distance of The Route to Where They Were Going	37.58	37.58	37.59	34.29	36.76
8	Walking Comfort Due to Pedestrian Congestion	34.28	38.58	35.09	35.09	35.76
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	30.00	34.29	38.58	34.29	34.29
10	Maintenance and Cleanliness of Walking Path	35.09	41.07	41.07	41.07	39.58
11	Availability of Walking Paths	41.07	47.05	44.56	48.04	45.18
12	Distance from One Pedestrian Crossing Point to Another	24.02	30.80	26.52	30.80	28.03
13	Path Coverage (Area of Coverage)	40.27	41.07	36.78	40.27	39.60
14	Shared Street Network and Connectivity/Alternative Routes	34.28	33.30	30.80	37.77	34.04
15	Obstructions Free Walking Path (Permanent/Temporary–to Note)	28.13	27.32	36.78	35.10	31.83
16	Existence and Quality of Facilities for Blind and Disabled Persons/Disability Infrastructure	20.54	20.54	10.27	10.27	15.40
17	Walking Path (Width and Safety)	38.58	41.07	40.27	34.29	38.55
	C. VISUAL INTEREST & ATTRACTIVENESS					
18	Streetscape and Pedestrian Facilities	31.79	34.29	36.78	34.29	34.29
19	Walking Path (Quality of Design and Materials)	34.29	41.07	40.27	41.07	39.17
20	Trees and Vegetation	35.98	36.78	34.29	38.58	36.41
21	Diverse of Activities Along Path	32.49	30.00	30.00	34.29	31.69
	D. COMFORT					
22	Street Lighting	28.31	35.09	34.29	36.78	33.62
23	Resting Amenities	27.50	30.00	26.52	30.00	28.50
24	Smell, Air Quality & Cleanliness	37.77	30.80	30.80	30.80	32.55
25	Shelter	36.97	36.97	33.48	33.48	35.22
26	Shadow Of Trees/Buildings/Elements	34.29	36.78	43.75	36.78	37.90
	E. USES AND ACTIVITIES					
27	Land Use Mix	31.61	30.80	30.00	30.80	30.80
28	Active Traditional Shop Houses	36.78	30.00	26.52	30.80	31.03
29	Active Commercial Modern Building	35.10	34.29	40.27	30.80	35.11
30	Active Heritage and Cultural Street	31.61	28.12	30.80	27.32	29.46
31	Active Commercial Street	36.78	36.78	34.29	40.27	37.03
32	Mix of Residential and Commercial Street	26.51	24.02	20.54	20.54	22.90
33	Availability of Mix Public Transport	37.76	35.09	19.54	31.60	31.00
34	Public Space and Recreation/ Parks and Greenery	30.99	28.31	28.31	24.83	28.11
35	Urban Open Space/Plaza	28.50	30.99	24.83	30.80	28.78
	total	1147.98	1189.20	1116.19	1146.47	1149.96
	Unweighted Average	32.80	33.98	31.89	32.76	32.86

7.5 Urban Walkability in Alor Setar City Centre – The Overall Result of ASWI

Table 7.12 below indicated the overall result of ASWI for all four routes as executed by focus group survey. The unweighted average value, as shown at the bottom of the table signified that of all the four routes, Lebuhraya Darul Aman gets the highest urban walkability value of **76.02**. Second is Jalan Sultan Badlishah with urban walkability value of **58.87**, followed by Jalan Tunku Ibrahim with urban walkability value of **32.86**. Jalan Langgar received the least urban walkability value of **12.05**.

Table 7.12 Alor Setar Walkability Index (ASWI)- The Overall Result of ALL Four Routes

SURVEYED ROAD STRETCHES – Average all Four Groups					
	Parameters and Indicators	**Lebuhraya Darul Aman**	**Jalan Tunku Ibrahim**	**Jalan Langgar**	**Jalan Sultan Badlishah**
	A. SENSE OF SAFETY AND SECURITY				
1	Motorist Behaviour and Respect to Pedestrian	62.38	25.00	9.41	45.60
2	Walking Path Modal Conflict (Ped. / Veh. Conflict)	73.86	32.28	9.88	58.13
3	Availability of Crossings	63.18	28.03	7.33	42.19
4	Crossing Safety (Traffic Light / Traffic Mgmt. at Crossing)	44.56	27.81	7.33	38.19
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	58.68	35.98	7.94	42.16
6	Perception of Security from Crime	94.80	38.24	12.24	68.24
	B. CONVENIENCE				
7	Distance of The Route to Where They Were Going	74.10	36.76	9.23	76.66
8	Walking Comfort Due to Pedestrian Congestion	75.09	35.76	13.19	75.38
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	78.14	34.29	8.76	56.55
10	Maintenance and Cleanliness of Walking Path	84.83	39.58	12.63	83.71
11	Availability of Walking Paths	93.54	45.18	15.73	68.76
12	Distance from One Pedestrian Crossing Point to Another	57.40	28.03	12.55	33.81
13	Path Coverage (Area of Coverage)	81.20	39.60	14.31	71.01
14	Shared Street Network & Connectivity/Alternative Routes	83.96	34.04	15.45	62.59
15	Obstructions Free Walking Path (Permanent/Temporary)	72.76	31.83	9.67	52.69
16	Existence and Quality of Facilities for Blind and Disabled Persons/Disability Infrastructure	55.25	15.40	4.68	27.42
17	Walking Path (Width and Safety)	69.44	38.55	11.13	62.33
	C. VISUAL INTEREST & ATTRACTIVENESS				
18	Streetscape and Pedestrian Facilities	80.02	34.29	12.21	62.48
19	Walking Path (Quality of Design and Materials)	75.27	39.17	10.76	59.01
20	Trees and Vegetation	72.74	36.41	11.62	74.83
21	Diverse of Activities Along Path	88.14	31.69	12.83	69.48
	D. COMFORT				
22	Street Lighting	91.59	33.62	15.55	71.29
23	Resting Amenities	55.18	28.50	8.25	50.02
24	Smell, Air Quality & Cleanliness	69.41	32.55	12.67	87.34
25	Shelter	53.68	35.22	15.74	49.48
26	Shadow of Trees/Buildings/Elements	80.38	37.90	18.02	80.01
	E. USES AND ACTIVITIES				
27	Land Use Mix	83.16	30.80	15.86	74.56
28	Active Traditional Shop Houses	75.58	31.03	17.74	42.35
29	Active Commercial Modern Building	84.84	35.11	13.68	78.58
30	Active Heritage and Cultural Street	82.15	29.46	13.17	36.61
31	Active Commercial Street	94.46	37.03	19.27	89.53
32	Mix of Residential and Commercial Street	95.22	22.90	10.09	37.11
33	Availability of Mix Public Transport	81.13	31.00	13.52	43.03
34	Public Space and Recreation/ Parks and Greenery	92.24	28.11	8.92	46.94
35	Urban Open Space/Plaza	82.21	28.78	10.27	42.35
	TOTAL PER ROUTE	2660.58	**1149.96**	**421.63**	**2060.39**
	UNWEIGHTED AVERAGE	**76.02**	**32.86**	**12.05**	**58.87**

The above results were calculated using pedestrian counts for each route by taking the average of cumulative pedestrian counts at all counting stations during the scheduled time frame.

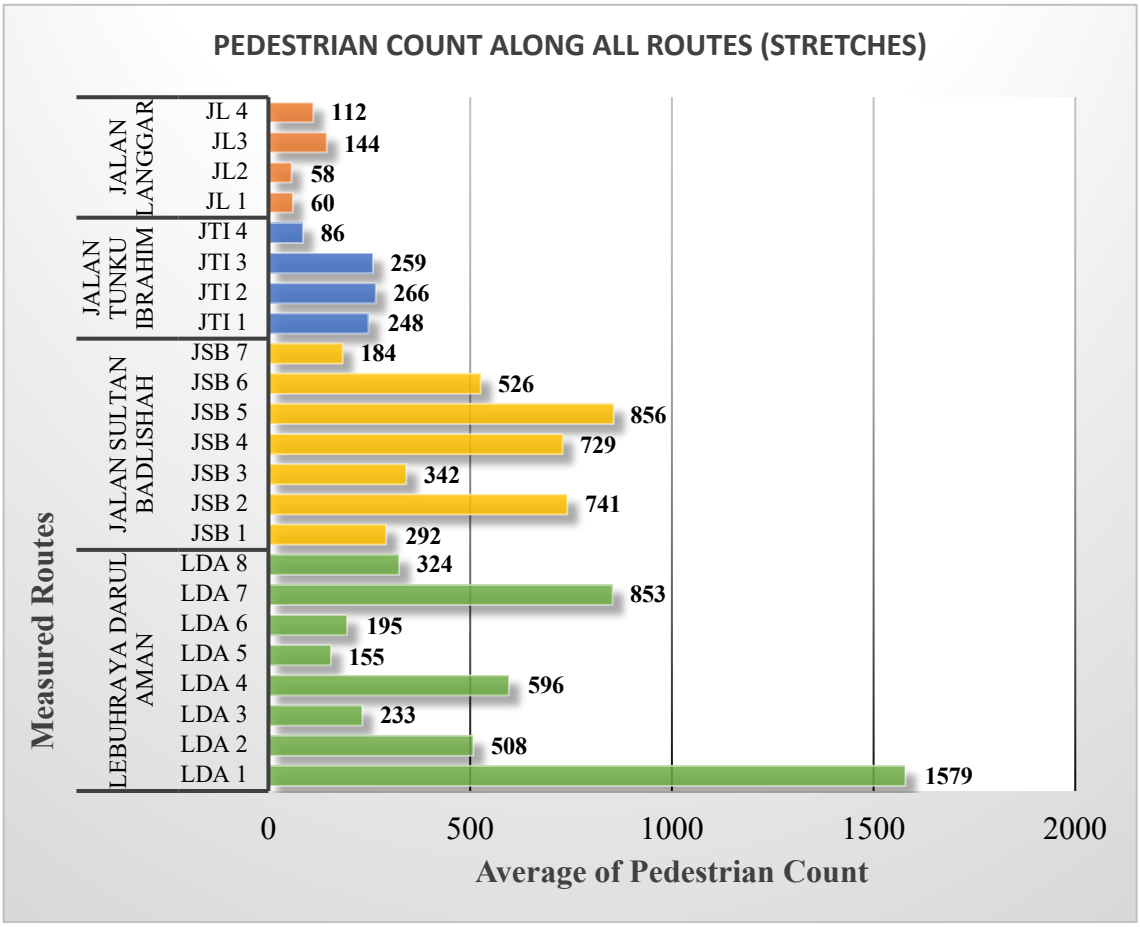

Figure 7.2 Pedestrian Counts for Each Routes measured

The unweighted average of each route was compared with the adjusted value of walkability (ref. Table 5.18 at Section 5.10.4) as detailed in Table 7.13 below. According to the range of adjusted value, the walkability status for Lebuhraya Darul Aman is 'Good Condition and Walkability' and the most walkable among the four routes. Second is Jalan Sultan Badlishah which walkability status is 'Moderate Condition and Walkability'. The walkability status for Jalan Tunku Ibrahim and Jalan Langgar were 'Poor Condition and Walkability' and 'Very Poor Condition and Walkability' respectively.

Table 7.13 Route Walkability Status Based on Range of Adjusted Value

Rank	Route	Unweighted Average Value	Range of Adjusted Value	Walkability Status
1	Lebuhraya Darul Aman	76.02	61 – 80	Good Condition and Walkability
2	Jalan Sultan Badlishah	58.87	41 – 60	Moderate Condition and Walkability
3	Jalan Tunku Ibrahim	32.86	21 – 40	Poor Condition and Walkability
4	Jalan Langgar	12.05	0 - 20	Very Poor Condition and Walkability

7.5.1 Lebuhraya Darul Aman - The Contributing Factors for Urban Walkability

Lebuhraya Darul Aman route was divided into eight stretches (ref. Figure 7.1) with a total length of 2.18 km, including sections in Pekan Cina. Table 7.14 displays the ASWI Unweighted Average for Lebuhraya Darul Aman with an itemisation of average for individual parameters.

Table 7.14 Alor Setar Walkability Index: Walkability for Lebuhraya Darul Aman (LDA)

	PARAMETER AND INDICATOR	Average of All Four Groups	Total for Each parameter	Average for Each Parameter
	A. SENSE OF SAFETY AND SECURITY			
1	Motorist Behaviour and Respect to Pedestrian	62.38	397.47	66.25
2	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	73.86		
3	Availability of Crossings	63.18		
4	Crossing Safety (Traffic Light / Traffic Management at Crossing)	44.56		
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	58.68		
6	Perception of Security from Crime	94.80		
	B. CONVENIENCE			
7	Distance of The Route to Where They Were Going	74.10	825.72	75.07
8	Walking Comfort Due to Pedestrian Congestion	75.09		
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	78.14		
10	Maintenance and Cleanliness of Walking Path	84.83		
11	Availability of Walking Paths	93.54		
12	Distance from One Pedestrian Crossing Point to Another	57.40		
13	Path Coverage (Area of Coverage)	81.20		
14	Shared Street Network and Connectivity/Alternative Routes	83.96		
15	Obstructions Free Walking Path (Permanent/Temporary–to Note)	72.76		
16	Existence and Quality of Facilities for Blind and Disabled Persons /Disability Infrastructure	55.25		
17	Walking Path (Width and Safety)	69.44		
	C. VISUAL INTEREST & ATTRACTIVENESS			
18	Streetscape and Pedestrian Facilities	80.02	316.17	79.04
19	Walking Path (Quality of Design and Materials)	75.27		
20	Trees and Vegetation	72.74		
21	Diverse of Activities Along Path	88.14		
	D. COMFORT			
22	Street Lighting	91.59	350.24	70.05
23	Resting Amenities	55.18		
24	Smell, Air Quality & Cleanliness	69.41		
25	Shelter	53.68		
26	Shadow of Trees/Buildings/Elements	80.38		
	E. USES AND ACTIVITIES			
27	Land Use Mix	83.16	770.98	85.66
28	Active Traditional Shop Houses	75.58		
29	Active Commercial Modern Building	84.84		
30	Active Heritage and Cultural Street	82.15		
31	Active Commercial Street	94.46		
32	Mix of Residential and Commercial Street	95.22		
33	Availability of Mix Public Transport	81.13		
34	Public Space and Recreation/ Parks and Greenery	92.24		
35	Urban Open Space/Plaza	82.21		
	Total	2660.58		
	Unweighted Average of LDA	76.02		

Note:
It is important to note that the average value for each parameter were meant for comparison between the parameters only and not used in the calculation for the Unweighted Average value.

Table 7.15 Mean value (Unweighted Value) of Each Group for Lebuhraya Darul Aman

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Groups_1	35	47.04	95.91	71.40
Groups_2	35	48.72	109.63	78.55
Groups_3	35	43.74	110.77	76.10
Groups_4	35	38.76	110.77	78.02
Valid N (listwise)	35			

Table of Descriptive Statistics above displays the mean value (Unweighted Average) of each group for Lebuhraya Darul Aman. The range of value for all groups is consistent from 71.40 to 78.55.

The ASWI Unweighted Average for Lebuhraya Darul Aman is **76.02,** which is between the range **61– 80**, reflecting a **Good Condition and Walkability** as per the table of Adjusted Value.

a. The Contributing Parameters Toward Urban Walkability

All parameters at Lebuhraya Darul Aman secured **GOOD** walkability value from ASWI. The contributing factor for the high walkability rating is mainly from the parameter of Uses and Activity which scores 85.66 and the lowest contributing parameter for walkability at Lebuhraya Darul Aman is Sense of safety and Security with the score only 66.25. Figure 7.3 below showcases the high walkability value measured for all the parameters at Lebuhraya Darul Aman.

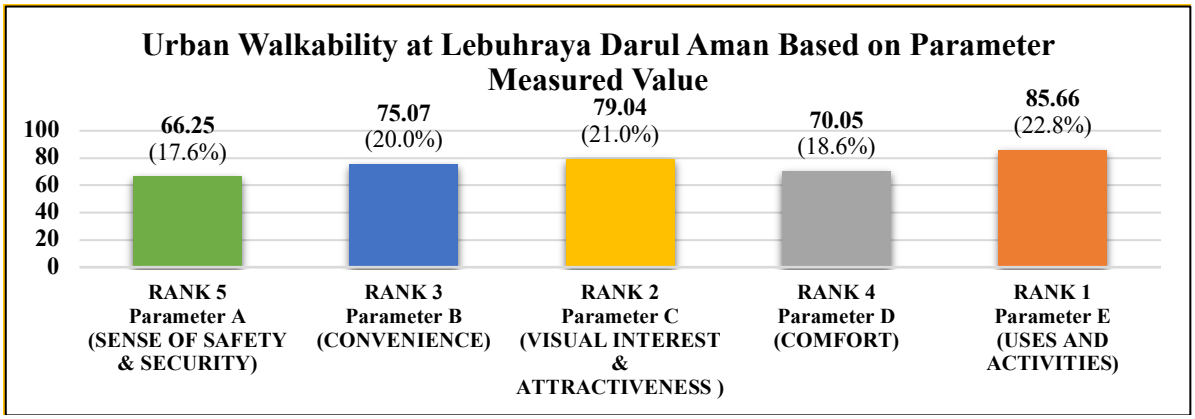

Figure 7.3 Rank of Parameter for Urban Walkability at Lebuhraya Darul Aman

Among the contributing factors of each parameters are:

i. USES AND ACTIVITIES

Lebuhraya Darul Aman (LDA) is an active street with many uses and activities along the pedestrian walkways. The findings concluded that the Parameter: Uses and Activity score value of 85.66, contributed highly to the walkability of Lebuhraya Darul Aman were due to reasons as stated below;

Table 7.16 Summary of Findings for Parameter: Uses and Activity at Lebuhraya Darul Aman

Indicator's No.	Indicator in parameter	The Findings
27	Land Use Mix	The availability of many shops, cafes, restaurants, residentials, government institutions and other businesses
28	Active Traditional Shop Houses	Traditional shophouses especially in Pekan Cina were still in operation. These shophouses were selling household item, toys and food serving the locals which mostly are regulars.
29	Active Commercial Modern Building	The introduction of the largest shopping mall (Aman Central) has becoming the pulling factor for the locals to frequent the area. The shopping complex was the catalyst for pedestrians and the source of human movements.
30	Active Heritage and Cultural Street	The Historical Zone which is located next to Aman Central is regularly visited by both foreign and local tourists. This has made the area as a popular pedestrian zone.
31	Active Commercial Street	The rows of modern commercial buildings housing shops and offices were generating active activities along LDA. People parked their cars and walk to their destinations.
32	Mix of Residential and Commercial Street	The mixture of residential and commercial has proven to be successful in attracting users and encourage walkability.
33	Availability of Mix Public Transport	Public transportation system was lacking here. Most visitors use their own motorcycles or cars. The availability of parking spaces along the road and in front of the shops encouraging the usage of private transport. The place cramped with cars especially during lunch and peak hours.
34	Public Space & Recreation/ Parks & Greenery	The availability of public and recreational space along the river promenade acted as community space and meeting points. Locals were seen exercising and relaxing along the promenade especially in the morning and evening. Workers used this area as their resting spot and ate their lunch during lunch hour.
35	Urban Open Space / Plaza	The accessibility and readiness of urban open spaces, urban plaza and pocket parks scattered along LDA have made the route highly walkable. Resting spaces, natural shades from street planting and good pedestrian network along the route have also made it very convenience.

ii. VISUAL INTEREST & ATTRACTIVENESS

The second highest parameter that contributes to high walkability measure along Lebuhraya Darul Aman is Parameter: Visual Interest & Attractiveness with the score value of 79.04. The reasons, as stated in the table below, rationalise of its contribution to the result.

Table 7.17 Summary of Findings for Parameter: Visual Interest and Attractiveness at Lebuhraya Darul Aman

Indicator's No.	Indicator in parameter	The Findings
1	Streetscape and Pedestrian Facilities	The availability of properly design streetscape and pedestrian facilities along LDA had contributed to the higher value of walkability along that route. River promenade with attractive landscapes as recreational spot and community space was seen as one of the pulling factors that contributed to a high walkability around this area.
2	Walking Path (Quality of Design and Materials)	The newly improvement project funded by National Landscape Department and the state government in 2015 had proven to be successful. The walking paths on both sides of LDA were extended to the branching roads. The materials used for the pathways were of good quality, heavy duty and fitting for outdoor use. The non-slippery materials were suitable to withstand the hot sun and heavy rain.
3	Trees and Vegetation	Mature shade trees along the LDA generated a more conducive walking environment, thus encouraged pedestrians to use this route.
4	Diverse of Activities Along Path	Various activities were seen at both day and night along LDA. Licensed street vendors operated along the road near Menara Alor Setar (Alor Setar Tower) and Aman Mall. The historical ambiance along the route were very attractive with historical buildings, artefacts and portraying strong local image and identity making it a popular tourist destination. Consequently, there were toy sellers and prepacked food, drinks and snacks vendors trading at Dataran Bandar (City Plaza) near the Historical Zone. All of these activities acted as catalysts and were successful in attracting pedestrian, hence increased walkability along LDA.

iii. CONVENIENCE

The Parameter: Convenience attained the third highest score that contributed to a high walkability measure at Lebuhraya Darul Aman. This parameter has the most indicators of all parameters and contributed the score value of 75.07 towards the high walkability attributable to the findings below;

Table 7.18 Summary of Findings for Parameter: Convenience at Lebuhraya Darul Aman

Indicator's No.	Indicator in parameter	The Findings
7	Distance of The Route to Where They Were Going	Most of public places and attractions were within walking distance and well connected with walking paths.
8	Walking Comfort Due to Pedestrian Congestion	Walking paths were wide and comfortable for walking even during peak hours with the exception at Stretch 6: Jalan Dato' Dr Cheah Toon Lok and Stretch 4: Jalan Tunku Yaakob Junction – Sultan Abdul Halim Bridge with narrow pedestrian walkways of 1-1.5 meters at certain area due to space constrained.
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	Public amenities were well provided along LDA with extensive street lighting covering all pedestrian walkways. Resting and seating spaces were provided at several spots in the form of small pocket gardens. All of the shophouses especially at Pekan Cina were designed with covered walkway or five-foot way for pedestrians' comfort.
10	Maintenance and Cleanliness of Walking Path	Walking paths along LDA were clean and well maintained. Landscape areas along walking paths were also attractive, well-kept and clean.
11	Availability of Walking Paths	Walking paths were available at both sides of LDA and extended to the branching roads connecting to all nearby public places.
12	Distance from One Pedestrian Crossing Point to Another	Pedestrian crossings were provided only the traffic lights. The distance of pedestrian crossings was within walking distance but limited.
13	Path Coverage (Area of Coverage)	Walking paths were available along the route and interconnected with the surrounding area. Path coverage were also widespread.
14	Shared Street Network & Connectivity /Alternative Routes	Shared street network and connectivity were limited to the newly developed areas especially around Aman Central shopping complex and modern shop houses.
15	Obstructions Free Walking Path (Permanent/Temporary)	All walking paths were free from any obstructions. However, there were light and road signposts were being erected on the walking path at Stretch 4: Jalan Tunku Yaakob Junction – Sultan Abdul Halim Bridge due to space constrained.
16	Existence and Quality of Facilities for Blind and Disabled Persons/Disability Infrastructure	None
17	Walking Path (Width and Safety)	Most of the walking paths along and around LDA were 2-3 meters wide, thus provided comfortable and safe walking space. (with exception to stretches Stretch 6: Jalan Dato' Dr Cheah Toon Lok and Stretch 4: Jalan Tunku Yaakob Junction – Sultan Abdul Halim Bridge with narrow pedestrian walkways of 1-1.5 meters at certain area due to space constrained)

iv. COMFORT

Parameter: Comfort contributed greatly to the high walkability along Lebuhraya Darul Aman with the score value of 70.05. Among the contributing factors are;

Table 7.19 Summary of Findings for Parameter: Comfort at Lebuhraya Darul Aman

Indicator's No.	Indicator in parameter	The Findings
22	Street Lighting	Street lighting were extensive and covering all walking paths. This has made walking along LDA comfortable and safe.
23	Resting Amenities	Resting and seating spaces were provided at several spots in the form of small pocket gardens. Seating, pergolas and gazebos were provided at the park fronting Aman Central. Resting and seating spaces were also provided at Dataran Bandar (City Plaza).
24	Smell, Air Quality & Cleanliness	The level of cleanliness along LDA was high. There was no unpleasant smell and the air quality was rank as GOOD at the average of 32 AQI (Malaysian Air Quality Index based on PM_{10}).
25	Shelter	Pergolas and gazebos were provided at the park fronting Aman Central. There were informal shelters in and around public buildings and shophouses along LDA that pedestrian can take refuge if needed.
26	Shadow of Trees/Buildings/ Elements	Walking paths along LDA was considered as well shaded with mature shade trees, public buildings and also shophouses with five-foot way.

v. SENSE OF SAFETY AND SECURITY

Although the Parameter: Sense of Safety and Security was ranked fifth in contributing for the walkability along Lebuhraya Darul Aman, the score value of 66.25 is still high according to the table of adjusted value for walkability. The contributing factors are as follows;

Table 7.20 Summary of Findings for Parameter: Sense of Safety and Security at Lebuhraya Darul Aman

Indicator's No.	Indicator in parameter	The Findings
1	Motorist Behaviour and Respect to Pedestrian	Motorist were the dominant users along LDA and the level of respect towards pedestrian was considered average. Since LDA is the major road in Alor Setar, the 'perception of my right of way' were high among motorists.
2	Walking Path Modal Conflict (Ped. / Vehicle Conflict)	There were conflicts between pedestrian and motorists due to limited number of pedestrian crossing along LDA. However, the conflicts were considered minor because there are controlled pedestrian crossing at traffic lights.
3	Availability of Crossings	There were limited number of pedestrian crossing along LDA and only available at the traffic lights.
4	Crossing Safety (Traffic Light / Traffic Mgmt. at Crossing)	There were controlled pedestrian crossing at the traffic lights.
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	Marked pedestrian crossing were available at the traffic lights. Interlocking pavers as road surface materials in front of Dataran Bandar, Masjid Zahir until Jalan Tunku Yaakub Junction as a form of vehicular speed control to allow pedestrian crossing.
6	Perception of Security from Crime	Perception of security from crime was high along LDA due to separation of pedestrian walkways from the road, metal and bollards railings along walking paths, many open spaces and public areas increase public policing and the extensive provision of lighting along LDA make pedestrian feel safe from crime.

7.5.2 Jalan Tunku Ibrahim - The Contributing Factors for Urban Walkability Based on The Parameters

Jalan Tunku Ibrahim route was divided into four stretches as detailed in Figure 7.1, with a total length of 0.79 km starting from Jalan Kolam Air Junction to Lebuhraya Darul Aman junction.

Table 7.21 displays the ASWI Unweighted Average for Jalan Tunku Ibrahim with an itemisation of average for individual parameters.

Table 7.21 Alor Setar Walkability Index: Walkability for Jalan Tunku Ibrahim

	PARAMETER AND INDICATOR	Average of All Four Groups	Total for Each parameter	Average for Each Parameter
	A. SENSE OF SAFETY AND SECURITY			
1	Motorist Behaviour and Respect to Pedestrian	25.00		
2	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	32.28		
3	Availability of Crossings	28.03		
4	Crossing Safety (Traffic Light / Traffic Management at Crossing)	27.81	187.35	31.22
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	35.98		
6	Perception of Security from Crime	38.24		
	B. CONVENIENCE			
7	Distance of The Route to Where They Were Going	36.76		
8	Walking Comfort Due to Pedestrian Congestion	35.76		
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	34.29		
10	Maintenance and Cleanliness of Walking Path	39.58		
11	Availability of Walking Paths	45.18		
12	Distance from One Pedestrian Crossing Point to Another	28.03		
13	Path Coverage (Area of Coverage)	39.60	379.02	34.46
14	Shared Street Network and Connectivity/Alternative Routes	34.04		
15	Obstructions Free Walking Path (Permanent/Temporary–to Note)	31.83		
16	Existence and Quality of Facilities for Blind and Disabled Persons /Disability Infrastructure	15.40		
17	Walking Path (Width and Safety)	38.55		
	C. VISUAL INTEREST & ATTRACTIVENESS			
18	Streetscape and Pedestrian Facilities	34.29		
19	Walking Path (Quality of Design and Materials)	39.17	141.57	35.39
20	Trees and Vegetation	36.41		
21	Diverse of Activities Along Path	31.69		
	D. COMFORT			
22	Street Lighting	33.62		
23	Resting Amenities	28.50		
24	Smell, Air Quality & Cleanliness	32.55	167.80	33.56
25	Shelter	35.22		
26	Shadow Of Trees/Buildings/Elements	37.90		
	E. USES AND ACTIVITIES			
27	Land Use Mix	30.80		
28	Active Traditional Shop Houses	31.03		
29	Active Commercial Modern Building	35.11		
30	Active Heritage and Cultural Street	29.46		
31	Active Commercial Street	37.03	274.23	30.47
32	Mix of Residential and Commercial Street	22.90		
33	Availability of Mix Public Transport	31.00		
34	Public Space and Recreation/ Parks and Greenery	28.11		
35	Urban Open Space/Plaza	28.78		
	total	1149.96		
	Unweighted Average of JTI	32.86		

Note:
It is important to note that the average value for each parameter were meant for comparison between the parameters only and not used in the calculation for the Unweighted Average value.

Table 7.22 Mean value (Unweighted Value) of Each Group for Jalan Tunku Ibrahim

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Groups_1	35	21	41	32.80
Groups_2	35	21	47	33.98
Groups_3	35	10	45	31.89
Groups_4	35	10	48	32.76
Valid N (listwise)	35			

Table 7.16 of Descriptive Statistics above displays the mean value (Unweighted Average) of each group for Jalan Tunku Ibrahim. The range of value for all groups is consistent from 31.89 to 33.98.

The ASWI Unweighted Average for Jalan Tunku Ibrahim is **32.86,** which is between the range **21 – 40**, reflecting a **Poor Condition and Walkability** as per the table of Adjusted Value.

a. The Contributing Parameters Toward Urban Walkability

The finding from ASWI result at Jalan Tunku Ibrahim indicated **POOR** walkability value for all parameters. The ASWI value for this route ranging from 35.39 for Parameter: Visual Interest and Attractiveness as the highest to 31.22 for Parameter: Sense of Safety and Security as the lowest. Figure 7.4 below showcases the Poor walkability value measured for all the parameters at Jalan Tunku Ibrahim.

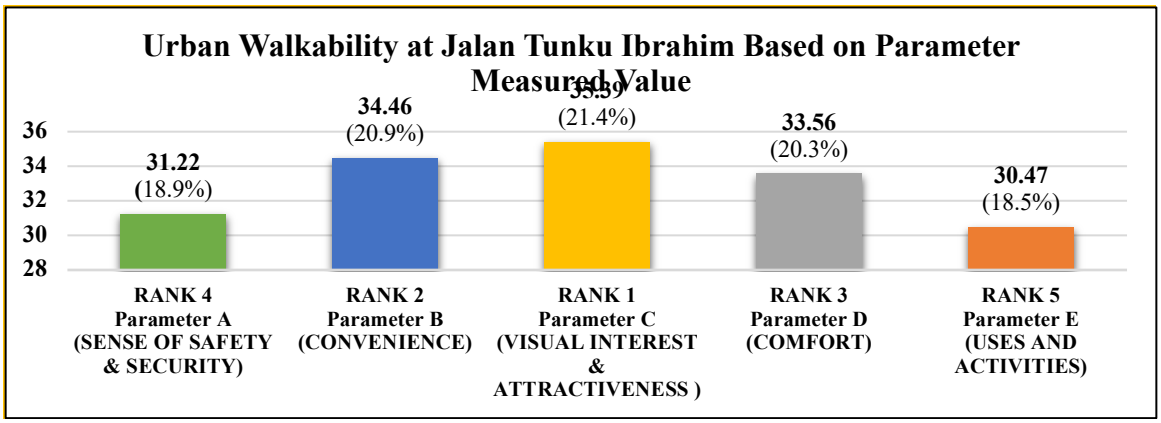

Figure 7.4 Rank of Parameter for Urban Walkability at Jalan Tunku Ibrahim

i. VISUAL INTEREST & ATTRACTIVENESS

Although this route was considered attractive with its modern landscape elements such as at Setar Walk (along Stretch 1) and pathways in front of Pekan Rabu (along Stretch 3), the Unweighted Average for this parameter was lessened due to inconsistence of visual

interest and attractive elements stretches 2 and 4 of Jalan Tunku Ibrahim. Based on Focus Group observations, this route has the potential to attract more users if visually pleasing elements and places of attraction were distributed strategically along the route.

ii. CONVENIENCE

The level of convenience was low due to several significant issues encountered by focus group members. First, the physical condition, pathways were not properly maintained with many broken and missing bricks. Secondly, Cleanliness of pathways and surrounding areas was another issue of concerned where dirt, dried leaves and rubbish were scattered on and along the walkways. Thirdly, the conflict between pedestrians with motorists was seen as serious because of a limited number of pedestrian crossing and the distance between crossing points. Fourthly, there were no facilities for the blinds and disabled people making the route very challenging for people with disabilities.

iii. COMFORT

Based on the Focus Group survey, evidently, this route lacked in resting amenities for pedestrians. There was no seating provided along this route. The only way for pedestrians to rest was at the street cafes and as a customer. The street café operators serve hot food cook on-site, thus leaving foul smell from the food waste due to improper cleaning and waste disposals.

iv. SENSE OF SAFETY AND SECURITY

There were conflicts between motorists and pedestrian especially at Stretch 1: Jalan Kolam Air Junction – Jalan Sultan Badlishah Junction. There was no proper pedestrian crossing provided at this stretch and people can be seen jaywalking and standing in the middle of the road waiting for cars to pass. Contradictorily, at Stretch 2: Jalan Sultan Badlishah Junction – Pekan Rabu Complex, a pedestrian crossing bridge with escalator was provided connecting Pekan Rabu Complex to shophouses area. However, pedestrians can still be seen crossing the road by climbing the metal railings separating pedestrian walkways from the road and not using the crossing bridge provided.

v. USES AND ACTIVITIES

This parameter was ranked fifth in contributing for the walkability along Jalan Tunku Ibrahim. This was due to the limited land use variety and lack of street activities along

this route. Low point values were given by focus groups for Land use Mixed and Mix of Residential and Commercial Street. Public spaces and Urban Open Space are also limited; as a result, pedestrian pulling factors to this route was at a low level.

7.5.3 Jalan Langgar - The Contributing Factors for Urban Walkability Based on The Parameters

Jalan Langgar route was divided into four stretches as detailed in Figure 7.1, with a total length of 0.845 km starting from Jalan Stesen Junction to Jalan Sultan Muhammad Jiwa junction. Table 7.23 displays the ASWI Unweighted Average for Jalan Langgar with an itemisation of average for individual parameters.

Table 7.23 Alor Setar Walkability Index: Walkability for Jalan Langgar

	PARAMETER AND INDICATOR	Average of All Four Groups	Total for Each parameter	Average for Each Parameter
	A. SENSE OF SAFETY AND SECURITY			
1	Motorist Behaviour and Respect to Pedestrian	9.41		
2	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	9.88		
3	Availability of Crossings	7.33		
4	Crossing Safety (Traffic Light / Traffic Management at Crossing)	7.33	54.12	9.02
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	7.94		
6	Perception of Security from Crime	12.24		
	B. CONVENIENCE			
7	Distance of The Route to Where They Were Going	9.23		
8	Walking Comfort Due to Pedestrian Congestion	13.19		
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	8.76		
10	Maintenance and Cleanliness of Walking Path	12.63		
11	Availability of Walking Paths	15.73		
12	Distance from One Pedestrian Crossing Point to Another	12.55		
13	Path Coverage (Area of Coverage)	14.31	127.34	11.58
14	Shared Street Network and Connectivity/Alternative Routes	15.45		
15	Obstructions Free Walking Path (Permanent/Temporary–to Note)	9.67		
16	Existence and Quality of Facilities for Blind and Disabled Persons /Disability Infrastructure	4.68		
17	Walking Path (Width and Safety)	11.13		
	C. VISUAL INTEREST & ATTRACTIVENESS			
18	Streetscape and Pedestrian Facilities	12.21		
19	Walking Path (Quality of Design and Materials)	10.76	47.43	11.86
20	Trees and Vegetation	11.62		
21	Diverse of Activities Along Path	12.83		
	D. COMFORT			
22	Street Lighting	15.55		
23	Resting Amenities	8.25		
24	Smell, Air Quality & Cleanliness	12.67	70.23	14.05
25	Shelter	15.74		
26	Shadow Of Trees/Buildings/Elements	18.02		
	E. USES AND ACTIVITIES			
27	Land Use Mix	15.86		
28	Active Traditional Shop Houses	17.74		
29	Active Commercial Modern Building	13.68		
30	Active Heritage and Cultural Street	13.17		
31	Active Commercial Street	19.27	122.52	13.61
32	Mix of Residential and Commercial Street	10.09		
33	Availability of Mix Public Transport	13.52		
34	Public Space and Recreation/ Parks and Greenery	8.92		
35	Urban Open Space/Plaza	10.27		
	Total	421.63		
	Unweighted Average of JL	12.05		

Note:
It is important to note that the average value for each parameter were meant for comparison between the parameters only and not used in the calculation for the Unweighted Average value.

Table 7.24 Mean value (Unweighted Value) of Each Group for Jalan Langgar

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Groups 1	35	5	21	12.40
Groups 2	35	5	19	11.63
Groups 3	35	5	19	11.94
Groups 4	35	5	19	12.21
Valid N (listwise)	35			

Table of Descriptive Statistics above displays the mean value (Unweighted Average) of each group for Jalan Langgar. The range of value for all groups is consistent from 11.64 to 12.40.

The ASWI Unweighted Average for Jalan Langgar is **12.05,** which is between the range **0 – 20**, reflecting a **Very Poor Condition and Walkability** as per the table of Adjusted Value.

a. The Contributing Parameters Toward Urban Walkability

The finding from ASWI result at Jalan Langgar indicated **VERY POOR** walkability value for all parameters. The ASWI value for this route ranging from 35.39 for Parameter: Visual Interest and Attractiveness as the highest to 31.22 for Parameter: Sense of Safety and Security as the lowest. Figure 7.5 below showcases the Poor walkability value measured for all the parameters at Jalan Langgar.

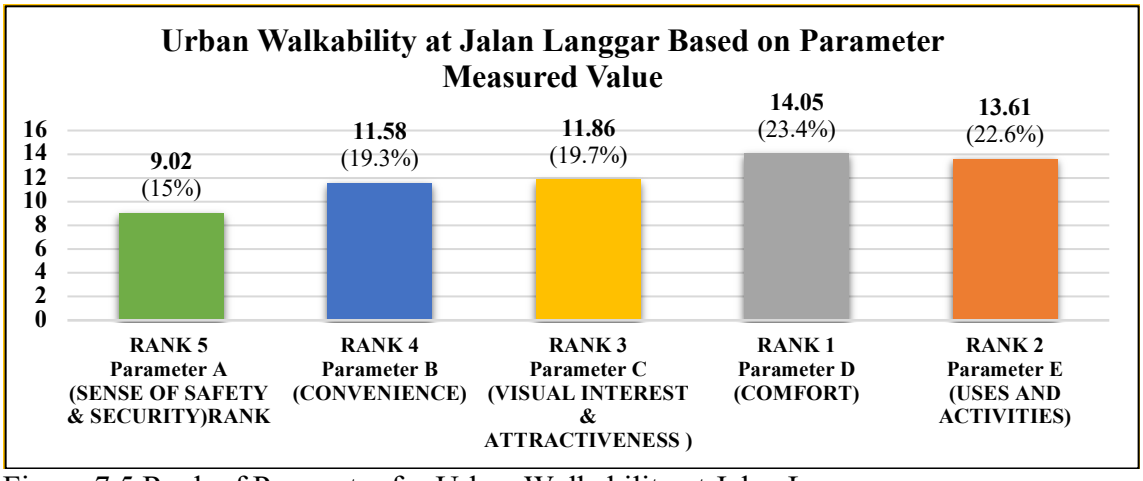

Figure 7.5 Rank of Parameter for Urban Walkability at Jalan Langgar

i. COMFORT

This parameter ranked the highest at Jalan Langgar due to the availability of street lighting along the route that promotes comfort, as suggested in literature findings. In addition, high points were also given for shelters and shadows (of buildings) at the five foot walkway that pedestrian can take refuge from heat and rains. However, low points were accorded due to foul smell, poor cleanliness and no resting amenities along the route.

ii. USES AND ACTIVITIES

There were several indicators accorded moderate to good points such as Land use Mix, Active Traditional Shophouses, Active Commercial Modern Building and Active Commercial Street (Partial) by focus group members. The overall Unweighted Average declined attributable to lower points given for indicators such as Mix of Residential and Commercial Street; and Availability of Mix Public Transport. Moreover, the unavailability of Public Space and Recreation/ Parks and Greenery and Urban Open Space/Plaza along the route made the final Unweighted Average plunged to a Very Poor Condition and Walkability.

iii. VISUAL INTEREST & ATTRACTIVENESS

Visual Interest and Attractiveness were of main concern along Stretch 1: Jalan Stesen Junction – Jalan Sehala Junction and Stretch 2: Jalan Sehala Junction – Jalan Limbong Kapal Junction because of poor quality and maintenance of Streetscape and Pedestrian Facilities, Walking Path's Design and Materials used; and significantly lack Trees and Vegetation. Furthermore, insignificant of Diverse of Activities Along Path further lowered the Unweighted Average.

iv. CONVENIENCE

Walking along this route was inconvenienced due to the absent of Facilities for the Blinds and Disable Persons, Obstruction of Pedestrian Walking path, Pedestrian Amenities and Distance of Route to Where the Pedestrians Were Going. These four indicators were accorded the lowest points of Very Poor to Poor.

v. SENSE OF SAFETY AND SECURITY

The most significant issues along Jalan Langgar were with the Parameter: Sense of Safety and Security. This was clearly evident from the ASWI result of 9.02 in the Unweighted

Average. Motorist Behavior and Respect to Pedestrian was at the lowest at this route as compared to other routes. The conflicts between pedestrian and motorists were obvious along the route due to lack of designated pedestrian crossing and the significant distance between each crossing. Moreover, with the significantly lower number of pedestrian traffic along this route has diminished the sense of Safety and Security at Jalan Langgar.

7.5.4 Jalan Sultan Badlishah

Jalan Sultan Badlishah route was divided into seven stretches as detailed in Figure 7.1, with a total length of 1.815 km starting from Jalan Teluk Wan Jah roundabout to Jalan Tunku Ibrahim junction.

Table 7.25 Alor Setar Walkability Index: Walkability for Jalan Sultan Badlishah

	PARAMETER AND INDICATOR	Average of All Four Groups	Total for Each parameter	Average for Each Parameter
	A. SENSE OF SAFETY AND SECURITY			
1	Motorist Behaviour and Respect to Pedestrian	45.60	294.50	49.08
2	Walking Path Modal Conflict (Pedestrian/Vehicular Conflict)	58.13		
3	Availability of Crossings	42.19		
4	Crossing Safety (Traffic Light / Traffic Management at Crossing)	38.19		
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	42.16		
6	Perception of Security from Crime	68.24		
	B. CONVENIENCE			
7	Distance of The Route to Where They Were Going	76.66	670.91	60.99
8	Walking Comfort Due to Pedestrian Congestion	75.38		
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	56.55		
10	Maintenance and Cleanliness of Walking Path	83.71		
11	Availability of Walking Paths	68.76		
12	Distance from One Pedestrian Crossing Point to Another	33.81		
13	Path Coverage (Area of Coverage)	71.01		
14	Shared Street Network and Connectivity/Alternative Routes	62.59		
15	Obstructions Free Walking Path (Permanent/Temporary--to Note)	52.69		
16	Existence and Quality of Facilities for Blind and Disabled Persons /Disability Infrastructure	27.42		
17	Walking Path (Width and Safety)	62.33		
	C. VISUAL INTEREST & ATTRACTIVENESS			
18	Streetscape and Pedestrian Facilities	63.24	266.43	66.61
19	Walking Path (Quality of Design and Materials)	59.74		
20	Trees and Vegetation	75.72		
21	Diverse of Activities Along Path	67.73		
	D. COMFORT			
22	Street Lighting	71.29	338.13	67.63
23	Resting Amenities	50.02		
24	Smell, Air Quality & Cleanliness	87.34		
25	Shelter	49.48		
26	Shadow Of Trees/Buildings/Elements	80.01		
	E. USES AND ACTIVITIES			
27	Land Use Mix	74.56	491.05	54.56
28	Active Traditional Shop Houses	42.35		
29	Active Commercial Modern Building	78.58		
30	Active Heritage and Cultural Street	36.61		
31	Active Commercial Street	89.53		
32	Mix of Residential and Commercial Street	37.11		
33	Availability of Mix Public Transport	43.03		
34	Public Space and Recreation/ Parks and Greenery	46.94		
35	Urban Open Space/Plaza	42.35		
	Total	2061.02		
	Unweighted Average JSB	58.89		

Note:
It is important to note that the average value for each parameter were meant for comparison between the parameters only and not used in the calculation for the Unweighted Average value.

Table 7.26 Mean value (Unweighted Value) of Each Group for Jalan Sultan Badlishah

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Groups_1	35	31	93	60.76
Groups_2	35	21	88	60.58
Groups_3	35	21	96	57.33
Groups_4	35	30	91	56.87
Valid N (listwise)	35			

Descriptive Statistics above displays the mean value (Unweighted Average) of each group for Jalan Sultan Badlishah. The range of value for all groups is consistent from 56.87 to 60.76 (Group 1 and Group 2 scores were close to 61).

ASWI Unweighted Average for Jalan Sultan Badlishah is **58.89,** which is at the range **41 – 60** reflecting a **Moderate Condition and Walkability** as per the table of Adjusted Value.

a. The Contributing Parameters Toward Urban Walkability

The finding from ASWI result at Jalan Sultan Badlishah indicated **MODERATE** walkability value for parameters. The ASWI value for this route ranging from 35.39 for Parameter: Visual Interest and Attractiveness as the highest to 31.22 for Parameter: Sense of Safety and Security as the lowest. Figure 7.6below showcases the Poor walkability value measured for all the parameters at Jalan Tunku Ibrahim.

