# THE RELATIONSHIP BETWEEN SPATIAL MISMATCH AND JOB ACCESSIBILITY AMONG LOW-INCOME WORKERS IN PENANG ISLAND, MALAYSIA

## HAFIZAH ROSLI [1], NARIMAH SAMAT [2]* and MOHD. AZMEER ABU BAKAR [3]

[1,2,3] Geography Section, School of Humanities, Universiti Sains Malaysia, 11800 USM, Pulau Pinang, Malaysia.
*Corresponding Author Email: narimah@usm.my

**Abstract**

Low-income households residing in areas distant from job opportunities face limited job accessibility due to the presence of spatial mismatch. The objective of the study was to ascertain the presence of spatial mismatch and evaluate the extent of job accessibility among the respondents chosen among low-income workers who are working and living in Penang Island, Malaysia. A quantitative survey was conducted among 306 respondents from low-income households who were registered in the eKasih welfare programme in Penang in 2016. The respondents were selected using stratified random sampling based on a specific ratio. The study aims to analyze the spatial distribution of respondents' home and working locations in order to evaluate their job accessibility from their residential areas, using the geocode data obtained from the survey. Subsequently, an investigation was conducted to assess the job accessibility factors, including the distance between respondents' residence and workplace, the mode of transportation chosen, and the duration of the commute. The research findings suggest that there is a spatial mismatch among respondents' residential areas in suburban areas. However, respondents in both urban and suburban areas rely largely on their individual vehicles. A significant portion of the population depends on motorcycles as their primary mode of mobility. Hence, it is imperative for housing and transportation policy to incorporate a strategic approach to alleviate spatial mismatch, as well as improving public transportation services to attract the low-income workers to choose public transport to access jobs.

**Keywords:** Spatial Mismatch, Job Accessibility, Transport Mode Choice.

## INTRODUCTION

The United Nations (2016) has identified SDG 11 and SDG 3 as key initiatives aimed at fostering the development of sustainable communities within livable and sustainable cities. By considering low-income urban workers as the subject of the sustainable communities to be created, they need sustainable and livable cities to reside in. Therefore, they need ideal residential locations with outstanding job accessibility which is embedded with adequate and efficient public transportation as its complement element. Therefore, it is imperative for the housing and transportation sectors to collaborate in order to develop comprehensive strategies for constructing sustainable and livable cities that encompass sustainable communities.

In comparison to wealthy nations, which provide a more extensive array of sustainable transportation options, there is a significant prevalence of well-established public transportation networks. The complex relationship between housing and transit in developing nations such as Malaysia presents difficulties in achieving job accessibility. Inadequate public transport services exacerbate these challenges. Further investigation is necessary to examine the intricate nature of the interdependent housing and transportation challenges in developing

nations, particularly in the context of limited public transportation infrastructure. The theory of spatial mismatch elucidates the significance of achieving a balance between housing and job accessibility is necessary for eradicating poverty through a high level of job accessibility from the low- income residential locations (Kain, 1968). This equilibrium is crucial as it addresses the issue of low-income households are being segregated from job opportunities in their residential areas, which renders them vulnerable to unemployment and increased deprivation. This issue is particularly crucial when considering the implications for low-income individuals seeking access to job opportunities.

Recent studies have indicated that individuals belonging to low-income demographics are susceptible to experiencing disparities and segregation from job accessibility within metropolitan regions throughout numerous nations. Xiao et al., (2021) observed that the polycentric urban structure of Shanghai, China facilitates a notable degree of job accessibility for highly skilled individuals residing in the city centre. However, they noted that individuals with lower skill levels residing in the outer regions of the city centre experience a lack of job accessibility due to residential segregation. In contrast, Slovic et al., (2019) conducted a study that investigated the disparities in transport policies targeting poor socioeconomic communities in São Paulo, Brazil. The findings revealed that these policies have led to reduced levels of job accessibility and inadequate infrastructure, hence exacerbating the socioeconomic challenges faced by these communities and contributing to a decrease in their life expectancy (Slovic et al., 2019). In a recent study conducted by Zhu and Shi (2022), an examination of job accessibility within the framework of metropolitan public transport services in Kunshan, China was undertaken. The researchers discovered that alterations in the journey time threshold resulted in a steady reduction of the disparities in job accessibility between public transport and private cars. Furthermore, it was discovered that high-cost residential regions exhibit a more equitable distribution of employment accessibility in comparison to low-income residential areas.

In concerning on the level of job accessibility among low-income groups from their residential areas, this study aims to investigate the level of job accessibility among this group who are working in Penang Island, Malaysia, by mapping their residential and workplace distributions in order to look at its spatial distribution. Then, the job accessibility properties such as distance between home and workplace, transport mode choice, as well as the commuting time taken by them to commute between home and their workplace will be investigated, to determine the existence of housing spatial mismatch and investigate the level of job accessibility among them.

