

RESIDENTIAL DENSITY GRADIENTS OF ISKANDAR MALAYSIA'S
NEIGHBOURHOODS FROM 1970s TO 2000s

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Specially dedicated to *Mama* and *Abah*
and
my late *Tok* and *Bapak. Al Fatihah.*

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ABSTRACT

At the *Conference of Parties 21 (COP21)* in 2015, Malaysia as a developing country is expected to make changes to reduce carbon emission parallel with the main agenda on targeting to limit the global temperature rise by only 2⁰C or less. In spite of all the efforts to promote sustainable development in Malaysia, limited research has been carried out about the sustainability reality of neighbourhood design especially in Iskandar Malaysia. Thus, this study intends to explore the trend of residential density gradient within neighbourhoods in Iskandar Malaysia. A total of 133 neighbourhoods were studied based on the secondary data obtained from *Iskandar Regional Development Authority (IRDA)* office that included the type of land uses and road networks. Sixteen semi-structured interviews were also conducted among developers, planning consultants and planning officers to get their opinions on sustainability of neighbourhood designs in Iskandar Malaysia. Residential density analysis was conducted by using ArcGIS10 software to determine the residential density pattern in neighbourhoods. The analysis indicated that the trend of neighbourhood designs in Iskandar Malaysia was going opposite to what was thought of as ideal. What happened in most neighbourhoods was the higher the residential density, the higher the distance to commercial center. As a result, there would be more carbon emitted because more residents need to travel longer distance for their daily routines. The interviews meanwhile revealed that the planning consultants have limited understanding and awareness about ideal neighbourhood design involving density gradients compared to developers and planning officers. Several planning experts also agreed to a point that marketing purposes was the main reason behind this scenario and majority of the respondents agreed that Iskandar Malaysia's existing neighbourhood designs did not mitigate climate change because of higher dependency on private vehicles. Therefore, as Iskandar Malaysia is turning into a region with more and more neighbourhoods to cater for approximately 3 million residents by the year 2025, a relook at its neighbourhood design policies or guidelines can certainly help its vision of becoming a low carbon city.

ABSTRAK

Persidangan *Conference of Parties 21 (COP21)* di Paris pada tahun 2015, Malaysia sebagai sebuah negara membangun dijangka dapat melakukan perubahan dalam pengurangan pelepasan karbon selari dengan agenda utama persidangan tersebut iaitu mengehadkan peningkatan suhu dengan hanya 2⁰C atau kurang. Walaupun pelbagai usaha dijalankan untuk menggalakkan pembangunan mampan di Malaysia, kajian mengenai realiti kelestarian reka bentuk kejiranan terutamanya di Iskandar Malaysia masih lagi terhad. Oleh itu, kajian ini bertujuan untuk meneroka tren kepadatan kawasan perumahan dan jarak ke pusat komersial dalam kawasan kejiranan Iskandar Malaysia. Sejumlah 133 kawasan kejiranan telah dikaji berdasarkan data sekunder yang diperolehi dari pejabat *Pihak Berkuasa Wilayah Pembangunan Iskandar (IRDA)* yang mengandungi atribut guna tanah dan rangkaian jalan raya. Sebanyak 16 sesi temu bual separa struktur turut dijalankan dalam kalangan pemaju, perunding jururancang dan pegawai jururancang untuk mendapatkan pendapat mereka mengenai reka bentuk kawasan kejiranan yang mampan di Iskandar Malaysia. Analisis kepadatan kawasan perumahan telah dijalankan dengan menggunakan perisian ArcGIS10 untuk menentukan corak kepadatan tersebut di kawasan kejiranan. Analisis tersebut menunjukkan tren reka bentuk kawasan-kawasan kejiranan di Iskandar Malaysia ini bertentangan dengan apa yang dianggap sebagai ideal. Realiti di beberapa kawasan perumahan, semakin tinggi kepadatan kawasan perumahan, semakin jauh jarak ke pusat komersial. Hal ini akan menyebabkan lebih banyak karbon dilepaskan kerana lebih ramai penduduk terpaksa menempuh jarak perjalanan yang jauh untuk memenuhi rutin harian mereka. Sesi temu bual yang dijalankan menunjukkan perunding jururancang mempunyai pengetahuan yang terhad terhadap konsep kejiranan yang ideal yang menitikberatkan kecerunan kepadatan berbanding pemaju dan pegawai jururancang. Kebanyakan responden bersetuju bahawa faktor pemasaran adalah sebab utama senario ini berlaku dan mereka juga bersetuju bahawa reka bentuk kejiranan sedia ada tidak menyumbang dalam pengurangan perubahan iklim disebabkan pergantungan yang lebih tinggi terhadap kenderaan persendirian. Oleh itu, dalam Iskandar Malaysia berkembang menjadi sebuah kawasan yang mempunyai lebih banyak kawasan kejiranan untuk menampung kira-kira 3 juta penduduk menjelang tahun 2025, pengkajian semula polisi atau garis panduan reka bentuk kejiranan amat diharapkan bagi membantu mencapai visinya untuk menjadi sebuah bandar rendah karbon.

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LIST OF ACRONYMS

CDP	- <i>Comprehensive Development Plan</i>
EWA	- <i>Effective Walking Distance</i>
GHG	- <i>Greenhouse Gases</i>
GIS	- <i>Geographic Information System</i>
IM	- <i>Iskandar Malaysia</i>
IRDA	- <i>Iskandar Regional Development Authority</i>
MBJB	- <i>Majlis Bandaraya Johor Bahru</i>
MDP	- <i>Majlis Daerah Pontian</i>
MIP	- <i>Malaysian Institute of Planners</i>
MPJBT	- <i>Majlis Perbandaran Johor Bahru Tengah</i>
MPKu	- <i>Majlis Perbandaran Kulai</i>
MPPG	- <i>Majlis Perbandaran Pasir Gudang</i>
PRD	- <i>Pedestrian Route Directness</i>
PTN	- <i>Primary Transit Nodes</i>
STN	- <i>Secondary Transit Nodes</i>
TOD	- <i>Transit Oriented Development</i>
VMT	- <i>Vehicles Miles Travel</i>

