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Subdivisions in Iskandar Malaysia: Do Their Designs Encourage Increase in Travel Carbon Emissions?

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ABSTRACT

This study looks into the travel impact of distribution of housing densities within a subdivision on local travel patterns within neighbourhoods of Iskandar Malaysia. The goal of this study is to investigate the relationship between these distributions of housing densities and travel carbon emission in Iskandar Malaysia. It attempts to show how the location of various housing densities (high density, medium density and low density) with respect to commercial centres affects the residents' travels, thus affecting carbon emission too. This study involves over three hundred subdivisions in Iskandar Malaysia. The housing densities were determined through ArcGis software while CommunityViz software was used to determine the amount of travel carbon emission. The findings indicate that most of Iskandar Malaysia's subdivisions do not meet the preferred design standards for carbon reduction and can contribute to higher carbon emission. The design of these subdivisions focuses more on its aesthetic aspects rather than being functional and sustainable. However, this is only looking at the travel minimisation aspect of the design though it is not a minimal aspect itself.

KEYWORDS

Iskandar Malaysia, subdivision design, CommunityViz, travel carbon emission

1.0 Introduction

At the Conference of Parties 15 (COP 15) in Copenhagen, our 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). 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.

Eventhough Malaysia is on the right track in in implementing various policies and actions on sustainability, conventional layout still being implemented today. Like Iskandar Malaysia neighbourhoods, vehicles-miles-travel (VMT) has been increasing resulting from urban form factors such as density, diversity, design and destination accessibility.

Type of urban form that will be focussed on this paper is the distribution of housing density. Density is a measure of concentration of people or households in a given area or neighbourhood and most often a measure of the residential population, residential dwelling units, or employment per unit of land area (Moudon and Stewart, 2013). The distribution of housing densities affects residents' travels and carbon emission as well.

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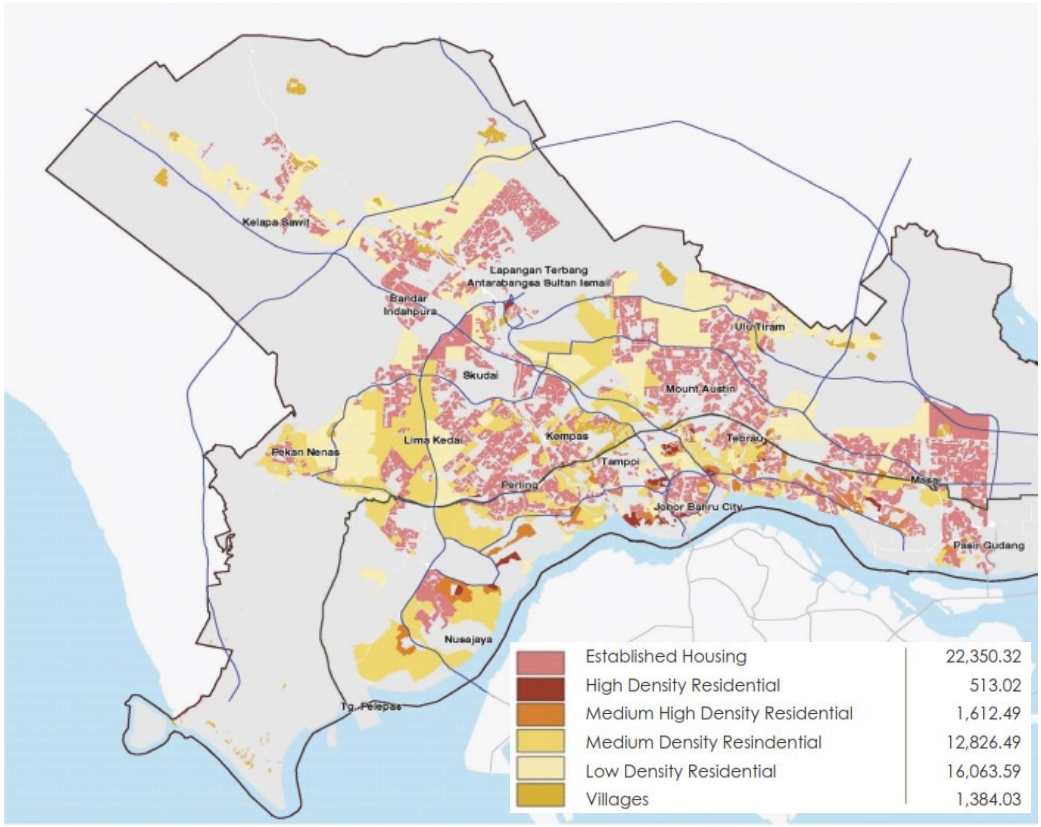