## LITERATURE REVIEW

The spatial mismatch hypothesis was proposed in 1968 when academics initially aimed to comprehend the topographical obstacles to employment faced by African-American inner-city residents (Kain, 1968). Besides, Kain had observed that geographically, it is intricately linked to and ingrained within the social framework, rather than the physical structure (Kain, 1992). The consequences of spatial mismatch had an impact on the reduction of job prospects in the

labour market for African Americans (Ermagun et al., 2023). Hence, it has been proven to have a significant impact on vulnerable communities, including wide-ranging social and economic effects (Ihlanfeldt, 1994). Spatial mismatch affects job accessibility through factors such as lengthy commuting distances between workers' residences and workplaces (Cervero, 1989; Giuliano & Small, 1993; Wang, 2000). In addition, the extended commutes will result in increased transportation expenses, exacerbate traffic congestion and air pollution, and reduce job efficiency (Cervero, 1989; Giuliano, 1991).

Typically, low-income groups are the most vulnerable to the disparity of job accessibility until they become segregated and discriminated against in the job and housing market (Gobillon et al., 2007). The disparity in job accessibility occurs across different residential locations, particularly when comparing urban and suburban communities. Especially, suburban areas which suffer from a dearth of transportation infrastructure, resulting in restricted accessibility to essential services and facilities (Criden, 2008). In a situation, there exists a demographic of low-income households residing in urban areas who are compelled to relocate from these locations due to financial constraints, namely the inability to meet the expenses associated with both living and housing, despite the convenient accessibility of transit options within those areas (Sun et al., 2022). These circumstances render low-income households incapable of utilizing public transportation as a means of mobility, as they are relocated to areas with low accessibility of transit options until they need to possess their own means of transportation. Nevertheless, the acquisition of a vehicle could pose a significant economic hardship for low-income households. The reason for this is that the ownership of a car entails a significant financial burden, particularly for those with limited income who are required to undertake lengthy commutes to their workplaces, necessitating their relocation to suburban areas (Ezike & Burrowes, 2020). As a result, spatial mismatch between residential locations and job accessibility happens resulting in a reliance on private vehicles which contributes to the issue of traffic congestion as the number of vehicles on the roads increases.

In Penang state, the minimum price of the affordable houses offered at price 53166.22 USD with a monthly mortgage of USD224.15 (The Star, 2023). This minimum price of affordable house is totally unaffordable for most low-income workers, as the minimum wage per month is just USD319.00 (Astro Awani, 2023). Since the year of 1966, the Malaysian government has implemented social housing initiatives aimed at providing affordable housing options for low-income and disadvantaged households, enabling them to achieve homeownership (REHDA, 2020).

The Penang state government provides affordable social housing options at highly subsidized rates, in addition to implementing a rent-to-own housing program aimed at facilitating homeownership for those within specific demographic segments (LPNPP, 2023). The state government is also providing social housing rentals for low- income households and unmarried individuals in order to facilitate their residence in metropolitan areas near high- employment zones, namely in the northeast district (Bernama, 2023). Despite the state government's genuine concern over homeownership among low-income groups within this jurisdiction, their current initiatives remain insufficient in meeting the substantial demand for social housing in urban

areas. The scarcity of land suitable for affordable housing in metropolitan regions, along with the continuous escalation of construction material expenses, has led to the emergence of social housing initiatives in the suburban region of the southwest district within the state of Penang (Khalil et al., 2011). The presence of hilly terrain in the specific area of the island, which acts as a natural barrier between the northeastern and southwestern sections, has posed challenges in the development of several types of infrastructure. As a result, the current social housing developments are located at a significant distance from the primary commercial districts and industrial sectors, which offer a multitude of job opportunities (Consumers' Association of Penang, 2019). Essentially, it is situated in suburban areas that usually have restricted accessibility, particularly in relation to public transport. As a result, residents are heavily dependent on private vehicles. The spatial mismatch created by the circumstance is further aggravated by the limited accessibility of public transport, which hinders residents from low-income households in accessing job opportunities.

## METHODOLOGY

The current housing and transit scenario in Penang state indicates a clear presence of spatial mismatch among low- income groups in the region. Therefore, in order to undertake the spatial analysis for examining the actual circumstances of spatial mismatch in urban and suburban areas, as well as its impact on job accessibility for low-income urban workers in this particular state, the present study was conducted on Penang Island, Malaysia.

The study employed a quantitative method approach, by the administration of a quantitative survey on the northeast and southwest districts of Penang state, which both are located in the island part of the state. In addition to the quantitative survey, the geocode location data of each respondent's residential and workplace locations were also obtained.