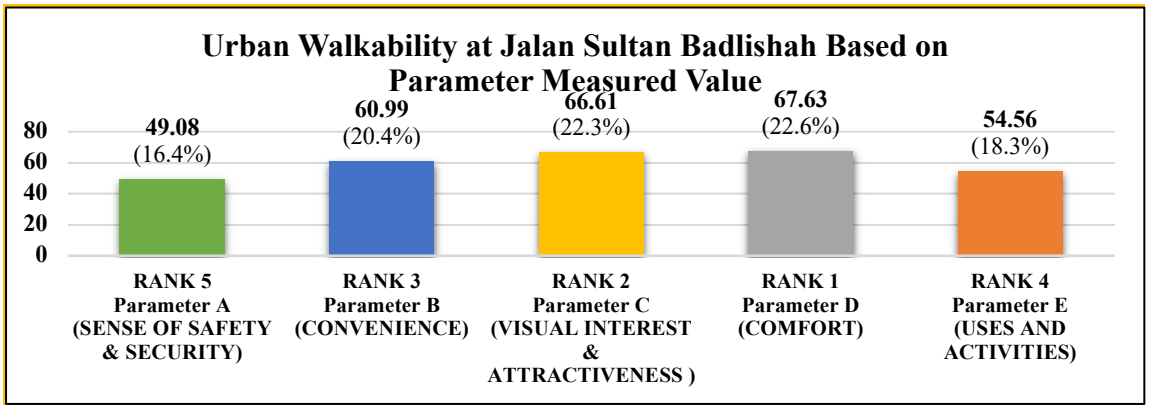

Figure 7.6 Rank of Parameter for Urban Walkability at Jalan Sultan Badlishah

i. COMFORT

Parameter: Comfort contributed the most to the moderate walkability along Jalan Sultan Badlishah with the score value of 67.63. Among the contributing factors are;

Table 7.27 Summary of Findings for Parameter: Comfort at Jalan Sultan Badlishah

Indicator's No.	Indicator in parameter	The Findings
22	Street Lighting	Street lighting are extensive and covering all walking paths. This has made walking along JSB comfortable and safe.
23	Resting Amenities	Resting and seating spaces are provided at several spots in the form of small pocket gardens. However, the resting spaces were limited and sited only along the main route.
24	Smell, Air Quality & Cleanliness	The level of cleanliness along JSB was high. There was no unpleasant smell and the air quality was rank as GOOD at the average of 32 AQI (Malaysian Air Quality Index based on PM_{10}).
25	Shelter	There were only two gazebos along JSB.
26	Shadow of Trees/Buildings/ Elements	Walking paths along JSB is considered as well shaded with mature shade trees, public buildings and also shophouses with five-foot way.

ii. VISUAL INTEREST & ATTRACTIVENESS

The second highest parameter that contributes to moderate walkability measure along Jalan Sultan Badlishah is Parameter: Visual Interest & Attractiveness with the score value of 66.61. The reasons, as stated in the table below, rationalise of its contribution to the result.

Table 7.28 Summary of Findings for Parameter: Visual Interest and Attractiveness at Jalan Sultan Badlishah

Indicator's No.	Indicator in parameter	The Findings
1	Streetscape and Pedestrian Facilities	The availability of properly design streetscape and pedestrian facilities along JSB very much contributed to the moderate value of walkability along that route.
2	Walking Path (Quality of Design and Materials)	The materials used for the pathways were of good quality, heavy duty and fitting for outdoor use. The non-slippery materials are suitable to withstand the hot sun and heavy rain. However, there were stretches where pedestrian walkways were not properly maintained, broken pavements and missing tiles which posed danger to pedestrians.
3	Trees and Vegetation	Mature shade trees along JSB generate a more conducive walking environment, thus encouraging pedestrians to use this route.
4	Diverse of Activities Along Path	Various activities can be seen during both day and night along JSB. Licensed street vendors can be seen operating along the road near business areas and banks. All of these activities act as catalyst and were successful in attracting pedestrian, hence increase walkability along JSB.

iii. CONVENIENCE

Convenience as the parameter attained the third highest score that contributes to moderate walkability measure at Lebuhraya Darul Aman. This parameter has contributed the score value of 60.99 towards the urban walkability which is attributable to the findings below;

Table 7.29 Summary of Findings for Parameter: Convenience at Jalan Sultan Badlishah

Indicator's No.	Indicator in parameter	The Findings
7	Distance of The Route to Where They Were Going	Most of public places and attractions were within walking distance and well connected with walking paths.
8	Walking Comfort Due to Pedestrian Congestion	Walking paths were comfortable for walking except during peak hours especially along stretches 3,4,5 and 6.
9	Pedestrian Amenities (Cover, Public Toilets, Street Lights)	Public amenities were provided covering the basic requirements such as street lighting and pedestrian walking paths. Resting and seating spaces are provided only along the main route of JSB but not at the branching routes in the form of small pocket gardens. All of the shophouses especially along Jalan Mahsuri and Lorong Padi were designed with covered walkway or five-foot way for pedestrians' comfort.
10	Maintenance and Cleanliness of Walking Path	Walking paths along the main route of JSB are clean and well maintained. However, there were broken pavements and missing tiles and maintenance were not carried out properly at several areas along Stretches 1 and 2. Landscape areas along walking paths along the main route of JSB were also attractive, well-kept and clean.
11	Availability of Walking Paths	Walking paths were available at both sides of JSB and extended to the branching roads connecting to all nearby public places.
12	Distance from One Pedestrian Crossing Point to Another	Pedestrian crossings were limited and provided only the traffic lights. The distance of pedestrian crossings was considered far but still within walking distance.
13	Path Coverage (Area of Coverage)	Walking paths were available along the route and interconnected with the surrounding area. Path coverage were also widespread.
14	Shared Street Network & Connectivity /Alternative Routes	Shared street network and connectivity were considered good with choices of alternative routes.
15	Obstructions Free Walking Path (Permanent/Temporary)	All walking paths were free from any obstructions. However, there were light and road signposts being erected on the walking path at Stretch 5,6 and 7.
16	Existence and Quality of Facilities for Blind and Disabled Persons/Disability Infrastructure	None
17	Walking Path (Width and Safety)	Most of the walking paths along and around LDA are wide of 1.5 - 2 meters, thus providing comfortable and safe walking space.

iv. USES AND ACTIVITIES

Jalan Sultan Badlishah (JSB) is a moderately active street with many uses and activities along the pedestrian walkways. The findings concluded that the Parameter: Uses and Activity score value of 54.56, moderately contributed to walkability this route and were due to reasons as stated below;

Table 7.30 Summary of Findings for Parameter: Uses and Activity at Jalan Sultan Badlishah

Indicator's No.	Indicator in parameter	The Findings
27	Land Use Mix	The availability of many shops, cafes, restaurants, residentials, government institutions and other businesses
28	Active Traditional Shop Houses	Traditional shophouses were operating only along Jalan Mahsuri and Lorong Padi but not significant.
29	Active Commercial Modern Building	There were many active commercial modern buildings along JSB ranging from retails shops, banks and offices.
30	Active Heritage and Cultural Street	Historical and Cultural activities were insignificant along JSB.
31	Active Commercial Street	The rows of modern commercial buildings housing shops, retail stores, banks, eateries and offices generated active activities along JSB. People parked their cars along the street and walked to their destinations.
32	Mix of Residential and Commercial Street	The mixture of residential and commercial street was insignificant along JSB.
33	Availability of Mix Public Transport	Public transportation system was lacking here. Most visitors use their own motorcycles or cars. The availability of parking spaces along the road and in front of the shops encouraging the usage of private transport. The place was cramped with cars especially during lunch and peak hours.
34	Public Space & Recreation/ Parks & Greenery	The availability of public and recreational space along JSB were limited (only at the main route of JSB).
35	Urban Open Space / Plaza	Urban Open Space / Plaza were insignificant along JSB.

v. SENSE OF SAFETY AND SECURITY

The lowest contributing parameter to Jalan Sultan Badlishah urban walkability is Parameter: Sense of Safety and Security and was ranked fifth with the score value of 49.08. The contributing factors are as follows;

Table 7.31 Summary of Findings for Parameter: Sense of Safety and Security at Jalan Sultan Badlishah

Indicator's No.	Indicator in parameter	The Findings
1	Motorist Behaviour and Respect to Pedestrian	Motorist were the dominant users along JSB and the level of respect towards pedestrian was considered poor. Since JSB is the major road in Alor Setar, the 'perception of my right of way' were high among motorists. Motorist were seen to ignore the pedestrian crossing light at the marked pedestrian crossing point.
2	Walking Path Modal Conflict (Ped. / Vehicle Conflict)	There were conflicts between pedestrian and motorists due to limited number of pedestrian crossing along JSB. However, the conflicts were considered minor because there are controlled pedestrian crossing at traffic lights.
3	Availability of Crossings	There were limited number of pedestrian crossing along JSB and only available at the traffic lights.
4	Crossing Safety (Traffic Light / Traffic Mgmt. at Crossing)	There were controlled pedestrian crossing at the traffic lights.
5	Clearly Mark Pedestrian Crossing Line/Zebra Line/Raised Road Level (Flushed) Crossing	Marked pedestrian crossing were available at the traffic lights and at Stretch 2.
6	Perception of Security from Crime	Perception of security from crime was high along the main route of JSB due to separation of pedestrian walkways from the road, metal and bollards railings along walking paths, many open spaces and public areas increase public policing and the extensive provision of lighting along JSB make pedestrian feel safe from crime.

7.6 Summary of the Chapter

The research on urban walkability and its influencing factors started with the identification of the case study site at the Medium-sized City of Alor Setar. The identified parameters and indicators were validated for a justifiable assessment of urban walkability. The three steps statistical test to validate identified parameters and its indicators (from Literature search) was established from three analysis objectives; 1) *Analysis of dimension reduction factor*, 2) *Analysis of correlation between indicators*, and 3) *Analysis to determine the correlation between each indicator and its latent variable*. The validated parameters and indicators formed the final list of Alor Setar Walkability Index (ASWI), which was then used on-site as a measuring instrument.

The ASWI method of calculation and analysis was developed with the intention to identify the status of urban walkability at selected routes in Alor Setar city centre; to compare the ASWI result with the result from Alor Setar Green Urbanism Index (ASGUI) in Chapter 8. The following chapter covers Green Urbanism Principles associated with the urban walkability qualities and the development of ASGUI.

Chapter 8

GREEN URBANISM PRINCIPLES (GUP) ASSOCIATED TO QUALITIES OF URBAN WALKABILITY

8.0 Introduction

This chapter presents the result and analysis for Green Urbanism Quality following the survey in Alor Setar as the case study area. This chapter intents is to provide an insight into the quality of the environment portrayed by the physical characteristics and features of the city from the Green Urbanism context. This chapter also provides background information to the analysis that follows.

This chapter is divided into nine sections. The first section provides a brief introduction to the chapter. The second section introduces the Delphi Survey and its purpose, and the third section covers the Stage 1 Delphi Survey Analysis - Associated Green Urbanism Principles (GUP) with Urban Walkability. It provides the detail process of analysis and method of calculation in finding the Associated principles with urban walkability using Percentage of Consensus of Agreement. Next section is the Stage 2 Delphi Survey Analysis – Identification of Themes, Parameters and Key Attributes from Identified Associated Principles. This section discusses the process of theme identification by participants and the selection process in determining the relevant GUP for specific site context employing Intraclass Correlation Coefficient (ICC) analysis. The fifth section is Stage 3 Delphi Survey Analysis – Identification of Indicators, where it involves the identification, finalising and validating of indicator to form the final Green Urbanism index.

Semi-structured Interview: Theme Identification from GUP for Association with Urban Walkability is in the sixth section. Data analysis and method of calculation are presented in section seventh, Alor Setar Green Urbanism Index (ASGUI) - Measuring Green Urbanism Quality. Next is section eight presents the Overall Result of ASGUI and Green Urbanism Quality in Alor Setar. Finally, section ninth is the summary of Chapter 8.

8.1 Delphi Survey: The Development of ASGUI

The ASGUI development process started with identifying i) the general component of Green urbanism, ii) the principles of Green Urbanism through Literature Investigation. Then, the three-stage Delphi Surveys were carried out systematically to conclude the iii) associated GUP with urban walkability, iv) parameters and potential indicators of Green Urbanism in measuring urban walkability, and v) associated Green Urbanism key indicators with urban walkability.

8.2 Stage 1 Delphi Survey Analysis - Associated Green Urbanism Principles (GUP) with Urban Walkability

Literature Investigations concluded that there are 15 GUP involved in developing a sustainable-zero carbon city. However, not all fifteen principles can be used in measuring urban walkability. Participants for Stage 1 Delphi Survey were given a checklist of 15 Green Urbanism Principles as proposed by Lehmann (2010b), which attempts to establish cities that emphasize the high quality of life and the creation of highly liveable neighbourhoods and communities (Refer Appendix GU-1). Table 8.1 below showcase the findings;

Table 8.1 Result of Delphi Survey Stage 1: The Association of Green Urbanism Principles (GUP) with Urban Walkability at the MC of Alor Setar

Academics (*N*)	GREEN URBANISM PRINCIPLES														
	GU P1	**GU P2**	**GU P3**	**GU P4**	**GU P5**	**GU P6**	**GU P7**	**GU P8**	**GU P9**	**GU P10**	**GU P11**	**GU P12**	**GU P13**	**GU P14**	**GU P15**
SRL1	3	2	1	2	5	5	1	3	2	5	2	5	1	1	1
SRL2	5	1	1	2	5	5	1	3	2	5	2	5	1	1	1
SRL3	3	2	1	3	5	5	1	3	1	5	2	5	1	1	1
SRL4	3	2	1	2	5	5	1	2	1	5	3	5	1	1	1
SRL5	3	1	1	3	5	5	1	2	2	5	2	5	1	1	1
SRL6	3	2	1	3	5	5	1	3	2	5	2	5	1	1	1
SRL12	3	1	1	1	5	5	1	2	2	5	3	5	1	2	1
SRL7	4	1	1	2	5	5	1	2	1	5	2	5	1	1	1
SRL8	3	2	1	2	5	5	1	2	1	5	3	5	1	1	1
SRL9	4	2	1	3	5	5	1	2	1	5	2	5	1	1	1
SRL10	3	1	1	2	5	5	1	2	2	5	3	5	2	2	1
SRL11	3	1	1	2	5	5	1	3	1	5	2	5	2	1	1
SRL13	3	1	1	3	5	5	1	4	1	5	2	5	1	2	1
SRL14	4	1	1	2	5	5	1	3	1	5	3	5	1	2	1
L1	3	1	1	2	5	5	1	2	2	5	1	5	1	2	1
L2	4	2	1	3	5	5	1	2	1	5	1	5	2	1	1
L3	4	1	1	2	5	5	1	2	2	5	3	5	1	1	1
L4	3	1	1	1	5	5	1	2	2	5	2	5	2	1	1
L5	4	1	1	2	5	5	1	2	3	5	2	5	1	1	1
Total Rating	65	26	19	42	95	95	19	46	30	95	42	95	23	24	19
% Agreement	**68.4**	27.4	20.0	44.2	**100.0**	**100.0**	20.0	48.4	31.6	**100.0**	44.2	**100.0**	24.2	25.3	20.0

Note: Level of Relevance (1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high);
SRL = Senior Lecturer; L = Lecturer; Cut-off Point Percentage = 66.7%

The calculation for Percentage of Consensus of Agreement is done by taking the Accumulated Given Rating by participants and divided by the Total of Maximum Rating [Maximum rating Point (= 5) x Number of Participants (*N* = 19)] and multiply by 100. The calculation used a simple percentage formula of;

$$Percentage\ of\ Consensus\ of\ sgreement\ = \frac{Accumulated\ Given\ rating}{Total\ of\ Maximum\ Rating}\ \text{x}\ 100$$

Taking 66.7% as cut-off point as explained in section ***4.7.4 (a)*** for Consensus of Agreement percentage, the findings of Stage 1 Delphi Survey indicated five GUPs were found to have a significant association with urban walkability as detailed in table 8.2 below;

Table 8.2 Result of Delphi Survey Stage 1: The five Green Urbanism Principles (GUP) Associated with the Medium-sized City of Alor Setar Based from the Percentage of Consensus of Agreement

Principles	Description	Percentage
Principle 1: Climate and context	Respond well to their climate, location, orientation and context, optimizing natural assets such as sunlight and wind flow; are quiet, clean and effective, with a healthy microclimate.	68.4
Principle 5: Landscape, gardens and urban biodiversity	Integrate landscape, gardens and green roofs to maximize urban biodiversity and mitigate the urban heat island effect. Preserves and maximizes its open spaces, natural landscapes and recreational opportunities is a more healthy and resilient city.	100.0
Principle 6: Sustainable transport and good public space: compact and poly-centric cities	Provide easy accessibility and mobility, are well inter- connected, and provide an efficient low-impact public transport system. Integrated non-motorized transport, such as cycling or walking, and, consequently, bicycle/pedestrian- friendly environments, with safe bicycle ways, free rental bike schemes and pleasant public spaces. It is important to identify the optimal transport mix that offers inter-connections for public transport and the integration of private and public transport systems.	100.0
Principle 10: Liveability, healthy communities and mixed-use programs	A mixed-use (and mixed income) city delivers more social sustainability and social inclusion and helps to repopulate the city centre. Mixed land uses are particularly important as it helps reduce traffic and by integrating a diverse range of economic and cultural activities will avoid mono-functional projects, which generate a higher demand for people movement and mobility.	100.0
Principle 12: Cultural heritages, identity and sense of place	Create a vibrant sense of place and authentic cultural identity, where existing districts are densified and make use of urban mixed-use infill projects. Balances heritage with conservation and development; fostering distinctive places with a strong sense of place, where densities are high enough to support basic public transit and walk-to retail services. Developments should create details and unique qualities of localities, demographic qualities of the populace and the creativity of the authorities and citizens; and to support the health, the activities and the safety of its residents. Cities to aim for air quality, health and pollution reduction, to foster resilient communities, to have strong public space networks and community facilities.	100.0

Table 8.2 displayed the five selected associated principles with urban walkability in the MC of Alor Setar. The result indicated that 100% of participants were in agreement that Principles 5, 6, 10 and 12 have a significant association with urban walkability. However, Principle 1 holds only 68% consensus but still above the cut-off of 66.7%. Thus, all five principles were valid and included for Stage 2 of the Delphi Survey.

8.3 Stage 2 Delphi Survey Analysis – Identification of Themes, Parameters and Key Attributes from Identified Associated Principles

In Stage 2 Delphi Survey, all participants were given detail descriptions and information on all five selected GUP (from Stage 1), for their discussion, deliberation and assessment. In Stage 2 of the survey, the participants established the associated theme for each principle, a list of Parameters and Key Attributes as a preliminary stage in formulating the Green Urbanism index for Alor Setar. The discussion and deliberation in Stage 2 was

divided into two part; first, identification of Themes, Parameters and Key Attributes from the five selected Principles (from Stage 1); and second, determining the relevancy of all Parameters and Key Attributes for the research and its suitability for the Malaysian MC, particularly Alor Setar. The outcome of the first part is a list of Parameters and Key Attributes (Table 8.3) based on each selected Principle.

In this stage, all participants discussed on the suitable themes for each principle and reached 100% in the consensus of agreement of the themes based from the detail criteria of each principle; as indicated under the column 'Theme' in Table 8.3 below. However, Intense discussion and deliberation took place on the suitability of Principle 1 to the overall research and site context. Participants were asked to decide in the relevancy of the Principle and its key attributes by indicating 'Yes' for agreeing of its relevancy or 'No' for disagreeing in a provided checklist.

Table 8.3 List of Selected Principles: The Identified Parameters and Key Attributes

PRINCIPLE	THEME	PARAMETER	KEY ATTRIBUTE
Principle 1: Climate and Context	Natural Context	1. Urban Heat Island/Urban Cooling	a) Reduce Inner City Heat
		2. Natural Values	a) Biodiversity
			b) Topographical Condition
		3. Climate Adaptation	a) Urban Ecosystem
			b) Spirit of the Place
		4. Location Potential	a) Societal Setting & context /
			b) Neighbourhood Layout
			c) Climate-responsive City/Environment
Principle 5: Landscape, Gardens and Biodiversity	Nature and Biodiversity	5. Urban Cooling	a) Presence of urban vegetation
			b) Inner-city Garden
			c) Urban farming
			d) Building greenery
		6. Integrated urban landscape	a) Urban landscape
			b) Accessibility to parks, gardens & public spaces
			c) Leisure & recreation
		7. Local Biodiversity	a) Habitat
			b) Ecology
			c) Wildlife Rehabilitation
			d) Forest Conservation
		8. Conserving Natural Resources	a) Restoring Streams
			b) Re-establishing Riverbanks
Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities	Sustainable Urbanism	9. Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)
			b) Integrated motorized transport (private / public)
		10. Good Public Space Network	a) Pleasant public spaces
			b) Pedestrian network and connectivity
		11. Compact and polycentric city	c) Land uses
			d) Diversity
Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes	Liveability	12. Liveability	a) Housing range and users
			b) Sense of community
		13. Healthy community & Mixed-use programmes	a) Amenities and facilities
			b) Healthy communities
Principle 12: Cultural Heritage, Identity and Sense of Place	Culture, Heritage & Identity	14. Cultural Heritage	a) Local culture
		15. Identity & Sense of place	a) Historical elements
			b) Historical dominance
			c) Spiritual presence

8.3.1 Principle 1: Climate and Context – The Parameters and Key Attributes

The testing on the relevancy of Principle 1 using the four parameters employing Intraclass Correlation Coefficient (ICC) analysis as in Table 8.4 indicated **75.5%** of participants opted '**NO**' on the relevancy of Principle 1, which is very significant.

Table 8.4 Intraclass Correlation Coefficient: The Relevancy of Principle 1 for the Research

Intraclass Correlation Coefficient							
	Intraclass Correlation [b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.436[a]	.207	.681	4.074	18	54	.000
Average Measures	.755	.511	.895	4.074	18	54	.000

Two-way random effects model where both people effects and measures effects are random.
a. The estimator is the same, whether the interaction effect is present or not.
b. Type A intraclass correlation coefficients using an absolute agreement definition.

After a long discussion and deliberation, participants had reached to a consensus of agreement to exclude Principle 1 and its parameters on three grounds; 1) Redundancy of Parameters and Key Attributes with other Principles; 2) Limitation of information and records on-site/local authority; 3) Not relevant to the local context (especially in Malaysia's small towns and MC).

a. Parameter: Urban Heat Island/Urban Cooling

Table 8.5 Justification for the Exclusion of Principle 1 - Parameter: Urban Heat Island / Urban Cooling

Principal 1: Climate and Context		
Parameter	**Key Attribute**	**Justification**
1. Urban Heat Island/Urban Cooling	a) Reduce Inner City Heat	Redundant with Principle 5 (Parameter: Urban Cooling)

The statistical analysis as in Table 8.6 below indicated that only 21.1% of the participants agreed to include this parameter in the study while 78.9% of participants have voted to omit the Parameter – Urban Heat Island/Urban Cooling due to the redundancy with parameters in Principle 5.

Table 8.6 Percentage of Agreement to Exclude Principle 1 - Parameter: Urban Heat Island / Urban Cooling

Principle 1: Climate and Context & Parameter: Urban Heat Island / Urban Cooling					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	21.1	21.1	21.1
	No	15	78.9	78.9	100.0
	Total	19	100.0	100.0	

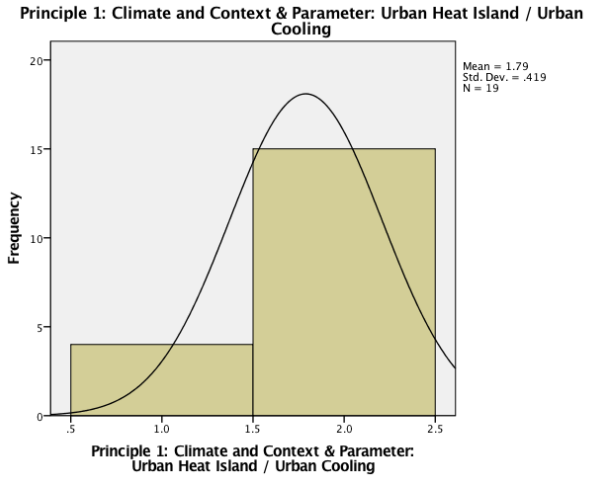

Figure 8.1 The Frequency of selection for exclusion of Principle 1 - Parameter: Urban Heat Island / Urban Cooling.

b. Parameter: Natural Values

Table 8.7 Justification for the Exclusion of Principle 1 - Parameter: Natural Values

Principal 1: Climate and Context		
Parameter	**Key Attribute**	**Justification**
2. Natural Values	a) Biodiversity	Redundant with Principle 5 (Parameter: Local Biodiversity)
	b) Topographical Condition	Not relevant with local context (Alor Setar is generally flat)

The statistical analysis as in Table 8.8 below indicated that only 10.5% of the participants agreed to include this parameter in the study. In contrast, 89.5% of participants have voted to omit the Parameter – Natural Values due to the redundancy with parameters in Principle 5 and the key attribute is not relevant to Alor Setar topographical context which is generally flat.

Table 8.8 Justification for the Exclusion of Principle 1 - Parameter: Natural Values

Principle 1: Climate and Context & Parameter: Natural Values					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	10.5	10.5	10.5
	No	17	89.5	89.5	100.0
	Total	19	100.0	100.0	

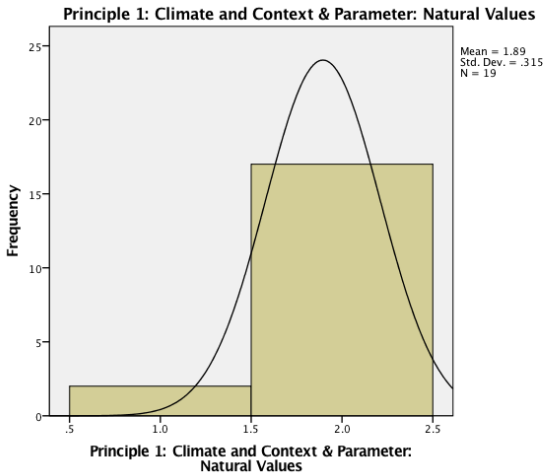

Figure 8.2 The Frequency of selection for exclusion of Principle 1 - Parameter: Natural Values.

c. Parameter: Climate Adaptation

Table 8.9 Justification for the Exclusion of Principle 1 - Parameter: Climate Adaptation

Principal 1: Climate and Context		
Parameter	**Key Attribute**	**Justification**
3. Climate Adaptation	a) Urban Ecosystem	Limited information (in the case of Alor Setar)
	b) Spirit of the Place	Redundant with Principle 12 (Parameter: Identity and Sense of Place)

Due to the limited information on Urban Ecosystem in Alor Setar and redundancy of Spirit of the Place with attribute under Principle 12, 73% of participants were in the opinion that these key attributes are irrelevant to the study compared to only 26.3% decided otherwise as shown in table 8.10.

Table 8.10 Justification for the Exclusion of Principle 1 - Parameter: Climate Adaptation

Principle 1: Climate and Context & Parameter: Climate Adaptation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	26.3	26.3	26.3
	No	14	73.7	73.7	100.0
	Total	19	100.0	100.0	

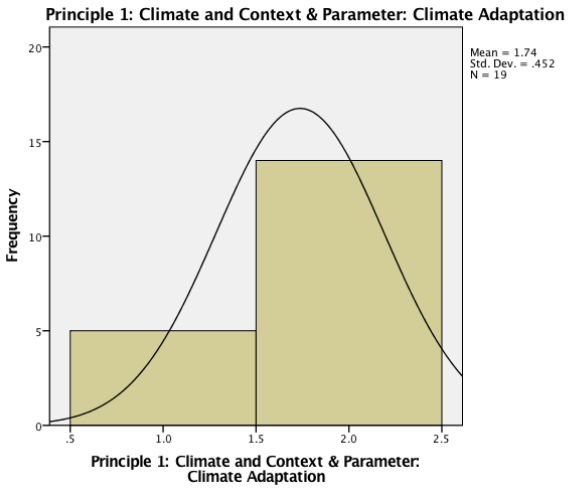

Figure 8.3 The Frequency of selection for exclusion of Principle 1 - Parameter: Climate Adaptation

d. Parameter: Location Potential

Table 8.11 Justification for the Exclusion of Principle 1 - Parameter: Location Potential

Principle 1: Climate and Context		
Parameter	**Key Attribute**	**Justification**
4. Location Potential	a) Societal Setting & Context	Related to Principle 10 (Parameter: Liveability – Housing and Community)
	b) Neighbourhood Layout	Not relevant with local context
	c) Climate-responsive City/Environment	Not relevant with local context

The Societal Setting and Context is, according to the participants are related to the Liveability Parameter under Principle 10, which include Housing Range and Users, and Sense of Community. Therefore, 78.9% of the participants decided to exclude it from the list.

Table 8.12 Justification for the Exclusion of Principle 1 - Parameter: Location Potential

Principle 1: Climate and Context & Parameter: Location Potential					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	21.1	21.1	21.1
	No	15	78.9	78.9	100.0
	Total	19	100.0	100.0	

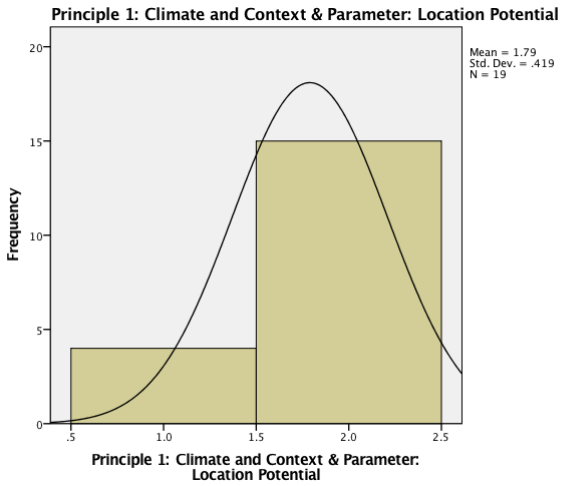

Figure 8.4 The Frequency of selection for exclusion of Principle 1 - Parameter: Local Potential

8.3.2 Principle 5: Landscape, Gardens and Biodiversity – The Parameters and Key Attributes

Frequency Analysis on the Principle 5 indicated that the majority of participants opted for '**Yes**' on the relevancy of Key Attributes to their Parameters with the Percentage of Consensus of Agreement of above 66.7% cut-off point; thus, validated all Key Attributes to their Parameters. The Intraclass Correlation Coefficient (ICC) calculation of Principle 5 Key Attributes to its Parameters indicated Sig. Values of 0.002, thus signifying a highly significant.

Table 8.13 Principle 5: Correlation and Significant Value of Key Attributes to Parameters

Intraclass Correlation Coefficient							
	Intraclass Correlation [b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.412[a]	.130	.682	3.077	18	36	.002
Average Measures	.677	.310	.866	3.077	18	36	.002

Two-way random effects model where both people effects and measures effects are random.
a. The estimator is the same, whether the interaction effect is present or not.
b. Type A intraclass correlation coefficients using an absolute agreement definition.

All participants reached a majority of consensus of agreement above 66.7% cut-off point on the relevancy of all Key Attributes to its Parameters under Principle 5 that associated with urban walkability for Alor Setar. Case Processing Summary using SPSS statistical Frequency Analysis in a series of tables below revealed the full consensus of the agreement for each Key Attributes to their Parameters.

a. Parameter: Urban Cooling

Table 8.14 Percentage of Agreement - Parameter: Urban Cooling and its Key Attributes

Parameter: Urban Cooling					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Presence of urban vegetation**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Inner-city Garden**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Urban Farming**	Yes	15	78.9	78.9	78.9
	No	4	21.1	21.1	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Building Greenery**	Yes	17	89.5	89.5	89.5
	No	2	10.5	10.5	100.0
	Total	19	100.0	100.0	

All attributes under Parameter: Urban Cooling as in Table 8.14 displayed significant Percentage of Consensus of Agreement. The percentage of agreement for Key Attributes of Presence of Vegetation, and Inner-city garden were all 100%, and Key Attributes of Urban Farming and Building Greenery were 78.9% and 85.5% respectively. Therefore, the parameter and its key attributes were valid for the subsequent procedure in Stage 3 of the Delphi Survey.

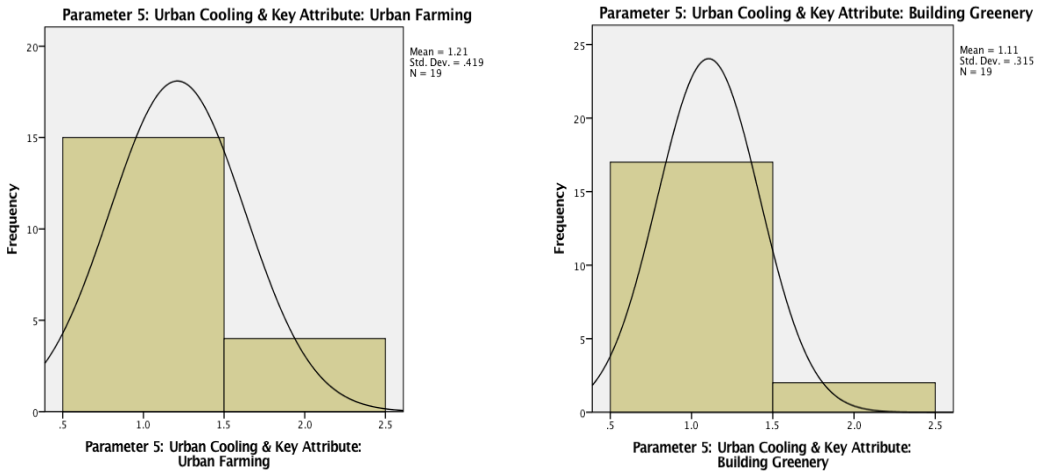

Figure 8.5 The Frequency of selection for Parameter 5 - Key Attributes: Urban Farming & Building Greenery

b. Parameter: Integrated Urban Landscape

Table 8.15 Percentage of Agreement - Parameter: Integrated Urban Landscape and its Key Attributes

Parameter: Integrated Urban Landscape					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Urban Landscape**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Accessibility to parks, gardens & public spaces**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Leisure and Recreation**	Yes	19	100.0	100.0	100.0

All attributes under Parameter: Integrated Urban Landscape as in Table 8.14 displayed 100% of the Consensus of Agreement. Therefore, valid for the procedure in Stage 3 of the Delphi Survey.

c. Parameter: Local Biodiversity

Table 8.16 Percentage of Agreement - Parameter: Local Biodiversity and its Key Attributes

Parameter: Local Biodiversity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Habitat**	Yes	15	78.9	78.9	78.9
	No	4	21.1	21.1	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Ecology**	Yes	16	84.2	84.2	84.2
	No	3	15.8	15.8	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Wildlife Rehabilitation**	Yes	15	78.9	78.9	78.9
	No	4	21.1	21.1	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Leisure and Recreation**	Yes	14	73.7	73.7	73.7
	No	5	26.3	26.3	100.0
	Total	19	100.0	100.0	

All attributes under Parameter: Local Biodiversity as in Table 8.16 displayed significant Percentage of Consensus of Agreement with all percentages exceeded the cut-off point of 66.7%. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey. The percentage of agreement for Key Attributes of Habitat and Ecology were 78.9% and 84.2% respectively.

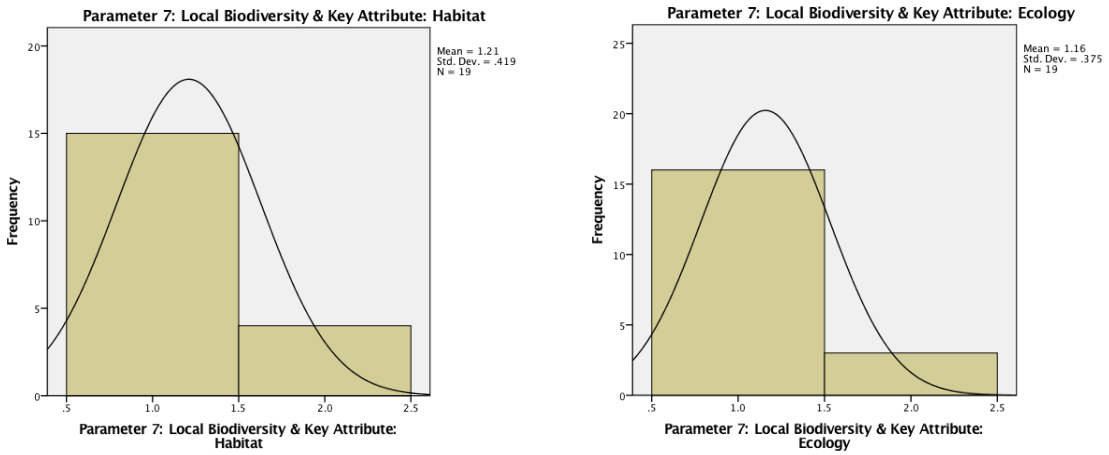

Figure 8.6 The Frequency of selection for Parameter 5 - Key Attributes: Habitat & Ecology

Correspondingly, the percentage of agreement for Key Attributes of Wildlife Rehabilitation was 78.9%, and Leisure and Recreation was 73.3%.

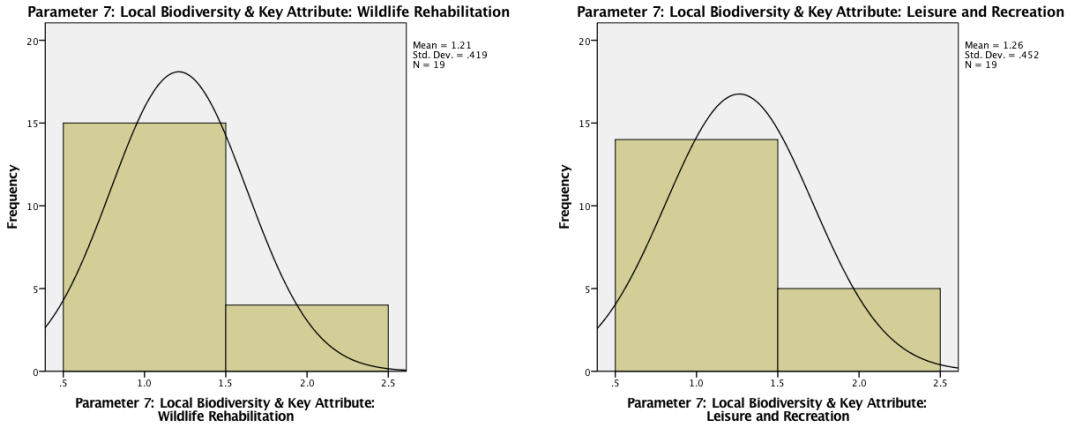

Figure 8.7 The Frequency of selection for Parameter 5 - Key Attributes: Wildlife Rehabilitation & Leisure and Recreation

d. Parameter: Conserving Natural Resources

Table 8.17 Percentage of Agreement - Parameter: Conserving Natural Resources and its Key Attributes

Parameter: Conserving Natural Resources					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Restoring Streams**	Yes	14	73.7	73.7	73.7
	No	5	26.3	26.3	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Re-establishing Riverbanks**	Yes	15	78.9	78.9	78.9
	No	4	21.1	21.1	100.0
	Total	19	100.0	100.0	

All attributes under Parameter: Conserving Natural Resources as in Table 8.17 displayed significant Percentage of Consensus of Agreement. The percentage of agreement for Key

Attributes of Restoring Streams was at 73.3%, and Re-establishing Riverbanks was 78.9%. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

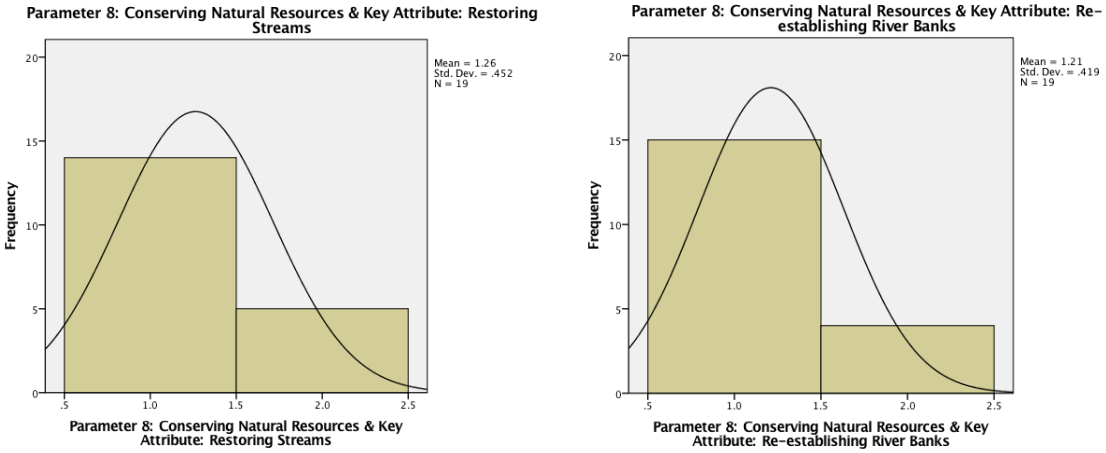

Figure 8.8 The Frequency of selection for Parameter 5 - Key Attributes: Restoring Streams & Re-establishment of Riverbanks

8.3.3 Principle 6: Sustainable Transport and Good Public Space; Compact and Poly-Centric Cities – The Parameters and Key

All participants reached a **100%** consensus of agreement on the relevancy of all Parameters and all Key Attributes under Principle 6 associated with urban walkability for Alor Setar. Case Processing Summary using SPSS statistical Frequency Analysis in a series of tables below indicated the full consensus of the for each Parameter and Key Attributes.

a. Parameter: Sustainable Transport System

Table 8.18 Percentage of Agreement - Parameter: Sustainable Transport System and its Key Attributes

Parameter: Sustainable Transport System					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Integrated non-motorized transport (cycling/walking)**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Integrated motorized transport (private/public)**	Yes	19	100.0	100.0	100.0

All attributes under Parameter: Sustainable Transport System as in Table 8.18 displayed 100% of the consensus of agreement. Therefore, valid for subsequent the procedure in Stage 3 of the Delphi Survey.

b. Parameter: Good Public Space Network

Table 8.19 Percentage of Agreement - Parameter: Good Public Space Network and its Key Attributes

Parameter: Good Public Space Network					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Pleasant Public Spaces**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Pedestrian network and connectivity**	Yes	19	100.0	100.0	100.0

All attributes under Parameter: Good Public Space Network as in Table 8.19 displayed 100% of the Consensus of Agreement. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

c. Parameter: Compact and Polycentric City

Table 8.20 Percentage of Agreement - Parameter: Compact and Polycentric City and its Key Attributes

Parameter: Compact and Polycentric City					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Land Uses**	Yes	19	100.0	100.0	100.0
Parameter 11: Compact and Polycentric City					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Diversity**	Yes	19	100.0	100.0	100.0

All attributes under Parameter: Compact and Polycentric City as in Table 8.20 displayed 100% of the consensus of agreement. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

8.3.4 Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes – The Parameters and Key

All participants reached a **majority** of consensus of agreement on the relevancy of all Parameters and all Key Attributes under Principle 10 associated with urban walkability for Alor Setar. Case Processing Summary using SPSS statistical Frequency Analysis in a series of tables below indicated the Percentage of Consensus of Agreement for each Parameter and Key Attributes.

a. Parameter: Liveability

Table 8.21 Percentage of Agreement - Parameter: Liveability and its Key Attributes

Parameter 12: Liveability					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Housing Range and Users**	Yes	18	94.7	94.7	94.7
	No	1	5.3	5.3	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Sense of Community**	Yes	19	100.0	100.0	100.0

All key attributes under Parameter: Liveability as in Table 8.21 displayed significant Percentage of Consensus of Agreement. The Bar chart in Figure 8.9 indicated the split agreement among participated experts with 94.7% consensus of agreement. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

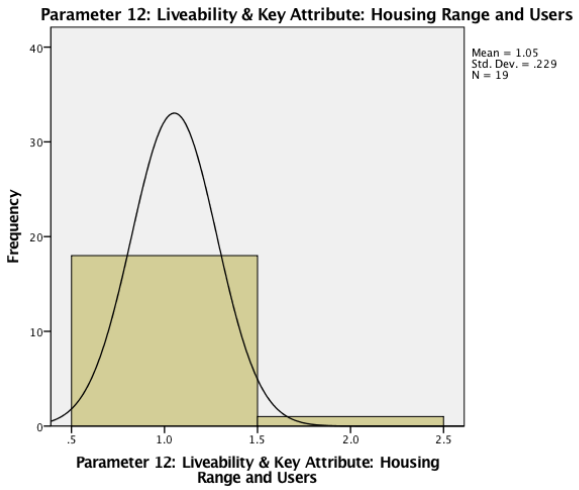

Figure 8.9 The Frequency of selection for Parameter 12 - Key Attribute: Housing Range and Users

b. Parameter: Healthy Community and Mixed-Use Programmes

Table 8.22Table 8.21 Percentage of Agreement - Parameter: Healthy Community and Mixed-Use Programmes and its Key Attributes

Parameter 13: Healthy Community and Mixed-Use Programmes					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Amenities and Facilities**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Healthy Communities**	Yes	19	100.0	100.0	100.0

All key attributes under Parameter: Liveability as in Table 8.21displayed 100% of the consensus of agreement. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

8.3.5 Principle 12: Cultural Heritage, Identity and Sense of Place – The Parameters and Key

All participants reached a majority of consensus of agreement on the relevancy of all Parameters and all Key Attributes under Principle 12 associated with urban walkability for Alor Setar. Case Processing Summary using SPSS statistical Frequency Analysis in a series of tables below indicated the Percentage of Consensus of Agreement for each Parameter and Key Attributes.

a. Parameter: Cultural Heritage

Table 8.23 Percentage of Agreement - Parameter: Cultural Heritage and its Key Attribute

Parameter 14: Cultural Heritage					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Local Culture**	Yes	19	100.0	100.0	100.0

The attributes under Parameter: Cultural Heritage as in Table 8.23 displayed 100% of the consensus of agreement. Therefore, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

b. Parameter: Identity and Sense of Place

Table 8.24 Percentage of Agreement - Parameter: Identity and Sense of Place and its Key Attributes

Parameter 15: Identity and Sense of Place					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid **Key Attribute: Historical Elements**	Yes	19	100.0	100.0	100.0
Valid **Key Attribute: Historical Dominance**	Yes	14	73.7	73.7	73.7
	No	5	26.3	26.3	100.0
	Total	19	100.0	100.0	
Valid **Key Attribute: Spiritual Presence**	Yes	15	78.9	78.9	78.9
	No	4	21.1	21.1	100.0
	Total	19	100.0	100.0	

The attributes under Parameter: Cultural Heritage as in Table 8.24 displayed a high majority of consensus of agreement. The percentage of agreement for Key Attributes of Historical Dominance was at 73.7%, and Spiritual Presence was at 78.9%. Consequently, valid for the subsequent procedure in Stage 3 of the Delphi Survey.

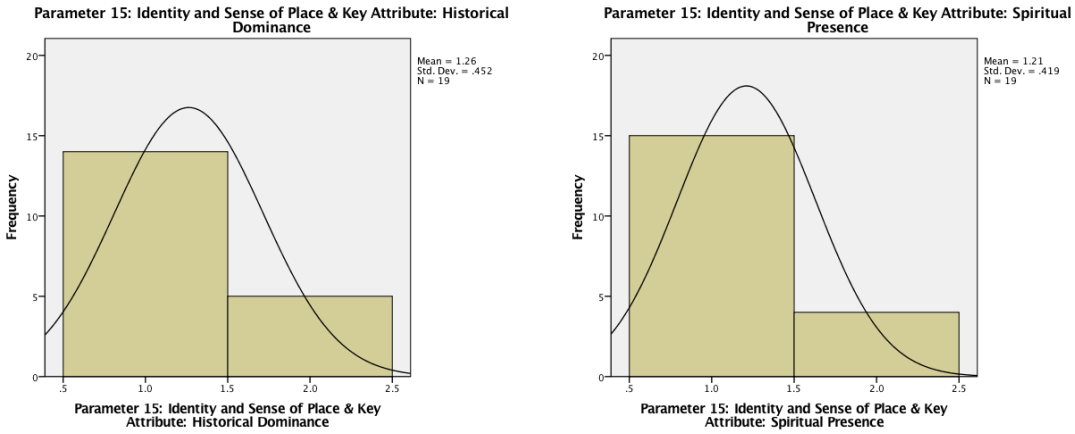

Figure 8.10 The Frequency of selection for Parameter 5 - Key Attributes: Historical Dominance & Spiritual Presence

8.3.6 Outcome of Stage 2

All participants were finally agreed on the conclusion of the discussion and deliberations of the Stage 2 Delphi Survey. The Stage 2 outcome (

Table 8.25) was a list of Four Principles, 11 Parameters and 27 Key Attributes as follows:

Table 8.25 The Outcome of Stage 2 Delphi Survey - List of Principles, Parameters and Key Attributes

PRINCIPLE	PARAMETER	KEY ATTRIBUTE
Principle 5: Landscape, Gardens and Biodiversity	1- Urban Cooling	a) Presence of urban vegetation
		b) Inner-city Garden
		c) Urban farming
		d) Building greenery
	2- Integrated urban landscape	a) Urban landscape
		b) Accessibility to parks, gardens & public spaces
		c) Leisure & recreation
	3- Local Biodiversity	a) Habitat
		b) Ecology
		c) Forest Conservation
	4- Conserving Natural Resources	a) Restoring Streams
		b) Re-establishing Riverbanks
		b) Re-establishing Riverbanks
Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)
		b) Integrated motorized transport (private / public)
	6- Good Public Space Network	a) Pleasant public spaces
		b) Pedestrian Network and Connectivity
	7- Compact and polycentric city	c) Land uses
		d) Diversity
Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes	8- Liveability	a) Housing range and users
		b) Sense of community
	9- Healthy community & Mixed-use programmes	a) Amenities and facilities
		b) Healthy communities
Principle 12: Cultural Heritage, Identity and Sense of Place	10- Cultural Heritage	a) Local culture
		b) Heritage
	11- Identity & Sense of place	a) Historical elements
		b) Identity
		c) Spiritual presence

8.4 Stage 3 Delphi Survey Analysis – Identification of Indicators

Pursuant to the outcome of Stage 2 Delphi Survey, the Stage 3 objective is to develop a list of indicators for the purpose of field works. Stage 3 started with the weighing of the definition of Green urbanism, detail description of each Principle, the traverse of key attributes and to finally arrive at the detail measurable indicators for urban walkability established from Green Urbanism principles. The identified indicators were then tabulated for detail discussion where the process of addition and omission took place based on mutual and majority of agreement for the final register of Green Urbanism Indicators list.