Source: SJER CDP 2025

Figure 1.1: RESIDENTIAL LAND USE DISTRIBUTION IN ISKANDAR MALAYSIA

By referring at the Figure 1.1 above, it shows that high density residential is located at city of Johor Bahru which is the capital city of Johor itself with 513.02 hectare. Whereas low density residential is scattered around the region with an area of 16,063.59 hectare.

2.0 Literature Review

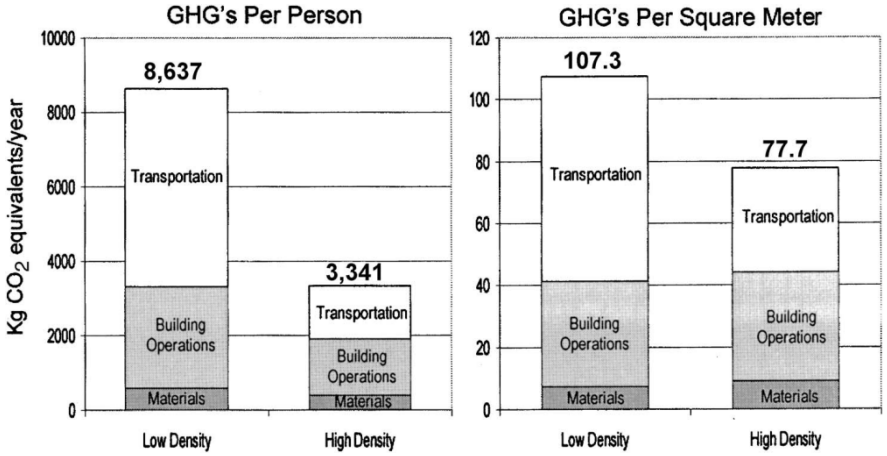
Despite from all the sustainability approaches being implemented to promote sustainable development in Malaysia, not much research has been carried out in Malaysia about how distribution of housing densities affect travel-induced carbon emission . In other countries, research on how neighbourhood characteristic/urban form can help reduce carbon emission (i.e. 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, built environment is found to be a significant predictor of vehicle miles travels.

Physical design attributes or metrics such as street connectivity, walking facilities, land use mixes and residential density differ in each neighbourhood and this research will analyse how different metrics explain the travel behaviours and consequently carbon emissions according to its housing densities. 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). Levinson & Kumar (1997), on the other hand, 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. But, on the other hand, the dispersion of urban land use over a large area may lead to longer distances, which lead residents to use their cars.

Apart from that, another recent study reported by Nordin (2012) and Majid (2012) 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, are interwoven and 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 & Marshall, 2001).

Furthermore, a research by J. Norman et.al (2006) as shown in Figure 2.1 explained that low density residential contributed higher GHG emission (transportation) compared to high density residential. This explained that residents in low density residential depend more on their automobiles to fulfill needs.



Source: J. Norman et.al (2006)

Figure 2.1: THE AMOUNT OF GHG EMITTED BY LOW DENSITY AND HIGH DENSITY RESIDENTIAL

3.0 Methodology

For this research, the study area involves over three hundred subdivisions in Iskandar Malaysia, Johor. These subdivisions are located within Iskandar Malaysia with irregular spatial shapes and land areas between 10 acres (minimum) and 3000 acres (maximum). Secondary data was the most required in this research and collected from various local authorities since Iskandar Malaysia is under the jurisdiction of five local authorities. Those local authorities are Johor Bahru Tengah Municipal Council (MPJBT), Johor Bahru Municipal Council (MBJB), Pasir Gudang Municipal Council (MPPG), Kulai Municipal Council (MPKu) and Pontian District Council (MDP). The data obtained from these five local authorities helped in finding the population density in each subdivision involved. Besides, the analysis of population density of this research was conducted by using ArcGis software and transformed it to 3-Dimensional product by using ArcScene.