### Study Area

The study area is the island part of the Penang state which encompasses the northeast and southwest districts, as depicted in Figure 1. Penang is a state situated along the northwest coast of Peninsular Malaysia with the geographical entity consisting of an island and a contiguous rectangular land area on the mainland. Penang is considered to be a location of significant development within the Malaysian environment, providing a wide range of employment prospects. The quantitative methodology was employed to collect data by distributing questionnaires to a total of 306 respondents. The respondents in this study were chosen using a stratified random sampling upon ratio among low-income households enrolled in the welfare programme known as eKasih in Penang state during the year 2016. All respondents chosen for this study are employed in urban locations within the geographical boundaries of Penang Island. In general, the respondents are residing and working in Penang Island. They are suitable to be chosen as the respondents due to their maturity and regular commuting routine within the geographical area of Penang Island, encompassing the distance between their home and workplace.
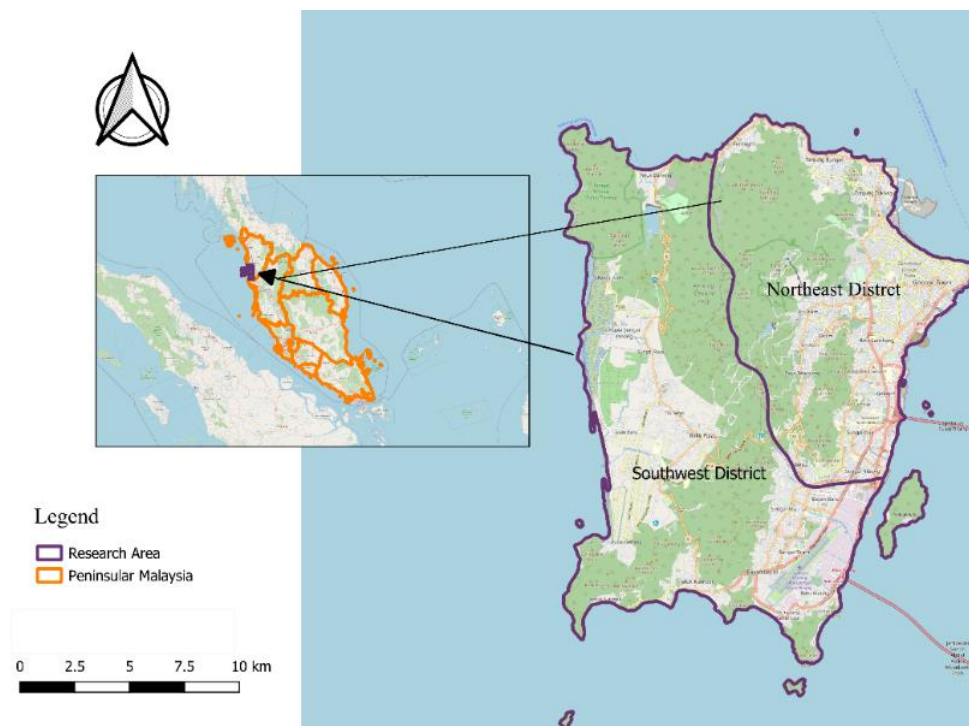
**Figure 1: Research Area**

## RESULTS AND DISCUSSION

The acquired quantitative data underwent statistical analysis utilizing descriptive statistics and cross-tabulation techniques. Meanwhile, the geocode location data of respondents' residential and workplace locations, collected during the fieldwork, was converted into geospatial visualization data using the QGIS software. The geospatial visualization displayed as a map showing the spatial distribution.

### Demographics Characteristics

The demographic characteristics of the respondents align with the data presented in Table 1. The demographic breakdown of the respondents reveals that the Malay ethnicity constitutes 35.62% of the sample from the northeast district and 48.04% from the southwest district. The Chinese ethnicity accounts for 2.61% of respondents from the northeast district and 2.29% from the southwest district. Additionally, the Indian ethnicity comprises 4.25% of respondents from the northeast district and 7.19% from the southwest district. The majority of respondents in the study possess diplomas, with 23.2% residing in the northeast district and 34.64% residing in the southwest area, respectively. Moreover, a significant proportion of the respondents (54.25%) residing in the southwest district reported a monthly household income below USD528.82. Similarly, the northeast district exhibits a notable trend, as the bulk of respondents from this region belong to the household income bracket of less than USD528.82, constituting a significant proportion of 37.58% of the total respondents. The findings indicate that a

significant proportion of respondents, specifically 28.44% in the northeast district and 29.08% in the southwest district, reported being married.

**Table 1: Demographic Characteristics of the Respondents**

| Demographic Characteristics | Northeast District | | Southwest District | |
|---|---|---|---|---|
| Age | Total | Percentage (%) | Total | Percentage (%) |
| 18-28 years old | 56 | 18.3 | 105 | 34.31 |
| 29-38 years old | 44 | 14.38 | 41 | 13.4 |
| 39-48 years old | 18 | 5.88 | 19 | 6.21 |
| 49-58 years old | 10 | 3.27 | 7 | 2.29 |
| 59-68 years old | 2 | 0.65 | 4 | 1.31 |
| Ethnicity | Total | Percentage (%) | Total | Percentage (%) |
| Malay | 109 | 35.62 | 147 | 48.04 |
| Chinese | 8 | 2.61 | 7 | 2.29 |
| Indian | 13 | 4.25 | 22 | 7.19 |
| Education Background | Total | Percentage (%) | Total | Percentage (%) |
| Secondary school | 17 | 5.56 | 7 | 2.29 |
| Diploma | 71 | 23.2 | 106 | 34.64 |
| Degree | 34 | 11.11 | 50 | 16.34 |
| Household Income | Total | Percentage (%) | Total | Percentage (%) |
| Less than USD528.82 | 115 | 37.58 | 166 | 54.25 |
| USD528.82- USD670.33 | 13 | 4.25 | 8 | 2.62 |
| USD670.55- USD839.56 | 2 | 0.65 | 2 | 0.65 |
| Marital Status | Total | Percentage (%) | Total | Percentage (%) |
| Bachelor | 34 | 11.11 | 80 | 26.14 |
| Married | 87 | 28.44 | 89 | 29.08 |
| Divorcee/widow/ widower | 9 | 2.94 | 7 | 2.29 |