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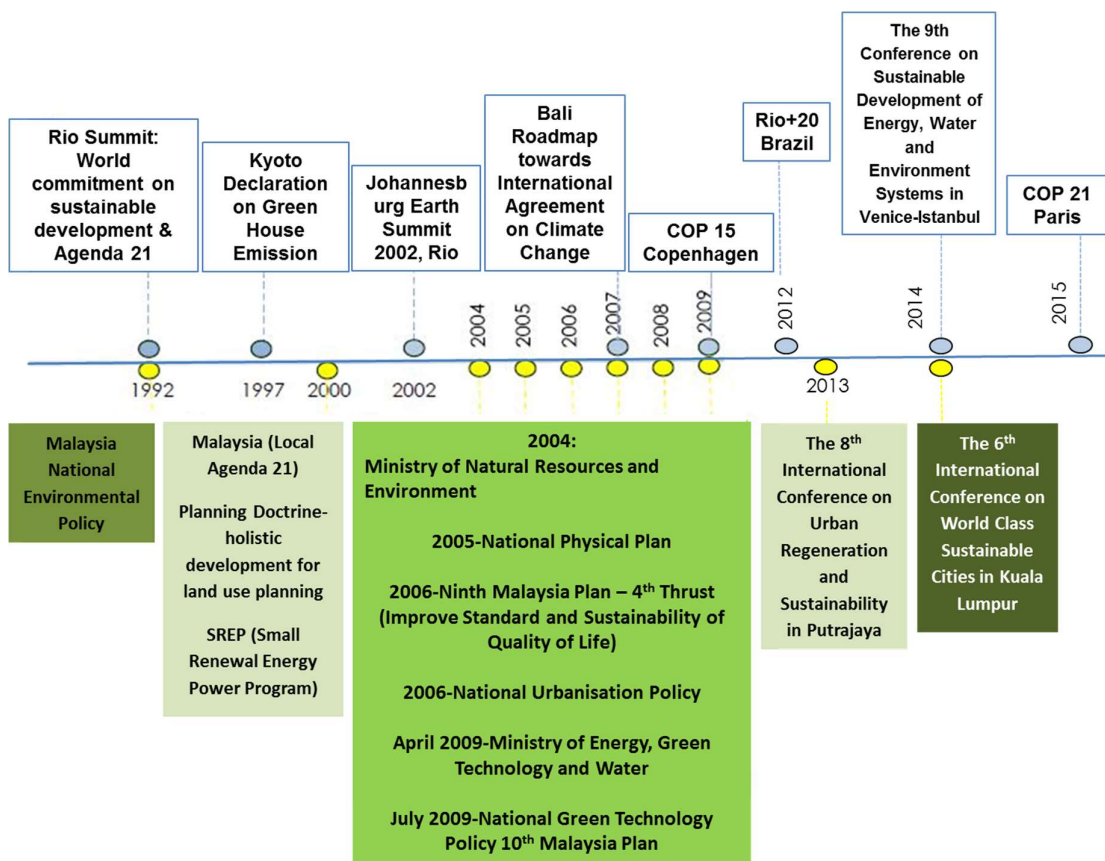
CHAPTER 1

INTRODUCTION

1.1 Introduction

At the Conference of Parties 15 (COP 15) in Copenhagen, Malaysia's Prime Minister has proposed a voluntary carbon emission reduction of 40 percent in terms of emissions intensity of GDP (gross domestic product) by the year 2020 compared to 2005 levels (Izma, 2010). In continuation to that, COP21 in Paris (2015) has outlined one of the main agenda which is targeting to limit the temperature rise by only 2^o Celcius or less (Taylor, Aarons, and Durand, 2015). To support this commitment, it is essential that rapid-growth urban areas such as Iskandar Malaysia make all efforts to minimize its carbon emissions. Under the National Key Economics Areas (NKEA) programmes, national projects are expected to align with the Clean Development Mechanism (CDM) of the Kyoto Protocol by the United Nations Framework Convention on Climate Change. In support of the Clean Development Mechanism (CDM) effort, government also introduced the Green Technology Policies. Green Technology Policies encourage development and application of products, equipment, and systems that can conserve the natural environment and resources, minimize and reduce negative impact of human activities (KeTTHA, 2009). Sustainable development is the core of green technologies. Besides the Green Technology Policies, The Malaysian Green Neighbourhood Planning Guidelines introduced in November 2011 is another step forward to support the CDM and help Malaysia reduce

fourty percent carbon emission by year 2020. Malaysia is one of the countries that concern about sustainability development. It can be proven by the insertion of sustainability aspect in 10th Malaysian Plan which is in Thrust 4: Improving the Standard and Sustainability of Quality of Life. This shows that sustainability is an important aspect in creating good environment to citizens in Malaysia.



Source: Adapted from Malaysian Institute of Planners (2011)

Figure 1.1: Sustainable Development Agenda at Local and National Level

As stated in the figure above, various countries are trying their best in creating sustainable development and particular countries are required to involve in the agenda, plus they need to fulfil the requirements needed in the agenda and give feedbacks. This indirectly will show their commitment towards implementing sustainable development all around the world. As for Malaysia, the government published

Malaysia National Environmental Policy in 1992 to achieve our economic, social and cultural progress through sustainable development (Mohammad, 2011). In 2000s, Malaysia has involved in various sustainability program such as Local Agenda 21, introduced planning doctrine, National Physical Plan, Malaysia Ninth Malaysia Plan:4th Thrust, National Urbanisation Policy, Ministry of Energy, Green Technology and Water and National Green Technology Policy in 10th Malaysia Plan. Throughout 2012 until 2014, there are three main events; The United Nations Conference on Sustainable Development (UNCSD) also known as Rio+20 in Brazil, the 9th Conference on Sustainable Development of Energy, Water and Environment Systems in Venice-Istanbul. Apart from that, Malaysia also take part in The 8th International Conference on Urban Regeneration and Sustainability in Putrajaya and the 6th International Conference on World Class Sustainable Cities in Kuala Lumpur. Both of the events shared its same concern on sustainable development in cities.