8.4.1 The Preliminary Listing of Indicators

Apart from the experiences and their own knowledge on the topic, the participants referred to four publications and a set of current journal articles namely;

1) Green Urbanism – Learning from European Cities by Timothy Beatley (2000)
2) Green Urbanism Down Under – Learning from Sustainable Communities in Australia (2009)
3) The Principle of Green Urbanism – Transforming the City for Sustainability by Stephan Lehmann (2010a, 2010b)
4) Green Urbanism in Asia – The Emerging Green Tigers by Petar Newman & Ann Matan (2013)
5) Current published journals provided by the author in the form of softcopy.

Subsequently, the preliminary listing of Indicators after the first round of discussion has identified a total of 72 indicators, as shown in Table 8.26 for all Key Attributes.

Table 8.26 The Total Numbers of Parameters, Key Attributes and Indicators for Each Principle

Principle	Parameters	Key Attributes	Preliminary Indicators
Principle 5	4	13	37
Principle 6	3	6	17
Principle 10	2	4	9
Principle 12	2	4	9
Total	11	27	72

8.4.2 Refining the List of Green Urbanism Indicators

The progression of refining the preliminary list of indicators undergone a process of 'omission and addition' in order to identify the best-suited indicators fit for the research and site context. The second round of rigorous discussion and rationalisation have identified 14 overlapping and redundant indicators that can be merged and will not jeopardise the inclusivity and entirety of the final index, and three indicators were amended by rewording the for easy understanding. The Key Attribute of Historical Dominance was omitted and merged with Historical Element, and one Key Attribute (Identity) with Indicator (Showcase Distinct Image and Identity) was added. The

comments, addition and omission of key attributes and indicators are shown in Appendix GU-2. The summary of the process is shown in tables 8.27 – 8.29 below.

a. Redundant and Overlapped Indicators

The 14 indicators that were found to be redundant and overlapping are as detailed in Table 8.27 below:

Table 8.27 Redundant and Overlapping Indicators

Principal	Parameter	Key Attribute	Indicator	Modification
GUP 5	1. Urban Cooling	b) Inner-city Garden	1. Display Garden 2) Pocket park/Vertical garden/Linear garden	To Merge
		c) Urban farming	7) Potted 8) Plot land or Bedded	To Merge
	2. Integrated Urban Landscape	b) Leisure & recreation	19) Recreational Park - Relaxation/strolling 20) Recreational Park-Exercise and Jogging	To Merge
	4. Conserving Natural Resources	a) Restoring Streams b) Re-establishing River Banks	34) Reinstating the function of the river 35) Reinstating uses and function of river/riverbanks	To Merge
GUP 6	5. Sustainable Transport System	a) Integrated non-motorized transport (cycling or walking)	38) Presence of pedestrian walkways network 41) Pedestrian Network and Connectivity	To Merge
	6. Good Public Space Network	b) Pedestrian network and connectivity	49) Good public space network and connectivity 50) Connected pedestrian network	To Merge
GUP 12	10. Cultural Heritage	a) Local Culture	64) Cultural values –Intangible (day to day activity/story) 65) Cultural significant –Tangible (Structure artefact)	To Merge

b. Reworded and Edited Indicators

The three indicators that were edited and reworded are as detailed in Table 8.28 below:

Table 8.28 Editing and Rewording of Indicators

Principle	Parameter	Key Attribute	Indicator	Modification
GUP 5	1. Urban Cooling	b) Inner-city Garden	5) Users and Activities	Rewording to – Mix Users and Activities
GUP 6	6. Urban Cooling	a) Pleasant Public Spaces	47) Good legibility and accessibility	Good legibility and accessibility of public space
	7. Compact and Polycentric City	c) Land uses	52) Surrounded by residential areas	Close proximity to residential area

Majority of the participants opted to re-word the three indicators for easy understanding, more focus, referring to specific situation/condition and also to truly depicting the intention of the survey as listed below;

- (Mix) Users and Activities: referring to broader types of users of different age, social, background etc.
- Good legibility and accessibility (of public space): referring to a specific area of space, which in this case is public spaces 'only' that have good legibility and accessibility.
- (Close proximity) to residential areas: referring to the 'near or close' distance to residential areas.

c. Revised Key Attributes and Indicators

The Key Attributes and Indicators that were revised, omitted and added are as detailed in Table 8.29 below:

Table 8.29 Revised Key Attributes and Indicators

Principle	Parameter	Key Attribute	Indicator	Modification
GUP 12	10. Cultural Heritage	To Add key attribute 'b) Heritage'	To Add indicator 'Heritage values (Areas/Buildings/Structures/Activity)'	Addition
	11. Identity and Sense of Place	a) Historical elements	68) Historical significant	Move 68) Historical significant (structures/Artefacts) to a) to Add
		b. Historical Dominance	69) Distinct Environment	To Omit b) Historical Dominance to Add : Key Attribute 'b) Identity' : Indicator 'Showcase Distinct Image and Identity'

8.4.3 The List of Green Urbanism Indicators

All participants have reached a consensus of the agreement for an amended list of 58 Indicators. Table 8.30 below displayed the list of Indicator for each Key Attribute as the outcome of Stage 3 Delphi Survey.

Table 8.30 The Final List of Principles, Parameters, Key Attributes and Indicators

PRINCIPLE 5: LANDSCAPE, GARDENS AND BIODIVERSITY		
Parameter	**Key Attribute**	**Indicator**
1- Urban Cooling		1) Functional trees -street planting

	a) Presence of urban vegetation	2) Aesthetic & display– palms/shrubberies
	b) Inner-city Garden	3) Pocket park/vertical garden/linear garden/display garden
		4) Mix users and activities
		5) Social interaction and community activities
	c) Urban farming	6) Plot land/bedded/potted
	d) Building greenery	7) Green roof and balcony
2- Integrated urban landscape	a) Urban landscape	8) Image/identity creation
		9) Coverage (continuous throughout the city)
	b) Accessibility to parks, gardens & public spaces	10) Access legibility
		11) Sense of direction (notice board, direction signs, visual linkage)
		12) Connection to public transport
		13) Easy access for pedestrian (connection with primary/secondary roads)
		14) Easy access vehicle (connection with primary/secondary roads/parking)
	c) Leisure & recreation	15) Recreational park -Relaxation/Strolling -Exercise and Jogging
3- Local Biodiversity	a) Habitat	16) Presence of wildlife
		17) Presence of urban wildlife (crows, pigeon and stray cats & dogs
	b) Ecology	18) Presence of urban peri-landscape
		19) Presence of native vegetation
		20) Inclusion of natural resources in urban development (trees, rivers and wildlife)
	c) Forest Conservation	21) Presence of urban forest
4- Conserving Natural Resources	a) Restoring Streams	22) Reintroducing streams and rivers in the city
		23) Maintenance and management of streams and rivers
	b) Re-establishing Riverbanks	24) Reinstating uses and function of riverbanks
		25) Presence of recreational activities along the river
		26) Presence of community involvement/activities along the riverbanks
PRINCIPLE 6: SUSTAINABLE TRANSPORT AND GOOD PUBLIC SPACE _ COMPACT AND POLY-CENTRIC CITIES		
Parameter	**Key Attribute**	**Indicator**
5- Sustainable Transport System	a) Integrated non-motorized transport (cycling/walking)	27) Presence of pedestrian walkways network
		28) Assigned walkways/Paved or Unpaved path
		29) Availability of cycling lanes and Facilities
		30) Safe pedestrian ways
		31) Safe bicycle ways
	b) Integrated motorized transport (private/public)	32) Integrated public and private transport system
		33) Centralised parking spaces (park and ride)
		34) Availability & close proximity of public transport stations/stops along pedestrian routes
6- Good Public Space Network	a) Pleasant public spaces	35) Good legibility and accessibility
		36) Presence of social interaction and community activities
	b) Pedestrian Network and Connectivity	37) Connected pedestrian network
		38) Streetscape that encourage healthy and active life

7- Compact and polycentric city	c) Land uses	39) Close proximity to residential areas
		40) Mix development / land use (residential and business)
	d) Diversity	41) Diverse business types
PRINCIPLE 10: LIVEABILITY, HEALTHY COMMUNITIES AND MIXED-USE PROGRAMMES		
Parameter	**Key Attribute**	**Indicator**
8- Liveability	a) Housing range and users	42) Mixed users - social status (based on housing type)
		43) Mixed users – age, race, workers/students (city campus)
	b) Sense of community	44) Compact housing and communities
		45) Connected housing areas
9- Healthy community & Mixed-use programmes	a) Amenities and facilities	46) Integrated housing amenities and facilities
		47) Community centres
	b) Healthy communities	48) Facilities for healthy lifestyles
		49) Recreational areas and facilities
		50) Social spaces
PRINCIPLE 12: CULTURAL HERITAGE, IDENTITY AND SENSE OF PLACE		
Parameter	**Key Attribute**	**Indicator**
10- Cultural Heritage	a) Local culture	51) Cultural significant/values (day to day activity/story)
	b) Heritage	52) Heritage values (areas/buildings/structures/activity)
11- Identity & Sense of place	a) Historical elements	53) Local based history
		54) Foreign influences history
		55) Historical significant structures/artefacts)
	b) Identity	56) Showcase distant image and identity
	c) Spiritual presence	57) Religious based
		58) Cultural and race based

8.4.4 Validation of the Final List of Indicators

Two senior academics then validated the completed list of indicators from two different local public universities (as validators). The completed list was given to the two validators separately for their ranking of relevancy. The ranking ranges from '1' = very low to '5' = very high. The results of the ranking of relevancy were then calculated and analysed using the Cohen Kappa Coefficient (k) in SPSS to measure inter-rater agreement between the two validators. Cohen Kappa's analysis is very comprehensive in analysing the inter-rater coefficient or agreement between two raters (Ihsan et al., 2015; Othman & Abdul Aziz, 2012) as it omitted chances (Barkemeyer, Holt, Preuss, & Tsang, 2014). Table 8.31 below displays the Level of Agreement between the two validators that indicate a very high level of agreement.

Table 8.31 Level of Agreement Between Two Validators

Validator 2 * Validator 1 Crosstabulation				
	Validator 1			
	Moderate	High	Very High	Total

Validator 2	Moderate	Count	2	0	0	2
		Expected Count	.1	.3	1.7	2.0
		% within Validator 2	100.0%	0.0%	0.0%	100.0%
		% within Validator 1	100.0%	0.0%	0.0%	3.4%
		% of Total	3.4%	0.0%	0.0%	3.4%
	High	Count	0	8	3	11
		Expected Count	.4	1.5	9.1	11.0
		% within Validator 2	0.0%	72.7%	27.3%	100.0%
		% within Validator 1	0.0%	100.0%	6.3%	19.0%
		% of Total	0.0%	13.8%	5.2%	19.0%
	Very High	Count	0	0	45	45
		Expected Count	1.6	6.2	37.2	45.0
		% within Validator 2	0.0%	0.0%	100.0%	100.0%
		% within Validator 1	0.0%	0.0%	93.8%	77.6%
		% of Total	0.0%	0.0%	77.6%	77.6%
Total		Count	2	8	48	58
		Expected Count	2.0	8.0	48.0	58.0
		% within Validator 2	3.4%	13.8%	82.8%	100.0%
		% within Validator 1	100.0%	100.0%	100.0%	100.0%
		% of Total	3.4%	13.8%	82.8%	100.0%

Based on the data perimeter, the result indicated that both validators agreed that 45 out of 58 indicators as very high relevancy which is higher than the expected count value (by change value) of 37.2. They also agreed that eight of the indicators as high relevancy and two indicators as moderate, which were higher than the expected count of 1.5 and 0.1, respectively.

Table 8.32 The Kappa Value for the Level of Agreement Between the Two Validators

Symmetric Measures					
		Value	Asymptotic Standard Error [a]	Approximate T [b]	Approximate Significance
Measure of Agreement	Kappa	.844	.088	7.537	.000
N of Valid Cases		58			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					

The Kappa value is 0.844 or (84.4%) with the standard error of 0.088 as in Table 8.32 above indicated that the Level of Agreement beyond chance is Almost Perfect Agreement (as shown in Figure 8.11) with a statistical significance value of 0.000 indicating that it is highly significant.

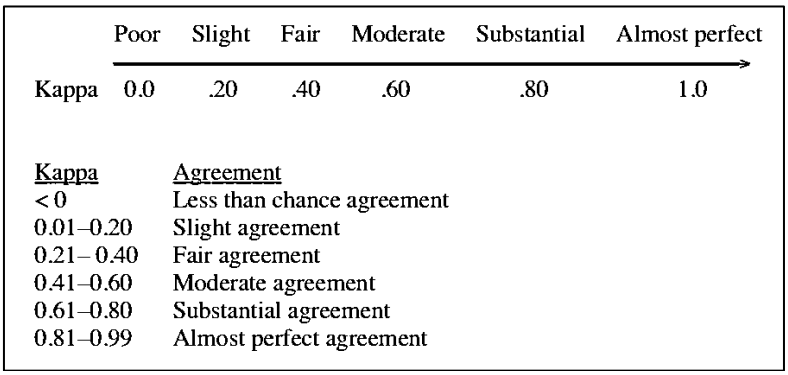

Figure 8.11 Interpretation of Kappa Value (Source: (Brownson et al., 2009; Viera & Garrett, 2005))

Accordingly, the list of indicators as selected by the Delphi Survey participants has been validated with Kappa Value of 'Almost Perfect Agreement' and with highly significance Level of Relevancy related to: i) the purpose of the research, ii) the validity of the list of indicators, and iii) the site context. Therefore, the list of indicators as in Table 8.30 above, was validated and accepted as the Alor Setar Green Urbanism Index or ASGUI.

8.5 Semi-structured Interview: Theme Identification from GUP for Association with Urban Walkability

The Semi-structured interviews involved 16 local professionals, practitioners and authorities in the Built Environment, which took place at the interviewees' office and were recorded; except when decline by the participants, manual notetakings were employed. All the digitally and manually recorded conversations from the interviews were transcribed and coded using Computer Assisted/Aided Qualitative Data Analysis Software (CAQDAS), NVIVO Version 12.

The Semi-structured interviews were conducted as part of the method to identify the main theme to associate Green Urbanism Principles in ASGUI and urban walkability in ASWI. This section is meant to compare and validate themes identified from literature investigation in subsection 5.4 and Stage 2 Delphi Survey as in Table 8.3.

8.5.1 The Associating Themes between ASGUI and ASWI

The Thematic Analysis was performed using NVIVO 12 to identified main themes associating ASGUI and ASWI. During the interviews, participants were asked for

keywords of characters, which to them best reflect a theme/s to associate each of the four Green Urbanism Principles (from stage 3 Delphi Survey) and urban walkability quality.

a. GU Principle 5: Landscape, Gardens and Urban Biodiversity.

The Thematic analysis and word frequency revealed that there are two dominant keywords out of eight keywords. The word NATURE has the highest frequency of 34.78% and NATURAL with frequency of 21.74%, as indicated in Figure 8.12. Based on the Thematic analysis, most of the participant either mentioned Natural or Nature to relate the Green Urbanism Quality needed for a walkable urban environment. As one of the participants (Ref: AC2) mentioned "…pleasant, green and quality surrounding environment replicating nature in urban area, promote comfort, security and sense of attachment to the town. Having these will definitely help town's walkability."

Another participant (Ref: PM 3) relates that "Imagine this, if the town can tear up its many parking spaces and hard surface areas; and replace it with trees and greeneries and bring nature back into the city… the whole of its environment will become pedestrian heaven. People will walk all over the town and spaces will be filled with people doing or participating in activities… even a group of people sitting in an urban space is a remarkable and motivating scene…". All of the participants were in agreement on the important association of nature and the natural environment and urban walkability. Thus, the associating Theme for Principle 5 with the quality of urban walkability is NATURE.

Length	Word	Count	Weighted Percentage
6	nature	16	34.78%
7	natural	10	21.74%
11	environment	7	15.22%
5	urban	6	13.04%
5	green	3	6.52%
11	surrounding	2	4.35%
12	biodiversity	1	2.17%
9	landscape	1	2.17%



Figure 8.12 Weighted Percentage of Word Frequency for GUP no. 5. Association with Urban Walkability
Source: The Author (2019, NVIVO-Thematic Analysis)

Figure 8.13 below indicated the percentage of cited keywords associated with the theme: Nature by interviewees during the Semi-structured Interview.

(i) Parameters to Theme: The Parameters of Urban Cooling, Integrated Urban Landscape and Local Biodiversity were cited by 100% of interviewees; and only 68.75% of interviewees cited Conserving Natural Resources as related to Nature.

(ii) Indicators to Theme: The percentage of all of the cited indicators are more than 50% except for Restoring Streams (31.25%), Re-establishing Riverbanks (37.5%) and Forest Conservation (43.75%). Although the percentage of cited association of the three mentioned indicators are below 50%, nonetheless, the percentage of their parameter (Conserving Natural Resources) is still satisfactorily high.

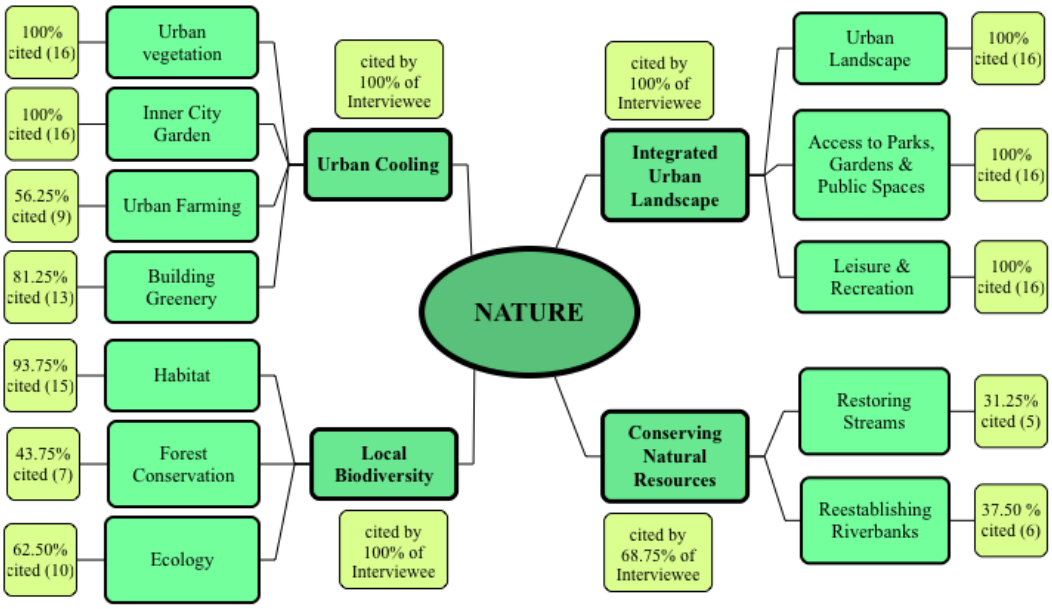

Figure 8.13 Percentage of interviewees cited keywords associated to Theme: Nature
Source: The Author (2019, NVIVO-Thematic Analysis)

b. GU Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities

The outcome from Thematic analysis signified that the word URBANISM has the highest frequency of 21 with Weighted Percentage of 39.62% as exhibited in Figure 8.14 below. A total of 75% (generated from NVIVO Aggregate Coding) of the interviewees agreed that Principle 6 is related to providing sufficient facilities to encourage urban walkability, which is good urbanism. As mentioned by a senior academic referred to as AC2 "…people walk in the town for diverse reasons, for shopping, for work, for health and some for leisure. People are encouraged to walk to, in and around a town when the conditions enable them to; and if the pedestrian network advantageously and efficiently designed to link public transportation hub and places of activities and nodes in the town. Good access to public transport services is crucial, and it helps to reduce the vehicular

usage in the city and also reduce car dependency. This is about providing a good urbanism... by providing sufficient facilities for the pedestrian. But, how to implement in Alor Setar or any cities in Malaysia is the biggest hiccup."

Another interviewee (Ref: UP2) was in the opinion that Principle 6 is all about sound urban development corresponding to urban sustainability, "…The way I see is that this principle is about good urban development, providing enough facilities and support for people to walk in the city. It is like a concept of sustainable urbanism... yes, a positive urbanism that promotes urban walkability…". Majority of the participants were in agreement that the provision of facilities, environment and support from good and positive URBANISM could be associated with successful urban walkability. Thus, the associating Theme for Principle 6 with the quality of urban walkability is URBANISM.

Length	Word	Count	Weighted Percentage
8	urbanism	21	39.62%
5	green	9	16.98%
11	sustainable	8	15.09%
4	city	7	13.21%
11	development	2	3.77%
5	smart	2	3.77%
5	urban	2	3.77%
10	developmen	1	1.89%
8	urbanity	1	1.89%



Figure 8.14 Weighted Percentage of Word Frequency for GUP no. 6. Association with Urban Walkability
Source: The Author (2019, NVIVO-Thematic Analysis)

Figure 8.15 revealed the percentage of cited keywords associated with the theme: Urbanism by interviewees during the Semi-structured Interview.

(i) Parameters to Theme: The Parameters of Sustainable Transport System and Good Public Space Network were cited by 100% of interviewees. However, only 75% of interviewees cited Compact & Polycentric City as related to Urbanism.

(ii) Indicators to Theme: All of the indicators were 100% cited by interviewees except for Diversity which was cited only 87.5%. Nonetheless, the percentage is still very high.

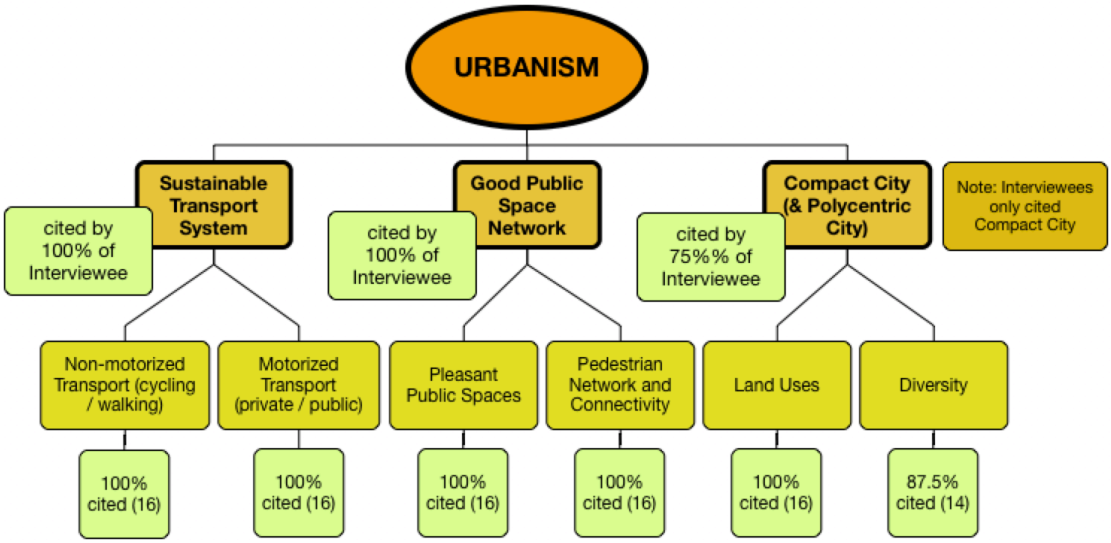

Figure 8.15 Percentage of interviewees cited keywords associated to Theme: URBANISM
Source: The Author (2019, NVIVO-Thematic Analysis)

c. GU Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes

The analysis indicated that the word LIVEABILITY has the highest Weighted Percentage of 31.48% with a frequency of 17, as shown in Figure 8.16 below. All of the interviewees were in agreement that principle 10 subject to promote city living and community development. As mentioned by a Landscape Architect in the interview (Ref: LA1), "…people will definitely stay in the city, start building communities and make use of urban open space as communal spaces; perhaps plan and participate in their community programmes… from leisure activities up to more serious ones like education and community policing. Later on, urban liveability agenda will be materialised... and we can solve the ghost town issues in many small towns in Malaysia.

In addition, the security in the urban environment and economic stability also play essential roles in promoting liveability in any towns and cities as accorded by one of the senior academics referred to as AC1, "…It is natural for people to desire security and stability in life. It is common sense in an urban environment. Liveability and healthy communities are attributes of people friendly towns and cities - there is security. Mixed-use programmes are economically sensible – there is stability. If people can have security and stability within walking distance, I believe they would be encouraged to walk."

The Policy Maker referred to as PM1, in the interview was in the opinion that economic stability in the form encouraging street activities by the small vendor also crucial in stimulating town's liveability and community building. PM1 also mentioned that "Green Urbanism definitely stimulate economic activities from small street vendors to proper shop or retail businesses. This will encourage more activities within the town centre and induce the town's liveability and community building". Therefore, the associating Theme for Principle 10 with the quality of urban walkability is LIVEABILITY.

Length	Word	Count	Weighted Percentage
11	liveability	17	31.48%
4	city	12	22.22%
6	living	8	14.81%
8	liveable	7	12.96%
5	urban	7	12.96%
4	life	2	3.70%
11	sustainable	1	1.85%

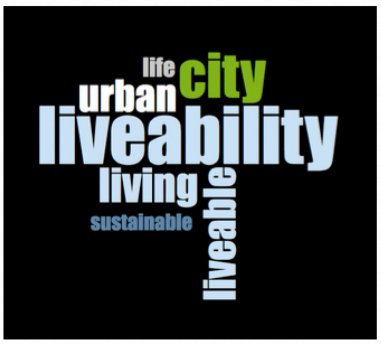

Figure 8.16 Weighted Percentage of Word Frequency for GUP no. 10. Association with Urban Walkability
Source: The Author (2019, NVIVO-Thematic Analysis)

Figure 8.17 below indicated the percentage of cited keywords associated with the theme: Liveability by interviewees during the Semi-structured Interview.

(i) Parameters to Theme: Both Parameters Urban Liveability and Healthy Community & Mixed-use Programme were cited by 100% of interviewees.

(ii) Indicators to Theme: The indicators of Sense of Community and Amenities and Facilities were both cited by 100% of interviewees, while indicators Housing Range and Users were cited only 56.25% and Healthy Communities were cited 87.50%. Nonetheless, both are still above 50% and satisfactorily high.

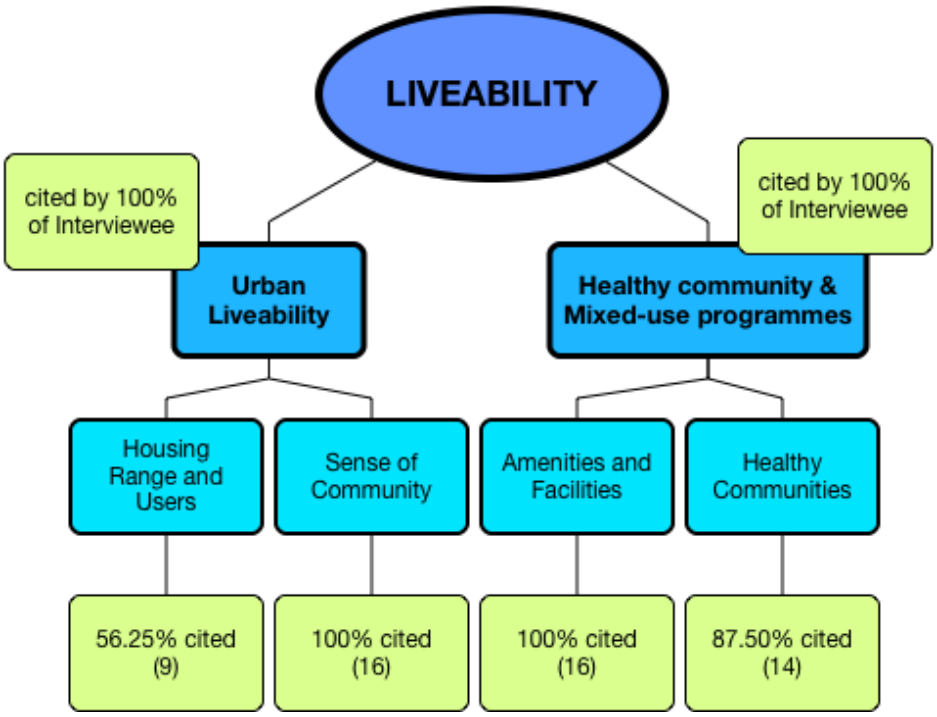

Figure 8.17 Percentage of interviewees cited keywords associated to Theme: LIVEABILITY
Source: The Author (2019, NVIVO-Thematic Analysis)

d. GU Principle 12: Cultural Heritage, Identity and Sense of Place

Principle 12 involved a more extensive breadth of fields, and two root words and one stem word appeared to have high frequencies, as shown in Figure 8.18. The first is Identity with 27.8% of Weighted Percentage, second is Culture with 22.95% of Weighted Percentage, and the third is Cultural which is a stem word from Culture with 8.20% (total of Weighted Percentage 31.15%).

Culture and cultural values are one of the key components in promoting towns and cities. The interview with a senior Town Planner and Head Researcher referred to as TP2 highlighted that, "Old Asian towns and cities like what we have in Malaysia are mostly walkable cities, as they are compactly built with mixed uses (ground floor is shop or work area, upper floor living quarter). Our towns also best in displaying our unique and diverse cultures, cultural values and heritage. This makes walking in towns like these pleasant and memorable. Alor Setar as I remember it is one of the nicest towns to walk and enjoy the displayed culture... very interesting!".

Another interviewee referred to as PM3 was in the view that unique identity helps to promote a place and persuade people to walk more at these places. In the interview, PM3 cited that "I believe that a town with a strong identity will make the people feel proud and make the best use of it. In the period where people are more well inform and appreciative towards history, culture and heritage… I would agree that a town with distinctive character and identity will make people go out and visit all these heritage and cultural places; perhaps walk more. In the case of Alor Setar, we do have several remarkable buildings and structures of heritage value and with significant Malay Identity. All the structures were beautifully crafted and constructed and representing our forefather's identity and great understanding of architectural design, technicalities and functionalities and surrounding spaces; and also engineering.".

Length	Word	Count	Weighted Percentage
8	identity	17	27.87%
7	culture	14	22.95%
5	local	9	14.75%
8	heritage	7	11.48%
6	spirit	6	9.84%
8	cultural	5	8.20%
5	image	2	3.28%
5	place	1	1.64%



Figure 8.18 Weighted Percentage of Word Frequency for GUP no. 12. Association with Urban Walkability
Source: The Author (2019, NVIVO-Thematic Analysis)

Figure 8.23 below indicated the percentage of cited keywords associated with the theme: Culture and Identity by interviewees during the Semi-structured Interview.

(i) Parameters to Theme: Both Parameters Cultural Heritage and Identity & Sense of Place were cited by 100% of interviewees.

(ii) Indicators to Theme: The percentage of all of the cited indicators are 100% except for Historical Elements (81.25%) and Spiritual Presence (68.75%). Although the percentage of cited association of the two mentioned indicators are not 100%, nonetheless, the percentages satisfactorily high.

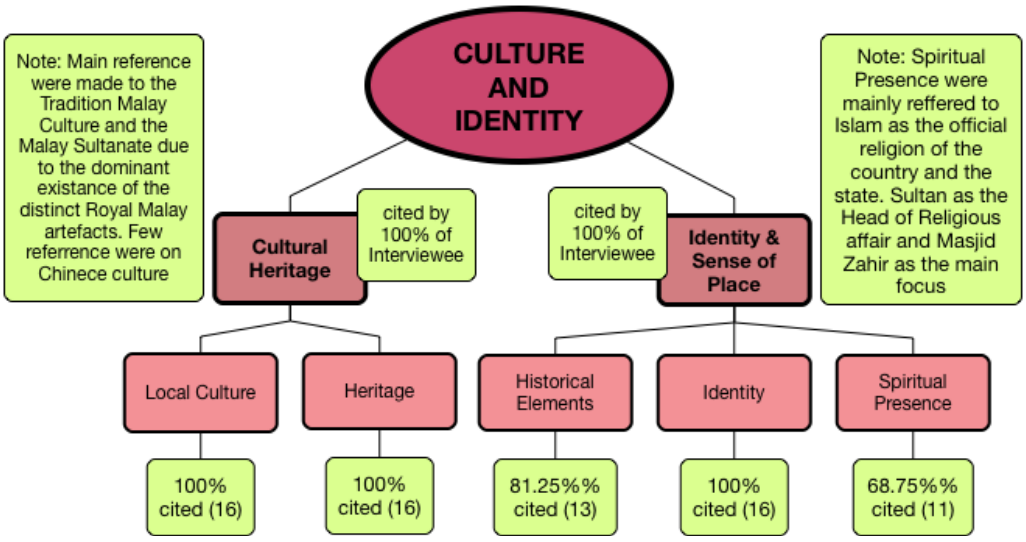

Figure 8.19 Percentage of interviewees cited keywords associated to Theme: CULTURE AND IDENTITY
Source: The Author (2019, NVIVO-Thematic Analysis)

Conclusively, the literature investigation on Green Urbanism definition revolves around four pivotal themes as in subsection 5.4. They are Nature, Urbanism, Liveability, and Culture and Identity. In order to make a cogent association of Green Urbanism Quality between Green Urbanism principles and urban walkability. The comparison of assigned themes according to GU principles by Delphi Survey and Semi-structured Interview are relatively similar and involved similar keywords as summarised in Table 8.33 below.

Table 8.33 Comparison of Associated Themes with GU Principles.

Theme in GU Definition	GU Principles	Theme by Delphi Survey	Theme by Structured Interview
• **Nature** • **Urbanism** • **Liveability** • **Culture and Identity**	**GUP 5**: Landscape, Gardens and Biodiversity	Nature and Biodiversity	Nature
	GUP 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities	Urbanism	Urbanism
	GUP 10: Liveability, Healthy Communities and Mixed-Use Programmes	Liveability	Liveability
	GUP 12: Cultural Heritage, Identity and Sense of Place	Culture, Heritage and Identity	Culture and Identity

8.6 Alor Setar Green Urbanism Index (ASGUI) - Measuring Green Urbanism Quality.

The measurement of Green Urbanism quality that supports urban walkability in Alor Setar using ASGUI differs from that of urban walkability using ASWI. ASGUI measured the categorical quality of environment identifiable to GUP, was not concerning the pedestrian count of a specific time and route distance. The reason to exclude pedestrian count was; first, to eliminate 'unconscious bias information based on pedestrian numbers' (Leather et al., 2011; Luadsakul & Ratanvaraha, 2013). Second, the issue of low utilisation of spaces along walking stretch contributes to the inherent bias in walkability index based on environmental quality (Leather et al., 2011; Luadsakul & Ratanvaraha, 2013), thus the reason for exclusion of pedestrian walkway route distance. The third, it helped to identify the presence of GUP that singularly contributes to environmental quality without the addition of other factors, i.e. number of pedestrians or length of survey routes. Finally, the exclusion of pedestrian count and route distance permitted an explicit identification of any environmental factors that promote urban walkability (Leather et al., 2011), thus finding the association between the GUP and ASWI at the case study area.
The results of the ASGUI survey are presented in three stages;

1) The sample of ASGUI calculations based on road groups, stretches and routes.
2) Green Urbanism quality (GUQ) in Alor Setar City Centre - The overall result of ASGUI (based on POMP Score).
3) The contributing factors of Green Urbanism qualities towards urban walkability in Alor Setar based on the parameters of the individual route (based on Categorical Ranking).

8.6.1 The Sample of ASGUI Calculations

This section describes the process and method of calculation used in the research. For the purpose of demonstrating the ASGUI calculations, only ONE sample data from ONE group at ONE route was used. The result used in this sample of calculation is derived from the data by Group 2 only at Jalan Tunku Ibrahim (JTI) which has four stretches (refer Figure 7.1) for route details.

The overall result of ASGUI is divided into three types;

a. Total Observed Rounded Value – Overall Route Score

To obtain the Total Observed Rounded Value for JTI, first the ranking value at all stretches given by one group (sample: Group 2) were calculated and the total was then divided by the number of stretches (Sample: four stretches) along the route (Sample: Jalan Tunku Ibrahim) for a 'Raw Average Value for Category'. Table 8.34 below shows the calculation of route average by Group 2 ONLY for Jalan Tunku Ibrahim. At the bottom end of the table indicated the 'Total Observed Rounded Value' for Jalan Tunku Ibrahim by Group 2 is 125.

Next, 'Raw Average Value for Category' (under column 10) from **ALL GROUPS** were calculated to generate the Mean Values. The mean values were then rounded up (under column 12) for easy classification of categories.

Finally, the 'Total Observed Rounded Value' (for a specific route, i.e. JTI) at the bottom of the table was derived by summing up the 'Rounded Value for Category' at column 12 as displayed in Table 8.35. Explicitly the table highlights ASGUI's Total Observed Rounded Value of GUQ from **ALL GROUPS** for Jalan Tunku Ibrahim is **127**. After that, this 127 GUQ value for Jalan Tunku Ibrahim was applied to calculate for POMP Score.

Table 8.34 Sample Calculation of Alor Setar Green Urbanism Index (ASGUI) at Jalan Tunku Ibrahim (Group 2: at Four Stretches)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: **JALAN TUNKU IBRAHIM**
Time: **AM**
Group: **2**
Survey No: **4/4(y)**
Peak Hours: **YES.**
Weather Cond.: **CLEAR SKY**

CATEGORY		
	1	VERY POOR
	2	POOR
	3	MODERATE
	4	GOOD
	5	VERY GOOD

GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	STRETCH 1	STRETCH 2	STRETCH 3	STRETCH 4	TOTAL	GP2 - RAW AVERAGE VALUE OF CATEGORY	COLOUR CODE FOR CATEGORY	GP2 - ROUNDED VALUE FOR CATEGORY	
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional Trees -Street Planting	4.00	3.00	4.00	3.00	14.00	3.50		**4**	
			ii) Aesthetic & Display– Palms/Shrubberies	4.00	4.00	4.00	3.00	15.0	3.75		4	
		b) Inner-city garden	i) Pocket park / Vertical garden / Linear garden/ Display Garden	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Mix Users and activities	4.00	3.00	3.00	3.00	13.0	3.25		3	
			iii) Social interaction and community activities	3.00	4.00	3.00	3.00	13.0	3.25		3	
		c) Urban farming	i) Plot land/ Bedded / Potted	2.00	1.00	1.00	1.00	5.0	1.25		1	
		d) Building greenery	i) Green roof and Balcony	1.00	1.00	1.00	1.00	4.0	1.00		1	
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / Identity creation	2.00	3.00	3.00	2.00	10.0	2.50		3	
			ii) Coverage (Continuous throughout the city)	2.00	2.00	2.00	2.00	8.0	2.00		2	
		b) accessibility to parks, gardens & public spaces	i) Access legibility	4.00	4.00	3.00	2.00	13.0	3.25		3	
			ii) Sense of Direction (notice board, direction signs, visual linkage)	4.00	3.00	1.00	1.00	9.0	2.25		2	
			iii) Connection to Public transport	3.00	5.00	3.00	3.00	14.0	3.50		4	
			iv) Easy access for pedestrian (connection with primary/secondary roads)	4.00	4.00	3.00	2.00	13.0	3.25		3	
			v) Easy access vehicle (connection wh primary/secondary roads / parking)	5.00	5.00	5.00	4.00	19.0	4.75		5	
		c) Leisure & recreation	i) Recreational Park (Relaxation / strolling & Exercise and Jogging)	1.00	2.00	1.00	1.00	5.0	1.25		1	
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	2.00	3.00	3.00	2.00	10.0	2.50		3	
		b) Ecology	i) Presence of urban peri-landscape	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Presence of native vegetation	1.00	1.00	1.00	1.00	4.0	1.00		1	
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	1.00	1.00	1.00	1.00	4.0	1.00		1	
		d) Forest conservation	i) Presence of urban forest	1.00	2.00	1.00	1.00	5.0	1.25		1	
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Maintenance and management of streams and rivers	1.00	2.00	1.00	2.00	6.0	1.50		1	
		b) Re-establishing River Banks	i) Reinstating uses and function of river banks	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Presence of recreational activities along the river	1.00	2.00	1.00	1.00	5.0	1.25		1	Sum of GUP 5
			iii) Presence of community involvement/activities along the river banks	1.00	1.00	1.00	1.00	4.0	1.00		1	
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and Connectivity	5.00	5.00	5.00	5.00	20.0	5.00		5	
			ii) Assigned walkways / Paved or Unpaved path	5.00	4.00	4.00	4.00	17.0	4.25		4	
			iii) Availability of cycling lanes and facilities	1.00	1.00	1.00	1.00	4.0	1.00		1	
			iv) Safe pedestrian ways	4.00	3.00	2.00	2.00	11.0	2.75		3	
			v) Safe bicycle ways	1.00	1.00	1.00	1.00	4.0	1.00		1	
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	3.00	3.00	3.00	2.00	11.0	2.75		3	
			ii) Centralised parking spaces (park and ride)	4.00	3.00	3.00	2.00	12.0	3.00		3	
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	3.00	5.00	2.00	2.00	12.0	3.00		3	
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	3.00	2.00	2.00	2.00	9.0	2.25		2	
			ii) Presence of social interaction and community activities	3.00	4.00	2.00	2.00	11.0	2.75		3	
		b) Pedestrian network and connectivity	i) Connected pedestrian network	4.00	5.00	2.00	2.00	13.0	3.25		3	
			ii) Streetscape that encourage healthy and active life	2.00	2.00	2.00	1.00	7.0	1.75		2	
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	2.00	2.00	2.00	1.00	7.0	1.75		2	
			ii) Mix development / land use (residential and business)	3.00	3.00	2.00	1.00	9.0	2.25		2	Sum of GUP 6
		b) Diversity	i) Diverse business types	4.00	5.00	3.00	2.00	14.0	3.50		4	
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	2.00	1.00	1.00	1.00	5.0	1.25		1	
			ii) Mixed users – age, race, workers/students (city campus)	4.00	4.00	2.00	1.00	11.0	2.75		3	
		b) Sense of community	i) Compact housing and communities	2.00	2.00	2.00	1.00	7.0	1.75		2	
			ii) Connected housing areas	1.00	2.00	1.00	1.00	5.0	1.25		1	
	9- Healthy community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Community centres	2.00	2.00	2.00	1.00	7.0	1.75		2	
		b) Healthy communities	i) Facilities for healthy lifestyles	1.00	1.00	1.00	1.00	4.0	1.00		1	
			ii) Recreational areas and facilities	1.00	2.00	1.00	1.00	5.0	1.25		1	Sum of GUP 10
			iii) Social spaces	1.00	2.00	1.00	1.00	5.0	1.25		1	
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	3.00	4.00	2.00	1.00	10.0	2.50		3	
		b) Heritage	i) Heritage values (Areas/Buildings/Structures/Activity)	2.00	3.00	2.00	2.00	9.0	2.25		2	
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	3.00	3.00	2.00	2.00	10.0	2.50		3	
			ii) Foreign influences history	2.00	1.00	1.00	1.00	5.0	1.25		1	
			iii) Historical significant (Structure /Artefact)	1.00	2.00	1.00	1.00	5.0	1.25		2	
		b) Identity	i) Image and Identity	3.00	3.00	2.00	2.00	10.0	2.50		3	
		c) Spiritual presence	i) Religious based	1.00	1.00	1.00	1.00	4.0	1.00		1	Sum of GUP 12
			ii) Cultural and race based	2.00	4.00	2.00	2.00	10.0	2.50		3	
									Total Observed Rounded Value		**125**	

Table 8.35 Sample Calculation of Alor Setar Green Urbanism Index (ASGUI) at Jalan Tunku Ibrahim (All groups Mean Value)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: JALAN TUNKU IBRAHIM **Group: ALL GROUPS** **Survey No: 4/4(y)**

Time: AM **Peak Hours: YES.** **Weather Condition: CLEAR SKY**

COLOUR CODE	CATEGORY	
1	1	VERY POOR
2	2	POOR
3	3	MODERATE
4	4	GOOD
5	5	VERY GOOD

GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	JALAN TUNKU IBRAHIM							
				Group 1	Group 2	Group 3	Group 4	Total	Mean Value	Colour Code for Category	Rounded Value for Category
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional Trees -Street Planting	2	4	4	2	12.00	3.00		3
			ii) Aesthetic & Display– Palms/Shrubberies	2	4	4	2	12.00	3.00		3
		b) Inner-city Garden	i) Pocket park / Vertical garden / Linear garden/ Display Garden	1	1	2	1	5.00	1.25		1
			ii) Mix Users and activities	3	2	2	2	9.00	2.25		2
			iii) Social interaction and community activities	3	3	2	3	11.00	2.75		3
		c) Urban farming	i) Plot land/ Bedded / Potted	3	1	2	1	7.00	1.75		2
		d) Building greenery	i) Green roof and Balcony	1	1	1	1	4.00	1.00		1
	2- Integrated urban landscape	a) Urban landscape	i) Image / Identity creation	3	3	2	3	11.00	2.75		3
			ii) Coverage (Continuous throughout the city)	2	2	1	1	6.00	1.50		2
		b) accessibility to parks, gardens & public spaces	i) Access legibility	3	3	2	2	10.00	2.50		3
			ii) Sense of Direction (notice board, direction signs, visual linkage)	3	2	2	2	9.00	2.25		2
			iii) Connection to Public transport	3	4	2	2	11.00	2.75		3
			iv) Easy access for pedestrian (connection with primary/secondary roads)	4	3	4	4	15.00	3.75		4
			v) Easy access vehicle (connection with primary/secondary roads / parking)	5	5	5	5	20.00	5.00		5
		c) Leisure & recreation	i) Recreational Park (Relaxation / strolling & Exercise and Jogging)	1	1	1	2	5.00	1.25		1
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	1	1	1	2	5.00	1.25		1
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	3	3	3	3	12.00	3.00		3
		b) Ecology	i) Presence of urban peri-landscape	1	1	2	2	6.00	1.50		2
			ii) Presence of native vegetation	1	1	2	2	6.00	1.50		2
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	1	1	2	1	5.00	1.25		1
		d) Forest Conservation	i) Presence of urban forest	1	1	1	1	4.00	1.00		1
	4- Conserving Natural Resources	a) Restoring Streams	i) Reintroducing streams and rivers in the city	1	1	2	1	5.00	1.25		1
			ii) Maintenance and management of streams and rivers	1	1	2	1	5.00	1.25		1
		b) Re-establishing River Banks	i) Reinstating uses and function of river banks	1	1	1	1	4.00	1.00		1
			ii) Presence of recreational activities along the river	1	1	2	1	5.00	1.25		1
			iii) Presence of community involvement/activities along the river banks	1	1	1	1	4.00	1.00		1
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and Connectivity	5	5	5	5	20.00	5.00		5
			ii) Assigned walkways / Paved or Unpaved path	4	4	4	4	16.00	4.00		4
			iii) Availability of cycling lanes and facilities	1	1	1	1	4.00	1.00		1
			iv) Safe pedestrian ways	3	3	2	4	12.00	3.00		3
			v) Safe bicycle ways	1	1	1	1	4.00	1.00		1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	3	3	1	2	9.00	2.25		2
			ii) Centralised parking spaces (park and ride)	2	3	1	1	7.00	1.75		2
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	3	3	2	3	11.00	2.75		3
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	4	2	3	2	11.00	2.75		3
			ii) Presence of social interaction and community activities	3	3	1	2	9.00	2.25		2
		b) Pedestrian network and connectivity	i) Connected pedestrian network	3	3	3	4	13.00	3.25		3
			ii) Streetscape that encourage healthy and active life	2	2	2	3	9.00	2.25		2
	7- Compact and polycentric city	a) Land uses	i) Close proximity to residential areas	3	2	1	1	7.00	1.75		2
			ii) Mix development / land use (residential and business)	3	2	3	2	10.00	2.50		3
		b) Diversity	i) Diverse business types	3	4	4	4	15.00	3.75		4
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	1	1	1	1	4.00	1.00		1
			ii) Mixed users – age, race, workers/students (city campus)	3	3	3	3	12.00	3.00		3
		b) Sense of community	i) Compact housing and communities	3	2	1	1	7.00	1.75		2
			ii) Connected housing areas	2	1	1	1	5.00	1.25		1
	9- Healthy community & Mixed-use programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	3	1	1	2	7.00	1.75		2
			ii) Community centres	3	2	1	1	7.00	1.75		2
		b) Healthy communities	i) Facilities for healthy lifestyles	2	1	1	1	5.00	1.25		1
			ii) Recreational areas and facilities	2	1	1	1	5.00	1.25		1
			iii) Social spaces	4	1	2	3	10.00	2.50		3
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	3	3	1	3	10.00	2.50		3
		b) Heritage	i) Heritage values (Areas/Buildings/Structures/Activity)	3	2	2	3	10.00	2.50		3
	11- Identity & Sense of place	a) Historical elements	i) Local based history	2	3	2	1	8.00	2.00		2
			ii) Foreign influences history	3	1	1	1	6.00	1.50		2
			iii) Historical significant (Structure /Artefact)	2	2	1	1	6.00	1.50		2
		b) Identity	i) Image and Identity	3	3	2	3	11.00	2.75		3
		c) Spiritual presence	i) Religious based	1	1	1	1	4.00	1.00		1
			ii) Cultural and race based	1	3	1	1	6.00	1.50		2
								Total Observed Rounded Value for JTI			**127**

b. <u>POMP Score</u> – Overall Route Score

The calculation for overall Route Performance of each route based from ASGUI result (see sub-section 8.5.2). ASGUI measured the quality of the environment for the whole roads stretches using the *Percentage of Maximum Possible* (POMP) Score technique. This technique was able to quantify the observed ranking value into a valid percentage statistically. Thus, it permits a valid comparison of the overall percentage of Green Urbanism quality on each route. The advantage of using POMP Score as accorded by (Gota et al., 2010) are;

i) it made possible to convert the unit of Likert scale ranking into a percentage,

ii) The percentage of value attained from POMP scores were then easily associated with the Adjusted Value for Standard Range of Green Urbanism Quality (GUQ) (Table 4.12 under Section 4.9.5).

iii) POMP Score helped in establishing a comparable result of both ASWI and ASGUI for a possible association between the two.