## Job Accessibility

The geospatial visualization done in this study on the distribution of respondents and their workplace was projected in Figure 2. Evidently, the low-income urban workforce dwelling in the southwest district experiences limited job accessibility. The southwest district is located in suburban regions characterized by low levels of development. Its geographical location is impeded by hilly terrain with narrow and winding roads poses significant risks to mobility, particularly during periods of rainfall. Numerous incidents have occurred within that vicinity. Nevertheless, due to the abundance of available land for development, numerous sites for low-cost social housing have been constructed in the aforementioned area. Low-income households residing in publicly-provided social housing are obligated to traverse a perilous topographical landscape in order to reach the urban core, industrial areas, and other business districts.

On the other hand, the distribution of workplaces among the respondents is predominantly concentrated in the northeast district. In addition, the city core, which serves as the primary hub for state government and other main business activities, is situated in the northeastern sector. This study reveals that a significant proportion of low-income urban workers are residing in close proximity to their workplaces in the city centre district. This finding elucidates that the urban core in this district remains livable for low-income households, affording them

the chance to reach job opportunities with ease. This finding also indirectly elucidates that there is no disparity in job accessibility for low-income households in this city core. However, this finding presents a contradiction in several recent studies.

Slovic et al. (2019) examined the issue of disparities in job accessibility within São Paulo, Brazil, which is one of the world's megacities. Their findings revealed that job accessibility is closely tied to socioeconomic class. Their finding indicated a notable low level of job opportunities among the low-income population in that megacity. It happened as the result of mostly attributed to the displacement of the low-income population from the city centre to peripheral areas due to inadequate low-cost public housing programmes for them in the core city centre of that megacity. In addition, Nakamura and Avner (2021) conducted an analysis of the spatial patterns of job accessibility within the urban area of Nairobi, situated in Africa. It was discovered that the cost of living near job prospects in Nairobi was too high, hence preventing low-income households from settling in close proximity to job areas. The presence of a spatial mismatch between the residential areas of low- income households and the locations of job opportunities inside the city of Nairobi elucidates a limited level of job accessibility for households with low incomes in said city.
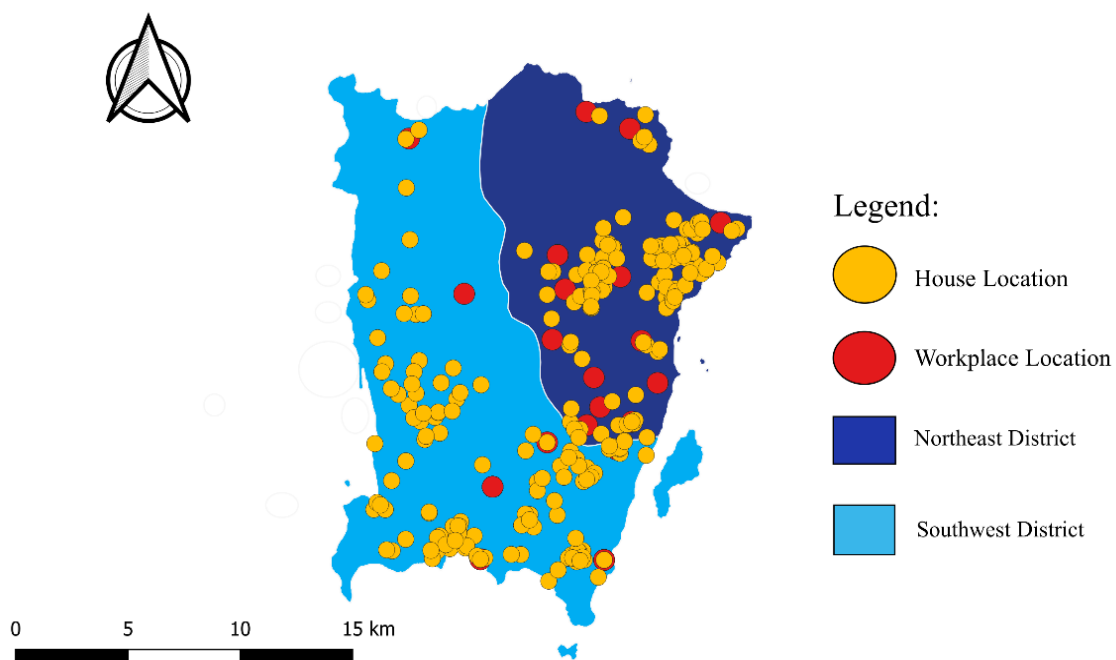