1.2 Research Background

Despite all the sustainability approaches being implemented to promote sustainable development in Malaysia, not much research has been carried out about the neighbourhood design in terms of density gradient especially in Iskandar Malaysia. The whole idea of density gradient can be understood through the transect concept. A transect in a macro level is an ordering system of a geographic gradient to arrange the sequence of natural habitats, from rural to urban areas (Duany, 2002). In this study, transect is preferable to be adapted in micro level, a neighbourhood. Density gradient in this study is referred to high density, medium density and low density residential. According to transect, every zone is arranged with their particular development intensities. In neighbourhood context, Transit-Oriented Development (TOD) can be translated into transect in micro scale. Besides, TOD also can be defined as transect because the density gradient changes away from the transit. The best practice of transect in neighbourhood context is the higher the density, the shorter the distance to

transit. Unlike Kuala Lumpur with their variety of public transportation modes, Iskandar Malaysia still struggle in promoting public transportation.

In fact, other sustainable neighbourhood design such as compact neighbourhood helps in reducing greenhouse gases (GHG) as residents are not depending on their private vehicles to move and using public transportation instead. Besides, Shrivastava and Sharma (2012) agreed that compact neighbourhoods act as a key element to protect local environments and climates as well as reducing sprawls. Controlling urban sprawl is the main agenda in compact development because it encourages high dense and mixed use development in city center so people could reach to services without private vehicle consumption. In other countries, research on how neighbourhood characteristic and urban form can help reduce carbon emission (i.e. vehicles miles travelled or VMT) has been conducted widely. Based on research conducted by Ewing and Cervero (2001) regarding the importance of built environment in explaining individuals' travel behaviour, the design of built environment is found to be a significant predictor of VMTs.

Physical design attributes or metrics such as street connectivity, walking facilities, land use mixes and residential density differ in each neighbourhood and this study analyses the trend of density gradient in neighbourhoods plus the distance between residential and commercial. At the micro scale, the built environment's impact on environment can be traced by focusing on a neighbourhood and its activity centre. Prior research suggests that certain neighbourhood design attributes are related to a higher number of non-work trips. Compared to a lower density neighbourhood, higher density neighbourhood was expected to help reduce the need to travel longer distance thus reduce the carbon emission (Steiner, 1994). On the other hand, Levinson and Kumar (1997) found a positive relationship for automobile and transit commuters between metropolitan residential density and average commuting distance. These could be related to a settlement size. Large settlements offer more services and facilities, which could reduce travel distances and favour the use of slower transport modes and public transport. However, the dispersion of urban land use over a large area may lead to longer distances, which lead residents to use their cars. Another recent

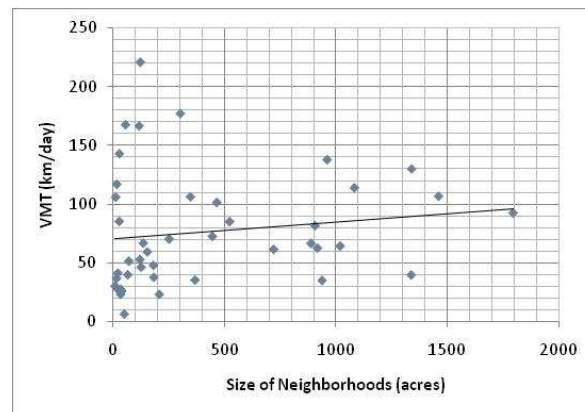
study reported by Majid, Nordin and Medugu (2014) revealed the relationship between neighbourhood design and travel behaviour is complex. Different characteristics of the built environment, such as density, city size and urban structure have a composite impact on travel behaviour. These characteristics also work in tandem with the socioeconomic (income, for example) and demographic characteristics of households (Steiner, 1994; Stead and Marshall, 2001).

Neighbourhood design requires innovative ideas and decisions between developers, planning consultants and also planning officers in authority level. According to Nuruddin, Syed Abu Bakar, and Jaafar (2015), out of three stages of housing development process which are planning stage, construction stage and post-construction stage, planning is the most important stage. This is where all the planning experts brainstorming and exchanging ideas and knowledge to produce a sustainable master plan. Nevertheless, due to different views among planning experts about their certain ideas or designs somehow lead to the antithesis between theory and reality. Certain town planners especially those who are working as developers and consultants might come to a point where their ideas are opposed to what ideal design should be, after considering all aspects such as demand and revenue. Therefore, apart from analysing the trend of density gradient in Iskandar Malaysia's neighbourhoods, this study also acknowledges the factors of neighbourhood designs among planning experts.

1.3 Problem Statement

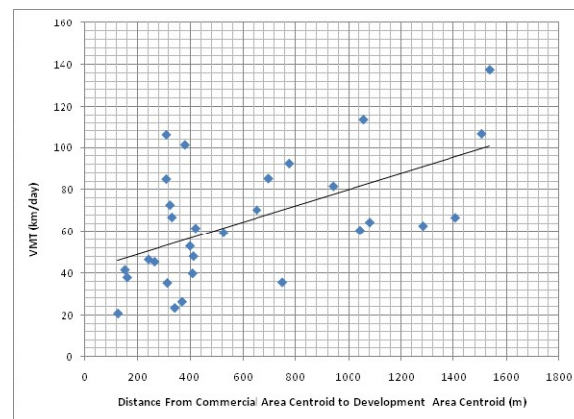
Housing development is inseparable from experiencing certain issues. For instance, neighbourhood designs sometimes do not portray sustainability like being promoted in policies and precedent studies on sustainability. As Iskandar Malaysia is growing into more extensive regional development, sustainable neighbourhood is becoming the main agenda in residential development. Some neighbourhoods are

committed with sustainability while some still in struggle to apply sustainable neighbourhood design principle in their layout plans. Residential layout design that is not sustainable encouraging residents to depend more on their private automobile than walking or using public transportation. Resulting from this, more carbon emission released due to increasing VMT. According to Majid et al., (2014) in their studies revealed that average VMTs in Iskandar Malaysia has been increasing because of neighbourhood design factors that include density. These factors indicate that it affects VMTs and travel behaviour of residents in a neighbourhood. A recent study by Nordin (2014) showed the increase in VMT is due to neighbourhood size and location of commercial area that had occurred in Iskandar Malaysia's neighbourhoods (Figure 1.2 and Figure 1.3).