4.0 Result

After population density analysis was conducted, the result indicated that most of subdivision design in Iskandar Malaysia did not meet the expectation of design standards as being introduced in subdivision design guidelines or policies. It turned out the design was unsustainable and encouraging more carbon emission to be released. According to the design guideline by Federal Department of Town and Country Planning Peninsular Malaysia (JPBD) in 2011, they have come out with certain number of housing units for high density, medium density and low density residential and also for townhouses. This guideline should be parallel with the design concept or theory in order to create a sustainable neighbourhood.

Table 1: Residential Densities in Peninsular Malaysia

Residential Densities	Number of Units/acre
High Density Residential (terrace)	20
High Density Residential (high-rise)	30
Medium Density Residential (semi-D)	12
Low Density Residential (single storey)	6
Townhouses	24

Source: JPBD Peninsular Malaysia (2011)

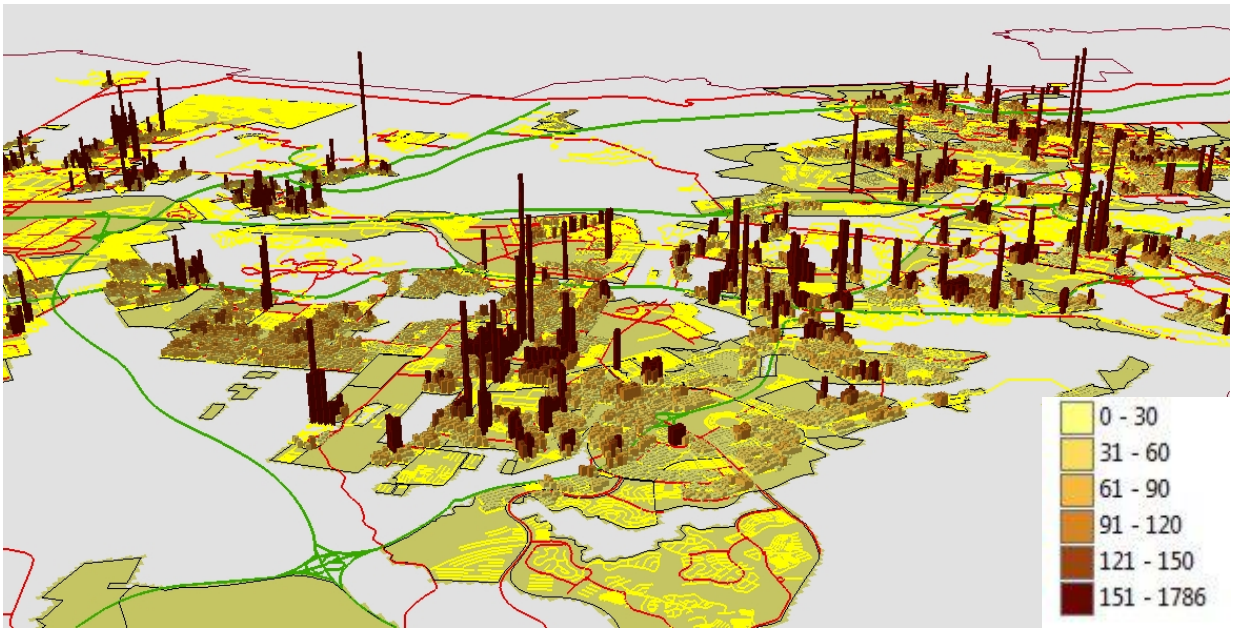


Figure 4.1: POPULATION DENSITIES DISTRIBUTIONS IN ISKANDAR MALAYSIA'S SUBDIVISIONS

Figure 4.1 above shows the population densities distribution in Iskandar Malaysia's subdivisions. The analysis was conducted by using one acre of land. It indicated that high population densities were located at the center of Iskandar Malaysia which is in Johor Bahru. As Iskandar Malaysia is turning into region with more and more subdivisions to cater approximately 3 million populations by the year of 2025, it was expected the city of Johor Bahru will be denser than other districts. However, not all housing densities were distributed accordingly to our expected theory such as Transit Oriented Development (TOD) which locates high-density residential at the center of subdivision boundary. As what happen in most Iskandar Malaysia's subdivisions nowadays, high-density residential is located at the fringe of it whereas low-density residential is located at the center which is opposite from what TOD concept should be implemented.