The calculation for ASGUI using POMP Score for Jalan Tunku Ibrahim is as follows:
POMP Score = [(observed value – minimum value) / (maximum possible value – minimum value)] × 100, where observed = the observed score for a single case, minimum = the minimum possible score on the scale (58 indicator x 1), and maximum = the maximum possible score on the scale (58 indicators x 5).

$$\text{ASGUI POMP Score} = \frac{\text{Total Observed value – Minimum value}}{\text{Maximum possible value – Minimum value}} \text{ x } 100$$

$$\text{ASGUI POMP Score} = \frac{127-58}{290-58} \text{ x } 100$$

$$\text{ASGUI POMP Score} = \frac{69}{232} \text{ x } 100$$

$$\textbf{ASGUI POMP Score for LDA} = \mathbf{29.73\%}$$

Thus, Lebuhraya Darul Aman ASGUI POMP Score is 29.73%, this value will then be compared with the POMP Score of other routes to help identify which route has the highest POMP Score value.

c. Categorical ranking – Detail Parameters and Principles Ranking Values

The calculation for Categorical ranking involves the overall result gathered by ALL GROUPS for a particular route (i.e. data from all four groups for JTI). The detail calculation indicating categorical values for the individual indicator, parameter and Principle for each route based from ASGUI result (see sub-section 8.6.1 – 8.6.4). The categorical ranking allows a parallel comparison (based on the range as in Table 6.12) on the extent of contribution of each indicator and each Principle towards the GUQ on each route.

Table 8.36 below showcases the **sample of calculation** for 'Categorical Ranking Based on Green Urbanism Quality' for Jalan Tunku Ibrahim by Group 2 data **ONLY** (whereby the actual calculations for Categorical Ranking were using the Mean Value Data from all four groups). The table shows Raw Average Value (derived from the four stretches) of each category ranking for every measured indicator.

Table 8.36 Jalan Tunku Ibrahim – Calculation for Categorical Ranking Based on Green Urbanism Quality (Sample Calculation by Group 2 Only)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: **JALAN TUNKU IBRAHIM**
Time: **AM**
Group: **2**
Survey No: **4/4(y)**
Peak Hours: **YES.**
Weather Cond.: **CLEAR SKY**

COLOUR CODE	RANGE	CATEGORY
	0.000 - 1.001	VERY POOR
	1.001 - 2.001	POOR
	2.001 - 3.001	MODERATE
	3.001 - 4.001	GOOD
	4.001 - 5.000	VERY GOOD

GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	FREQUENCY OF RANKING (G2)	MEAN VALUE (G2)	RANGE OF CATEGORY	CATEGORY	COLOUR CODE FOR CATEGORY	ROUNDED VALUE FOR CATEGORY (G2)
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional Trees -Street Planting	14.00	3.50	3.001 - 4.001	Good		4
			ii) Aesthetic & Display– Palms/Shrubberies	15.00	3.75	3.001 - 4.001	Good		4
		b) Inner-city Garden	i) Pocket park / Vertical garden / Linear garden/ Display Garden	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Mix Users and activities	13.00	3.25	2.001 - 3.001	Moderate		3
			iii) Social interaction and community activities	13.00	3.25	2.001 - 3.001	Moderate		3
		c) Urban farming	i) Plot land/ Bedded / Potted	5.00	1.25	0.000 - 1.001	Very Poor		1
		d) Building greenery	i) Green roof and Balcony	4.00	1.00	0.000 - 1.001	Very Poor		1
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / Identity creation	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Coverage (Continuous throughout the city)	8.00	2.00	1.001 - 2.001	Poor		2
		b) accessibility to parks, gardens & public spaces	i) Access legibility	13.00	3.25	2.001 - 3.001	Moderate		3
			ii) Sense of Direction (notice board, direction signs, visual linkage)	9.00	2.25	1.001 - 2.001	Poor		2
			iii) Connection to Public transport	14.00	3.50	3.001 - 4.001	Good		4
			iv) Easy access for pedestrian (connection with primary/secondary roads)	13.00	3.25	2.001 - 3.001	Moderate		3
			v) Easy access vehicle (connection wh primary/secondary roads / parking)	19.00	4.75	4.001 - 5.000	Very Good		5
		c) Leisure & recreation	i) Recreational Park (Relaxation / strolling & Exercise and Jogging)	5.00	1.25	0.000 - 1.001	Very Poor		1
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	10.00	2.50	2.001 - 3.001	Moderate		3
		b) Ecology	i) Presence of urban peri-landscape	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Presence of native vegetation	4.00	1.00	0.000 - 1.001	Very Poor		1
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	4.00	1.00	0.000 - 1.001	Very Poor		1
		d) Forest Conservation	i) Presence of urban forest	5.00	1.25	0.000 - 1.001	Very Poor		1
	4- Conserving Natural Resources	a) Restoring Streams	i) Reintroducing streams and rivers in the city	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Maintenance and management of streams and rivers	6.00	1.50	0.000 - 1.001	Very Poor		1
		b) Re-establishing River Banks	i) Reinstating uses and function of river banks	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Presence of recreational activities along the river	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Presence of community involvement/activities along the river banks	4.00	1.00	0.000 - 1.001	Very Poor		1
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and Connectivity	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Assigned walkways / Paved or Unpaved path	17.00	4.25	3.001 - 4.001	Good		4
			iii) Availability of cycling lanes and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			iv) Safe pedestrian ways	11.00	2.75	2.001 - 3.001	Moderate		3
			v) Safe bicycle ways	4.00	1.00	0.000 - 1.001	Very Poor		1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	11.00	2.75	2.001 - 3.001	Moderate		3
			ii) Centralised parking spaces (park and ride)	12.00	3.00	2.001 - 3.001	Moderate		3
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	12.00	3.00	2.001 - 3.001	Moderate		3
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	9.00	2.25	1.001 - 2.001	Poor		2
			ii) Presence of social interaction and community activities	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Pedestrian network and connectivity	i) Connected pedestrian network	13.00	3.25	2.001 - 3.001	Moderate		3
			ii) Streetscape that encourage healthy and active life	7.00	1.75	1.001 - 2.001	Poor		2
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Mix development / land use (residential and business)	9.00	2.25	1.001 - 2.001	Poor		2
		b) Diversity	i) Diverse business types	14.00	3.50	3.001 - 4.001	Good		4
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Mixed users – age, race, workers/students (city campus)	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Sense of community	i) Compact housing and communities	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Connected housing areas	5.00	1.25	0.000 - 1.001	Very Poor		1
	9- Healthy community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Community centres	7.00	1.75	1.001 - 2.001	Poor		2
		b) Healthy communities	i) Facilities for healthy lifestyles	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Recreational areas and facilities	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Social spaces	5.00	1.25	0.000 - 1.001	Very Poor		1
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	10.00	2.50	2.001 - 3.001	Moderate		3
		b) Heritage	i) Heritage values (Areas/Buildings/Structures/Activity)	9.00	2.25	1.001 - 2.001	Poor		2
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Foreign influences history	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Historical significant (Structure /Artefact)	5.00	1.25	1.001 - 2.001	Poor		2
		b) Identity	i) Image and Identity	10.00	2.50	2.001 - 3.001	Moderate		3
		c) Spiritual presence	i) Religious based	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Cultural and race based	10.00	2.50	2.001 - 3.001	Moderate		3

Then, the Average Values were compared with the table of range for the category classifications, as in

Table 8.37 detailed the frequency and valid percentage of each category and each Principle.

Table 8.37 Categorical Ranking Value – Frequency and Valid Percentage Based on Each Principle for Jalan Tunku Ibrahim (Sample Calculation by Group 2 Only)

		JTI (Average)		GUP 5		GUP 6		GUP 10		GUP 12	
Colour Code	**Category**	***f*** **(58)**	**Valid %**	***f*** **(26)**	**Valid %**	***f*** **(15)**	**Valid %**	***f*** **(9)**	**Valid %**	***f*** **(8)**	**Valid %**
	Very Poor	24	41.38	14	53.85	2	13.33	6	66.67	2	25.00
	Poor	10	17.24	2	7.69	4	26.67	2	22.22	2	25.00
	Moderate	17	29.31	6	23.08	6	40.00	1	11.11	4	50.00
	Strong	5	8.62	3	11.54	2	13.33	0	0.00	0	0.00
	Very Strong	2	3.45	1	3.85	1	6.67	0	0.00	0	00.00
Total %			100.00		100.00		100.00		100.00		100.00
Total Valid % (Moderate to Strong)			**41.38%**		**38.40%**		**60.00%**		**11.10%**		**50.00%**

Note: ***f*** **= Frequency and Valid % = Valid Percentage**

Accordingly, the Valid Percentage accumulated from 'Moderate' to 'Strong' were added to determine the level of GUQ at along Jalan Tunku Ibrahim. As indicated in the above table, the average GUQ for Jalan Tunku Ibrahim is 41.38%. Specifically, amongst the four Principles, Principle 6 scored the highest Valid Percentage of GUQ with 60.00%, followed by Principle 12 with 50.00%. The third is Principle 5 with 38.40% and lastly, Principle 10 with 11.10%. Discussion on Principle's contributions and its parameters will follow as the discussion for each route progressed in the subsequent subchapters.

8.7 Green Urbanism Quality (GUQ) in Alor Setar – The Overall Result of ASGUI

Table 8.38 below indicated the overall result of ASGUI for all four routes. The Total Observed Values [refer sample calculation under sub-section 8.6.1 (a)], as shown at the bottom of the table signified that of all the four routes;

i. Lebuhraya Darul Aman secures the highest ASGUI value of **210** (refer table 8.40 for detail calculation) with POMP Score of **65.52%**.
ii. Jalan Sultan Badlishah secures the second highest with ASGUI value of **180** (refer table 8.52 for detail calculation) with POMP Score of **52.59%.**

iii. Jalan Tunku Ibrahim secures the third highest with ASGUI value of **127** (refer table 8.44 for detail calculation) with POMP Score of **29.74%.**

iv. Jalan Langgar received the least ASGUI value of **104** (refer table 8.48 for detail calculation) with POMP Score of **19.83%**.

Both Jalan Tunku Ibrahim and Jalan Langgar scores were below the mean value of 155.25.

Table 8.38 Alor Setar Green Urbanism Index Quality Associated with Urban Walkability Index - The Overall Result of ALL Four Routes

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: **ALL ROUTES** **Group: ALL GROUPS** **Survey No: 4/4(y)**

SCORE VALUE	CATEGORY
1	VERY POOR
2	POOR
3	MODERATE
4	GOOD
5	VERY GOOD

GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Rounded Value for Category: Lebuhraya Darul Aman	Jalan Tunku Ibrahim	Jalan Langgar	Jalan Sultan Badlishah
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional Trees -Street Planting	5	3	2	5
			ii) Aesthetic & Display– Palms/Shrubberies	5	3	2	5
		b) Inner-city garden	i) Pocket park / Vertical garden / Linear garden/ Display Garden	5	1	1	5
			ii) Mix Users and activities	5	2	2	4
			iii) Social interaction and community activities	5	3	2	3
		c) Urban farming	i) Plot land/ Bedded / Potted	3	2	2	3
		d) Building greenery	i) Green roof and Balcony	2	1	1	1
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / Identity creation	5	3	2	4
			ii) Coverage (Continuous throughout the city)	3	2	1	4
		b) accessibility to parks, gardens & public spaces	i) Access legibility	4	3	1	5
			ii) Sense of Direction (notice board, direction signs, visual linkage)	3	2	1	5
			iii) Connection to Public transport	3	3	2	3
			iv) Easy access for pedestrian (connection with primary/secondary roads)	5	4	2	5
			v) Easy access vehicle (connection with primary/secondary roads / parking)	4	5	3	4
		c) Leisure & recreation	i) Recreational Park (Relaxation / strolling & Exercise and Jogging)	3	1	1	3
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	2	1	2	2
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	3	3	2	4
		b) Ecology	i) Presence of urban peri-landscape	3	2	2	3
			ii) Presence of native vegetation	3	2	2	3
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	2	1	2	3
		d) Forest conservation	i) Presence of urban forest	2	1	2	2
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	2	1	1	2
			ii) Maintenance and management of streams and rivers	2	1	1	2
		b) Re-establishing River Banks	i) Reinstating uses and function of river banks	2	1	1	2
			ii) Presence of recreational activities along the river	4	1	1	1
			iii) Presence of community involvement/activities along the river banks	2	1	1	1
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and Connectivity	5	5	3	5
			ii) Assigned walkways / Paved or Unpaved path	5	4	2	5
			iii) Availability of cycling lanes and facilities	1	1	1	1
			iv) Safe pedestrian ways	5	3	3	5
			v) Safe bicycle ways	1	1	1	1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	3	2	2	3
			ii) Centralised parking spaces (park and ride)	3	2	1	4
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	3	3	1	2
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	5	3	2	4
			ii) Presence of social interaction and community activities	4	2	2	3
		b) Pedestrian network and connectivity	i) Connected pedestrian network	5	3	2	5
			ii) Streetscape that encourage healthy and active life	2	2	2	4
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	5	2	2	3
			ii) Mix development / land use (residential and business)	4	3	3	3
		b) Diversity	i) Diverse business types	5	4	3	4
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	5	1	1	3
			ii) Mixed users – age, race, workers/students (city campus)	4	3	2	3
		b) Sense of community	i) Compact housing and communities	4	2	2	1
			ii) Connected housing areas	3	1	2	1
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	2	2	1	2
			ii) Community centres	3	2	1	2
		b) Healthy communities	i) Facilities for healthy lifestyles	2	1	1	2
			ii) Recreational areas and facilities	2	1	1	2
			iii) Social spaces	5	3	2	2
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	5	3	3	3
		b) Heritage	i) Heritage values (Areas/Buildings/Structures/Activity)	5	3	3	3
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	5	2	2	3
			ii) Foreign influences history	3	2	2	2
			iii) Historical significant (Structure /Artefact)	5	2	2	2
		b) Identity	i) Image and Identity	5	3	3	5
		c) Spiritual presence	i) Religious based	4	1	2	4
			ii) Cultural and race based	5	2	2	4
			Total Observed Rounded Value	**210**	**127**	**104**	**180**
			Minimum Value	58			
			Maximim Value	290			
			POMP Score	**65.52**	**29.74**	**19.83**	**52.59**

The above results of POMP Scores were compared with the Adjusted Value for Standard Range of Green Urbanism Quality Measure Associated to Urban Walkability (ref. Table 4.12 at Section 4.9.5) as detailed in Table 8.39 below. According to the range of adjusted value, the GUQ status for Lebuhraya Darul Aman is at 'Good Green Urbanism Quality' and the most walkable among the four routes. Second is Jalan Sultan Badlishah which walkability status is 'Moderate Green Urbanism Quality'. The walkability status for Jalan Tunku Ibrahim and Jalan Langgar were 'Poor Green Urbanism Quality' and 'Very Poor Green Urbanism Quality' respectively.

Table 8.39 Green Urbanism Quality's Route Status Based on Range of Adjusted Value

Rank	Route	ASGUI Observed Score	POMP Score (%)	Range of Adjusted Value	Green Urbanism Quality Status
1	Lebuhraya Darul Aman	**210**	**65.52**	61 – 80	Good Green Urbanism Quality
2	Jalan Sultan Badlishah	**180**	**59.06**	41 – 60	Moderate Green Urbanism Quality
3	Jalan Tunku Ibrahim	**127**	**21.62**	21 – 40	Poor Green Urbanism Quality
4	Jalan Langgar	**104**	**16.17**	0 - 20	Very Poor Green Urbanism Quality

8.7.1 Lebuhraya Darul Aman – The contributing Factors for Green Urbanism Quality (GUQ)

The data collected for LDA are divided into three types as follows;

a. Total Observed Rounded Value – Overall Route Score for LDA

Table 8.40 displays the ASGUI Mean Value, Standard of Range, Category (based on Standard of Range) and Rounded Value for Category for all groups. Mean Value helps the identification of category (from Very Poor to Very Good) based on the standard range of 0.000 to 5.000. The Mean Value were rounded up (Rounded Value for Category) to simplify the classification of category and comparison process.

Table 8.40 below displays the Mean Value based from scores given by all four groups, Range of the Category and the Rounded Value for category as clarified under sub-section 8.5.1 (a).

Table 8.40 Alor Setar Green Urbanism Index: Green Urbanism Quality (GUQ) for Lebuhraya Darul Aman (LDA)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: LEBUHRAYA DARUL AMAN **Group:** ALL GROUPS **Survey No:** 4/4(y)

Time: AM **Peak Hours:** YES. **Weather Condition:** CLEAR SKY

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				LEBUHRAYA DARUL AMAN										
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Group 1	Group 2	Group 3	Group 4	Total	Mean Value	Range	Category	Colour Code for Category	Rounded Value for Category	
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional Trees -Street Planting	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Aesthetic & Display– Palms/Shrubberies	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
		b) Inner-city garden	i) Pocket park / Vertical garden / Linear garden/ Display Garden	5	5	5	4	19.00	4.75	4.001 - 5.000	Very Good		5	
			ii) Mix Users and activities	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			iii) Social interaction and community activities	5	4	5	5	19.00	4.75	4.001 - 5.000	Very Good		5	
		c) Urban farming	i) Plot land/ Bedded / Potted	3	3	3	3	12.00	3.00	2.001 - 3.001	Moderate		3	
		d) Building greenery	i) Green roof and Balcony	2	2	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / Identity creation	5	4	5	5	19.00	4.75	4.001 - 5.000	Very Good		5	
			ii) Coverage (Continuous throughout the city)	3	3	3	2	11.00	2.75	2.001 - 3.001	Moderate		3	
		b) accessibility to parks, gardens & public spaces	i) Access legibility	5	3	3	3	14.00	3.50	3.001 - 4.001	Good		4	
			ii) Sense of Direction (notice board, direction signs, visual linkage)	4	3	2	2	11.00	2.75	2.001 - 3.001	Moderate		3	
			iii) Connection to Public transport	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			iv) Easy access for pedestrian (connection with primary/secondary roads)	5	4	4	5	18.00	4.50	4.001 - 5.000	Very Good		5	
			v) Easy access vehicle (connection with primary/secondary roads / parking)	4	3	3	5	15.00	3.75	3.001 - 4.001	Good		4	
		c) Leisure & recreation	i) Recreational Park (Relaxation / strolling & Exercise and Jogging)	3	2	2	3	10.00	2.50	2.001 - 3.001	Moderate		3	
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	2	1	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	4	4	3	3	14.00	3.50	2.001 - 3.001	Moderate		3	
		b) Ecology	i) Presence of urban peri-landscape	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Presence of native vegetation	3	2	3	3	11.00	2.75	2.001 - 3.001	Moderate		3	
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	3	2	2	2	9.00	2.25	1.001 - 2.001	Poor		2	
		d) Forest conservation	i) Presence of urban forest	2	2	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			ii) Maintenance and management of streams and rivers	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
		b) Re-establishing River Banks	i) Reinstating uses and function of river banks	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			ii) Presence of recreational activities along the river	4	4	4	4	16.00	4.00	3.001 - 4.001	Good		4	Sum of GUP 5 87
			iii) Presence of community involvement/activities along the river banks	3	2	2	2	9.00	2.25	1.001 - 2.001	Poor		2	
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and Connectivity	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Assigned walkways / Paved or Unpaved path	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			iii) Availability of cycling lanes and facilities	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			iv) Safe pedestrian ways	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			v) Safe bicycle ways	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Centralised parking spaces (park and ride)	3	4	3	3	13.00	3.25	2.001 - 3.001	Moderate		3	
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	5	5	5	4	19.00	4.75	4.001 - 5.000	Very Good		5	
			ii) Presence of social interaction and community activities	4	4	3	4	15.00	3.75	3.001 - 4.001	Good		4	
		b) Pedestrian network and connectivity	i) Connected pedestrian network	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Streetscape that encourage healthy and active life	2	2	2	3	9.00	2.25	1.001 - 2.001	Poor		2	
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	5	4	4	5	18.00	4.50	4.001 - 5.000	Very Good		5	
			ii) Mix development / land use (residential and business)	3	3	4	4	14.00	3.50	3.001 - 4.001	Good		4	Sum of GUP 6 56
		b) Diversity	i) Diverse business types	5	5	4	5	19.00	4.75	4.001 - 5.000	Very Good		5	
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	4	5	4	5	18.00	4.50	4.001 - 5.000	Very Good		5	
			ii) Mixed users – age, race, workers/students (city campus)	4	4	4	4	16.00	4.00	3.001 - 4.001	Good		4	
		b) Sense of community	i) Compact housing and communities	3	3	4	4	14.00	3.50	3.001 - 4.001	Good		4	
			ii) Connected housing areas	3	3	3	3	12.00	3.00	2.001 - 3.001	Moderate		3	
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	2	1	1	2	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Community centres	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
		b) Healthy communities	i) Facilities for healthy lifestyles	2	1	2	2	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Recreational areas and facilities	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	Sum of GUP 10 30
			iii) Social spaces	5	5	4	4	18.00	4.50	4.001 - 5.000	Very Good		5	
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	5	4	5	4	18.00	4.50	4.001 - 5.000	Very Good		5	
		b) Heritage	i) Heritage values (Areas/Buildings/Structures/Activity)	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Foreign influences history	3	3	3	3	12.00	3.00	2.001 - 3.001	Moderate		3	
			iii) Historical significant (Structure /Artefact)	4	5	5	5	19.00	4.75	4.001 - 5.000	Very Good		5	
		b) Identity	i) Image and Identity	4	5	5	5	19.00	4.75	4.001 - 5.000	Very Good		5	
		c) Spiritual presence	i) Religious based	2	5	5	5	17.00	4.25	3.001 - 4.001	Good		4	Sum of GUP 12 37
			ii) Cultural and race based	5	4	5	5	19.00	4.75	4.001 - 5.000	Very Good		5	
												Total Observed Rounded Value	**210**	

The 'Total Observed Rounded Value' for LDA is 210 and can be translated according to overall rating and percentage of the category that were contributed by all Principles towards GUQ along LDA as illustrated in Figure 8.20 below.

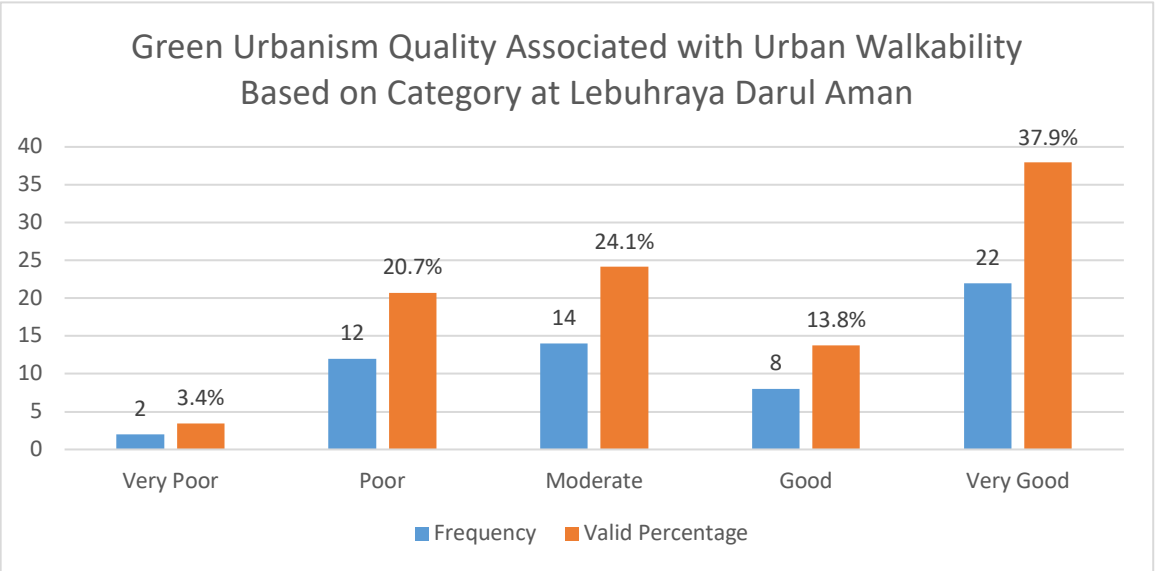

Figure 8.20 Green Urbanism Quality (GUQ) Based on Category at Lebuhraya Darul Aman

Figure 8.20 indicated the contributions of all Principles that 22 of 58 or 37.9% of indicators for GUQ along LDA were rated as 'Very Good'. This is followed by 14 out of 58 or 24.1% of indicators as 'Moderate', 12 out of 58 or 20.7% of indicators as 'Poor', 8 out of 58 or 13.8% as 'Good' and finally only 2 out of 58 or 3.4% of indicators were rated as 'Very Poor'.

b. POMP Score – Overall Route Score for LDA

The overall POMP Score for Lebuhraya Darul Aman is 65.52% (the calculation as detailed in sub-section 8.5.1 (b). In order to identify the contribution of individual Principle, POMP Score of each Principle was calculated and divided with the total accumulated POMP Score of all four Principles. Table 8.41 below indicated that Principle 12 has the highest POMP Score amongst all four Principles, with 90.63%. The second and third are Principle 6 and 5 with POMP Score of 68.33% and 58.65% respectively. The last is Principle 10 with POP Score of only 58.65%.

Table 8.41 Percentage of Contribution of Individual Principle for Green Urbanism Quality (GUQ) at Lebuhraya Darul Aman

Items	Principle 5	Principle 6	Principle 10	Principle 12
*Total Indicators	26	15	9	8
*Min. Score	26	15	9	8
*Max. Score	130	75	45	40
Observed Indicators	87	56	30	37
*All Routes Mean (ASGUI)	2.703			
LDA Mean	3.621			
Individual Principle Mean	3.346	3.733	3.333	4.625
***LDA POMP Score**	**65.52%**			
POMP Score	58.65	68.33	58.33	90.63
Percentage of Contribution	**21.26%**	**24.76%**	**21.14%**	**32.84%**

* - Same value for all for routes

Table 8.41 above also highlighted the percentage of contribution of Principle 12 towards GUQ was the highest among all four Principles, which was at 32.84%, also with the highest mean value of 4.625. The second highest was Principle 6 with 24.76% and mean value of 3.733. Both mean values for Principles 12 and 6 were above LDA mean value of 3.621 and all routes mean of 2.703. This is followed by Principle 5 with 21.26% and a mean value of 3.346 and lastly, Principle 10 with 21.14 percent and mean value of 3.33. Both mean values of Principles 5 and 10 were below LDA mean value, however still higher than all routes mean.

c. Categorical ranking – Detail Parameters and Principles Ranking Values

The categorical ranking enables parallel comparison of the extent of contribution of all four Principles, parameters and indicators for GUQ along LDA (as in Table 6.12 Standard of Range). The calculated Mean Values (from the Frequency of Ranking by all four groups) were equated with the Range of Category. The Mean Values were rounded up for easy classification of Category (as labelled at the top right of the table).

Table 8.42 below shows the calculation for 'Categorical Ranking Based on Green Urbanism Quality' for LDA.

Table 8.42 Lebuhraya Darul Aman – Calculation for Categorical Ranking Based on Green Urbanism Quality (GUQ)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: LEBUHRAYA DARUL AMAN **Group:** ALL GROUPS **Survey No:** 4/4(y)

Time: AM **Peak Hours:** YES. **Weather Condition:** CLEAR SKY

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				LEBUHRAYA DARUL AMAN					
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Frequency of Ranking (4 Groups)	Mean Value	Range of Category	Category	Colour Code for Category	Rounded Value for Category
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Aesthetic & display– palms/shrubberies	20.00	5.00	4.001 - 5.000	Very Good		5
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	19.00	4.75	4.001 - 5.000	Very Good		5
			ii) Mix users and activities	20.00	5.00	4.001 - 5.000	Very Good		5
			iii) Social interaction and community activities	19.00	4.75	4.001 - 5.000	Very Good		5
		c) Urban farming	i) Plot land/ bedded / potted	12.00	3.00	2.001 - 3.001	Moderate		3
		d) Building greenery	i) Green roof and balcony	7.00	1.75	1.001 - 2.001	Poor		2
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	19.00	4.75	4.001 - 5.000	Very Good		5
			ii) Coverage (continuous throughout the city)	11.00	2.75	2.001 - 3.001	Moderate		3
		b) accessibility to parks, gardens & public spaces	i) Access legibility	14.00	3.50	3.001 - 4.001	Good		4
			ii) Sense of direction (notice board, direction signs, visual linkage)	11.00	2.75	2.001 - 3.001	Moderate		3
			iii) Connection to public transport	10.00	2.50	2.001 - 3.001	Moderate		3
			iv) Easy access for pedestrian (connection with primary/secondary roads)	18.00	4.50	4.001 - 5.000	Very Good		5
			v) Easy access vehicle (connection with primary/secondary roads / parking)	15.00	3.75	3.001 - 4.001	Good		4
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	10.00	2.50	2.001 - 3.001	Moderate		3
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	14.00	3.50	2.001 - 3.001	Moderate		3
		b) Ecology	i) Presence of urban peri-landscape	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Presence of native vegetation	11.00	2.75	2.001 - 3.001	Moderate		3
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	9.00	2.25	1.001 - 2.001	Poor		2
		d) Forest conservation	i) Presence of urban forest	7.00	1.75	1.001 - 2.001	Poor		2
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	8.00	2.00	1.001 - 2.001	Poor		2
			ii) Maintenance and management of streams and rivers	8.00	2.00	1.001 - 2.001	Poor		2
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	8.00	2.00	1.001 - 2.001	Poor		2
			ii) Presence of recreational activities along the river	16.00	4.00	3.001 - 4.001	Good		4
			iii) Presence of community involvement/activities along the river banks	9.00	2.25	1.001 - 2.001	Poor		2
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Assigned walkways / paved or unpaved path	20.00	5.00	4.001 - 5.000	Very Good		5
			iii) Availability of cycling lanes and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			iv) Safe pedestrian ways	20.00	5.00	4.001 - 5.000	Very Good		5
			v) Safe bicycle ways	4.00	1.00	0.000 - 1.001	Very Poor		1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Centralised parking spaces (park and ride)	13.00	3.25	2.001 - 3.001	Moderate		3
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	11.00	2.75	2.001 - 3.001	Moderate		3
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	19.00	4.75	4.001 - 5.000	Very Good		5
			ii) Presence of social interaction and community activities	15.00	3.75	3.001 - 4.001	Good		4
		b) Pedestrian network and connectivity	i) Connected pedestrian network	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Streetscape that encourage healthy and active life	9.00	2.25	1.001 - 2.001	Poor		2
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	18.00	4.50	4.001 - 5.000	Very Good		5
			ii) Mix development / land use (residential and business)	14.00	3.50	3.001 - 4.001	Good		4
		b) Diversity	i) Diverse business types	19.00	4.75	4.001 - 5.000	Very Good		5
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	18.00	4.50	4.001 - 5.000	Very Good		5
			ii) Mixed users – age, race, workers/students (city campus)	16.00	4.00	3.001 - 4.001	Good		4
		b) Sense of community	i) Compact housing and communities	14.00	3.50	3.001 - 4.001	Good		4
			ii) Connected housing areas	12.00	3.00	2.001 - 3.001	Moderate		3
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Community centres	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Healthy communities	i) Facilities for healthy lifestyles	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Recreational areas and facilities	8.00	2.00	1.001 - 2.001	Poor		2
			iii) Social spaces	18.00	4.50	4.001 - 5.000	Very Good		5
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	18.00	4.50	4.001 - 5.000	Very Good		5
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	20.00	5.00	4.001 - 5.000	Very Good		5
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Foreign influences history	12.00	3.00	2.001 - 3.001	Moderate		3
			iii) Historical significant (structure /artefact)	19.00	4.75	4.001 - 5.000	Very Good		5
		b) Identity	i) Image and identity	19.00	4.75	4.001 - 5.000	Very Good		5
		c) Spiritual presence	i) Religious based	17.00	4.25	3.001 - 4.001	Good		4
			ii) Cultural and race based	19.00	4.75	4.001 - 5.000	Very Good		5

Table 8.43 Categorical Ranking Value – Frequency and Valid Percentage Based on Each Principle for Lebuhraya Darul Aman displays the findings of ASGUI details of frequency and percentage of category for each Principle. Valid Percentages of 'Moderate' to 'Very Good' were calculated to identify the highest Categorical Ranking Value among the five GU Principles. Principle 12 had gotten the highest frequency with Valid Percentage of 100.00%. Second is Principle 6 with 80.00%, and third is Principle 5 with 69.23% and lastly, Principle 10 with 66.67% of Valid Percentage.

Table 8.43 Categorical Ranking Value – Frequency and Valid Percentage Based on Each Principle for Lebuhraya Darul Aman

		LDA (Average)		**GUP 5**		**GUP 6**		**GUP 10**		**GUP 12**	
Colour Code	**Category**	***f*** **(58)**	**Valid %**	***f*** **(26)**	**Valid %**	***f*** **(15)**	**Valid %**	***f*** **(9)**	**Valid %**	***f*** **(8)**	**Valid %**
	Very Poor	2	3.45	0	0.00	2	13.33	0	0.00	0	0.00
	Poor	12	20.69	8	30.77	1	6.67	3	33.33	0	0.00
	Moderate	14	24.14	8	30.77	3	20.00	2	22.22	1	12.50
	Good	8	13.79	3	11.54	2	13.33	2	22.22	1	12.50
	Very Good	22	37.93	7	26.92	7	46.67	2	22.22	6	75.00
Total %			100.00		100.00		100.00		100.00		100.00
Total Valid % (Moderate to Very Good)			75.86		69.23		80.00		66.67		100.00

Note: ***f*** **= Frequency and Valid % = Valid Percentage**

8.7.2 Jalan Tunku Ibrahim – The contributing Factors for Green Urbanism Quality (GUQ)

The collected data for JTI are divided into three types as follows;

a. Total Observed Rounded Value – Overall Route Score for JTI

Table 8.44 Alor Setar Green Urbanism Index: Green Urbanism Quality (GUQ) for Jalan Tunku Ibrahim (JTI) shows the ASGUI Mean Value, Standard of Range, Category (based on Standard of Range) and Rounded Value for Category by all groups' data for Jalan Tunku Ibrahim. The data process and translation were the same as Lebuhraya Darul Aman (8.6.1).

Table 8.44 Alor Setar Green Urbanism Index: Green Urbanism Quality (GUQ) for Jalan Tunku Ibrahim (JTI)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: **JALAN TUNKU IBRAHIM** **Group: ALL GROUPS** **Survey No: 4/4(y)**

Time: **AM** **Peak Hours: YES.** **Weather Condition: CLEAR SKY**

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				JALAN TUNKU IBRAHIM										
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Group 1	Group 2	Group 3	Group 4	Total	Mean Value	Range	Category	Colour Code for Category	Rounded Value for Category	
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	2	4	4	2	12.00	3.00	2.001 - 3.001	Moderate		3	
			ii) Aesthetic & display– palms/shrubberies	2	4	4	2	12.00	3.00	2.001 - 3.001	Moderate		3	
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Mix users and activities	3	3	2	2	10.00	2.50	1.001 - 2.001	Poor		2	
			iii) Social interaction and community activities	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
		c) Urban farming	i) Plot land/ bedded / potted	3	1	2	1	7.00	1.75	1.001 - 2.001	Poor		2	
		d) Building greenery	i) Green roof and balcony	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
			ii) Coverage (continuous throughout the city)	2	2	1	1	6.00	1.50	1.001 - 2.001	Poor		2	
		b) accessibility to parks, gardens & public spaces	i) Access legibility	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Sense of direction (notice board, direction signs, visual linkage)	3	2	2	2	9.00	2.25	1.001 - 2.001	Poor		2	
			iii) Connection to public transport	3	4	2	2	11.00	2.75	2.001 - 3.001	Moderate		3	
			iv) Easy access for pedestrian (connection with primary/secondary roads)	4	3	4	4	15.00	3.75	3.001 - 4.001	Good		4	
			v) Easy access vehicle (connection with primary/secondary roads / parking)	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	1	1	1	2	5.00	1.25	0.000 - 1.001	Very Poor		1	
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	1	1	1	2	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	3	3	3	3	12.00	3.00	2.001 - 3.001	Moderate		3	
		b) Ecology	i) Presence of urban peri-landscape	1	1	2	2	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Presence of native vegetation	1	1	2	2	6.00	1.50	1.001 - 2.001	Poor		2	
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
		d) Forest conservation	i) Presence of urban forest	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Maintenance and management of streams and rivers	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			ii) Presence of recreational activities along the river	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	Sum of GUP 5 53
			iii) Presence of community involvement/activities along the river banks	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Assigned walkways / paved or unpaved path	4	4	4	4	16.00	4.00	3.001 - 4.001	Good		4	
			iii) Availability of cycling lanes and facilities	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			iv) Safe pedestrian ways	3	3	2	4	12.00	3.00	2.001 - 3.001	Moderate		3	
			v) Safe bicycle ways	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	3	3	1	2	9.00	2.25	1.001 - 2.001	Poor		2	
			ii) Centralised parking spaces (park and ride)	2	3	1	1	7.00	1.75	1.001 - 2.001	Poor		2	
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	4	2	3	2	11.00	2.75	2.001 - 3.001	Moderate		3	
			ii) Presence of social interaction and community activities	3	3	1	2	9.00	2.25	1.001 - 2.001	Poor		2	
		b) Pedestrian network and connectivity	i) Connected pedestrian network	3	3	3	4	13.00	3.25	2.001 - 3.001	Moderate		3	
			ii) Streetscape that encourage healthy and active life	2	2	2	3	9.00	2.25	1.001 - 2.001	Poor		2	
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	3	2	1	1	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Mix development / land use (residential and business)	3	2	3	2	10.00	2.50	2.001 - 3.001	Moderate		3	Sum of GUP 6 40
		b) Diversity	i) Diverse business types	3	4	4	4	15.00	3.75	3.001 - 4.001	Good		4	
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			ii) Mixed users – age, race, workers/students (city campus)	3	3	3	3	12.00	3.00	2.001 - 3.001	Moderate		3	
		b) Sense of community	i) Compact housing and communities	3	2	1	1	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Connected housing areas	2	1	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	3	1	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Community centres	3	2	1	1	7.00	1.75	1.001 - 2.001	Poor		2	
		b) Healthy communities	i) Facilities for healthy lifestyles	2	1	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Recreational areas and facilities	2	1	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	Sum of GUP 10 16
			iii) Social spaces	4	1	2	3	10.00	2.50	2.001 - 3.001	Moderate		3	
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	3	3	1	3	10.00	2.50	2.001 - 3.001	Moderate		3	
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	3	2	2	3	10.00	2.50	2.001 - 3.001	Moderate		3	
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	2	3	2	1	8.00	2.00	1.001 - 2.001	Poor		2	
			ii) Foreign influences history	3	1	1	1	6.00	1.50	1.001 - 2.001	Poor		2	
			iii) Historical significant (structure /artefact)	2	2	1	1	6.00	1.50	1.001 - 2.001	Poor		2	
		b) Identity	i) Image and identity	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
		c) Spiritual presence	i) Religious based	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	Sum of GUP 12 18
			ii) Cultural and race based	1	3	1	1	6.00	1.50	1.001 - 2.001	Poor		2	
											Total Observed Rounded Value		**127**	

The above data indicated the 'Total Observed Rounded Value' for JTI is 127. The frequency of overall rating and percentage of the category that were contributed by all Principles towards GUQ along JTI is illustrated in Figure 8.21 below.

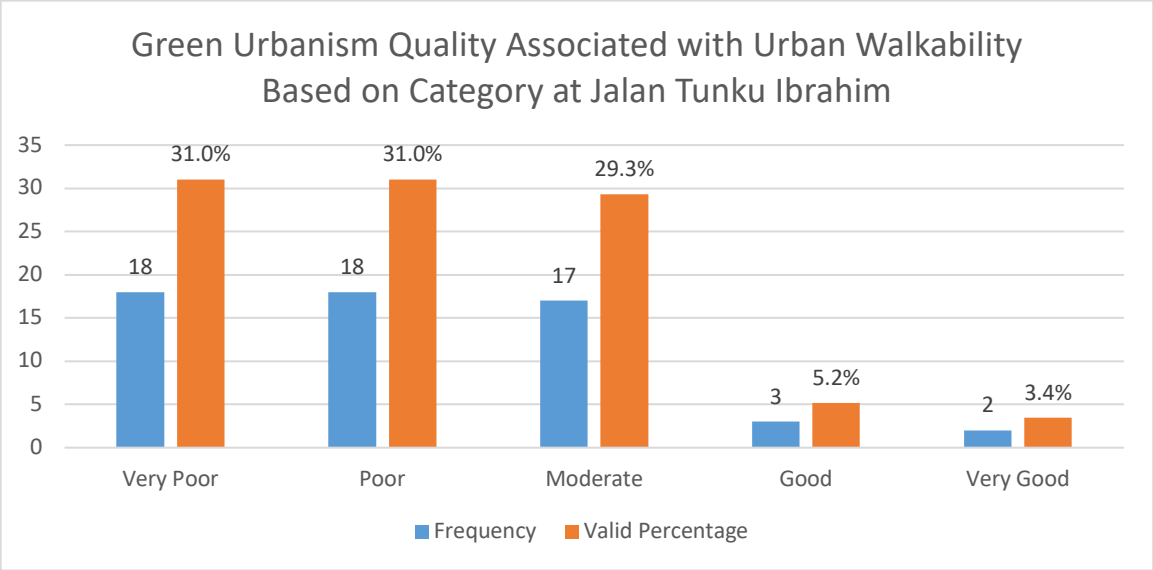

Figure 8.21 Green Urbanism Quality Based on Category at Jalan Tunku Ibrahim

The figure above indicated the contributions of all Principles and pointed out that the frequencies for both 'Very Poor' and 'Poor' categories were 18 out of 58 or equivalent to 31.0%. This is followed by 'Moderate' category with 17 out of 58 or 29.3%, 'Good' category is 3 out of 58 or 5.2%, and 'Good' category is only 2 out of 58 corresponding to 3.4%.

b. POMP Score – Overall Route Score for JTI

To ascertain the contribution of individual Principle, POMP Score of each Principle was calculated and divided with the total accumulated POMP Score of all four Principles as detailed in Table 8.45 below. Accordingly, Principle 6 topped the rank with the percentage of contribution towards GUQ at 35.21% and POMP Score of 25.96. Second is Principle 12 with the Percentage of Contribution of 26.41% and POMP Score of 31.25. Next is Principle 5 with Percentage of Contribution and POMP Score of 21.34 and 25.96 respectively - finally, Principle 10 with 16.43% of the percentage of contribution and POMP Score of 19.44. The table also indicated that all Mean Value for JTI, which is 2.189 is lower than the All Routes Mean Value of 2.703. In addition, only Mean Values for Principle 6 and 12 were above JTI Mean Value which is 2.666 and 2.250, respectively.

Table 8.45 Percentage of Contribution of Individual Principle for Green Urbanism Quality (GUQ) at Jalan Tunku Ibrahim

	Principle 5	Principle 6	Principle 10	Principle 12
*Total Indicators	26	15	9	8
*Min. Score	26	15	9	8
*Max. Score	130	75	45	40
Observed Indicators	53	40	16	18
*All Routes Mean (ASGUI)	2.703			
JTI Mean	2.189			
Individual Principle Mean	2.038	2.666	1.777	2.250
POMP Score	25.96	41.67	19.44	31.25
Percentage of Contribution	**21.34%**	**35.21%**	**16.43%**	**26.41%**

* - Same value for all for route

c. <u>Categorical ranking</u> – Detail Parameters and Principles Ranking Values

Table 8.46 below shows the calculation for 'Categorical Ranking Based on Green Urbanism Quality' for JTI. The calculated Mean Values (from the Frequency of Ranking by all four groups) were equated with the Range of Category. The Mean Values were rounded up for easy classification of Category (as labelled at the top right of the table).