Source: Nordin (2014)

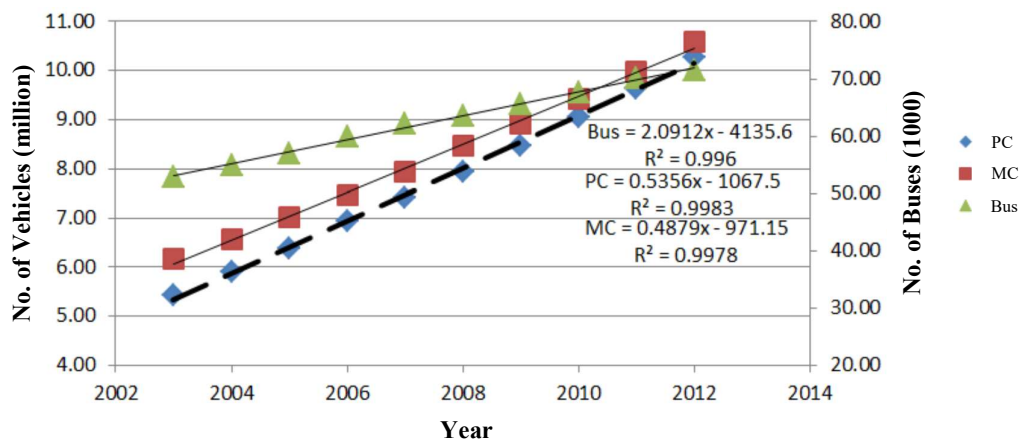
Figure 1.2: Vehicle Miles Travelled by Neighbourhood Sizes



Source: Nordin (2014)

Figure 1.3 VMT (km/day) to Commercial Area within the Neighbourhoods

In order to achieve sustainability, the impact of carbon emission to environment is an essential part in planning stage. GHG emissions per capita in Iskandar Malaysia are projected to increase from 9.3 tonnes of CO² in 2005 to 15.1 tonnes of CO² in 2025 and transportation becomes the second largest contributor after industrial activities (Low Carbon City 2025 - Sustainable Iskandar Malaysia, 2009). This situation has led to a perception that motorized vehicles are risen either for work or non-work trips. People would highly be dependent on cars than any other transportation to fulfil needs. Stead and Marshall (2001) claimed that car ownership gives a huge influence on transport energy consumption, apart from the distance travelled between home and the urban centre, the proximity to facilities and services from the home, and also socio-economic factors such as income per capita. Higher car ownership means people travel more by cars and eventually it will increase the energy consumption. In the context of Malaysia, the number of vehicles registered are consistently increasing from 2003 to 2014 for passenger car (PC), motorcycle (MC) and buses (Figure 1.4) per capita. PC even shows the higher rate than MC and buses (Abdelfatah, M. Hussein, and Othman (2015)). This situation is interconnected with neighbourhood design that people choose to travel by car because of inefficient layout design. This study sees the importance of density gradient in neighbourhoods like being proposed by transect concept, high density should be given high access to commercial and services by walking or cycling rather than private automobile.



Source: Abdelfatah, M. Hussein, and Othman (2015)

Figure 1.4: Registered Passenger Cars, Motorcycles and Buses

Over the years, Iskandar Malaysia is committed in enhancing sustainability in all aspects such as land use and transportation. One of the current important agenda that Iskandar Malaysia participate in is Low-Carbon Society (LCS) and come out with an official blueprint in 2013. LCS comprises of all development strategies including green economy, green community and green environment driven by sustainability approach. The federal level also presented a special guideline considering green neighbourhood implementation. In addition, Iskandar Malaysia is seen to be parallel with global concern on carbon emission reduction. With various reports, blueprints and guidelines on sustainable development, future development is expected to deliver their innovative concepts by putting the highest concern on low carbon emission.

However, not all neighbourhood layouts are designed with sustainability particularly in terms of its density gradient and the amount of distance travelled even with all of these guideline and policies are introduced. Even though various policies are introduced it is interesting to know what is the major factors contributing to unsustainable neighbourhood design. Therefore, this scenario will be proven through the analysis of the density gradients via ArcGIS plus the factors influencing the neighbourhood designs through semi-structured interviews.

1.4 Goal

The goal of the research is:

“Investigating the trend of residential density gradient and factors influencing the neighbourhood design”

1.5 Research Questions

An understanding of the significance of this research can be done by bringing out these research questions:

1.5.1 How the density gradient of neighbourhood design in Iskandar Malaysia has changed over the decades?

1.5.2 What are the opinions of planning experts about the current neighbourhood design in Iskandar Malaysia?

1.5.3 Does the planning experts aware and understand the definition of sustainable neighbourhood design considering density gradient in Iskandar Malaysia?

1.6 Objectives

In assuring the goal of this research achieved, several objectives have been underlined as follow:

1.6.1 To determine the trend of residential density gradient of residential neighbourhood design for the past decades until now.

1.6.2 To compare the opinions of the planning experts about the current neighbourhood design in Iskandar Malaysia.

1.6.3 To explore the awareness and the understanding of sustainable neighbourhood design considering density gradient in Iskandar Malaysia.

1.7 Scope of Study

This study attempts to enlighten the trend of density gradient whether the existing designs indeed follow the preferable ideal concept such as compact

development, transect and TOD. Quantitatively, the scope of the research is focused on one of the urban forms which are residential density specifically on the density gradients throughout 1970s until 2000s. Besides, other land use than residential in neighbourhoods such as commercial, public facilities and open space, commercial is selected to determine its distance between residential. All 300 neighbourhoods in Iskandar Malaysia are selected in order to conduct residential density analysis but only 133 neighbourhoods were analysed to show the trend of residential density throughout the years of 1970s, 1980, 1990s and 2000s. The selected neighbourhood also were chosen based on the availability of commercial areas because not all neighbourhoods have its own commercial area. Qualitatively, the semi-structured interviews among planning experts involved 16 interviewees, with company based in Johor Bahru and Kuala Lumpur.