**Figure 2: Distribution of Respondents and Their Workplace**

Obviously, in this study, job accessibility is still accessible in the core city of Penang among low-income households as most of the respondents in the northeast district are located proximate to job opportunities. Further, the distance from the residential locations to the workplace locations among the respondents is investigated and visualized as shown in Figure 3. The observed pattern indicates that there is a uniform distribution of residential locations for low- income workers within a distance range of 1 to 15 km from their respective workplaces in

both the northeast and southwest districts. Nevertheless, a small proportion of respondents from both districts still reside at a distance of approximately 46 to 60 km from their workplaces, which will definitely result in lengthy commute times. The software development company proposed that an optimal commuting distance should be within a range of 50 miles or around 80.5 km with a commuting time of less than 30 minutes, between an individual's residence and their workplace (Luintel, 2023). Based on data from Eurostat, it is expected that the average duration of travelling to the workplace in European countries should not exceed 30 minutes (Eurostat, 2020). In accordance with data provided by the U.S. Census Bureau, the mean duration of travel to one's place of employment in the year 2019 was recorded as 27.6 minutes (United States Census Bureau, 2023). Generally, the suggestion for the acceptable distance is up to 30 minutes of commuting to the workplace from home (Gerguri, 2022). Nevertheless, there are variations in commuting time and work-home distance across different countries.
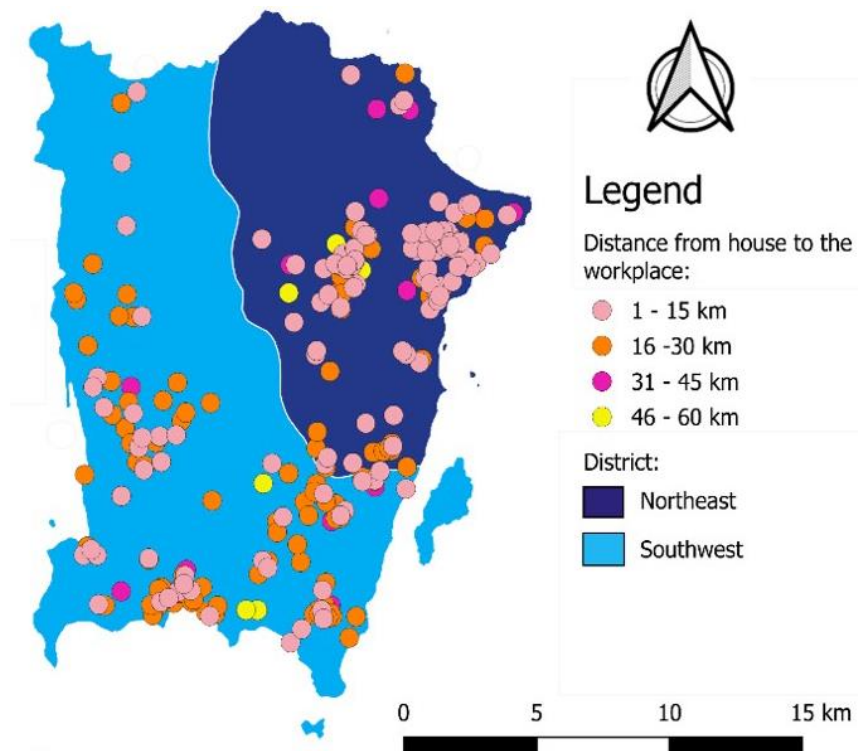


**Figure 3: Distance from House to the Workplace**

The cross-tabulation between the distance from respondents' homes to their workplace and the commuting time required was conducted, as seen in Figure 4, as a means to assess the commonly used metric of the ideal and average distance from home to work. The data indicates that a substantial percentage, specifically 37.58%, of the respondents undertake journeys across a range of 1 to 15 km, all completed within a 30-minute timeframe. Therefore, it can be deduced that low-income urban workers in Penang Island demonstrate similar average commuting distances and durations as urban workers in European and American countries. Nevertheless, a notable proportion of the respondents, up to 1.63%, reported commuting distances of less than