Table 8.46 Jalan Tunku Ibrahim – Calculation for Categorical Ranking Based on Green Urbanism Quality (GUQ).

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: **JALAN TUNKU IBRAHIM** **Group: ALL GROUPS** **Survey No: 4/4(y)**

Time: **AM** **Peak Hours: YES.** **Weather Condition: CLEAR SKY**

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				JALAN TUNKU IBRAHIM					
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Frequency of Ranking (4 Groups)	Mean Value	Range of Category	Category	Colour Code for Category	Rounded Value for Category
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	12.00	3.00	2.001 - 3.001	Moderate		3
			ii) Aesthetic & display– palms/shrubberies	12.00	3.00	2.001 - 3.001	Moderate		3
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Mix users and activities	10.00	2.50	1.001 - 2.001	Poor		2
			iii) Social interaction and community activities	11.00	2.75	2.001 - 3.001	Moderate		3
		c) Urban farming	i) Plot land/ bedded / potted	7.00	1.75	1.001 - 2.001	Poor		2
		d) Building greenery	i) Green roof and balcony	4.00	1.00	0.000 - 1.001	Very Poor		1
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	11.00	2.75	2.001 - 3.001	Moderate		3
			ii) Coverage (continuous throughout the city)	6.00	1.50	1.001 - 2.001	Poor		2
		b) accessibility to parks, gardens & public spaces	i) Access legibility	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Sense of direction (notice board, direction signs, visual linkage)	9.00	2.25	1.001 - 2.001	Poor		2
			iii) Connection to public transport	11.00	2.75	2.001 - 3.001	Moderate		3
			iv) Easy access for pedestrian (connection with primary/secondary roads)	15.00	3.75	3.001 - 4.001	Good		4
			v) Easy access vehicle (connection with primary/secondary roads / parking)	20.00	5.00	4.001 - 5.000	Very Good		5
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	5.00	1.25	0.000 - 1.001	Very Poor		1
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	12.00	3.00	2.001 - 3.001	Moderate		3
		b) Ecology	i) Presence of urban peri-landscape	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Presence of native vegetation	6.00	1.50	1.001 - 2.001	Poor		2
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	5.00	1.25	0.000 - 1.001	Very Poor		1
		d) Forest conservation	i) Presence of urban forest	4.00	1.00	0.000 - 1.001	Very Poor		1
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Maintenance and management of streams and rivers	5.00	1.25	0.000 - 1.001	Very Poor		1
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Presence of recreational activities along the river	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Presence of community involvement/activities along the river banks	4.00	1.00	0.000 - 1.001	Very Poor		1
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Assigned walkways / paved or unpaved path	16.00	4.00	3.001 - 4.001	Good		4
			iii) Availability of cycling lanes and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			iv) Safe pedestrian ways	12.00	3.00	2.001 - 3.001	Moderate		3
			v) Safe bicycle ways	4.00	1.00	0.000 - 1.001	Very Poor		1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	9.00	2.25	1.001 - 2.001	Poor		2
			ii) Centralised parking spaces (park and ride)	7.00	1.75	1.001 - 2.001	Poor		2
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	11.00	2.75	2.001 - 3.001	Moderate		3
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	11.00	2.75	2.001 - 3.001	Moderate		3
			ii) Presence of social interaction and community activities	9.00	2.25	1.001 - 2.001	Poor		2
		b) Pedestrian network and connectivity	i) Connected pedestrian network	13.00	3.25	2.001 - 3.001	Moderate		3
			ii) Streetscape that encourage healthy and active life	9.00	2.25	1.001 - 2.001	Poor		2
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Mix development / land use (residential and business)	10.00	2.50	2.001 - 3.001	Moderate		3
		b) Diversity	i) Diverse business types	15.00	3.75	3.001 - 4.001	Good		4
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Mixed users – age, race, workers/students (city campus)	12.00	3.00	2.001 - 3.001	Moderate		3
		b) Sense of community	i) Compact housing and communities	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Connected housing areas	5.00	1.25	0.000 - 1.001	Very Poor		1
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Community centres	7.00	1.75	1.001 - 2.001	Poor		2
		b) Healthy communities	i) Facilities for healthy lifestyles	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Recreational areas and facilities	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Social spaces	10.00	2.50	2.001 - 3.001	Moderate		3
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	10.00	2.50	2.001 - 3.001	Moderate		3
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	10.00	2.50	2.001 - 3.001	Moderate		3
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	8.00	2.00	1.001 - 2.001	Poor		2
			ii) Foreign influences history	6.00	1.50	1.001 - 2.001	Poor		2
			iii) Historical significant (structure /artefact)	6.00	1.50	1.001 - 2.001	Poor		2
		b) Identity	i) Image and identity	11.00	2.75	2.001 - 3.001	Moderate		3
		c) Spiritual presence	i) Religious based	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Cultural and race based	6.00	1.50	1.001 - 2.001	Poor		2

Table 8.47 below displays the findings of ASGUI details of frequency and percentage of category for each Principle. Valid Percentages of 'Moderate' to 'Very Good' were calculated to identify the highest Categorical Ranking Value among the five GU Principles. Principle 6 had gotten the highest frequency with Valid Percentage of 53.33%. Second is Principle 12 with 37.50%, and third is Principle 5 with 34.62% and lastly, Principle 10 with 22.22% of Valid Percentage.

Table 8.47 Categorical Ranking Value – Frequency and Valid Percentage Based on Each Principle for Jalan Tunku Ibrahim

		JTI (Average)		GUP 5		GUP 6		GUP 10		GUP 12	
Colour Code	**Category**	***f* (58)**	**Valid %**	***f* (26)**	**Valid %**	***f* (15)**	**Valid %**	***f* (9)**	**Valid %**	***f* (8)**	**Valid %**
	Very Poor	18	31.03	11	42.31	2	13.33	4	44.44	1	12.50
	Poor	18	31.03	6	23.08	5	33.33	3	33.33	4	50.00
	Moderate	17	29.31	7	26.92	5	33.33	2	22.22	3	37.50
	Good	3	5.17	1	3.85	2	13.33	0	0.00	0	0.00
	Very Good	2	3.45	1	3.85	1	6.67	0	0.00	0	0.00
Total %			100.00		100.00		100.00		100.00		100.00
Total Valid % (Moderate to Very Good)			**37.93**		**34.62**		**53.33**		**22.22**		**37.50**

Note: ***f* = Frequency and Valid % = Valid Percentage**

8.7.3 Jalan Langgar – The contributing Factors for Green Urbanism Quality (GUQ)

The presentation of collected data at JL are divided into three types as follows;

a. Total Observed Rounded Value – Overall Route Score for JL

Table 8.48 shows the ASGUI Mean Value, Standard of Range, Category (based on Standard of Range) and Rounded Value for Category by all groups' data for Jalan Langgar. The data process and translation were the same as for Lebuhraya Darul Aman (8.6.1).

Table 8.48 Alor Setar Green Urbanism Index: Green Urbanism Quality (GUQ) for Jalan Langgar (JL)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: JALAN LANGGAR **Group:** ALL GROUPS **Survey No:** 4/4(y)

Time: AM **Peak Hours:** YES. **Weather Condition:** CLEAR SKY

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				JALAN LANGGAR									
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Group 1	Group 2	Group 3	Group 4	Total	Mean Value	Range	Category	Colour Code for Category	Rounded Value for Category	
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	1	2	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Aesthetic & display– palms/shrubberies	1	2	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	1	2	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Mix users and activities	2	2	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
			iii) Social interaction and community activities	2	2	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
		c) Urban farming	i) Plot land/ bedded / potted	1	2	2	2	7.00	1.75	1.001 - 2.001	Poor		2	
		d) Building greenery	i) Green roof and balcony	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	2	2	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Coverage (continuous throughout the city)	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
		b) accessibility to parks, gardens & public spaces	i) Access legibility	1	2	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Sense of direction (notice board, direction signs, visual linkage)	1	2	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			iii) Connection to public transport	2	2	2	1	7.00	1.75	1.001 - 2.001	Poor		2	
			iv) Easy access for pedestrian (connection with primary/secondary roads)	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			v) Easy access vehicle (connection with primary/secondary roads / parking)	2	4	4	3	13.00	3.25	2.001 - 3.001	Moderate		3	
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	2	1	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	3	2	2	2	9.00	2.25	1.001 - 2.001	Poor		2	
		b) Ecology	i) Presence of urban peri-landscape	1	2	3	1	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Presence of native vegetation	2	1	3	1	7.00	1.75	1.001 - 2.001	Poor		2	
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	2	1	3	1	7.00	1.75	1.001 - 2.001	Poor		2	
		d) Forest conservation	i) Presence of urban forest	1	1	2	2	6.00	1.50	1.001 - 2.001	Poor		2	
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Maintenance and management of streams and rivers	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Presence of recreational activities along the river	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	Sum of GUP 5 42
			iii) Presence of community involvement/activities along the river banks	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	2	3	4	3	12.00	3.00	2.001 - 3.001	Moderate		3	
			ii) Assigned walkways / paved or unpaved path	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			iii) Availability of cycling lanes and facilities	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			iv) Safe pedestrian ways	2	3	2	3	10.00	2.50	2.001 - 3.001	Moderate		3	
			v) Safe bicycle ways	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	2	3	1	1	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Centralised parking spaces (park and ride)	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	1	2	1	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	2	2	2	1	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Presence of social interaction and community activities	2	3	1	2	8.00	2.00	1.001 - 2.001	Poor		2	
		b) Pedestrian network and connectivity	i) Connected pedestrian network	1	2	2	2	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Streetscape that encourage healthy and active life	1	2	1	2	6.00	1.50	1.001 - 2.001	Poor		2	
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	3	2	1	2	8.00	2.00	1.001 - 2.001	Poor		2	
			ii) Mix development / land use (residential and business)	2	3	3	3	11.00	2.75	2.001 - 3.001	Moderate		3	Sum of GUP 6 30
		b) Diversity	i) Diverse business types	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			ii) Mixed users – age, race, workers/students (city campus)	3	2	1	3	9.00	2.25	1.001 - 2.001	Poor		2	
		b) Sense of community	i) Compact housing and communities	2	1	1	2	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Connected housing areas	2	1	1	3	7.00	1.75	1.001 - 2.001	Poor		2	
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			ii) Community centres	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
		b) Healthy communities	i) Facilities for healthy lifestyles	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	
			ii) Recreational areas and facilities	1	1	1	1	4.00	1.00	0.000 - 1.001	Very Poor		1	Sum of GUP 10 13
			iii) Social spaces	2	1	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	3	2	1	4	10.00	2.50	2.001 - 3.001	Moderate		3	
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	3	1	2	4	10.00	2.50	2.001 - 3.001	Moderate		3	
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	2	2	1	2	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Foreign influences history	3	1	2	1	7.00	1.75	1.001 - 2.001	Poor		2	
			iii) Historical significant (structure /artefact)	1	1	1	3	6.00	1.50	1.001 - 2.001	Poor		2	
		b) Identity	i) Image and identity	3	3	2	5	13.00	3.25	2.001 - 3.001	Moderate		3	
		c) Spiritual presence	i) Religious based	4	1	1	1	7.00	1.75	1.001 - 2.001	Poor		2	Sum of GUP 12 19
			ii) Cultural and race based	4	1	1	1	7.00	1.75	1.001 - 2.001	Poor		2	
												Total Observed Rounded Value	104	

The ‘Total Observed Rounded Value’ for JL is 104 and can be translated according to overall rating and percentage of category that were contributed by all Principles towards GUQ along LDA as illustrated in Figure 8.22 below.

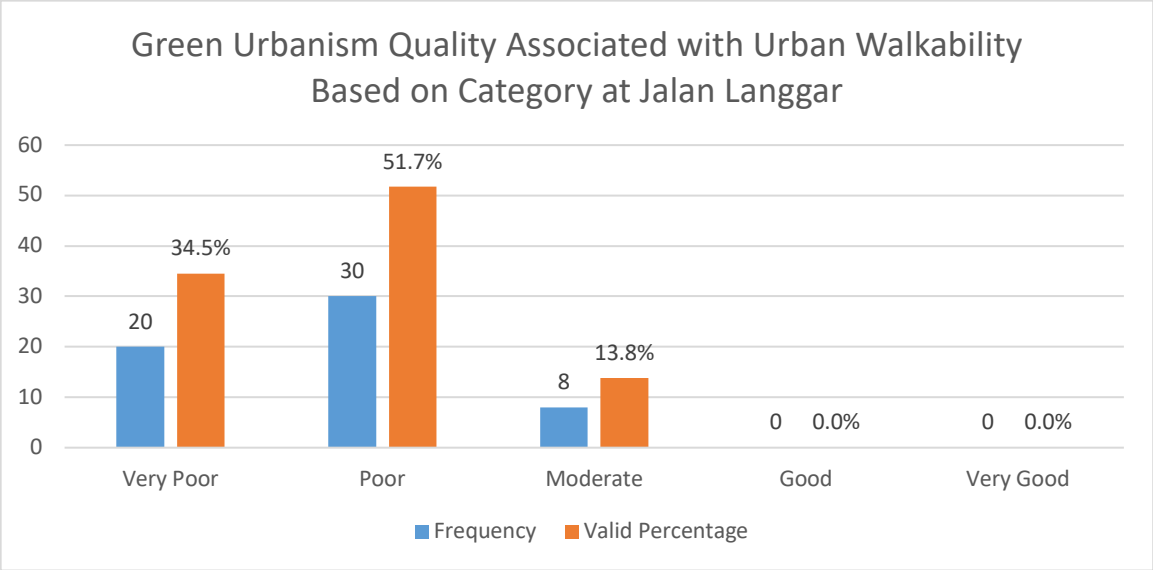

Figure 8.22 Green Urbanism Quality (GUQ) Based on Category at Jalan Langgar

Figure 8.22 indicated the contributions of all Principles that 30 of 58 or 51.7% of indicators for GUQ along JL were rated as ‘Poor’. This is followed by 20 out of 58 or 34.5% of indicators as ‘Very Poor’, 8 out of 58 or 13.8% of indicators as ‘Moderate’. None of the indicators was rated as ‘Good’ and ‘Very Good’ for GUQ along JL.

b. POMP Score - Overall Route Score for JL

To ascertain the contribution of individual Principle, POMP Score of each Principle was calculated and divided with the total accumulated POMP Score of all four Principles as detailed in Table 8.49 Percentage of Contribution of Individual Principle for Green Urbanism Quality (GUQ) at Jalan Langgarbelow. Accordingly, Principle 12 topped the rank with the percentage of contribution towards GUQ at 40.03% and POMP Score of 34.38. Second is Principle 6 with the Percentage of Contribution of 29.11% and POMP Score of 25.00. Next is Principle 5 with Percentage of Contribution and POMP Score of 17.92 and 15.38 respectively - finally, Principle 10 with only 12.94% of the percentage of contribution and POMP Score of 11.11. The table also indicated that Mean Value for JL is 1.896, which is lower than the All Routes Mean Value of 2.703. In addition, only Mean Values for all Principles were also lower than All Routes Mean Value.

Table 8.49 Percentage of Contribution of Individual Principle for Green Urbanism Quality (GUQ) at Jalan Langgar

	Principle 5	Principle 6	Principle 10	Principle 12
*Total Indicators	26	15	9	8
*Min. Score	26	15	9	8
*Max. Score	130	75	45	40
Observed Indicators	46	30	13	19
*All Routes Mean (ASGUI)	2.703			
JL Mean	1.896			
Individual Principle Mean	1.615	2.000	1.444	2.375
POMP Score	15.38	25.00	11.11	34.38
Percentage of Contribution	**17.92%**	**29.11%**	**12.94%**	**40.03%**

* - Same value for all for route

c. Categorical Ranking - Detail Parameters and Principles Ranking Values

Table 8.50 below shows the of calculation for 'Categorical Ranking Based on Green Urbanism Quality' for JL. The calculated Mean Values (from the Frequency of Ranking by all four groups) were equated with the Range of Category. The Mean Values were rounded up for easy classification of Category (as labelled at the top right of the table).

Table 8.50 Jalan Langgar – Calculation for Categorical Ranking Based on Green Urbanism Quality (GUQ).

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: JALAN LANGGAR **Group: ALL GROUPS** **Survey No: 4/4(y)**

Time: AM **Peak Hours: YES.** **Weather Condition: CLEAR SKY**

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				JALAN LANGGAR					
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Frequency of Ranking (4 Groups)	Mean Value	Range of Category	Category	Colour Code for Category	Rounded Value for Category
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Aesthetic & display– palms/shrubberies	6.00	1.50	1.001 - 2.001	Poor		2
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Mix users and activities	7.00	1.75	1.001 - 2.001	Poor		2
			iii) Social interaction and community activities	7.00	1.75	1.001 - 2.001	Poor		2
		c) Urban farming	i) Plot land/ bedded / potted	7.00	1.75	1.001 - 2.001	Poor		2
		d) Building greenery	i) Green roof and balcony	4.00	1.00	0.000 - 1.001	Very Poor		1
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Coverage (continuous throughout the city)	5.00	1.25	0.000 - 1.001	Very Poor		1
		b) accessibility to parks, gardens & public spaces	i) Access legibility	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Sense of direction (notice board, direction signs, visual linkage)	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Connection to public transport	7.00	1.75	1.001 - 2.001	Poor		2
			iv) Easy access for pedestrian (connection with primary/secondary roads)	8.00	2.00	1.001 - 2.001	Poor		2
			v) Easy access vehicle (connection with primary/secondary roads / parking)	13.00	3.25	2.001 - 3.001	Moderate		3
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	4.00	1.00	0.000 - 1.001	Very Poor		1
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	9.00	2.25	1.001 - 2.001	Poor		2
		b) Ecology	i) Presence of urban peri-landscape	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Presence of native vegetation	7.00	1.75	1.001 - 2.001	Poor		2
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	7.00	1.75	1.001 - 2.001	Poor		2
		d) Forest conservation	i) Presence of urban forest	6.00	1.50	1.001 - 2.001	Poor		2
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Maintenance and management of streams and rivers	5.00	1.25	0.000 - 1.001	Very Poor		1
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Presence of recreational activities along the river	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Presence of community involvement/activities along the river banks	4.00	1.00	0.000 - 1.001	Very Poor		1
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	12.00	3.00	2.001 - 3.001	Moderate		3
			ii) Assigned walkways / paved or unpaved path	8.00	2.00	1.001 - 2.001	Poor		2
			iii) Availability of cycling lanes and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			iv) Safe pedestrian ways	10.00	2.50	2.001 - 3.001	Moderate		3
			v) Safe bicycle ways	5.00	1.25	0.000 - 1.001	Very Poor		1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Centralised parking spaces (park and ride)	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	5.00	1.25	0.000 - 1.001	Very Poor		1
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Presence of social interaction and community activities	8.00	2.00	1.001 - 2.001	Poor		2
		b) Pedestrian network and connectivity	i) Connected pedestrian network	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Streetscape that encourage healthy and active life	6.00	1.50	1.001 - 2.001	Poor		2
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	8.00	2.00	1.001 - 2.001	Poor		2
			ii) Mix development / land use (residential and business)	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Diversity	i) Diverse business types	11.00	2.75	2.001 - 3.001	Moderate		3
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Mixed users – age, race, workers/students (city campus)	9.00	2.25	1.001 - 2.001	Poor		2
		b) Sense of community	i) Compact housing and communities	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Connected housing areas	7.00	1.75	1.001 - 2.001	Poor		2
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Community centres	4.00	1.00	0.000 - 1.001	Very Poor		1
		b) Healthy communities	i) Facilities for healthy lifestyles	4.00	1.00	0.000 - 1.001	Very Poor		1
			ii) Recreational areas and facilities	4.00	1.00	0.000 - 1.001	Very Poor		1
			iii) Social spaces	6.00	1.50	1.001 - 2.001	Poor		2
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	10.00	2.50	2.001 - 3.001	Moderate		3
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	10.00	2.50	2.001 - 3.001	Moderate		3
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Foreign influences history	7.00	1.75	1.001 - 2.001	Poor		2
			iii) Historical significant (structure /artefact)	6.00	1.50	1.001 - 2.001	Poor		2
		b) Identity	i) Image and identity	13.00	3.25	2.001 - 3.001	Moderate		3
		c) Spiritual presence	i) Religious based	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Cultural and race based	7.00	1.75	1.001 - 2.001	Poor		2

Table 8.51 below displays the findings of ASGUI details of frequency and percentage of category for each Principle. Valid Percentages of 'Moderate' to 'Very Good' were calculated to identify the highest Categorical Ranking Value among the five GU Principles. Principle 12 had gotten the highest frequency with Valid Percentage of 37.50%. Second is Principle 6 with 26.67%, and third is Principle 5 with 3.85% of Valid Percentage and lastly, Principle 10 with null percent.

Table 8.51 Categorical Ranking Value – Frequency and Valid Percentage Based on Each Principle for Jalan Langgar

		JL (Average)		GUP 5		GUP 6		GUP 10		GUP 12	
Colour Code	**Category**	***f* (58)**	**Valid %**	***f* (26)**	**Valid %**	***f* (15)**	**Valid %**	***f* (9)**	**Valid %**	***f* (8)**	**Valid %**
	Very Poor	20	34.48	11	42.31	7	46.67	5	55.56	0	0.00
	Poor	30	51.72	14	53.85	4	26.67	4	44.44	5	62.50
	Moderate	8	13.79	1	3.85	4	26.67	0	0.00	3	37.50
	Good	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Very Good	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total %			100.00		100.00		100.00		100.00		100.00
Total Valid % (Moderate to Very Good)			**13.79%**		**3.85%**		**26.67%**		**0.00%**		**37.50%**

Note: ***f* = Frequency and Valid % = Valid Percentage**

8.7.4 Jalan Sultan Badlishah – The contributing Factors for Green Urbanism Quality (GUQ)

The presentation of collected data at JL are divided into three types as follows;

a. Total Observed Rounded Value – Overall Route Score for JSB

Table 8.52 below shows the ASGUI Mean Value, Standard of Range, Category (based on Standard of Range) and Rounded Value for Category by all groups' data for Jalan Sultan Badlishah. The data process and translation were the same as for Lebuhraya Darul Aman (8.6.1).

Table 8.52 Alor Setar Green Urbanism Index: Green Urbanism Quality (GUQ) for Jalan Sultan Badlishah (JSB)

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: JALAN SULTAN BADLISHAH **Group: ALL GROUPS** **Survey No: 4/4(y)**

Time: AM **Peak Hours: YES.** **Weather Condition: CLEAR SKY**

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				JALAN SULTAN BADLISHAH									
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Group 1	Group 2	Group 3	Group 4	Total	Mean Value	Range	Category	Colour Code for Category	Rounded Value for Category	
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Aesthetic & display– palms/shrubberies	5	5	5	4	19.00	4.75	4.001 - 5.000	Very Good		5	
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	5	5	4	4	18.00	4.50	4.001 - 5.000	Very Good		5	
			ii) Mix users and activities	4	4	4	4	16.00	4.00	3.001 - 4.001	Good		4	
			iii) Social interaction and community activities	4	3	2	3	12.00	3.00	2.001 - 3.001	Moderate		3	
		c) Urban farming	i) Plot land/ bedded / potted	3	3	3	3	12.00	3.00	2.001 - 3.001	Moderate		3	
		d) Building greenery	i) Green roof and balcony	1	1	1	2	5.00	1.25	0.000 - 1.001	Very Poor		1	
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	5	5	4	3	17.00	4.25	3.001 - 4.001	Good		4	
			ii) Coverage (continuous throughout the city)	4	4	4	4	16.00	4.00	3.001 - 4.001	Good		4	
		b) accessibility to parks, gardens & public spaces	i) Access legibility	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			ii) Sense of direction (notice board, direction signs, visual linkage)	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			iii) Connection to public transport	3	4	3	3	13.00	3.25	2.001 - 3.001	Moderate		3	
			iv) Easy access for pedestrian (connection with primary/secondary roads)	5	5	5	5	20.00	5.00	4.001 - 5.000	Very Good		5	
			v) Easy access vehicle (connection with primary/secondary roads / parking)	4	4	3	3	14.00	3.50	3.001 - 4.001	Good		4	
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	4	4	3	2	13.00	3.25	2.001 - 3.001	Moderate		3	
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	4	5	2	3	14.00	3.50	3.001 - 4.001	Good		4	
		b) Ecology	i) Presence of urban peri-landscape	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Presence of native vegetation	3	2	2	3	10.00	2.50	2.001 - 3.001	Moderate		3	
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	4	3	2	3	12.00	3.00	2.001 - 3.001	Moderate		3	
		d) Forest conservation	i) Presence of urban forest	2	3	2	2	9.00	2.25	1.001 - 2.001	Poor		2	
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	1	2	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Maintenance and management of streams and rivers	1	2	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	1	2	2	1	6.00	1.50	1.001 - 2.001	Poor		2	
			ii) Presence of recreational activities along the river	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	Sum of GUP 5
			iii) Presence of community involvement/activities along the river banks	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	84
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	5	5	2	5	17.00	4.25	4.001 - 5.000	Very Good		5	
			ii) Assigned walkways / paved or unpaved path	5	5	2	5	17.00	4.25	4.001 - 5.000	Very Good		5	
			iii) Availability of cycling lanes and facilities	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			iv) Safe pedestrian ways	5	5	2	5	17.00	4.25	4.001 - 5.000	Very Good		5	
			v) Safe bicycle ways	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	3	4	2	2	11.00	2.75	2.001 - 3.001	Moderate		3	
			ii) Centralised parking spaces (park and ride)	4	4	2	3	13.00	3.25	3.001 - 4.001	Good		4	
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	2	4	2	2	10.00	2.50	1.001 - 2.001	Poor		2	
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	4	5	2	3	14.00	3.50	3.001 - 4.001	Good		4	
			ii) Presence of social interaction and community activities	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
		b) Pedestrian network and connectivity	i) Connected pedestrian network	5	5	2	5	17.00	4.25	4.001 - 5.000	Very Good		5	
			ii) Streetscape that encourage healthy and active life	4	4	2	3	13.00	3.25	3.001 - 4.001	Good		4	
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Mix development / land use (residential and business)	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	Sum of GUP 6
		b) Diversity	i) Diverse business types	3	3	2	5	13.00	3.25	3.001 - 4.001	Good		4	52
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Mixed users – age, race, workers/students (city campus)	3	3	2	3	11.00	2.75	2.001 - 3.001	Moderate		3	
		b) Sense of community	i) Compact housing and communities	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
			ii) Connected housing areas	1	1	2	1	5.00	1.25	0.000 - 1.001	Very Poor		1	
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	2	2	2	1	7.00	1.75	1.001 - 2.001	Poor		2	
			ii) Community centres	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
		b) Healthy communities	i) Facilities for healthy lifestyles	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			ii) Recreational areas and facilities	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	Sum of GUP 10
			iii) Social spaces	3	2	2	2	9.00	2.25	1.001 - 2.001	Poor		2	18
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	3	4	2	4	13.00	3.25	2.001 - 3.001	Moderate		3	
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	3	3	2	2	10.00	2.50	2.001 - 3.001	Moderate		3	
			ii) Foreign influences history	2	2	2	2	8.00	2.00	1.001 - 2.001	Poor		2	
			iii) Historical significant (structure /artefact)	2	2	2	1	7.00	1.75	1.001 - 2.001	Poor		2	
		b) Identity	i) Image and identity	5	5	2	5	17.00	4.25	4.001 - 5.000	Very Good		5	
		c) Spiritual presence	i) Religious based	4	4	2	3	13.00	3.25	3.001 - 4.001	Good		4	Sum of GUP 12
			ii) Cultural and race based	4	4	2	4	14.00	3.50	3.001 - 4.001	Good		4	26
											Total Observed Rounded Value		180	

The above data indicated the 'Total Observed Rounded Value' for JSB is 180. The frequency of overall rating and percentage of the category that were contributed by all Principles towards GUQ along JL is illustrated in Figure 8.23 below.

Figure 8.23 showed the contributions of all Principles that 16 of 58 or 27.6% of indicators for GUQ along JSB were rated as 'Moderate'. This is followed by 13 out of 58 or 22.4% of indicators as 'Poor'. Next, 11 out of 58 or 19.0% of indicators as both 'Good' and 'Very Good'. Lastly, 7 or 12.1% of the indicators were rated as 'Very Poor' for GUQ along JSB.

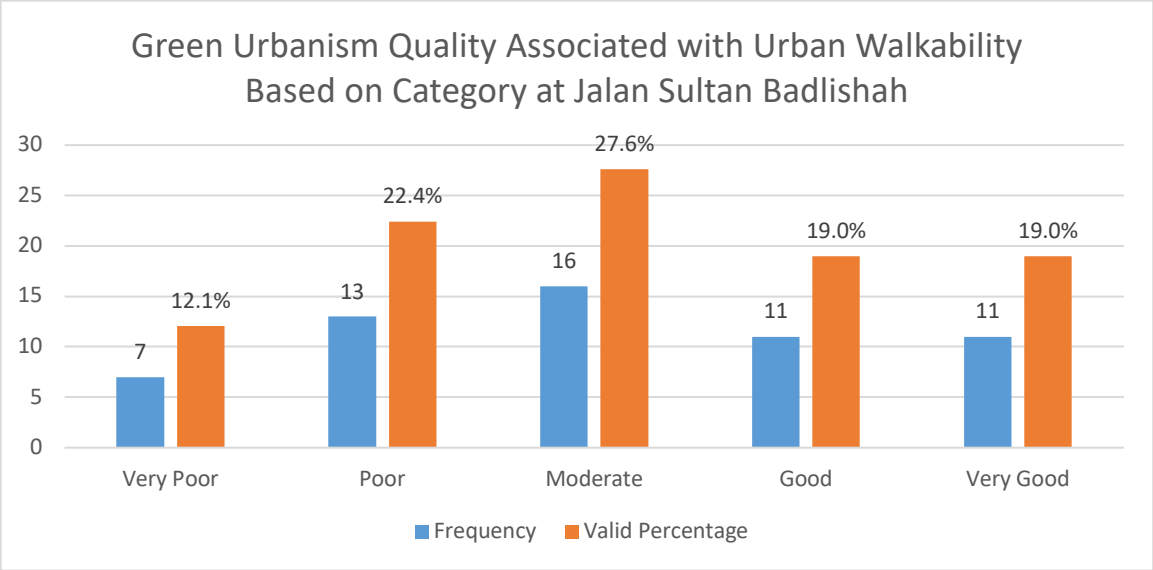

Figure 8.23 Green Urbanism Quality (GUQ) Based on Category at Jalan Sultan Badlishah

b. POMP Score - Overall Route Score for JSB

To ascertain the contribution of individual Principle, POMP Score of each Principle was calculated and divided with the total accumulated POMP Score of all four Principles as detailed in Table 8.53 below. Accordingly, Principle 6 topped the rank with the percentage of contribution towards GUQ at 31.04% and POMP Score of 61.67. Second is Principle 12 with the Percentage of Contribution of 28.31% and POMP Score of 56.25. Next is Principle 5 with Percentage of Contribution and POMP Score of 28.07% and 55.77 respectively - finally, Principle 10 with only 12.58% of the percentage of contribution and POMP Score of 25.00. The table also indicated that Mean Value for JSB is 3.103, which is higher than the All Routes Mean Value of 2.703. In addition, Mean

Values for all Principles were also higher than All Routes Mean Value, except for Principle 10 with Mean value of only 2.00.

Table 8.53 Percentage of Contribution of Individual Principle for Green Urbanism Quality (GUQ) at Jalan Sultan Badlishah

	Principle 5	**Principle 6**	**Principle 10**	**Principle 12**
*Total Indicators	26	15	9	8
*Min. Score	26	15	9	8
*Max. Score	130	75	45	40
Observed Indicators	84	52	18	26
*All Routes Mean (ASGUI)	2.703			
JSB Mean	3.103			
Individual Principle Mean	3.320	3.466	2.000	3.250
POMP Score	55.77	61.67	25.00	56.25
Percentage of Contribution	**28.07%**	**31.04%**	**12.58%**	**28.31%**

* - Same value for all for route

c. Categorical Ranking - Detail Parameters and Principles Ranking Values

Table 8.54 below shows the calculation for 'Categorical Ranking Based on Green Urbanism Quality' for JL. The calculated Mean Values (from the Frequency of Ranking by all four groups) were equated with the Range of Category. The Mean Values were rounded up for easy classification of Category (as labelled at the top right of the table).

Table 8.54 Jalan Sultan Badlishah – Calculation for Categorical Ranking Based on Green Urbanism Quality (GUQ).

ALOR SETAR GREEN URBANISM INDEX (ASGUI)

Road Name: JALAN SULTAN BADLISHAH **Group: ALL GROUPS** **Survey No: 4/4(y)**

Time: AM **Peak Hours: YES.** **Weather Condition: CLEAR SKY**

COLOUR CODE	MEAN RANGE	CATEGORY
1	0.000 - 1.001	Very Poor
2	1.001 - 2.001	Poor
3	2.001 - 3.001	Moderate
4	3.001 - 4.001	Good
5	4.001 - 5.000	Very Good

				JALAN SULTAN BADLISHAH					
GUP	PARAMETER	KEY ATTRIBUTE	INDICATOR	Frequency of Ranking (4 Groups)	Mean Value	Range of Category	Category	Colour Code for Category	Rounded Value for Category
GU PRINCIPLE 5	1- Urban Cooling	a) Presence of urban vegetation	i) Functional trees -street planting	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Aesthetic & display– palms/shrubberies	19.00	4.75	4.001 - 5.000	Very Good		5
		b) Inner-city garden	i) Pocket park / vertical garden / linear garden/ display garden	18.00	4.50	4.001 - 5.000	Very Good		5
			ii) Mix users and activities	16.00	4.00	3.001 - 4.001	Good		4
			iii) Social interaction and community activities	12.00	3.00	2.001 - 3.001	Moderate		3
		c) Urban farming	i) Plot land/ bedded / potted	12.00	3.00	2.001 - 3.001	Moderate		3
		d) Building greenery	i) Green roof and balcony	5.00	1.25	0.000 - 1.001	Very Poor		1
	2- Integrated Urban Landscape	a) Urban landscape	i) Image / identity creation	17.00	4.25	3.001 - 4.001	Good		4
			ii) Coverage (continuous throughout the city)	16.00	4.00	3.001 - 4.001	Good		4
		b) accessibility to parks, gardens & public spaces	i) Access legibility	20.00	5.00	4.001 - 5.000	Very Good		5
			ii) Sense of direction (notice board, direction signs, visual linkage)	20.00	5.00	4.001 - 5.000	Very Good		5
			iii) Connection to public transport	13.00	3.25	2.001 - 3.001	Moderate		3
			iv) Easy access for pedestrian (connection with primary/secondary roads)	20.00	5.00	4.001 - 5.000	Very Good		5
			v) Easy access vehicle (connection with primary/secondary roads / parking)	14.00	3.50	3.001 - 4.001	Good		4
		c) Leisure & recreation	i) Recreational park (relaxation / strolling & exercise and Jogging)	13.00	3.25	2.001 - 3.001	Moderate		3
	3- Local Biodiversity	a) Habitat	i) Presence of wildlife	8.00	2.00	1.001 - 2.001	Poor		2
			ii) Presence of urban wildlife (crows, pigeon and stray cats & dogs	14.00	3.50	3.001 - 4.001	Good		4
		b) Ecology	i) Presence of urban peri-landscape	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Presence of native vegetation	10.00	2.50	2.001 - 3.001	Moderate		3
			iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	12.00	3.00	2.001 - 3.001	Moderate		3
		d) Forest conservation	i) Presence of urban forest	9.00	2.25	1.001 - 2.001	Poor		2
	4- Conserving Natural Resources	a) Restoring streams	i) Reintroducing streams and rivers in the city	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Maintenance and management of streams and rivers	6.00	1.50	1.001 - 2.001	Poor		2
		b) Re-establishing river banks	i) Reinstating uses and function of river banks	6.00	1.50	1.001 - 2.001	Poor		2
			ii) Presence of recreational activities along the river	5.00	1.25	0.000 - 1.001	Very Poor		1
			iii) Presence of community involvement/activities along the river banks	5.00	1.25	0.000 - 1.001	Very Poor		1
GU PRINCIPLE 6	5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and connectivity	17.00	4.25	4.001 - 5.000	Very Good		5
			ii) Assigned walkways / paved or unpaved path	17.00	4.25	4.001 - 5.000	Very Good		5
			iii) Availability of cycling lanes and facilities	5.00	1.25	0.000 - 1.001	Very Poor		1
			iv) Safe pedestrian ways	17.00	4.25	4.001 - 5.000	Very Good		5
			v) Safe bicycle ways	5.00	1.25	0.000 - 1.001	Very Poor		1
		b) Integrated motorized transport (private / public)	i) Integrated public and private transport system	11.00	2.75	2.001 - 3.001	Moderate		3
			ii) Centralised parking spaces (park and ride)	13.00	3.25	3.001 - 4.001	Good		4
			iii) Availability & close proximity of public transport stations/stops along pedestrian routes	10.00	2.50	1.001 - 2.001	Poor		2
	6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	14.00	3.50	3.001 - 4.001	Good		4
			ii) Presence of social interaction and community activities	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Pedestrian network and connectivity	i) Connected pedestrian network	17.00	4.25	4.001 - 5.000	Very Good		5
			ii) Streetscape that encourage healthy and active life	13.00	3.25	3.001 - 4.001	Good		4
	7- Compact and Polycentric City	a) Land uses	i) Close proximity to residential areas	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Mix development / land use (residential and business)	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Diversity	i) Diverse business types	13.00	3.25	3.001 - 4.001	Good		4
GU PRINCIPLE 10	8- Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Mixed users – age, race, workers/students (city campus)	11.00	2.75	2.001 - 3.001	Moderate		3
		b) Sense of community	i) Compact housing and communities	5.00	1.25	0.000 - 1.001	Very Poor		1
			ii) Connected housing areas	5.00	1.25	0.000 - 1.001	Very Poor		1
	9- Healthy Community & Mixed-use Programmes	a) Amenities and facilities	i) Integrated housing amenities and facilities	7.00	1.75	1.001 - 2.001	Poor		2
			ii) Community centres	8.00	2.00	1.001 - 2.001	Poor		2
		b) Healthy communities	i) Facilities for healthy lifestyles	8.00	2.00	1.001 - 2.001	Poor		2
			ii) Recreational areas and facilities	8.00	2.00	1.001 - 2.001	Poor		2
			iii) Social spaces	9.00	2.25	1.001 - 2.001	Poor		2
GU PRINCIPLE 12	10- Cultural Heritage	a) Local culture	i) Cultural significant/ values –(day to day activity)	13.00	3.25	2.001 - 3.001	Moderate		3
		b) Heritage	i) Heritage values (areas/buildings/structures/activity)	10.00	2.50	2.001 - 3.001	Moderate		3
	11- Identity & Sense of Place	a) Historical elements	i) Local based history	10.00	2.50	2.001 - 3.001	Moderate		3
			ii) Foreign influences history	8.00	2.00	1.001 - 2.001	Poor		2
			iii) Historical significant (structure /artefact)	7.00	1.75	1.001 - 2.001	Poor		2
		b) Identity	i) Image and identity	17.00	4.25	4.001 - 5.000	Very Good		5
		c) Spiritual presence	i) Religious based	13.00	3.25	3.001 - 4.001	Good		4
			ii) Cultural and race based	14.00	3.50	3.001 - 4.001	Good		4

Table 8.55 below displays the findings of ASGUI details of frequency and percentage of category for each Principle. Valid Percentages of 'Moderate' to 'Very Good' were calculated to identify the highest Categorical Ranking Value among the five GU Principles. Principle 6 had gotten the highest frequency with Valid Percentage of 80.01%. Second is Principle 12 with 75.00%, and third is Principle 5 with 69.23% and lastly, Principle 10 with 22.22% of Valid Percentage.

Table 8.55 Categorical Ranking Value – Frequency and Valid Percentage Based on Each Principle for Jalan Sultan Badlishah

		JSB (Average)		GUP 5		GUP 6		GUP 10		GUP 12	
Colour Code	**Category**	***f* (58)**	**Valid %**	***f* (26)**	**Valid %**	***f* (15)**	**Valid %**	***f* (9)**	**Valid %**	***f* (8)**	**Valid %**
	Very Poor	7	12.07	3	11.54	2	13.33	2	22.22	0	0.00
	Poor	13	22.41	5	19.23	1	6.67	5	55.56	2	25.00
	Moderate	16	27.59	7	26.92	4	26.67	2	22.22	3	37.50
	Good	11	18.97	5	19.23	4	26.67	0	0.00	2	25.00
	Very Good	11	18.97	6	23.08	4	26.67	0	0.00	1	12.50
Total %			100.00		100.00		100.00		100.00		100.00
Total Valid % (Moderate to Very Good)			**65.53%**		**69.23%**		**80.01%**		**22.22%**		**75.00%**

Note: ***f* = Frequency and Valid % = Valid Percentage**

8.8 Summary of the Chapter

This chapter highlights the associated qualities of Green Urbanism Principles with urban walkability. The research on associating factors between GUP and urban walkability started with the Literature Investigation to identify i) the general component of Green urbanism, ii) the principles of Green Urbanism through Literature Investigation. Then, the three-stage Delphi Surveys were carried out systematically to conclude the iii) associated GUP with urban walkability, iv) parameters and potential indicators of Green Urbanism in measuring urban walkability, and v) associated themes of Green Urbanism Quality with urban walkability. The outcome of Delphi Survey is a validated ASGUI using method of analysis: 1) Percentage of Consensus of Agreement, 2) Cohen's Kappa value of Inter-rater Correlation Coefficient, and assessed with associated Themes from the outcome of Semi Structure Interview. The validated parameters and indicators formed the final list of Alor Setar Green Urbanism Index (ASWI), which was then used on-site as a measuring instrument.

The identified parameters and indicators were validated for a justifiable assessment of Green Urbanism Quality (GUQ). The three steps statistical test to validate identified parameters and its indicators were established from three analysis objectives; 1) *Total Observed Rounded Value by Mean Calculation*, 2) *Percentage of Maximum Possible (POMP Value)*, and 3) *Categorical Ranking assess from Table of Adjusted Value*.

The ASGUI method of calculation and analysis was developed to identify the status of Green Urbanism Quality along selected routes in Alor Setar city centre and to compare the ASGUI result with the result from Alor Setar Walkability Index (ASWI) in Chapter 7. The following chapter covers the discussion of findings and associated factors between ASWI and ASGUI.

Chapter 9

DISCUSSION OF THE FINDINGS

9.0 Introduction

This chapter discusses the influencing factors for urban walkability based on the analysed results of ASWI in Chapter 7 and ASGUI in Chapter 8. The purpose of this chapter is to provide construct comparisons in order to establish associated physical characteristics, features and factors between ASWI and ASGUI that promote urban walkability in the Medium-sized City of Alor Setar. The result from LDA (being the most walkable route as per ASWI and the highest Green urban Urbanism Quality value as per ASGUI) is used in the discussions and comparisons.

This chapter is divided into six sections — the first section in the introduction of the chapter. The second and third sections cover the summaries of the analytical analysis of ASWI and ASGUI; which centres on the influential key factors for urban walkability. The fourth section envelops and ties the associated factors of Green urbanism Principles with urban walkability. The fifth section presents the synthesis of Research Objectives in answering Research Questions, and the last section sums the discussion of Chapter 9.

9.1 ASWI: The Discussion of Findings

The analysed ASWI values indicated that Lebuhraya Darul Aman and its surrounding was the most walkable route at the Medium-sized City of Alor Setar. ASWI Unweighted Value of the route is **76.02** which is '**Good Condition and Walkability**'; with all of its parameters valued (as in Table 7.14) were above '61-80: Good Condition and Walkability' to '81-100: Very Good Condition and Walkability'.
This is followed by Jalan Sultan Badlishah with ASWI Unweighted Value of the route is **58.87** which is '**Moderate Condition and Walkability**'. Although in second place, the parameters' values were far lower than Lebuhraya Darul Aman. The Third is Jalan Tunku Ibrahim with Unweighted Value of the route is **32.86** which is '**Poor Condition and**

Walkability'; and the lowest is Jalan Langgar with Unweighted Value of the route is **12.05** which is 'Very **Poor Condition and Walkability**'.

9.1.1 The Influencing Parameters and Indicators Towards Urban Walkability

The analysis of ASWI result for all routes has revealed that LDA was the most walkable route. It also established the most impacted parameters and influenced factors that made LDA the most walkable among all four routes at the Medium-sized City of Alor Setar, as discussed below;

a. PARAMETER: USES AND ACTIVITY

Of all the parameter, **USES AND ACTIVITY** contributed the highest towards overall Urban walkability with 22.8% (Table 9.1). This was due to three classifications of factors, 1) Mixed Land Use of commercial and residential encourages active pedestrian activities along the route. Additionally, with the Mixed of modern and traditional business invites various types of users to frequent this area and increase road level activities. 2) The natural and designed of Greeneries, Landscape and Urban Open Spaces were distributed along the route at walking distance; 3) Strong and bold Heritage and Cultural identity were present along the route making it noticeable and appreciated.

Table 9.1 The Contributing Factors Under Parameter: USES AND ACTIVITIES

NO	*INDICATOR*	*MEAN SCORE Average Score of All Four Groups*	*PERCENTAGE OF CONTRIBUTION for Urban Walkability*	*AVERAGE PARAMETER SCORE*
1) Mixed Land Use			22.8% RANK 1	85.66
i)	Mix of residential and Commercial Street	95.22		
ii)	Active Commercial Street	94.46		
iii)	Active Commercial Modern Buildings	84.84		
iv)	Land Use Mix	83.16		
v)	Active Traditional Shophouses	75.58		
2) Greeneries, Landscape and Urban Open Spaces				
i)	Public Space and Recreation / Parks and Greenery	92.24		
ii)	Urban Open Space/Plaza	82.21		
3) Heritage and Cultural Identity				
i)	Active Heritage and Cultural Street	82.15		

b. PARAMETER: VISUAL INTEREST AND ATTRACTIVENESS

The second highest is the parameter of **VISUAL INTEREST AND ATTRACTIVENESS** with 21.0% contribution towards urban walkability (Table 9.2). The contributions can be correlated to three classifications of factors such as; 1) The availability of public spaces create opportunities for users and visitors to do and participate in the Diverse of Activities Along Path such as street vendors, cultural activities and resting along the route; 2) Streetscape, Pedestrian Walkway and Facilities; are well distributed and easily accessible along the route. 3) Pathways were enhanced with Trees and Vegetation, creating Attractive and Relaxing Pathways.