1.8 Research Framework

Basically this research involves four stages need to be conducted. First stage is the preliminary study that includes the basis needed for this research. Second stage contains the comprehensive readings for literature reviews and the third stage is explained about data collection methods. Lastly, in fourth stage, the analysis and synthesis data are conducted through ArcGIS as well as recommendations. Figure 1.5 shows the flow of research framework for this study.

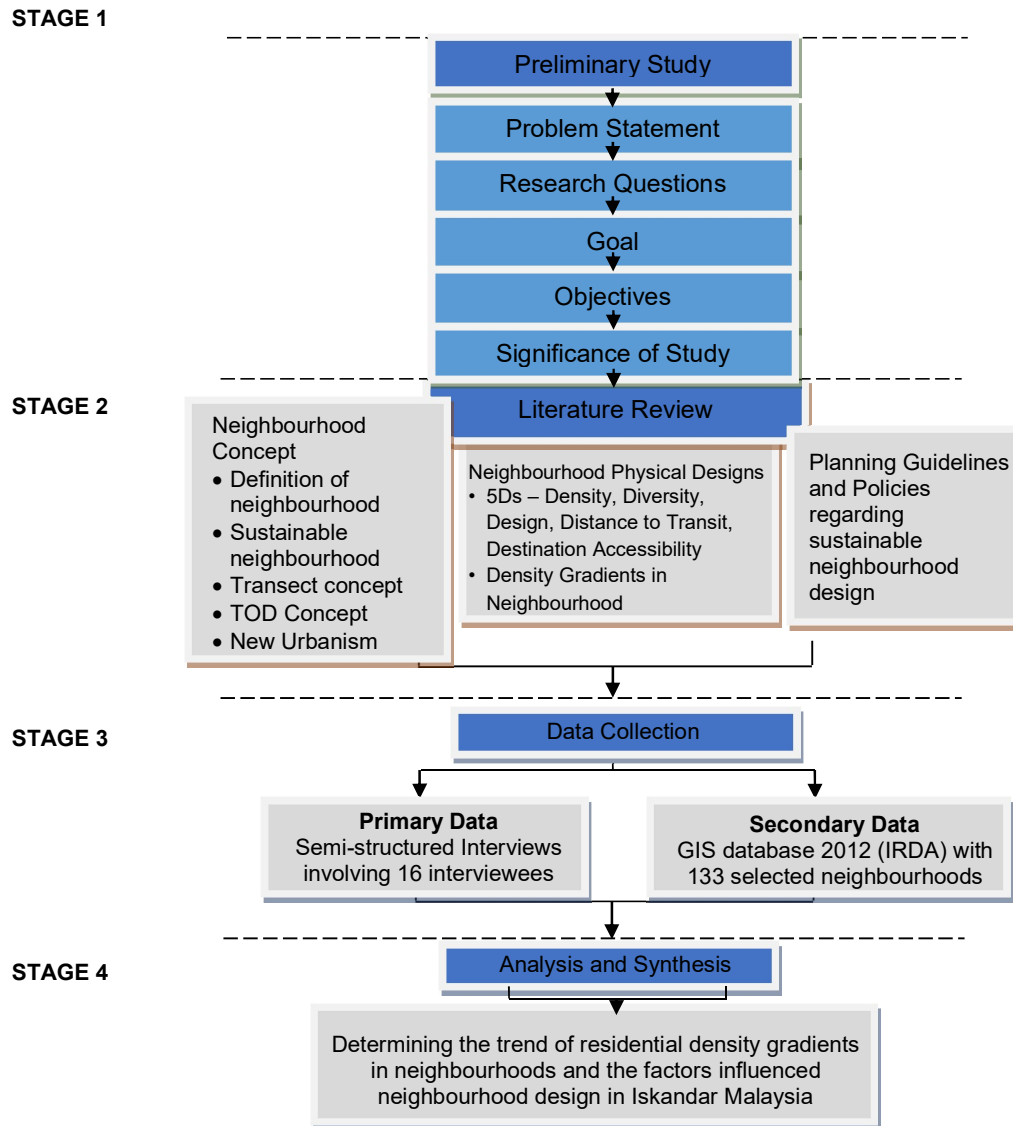


Figure 1.5: Research Framework in this Study

1.9 Significance of the Study

Based on the expected outcomes stated, the findings of this research help in improving the living quality of neighbourhood in Malaysia towards sustainability approach. As what being revealed by various studies on city planning, sustainable development is the goal for any developments and to accomplish that, this research can be one of the ways to promote sustainability. To cater livability and sustainability in a neighbourhood, this research would help to develop awareness to people about the importance of designing sustainable neighbourhood that promotes Malaysians to decrease the usage of private vehicles. Apart from that, this research also assists in finding the major factors in existing neighbourhood design regards with the increase in carbon emission in neighbourhood scale. Like a study by Cervero et al., (2009), revealed that the attributes of built environment such as density and mixed land use did not associate with green transportation in neighbourhood but the design it is. Neighbourhood design will determine the travel behaviour whether people will prefer walking or using cars. Therefore, this could help in this research in terms of refining the attributes that contribute to travel behaviour of residents. Besides that, this research is expected to give exposure to society that sustainable urban development in GHG mitigation is considerably arise on its necessity despite from its hazardous effects on human's health..

1.10 Thesis Structure

The structure of this thesis is divided into five chapters. Each chapters addressed the following topics:

Chapter 1: Introduction

This chapter initially elaborates the brief introduction and background of the study. Then, followed by issues and problems that leads to the production of this thesis. It also includes goal and objectives, scope of the study, research framework as well as study significance.

Chapter 2: Sustainable Neighbourhood Design and Density

Further explanation on theory of sustainable neighbourhood that being revealed by other scholars including several case studies regarding residential density in a neighbourhood.

Chapter 3: Research Method

The overall process of conducting this research is explained further in this chapter. It will take into account the study area, research design, data collection and method of data analysis.

Chapter 4: Analysis and Discussion

This is the gist of this study. The result will be explained further about the trend of density gradient, which is opposed from ideal neighbourhood concept plus the factors influencing the neighbourhood designs among the selected planning experts.