15 km to their respective workplaces. However, it is worth noting that despite the relatively short distance, these individuals experienced extended commuting durations ranging from 61 to 90 minutes, maybe attributable to severe traffic congestion. The presence of significant traffic congestion on numerous routes inside Penang Island has the potential to extend a 10-minute commute to as long as 45 minutes, despite the relatively short distance being covered (The Star, 2023). The statement expresses the persistent issues of traffic congestion experienced by urban workers on Penang Island during peak commuting hours.
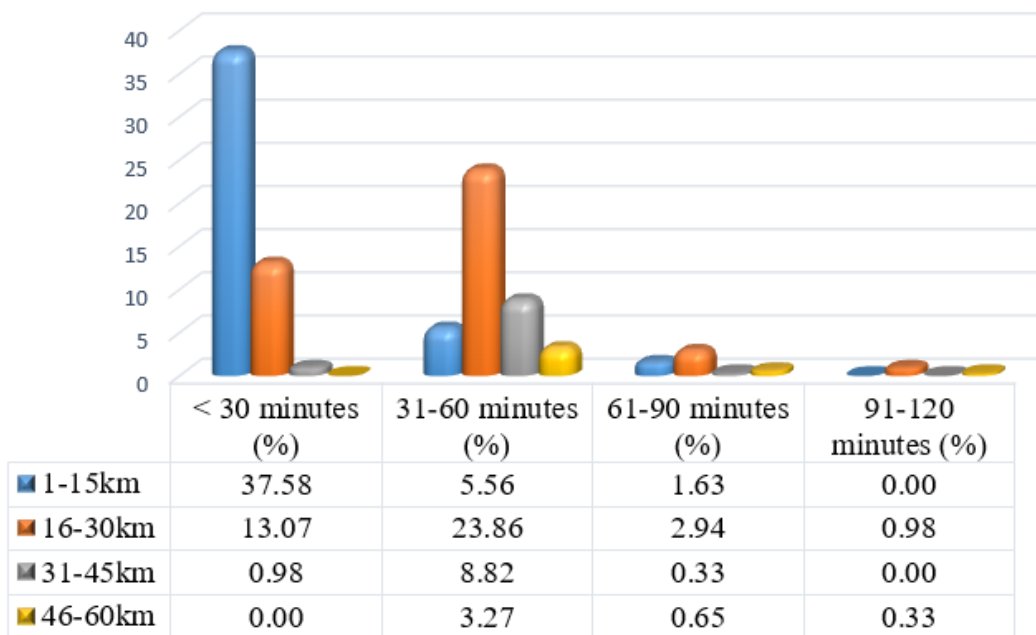


| | < 30 minutes (%) | 31-60 minutes (%) | 61-90 minutes (%) | 91-120 minutes (%) |
|---|---|---|---|---|
| 1-15km | 37.58 | 5.56 | 1.63 | 0.00 |
| 16-30km | 13.07 | 23.86 | 2.94 | 0.98 |
| 31-45km | 0.98 | 8.82 | 0.33 | 0.00 |
| 46-60km | 0.00 | 3.27 | 0.65 | 0.33 |

**Figure 4: Cross-tabulation Distance from Home to the Workplace with the Commuting Time**

Subsequently, for further spatial distribution analysis, the distribution of dominant transport mode choice among the respondents was investigated and shown in Figure 8. Meanwhile, the percentage according to respective districts for the dominant transport mode choice to the workplace among the respondents is illustrated in Figure 7. According to the data, within the northeast district, respondents utilize several modes of transportation for their daily commute to work, including public buses, motorcycles, cars, and employer-provided vehicles such as buses or vans. In the context of vehicular classification, it can be observed that motorcycles and cars exclusively fall under the category of private vehicles, whereas the remaining two categories do not possess this characteristic. The findings of this study indicated that motorcycles are the most preferred mode of transportation among the respondents. Specifically, 29.08% of respondents from the northeast district and 42.81% of respondents from the southwest district reported using motorcycles for commuting to their workplaces.
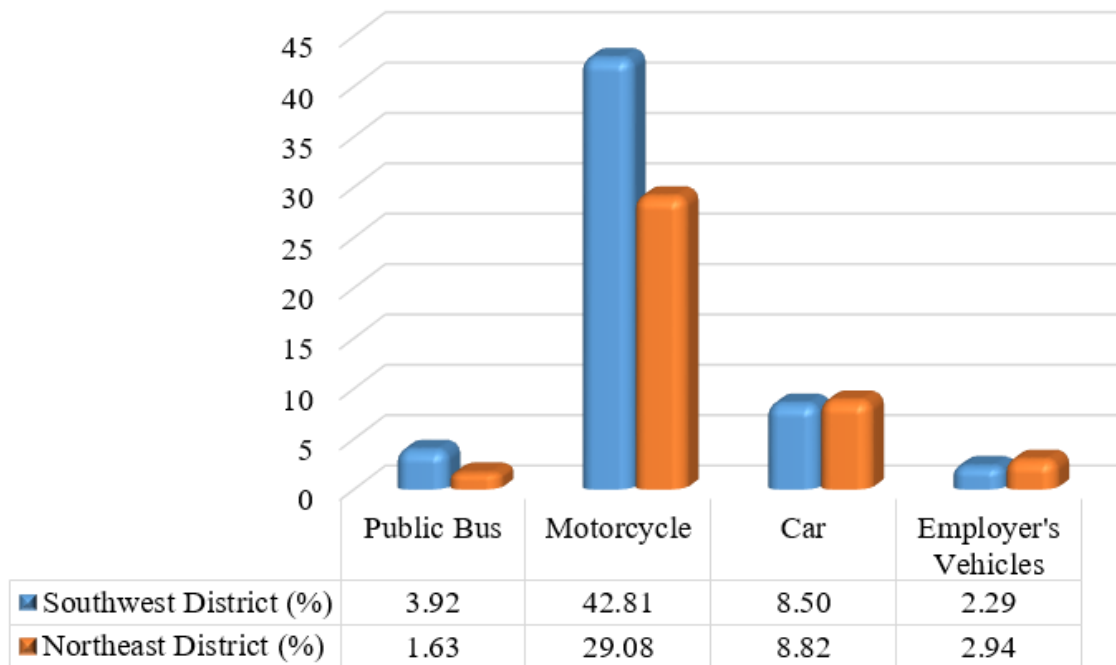
| | Public Bus | Motorcycle | Car | Employer's Vehicles |
|---|---|---|---|---|
| ■ Southwest District (%) | 3.92 | 42.81 | 8.50 | 2.29 |
| ■ Northeast District (%) | 1.63 | 29.08 | 8.82 | 2.94 |