Table 9.2 The Contributing Factors Under Parameter: VISUAL INTEREST AND ATTRACTIVENESS

NO	*INDICATOR*	*MEAN SCORE Average Score of All Four Groups*	*PERCENTAGE OF CONTRIBUTION for Urban Walkability*	*AVERAGE PARAMETER SCORE*
1) Diverse of Activities in Public Spaces			21.0% RANK 2	79.04
	i) Diverse of Activities Along path	88.14		
2) Streetscape and Facilities				
	i) Streetscape and Pedestrian Facilities	80.02		
2) Attractive and Relaxing Pathways				
	i) Walking Path (Quality of Design and Materials)	75.27		
	ii) Trees and Vegetation	72.74		

c. PARAMETER: CONVENIENCE

The parameter of **CONVENIENCE** is the third-highest contributor to Lebuhraya Darul Aman urban walkability with 20.0% (Table 9.3). The impacting factors are, 1) Pedestrian Amenities and Maintenance; which were available along the routes and adequately maintained by the City Council. 2) Path Coverage, Distance and Connectivity; walking paths were available connecting the major nodes and landmarks within the surrounding areas. 3) Walking Path Comfort, Safety and Obstruction; walkways were in good condition, adequately maintained with safety railings along the busy roads. There were no safety issues along the route and obstruction on pathways were very minimal. 4) Disability Infrastructure; there were minimal universal design considerations along the route. Ramps were provided at most crossing points for wheelchairs and physically

challenged people, and tactile paving was also provided along walkways at major nodes and landmarks.

Table 9.3 The Contributing Factors Under Parameter: CONVENIENCE

NO	*INDICATOR*	*MEAN SCORE Average Score of All Four Groups*	*Percentage of Contribution for Urban Walkability*	*AVERAGE PARAMETER SCORE*
1) Pedestrian Amenities and Maintenance			20.0% RANK 3	75.07
	i) Availability of Walking Paths	93.54		
	ii) Maintenance and Cleanliness of Walking Path	84.83		
	iii) Pedestrian Amenities (Cover, Public Toilets, Street Lights)	78.14		
2) Path Coverage, Distance and Connectivity				
	i) Shared Street Network and Connectivity / Alternative Routes	83.96		
	ii) Path Coverage (Area of Coverage)	81.20		
	iii) Distance of the Route to Where They Were Going	74.10		
	iv) Distance from one Pedestrian Crossing Point to Another	57.40		
3) Walking Path Comfort, Safety and Obstruction				
	i) Walking Comfort Due to Pedestrian Congestion	75.09		
	ii) Obstruction Free Walking Path (Permanent/Temporary)	72.76		
	iii) Walking Path (Width and Safety)	69.44		
4) Disability Infrastructure				
	i) Existence and Quality of facilities for Blinds and Disabled Persons/Disability Infrastructure	55.25		

d. PARAMETER: COMFORT

The fourth is **COMFORT** with 18.6% (Table 9.4 The Contributing Factors Under Parameter: COMFORT), and the contributing factors are related to the 1) availability Facilities and Amenities such as street lighting along the route has made pedestrian feel comfortable walking along the route at night; Shelters and Seating provide comfort that encourages people to walk. It is still comfortable to walk along this route during daytime due to the availability; 2) The availability Shades in the form of Shadows from trees and buildings along walkways provide comfort for walking especially in the hot weather of Malaysia. The rows of shophouses also provide the roofed five foot walkways, shadow corridor for pedestrian and shaded street planting is an added value that makes the route

pleasant for walking. The 3) Smell, air quality and cleanliness along the route also extra merit for the pedestrian to walk comfortably.

Table 9.4 The Contributing Factors Under Parameter: COMFORT

NO	*INDICATOR*	*MEAN SCORE Average Score of All Four Groups*	*Percentage of Contribution for Urban Walkability*	*AVERAGE PARAMETER SCORE*
Facilities and Amenities for Comfort			18.6% RANK 4	70.05
	i) Street Lighting	91.59		
	ii) Resting Amenities	55.18		
	iii) Shelter	53.68		
Shades and Shadows				
	i) Shadow of Trees/Buildings/Elements	80.38		
Environmental Quality				
	i) Smell, Air Quality and Cleanliness	69.41		

e. PARAMETER: SENSE OF SAFETY AND SECURITY

The least contributing parameter is **SENSE OF SAFETY AND SECURITY,** with 17.6% (Table 9.5). The active surrounding environment with diverse activities boosted a positive 1) Perception of Security from Crime along LDA. Paved walkways with suitable materials, low shrubs and street lighting are features that make the pedestrian feel safe and secure from crime. The 2) Availability of Pedestrian Crossings and metal railing separating pedestrian ways from the road reduced 3) Walking Path Modal Conflicts between pedestrian and vehicular.

Table 9.5 The Contributing Factors Under Parameter: SENSE OF SAFETY AND SECURITY

NO	*INDICATOR*	*MEAN SCORE Average Score of All Four Groups*	*Percentage of Contribution for Urban Walkability*	*AVERAGE PARAMETER SCORE*
Security from Crime			17.6% RANK 5	66.25
	i) Perception of Security from Crime	94.80		
Pedestrian Crossing				
	i) Availability of Crossings	63.18		
	ii) Clearly Mark Pedestrian Crossing Line / Zebra Line / Raised Road Level (Flushed) Crossing	58.68		
	iii) Crossing Safety (Traffic Light / Traffic Light Management at Crossing)	44.56		
Safety for Pedestrian				

	i) Walking Path Modal Conflict (Pedestrian/Vehicular Conflict) ii) Motorist Behaviour and Respect to Pedestrian	73.86 62.38		

9.2 ASGUI: The Discussion of Findings

The analysed ASGUI values revealed that Lebuhraya Darul Aman and its surrounding has the highest Green Urbanism Quality (GUQ) at the Medium-sized City of Alor Setar. ASGUI Observed Score of the route is 210 with POMP Score of **65.52** which is 'Good Green Urbanism Quality'. Individually (as in Table 8.40), Principle 12 obtained the highest POMP Score of 90.63, followed by Principle 6 with 68.33, both of which were higher than LDA's POMP Score.

Next is Jalan Sultan Badlishah with ASGUI Observed Score of 180 and POMP Score of 52.59, which is 'Moderate Green Urbanism Quality'. Third is Jalan Tunku Ibrahim with ASGUI Observed Score of 127 and POMP Score of 29.74, which is 'Poor Green Urbanism Quality', and lastly Jalan Langgar with ASGUI Observed Score of 104 and POMP Score of 19.83, which is 'Very Poor Green Urbanism Quality'.

Table 9.6 below highlight the positive condition established (indicators from ASGUI) established for each route.

Table 9.6 Summary of Overall ASGUI Findings at Each Route

	Lebuhraya Darul Aman	Jalan Sultan Badlishah	Jalan Tunku Ibrahim	Jalan Langgar
ASGUI POMP Score	**65.52** which is between the range of 61 – 80, **(Good Green Urbanism Quality)**	**52.59** which is between the range of 41 – 60, **(Moderate Green Urbanism Quality)**	**29.74** which is between the range of 21 – 40, **(Poor Green Urbanism Quality)**	**19.83** which is between the range of 0 – 20, **(Very Poor Green Urbanism Quality)**
Factor (in relation to Green Urbanism Quality)	**Urbanism** • Mixed Land Use - Mixed of modern and traditional business **Culture and Identity** • Heritage & Cultural Identity **Nature** • Greeneries, Landscape and Urban Open Spaces **Liveability** • Active Urban Residents and Social Interaction	**Urbanism** • Mixed Land Use- Mixed of modern and traditional business **Nature** • Greeneries, Landscape and Urban Open Spaces	**Urbanism** • Mixed Land Use	**Urbanism** • Mixed Land Use

Positive Condition	• Local Cultural Heritage • Robust Sense of Identity • Strong Sense of Place • Pedestrian Network and Connectivity • Pedestrian Safety and Security • Public Spaces Network and Accessibility • Mixed Land Use Development • Compact and Diverse Business Types • Close Proximity to Residential Area • Quality of Urban Cooling, Garden and Shades • Availability and Accessibility to Urban Landscape • Recreational Spaces and Activities • Active and Quality of Urban Open Spaces • Community Spaces • Safety and Security • Perception of Security from Crime • Active Commercial Street	• Pedestrian Network and Connectivity • Pedestrian Safety and Security • Public Spaces Network and Accessibility • Quality of Urban Cooling, Garden and Shades • Availability and Accessibility to Urban Landscape • Availability and Accessibility to Urban Landscape • Perception of Security from Crime • Active Commercial Street	• Pedestrian Network and Connectivity • Pedestrian Safety Mixed Land Use Development • Compact and Diverse Business Types	• Pedestrian Network and Connectivity • Mixed Land Use Development

9.2.1 Comparison of Overall ASGUI Findings Between Lebuhraya Darul Aman and Jalan Langgar

Table Table 9.6 above also highlight the differences between Lebuhraya Darul Aman which has the highest score and Jalan Langgar which has the lowest score among all four routes. The differences between Lebuhraya Darul Aman and Jalan Langgar are apparent; with 45.69 difference in POMP Score. JL is by far the weakest in all four themes of urban design qualities and characters as explained in section 6.4. Tables 9.7 below feature the comparisons of the two routes according to the four GU theme based on ASGUI result and the researcher's site observation. The detail contributions of each principles and its parameters toward GUQ were discussed in detail in sub-section 9.2.2 below.

Table 9.7 GU Theme: Urbanism - Comparison Between LDA and JL

GU Theme: Urbanism	
Quality of Character: Land use and diversities of activities	
Lebuhraya Darul Aman	**Jalan Langgar**
• Mixed land use – a mix of modern and traditional business • Diversities of business, services and activities	• Limited Land Use • Located far from residential areas • Mixed land use but with a limited type of businesses (workshops, offices, textiles, etc.) with many vacant/dilapidated shops

• The route is surrounded by residential areas and within walking distance • Modern shops and offices are vibrant and lively. • Attracting users of all ages • Pedestrian walkways are wide, adequately maintained, clean and continuous. Mostly unobstructed and separated from the road by metal railings	• Pedestrian walkways mostly narrow, not properly maintained and often obstructed by road signposts and advertisements
 Figure 9.1 Mixed land uses of traditional shophouses and residential with five foot pedestrian way along LDA.	 Figure 9.3 Limited land uses of traditional shophouses with obstructive five foot way and narrow pedestrian walkway.
 Figure 9.2 Mixed land uses of modern shops, offices and shopping mall with wide pedestrian way.	 Figure 9.4 A dilapidated / vacant shophouse at JI.
GU Theme: Culture and Identity	
Quality of Character: Robust and rich heritage & cultural Identity	
Lebuhraya Darul Aman	**Jalan Langgar**
• Rich and strong displays of cultures and a robust sense of local identity • Displays of the Royal structures and artefacts • Religious institutions are dominant with Mosque (Malay), Hindu Temple (Indian) and Buddhist Temple (Chinese) • Mixture of architectural style, traditional Malay, Moorish, Southern Chinese Eclectic, Strait Eclectic and Art Deco • Residents performing cultural activities and religious rituals • Tourist attraction zone	• Local culture and Identity is weak • Southern Chinese Eclectic, Strait Eclectic and Art Deco style of shophouses



Figure 9.5 The historic 'Gerbang Muhibah' or Harmony Archway is representing the multiracial unity of the Malay and the Chinese in Kedah.



Figure 9.6 Monuments, Royal artefacts and the historic state mosque along LDA portraying a robust local image and identity.



Figure 9.7 Typical shophouses along JL.

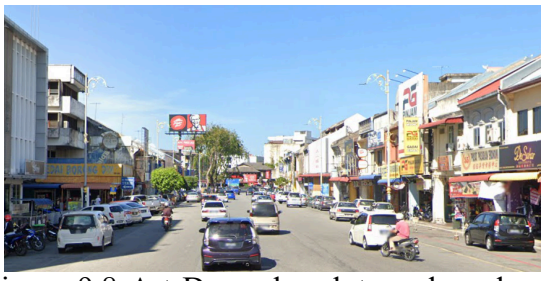

Figure 9.8 Art Deco shop lots and modern building along JL without noticeable local image and identity.

GU Theme: Nature	
Quality of Character: Greeneries, landscape and urban open spaces	
Lebuhraya Darul Aman	**Jalan Langgar**
• Active riverfront • Community spaces with greeneries • Native vegetation along the river and at the periphery • Enhanced by the designed landscape, street trees and gardens • Active urban open spaces, plaza and street activities • Recreational spaces and resting areas are available for residents and visitors	• Minimal greeneries • No open spaces and community spaces • Minimal street trees along the route • No street level activities • No recreational space and resting areas



Figure 9.9 A beautifully landscaped and public park along LDA.



Figure 9.11 Lack of street trees along JL.



Figure 9.10 The shaded area along Sungai Kedah river promenade at Jalan Tunku Yaakob/Pekan Cina.

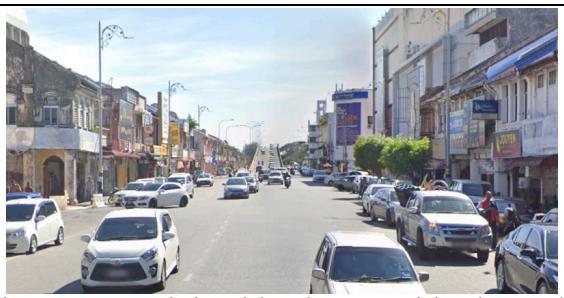

Figure 9.12 Minimal landscape with trimmed shrubs along JL.

GU Theme: Liveability	
Quality of Character: Social & community space and safety and security	
Lebuhraya Darul Aman	**Jalan Langgar**
• Traditional shophouses (shop and residential) are active day and night • Active Urban Residents and Social Interaction • Community programmes • Active commercial street • Strong sense of safety and security	• Only active during business and office hours • No activities at night • Weak sense of safety and security



Figure 9.13 The local grocer and retail shop at Pekan Cina, the top floor is the shop owner's resident.



Figure 9.14 Shophouses in Pekan Cina are active during the day and night. Majority conducted businesses at the front of the ground floor, the back is the kitchen, and the top floor is the owner's residence.



Figure 9.15 The abandoned old shophouse at JL, which was once a coffee shop on the ground floor and a resident on the top floor.

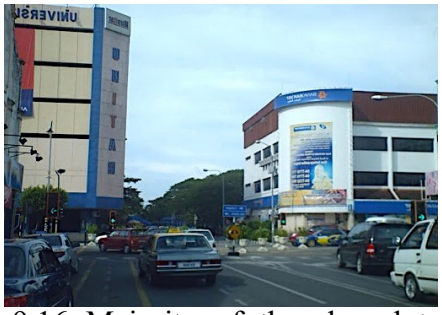

Figure 9.16 Majority of the shop lots are modern buildings conducting businesses and services during the day. This route is quiet at night.

9.2.2 The Contributing Principles and its Parameters Toward Green Urbanism Quality

The outcome of ASGUI survey at LDA had identified the contribution of each Principle towards Green Urbanism quality towards urban walkability. Correspondingly, both the calculation of POMP Score and percentage of contribution (Table 8.41) and Percentage of Category Table 8.43 verified that Principle 12 (32.84%) contributed the most towards Green Urbanism quality associated with urban walkability. This is followed by Principle 6 (24.76%) as the second most contributing Principle. Principle 5 (21.26%) and 10 (21.14%) are the third and fourth, respectively, as summarised in Figure 9.17 below.

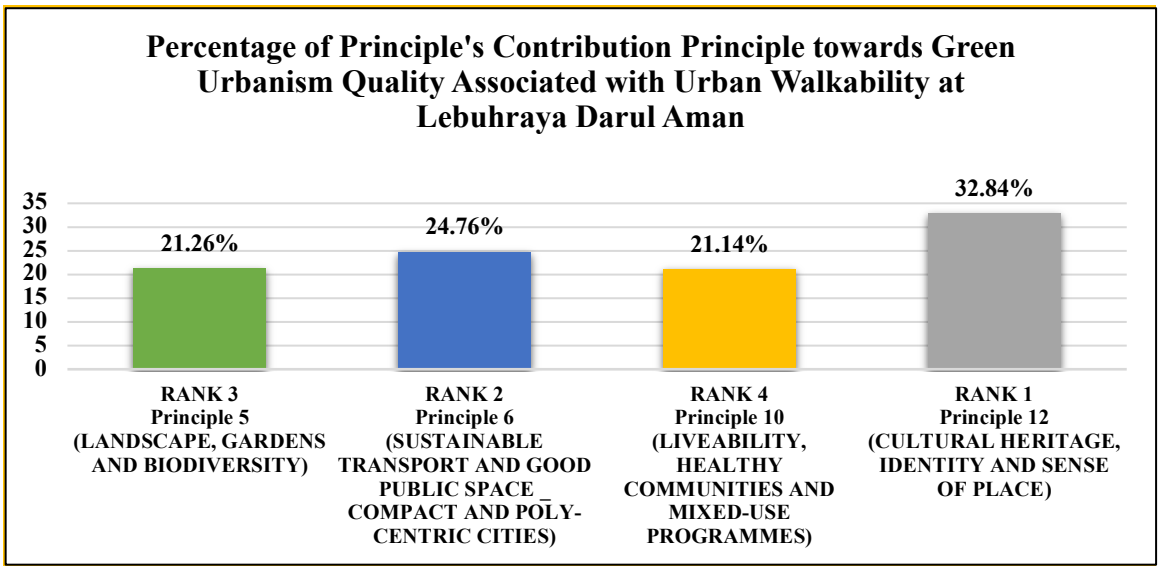

Figure 9.17 Rank of Principle's Percentage of Contribution for Green Urbanism Quality Associated with Urban Walkability (GUQ) at Lebuhraya Darul Aman.

ASGUI result also demonstrated the level of impact contributed by each indicator to the GUQ based on its mean value. Table 9.8 below reflected the hierarchical order of indicators (from highest mean to the lowest mean) under each parameter and key attribute. The composition of indicators in hierarchical order is advantageous for future related studies involving these indicators. It is also pragmatic for future application where funding is limited and selective development is required, thus focussing on the more important or impactful indicators would be an effective solution.

Table 9.8 Composition of Parameters and Indicators in Hierarchical Order Based on ASGUI Result

No	Parameter	Parameter's Mean	Indicator	Indicator's Mean
1	Cultural Heritage	5.000	Heritage values (Areas/Buildings/Structures/Activity)	5.00
			Cultural significant/ values – (day to day activity)	4.50
2	Compact & Polycentric City	4.666	Diverse business types	4.75
			Close proximity to residential areas	4.50
			Mix development / land use (residential and business)	3.50
3	Identity & Sense of Place	4.500	Local based history	5.00
			Historical significant (Structure /Artefact)	4.75
			Image and Identity	4.75
			Cultural and race based	4.75
			Religious based	4.25
			Foreign influences history	3.00
4	Urban Cooling	4.285	i) Functional Trees -Street Planting	5.00
			ii) Aesthetic & Display– Palms/Shrubberies	5.00
			i) Mix Users and activities	5.00
			ii) Pocket park / Vertical garden / Linear garden/ Display Garden	4.75
			iii) Social interaction and community activities	4.75
			i) Plot land/ Bedded / Potted	3.00
			i) Green roof and Balcony	1.75
5	Sustainable Transport System	3.250	Presence of pedestrian walkways network and Connectivity	5.00
			Assigned walkways / Paved or Unpaved path	5.00
			Safe pedestrian ways	5.00
			Centralised parking spaces (park and ride)	3.25
			Availability & close proximity of public transport stations/stops along pedestrian routes	2.75
			Availability of cycling lanes and facilities	1.00
			Safe bicycle ways	1.00
			Integrated public and private transport system	2.50
6	Good Public Space Network	4.000	Connected pedestrian network	5.00
			Good legibility and accessibility	4.75
			Presence of social interaction and community activities	3.75
			Streetscape that encourage healthy and active life	2.25
7	Liveability	4.000	Mixed users - social status (based on housing type)	4.50
			Mixed users – age, race, workers/students (city campus)	4.00
			Compact housing and communities	3.50
			Connected housing areas	3.00
8	Integrated Urban Landscape	3.571	Image / Identity creation	4.75
			Easy access vehicle (connection with primary/secondary roads / parking)	3.75
			Access legibility	3.50
			Coverage (Continuous throughout the city)	2.75
			Sense of Direction (notice board, direction signs, visual linkage)	2.75
			Connection to Public transport	2.50
			Recreational Park (Relaxation / strolling & Exercise and Jogging)	2.50
9	Healthy Community & Mixed-Use Programmes	2.800	Social spaces	4.50
			Community centres	2.75
			Recreational areas and facilities	2.00
			Facilities for healthy lifestyles	1.75
			Integrated housing amenities and facilities	1.50
10	Local Biodiversity	2.500	Presence of urban wildlife (crows, pigeon and stray cats & dogs	3.50
			Presence of native vegetation	2.75
			Presence of urban peri-landscape	2.50
			Inclusion of natural resources in urban development (trees, rivers & wildlife)	2.25
			Presence of urban forest	1.75
			Presence of wildlife	1.50
11	Conserving Natural Resources	2.400	Presence of recreational activities along the river	4.00
			Presence of community involvement/activities along the riverbanks	2.25
			Reinstating uses and function of riverbanks	2.00
			Reintroducing streams and rivers in the city	2.00
			Maintenance and management of streams and rivers	2.00

Among the contributing factors of each Principles are:

a. PRINCIPLE 12: CULTURAL HERITAGE, IDENTITY AND SENSE OF PLACE

Being a busy street with diversities of land uses and activities, LDA is rich with cultural ambience portraying strong traditional Malay identity. The existence of the historical artefacts is not throughout the route (only at stretches 2 and 3) yet very compelling in expressing a strong Sense of Place as displayed in Table 9.9 Principle 12 contributed 32.84% towards GUQ among all four routes with an overall mean value of 4.625 (ref. Table 9.9).

As displayed in Table 9.9 below, the Parameter of Cultural Heritage in Principle 12 interjected the most with the mean value of 5.000 to give rise to LDA's Green urbanism quality associated with urban walkability, with heritage significance in the form of buildings and structures along the route makes LDA as a 'Good Condition and Walkability'. The Parameter of Identity & Sense of Place also contributed significantly with the mean value of 4.500 to Green Urbanism quality associated with urban walkability along LDA. The appearance of historically significant buildings, structures and artefacts along LDA outline the strong 'local-based history' which highlights the rich chronicle of Malay Sultanate of Kedah, Islamic architecture and traditional Malay culture. The accumulation of all attributes in this Parameter established a strong identity and a distinct sense of place at LDA.

Table 9.9 Principle 12 - Mean Value and Category of Parameters

PARA-METER	*KEY ATTRIBUTE*	*INDICATOR*	*MEAN VALUE OF INDI-CATOR*	*MEAN VALUE OF PARA-METER*	*CATE-GORY*	*Percentage of Contribution for GUQ*	*POMP Score*
10-Cultural Heritage	a) Local culture	i) Heritage values (Areas/Buildings/ Structures/Activity)	5.00	5.000	Very Good	32.84% RANK 1	90.63
	b) Heritage	i) Cultural significant/ values – (day to day activity)	4.50		Very Good		
11-Identity & Sense of place	a) Historical elements	i) Local based history	5.00	4.500	Very Good		
		ii) Historical significant (Structure /Artefact)	4.75		Very Good		
		iii) Foreign influences history	3.00		Moderate		
	b) Identity	i) Image and Identity	4.75		Very Good		
	c) Spiritual presence	i) Cultural and race based	4.75		Very Good		
		ii) Religious based	4.25		Good		
					Mean Value of GUP 12		4.625

b. PRINCIPLE 6: SUSTAINABLE TRANSPORT AND GOOD PUBLIC SPACE: COMPACT AND POLY-CENTRIC CITIES

Principle 6 contributed 24.76% towards GUQ among all four routes with an overall mean value of 3.733 as Table 9.10 below. The parameter of Compact and Polycentric city contributed the most in GUQ for Principle 6 with a mean value of 4.666. This is followed by Parameter Good Public Space Network, which mean value of 4.000 contributed substantially to the quality of Green Urbanism, which encourages urban walkability. The third is the parameter Sustainable Transport System with a mean value of 3.25.

Table 9.10 Principle 6 - Mean Value and Category of Parameters

PARA-METER	*KEY ATTRIBUTE*	*INDICATOR*	*MEAN VALUE OF INDI-CATOR*	*MEAN VALUE OF PARA-METER*	*CATE-GORY*	*Percentage of Contribution for GUQ*	*POMP Score*
5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	i) Presence of pedestrian walkways network and Connectivity	5.00	3.250	Very Good	24.76 RANK 2	68.33
		ii) Assigned walkways / Paved or Unpaved path	5.00		Very Good		
		iii) Safe pedestrian ways	5.00		Very Good		
		iv) Availability of cycling lanes and facilities	1.00		Very Poor		
		v) Safe bicycle ways	1.00		Very Poor		
	b) Integrated motorized transport (private / public)	i) Centralised parking spaces (park and ride)	3.25		Moderate		
		ii) Availability & close proximity of public transport stations/stops along pedestrian routes	2.75		Moderate		
		iii) Integrated public and private transport system	2.50		Moderate		
6- Good Public Space Network	a) Pleasant public spaces	i) Good legibility and accessibility	4.75	4.000	Very Good		
		ii) Presence of social interaction and community activities	3.75		Good		
	b) Pedestrian network and connectivity	i) Connected pedestrian network	5.00		Very Good		
		ii) Streetscape that encourage healthy and active life	2.25		Poor		
7- Compact and polycentric city	a) Land uses	i) Close proximity to residential areas	4.50	4.666	Very Good		
		ii) Mix development / land use (residential and business)	3.50		Good		
	b) Diversity	i) Diverse business types	4.75		Very Good		
					Mean Value of GUP 6		3.733

c. PRINCIPLE 5: LANDSCAPE, GARDENS AND BIODIVERSITY

Principle 5 contributed 21.26% towards GUQ among all four routes with an overall mean value of 3.346 as displays in Table 9.11. The parameter Urban Cooling contributed the most in Principle 5 with mean value 4.285, followed by parameter Integrated Urban

Landscape with the mean value of 3.571. Both parameters of Local Biodiversity and Conserving Natural resources were given lower ratings with mean value only 2.500 and 2.400 respectively, which is lower than overall GUP 5 mean value.

Table 9.11 Principle 5 - Mean Value and Category of Parameters

PARA-METER	KEY ATTRIBUTE	INDICATOR	MEAN VALUE OF INDI-CATOR	MEAN VALUE OF PARA-METER	CATE-GORY	Percentage of Contribution for GUQ	POMP Score
1- Urban Cooling	a) Presence of urban vegetation	i) Functional Trees -Street Planting	5.00	4.285	Very Good	21.26 RANK 3	58.65
		ii) Aesthetic & Display– Palms/Shrubberies	5.00		Very Good		
	b) Inner-city Garden	i) Mix Users and activities	5.00		Very Good		
		ii) Pocket park / Vertical garden / Linear garden/ Display Garden	4.75		Very Good		
		iii) Social interaction and community activities	4.75		Very Good		
	c) Urban farming	i) Plot land/ Bedded / Potted	3.00		Moderate		
	d) Building greenery	i) Green roof and Balcony	1.75		Poor		
2- Integrated urban landscape	a) Urban landscape	i) Image / Identity creation	4.75	3.571	Very Good		
		ii) Coverage (Continuous throughout the city)	2.75		Moderate		
	b) accessibility to parks, gardens & public spaces	i) Easy access vehicle (connection with primary/secondary roads / parking)	3.75		Good		
		ii) Access legibility	3.50		Good		
		iii) Sense of Direction (notice board, direction signs, visual linkage)	2.75		Moderate		
		v) Connection to Public transport	2.50		Moderate		
	c) Leisure & recreation	i) Recreational Park (Relaxation / strolling & Exercise and Jogging)	2.50		Moderate		
3- Local Biodiversity	a) Habitat	i) Presence of urban wildlife (crows, pigeon and stray cats & dogs	3.50	2.500	Moderate		
		ii) Presence of wildlife	1.50		Poor		
	b) Ecology	i) Presence of native vegetation	2.75		Moderate		
		ii) Presence of urban peri-landscape	2.50		Moderate		
		iii) Inclusion of natural resources in urban development (trees, rivers and wildlife)	2.25		Poor		
	d) Forest Conservation	i) Presence of urban forest	1.75		Poor		
4- Conserving Natural Resources	a) Re-establishing Riverbanks	i) Presence of recreational activities along the river	4.00	2.400	Good		
		ii) Presence of community involvement/activities along the riverbanks	2.25		Poor		
		iii) Reinstating uses and function of riverbanks	2.00		Poor		
	b) Restoring Streams	i) Reintroducing streams and rivers in the city	2.00		Poor		
		ii) Maintenance and management of streams and rivers	2.00		Poor		
					Mean Value of GUP 5		3.346

d. PRINCIPLE 10: LIVEABILITY, HEALTHY COMMUNITIES AND MIXED-USE PROGRAMMES

Principle 10 contributed 21.14% towards GUQ among all four routes with an overall mean value of 3.333, as shown in Table 9.12 below. The mean value for the parameter of Liveability is 4.000, which is Very Good. However, the parameter Healthy community & Mixed-use programmes were given lower ratings; thus, the mean value is only 2.800, which is lower than the overall mean for Principle 10.

Table 9.12 Principle 10 - Mean Value and Category of Parameters

PARA-METER	*KEY ATTRIBUTE*	*INDICATOR*	*MEAN VALUE OF INDI-CATOR*	*MEAN VALUE OF PARA-METER*	*CATE-GORY*	*Percentage of Contribution for GUQ*	*POMP Score*
8-Liveability	a) Housing range and users	i) Mixed users - social status (based on housing type)	4.50	4.000	Very Good	21.14 RANK 4	58.33
		ii) Mixed users – age, race, workers/students (city campus)	4.00		Good		
	b) Sense of community	i) Compact housing and communities	3.50		Good		
		ii) Connected housing areas	3.00		Moderate		
9- Healthy community & Mixed-use programmes	a) Amenities and facilities	i) Community centres	2.75	2.800	Moderate		
		ii) Integrated housing amenities and facilities	1.50		Poor		
	b) Healthy communities	i) Social spaces	4.50		Very Good		
		ii) Recreational areas and facilities	2.00		Poor		
		iii) Facilities for healthy lifestyles	1.75		Poor		
					Mean Value of GUP 10		3.333

9.3 The Association between ASWI and ASGUI

Table 9.13 Comparison of ASWI and ASGUI Results at All Four Routes below showcase the result comparison between ASWI (Table 7.13 Route Walkability Status Based on Range of Adjusted Value) and ASGUI (Table 8.39) at all four routes in Alor Setar City Centre. The result revealed that the higher Green Urbanism Quality as in ASGUI result correspondence to higher urban walkability as in ASWI result. Thus, it indicated a **strong association between Green Urbanism Principle with urban walkability**.

Table 9.13 Comparison of ASWI and ASGUI Results at All Four Routes

	Alor Setar Walkability Index (ASWI)			Alor Setar Green Urbanism Index (ASGUI)			
	Unweighted Value	**Range of Adjusted Value**	**Walkability Status**	**Observed Rounded Value**	**POMP Score**	**Range of Adjusted Value**	**Walkability Status**
Lebuhraya Darul Aman	76.02	61– 80	Good Condition and Walkability	210	65.52	61– 80	Good Green Urbanism Quality
Jalan Sultan Badlishah	56.89	41 – 60	Moderate Condition and Walkability	180	52.59	41 – 60	Moderate Green Urbanism Quality
Jalan Tunku Ibrahim	32.86	21 – 40	Poor Condition and Walkability	127	29.74	21 – 40	Poor Green Urbanism Quality
Jalan Langgar	12.05	1– 20	Very Poor Condition and Walkability	104	19.83	1– 20	Very Poor Green Urbanism Quality

9.3.1 Factors Association Between Green Urbanism Principles and Urban Walkability at Lebuhraya Darul Aman

The following sub-sections present the association between GUP and urban walkability at LDA as the most walkable route with the highest GUQ. The discussions converge on the common themes of Nature, Urbanism, Liveability and Culture and Identity which were established in; i) literature investigation as discussed in sections 6.4, and ii) the associating themes between ASGUI and ASWI as discussed in sub-section 8.5.1. Table 9.14 below detailed the interrelated indicators under Parameters in ASWI and ASGUI that substantiated the association of factors/themes between GUP and urban walkability.

Table 9.14 The Associating Factors (Themes) Between Green Urbanism Principles and Urban Walkability at Lebuhraya Darul Aman

Lebuhraya Darul Aman		
INDEX	**ASGUI**	**ASWI**
CATEGORY	**Good Green Urbanism Quality**	**Good Condition and Walkability**
ASSOCIATING FACTOR (Theme)	**Nature** - Greeneries, Landscape and Urban Open Spaces	
	• Quality of Urban Cooling, Garden and Shades • Availability and Accessibility to Urban Landscape • Recreational Spaces and Activities • Active and Quality of Urban Open Spaces	• Greeneries and Landscape • Public Recreation Space • Urban Open Space
	Urbanism - Mixed Land Use - Mixed of modern and traditional business	
	• Mixed Land Use Development • Pedestrian Network and Connectivity • Pedestrian Safety and Security • Public Spaces Network and Accessibility • Compact and Diverse Business Types	• Mixed Land Uses • Modern Commercial • Streetscape and Pedestrian Facilities • Walking Paths • Active Commercial Street
	Culture and Identity - Heritage & Cultural Identity	
	• Local Cultural Heritage • Robust Sense of Identity • Strong Sense of Place	• Heritage and Culture
	Liveability - Active Urban Residents and Social Interaction	
	• Close Proximity to Residential Area • Community Spaces • Safety and Security	• Mix Residential and Commercial • Perception of Security from Crime

a. Nature

Bringing back nature, urban landscape, gardens and green courtyards in the city helps improves the city's aesthetics and help to reduce urban heat island effect (Newman & Matan, 2013). Cities should be developed with a greener environment, operates and serves in ways corresponding to nature, and protecting its biodiversity. This type of development is labelled by Lehmann (2010a) as 'responsible living' which is parallel to the idea of 'positive urbanism' in Beatley (2000). These qualities can be found along LDA, in consequence, the high GUQ value and urban walkability value.

Trees, garden and landscapes in urban areas area source of urban cooling, providing shades and presenting a more attractive environmental quality for pedestrians (Lehmann, 2010b). Besides, a city is said to be healthier and resilient when it preserves natural landscapes; and maximizes its open spaces for quality and active recreational activities (Lehmann, 2010b; Newman & Matan, 2013). Below are the associating factors

(established in both ASWI and ASGUI) under the Theme: Nature that contributed to the high GUQ and urban walkability value at LDA:

i. Quality of Urban Cooling, Garden and Shades (Greeneries and Landscape)

The availability of parks, gardens, pocket gardens and community spaces along LDA create an attractive and conducive walking environment for the public. The *Taman Rekreasi Menara Alor Setar* (Alor Setar Recreation Park) fronting the modern Aman Central Shopping Mall is one of the popular recreational places for residents and one of the sources of human movements along LDA. Big shaded trees along LDA, at the parks and along river promenade provided quality urban cooling and ample shade for pedestrians to walk comfortably.



Figure 9.18 (L) Alor Setar Tower Recreation Park (R) Canopy walkway along Jalan Tunku Yaakob.



Figure 9.19 Shaded pedestrian walkways along Lebuhraya Darul Aman

ii. Availability and Accessibility to Urban Landscape

The availability and easy access to parks, gardens, pocket gardens and community spaces along LDA create an attractive and conducive walking environment for the public. There are also several pocket garden along LDA that enticed pedestrian for a temporary stop, to sit and relax while walking along this route. The availability and accessibility to

greeneries, attractive urban landscape and public recreational spaces act as an important catalyst in generating high GUQ value and urban walkability value along LDA.

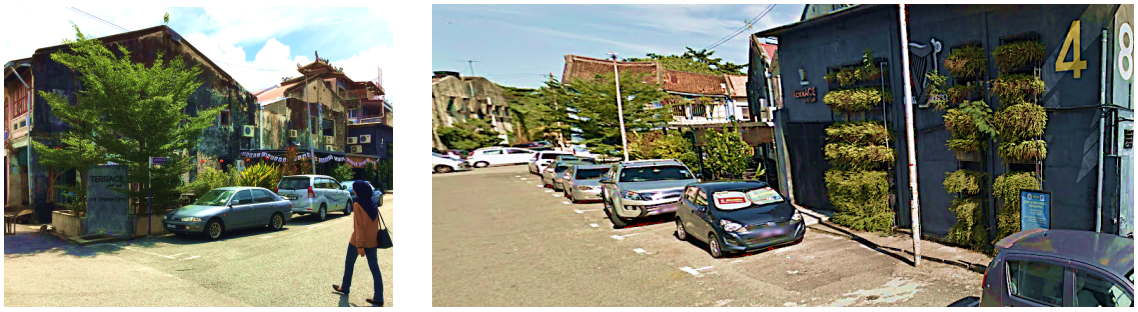

Figure 9.20 Pocket Gardens along Lebuhraya Darul Aman and Pekan Cina



Figure 9.21 Pocket garden and resting place along Lebuhraya Darul Aman being used at night by pedestrians

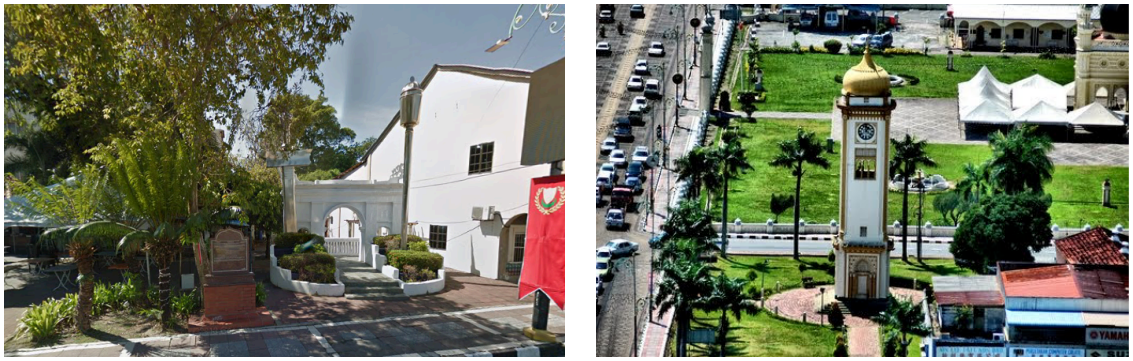

Figure 9.22 Pocket Garden at Lebuhraya Darul Aman (Masjid Zahir and Clock Tower)
Source: www.Penbiru.com

iii. Recreational Spaces and Activities (Public Recreation Spaces)

LDA provides several recreational spaces such as the river promenade at Kedah River used by the locals and visitors. The locals primarily the old folks use this space for a morning walk and light exercises; as relaxing spot in the afternoon with friends within the neighbourhood. Visitor mainly peoples from outside the city doing their shopping at Pekan Cina often used this area at Tanjung Chali Plaza and promenade at Jalan Tengku Yaakob for relaxation after shopping activities. Local taxi drivers (generally senior citizens) often use the gazebos near Tanjung Chali as waiting for cum resting place while

waiting for passengers/shoppers at china town travelling mostly to Shahab Perdana, the city's central bus station connecting to adjacent districts. There are pontoons and decking provided at certain spots where people use for fishing. The mature trees and dense vegetation along the promenade create a pleasant atmosphere where walking is undoubtedly relishing.



Figure 9.23 (L)Tanjung Chali, Pekan Cina, Alor Setar, (R) River Promenade along Kedah River at Pekan Melayu, Alor Setar



Figure 9.24 Nature walk along Kedah River at Tanjung Chali (Pekan Cina and Pekan Melayu)
Source: http://reenaonline.blogspot.com/2013/01/tanjung-chali-alor-setar-kedah.html

iv. Active and Quality of Urban Open Spaces

The opportuneness of having recreational spaces that allow varies of activities contributed significantly to its GUQ and urban walkability Values. Spaces such as Medan Bandar (Urban Plaza) is easily accessible either by foot or public transport. In addition, Dataran Bandar is located at the centre of the heritage zone, which is one of the most visited places in Alor Setar. The newly design plaza permits various activities and especially active at night. Being in the centre of many attractive places such as Masjid Zahir, Balai Besar, The Royal Museum and many others, it has become a popular meeting place and acts as

a nodal point for LDA. Attributable to its size and location, Medan Bandar often opted as a venue for big events, exhibitions and product launching by both private and government institutions.



Figure 9.25 Breakfasting activity at the Medan Bandar Alor Setar
Source: https://www.skyscrapercity.com/showthread.php?t=346208&page=1035





Figure 9.26 Active, colourful and vibrant nightlife at Medan Bandar, Alor Setar
Source: https://zaharibbdotcom.files.wordpress.com/2011/02/img_6717.jpg

Cultural and street performances also can be seen along LDA especially at Alor Setar Tower Plaza, Dataran Tanjung Chali and Medan Bandar. The city council effort in bringing back the youngsters into the city is seen fruitful with the introduction of various activities relevant to those generations such as street performances, buskers and modern urban cafes modern.


Figure 9.27 (L) Street performance at Alor Setar Tower Plaza, (R) Rollerblading at Tanjung Chali, Alor Setar.

The shade, green and natural atmosphere at specific locations along LDA specifically along Jalan Tengku Yaakob and the river promenade is most encouraging for walking. As reiterated by a Senior Academic (Ref. ACC2) interviewed, "Pleasant, green and quality surrounding environment replicating nature in the urban area promote comfort, security and sense of attachment to the town. Having these will definitely help the town's walkability!". The greeneries, natural environment and recreational spaces here have significantly contributed to the high GUQ and urban walkability value for LDA.

Parks and green areas, mature trees along LDA and the river at Pekan Melayu and Pekan Cina also help in reducing the heat along the route and soften this area. These are the qualities of an environment needed to establish an effective walking milieus as mentioned by a director of landscape consultant firm and also a landscape practitioner (Ref. LA2), '…utilizing nature as the solution to tackle the impact of the urbanisation like urban heat island by reducing the city's temperature, also acts as air purification in order to provide a high quality, comfortable and colder urban environment to walk in. Urban landscape, pocket parks, gardens, green walls, balcony and rooftop garden, add value and soften the urban environment. It persuades people to walk more in the city.'

b. Urbanism

Beatley (2000) underlined that the responsible way of living is by reducing the environmental impact through living lightly on the land. Green Urbanism emphasizes the essential role of cities with positive urbanism in shaping new sustainable cities with more sustainable places, communities and lifestyles. These qualities, as stated by Beatley, can

be found along LDA where urban living co-exist with nature at Pekan Cina (China Town) and Pekan Melayu (Malay Town). These two residential areas at the city centre prospered next to the natural flow of Kedah River and commercial areas of both traditional and modern.

A city should be well equipped, accessible and interconnected pedestrian walkways; and with streetscapes that motivate a healthy, active lifestyle and less dependent on motorised vehicular (Lehmann, 2010a). Compact and medium to a high-density urban area with a range of housing typology help in achieving an equilibrium of residences and employment (Lehmann, 2010b). The compact and polycentric development also denotes that most destinations are reachable by walking or a short ride with public transport (Newman, 2010). Below are the associating factors (established in both ASWI and ASGUI) under the Theme: Urbanism that contributed to the high GUQ and urban walkability value at LDA:

i. Mixed Land Use Development (Mixed Land Uses & Modern Commercial)

LDA is the best example of a mixed land use development in Alor Setar. The range of land use can be divided into five categories, 1) Commercial businesses, 2) Park and recreation, 3) Residential, 4) Historical zone and 5) A mix of traditional retail and residential (as in Figure 9.28). Commercial businesses area generally covers from the shopping mall, private offices and retail businesses.

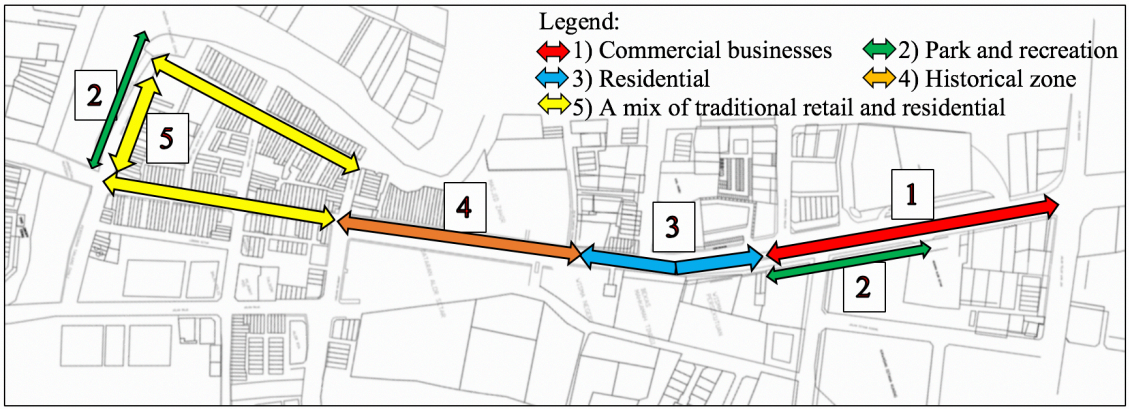

Figure 9.28 Type of land uses along Lebuhraya Darul Aman

LDA can attract a wide range of users due to the mixture of its land uses. The newly developed modern shopping mall (Aman Central) at the junction of this route acted as a node attracting and disbursing the crowd. The Menara Alor Setar Tower Recreation Park offers active activities with various children play equipment and resting places for

parents. Pedestrians were often seen traversing the main road from the park and surrounding residential areas to the shopping mall. There are also two condominium towers fronting the Aman Central which is within a five-minutes' walk from the mall.



Figure 9.29 Aerial view of Aman Central, Alor Setar Tower and Recreation Park; and modern commercial area
Source: https://www.kedah.gov.my/berita-terkini/Alor-Setar-Tower

Many parks their cars at the free parking spaces at the park and walk to the mall to avert high parking fee. There are two pedestrian crossings at the traffic lights; access to the mall is comfortable and safe. Still, many pedestrians are jaywalking from the parks and Alor Setar Tower to the mall, especially at night.



Figure 9.30 Pedestrian Jaywalking along Lebuhraya Darul Aman at modern commercial area

The central of LDA is the historical and heritage zone comprises of The Royal Palace, Royal structures and Museum, which often frequent by visitors. This zone attracted many visitors due to its traditional Malay architecture of the Palace, Moorish architecture and Post-colonial architecture along both sides of the road. Nest to the heritage zone is Pekan Cina, a mixed residential and traditional retail business. This area is a famous shopping

district among the locals and visitors alike. This area is well known for selling household items, toys, traditional medicines and light-machine mechanics, textiles and ironmongers. Roadside vendors are also active in the morning and at night selling mostly Chinese street food and fruits of both local and imported. This area will be most active and packed with people during night markets conducted once a week and also during the many Chinese ritual ceremonies.



Figure 9.31 Street vendor selling local Chinese food at Pekan Cina

ii. Pedestrian Network and Connectivity Walking Paths

LDA is one of the routes in Alor Setar with extensive pedestrian walkway network covering from Aman Central to Pekan Cina and Pekan Melayu. Pedestrian walkways along LDA are generally wide (average 1.5 - 2.0 meter), with the exception at Historic Zone where the width can reach up to 3 meters. Also, at specific locations in Pekan Cina where the pedestrian walkways are narrow (approx. 0.8 – 1.0 meter) due to the tight spaces between the road and shophouses. However, the narrow pedestrian walkways are compensated with the 'five foot walkway', which is integrated with the shophouses. Most of the pedestrian walkways are covered with shades from mature roadside trees and have good connectivity with other important places and places of interest in the city. Additionally, the landscape elements along LDA is an added value which makes the whole environment more pleasant for walking.




Figure 9.32 Wide pedestrian walkway along Lebuhraya Darul Aman and commercial zone in the city centre




Figure 9.33 Big mature roadside trees along a pedestrian walkway at Lebuhraya Darul Aman



Figure 9.34 Narrow pedestrian walkway being obstructed by a potted plant in front of a shophouse and the 'five foot walkway'

iii. Pedestrian Safety and Security Streetscape and Pedestrian Facilities

According to MBAS, there are no significant issues related to pedestrian safety and security at LDA. Pedestrian walkways are provided throughout LDA with suitable material for pedestrian safety. A Marked and controlled pedestrian crossing is also provided at specific locations for a pedestrian to cross safely and the time for crossing also sufficient. Metal railing is also provided along the pedestrian walkway from Aman

Central to the Heritage Zone to deter jaywalkers and pedestrian safety from accidents and crimes. The whole LDA is lighted with street lighting, which made LDA a safe place for pedestrians during both day and night.