Chapter 5: Conclusion

The final section of this thesis that will examine the findings and analysis of this study. The overall findings that lead to another future research.

REFERENCES

- Abdelfatah, A. S., M. Hussein, M. Z. S., & Othman, C. P. (2015). Evaluating the Sustainability of Traffic Growth in Malaysia. *Journal of Traffic and Logistic Engineering*, 3(1), 6–11. <http://doi.org/10.12720/jtle.3.1.6-11>
- Aditjandra, P. T., Mulley, C., & Nelson, J. D. (2013). The Influence of Neighbourhood Design on Travel Behaviour: Empirical Evidence from North East England. *Transport Policy*, 26, 54–65. <http://doi.org/10.1016/j.tranpol.2012.05.011>
- Anderson, W. P., Pavlos, S. K., & Eric, J. M. (1996). Urban Form , Energy and the Environm ent : A Review of Issues , Evidence and Policy, 33(June 1995), 7–35.
- APHG Class Wiki. (2014). Density and Concentration.
- Bernard, H. R. (2006). *Research Methods in Anthropology: Qualitative and Quantitative Approaches* (4th ed.). Oxford: AltaMira Press.
- Better Cities & Towns. (n.d.). The Transect.
- Bhatta, B. (2010). Causes and Consequences of Urban Growth and Sprawl. In *Analysis of Urban Growth and Sprawl from Remote Sensing Data* (pp. 17–36). <http://doi.org/10.1007/978-3-642-05299-6>
- Biderman, C. (2011). *Density and Scattered Development: A Tale of 10 Cities*.
- Boyko, C. T., & Cooper, R. (2011). Clarifying and Re-Conceptualising Density. *Progress in Planning*, 76(1), 1–61. <http://doi.org/10.1016/j.progress.2011.07.001>
- Brownstone, D., & Golob, T. F. (2009). The Impact of Residential Density on Vehicle Usage and Energy Consumption. *Journal of Urban Economics*, 65(1), 91–98. <http://doi.org/10.1016/j.jue.2008.09.002>
- Calthorpe, P. (1993). *The Next American Metropolis: Ecology, Community, and the American Dream*. New York: Princeton Architectural Press.
- Cape Town Spatial Planning and Urban Design Department. (2009). *Cape Town Densification Strategy Technical Report*. Cape Town.

- Center for Transit-Oriented Development. (2012). *Families and Transit-Oriented Development: Creating Complete Communities for All*. Washington, D.C. Retrieved from <http://reconnectingamerica.org/what-we-do/what-is-tod/>
- Cervero, R. (1988). *Land-Use Mixing and Suburban Mobility*.
- Cervero, R., & Kockelman, K. (1997). Travel Demand and The 3Ds: Density, Diversity, and Design, 2(3), 199–219.
- Cervero, R., Sarmiento, O. L., Jacoby, E., Gomez, L. F., & Neiman, A. (2009). Influences of Built Environments on Walking and Cycling: Lessons from Bogotá. *International Journal of Sustainable Transportation*, 3(4), 203–226. <http://doi.org/10.1080/15568310802178314>
- Chatman, D. G. (2005). *How the Built Environment Influences Non-Work Travel: Theoretical and Empirical Essays*. University of California.
- Churchman, A. (1999). Disentangling the Concept of Density. *Journal of Planning Literature*, 13(May), 389–411.
- City of Greater Geelong. (2008). *Housing Diversity Strategy*. City of Greater Geelong.
- City of Whittlesea. (2013). *Housing Diversity Strategy 2013-2033*. Melbourne.
- City of Winnipeg. (2011). *Winnipeg Transit-Oriented Development (TOD) Handbook*.
- Clark, G., & Moir, E. (2015). *Density: Drivers, Dividends and Debates*. London.
- Comprehensive Development Plan. (2006). *Comprehensive Development Plan for South Johor Economic Region 2006-2025*. Kuala Lumpur.
- Croucher, K., Wallace, A., & Duffy, S. (2012). *The Influence of Land Use Mix, Density and Urban Design on Health: A Critical Literature Review*. York.
- Delegation for Sustainable Cities. (2012). *Platform for Sustainable Cities: Barriers to Sustainable Urban Development*.
- Department of Environment and Transport and Regions. (2000). *By Design: Urban Design in the Planning System: Towards Better Practice*. London.
- Dill, J. (2004). *Measuring Network Connectivity for Bicycling and Walking*. Portland.
- Dill, J. (2006). Evaluating a New Urbanist Neighborhood. *Berkeley Planning Journal*, 19, 59–78.
- Duany, A. (2002). Introduction to the Special Issue: The Transect Introduction to the Special Issue : The Transect. *Journal of Urban Design*, 7(3), 251–260. <http://doi.org/10.1080/135748002200003932>