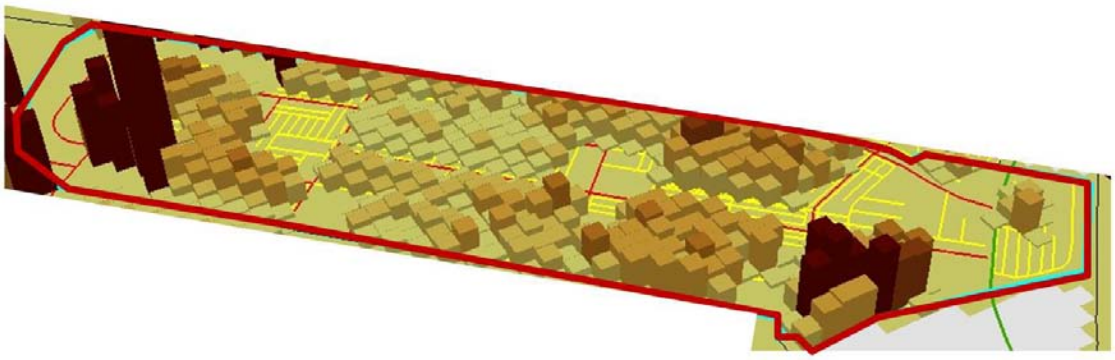


Figure 4.2: TAMAN UNGKU TUN AMINAH SUBDIVISION

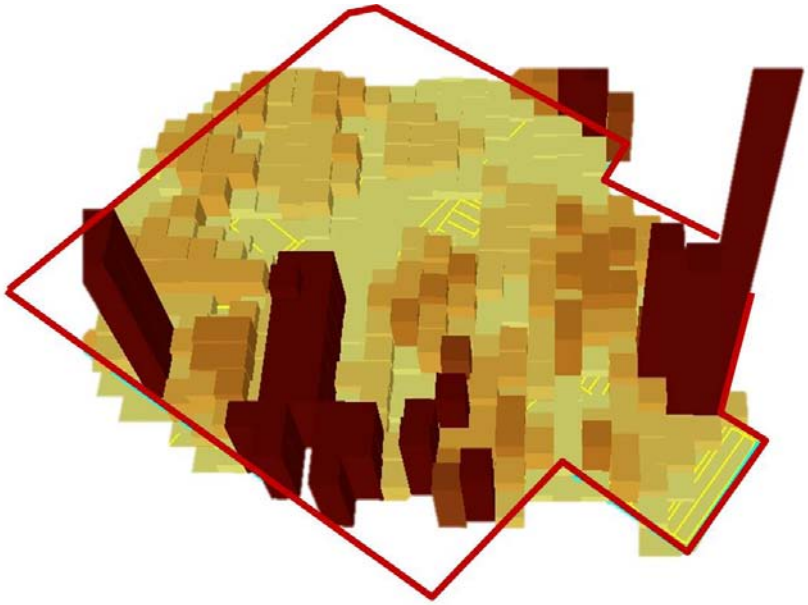


Figure 4.3: BANDAR BARU UDA SUBDIVISION

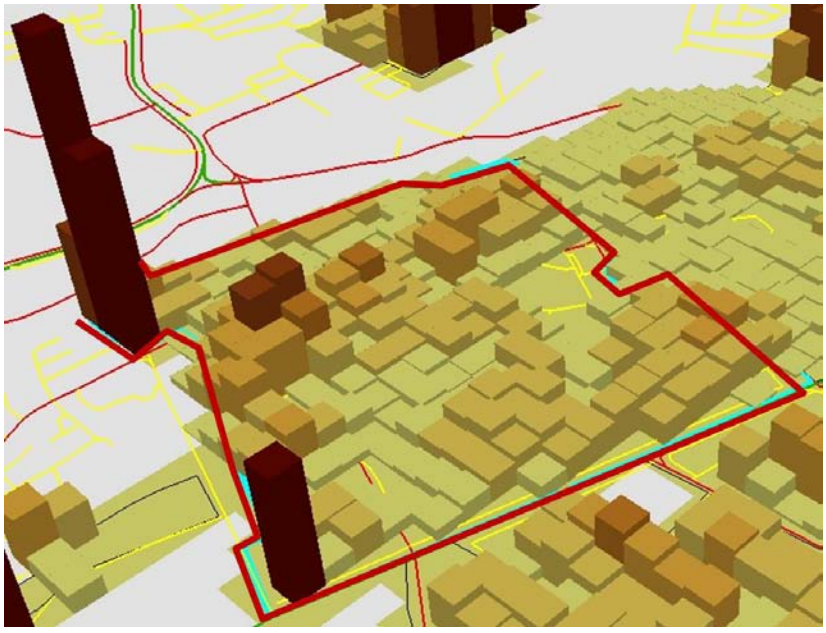


Figure 4.4: TAMAN ABAD SUBDIVISION

5.0 Discussion

From the analysis above, there was a trend of designing subdivisions in Iskandar Malaysia particularly without taking into account the amount of carbon emitted through residents' private automobiles. As high-density area was located at the fringe of the subdivision, there would be more carbon emitted to the atmosphere because residents need to travel more to fulfil needs. Figure 4.2, Figure 4.3 and Figure 4.4 showed three examples of subdivisions that neglecting the preferred design standard for carbon reduction. High density residentials were located away from facilities whereas low density residentials were located almost in the center that against the concept of TOD.

As for Malaysia, we created *Malaysia National Environmental Policy* in 1992 to achieve our economic, social and cultural progress through sustainable development (Mohammad, 2011). As in 2000s, we involved in *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* that being controlled by *YB Datuk Seri Panglima Dr. Maximus Johnity Ongkili*, 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 8th and 9th Conference on Sustainable Development of Energy, Water and Environment Systems in Croatia and Venice- Istanbul respectively. As for Malaysia, we involved 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. Though Malaysia took part in these initiatives in creating sustainable environment yet the result in the context of subdivision design still remain conventional and unsustainable.