Figure 9.35 (L) One of the controlled pedestrian crossings in front of Aman Central, (R) Pedestrian walkway with metal railings for safety

There are certain areas where pedestrian walkways were obstructed with motor vehicles, but the issue is not major along LDA as compared to other routes in Alor Setar.




Figure 9.36 Pedestrian walkway being obstructed by parked motor vehicles on pavements at the city centre

iv. Public Spaces Network and Accessibility

There are several active public spaces along LDA such as Plaza at Alor Setar Tower, the recreation park next to Alor Setar Tower, Dataran Medan Bandar, Dataran Masjid Zahir, Promenade along Sungai Kedah at Pekan Melayu and Pekan Cina, Open Space at Tanjung Chali and 'Boxpark'. These public spaces have a good network, easily accessible and interconnected with pedestrian walkways. These places have made LDA popular among the locals and visitors. The MBAS vision to bring back young people into the city has materialised with these networks of public spaces and active activities.



Figure 9.37 Easy accessibility to public spaces network along Lebuhraya Darul Aman (L) Dataran Medan Bandar, (R) Plaza at Alor Setar Tower

v. Compact and Diverse Business Types (Active Commercial Street)

Another excellent attribute of LDA is its compact and diverse business, especially at the modern commercial area. Owing to the variety of businesses types such as retails and private offices ranging from retails and trades, clinics and legal offices, this active place succeeded in attracting the various type of users.



Figure 9.38 The active commercial street along Lebuhraya Darul Aman

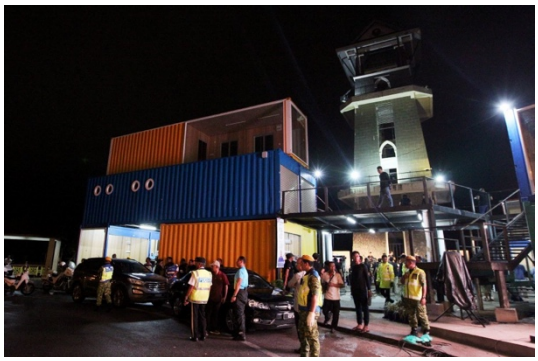

Figure 9.39 'Boxpark' is a new public recreation and eatery place at Pekan Cina – a popular place among the youngster
Source: https://www.bharian.com.my/berita/wilayah/2018/05/420316/boxpark-alor-setar-cetus-fenomena-bersantai-golongan-muda

Good and positive urbanism should consider human factors as the main agenda (Newman, 2010). The quality of mixed land uses along LDA have made this route successful in attracting pedestrians to come and participated in all sort of activities offered. According

to the state planning officer interviewed (Ref. UP2), the diversity of modern and traditional businesses here were able to transform a once car-oriented street into a bustling pedestrian street (MBAS, 2015). UP2 also mentioned that "… before this, people are afraid to walk along Lebuhraya Darul Aman due to lack of activities, poor pedestrian walkways, poor maintenance and no proper landscape. But, now with the funding from Federal government and proactive measures by MBAS… this road is now active with many people walking along the road day and night."

It is also essential to have a balance active pedestrian movement throughout the city. Thus, according to a State Landscape Director (Ref. PM2) "…it very important to have pedestrian network in the city. It should be well interconnected linking all the important public places, landmarks, nodes and places of attractions. Connectivity is a key to making the whole city active with pedestrians, and we need to have a good connectivity and networking joining public places in all of our city." LDA is seen to have a well-distributed pedestrian movement, making it active in almost all sections. This parallel to opinion from a Director of Architectural firm (Ref. AR2), that "…connectivity, here we can see the extent of the pedestrian network is seamlessly linked; the pedestrian environment is joined and attached to the town's attractions, activities and places of importance. Basically, it provides an extensive network connecting the town's core areas."

Compact development and excellent public transportation system are two intertwined qualities necessary in practising Green Urbanism approach. AR2 also in agreement with the approach and stated that "…if these principles can be implemented! I believe the town will be more accessible with good transportation system. Hence, people will commute with public transports and will walk more in the town. Good public space in the town will be another factor that can attract and promote walkability." AR2 continues to say that "My understanding of the ideas of Compact and Poly-centric cities is championing mixed-land uses and mixed-development that promote balance of residence and employment in the town. This will reduce private vehicle dependency and encourage the use of public transport and walking."

c. Culture and Identity

The Malay culture has a long history in Kedah dated back during the ancient Kedah empire but strengthens during the ruling of Sultan Muhammad Jiwa Zainal Abidin Mu'azzam Shah, Kedah's 19th. Ruler in 1735 (Moore, 2011); and the Malay identity has deeply embedded since then. The Malay culture and identity can be seen from the display of Malay Sultanate related artefacts, the secret royal garden behind the royal palace and other royal monuments. Luccarelli et al. (2012) mentioned that green, landscape and monuments with which attached historical context allow identification of place are related to culture and cultural memory.

The urban sustainability's aim is the protection of its environment, and the essence of a good urbanism quality of a city is in the safeguarding the essence of its distinct place, built heritage and the maintenance of its cultural identity (Lehmann, 2010a). City with strong, sustainable agenda focused on strengthening the culture and heritage that helps to generate local activities rather than globalised culture; this is parallel with Green Urbanism concept to developed local economies, by building on a local area's unique and distinctive sense of place, nurturing a high quality of life and a strong commitment to community (Newman et al., 2019). These are the qualities that exist along LDA and Pekan China; although that can be developed and intensify further, still, these are the qualities that escalates LDA GUQ and urban walkability value.

i. Local Culture and Heritage

The State of Kedah has a strong cultural identity and mostly affiliated to the Malay Sultan, the Malay people and Islam. All these essences are distinctively exhibited along LDA, especially at the Heritage Zone. The charm of cultural identity displays along LDA is without doubt successfully attracted visitors of both locals and foreigners, the majority of which strolling the street on foot and made the area active, especially at night.




Figure 9.40 (L) The Royal of Kedah Museum, (R) Masjid Zahir - The State Mosque

The Heritage Zone and the Dataran Medan Bandar often served as a place for traditional and cultural shows as well as a place for the extravagant Royal Ceremonies. Figure 9.41 below showcased the grand royal ceremony during the installation of the 29th Sultan of Kedah. The display of culture and identity along LDA is benefitted in making this area active with the vibrant environment, thus, contributed to the high GUQ and urban walkability.




Figure 9.41 The procession ceremony during the installation of 29th Sultan of Kedah on Oct. 22, 2018
Source: http://beritamalaysia.xyz/sultan-sallehuddin-selamat-ditabal-sultan-kedah-ke-29/

ii. Robust Sense of Identity

Apart from the Heritage Zone, Pekan Cina also has a robust sense of identity influenced by the Chinese community residing there. With a strong community association and clan societies, Pekan Cina thrives in retail businesses along with their cultural identity. Many cultural events took place here, displaying their rich culture and identity. Also, the Chinese community here are a staunch devotee of Buddhism/Ancestral worshipping, often performed religious ceremonies at the small temple and also along the road.



Figure 9.42 Chinese cultural show at Pekan Cina
Source: https://www.thestar.com.my/news/community/festival-of-all-things-chinese



Figure 9.43 (L) Traditional Chinese dance at Pekan Cina festival, (R) Chinese Orchestra playing traditional instruments
Source: https://www.thestar.com.my/news/community/festival-of-all-things-chinese

iii. Strong Sense of Place

Adaptive reuse of old and dilapidated Anglo Chinese buildings into boutique café and art gallery. The side alleyway was transformed into a place for events, cultural shows and art activities. This move is parallel to the approach of urban sustainability and contributed much to a high GUQ and urban walkability. Such positive and active activity fostered a strong sense of place in Pekan Cina.



Figure 9.44 Art and Cultural event at Jalan Penjara Lama, Pekan Cina.

The series of murals on the shophouses wall all over Pekan Melayu and Pekan Cina (as in figure 6.30 – 6.32, sub-section 6.6.1(b)-iv) carries a strong message of Patriotism with images of former Prime Ministers of Kedah origin. These adoring images of local crafts and artisans are memorable to many and evoked a sense of belonging as well as the sense of place.

d. Liveability

One of the positive urbanism criteria lies in the ability of the city to offer a good quality urban living to urban dwellers (Beatley 2000; Lehmann 2010a). It cannot be achieved singlehandedly and requires multitude effort by various sectors; and the integration of environmental, cultural, social and economic factors of living (Cheshmehzangi, 2015). High density and mixed land use with residential, retail and working places are essential in encouraging people to live in the city (Brookfield, 2016). Green infrastructures in the form of urban green spaces, urban nature spaces and public parks, offer human well-being and general health; together with the availability of community spaces would definitely encourage city living and community development (Simpson & Parker, 2018).

Active lifestyle, lively environment and effective public transportation are the catalysts to bring people back into the city and also encourage businesses to flourish. Active city centre stimulates economic stability and boosts safety and security (Abdulla et al., 2017). Below are the qualities that exist along LDA and Pekan China, although those qualities are not as compelling as in larger cities.

i. Close Proximity to Residential Area (Mix residential and Commercial)

The Alor Setar city centre is surrounded by many residential areas and some of which are located along LDA. There are four types of the residential area along LDA, namely a Modern planned residential, Traditional villages (Kampung), Shophouses (Mix residential and business) and modern condominium. All these residential areas are within walking distance and easily accessible to LDA (refer aerial view in Figure 6.10). This helps encourage people to walk or cycle from their houses to work or shops for their daily necessities; making LDA GUQ and urban walkability value higher as compared to other routes.



Figure 9.45 Residential Areas behind Masjid Zahir (along LDA)
Source: http://www.wonderfulmalaysia.com/attractions/alor-setar.htm





Figure 9.46 Residential area next to Kedah River at Tanjung Chali, Alor Setar
Source: https://foursquare.com/v/dataran-tanjung-chali/4d4535351ed56dcbf6b9b854/photos

ii. Community Spaces

There are Three main community spaces, two in Pekan Cina which is at the Temple and Kwangtung and Tengchow Community Association, and another one is at Pekan Melayu fronting Sungai Kedah. Local communities use all these spaces for events and social gatherings. Apart from the three formal spaces, there are also accessible small social spaces such as the pergolas fronting Kedah river, Tanjung Chali Plaza, Lorong Penjara Lama and pocket garden near Jalan Tengku Ibrahim junction; used by residents as meeting places, relaxation and for playing board games.





Figure 9.47 (L) Community Space at Pekan Melayu and Pekan Cina, (R) A community event at Kwangtung and Tengchow Community Association near Pekan Cina

iii. Safety and Security (Perception of Security and safety)

The whole stretch of LDA and Pekan Cina are well-lit and considerably active both day and night with residents performing their daily routine, visitor doing their shopping and some employees working there. Thus, public policing is relatively high, and the perception of Security from crime is also high. The provision for pedestrian walkways separated from the roads, metal railings along walkways, the five foot walkways and connected pedestrian walkways provide comfort for users and increase the perception on Safety from an accident (refer Figure 9.34 & Figure 9.35).

9.4 Answering Research Questions

The research had successfully answered all research questions as follows;

9.4.1 The Main Research Question

How can a Medium-sized City embody the qualities of Green Urbanism Principles that are related to the built environment, community, landscape and urban sustainability?

i. Objective No 1.: To understand the concept of Green Urbanism and its principles (GUP) and identify its qualities for the revitalisation of a Medium-sized City.

The study refers mainly on the Principle idea of SUD that leads to the detail principles of Green Urbanism by two primary authors, Timothy Beatley and Stefan Lehmann. These two-pioneering works served as the primary references, together with other latest publications and studies by other authors and researchers.

The exploration through Literature investigation underlined the need for a new way of thinking to develop our towns and cities sustainably that diverge from the conventional way of sustainable development (Newman). Beatley (2000) suggest for positive urbanism, Lehmann (2010a) advocate for more responsible living, Luccarelli et al. (2012) put forward the idea of planning beyond conventional sustainability; and Nassar (2013) indicates the need for smart urbanism. These calls for a new way of thinking in urban development are attributable to a bigger problem the world is facing as Møller (2010) identifies as an ‘age of scarcity’. Towns and cities are now facing with challenges to

reduce the carbon footprint, to protect and improve biodiversity, to support and continue to create economic opportunities; and to be responsible in affording healthy and liveable places (Beatley, 2000; Lehmann, 2014, 2010b; Beatley & Newman, 2009; Newman & Matan, 2013).

The investigation also gives understanding to the overall concept of Green Urbanism and its evolution dated back in 1902 (Garden Cities of Tomorrow) to the present day as detailed in Table 5.1, together with the nuance of definitions by various authors as detailed in Table 5.2. Based from the literature review and investigation covering the domain of Sustainable Urban Design (SUD), Green Urbanism transpired to be able to solve many urban issues overlooked by current urban development (Beatley, 2001; Lehmann, 2010b). The issues of dis-walkable urban areas, dispersal of landscape development and public urban spaces, hollowing of the city and pedestrian modal conflicts faced by all Malaysian cities, big or small, is potentially resolved by employing certain GU principles (Beatley, 2001; Lehmann, 2010b). The exploration and investigation concluded that the '15 Green Urbanism Principles' are the catalysts that a town should embody for a responsible, positive and smart sustainable urban development; for the betterment of the city's landscape and greeneries, urban structure and provisions, urban communities, and heritage and cultural identity. Besides, the research also identified the general Green Urbanism Components associated with urban walkability.

9.4.2 Subsidiary Research Question 1

How does urban walkability relate to Green Urbanism Principles (GUP)?

i. Objective No 2.: To distinguish the determinant elements in Green Urbanism Principles (GUP) that promote walkability in Medium-sized City.

The first subsidiary question was answered using the Three-stages of Delphi Survey. Stage 1 of the survey was the individual task to identify the relevant Green Urbanism Principles related to urban walkability. Stage 1 started with the 15 GUO as discovered in the Literature investigation (corresponding to the conclusion of the Research Objective No. 1). The calculation for Percentage of Consensus of Agreement performed on the survey data shown that out of 15, there are only five principles with score exceeded the cut-off point of 66.7%. Therefore, Stage 1 of Delphi Survey have concluded that potential

GUPs associated with urban walkability are Principle 1, 5, 6, 10 and 12; detail of which was discussed in chapter 8, under section 8.2.

This is followed by Stage 2 of the survey where participants discussed and deliberated the relevancy and affiliation of the five nominated principles to the specific site context, which is the Medium-sized City of Alor Setar. In this stage, all participants, 1) had reached 100% of the Consensus of Agreement on the relevant theme for each of the principles. 2) had voted on the relevancy of each principle and its parameters considering the locality, context, geographical location, economic development, local culture etc. The data of the vote were then calculated statistically using the Intraclass Correlation Coefficient (ICC). The result of ICC concluded that only four associated Principles, specifically Principle 5, 6, 10 and 12; which detailed in Chapter 8, under section 8.3.

Stage 3 started with the weighing of the definition of Green urbanism, detail description of each principal, the traverse of key attributes and to finally arrive at the detail measurable indicators for urban walkability established from Green Urbanism principles. The process of finalising the listing of key attributes and indicators using Majority of Agreement with series of process of refining the selections to identify redundant and overlapping items, revising and rewording for easy understanding, and addition and omission for a comprehensive listing. In the end, participants consented on 11 Parameters, 27 Key attributes and 58 indicators. The list of the preliminary index was then forwarded to two senior academics for validation using a 5-point Likert scale for the rank order.

The results of the ranking of relevancy were then calculated and analysed using Cohen Kappa Coefficient (k) in SPSS to measure inter-rater agreement between the two validators; the result showed a 'highly significant' and 'Almost Perfect Agreement' result as accorded in the Interpretation of Kappa Value table (refer Table 8.11). The outcome of the process was a validated walkability index measure identified as Alor Setar Walkability Index (ASWI). Accordingly, the complete list of Green Urbanism Parameters, Key Attributes and Indicators that are associated with urban walkability as detailed in ASWI has helped in distinguishing the determinant elements in Green Urbanism Principles (GUP) that promote walkability in Medium-sized City and therefore, answering the Subsidiary Research Question 1.

ii. Objective No 3.: To establish the link between green urbanism principles (GUP) and urban walkability and their potential impacts in improving the environment in Medium-sized City.

In order to establish the link of association between Green urbanism Principles and urban walkability at the Medium-sized City of Alor Setar, a series of Semi-structured interviews were carried out. The transcribed data from the interviews were analysed to identify the associating Themes between Green Urbanism principles and urban walkability using – CAQDAS, NVIVO thematic analysis. The process of identifying the main themes started with the categorisation of keywords linking Green Urbanism with urban walkability from the transcribed interviews into predetermined or emergence Coding. The list Coding was later on classified under relevant Themes for easy reference as detailed In Chapter 8, under sub-section 8.5.1. The outcome of the Thematic Analysis was a list of main Themes that associate Green Urbanism Principles and urban walkability. The main themes are, 1) Nature, 2) Urbanism, 3) Liveability and finally, 4) Culture and Identity. As means of validation, the main themes identified in the Thematic Analysis of Semi-structured interviews were then compared with the themes generated from Stage 2 Delphi Survey for similarity (wording, meaning and references) as detailed in Table 8.33. Therefore, Research Objective No. 3 has answered the Subsidiary Research Question 1.

9.4.3 Subsidiary Research Question 2

How can urban walkability be measured in terms of Green Urbanism Principles?

i. Objective No 2.: To distinguish the determinant elements in Green Urbanism Principles (GUP) that promote walkability in Medium-sized City.

- Focus Group

The developed indices of ASWI and ASGUI has helped in distinguishing determinant elements in Green Urbanism Principles that can promote urban walkability, especially in Medium-sized City. The development of ASWI has helped in identifying the categorical status of urban walkability according to walkability index developed by literature investigation and exploration of previously validated indices of global walkability index, urban planning/private agencies walkability index, Western walkability index, Asian walkability index and Malaysian walkability index; and establish the rank from the most to the least walkable route among the routes. The Method of Calculation for this index is as Statistical Analysis using Standard Global Walkability Index Ranking.

ASGUI, on the other hand, helped in identifying the categorical status of Green Urbanism Quality (GUQ) developed by the process of literature investigation and exploration of Green Urbanism Domain, the Three-stage Delphi Survey and Semi-structured Interview; and establish the rank from the most to the least GUQ among the routes. ASQI uses the Statistical Analysis using Standard Global Walkability Index Ranking as its Method of Index Calculation. These two indices were used in an on-site survey and observation by the Focus Group.

- Triangulation of ASWI and ASGUI Result

Accordingly, the data collected from both indices by Focus Group on-site survey were calculated and analysed to identify 1) the most walkable route and 2) determinant for urban walkability for ASWI, and 1) the highest Green Urbanism Quality route and 2) determinant for GUQ for ASGUI. The result triangulation signified that Lebuhraya Darul Aman was found to be the most walkable route (ASWI) and the highest GUQ among the four routes surveyed; have partly answered the Subsidiary Research Question No. 2

ii. Objective No 3.: To establish the link between green urbanism principles (GUP) and urban walkability and their potential impacts in improving the environment in Medium-sized City.

- Semi-structured Interview

The triangulated result from SWI and ASGUI have ascertained that Lebuhraya Darul Aman is the most walkable due to high GUQ value as compared to Jalan Sultan Badlishah (Ranked no. 2), Jalan Tengku Ibrahim (Ranked no. 3) and lastly, Jalan Langgar (Ranked no. 4) in the MC of Alor Setar. The findings of the associated themes are;

<u>Theme: Nature</u>

Principle 5: Landscape, Gardens and Biodiversity were associated with Nature. Its associated factors are, 1) Landscape and garden, and 2) Urban Biodiversity

<u>Theme: Urbanism</u>

Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities was associated with Urbanism, with factors of the association are, 1) Compact Development, Mixed Land Use and Polycentric City, 2) Sustainable Transport and Good Public Space, and 3) Pedestrian Network, Safety and Security, and Facilities

<u>Theme: Liveability</u>

Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes were associated with Liveability, with factors of the association are, 1) Liveability and 2) Healthy Community and Mixed-use Programmes.

Theme: Culture and Identity

Principle 12: Cultural Heritage, Identity and Sense of Place were associated with the theme Culture and Identity, and the associated factors are 1) Cultural Heritage, 2) Identity and Sense of Place.

The author believed that Research Objective no. 3 has answered the Subsidiary Research Question no. 2.

9.5 Summary of the Chapter

This chapter presents the discussion on factors that made Lebuhraya Darul Aman (LDA) as the most walkable as the established in ASWI analysis and with the highest Green Urbanism Quality as confirmed in the ASGUI analysis compared to three other studied routes.

The analysis from ASWI indicated that the most influential Parameters along LDA in ranking order are: 1) Uses and Activity; 2) Visual Interest and Attractiveness; 3) Convenience; 4) Comfort; and 5) Sense of Safety and Security. Meanwhile, the analysis from ASWI indicated that the most influential Parameters along LDA in ranking order are: 1) Cultural Heritage, Identity and Sense of Place; 2) Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities; 3) Landscape, Garden and Biodiversity; and 4) Liveability, Healthy Communities and Mixed-Use Programmes.

This chapter also highlights the associated themes, namely, 1) Nature – Greeneries, Landscape and Urban Open Spaces; 2) Urbanism – Mixed Land Use - Mixed of modern and traditional business; 3) Culture and Identity – Heritage & Cultural Identity; and 4) Liveability – Active Urban Residents and Social Interaction. Finally, this chapter also synthesises on approaches taken in Research Objective in answering the Main Research Question and Subsidiary Research Questions.

- Research Objective no. 1, Literature investigation on the domain of sustainable development and the concept of Green Urbanism answered the Main Research Question.
- Research Objective no. 2, the Three-Stage Delphi Survey, together with Research Objective no. 3, the Semi-structured Interview have accomplished in answering Subsidiary research Question 1.
- the result from both ASWI and AGSUI from Research Objective no. 2 and the Thematic Analysis performed on transcribed interviews from Research Objective no. 3 have also succeeded in answering the Subsidiary Research Question 2.

The following is Chapter 10, which concludes the progression of the study and the summary of the research findings.

Chapter 10

CONCLUSION AND RECOMMENDATIONS

10.0 Introduction

The purpose of this research is to explore the association between Green urbanism Principles and urban walkability in the Medium-sized City of Alor Setar, Kedah, Malaysia. Following the research methodology, two sets of indices were developed, ASWI – an urban walkability index measures modelled from Global Walkability Index with Green urbanism approach and ASGUI – a Green Urbanism Quality Index measures following the validated selection of Green Urbanism Principles. The process of developing both indices follow through a series of validation procedures involving various methods, namely Literature investigation and analysis of previous indices, Delphi Survey, Structure Interview and Focus Group Site Investigations. The results were then triangulated, forming the conclusion of the associating themes between Green Urbanism Principles and Urban walkability.

This final chapter is divided into six sections, with the first section delivers a brief introduction of the chapter. The second section summarises the main finding of the research in the first section. The third section presents the arises issues and difficulties during the course of the research; the fourth section discusses the research limitation and suggestion for future research. The fifth section underlines the contribution of this research and this chapter concludes with the Final Comments in section 6.

10.1 Summary of Findings

a. Result Similarities Between Alor Setar Walkability Index (ASWI) and Alor Setar Green Urbanism Index (ASGUI)

The statistical analysis performed on both ASWI and ASGUI generated significant similarities, although methods of statistical analysis were different. In ASWI, the calculations were done following the standard Global Walkability Index model (GWI) by Krambeck & Shah (2006) by calculating Unweighted Average Value with consideration on the number of pedestrian and distance of the walking area. This method was also employed by many previous researchers, as discussed in Chapter 4, Part Two (sub-section 4.7 – 4.9). Figure 10.1 below indicating the overall result of ASWI with Lebuhraya Darul Aman walkability status as top of the walkability rank.

Figure 10.1 Summary of ASWI Result indicating Walkability Status for all routes



However, in ASGUI, the method of calculations commissioned in two stages, starting with the calculation of ASGUI Observed Value and then the calculation of Percentage of Maximum Possible or POMP Score. The method of calculation only assessed the Green urbanism Quality value by disregarding the number of pedestrian and distance in both of calculations to prevent any bias as explained in Chapter 6, Part Two (sub-section 6.9).

Figure 10.2 below indicating the overall result of ASGUI and the result also shows that Lebuhraya Darul Aman as the top rank in the Green Urbanism Quality status.



Figure 10.2 Summary of ASGUI Result indicating Green Urbanism Quality Status for all routes

b. Thematic Association of Green Urbanism and Urban Walkability

Chapter 9, under section 9.3, detailed the association between Green Urbanism Principles with urban walkability (referring to ASWI and ASGUI). The associated indicators were consolidated under four themes which were determined by i) Delphi Survey (Chapter 8, section 8.3) and from Semi-structured Interviews (Chapter 8, sub-section 8.5.1). The findings below are the summary of result from Coding, and Thematic Analysis performed on the Semi-structured Interviews' transcripts with 16 professionals and practitioners in the built environment using NVIVO 12 software.

The appraisal of results from Delphi and Semi-structured Interview managed to come out with a generalisation of the themes. The properties of parameters, key attributes and indicators were considered significant to the associating themes;

i. THEME: NATURE

(Principle 5: Landscape, Gardens and Urban Biodiversity)

- Landscape and Gardens

Apart from making the city environment pleasant and appealing, Landscape and Garden also contribute to relegating pollution problems in the city centre. Trees and vegetation act as a sponge in absorbing carbon monoxide and release oxygen. Well-designed landscapes can act as barriers to filter pollutions of all sorts; air, noises, glares, views etc. Shaded tree lines along walkways generally provide walking comfort, and the same time can act as visual framing toward the city, give sense of direction, soften the city environment from the hard building block, reducing the effect of urban heat island, giving sense of scale at street level, and most of all humanise the city environment. People would be persuaded to walk when the pedestrian network is conveniently and efficiently integrated with the urban transportation system. Also, when the pedestrian network functions as green links between attractive public spaces claimed a retired Professor (Ref. AC1). Having all these will make walking in the city centre more appealing, and it is covered under Green Urbanism Principle 5, the initiative of transforming the city environment into a more pleasant ambience with the inclusion of landscape design, city gardens, green balconies and roofs (Lehmann, 2014).

- Urban Biodiversity

A conventional city environment often takes pride in its built environment, generally unsympathetic on nature, habitat and biodiversity. A city with positive urbanism as offered in Green Urbanism Principle 5 takes pride in taking a strong focus on local biodiversity, habitat and ecology. One of the ways is by bringing in nature into the city environment. It also imperative to partake in wildlife rehabilitations, forest conservation and the protection of regional characteristics. It is timely to convert the ‘energy-intensive technology’ city planning to ecological principles based (Lehmann, 2010a). Not only the product of the approach contributing to a healthier city but also a resilient one (Lehmann,2010a; Newman, 2013; Beatley, 2000). AC1 asserts that to build a town is to develop a culture. A town endowed with lush landscape, beautiful gardens, and bountiful biodiversity would encourage an outdoor lifestyle and a walking culture. This is the approach suggested in the Green Urbanism Principle 5, Urban Biodiversity.

ii. THEME: URBANISM

(Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities)

- Compact Development, Mixed Land Use and Polycentric City

Currently, the physical structure of Alor Setar is almost similar to that Classical Monocentric Model, with the concentration of economic activities and radial mobility of people from the periphery and neighbouring villages toward the city centre (Schläpfer, 2013). However, according to the State Planner involved in the state's special project (Ref.UP2), the city manager with support from the Federal Government are slowly expanding the city towards achieving the Composite Model in 2030, as many other bigger cities in Malaysia before finally accomplishing the Polycentric Model or the unlikely 'Utopian' Urban Village Model. Diversity and Mixed Land Use development are important in making sure of having diversified services offered. Thus, acclimatised an active environment at the street level all over the city (Ref. PB1). The initiative of 'Compact and Polycentric Cities' under the Green Urbanism Principle 6 has a big potential to guide the planning towards achieving the vision.

- Sustainable Transport and Good Public Space

The relocation of Central Bus Station from Jalan Sultan Badlishah in mid 2000 has diverted most of the potential pedestrians away from the city centre. The new Central Bus Station (Shahab Perdana) is now surrounded with shophouses and residentials, thus removing the economic activities and catalysts from the city centre, as accorded by a local Environmental Engineer (Ref. EE1). With the lessening of economic catalysts (street vendors, shops and restaurants) and potential pedestrian travelling by bus and other means of public transport making the city centre less attractive, visibly passive and seems empty (Ref. TP3). This has made walking unappealing due to the lack of active scenes triggered by street vendors and other small economic infrastructure support along the walking routes. As mentioned in the interviews by both Principle Town Planner in a private firm (Ref, TP1) and an Architect working with Kedah state government (Ref. AR1). The initiative under the Green Urbanism Principle 6, Sustainable Transport and Good Public Space can provide guidelines into transforming the MC of Alor Setar from the vehicular dominated city into an effective pedestrian dominated and green transport city.

- Pedestrian Network, Safety and Security, and Facilities

Having diversified and compact development in the city need additional support to ensure active motion at the street level. A good pedestrian network is important as a mean of connectivity and linkages of all public places, source of pedestrian movements and city nodes. The pedestrian network is the backbone of the city as acclaimed by a practising Landscape Architect (Ref. LA1, PB1). As expressed by AR1, Strong linkages between public transport hubs to the town centre and other places of interest within the city helps to disperse pedestrian concentration and also gives a sense of direction to visitors. This is also covered extensively under Principle 6 initiative, Sustainable Transport and Good Public Space.

iii. THEME: LIVEABILITY

(Principle 10: Liveability, Healthy Communities and Mixed-Use Programs)

- Liveability

A town should have a population, one of the active entities that will make a city function. According to a practising Urban Planner (Ref. UP1), it is one of the characters of the traditional Asian cities which is true to Malaysian cities as well, to have active urban dwellers who live and work in the city. As the city progressed and modernised, urban population started to decrease, and towns and cities became vacuous since people moved to the suburbs and commute to the city to work due to various reasons among which the cost of living escalated, family growth and avoiding chaotic city environment (Bardhan, Kurisu, & Hanaki, 2015; The Economic Planning Unit (Malaysia), 2015).

UP1 recommenced that most Malaysian cities are dead at night, especially smaller cities and only certain quarters of major cities in Malaysia are active. Another pressing issue faced by most MC and small towns in Malaysian is the hollowing of the city effect due to out-migration of urban dwellers. This phenomenon is affecting many cities resulted from reasons as above and also the migrating out of younger generations due to economic and personal issues (Mahmoudi Farahani, Beynon, & Garduno Freeman, 2018; Perera, 2006). Therefore, the Green Urbanism objective is a compact, high density, mixed land uses and a mixture of residential and businesses to thrive again in the city; so that people would come back again to the city to stay. Green Urbanism Principle 10 under Liveability initiative is seen capable of rectifying this issue; help to stimulate the walking culture and less dependent on the private vehicles.

- Healthy Community and Mixed-use Programmes

Urban communities will thrive once again with the initiatives in bringing back people to live in the city (Ref. PB1). In doing so, infrastructure and facilities to support businesses, residential and communities in the city need to be adequate and efficient. Mixed-use programme is advantageous in furnishing the city for a 24 hours cycle; and diversity in land uses extends the flexibility and various typology of activities for all age groups which opens for demographic changes since age is a major issue in urban design (Lehmann, 2010a).

Parallel to Lehmann's statement, an Architect and Urban Designer (Ref. AR2) stated that both liveability and mixed-use programmes would reduce the need to travel extensively to and from a city – allowing people to work and live within the city itself. This perhaps may allow people to walk more, rather than commute. As mention by AC1, Liveability and Healthy Community are attributes of people-friendly towns that reflect security in that city. Mixed-use Programs promotes economic stability reflecting the security of the city. Thus, when a city can offer both security and walkability within walking distance, urban walkability will be high. The Green Urbanism Principle 10, under Healthy Community and Mixed-use Programmes

iv. THEME: CULTURE AND IDENTITY

(Principle 12: Cultural Heritages, Identity and Sense of Place)

- Cultural Heritage

Apart from the common aim for a sustainable city, a city should also focus in its distinct environment, protection of its natural and built heritage; and the maintenance of a distinct cultural identity (Lehmann, 2010a; Newman & Matan, 2013). A city with culture, heritage and identity being preserved and displayed in a town, like in Alor Setar Heritage Zone would definitely be an advantage to the concept of a walkable town. As accorded by an Academic Professor (Ref. AC2). The implementation of Principle 12 is to sustain the social, cultural, and architectural distinctiveness of a town or city from which people would be persuaded to walk in order to explore the town's asset.

- Identity and Sense of Place

A city should focus on developing a special sense of place through its unique characters-be it the built environment or distinct natural features. Emphasis on developing place-oriented activities to strengthen its residents, economic and community; nurture and restoring natural and cultural heritage (Matan & Newman, 2015). Alor Setar has strong identity accumulated from its unique natural landscape, people and their culture and historical artefacts and 'leftover residents' that make the city distinctive. The intent under Identity and Sense of Place of Green urbanism Principle 12 can boost the city Identity and Sense of Place, thus encourage people to walk to explore, discover, and participate in the urban activities.

10.2 Arises Issues and Difficulties of the Research

This research has encountered several challenges especially during the stage of data collection, thus eliciting a number of limitations as explained below;

10.2.1 Delphi Survey:

Delphi Survey in this research was seen as imperative as means of validating findings from literature investigation on several key issues as presented below;
i) the association of GUP with urban walkability
ii) the parameters in Green Urbanism that are relevant to urban walkability
iii) the key attributes and indicator in Green Urbanism to measure urban walkability.

The process of conducting Delphi Survey started with finalisation GUP derived from various literature investigation with exceptional references from the works of Beatley (2000), Beatley and Newman (2009) and Lehmann (2010b). The three stages of the Delphi Survey validation process involving academicians and experts from local public universities.

With sufficient knowledge, experiences and expertise. The issues faced during these sessions were;

a. Difficulties in getting participants

The criteria for the participant was set as built environment academicians/experts with a minimum of five years' experience in teaching/practising in built environment related subjects/projects such as Landscape Architects, Architects, Urban Planners, Town Planners, Environmental Engineers and the likes. Initial planning was to get 30 built environment experts from several public universities to participate in the survey, but it was not proven very easy to get the numbers due to;

i. Distance

Location of public universities that have built environment experts is of a considerable distance from one another. Therefore, travelling to the meeting place was time-consuming for participants. Apart from long travelling time, to get all participants in one place involved cost implication which the researcher was unable to provide. This was due to the new ruling by the Ministry of Higher Education, Malaysia, not to continue offering financial support for data collection works such as airfare tickets to Malaysia, materials for the survey, and monetary remuneration to cover participants' travelling and accommodation cost.

ii. Time clashes between

Apart from the routine teaching, most of the experts hold university's positions, and many were involved in other projects or being tied up with other committed engagements. Thus, time was constrained, and it was unfeasible to expect these experts to abide researchers schedule.

Hence, the researcher, with the agreement and advice from supervisors decided to select the closest public university with the highest number of experts agreed to participate. The final number of participants was 19 experts with all having a minimum of 5 years of experience in the field of the built environment.
The implication to the research: Limited number of expert participants, Time delay and Common working environments and exposures.

b. The issue of commitment (having to disband the first group and finding another group of participants)

Conducting a Delphi Survey requires time and commitment to see through the process from the beginning to the end with the same set/group of experts. The first set of agreed participants (a total of 14 experts) comprising Associates Professors, Senior Lecturers and Lecturer/Researchers was disbanded due to commitment issues. The agreed schedules for meetings were often not met and needed to be cancelled and rescheduled due to insufficient numbers of turn up and the last-minute cancellations from the participants. After weeks of unsolved issues, postponement and delayed, all participants were made aware of the time constraint that the researcher was facing; thus, the need for the group to be disbanded.

It was even harder to get participants for the second groups with letters and emails of invitation to participate in the survey exercise were not answered. After numerous face-to-face invitations and persuasion, the second group was then formed comprises of 19 experts with a limited number of Associates Professors and Senior Lecturers; nonetheless, the minimum criteria were uncompromised.
The implication to the research: Time delay, the cost for additional materials and a limited number of senior experts participated.

c. Difficult to group all participants together due to time and availability

Although all participants were from the same public university, still the issue of time clashes was unavoidable. Many meeting schedules were cancelled and rescheduled (including on the weekend) due to various reasons. There were many disagreements and arguments in the process of completing the survey due to different views, different school of thought and different approaches. Thus, protracted the process of having a list of agreed GUP, key attributes and indicators associated with urban walkability. Fortunately, after the long delay, the second group of experts were more committed and able to complete all three stages of the Delphi Survey despite all disagreements and arguments.
The implication to the research: Time delay and cost for additional materials.

10.2.2 Interview with Local Experts:

As another key method of gathering data for this research, the process of interviewing the local experts was a challenging procedure. As explains below;

a. Lack of local experts in the subject matters

Malaysia is new to the concept of Green Urbanism, although the domain of sustainability has been around for many years. Looking from the policy analysis perspective, Malaysia was a pioneer in the 1970s in establishing a framework for environmental governance, but its response to the post sustainable development agenda 1992 has been sporadic and unsystematic (Hezri & Nordin, 2006; Yaman, Thadaniti, Ahmad, Halil, & Nasir, 2018). There are limited experts in the specific subject of Green Urbanism. Most that claimed to be experts were from the engineering background with a focus on green building index (GBI) and sustainable architecture. Thus, finding an expert with vast experience and a deep understanding of the subject matter was a daunting task.

However, the researcher was able to finally meet a gatekeeper whose previous project involving a number of built environment consultants dealing with the sustainable development of urban areas, smart city development and environmental projects that were related to the research topic.
The implication to the research: Lack of specific/subject matter experts.

b. Time, scheduling and availability

Dealing with the people of positions in an organisation was somehow a strenuous task. Their schedules were packed with committed appointments and unexpected engagements. With that in mind, appointments were made and agreed to the convenience of the interviewees as early as three months with several soft reminders prior to the scheduled meetings.

However, there were a number of withdrawals from participants at the last minutes and the process of selecting, contacting, and scheduling of new participants that need to be done in a very limited time. This has caused major set-back in the data collection program

and upsetting the whole planning since the duration of stay in Malaysia for all data collection procedures was limited to three months only (as allowed by the Ministry of Higher Education, Malaysia).
The implication to the research: Time delay, Major set-back on data collection schedule and Cost incurred for travelling and accommodation.

c. Cancellation of appointments during the last minutes

There have been several cancellations by interviewees during the last hour of scheduled. One of the interviewees cancelled the meeting even after two hours of waiting in the interviewee's office due to his busy schedule. These have a significant impact on the planning and the progress of data collection and cost incurred for travelling and accommodation due to additional travelling from the research base in Alor Setar to Kuala Lumpur (370km) and Johor Baharu (780km).
Implication to the research: Time delay, Major set-back on data collection schedule and Cost incurred for travelling and accommodation.

d. Cancellation of participation during the last minutes

There were two participants who earlier had agreed to participate in the interview but kept on postponing the scheduled meeting for almost two months due to busy schedule and engagements. After several reappointments and scheduling, the researcher had to finally drop their names due to time-constrained, even though they are amongst the experienced sustainability practitioners in Malaysia. The process of identifying, screening and scheduling for new interviewees need to be done in a very constricted time.
The implication to the research: Time delay and Major set-back on the data collection schedule

10.2.3 Focus Group Issues:

Focus Group data collection is required in this research as a mean of testing the developed ASWI and ASGUI on-site. Initial planning for the selection of participants was based on several criteria such as local residents, age group, working status, mixed races and mixed gender were not materialised and unmanageable attributable to;

a. Challenging to find local volunteers according to the age range

It was a seen as beneficial to have participants based on the age group range and their work status of (i) 13 – 18yrs: secondary school pupils, (ii) 19 – 25yrs: college/university students, (iii) 26 – 60yrs: working adults and (iv) 61-75yrs: pensioners/senior citizens. However, the planning was not materialised because of no volunteers from age group (i) and only two volunteers from age group (iv). However, after explaining the nature of works involved and the distance participants need to walk, both volunteers decided to withdraw. Most volunteers were among college students who were on semester holiday, young self-employed individuals and part-time teachers.

The implication to the research: Only one age group (18 -40yrs: college/university students and working adults)

b. Difficult to get volunteers from the Chinese community (Demand for excessive monetary remuneration)

The focus groups survey and discussions activities required all participants to be present and involved will all activities for four days, starting from 6.45 am until 7.00 pm. Majority of the participants were from the Malay ethnic with a small number of Indians. Initially, there were several local Chinese planned to participate but demanded the monetary remuneration of RM25/day (total of RM100/4days) to be increased to RM100/day and to be paid in cash instead of shopping vouchers. Since the budget was from the researcher's pocket and limited, it was unfeasible to meet their demand to which they, therefore, decided not to participate.

The implication to the research: Participants from the limited race.

c. Limit for younger volunteers due to the long-distance walking and weather condition.

Ideally, the collected data would be wide-ranging with the participation of all age groups. Explanation and discussion with volunteers were made on the nature of works involved, the long-distance of walking, long hours of data collections and weather conditions. Therefore, for health, safety and security reasons participants were limited to younger

volunteers of 18 -40yrs: college/university students and working adults; pensioners and senior citizens were not to be involved.
The implication to the research: Participants from the limited age group.

10.2.4 Unavailable, Uncooperative and Inexpert of representative from the local authority.

Apart from interviewing the local experts practising in the built environment, insight and data from the local authority were also required for a comprehensive data gathering. It became apparent that the three months data collection period were insufficient when dealing with personnel at the local authorities.
There were three challenging issues pertaining to dealing with the local authority, as such;

a. Many key personnel were unavailable for data sourcing and interview

It was almost impossible to have a meeting with key personnel at the local authority for data sourcing and interviews. It was challenging to set an appointment due to the many layers of red tapes and hierarchy of positions, and phone calls being diverted to various personnel at various units. The most frustrating part was when the meetings were cancelled at the last hour and rescheduled to the date after the researcher was back in the UK. Therefore, most information and feedbacks were generated from non-key personnel with limited knowledge on the subject matter.
The implication to the research: Limited input from key personnel at the local authority.

b. Many key personnel were uncooperative, very difficult to obtain data in the form of a statistical record of shophouses, infrastructure and planning.

Getting data in the form of a statistical record of shophouses, infrastructure and planning were met with a great impediment. It was hard to get access to the person-in-charge of the information when phone calls were not answered, and visitations to the office for face to face interaction were to no avail. The researcher was made to understand that the required data was not an open record for the public, and it can only be obtained with a formal application to the department head. However, the data were still unavailable even after sending the formal letter and paying the processing fee of RM200. The subsequent following up by phone calls were not entertained.

The implication to the research: Data unavailable, Time delay, Major set-back on data collection schedule and Cost incurred for travelling and processing fee.

10.2.5 Unavailable data, records and information

The data acquisition process often at a halt when it involved the local authority at MC and small towns.

a. No data were kept on certain issues at the local authority

Most data were not available, and records were not properly kept. For example, there is no statistical data recorded on the number, duration in year and status of vacant buildings and shophouses own by the council, vacant buildings and dilapidated shophouses in the city centre. All these data were necessary to understand the progression of development and the causal of hollowing of the city, which affect urban walkability.
The implication to the research: Data unavailable, Time delay, Major set-back on data collection schedule.

b. Uninformed personnel at the local authority

Most of the technical and assisting personnel dealt during data acquisitions have limited and inadequate knowledge on the subject matter, the department's program, the information and source of information and the pointer to information; thus, making data acquisition very challenging. Sufficient training for the personnel is needed in order to achieve efficiency and increase knowledge in the running of the department's programs.
The implication to the research: Data unavailable and Time delay.

10.2.6 Study area for walkability was too large

The process of data acquisition from focus groups' surveys and site observation were tedious and lengthy. It became apparent while performing the on-site survey with the focus groups that the area of coverage was too large. Ideally, the amount of time allocated

for the focus group surveys and discussions should be longer than the allocated four days for far-reaching data acquisition coverage. For example, the study area should be narrowed to one or two routes (Jalan Sultan Badlishah and Jalan Kolam Air or Lebuhraya Sultan Abdul Halim and Pekan Cina).
The implication to the research: Time constraint.

10.3 Limitation and Suggestion for Future Research

There are three significant limitations in this research as listed below;

a. The exclusion of Policy Support Parameter in walkability index

The Policy Support parameter, although deemed necessary as highlighted in literature and several walkability indices model, was excluded in this research. The decision was made due to difficulties in getting significant supporting statistical materials, recorded data and mapping and pointer on planning and development from key personnel of the local authority (after several meetings and many attempts). Unlike in mega and big cities, most MC and small towns in Malaysia are lacking statistical data to support the research. Even if there are any, those data were not readily and openly available and requires series of processes such as formal application the head of the department, payment of processing fee and approval by a committee in a special meeting. The amount of time required was not stated (will take months as informed by the front desk personnel) and very much dependant on the availability of each key personnel to attend the special meeting, which the researcher cannot afford to wait due to the time constrained.
Recommendation: it is recommended that future research should also include the Policy Support Parameter as part of walkability measure assessment for MC and small towns. Although time-consuming, the inclusion of those data able to assist in the assessment of planning guidelines, policy and governmental support as practised and implemented by the local authority.

b. One race majority

Malaysia's population is diverse, multi-racial and multi-cultural; thus, each MC and small-town possesses a unique character and rich in cultural background. Alor Setar is

reputable as an MC with fascinating heritage and indicative cultural significant. However, the issue with this city is one race majority, that is of Malay race; although, most of the residents in the city centre especially Pekan Cina (China Town) are of Chinese descents. As a result, the portrayal of culturally significant and involvement of participants are of single race majority with participants for focus group survey and respondents for interview were of the Malays race and limited number of Indians. Attempts to get participants from other races were unfruitful due to unavailability of gatekeeper caused inaccessibility into the Chinese community.

Recommendation: the input and perspectives of diverse cultures and different backgrounds deepen research understanding; and helps in developing a substantiated generalisation of parameters. The future research should look into these differences before making any generalisation of parameters, and to refine the research framework to accommodate for a generalisation within the Malaysian's diverse cultural context.

c. Single case study site

This research adopted a single case study site and limited to one MC in Malaysia. Alor Setar is reputable as an MC with fascinating heritage and indicative cultural significant. This limits generalisation to within the issues and context of one particular city and one local authority.

Recommendation: it is advantageous to have an additional case study site for comparative study before any generalisation can be made. The future research should consider having two or more site for study to increase thoroughness in generalisation.

10.4 Contribution of the Research

There are five most important contributions of this research:

a. The concept of Green Urbanism is relatively new to the Malaysian general public and (unfortunately) also to some professionals, practitioners and authorities of the built environment. The research has expanded our knowledge regarding the concept of Green Urbanism, its principles and potential contribution to the betterment of urban residents, urban environment and the overall urban sustainability. It is also developed our understanding that this concept of development not only relevant to major and big cities but also applicable

secondary and small cities or towns; however, the application may not be in its entirety; still certain principles are universal enough and befitted smaller cities.

b. The research also succeeded in establishing two indices derived from the principles of Green Urbanism; i) ASWI - an urban walkability index modelled from global walkability but with interjected Green Urbanism principles qualities, ii) ASGUI - A reliable and validated index to measure Green Urbanism Quality (GUQ) based on Green Urbanism Principles. The measurement of ASGUI purely measures the quality of the environment referred to Green Urbanism Quality or GUQ and not dependent on the number of pedestrians; thus, it is free from number-based bias. Although both indices were developed based on the characters of the Medium-sized City of Alor Setar, still, it applies to other cities and towns with some modifications.

c. The primary outcome of this research is that the proven association between Green Urbanism Principles and urban walkability. The assessment and analysis of result from the two indices as showcased in chapter 7 and 8 and the discussion of result in chapter 9 verified the claim.

d. All the outcome garnered from this research is hoped to bring public awareness of the issues and topic, also to be used by the authorities and city managers as well as all other involving parties in the development of towns and cities with focus on human factors, urban residents wellbeing, liveable city and the generally urban sustainable development.