- Duany, A., & Talen, E. (2001). Making The Good Easy: The Smart Code Alternative. *Fordham Urban Law*, 29(4).
- Duany, A., & Talen, E. (2002). Transect Planning. *Journal of the American Planning Association*, 68(3), 245–266. <http://doi.org/10.1080/01944360208976271>
- Duany Plater-Zyberk Company. (n.d.). Urban Design Derived from Nature. Retrieved August 27, 2016, from <http://www.dpz.com/Initiatives/Transect>
- Duany Plater-Zyberk Company. (2003). *The Lexicon of New Urbanism*.
- Energy and Environmental Affairs. (n.d.). Traditional Neighborhood Development. Retrieved November 13, 2016, from http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-tnd.html
- Engel-Yan, J., Kennedy, C., Saiz, S., & Pressnail, K. (2005). Toward Sustainable Neighbourhoods: The Need to Consider Infrastructure Interactions. *Canadian Journal of Civil Engineering*, 32(1), 45–57. <http://doi.org/10.1139/104-116>
- Ewing, R., & Cervero, R. (2001). Travel and the Built Environment: A Synthesis. *Transportation Research Record 1780*, 87–114.
- Ewing, R., & Cervero, R. (2010). Travel and the Built Environment: A Meta-Analysis. *Journal of the American Planning Association*, (June). <http://doi.org/10.1080/01944361003766766>
- Falk, N., & Carley, M. (2012). Sustainable Urban Neighbourhoods Building Communities That Last.
- Federal Department of Town and Country Planning Peninsular Malaysia. (2012). *Green Neighbourhood Planning Guideline*. Putrajaya.
- Federal Department of Town and Country Planning Peninsular Malaysia. (2014). *Planning for Transit Oriented Development in Malaysia*.
- Frank, L., Chapman, J., Bradley, M., & Lawton, T. K. (2005). *Travel Behavior, Emissions, & Land Use Correlation Analysis in the Central Puget Sound*. Puget Sound region.
- Frank, L. D., & Pivo, G. (1991). Impacts of Mixed Use and Density on Utilization of Three Modes of Travel: Single-Occupant Vehicle , Transit , and Walking.
- Fulton, L., Cazzola, P., Cuenot, F., Kojima, K., Onoda, T., Staub, J., & Taylor, M. (2009). *Transport, Energy and CO2: Moving Towards Sustainability*. Paris.
- Galster, G. (2001). On the Nature of Neighbourhood. *Urban Studies*, 38(12), 2111–2124. <http://doi.org/10.1080/00420980120087072>
- Guo, J. Y., & Bhat, C. R. (2007). Operationalizing the concept of neighborhood: Application to residential location choice analysis. *Journal of Transport*

- Geography*, 15(1), 31–45. <http://doi.org/10.1016/j.jtrangeo.2005.11.001>
- Handy, S. (1996). Methodologies For Exploring The Link Between Urban Form And Travel Behavior, *I*(2), 151–165.
- Healthy Active by Design. (n.d.). Housing Diversity. Retrieved November 8, 2016, from <http://staging.healthyactivebydesign.com/design-features/housing-diversity>
- Heckman, M. (2014). New Urbanism: Humanizing Cities, Connecting Neighborhoods. Retrieved November 12, 2016, from <http://marks-thomas.com/2014/11/new-urbanism-humanizing-cities-connecting-neighborhoods/>
- Holtzclaw, J., Clear, R., Dittmar, H., Goldstein, D., & Haas, P. (2002). Location Efficiency: Neighborhood and Socio- Economic Characteristics Determine Auto Ownership and Use - Studies in Chicago, Los Angeles and San Francisco. *Transportation Planning and Technology*, 25(1), 1–27. <http://doi.org/10.1080/03081060290032033>
- Imagine Holgate. (n.d.). *Transit-Oriented Community Vision Plan*. Portland.
- Institute for Transportation and Development Policy. (n.d.). *TOD Standard*. New York.
- Iskandar Regional Development Authority. (2014). About IRDA.
- Izma, N. (2010). The Decarbonization Drive. *Accountants Today*, (January 2010), 6–12.
- Jabareen, Y. R. (2006). Sustainable Urban Forms, (3), 38–52. <http://doi.org/10.1177/0739456X05285119>
- Jacob, J. D. (2011). Green Neighborhoods: the Making of a Sustainable City. Retrieved July 26, 2016, from http://www.geographyjobs.com/articles/green_neighborhoods_the_making_of_a_sustainable_city.html
- Jothilakshmi, N., & Vedamuthu, R. (2010). An Approach to Build a Sustainable City through the Tools , Models and Methods of the New Urbanism; Transect Approach-A Study of Chennai, 298–303.
- KeTTHA. (2009). *National Green Tenchnology Policy*. Kuala Lumpur.
- Khazanah Nasional. (2006). *Comprehensive Development Plan for South Johor Economic Region 2006-2025*.
- King, L. A., & Hirt, J. (2008). *Housing Diversity and Accessibility*.
- Lee, R. W., & Cervero, R. (2007). *The Effect of Housing Near Transit Stations on*

Vehicle Trip Rates and Transit Trip Generation: A Summary Review of Available Evidence. California.

- Leh, O. L. H., Hwa, T. K., Omar, D., Abdullah, J., & Fong, T. S. (2010). Transit Oriented Neighbourhood for Better Environmental Health. In *2010 International Conference on Science and Social Research* (pp. 516–521). Kuala Lumpur.
- Lehigh Valley Planning Commission. (2011). *Street Connectivity*. Pennsylvania.
- Levinson, D. M., & Kumar, A. (1997). Density and the Journey to Work. *Growth and Change*, 28.
- Litman, T. (2015). *Land Use Impacts on Transport: How Land Use Factors Affect Travel Behavior*. Victoria.
- London First Group. (2015). *Redefining Density: Making the Best Use of London's Land to Build More and Better Homes*. London.
- Loukaitou-sideris, A. (2001). *Transit-Oriented Development in the Inner City: A Delphi Survey*. California.
- Lund, H. M., Cervero, R., & Willson, R. W. (2004). *Travel Characteristics of Transit-Oriented Development in California*. California.
- Majid, M. R., Nordin, A. N., Johar, F., & Tifwa, H. Y. (2014). Travel Emission Profile of Iskandar Malaysia Neighbourhoods from Pre-1980s to 2000s, *012161*. <http://doi.org/10.1088/1755-1315/18/1/012161>
- Majid, M. R., Nordin, A. N., & Medugu, I. N. (2014). Influence of Housing Development Designs on Household Vehicle Miles Traveled: A case of Iskandar Malaysia. *Transportation Research Part D: Transport and Environment*, 33, 63–73. <http://doi.org/10.1016/j.trd.2014.09.001>
- Malaysian Institute of Planners. (2011). National Consultation Workshop United Nations Conference in Sustainable Development 2012: An Overview Advancing the Sustainable Development Agenda through aligning Malaysia Plans & Policies.
- Maunganidze, F. (2013). The Role of Government in the Establishment and Development of SMEs in Zimbabwe: Virtues and Vices. *Journal of Business Administration and Education*, 4(1), 1–16.
- Miskowiak, D., & Stoll, L. (2005). *Planning Implementation Tools Traditional Neighborhood Design*. Wisconsin.
- Mohammad, N. (2011). Environmental Law and Policy Practices in Malaysia : An Empirical Study, *5(9)*, 1248–1260.
- New Urbanism. (n.d.). New Urbanism. Retrieved November 12, 2016, from