**Figure 7: Percentage of Dominant Transport Mode Choice to Work**

Chiu (2023) conducted a study investigating the correlation between motorcycle travel and the built environment. The findings of that study revealed a positive association between motorcycle ownership and its preference as the primary mode of transportation, with population density, distance from residential areas to central business districts, and distance from residential areas to metro stations. This finding indirectly supports the findings of this study, as it sheds light on the influence of population density on the island of Penang and the spatial separation between residential or workplace locations and public transport stations on the selection of motorcycles as the dominant mode of transportation. Additionally, Chiu and Guerra (2023) provided clarification that motorbikes have been selected as a means of transportation due to factors such as income, age, commuting time, and commuting cost, in comparison to alternative modes of transportation. Therefore, this observation indirectly elucidates the outcomes of this study as well, as the impact of socioeconomic status, particularly low-income circumstances, on the preference for motorbikes as the dominant transport mode choice to economize on both travel time and expenses.

Subsequently, the geospatial data pertaining to the selection of transport modes among the respondents was graphically represented, as depicted in Figure 8. Figure 8 shows that there are public bus users in both districts. It also indicates a higher reliance on public bus transportation among low-income workers residing in the southwest area, in contrast to the northeast district. Furthermore, it is evident that low-income workers have greater access to public buses in a multitude of locations within the southwest district, in contrast to the northeast district. This finding is particularly noteworthy considering that the northeast district serves as the central

business district of Penang state, which would typically be expected to offer superior public transportation services to its residents.
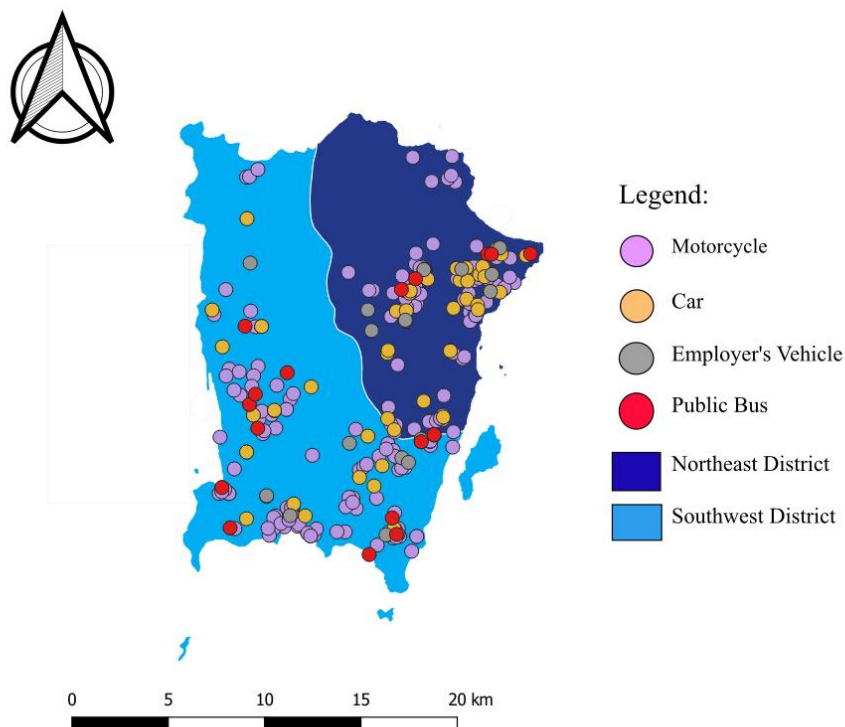