The reasons behind this problem still remain unclear whether town planners were seeking profit by focussing on low-density housing development or any reasons that they tend to build houses that way. In addition, the other reasons might be the tendency to focus more on aesthetical aspect such as loop, curvilinear or other aesthetical designs rather than creating a functional subdivision layout. Therefore, this research can be extend on why subdivisions in Iskandar Malaysia are still being implemented without taking into account the amount of carbon emitted resulted from the design itself. We believe that functional and efficient layout is way much worth better than aesthetical layout, by looking at the long term effect in social and economic development.

6.0 Conclusion

Thus, we can see the distribution of housing densities in Iskandar Malaysia is varied for each subdivision and most of it locate the high density residentials at the fringe of subdivisions rather than the center. This will eventually increase the carbon emission as residents would find difficult to move from one place to another. As Iskandar Malaysia is turning into region with more and more neighbourhoods to cater approximately 3 million populations by the year of 2025, it is becoming a concern to planners that neighbourhood designs nowadays are focusing on aesthetic design rather than efficient design (Majid et. al, 2014). Eventually, it encourages residents to travel more by cars. Therefore, steps need to be taken so that the future neighbourhoods' development will take into consideration the impact of these developments to carbon emissions. As Malaysia is about to achieve its target of reducing carbon emission by 40 percent, by studying back on neighbourhood designs is seen to give change to current amount of carbon emission.

Acknowledgments
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