<http://www.newurbanism.org/newurbanism.html>

- New York Division of Local Government Services. (2014). *Subdivision Review in New York State* (Vol. XXXIII). New York.
- Newman, P., Beatley, T., & Boyer, H. (2009). *Resilient Cities: Responding to Peak Oil and Climate Change*. Washington, Covelo and London: Island Press.
- Nordin, A. N. (2014). *The Relationship between Urban Form and Non-Urban Form with Vehicle Miles Travelled in Iskandar Malaysia Neighbourhoods*. Universiti Teknologi Malaysia.
- Norman, J., Maclean, H. L., Asce, M., & Kennedy, C. A. (2006). Comparing High and Low Residential Density : Life-Cycle Analysis of Energy Use and Greenhouse Gas Emissions, (March), 10–21.
- Nuruddin, A. R., Syed Abu Bakar, S. P., & Jaafar, M. (2015). Unveiling the Challenges Faced By Malaysian Housing Developers through Government Policy Changes. *Construction in Developing Countries*, 20(2), 37–52.
- Partners, T. G. and, Associates, D., Protection, C. for W., & Boothe, M. W. B. and. (2000). *The Neighborhood Model: Model Block for the Development Areas*. Virginia.
- Payton, N. I., & Hawkes, A. (2011). Designing New Transit Systems using a Transect-Based Model. In *Institution of Civil Engineers* (pp. 1–12). Los Angeles: Institution of Civil Engineers.
- Planning Institute Australia, Australian Local Government Association, National Heart Foundation of Australia, & Australian Government Department of Health and Ageing. (2009). *Design Principle: Connectivity and Permeability*.
- Rahnama, M. R., Roshani, P., Hassani, A., & Hossienpour, S. A. (2012). Use Principles of New Urbanism Approach in Designing Sustainable Urban Spaces. *International Journal of Applied Science and Technology*, 2(7), 195–203.
- Rashed-Ali, H., Lin, C., & Beyaztas, H. (2012). *The City of San Antonio Neighborhood Sustainability Assessment Antonio Neighborhood Sustainability Assessment*. San Antonio.
- Rogers, R. (1997). *Cities for a Small Planet*. London: Faber and Faber.
- Saffuan, R. (2011). Transit Oriented Development (TOD) Towards Enhancing Economics of Urban Centers in Klang Valley, (December).
- Shrivastava, R., & Sharma, A. (2012). Smart Growth: A Modern Urban Principle. *Architecture Research*, 1(1), 8–11. <http://doi.org/10.5923/j.arch.20110101.02>
- Siong, H. C., Matsuoka, Y., Loon Wai, C., Bor Tsong, T., & Gomi, K. (2013). *Low Carbon Society Blueprint for Iskandar Malaysia 2025*. Iskandar Malaysia.

- Stead, D., & Marshall, S. (2001). The Relationships between Urban Form and Travel Patterns. An International Review and Evaluation. *EJTIR*, 1(2), 113–141.
- Steiner, R. (1994). Residential Density and Travel Patterns: A Review of the Literature. *Transportation Research Record* 1466, 37–43.
- Stevens & Associates. (2013). Traditional Neighborhood Development: It's All About Density. Retrieved November 13, 2016, from <http://www.stevens-assoc.com/2013/01/03/traditional-neighborhood-development-its-all-about-density/>
- Sustainable Cities Institute. (n.d.). Traditional Neighbourhood Development (TND). Retrieved November 13, 2016, from [http://www.sustainablecitiesinstitute.org/topics/land-use-and-planning/traditional-neighborhood-development-\(tnd\)](http://www.sustainablecitiesinstitute.org/topics/land-use-and-planning/traditional-neighborhood-development-(tnd))
- Taylor, B., Aarons, M., & Durand, K. (2015). COP21: The Paris Climate Agreement and Malaysia. Retrieved October 18, 2016, from <http://cleanmalaysia.com/2015/12/14/cop-21-the-paris-climate-agreement-and-malaysia/>
- Taylor, Z. (2008). *Shaping the Toronto Region, Past , Present, and Future*. Toronto.
- Thorgrimson, B., Nixon, K., Mazur, F., & Hull, E. (2011). *Winnipeg Transit-Oriented Development Handbook*. Winnipeg.
- Urban Climates. (n.d.). Urban Climates. Retrieved November 2, 2016, from <http://thebritishgeographer.weebly.com/urban-climates.html>
- Urbanism Environment and Design Ltd. (2005). *Better Neighbourhoods : Making higher densities work*. London.
- USA Local Government Commission. (2003). *Creating Great Neighborhoods: Density in Your Community*. Sacramento, California.
- Vice Chancellor Council- Japan Society Promotion Science (VCC-JSPS). (2009). *Low Carbon City 2025 - Sustainable Iskandar Malaysia*. Iskandar Malaysia.
- Vicuna, M. (2012). The Forms of Residential Density in the Contemporary City. The Case of Santiago, Chile. In *Eighth International Space Syntax Symposium* (pp. 1–25). Santiago.
- Volk, L., & Zimmerman, T. (2002). American Households on (and off) the Urban-to- Rural Transect. *Journal of Urban Design*, 7(No.3), 341–352. <http://doi.org/10.1080/135748002200003937>
- Western Australian Planning Commission. (2015). *Liveable Neighbourhoods*. Perth.
- Yin, Y., Mizokami, S., & Maruyama, T. (2013). An Analysis of the Influence of Urban Form on Energy Consumption by Individual Consumption Behaviors

from a Microeconomic Viewpoint. *Energy Policy*, 61, 909–919.
<http://doi.org/10.1016/j.enpol.2013.06.054>

Zakaria, R., Vikneswaran, M., M. Ismid, M. S., Saleh, A. L., & Mustaffar, M. (2012). Sustainable Neighbourhood Planning and Design in Malaysian Perspective. *Applied Mechanics and Materials*, 209-211, 1690–1693.
<http://doi.org/10.4028/www.scientific.net/AMM.209-211.1690>