Finally, this research also insinuated the importance of;
- protecting the NATURE in our city environment through reducing pollutions, minimized motorized vehicular dependent, living lightly, and safeguarding nature, biodiversity and conserving our natural resources.
- foster positive URBANISM in all our urban's expansion by maximizing compact, high-density and polycentric city approach. Focus more on the provision of human factors such as pedestrian accessibility and networking, streetscape and facilities and missed land uses developments.

- safeguarding our CULTURE and IDENTITY because it helps in establishing a strong sense of place in our towns and cities. It gives values, idiosyncratic and character to our towns and cities.
- stimulate urban LIVEABILITY by encouraging community development, community social spaces and improve safety and security.

10.5 Final Comments:

New Issue and Context

In this dissertation, I examined the issue of urban walkability and Green Urbanism Quality in the Medium-sized City of Alor Setar. For urban walkability - The research sought to extend earlier research by reviewing various walkability indices developed by both individual researchers and International Urban Planning Agencies and Reputable Organisation, Pedestrian Level of Service, pedestrian preference surveys and streetscape observations. The research reviews on walkability indices from Global, Western countries, Asian and Malaysian.

Thus, this research develops from a wide range and disperse construct of walkability studies. Many of the earlier research on the study of urban walkability in Malaysia modelled the western countries indices where urban conditions, values, characters and demand were of incongruent. There were previous studies on the walkability in Malaysia, however, were of different focus issues and contexts, and neither involving Green Urbanism issue nor Medium-sized City as study context. For those reasons, this research is beneficial and contributes significantly to the body of research.

ASWI - New reliable measures of Walkability Index

Malaysia is a progressive developing country where developments are rapid and precipitous due to the demand in participating in the global race as a developed nation as well as participating the strengthening the economic growth. Most of the developments are not following sustainable development, as outlined in the SUD guidelines. As a result, jeopardising the quality of urban development, the quality of the urban environment, the quality urban living; and most of all the quality of space, milieu and opportunity for people to walk in urban areas. ASWI was developed based on Green Urbanism Principles

specialising in measuring urban walkability following the quality of comprehensive urbanism.

ASGUI - New Validated Environmental Quality Index

In relation to the physical walkability planning and design in Malaysia, this research has identified the need to have the quality of the urban environment that can stimulate walking. The four main themes, according to Green Urbanism Quality that has immense potential in generating a quality urban environment that can persuade and promote urban walkability in Malaysia are Nature, Urbanism, Liveability, and Culture and Identity. To accomplish the ideal Green Urbanism Quality, a city should be protective and caring towards Nature, practising positive and responsible urbanism, having the efficient infrastructure and sufficient facilities, and protect and safeguard the local culture, heritage and identity.

A highly walkable city has a positive chain reaction; it stimulates lively street-level activities, thus increase public policing and security. Active street promotes small vendors and small businesses to thrive, creating economic stability. The quality of the environment is very much associated with a sense of security in a new space or among unfamiliar people, a sense of being-a-part-of a new or unfamiliar place, and the willingness to participate and integrate with the people, when walking in a town.

Landscape, greeneries and shades will be encouraging factors to promote walkability. To build a town is to develop a culture. A town endowed with lush landscape, beautiful gardens, and bountiful biodiversity would encourage an outdoor lifestyle and a walking culture. People would be persuaded to walk when the pedestrian network is conveniently and efficiently integrated with the urban transportation system. Also, when the pedestrian network functions as green links between attractive public spaces.

The researcher proposed that every small town and MC to be developed following Green Urbanism Principles to achieve ideal Green Urbanism Quality (GUQ). Green Urbanism is definitely the way to redeem (not sustain) the notion of walkability in our towns and cities, where the harsh attributes of the tropical climate have been disregarded and planning for the automobiles (rather than for people) have been given priority.

How?

- By making big the organic to inorganic elements ratio in the urban environment.
- By thinking people first, then, the urban infrastructures and buildings future developments.
- To ‘green up’ the existing and still relevant infrastructures and buildings.
- Think volume of green, not area of green needed in our towns and cities.

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APPENDICES

No	Item	Chapter
GU-1	Delphi Survey Stage 1: Identification of Green Urbanism Principles that are related to urban walkability	Ch. 1
RF-2	Recruitment Fliers – for Focus Group on-site survey	Ch. 3
IGL-3	Instruction to Group Leader	Ch. 3
LAD-4	Attractions at Lebuhraya Darul Aman	Ch. 4
JTI-5	Attractions at Jalan Tunku Ibrahim	Ch. 4
JL-6	Attractions at Jalan Langgar	Ch. 4
JSB-7	Attractions at Jalan Sultan Badlishah	Ch. 4
PIM-8	Putrajaya and Iskandar Malaysia Images	Ch. 5
GU-9	Checklist from Delphi Survey Stage 3 based from Academics comments	Ch. 8
SI-10	Semi-structured Interview guided questions	
EA-11	Ethic Approval – University of Nottingham	
RFI-12	Request for Informational Interview	
IS-13	Information Sheet – Information on the research and data protection for interviewees	
CF-14	Consent Form for Interviewees	

GREEN URBANISM INDEX

Delphi Survey 1 – Validating Green Urbanism Indices (Focus Group – Panel of Experts)

NAME : _____

POSITION : _____

Linking Green Urbanism Principles with Walkability Index: a multi-method study of walkability in Malaysia.

√	**Stage 1: Identification of Green Urbanism Principles that are related to urban walkability**
	Stage 2: Examining and discussing the selected principles (from Stage 1) together with its detail content for relevancy to walkability. To extract and list as many as possible indicators from the detail content of the selected principles.
	Stage 3: Assessing the selected indicators (from Stage 2) to finally create a list of Key Indicators that associate Green Urbanism with urban walkability.

Green Urbanism attempts to establish cities that emphasize a high quality of life and the creation of highly liveable neighbourhoods and communities with its fifteen (15) principles (Lehmann, 2010).

Based from the list below, please RANK principles that to you are related and relevant in promoting urban walkability based on the Level of Relevance:

(1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high)

THE FIFTEEN GUIDING PRINCIPLES OF GREEN URBNISM	RANKING
Principle 1: climate and context Respond well to their climate, location, orientation and context, optimizing natural assets such as sunlight and wind flow; are quiet, clean and effective, with a healthy microclimate.	
Principle 2: renewable energy for zero co2 Have reduced or have no CO2 emissions, as they are self-sufficient energy producers, powered by renewable energy sources.	
Principle 3: zero-waste city Eliminate the concept of waste, as they are based on a closed-loop ecosystem with significant recycling, reusing, remanufacturing and composting.	
Principle 4: water The various aspects of this principle include, in general, reducing water consumption, finding more efficient uses for water resources, ensuring good water quality and the protection of aquatic habitats. Have high water quality, practicing sensitive urban water management.	
Principle 5: landscape, gardens and urban biodiversity Integrate landscape, gardens and green roofs to maximize urban biodiversity and mitigate the urban heat island effect. Preserves and maximizes its open spaces, natural landscapes and recreational opportunities is a more healthy and resilient city.	
Principle 6: sustainable transport and good public space: compact and poly-centric cities Provide easy accessibility and mobility, are well inter- connected, and provide an efficient low-impact public transport system. Integrated non-motorized transport, such as cycling or walking, and, consequently, bicycle/pedestrian- friendly environments, with safe bicycle ways, free rental bike schemes and pleasant public spaces. It is important to identify the optimal transport mix that offers inter-connections for public transport and the integration of private and public transport systems.	
Principle 7: local and sustainable materials with less embodied energy Take only their fair share of the earth's resources, using principles of urban ecology. Use regional and local materials and apply prefabricated modular construction systems.	

GREEN URBANISM INDEX

Delphi Survey 1 – Validating Green Urbanism Indices (Focus Group – Panel of Experts)

NAME : _____

POSITION : _____

Principle 8: density and retrofitting of existing districts Mixed-use urban infill projects, building the 'city above the city' by converting low density districts into higher density communities; and by revitalizing underutilized land for community benefit and affordable housing. In the compact city, every neighbourhood is sustainable and self- sufficient; and uses Energy Services Company principles for self-financing energy efficiency and in all retrofitting programs.	
Principle 9: green buildings and districts, using passive design principles Apply new technologies such as co-generation, solar cooling and electric-mobility. Use deep green passive design strategies and solar architecture concepts for all buildings, with compact massing for reduced heat gain in summer, and are laid-out and oriented in a way that keeps the buildings cool in summer, but which catches the sun in winter.	
Principle 10: liveability, healthy communities and mixed-use programs A mixed-use (and mixed-income) city delivers more social sustainability and social inclusion, and helps to repopulate the city centre. Mixed land uses are particularly important as it helps reduce traffic and by integrating a diverse range of economic and cultural activities will avoid mono-functional projects, which generate a higher demand for people movement and mobility.	
Principle 11: local food and short supply chains Have a local food supply through community gardens and urban farming and which achieve high food security and reduced 'food miles'.	
Principle 12: cultural heritages, identity and sense of place Create a vibrant sense of place and authentic cultural identity, where existing districts are densified and make use of urban mixed-use infill projects. Balances heritage with conservation and development; fostering distinctive places with a strong sense of place, where densities are high enough to support basic public transit and walk-to retail services. Developments should create details and unique qualities of localities, demographic qualities of the populace and the creativity of the authorities and citizens; and to support the health, the activities and the safety of its residents. Cities to aim for air quality, health and pollution reduction, to foster resilient communities, to have strong public space networks and community facilities.	
Principle 13: urban governance, leadership and best practice Applying best practice for urban governance and sustainable procurement methods. Networks and skills can be activated and utilized through engaging the local community and key stakeholders, to ensure sustainable outcomes.	
Principle 14: education, research and knowledge The various aspects of this principle include: technical training and up-skilling, research, exchange of experiences, knowledge dissemination through research publications about ecological city theory and sustainable design.	
Principle 15: strategies for cities in developing countries Developing and emerging countries have their own needs and require particular strategies, appropriate technology transfers and funding mechanisms to harmonizing the impacts of rapid urbanization and globalization.	
END OF QUESTIONS	

VOLUNTEERS NEEDED FOR FOCUS GROUP RESEARCH STUDY.

Title: LINKING GREEN URBANISM WITH WALKABILITY INDEX: a multi-method study of walkability in Malaysia

Participants' Criteria

We are conducting research to find out the association of Green Urbanism and town's walkability in Alor Setar city centre.

- Key eligibility criteria:
  - Both males and females
  - Local residents of Bandar Alor Setar
  - Ages between 18 – 40 years
  - Good health and able to walk along selected routes in Bandar Alor Setar
  - Able to participate in a FOUR (4) day survey works, group discussions and idea sharing activities.
- Task: Participants are required to walk in a group along selected routes within Bandar Alor Setar city centre to identify:
  - Walkable routes and green urbanism qualities based on a provided checklist and map.
  - To participate in group discussions and idea sharing at a workshop (Location of the workshop to be identified later)
- Each participant will receive a RM100 shopping voucher

Interested participants please contact:

CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528	CONTACT : ZUL zulke191@gmail.com OR 019 – 405 5528

INSTRUCTION TO GROUP LEADERS

A. Responsibility

1. To make sure he/she is reachable, availability and in constant communication with the researcher at all times during survey period.
2. To make sure the readiness and attendance of all group members every morning before starting the survey.
3. To make sure all recorded data are properly compiled and secured in the file compartment provided at the end of the survey every day.
4. To make sure the safety, security and wellbeing of all group members al all times. Group leader must stop all survey works if he/she feel or see any situation that may jeopardise the safety and security of all group members.
5. To inform the researcher as soon as possible if any of group member is sick or unable to proceed with the survey works.
6. To make sure the group members follow the survey format, schedule and instruction as explained during workshop.
7. To take responsibility in ensuring the safety, security, cleanliness and functionality of all survey documents, materials and tools.
8. To make sure all data are properly recorded, measured and photographed.
9. To make sure all pedestrian counts are done at designated stations and at specific times.
10. To always refer to the researcher if in any doubts, problems and uncertainties.

B. References

Below are the Description of Tasks for each group member and Description of survey areas.

NO	INDIVIDU	DESCRIPTION
1	Group Member	4 in a group with at least 1 Kedahan
2	Leader (Camera)	-To lead the group in completing the task, -To report/inform researcher on arising issues or problems during the course of surveys. -To make sure the safety of all group members. -To perform head count of pedestrians along the surveyed roads.
3	Photographer (Camera)	-To record Area of survey -To record Road Sections of survey areas -To record people movements, activities and events -To record number of people (for head count) -To record items listed on checklist along the surveyed roads.
4	Measurer (Measuring Tape, City Map/s,)	-To measure the Road stretch and record it on map/s -Locate and labelled on map the main roads, road stretch divisions, walkways, pathways etc. and responsible for synchronising the labelling and numbering with checklist.

5	Data Entry Person (Checklist)	-To record findings on the checklist (rate) -To record/note any issues, problems, events and potential bias during the course of surveys.

	SURVEY AREAS	
1	Main Road	i) In the case of the main road is too long: -The road can be divided into a max of 10 stretches. ii) Data for each road stretch must be recorded on separate checklist and each road stretch must be labelled, i.e. (**a/b**) – **a**: road stretch **b**: total number of road stretch iii) Data for Each branching roads/walkways (formal)/paths (informal) must be recorded on separate checklist and must be labelled, i.e. Branch 1, Walkway 1, Path 1 etc and including stretch number [**Branch 3 (4/10)**]
2	Zoning	In the event the main road cannot be identified due to the similar size of roads, too many branching out in a very short distances, and organic form and physicality of the town: The main road can be determined based from; i) the most vivid and clear road. ii) the safer and most straight road (less bending) iii) the most used road (many users) and the other roads as branches, walkways or paths.

The attractions at Lebuhraya Darul Aman.

a. The First Part - Lebuhraya Darul Aman

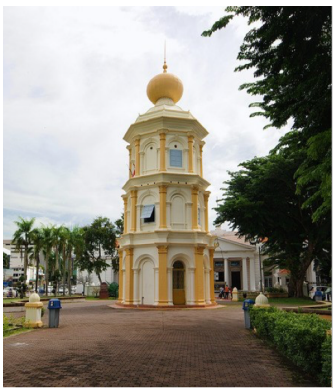
Image and Description
i. Istana Kuning (the Yellow Palace) The royal palace is located along its namesake *Jalan Istana Kuning* in the heart of Alor Setar. The palace is boldly painted in *yellow* since the colour is known as the Royal Malay's colour. The palace was built in the 17th century by the reigned Sultan Muhyiddin Mansur Shah and was the birthplace of Malaysia's first Prime Minister, Tunku Abdul Rahman Putra Al-Haj.  Figure 1 Istana Kuning - The Yellow Palace. Source: penbiru.com/2016/02/discover-kedah-2016-istana-kuning.html
ii. Balai Nobat & Gerbang Istana Kota Tengah (The Royal Drum Tower The octagonal tower with a beautiful onion-shaped dome was built in 1906. The Royal Drum Tower is the repository of the *Nobat* (the royal orchestra) and not open for public. The *Nobat* is predominantly comprised of percussion instruments. It is believed that the drum set was a gift from the Sultan of Malacca in the 15th century. The instruments are still in perfect working condition and are only brought out for ceremonial occasions and royal weddings.  Figure 2 Balai Nobat (The Royal Drum Tower). Source: http://www.penbiru.com/2016/02/discover-kedah-2016-istana-kuning.html
iii. Replica of the Gate of Kota Tengah Palace Next to the Royal Drum Tower is the Replica of the Gate of Kota Tengah Palace (Jabatan Keselamatan Jalan Raya Malaysia, 2018). The original Gate was destroyed in 1960 for the construction of State Office Building and was rebuilt in accordance to its original design in conjunction with the golden jubilee of the reign of the Kedah Sultan in 2008 (MBAS, 2018; (Jabatan Muzium Malaysia, 2001). 



Figure 3
(Top) The replica of Gerbang Istana Kota Tengah, (Bottom) The original Palace Archway. Source: (T) Author (2018), (B) Jabatan Muzium Dan Antikuiti Kedah (2018).

iv. Museum Di Raja Kedah (Kedah Royal Museum)

This wooden building is located behind the Great Audience Hall was a part of Kota Setar Palace built by the 19th Sultan of Kedah also the founder of Alor Setar in 1735, Sultan Muhammad Jiwa Zainal Abidin II. This old palace was refurbished according to the specific requirement, and on 25th July 1983 was officially declared as *Kedah Royal Museum.*





Figure 4
The Royal Kedah Museum
Source:media-cdn.tripadvisor.com/media/photo-royal-museum.
(Retrieved: 17th Mar 2016)

v. Balai Besar (The Great Audience Hall)

One of the best examples of traditional Malay architecture, this open-sided yellow building was built in 1896 as an extension to the royal palace behind it. This building is not open for public and still in use by the Sultan of Kedah for royal ceremonies. Although it is traditional Malay architecture, some of the carvings display Thais influences.



Figure 5 The Great Audience Hall
Source: orangkedah.com/category/blog/sejarah

vi. Masjid Zahir (The State Mosque)

The Kedah State Mosque is renown as the oldest and most beautiful mosque in Malaysia (Haji Muhamed, 2017). This grandeur of Moorish and Moghul influenced mosque was built in 1912. This foreign architecture was brought in by the British as a symbol of understanding, respect and diplomacy toward the Malay Rulers (Moore, 2011).



Figure 6 Masjid Zahir with Moorish and Moghul Architecture. Source: Haji Muhamed (2017)

vii. Menara Jam Besar (The Grand Clock Tower)

This Grand lock Tower was erected in 1912, at the same time with Masjid Zahir to remind the public of the prayer's times. According to (Khazaee, Yaacob, Alcheikh, & Awad, 2015; Yusof & Ibrahim, 2011), when the clock bell chimed at prayer time, the *Nobat* will be played at the nearby Royal Drum Tower and followed by a call for prayer (Azan) by the Mua'dzin.



Figure 7 The Grand Clock Tower of Alor Setar.
Source: (Hezri & Nordin, 2006; Yaman, Thadaniti, Ahmad, Halil, & Nasir, 2018)

b. The Second Part - Jalan Sultan Muhammad Jiwa, Jalan Tunku Yaakob and Jalan Penjara Lama is known as Pekan Cina (China Town)

i. Pekan China (China Town)

Pekan Cina is about two minutes away from the Alor Star city centre and was known to have the earliest road in Alor Setar. It was opened by Chinese settlers arrived in Alor Setar in 1862, lined with typical old shophouses adorn with Chinese-style decorations and construction. At present, the two-storey shophouses still offer a wide range of businesses, like printing service stationaries, toy retailers, motel, workshop, fishing equipment, fertiliser, cooking equipment & utensil, food and drink retailers, coffee shops and cafes.





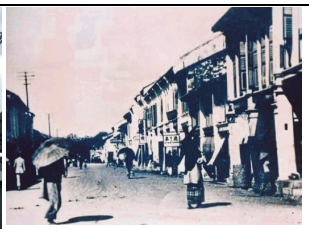




Figure 8 Pekan Cina busy street, Top Right: Old image of Pekan Cina; Bottom Right: Pocket Garden as community's social place (Below) Outdoor café at Jalan Penjara Lama







Jalan Penjara Lama



Jalan Tunku Yaakob

ii. Kaki Lima (Five Foot Walkway)

Pekan Cina is about two minutes away from the Alor Star city centre and was known to have the earliest road in Alor Setar. It was opened by Chinese settlers arrived in Alor Setar in 1862, lined with typical old shophouses adorn with usual Chinese-style decorations and construction. At present, the two-storey shophouses in Pekan Cina still offer a wide range of businesses, such as printing service stationaries, toy retailers, motel, workshop, fishing equipment stores, fertiliser shops, cooking equipment and utensil, food and drink retailers, coffee shops and cafes.





Figure 9 The narrow walkway and Five foot walkway







Figure 10 Jalan Tunku Yaakob towards Tanjung Chali viewing tower
Source: Author (2018)







Figure 11 Narrow pedestrian walkway at Pekan Cina

iii. Pesisir Sungai Kedah (Kedah River Promenade)

The Kedah River promenade is popular among the residents of Pekan Cina and the locals. The Pekan Cina residents usually frequent this area in the morning before opening the shop and during break time in the late afternoon, and the local visitors mostly patronise this area during their shopping trips.



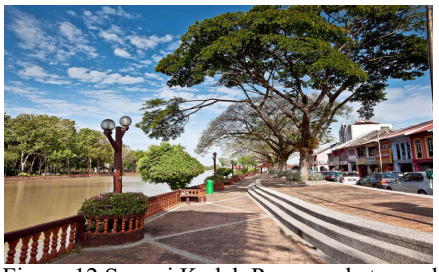


Figure 12 Sungai Kedah Promenade towards Tanjung Chali Plaza
Source: http://www.garmin.com.sg/travelroute/detail/travel_089/

iv. Dataran Tanjung Chali (Tanjung Chali Plaza)

Tanjung Chali Plaza originally was a market place strategically located near Sungai Kedah (Kedah River) founded by Tunku Yaakob in 1930 (Ismail, 2008). Due to its strategic location, it became a popular trading port for boats and vessels from China and India (Ihsan et al., 2015; Othman & Abdul Aziz, 2012).



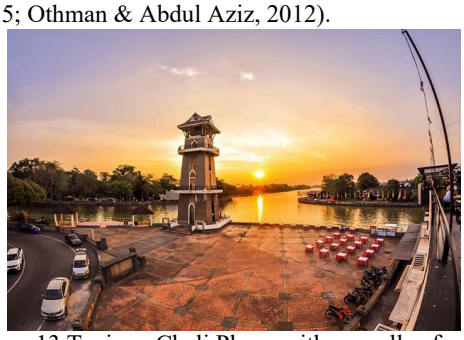


Figure 13 Tanjung Chali Plaza, with a small cafe with outdoor eating space
Source: https://websta.me/tag/tanjungchali





Figure 14 The Tanjung Chali River Fest 2017
Source:https://www1.nst.com/news/nation/tanjung-chali-river-fest-2017-makes-splash-sungai-kedah

v. Gerbang Muhibah (Harmony Archway)

The Harmony Archway is located at Persiaran Sultan Abdul Hamid bridge crossing Kedah River toward Jalan Sultan Muhammad Jiwa. The archway was constructed in 2008 as a symbol of harmony between races in Alor Setar and strategically located between Pekan Cina (China Town) and Pekan Melayu (Malay Town).



Figure 15 Narrow pedestrian walkway along Jalan Sultan Muhammad Jiwa and a five foot walkway (Pekan Cina)

vi. Street Art and Mural

Alor Setar Tourism Development Project launched in 2015 a series of mural and street art project all over Alor Setar. It was an initiative to attract visitors and aimed to draw more youths to come back to Alor Setar after graduation as to drive Alor Setar a fully developed town.






Figure 16 The first series of murals displaying the type of businesses at Pekan Cina; The traditional coffee maker, The carpenter and The clockmaker
Source: https://travelmalaysia.guide/AlorSetar/37457/@MuralPekanCina





Figure 17 Tunku Abdul Rahman Putra Al-Haj Mural The first Malaysia's Prime Minister at Jalan Sultan Muhammad Jiwa near Pekan Cina
Source: http://www.themalaymailonline.com/malaysia/article/after-dr-m-mural-of-tunku-abdul-rahman-adorns-building-wall-in-alor-star



Figure 18 Mural of Tun Mahathir Muhamad, the fourth and seventh (current)Prime Minister of Malaysia at Lorong Setar
Source: http://www.utusan.com.my/berita/wilayah/mural-jadi-tarikan-di-pekan-8232-cina-dan-pekan-melayu-1.105181

The attractions at Jalan Tunku Ibrahim.

i. Holiday Villa Hotel – Junction of Jalan Sultan Badlishah and Jalan Tunku Ibrahim

This is one of the popular hotels among visitors to Alor Setar due to its central location in the city. The Hotel is next to City Plaza Shopping Complex, Alor Setar City Council and fronting row of shophouses.



Figure 1 Jalan Sultan Badlishah and Jalan Tunku Ibrahim, with Holliday Villa Hotel tower at the back.

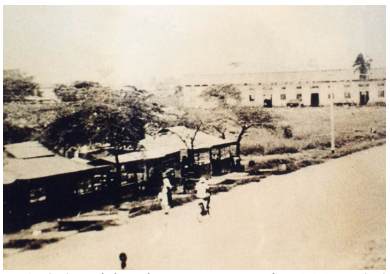




Figure 2 (L) Old Jalan Langgar in 1905; (R) Jalan Langgar at present
Source: https://www.google.com/MajlisBandarayaAlorSetar

ii. Alor Setar City Council (MBAS)

The council's main office is located on the Menara MBAS above the City Plaza Shopping Complex and Planning Department is located in a smaller building opposite the Holiday Villa Hotel. Therefore, the number of pedestrian traffic along this road is considerably high, especially during office hour.



Figure 3 Majlis Bandaraya Alor Setar Building (Old Building)
Source: https://www.google.com/MajlisBandarayaAlorSetar

iii. Star Walk

There are street cafes, resting spots and several canopies that provide shades along this pedestrian plaza makes this place a favourite spot for the younger generation to hang out.





Figure 4 Setar Walk Pedestrian Plaza with Resting Area and Outdoor Cafe Concept
Source: www.kospeta.org, https://www.openrice.com

iv. Main Public Transport Station (Bus and Taxi)

This is one of the main sources of human movement to the city of Alor Setar. The integrated public transport station for buses from outside of the city and taxis is located fronting Pekan Rabu Complex at the core area of Alor Setar city centre. There is a centralised parking area behind it, a pedestrian bridge connected to Pekan Rabu Complex and rows of shophouses and government institution surrounding the station.



Figure 5 The bus and taxi stop in the city centre.







Figure 6 The main bus station in front of Pekan Rabu Complex at Jalan Tunku Ibrahim
Source: https://www.google.com/ PerhentianBasPekanRabu

v. Pekan Rabu Complex

The Pekan Rabu complex holds a long and important history of Alor Setar. It was a brain of Tunku Yaakob, the then Head of State Agricultural Department in 1930. The initiation of Pekan Rabu was to encourage the Malays, especially farmers, to participate in economic activities of the state. Now, the complex houses businesses offering local product ranging from spices, medicinal herbs, traditional foods and cakes, household items and clothing. It is one of the attractions in Alor Setar.





Figure 7 The Pekan Rabu Ukir Mall and the New Pekan Rabu Complex - visitors buying traditional sweets, cakes and other local produce
Source: Utusan Online (https://Fwww.utusan.com.my, berita nasional, pekan-rabu-di-ukir-mall-terus-gamit-pengunjung)





Figure 8 Wide & shaded pedestrian walkway along Jalan Tunku Ibrahim - with street vendors selling local delicacies and traditional desserts



Figure 9 The CIMB Bank at Jalan Tunku Ibrahim - a popular spot for street vendors at night




Figure 10 The pedestrian crossing at Jalan Tunku Ibrahim



Figure 11 The five foot walkway at shophouses along Jalan Tunku Ibrahim opposite Setar Walk




Figure 12 Obstruction at the 'Five foot way' along Jalan Tunku Ibrahim by motorcycles

The attractions at Jalan Langgar.

i. The Modern Section of Jalan Langgar

This area mostly dominated by modern buildings like shops, offices private colleges



Figure 1 Pedestrian walkways along Jalan Langgar with irregular size, narrow and obstructed with street lighting posts

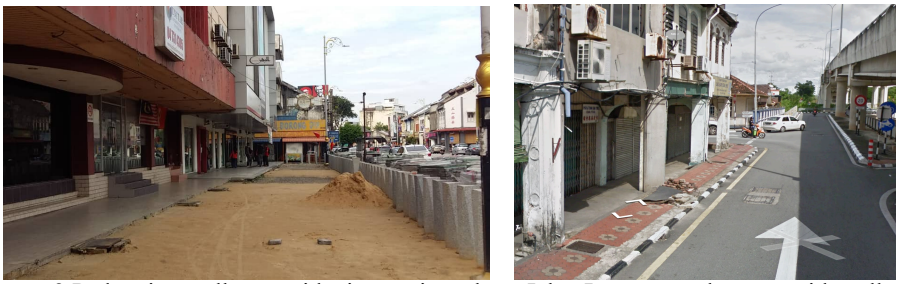


Figure 2 Pedestrian walkway widening project along Jalan Langgar and narrow sidewalk with broken pavers

ii. The Old section of Jalan Langgar – 'Little India'

It is generally dominated by old Straits Eclectic shop houses with traditional Five foot walkways and narrow sidewalks. Lack of maintenance is evident along these sidewalks. There are many rundown and dilapidated old buildings along the road with some collapsed roof and walls that pose a danger to pedestrians.



Figure 3 The street view of Jalan Langgar



Figure 4 The 'Little India' with Five foot walkway and narrow sidewalk



Figure 5 A row of vacant and deteriorating shophouses along Jalan Langgar with narrow sidewalk



Figure 6 The narrow sidewalk and vacant shophouses

The attractions at Jalan Sultan Badlishah.

i. Landmarks Along Jalan Sultan Badlishah

There several landmarks along Jalan Sultan Badlishah, Bangunan Sultan Abdul Halim, SADA Building and Wisma PKNK. The main is road branching to Jalan Kolam Air which too dominated by government buildings and offices.



Figure 1 Wisma PKNK as landmark of Jalan Sultan Badlishah



Figure 2 Sultan Abdul Halim Building located next to a roundabout



Figure 3 SADA Building Own by the State Water Company as the new landmark.

ii. Pedestrian Walkways, Landscape and Pocket Parks

This Road is one of the most landscape areas in Alor Setar with proper pedestrian walkways and pocket parks. Most of the pedestrian walkways were using interlocking pavers and shaded with the street tree planting. Metal railing is provided in most of the areas as ways to curb snatch thieves and for user's safety.







Figure 4 The pedestrian walkways along Jalan Sultan Badlishah with resting area, (Below) The pedestrian walkway and streetscape along Jalan Sultan Badlishah

.





Figure 5 Pocket parks and resting gazebo along the road





Figure 6 Street vendors selling local products and traditional cakes

iii. Jalan Kolam Air

Car and motorcycles parking at Jalan Kolam Air; near UTC Building. This is one of the sources of human movement in this area. UTC building is operating seven days a week from morning to 10 pm.





Figure 7 Active frontage at the Urban Transformation Centre Building

iv. Food court and cafes

There are several eating places at Jalan Kolam Air and Jalan Raja that contributed to the number of pedestrians in this area.



Figure 8 Food court at Jalan Raja, Jalan Kolam Air



Figure 9 Pedestrian walkway not continuous causing pedestrian-vehicular conflicts

i. Jalan Mahsuri and Lorong Padi

There are provisions for motorcycles and car park at both roads and illegal parking always a problem causing a blockage.



Figure 10 Motorcycle parking at congested Lorong Padi





Figure 11 Roadside eatery at the junction of Jalan Sultan Badlishah and Jalan Mahsuri

APPENDIX: PIM-8

A. Putrajaya, Malaysia

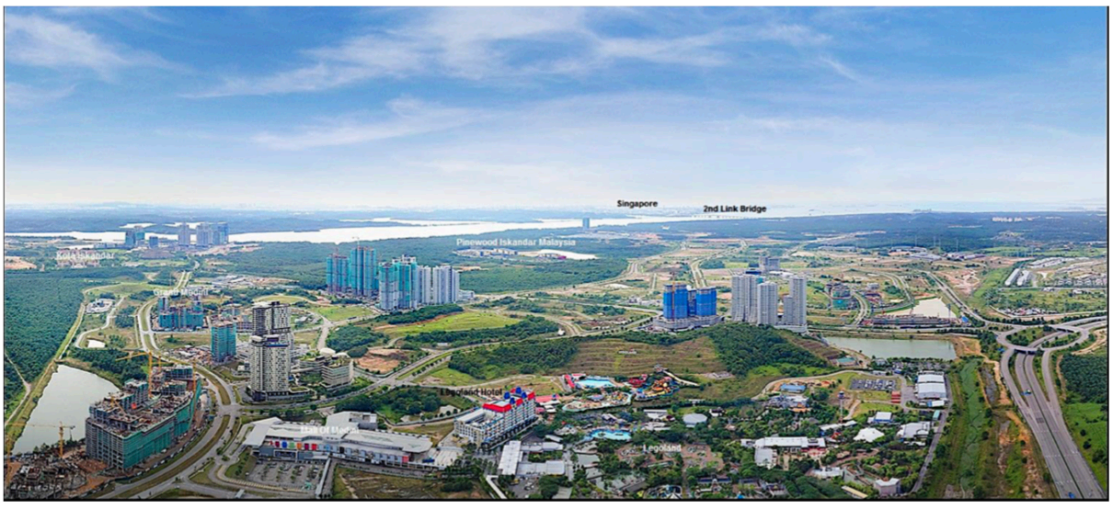


A.1) The Administration and Central Area at Precinct 1, Putrajaya, Malaysia
Source: http://www.malaysia-maps.com/kl/klia-map.htm (Retrieved on 16th June 2020).



A.2) Aerial view of Putrajaya, Malaysia
Source: http://www.malaysia-maps.com/kl/klia-map.htm (Retrieved on 16th June 2020).

B. Iskandar Malaysia Development



B.1) The ongoing construction works for Iskandar Malaysia
Source: https://themalaysianreserve.com/2019/10/02/is-iskandar-malaysia-development-ahead-of-its-time/ (Retrieved on 16th June 2020).



B.2) Aerial View of overall Iskandar Malaysia Development.
Source: https://themalaysianreserve.com/2019/10/02/is-iskandar-malaysia-development-ahead-of-its-time/ (Retrieved on 16th June 2020).

APPENDIX: GU-9

GREEN URBANISM PRINCIPLES INDICES CHECK LIST (LEHMAN, 2010)

SURVEY STAGE 3 - ACADEMICS COMMENTS

Principle 5: Landscape, Gardens and Biodiversity						
	KEY ATTRIBUTE	INDICATOR	Relevancy (N = 19)			NOTE
			YES	NO	Yes (Merge)	
1- Urban Cooling	a) Presence of urban vegetation	1) Functional Trees -Street Planting	19			
		2) Aesthetic & Display– Palms/Shrubberies	19			
	b) Inner-city Garden	3) Display Garden	19		1	3 & 4 to merge
		4) Pocket park / Vertical garden / Linear garden	19		1	3 & 4 to merge
		5) Users and activities	19			Reword - Mix Users and Activities
		6) Social interaction and community activities	19			
	c) Urban farming	7) Potted	17	2	1	7 & 8 to merge
		8) Plot land or Bedded	17	2	1	7 & 8 to merge
	d) Building greenery	9) Green roof and Balcony	16	3		3 participants opted for the removal of Green Balcony
2- Integrated urban landscape	a) Urban landscape	10) Image / Identity creation	18	1		
		11) Coverage (Continuous throughout the city)	19			
		12) Design Theme/concept (traditional / modern)	4	15		
		13) Complementing surrounding built environment	1	18		
	b) Accessibility to parks, gardens & public spaces	14) Access legibility	19			
		15) Sense of Direction (notice board, direction signs, visual linkage)	19			
		16) Connection to Public transport	19			
		17) Easy access for pedestrian (connection with primary/secondary roads)				
		18) Easy access vehicle (connection with primary/secondary roads / parking)	18	1		
	c) Leisure & recreation	19) Recreational Park -Relaxation / strolling	19		1	19 & 20 to merge
		20) Recreational Park-Exercise and Jogging	19		1	19 & 20 to merge
		21) Users are local residents / Community	3	16		
		22) Users are workers / business operators	5	14		
3- Local Biodiversity	a) Habitat	23) Presence of wildlife	15	4		
		24) Presence of urban wildlife (crows, pigeon and stray cats & dogs	15	4		
	b) Ecology	25) Presence of urban peri-landscape	17	2		
		26) Presence of native vegetation	19			
		27) Inclusion of natural resources in urban development (trees, rivers and wildlife)	18	1		

	c) Wildlife Rehabilitation	28) Reintroduction of wildlife in the city	3	16		
		29) Efforts to support wildlife	3	16		
		30) Laws and Guidelines pertaining to wildlife	3	16		
	d) Forest Conservation	31) Presence of urban forest	19			
4- Conserving Natural Resources	a) Restoring Streams	32) Reintroducing streams and rivers in the city	19			
		33) Maintenance and management of streams and rivers	19			
		34) Reinstating the function of the river	19		1	34 & 35 to merge (river and river banks)
	b) Re-establishing River Banks	35) Reinstating uses and function of river / river banks	19		1	34 & 35 to merge (river and river banks)
		36) Presence of recreational activities along the river	18	1		
		37) Presence of community involvement/activities along the river banks	19			

Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities						
	KEY ATTRIBUTE	INDICATOR	Relevancy			NOTE
			YES	NO	YES (Merge)	
5- Sustainable Transport System	a) Integrated non-motorized transport (cycling / walking)	38) Presence of pedestrian walkways network	19			38 & 41 to merge
		39) Assigned walkways / Unpaved path	19			
		40) Availability of cycling lanes and facilities	19			
		41) Pedestrian Network and Connectivity	19			redundant with 50
		42) Safe pedestrian ways	19			
		43) Safe bicycle ways	19			
	b) Integrated motorized transport (private / public)	44) Integrated public and private transport system	19			
		45) Centralised parking spaces (park and ride)	19			
		46) Availability & close proximity of public transport stations/stops along pedestrian routes	19			
6- Good Public Space Network	a) Pleasant public spaces	47) Good legibility and accessibility	18	1		to add "of public space" - Re-word
		48) Presence of social interaction and community activities	19			
	b) Pedestrian network and connectivity	49) Good public space network and connectivity	3	16	1	redundant with 50
		50) Connected pedestrian network	19			
		51) Streetscape that encourage healthy and active life	19			
7- Compact and polycentric city	c) Land uses	52) Surrounded by residential areas	19			rewording " Close proximity to residential area"
		53) Mix development / land use (residential and business)	19			
	d) Diversity	54) Diverse business types	19			

Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes						
	KEY ATTRIBUTE	INDICATOR	Relevancy			NOTE
			YES	NO	YES (Merge)	
8- Liveability	a) Housing range and users	55) Mixed users - social status (based on housing type)	17	2		
		56) Mixed users – age, race, workers/students (city campus)	19			
	b) Sense of community	57) Compact housing and communities	19			
		58) Connected housing areas	19			
9- Healthy community & Mixed-use programmes	a) Amenities and facilities	59) Integrated housing amenities and facilities	19			
		60) Community centres	17	2		2 participants - public spaces and social spaces as in 63 (redundant) as community centre
	b) Healthy communities	61) Facilities for healthy lifestyles	19			
		62) Recreational areas and facilities	19			
		63) Social spaces	19			

Principle 12: Cultural Heritage, Identity and Sense of Place						
	KEY ATTRIBUTE	INDICATOR	Relevancy			NOTE
			YES	NO	YES (Merge)	
10- Cultural Heritage	a) Local culture	64) Cultural values –Intangible (day to day activity/ story)	19		1	64 & 65 to merge (Cultural significant / values (day to day activity/ story)
		65) Cultural significant –Tangible (Structure artefact)	19		1	to add : key attribute "b) Heritage" : Indicator "Heritage values (Areas/Buildings/Structures /Activity)"
11- Identity & Sense of place	a) Historical elements	66) Local based history	19			
		67) Foreign influences history	17	2		no need to highlight foreign influences
	b) Historical dominance	68) Historical significant	19			Omit "b) Historical Dominance Move 68) Historical significant (structures /Artefacts) to a) to Add : Key Attribute "b) Identity" : Indicator "Showcase Distinct Image and Identity"
		69) Distinct Environment	3	16		
		70) Dominant physical elements	2	17		
	c) Spiritual presence	71) Religious based	19			
		72) Cultural and race based	19			

APPENDIX: SI-10

LINKING GREEN URBANISM WITH WALKABILITY INDEX: a multi-method study of walkability in Malaysia

STRUCTURED INTERVIEW QUESTIONS

KEY ISSUES: SUSTAINABILITY, GREEN URBANSIM AND WALKABILITY	
THEME	**QUESTIONS**
A. WALKABILITY	i. What is a walkable environment?
	ii. What encourages people to walk in a town? And what are the attributes of a walkable town?
	iii. In your opinion, does the surrounding environment play an important role in a town's walkability?
B. GREEN URBANISM PRINCIPLES	iv. Is the Green Urbanism concept beneficial to the urban built environment?
B. CONTRIBUTION OF GREEN URBANISM TO A WALKABLE URBAN ENVIRONMENT	v. Referring to Principle 5: Landscape, Gardens and Biodiversity- How do you think this principle could help increase walkability in our towns (you may refer to Alor Setar if you are familiar with the city)?
	vi. Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-Centric Cities, Can this principle help in encouraging walking activities in and around our towns (you may refer to Alor Setar if you are familiar with the city)? Why?
	vii. Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes- In your opinion, how can the implementation of this principle promote a walking culture in our towns (you may refer to Alor Setar if you are familiar with the city)?
	viii. Principle 12: Cultural Heritage, Identity and Sense of Place- Do you consider that the implementation of this principle in our towns (you may refer to Alor Setar if you are familiar with the city) will encourage more people to walk?
	ix. Malaysians are not normally associated with a walking culture; do you believe that the inclusion of Green Urbanism Principles in our towns and cities will encourage a walking culture?
	x. Do you consider the inclusion of Green Urbanism Principles in our towns and cities will be beneficial to: a) urban sustainability? b) economic sustainability? c) community sustainability? d) social sustainability? e) walkability?
	xi. Do you think linking the concept of Green Urbanism with walkability could help sustain our towns and cities in Malaysia? If so, how?
	xii. Do you think by applying these green urbanism principles helps to avoid the hollowing effect in the city?
	xiii. In simple words, under what themes or characters can you associate this principle with urban walkability? a) GUP 5 b) GUP 6 c) GUP 10 d) GUP 12
OTHER COMMENTS AND SUGGESTIONS?	

-END OF QUESTIONS-

Saturday, 5 November 2016 at 12:03:23 PM Greenwich Mean Time

Subject: Ethics application - Zulkefle Ayob - Decision
Date: Friday, 14 October 2016 at 1:50:35 PM British Summer Time
From: Astill-Shipman Donna
To: Ayob Zulkefle
Attachments: Reviewer Decision_DM.docx, Reviewer Decision_SA.docx, image001.jpg

Hi Zulkefle,

Please find attached the final decision on your recent ethics application.

The decision is: Approval Awarded – no changes required.

Best of luck with your study.

Many Thanks,
Donna

Donna Astill-Shipman
Research Policy and Governance Officer
APM Hub – L4 B03
Faculty of Engineering
The University of Nottingham
Nottingham
NG7 2RD
0115 9515561
donna.astill-shipman@nottingham.ac.uk

Hours of work – 08:15 – 16:30 Tues to Fri



APPENDIX: RFI-12

REQUEST FOR INTERVIEW

Subject: Requesting for Informational Interview

Topic: LINKING GREEN URBANISM WITH WALKABILITY: a study of walkability in Alor Setar, Malaysia

Date: _____, 2017

Name:
Position:
Address:

Dear _____,

My name is Zulkefle Ayob, and I am currently doing my PhD at the University of Nottingham, United Kingdom. I received your name from the Institute of Landscape Architects, Malaysia (ILAM) recommending you as a valuable resource regarding urban sustainable development and walkable towns. I am hoping you might be willing to set up an informational interview at your convenience. I would be happy to come to your office to meet with you or to interview by phone if that would be more convenient for you.

I am particularly interested in your own opinion regarding urban sustainable development particularly in green urbanism and town's walkability and what you feel are the advantages and disadvantages in associating green urbanism concept and town's walkability. I have four main questions and ten subsidiary questions to ask you and the interview should not take more than 45 minutes.

In addition to replying this email, you can also reach me at 019-405 5528 if you would like or I can call within the next two weeks to see whether we will be able to meet.

Thank you in advance for your time.

Sincerely,

Zulkefle Ayob
Sustainable Research Building,
Department of Architecture and Built Environment,
Faculty of Engineering,
University of Nottingham,
University Park,
Nottingham NG7 2RD,
UNITED KINGDOM

INFORMATION SHEET

LINKING GREEN URBANISM WITH WALKABILITY: a study of walkability in Alor Setar, Malaysia

This research is a short study to evaluate the association of Green Urbanism and town's walkability in Alor Setar city centre. You will be asked to participate in a short semi-structured interview as an expert with exceptional knowledge in the field, and familiar with the study site. This interview will take no longer than 45 minutes. The questions for the interview will cover the topic of sustainability, Green Urbanism and walkability; and you are welcome to share your personal opinion and experiences in regard to the topics. The objective of this semi-structured interview is to collect, gather and accrue as much as possible information, component and attributes related to Green Urbanism and walkability.

During the interview, the conversation will be recorded using audio recorder only and note taking. There will be several methods of recording during the task, you will be video recorded as the task is completed, also screen capture and mouse position will be recorded by the system during the task. The data collected will be used to analyse the association of Green Urbanism and town's walkability. You may contact me at any time for information about the research or in relation to your consent, my address details are:

Zulkefle Ayob
Sustainable Research Building,
Department of Architecture and Built Environment,
Faculty of Engineering,
University of Nottingham,
University Park,
Nottingham NG7 2RD,
UNITED KINGDOM

Your data will be stored in accordance with the Data Protection Act 1998, namely on a password protected drive in a secure facility and only for the duration for which it is required. It will only be accessible by those directly involved in the research.

You may withdraw consent at any time during or after the task for any reason without penalty by contacting me on the address above. In this event all data will be erased.

All data will be anonymised before publication, unless you have given specific consent for data to be published that could identify you. Publishing data will result in information becoming available through the internet to anyone who wishes to access it and the university's library.

CONSENT FORM

LINKING GREEN URBANISM WITH WALKABILITY: a study of walkability in Alor Setar, Malaysia

This research is a short study to evaluate the association of Green Urbanism and town's walkability in Alor Setar city centre. You will be asked to participate in a short semi-structured interview as an expert with exceptional knowledge in the field, and familiar with the study site. This interview will take no longer than 45 minutes. The questions for the interview will cover the topic of sustainability, Green Urbanism and walkability; and you are welcome to share your personal opinion and experiences in regard to the topics. The objective of this semi-structured interview is to collect, gather and accrue as much as possible information, component and attributes related to Green Urbanism and walkability.

During the interview, the conversation will be recorded using audio recorder only and note taking. There will be several methods of recording during the task, you will be video recorded as the task is completed, also screen capture and mouse position will be recorded by the system during the task. The data collected will be used to analyse the association of Green Urbanism and town's walkability. I have read and understand the attached information sheet, which includes information about the data to be recorded.

I understand that I can withdraw at any time by contacting the researcher at the address provided in the information sheet, and my personal data will be erased from the records.

I confirm that I am over the age of 18. This is to confirm that I have agreed to take part in

a research semi-structured interview on the date: .....

Name ..... Signed .....

Position: …… Tel No: .....

Email: .....

Address .....

.....

In addition to the data analysis, I give permission for data that could identify me (e.g. photos, video) to be published - ☐ (please tick)