**Figure 8: Distribution of Transport Mode Choice**

Further, by considering that in a large portion, public transport is not the dominant transport mode choice among respondents, the distance from their residential location to the nearest bus stop locations was investigated as depicted in Figure 9. There are the majority of 25.49% and 39.54% of the respondents in the northeast district and southwest district respectively, who are residing about 0.5 to 5.0 km from the nearest bus stop. This finding suggests that despite the proximity of the nearest public bus stop, which is situated within a range of 0.5 to 5.0 km from the residence, there is a diminished inclination to opt for public bus transportation. It is idealistic to expect everyone in a city to opt for public transport, but, even in a top-notch public transport system nation such as Singapore can attract only 40% of the population to use public transport (Free Malaysia Today, 2018). The rationale for using the public transport system is diminished due to the shortcomings present in the public transport infrastructure on the island of Penang. The public bus system on Penang Island exhibits certain shortcomings in its payment system, which exclusively accepts cash and lacks user-friendly technology for bus tracking, specifically the Rapid Penang Journey Planner Pulse App (New Straits Times, 2022). The fact that most of the Penangites especially in the island part of this state refused to opt for its usage because of its feebleness. Chee and Fernandez (2013) also testified from their research

on the factors of choosing transport mode, particularly in Penang, Malaysia found that there is only 26% opt for public transport as there are negative perceptions about public transport in Penang and the majority of their respondents are not satisfied with the overall quality of the bus service.
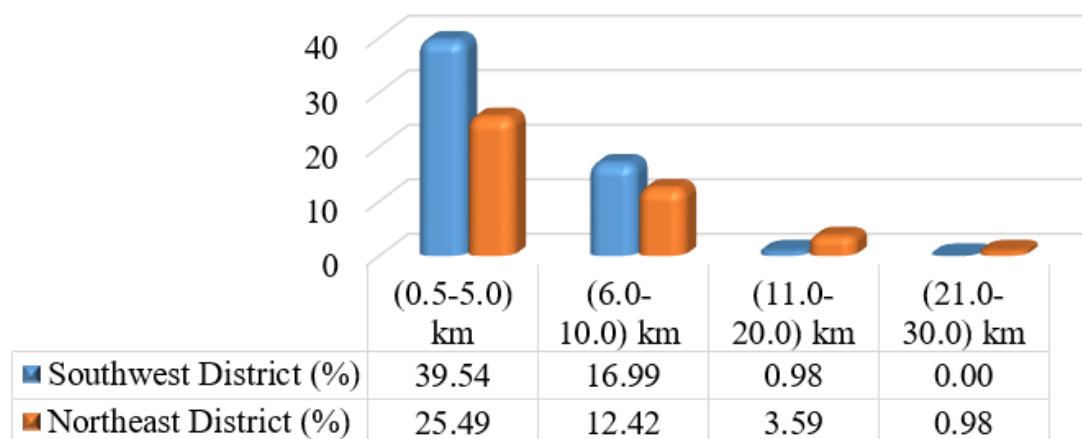
| | (0.5-5.0) km | (6.0-10.0) km | (11.0-20.0) km | (21.0-30.0) km |
|---|---|---|---|---|
| Southwest District (%) | 39.54 | 16.99 | 0.98 | 0.00 |
| Northeast District (%) | 25.49 | 12.42 | 3.59 | 0.98 |

**Figure 9: Distance from home to the nearest public bus stop**

## CONCLUSION

The study's spatial distribution of job accessibility among low- income urban workers in Penang Island reveals distinct patterns of spatial match in the northeast district and spatial mismatch in the southwest district for this demographic group. A significant proportion of low-income urban workers in the northeastern district are dwelling in close proximity to their workplaces, primarily due to the area's status as the capital of the state where the city centre is located.

Despite the presence of several residents in close proximity to their workplaces, the relatively short distance necessitates a lengthier commuting time for them. The aforementioned scenario may arise due to the occurrence of traffic congestion during individuals' commute to their workplaces. Penang is synonymous with heavy traffic congestion, especially during peak hours of working days. It is evident that the motorbike serves as the primary form of transportation for a significant majority of low-income workers in both areas. The proximity of the nearest bus stop to one's residence does not significantly impact the decision of the majority of low-income urban workers to choose public transportation as their means of commuting to work.

In order to enhance the selection of transport modes for low-income urban workers, it is imperative for employers, both in the public and private sectors, to collaborate and offer workers transport options that are integrated with a location-based mobility-on- demand system. This is particularly crucial in Penang, where traffic congestion is a recurring issue during peak working hours. Therefore, there will be a decrease in the quantity of private vehicles utilized by urban employees during peak hours.

In conclusion, spatial matching between residential locations and workplace locations is very important to improve job accessibility. Enhancing the sustainability of low-income households in urban areas can be achieved through the implementation of targeted social housing programmes, hence fostering the development of sustainable communities. In addition, the incorporation of a strategic approach that recognises the link between the housing and transport sectors is of utmost importance in the formulation of effective strategies. Ensuring job accessibility for low-income households dwelling in suburban areas is of paramount importance. The establishment of synergy is of utmost significance in the pursuit of developing sustainable communities by means of constructing livable cities that prioritise the alignment of housing and transportation spatially.

**Acknowledgement**

**References**

1)  Almselati, A., Rahmat, R., & Jaafar, O. (2011). An Overview of Urban Transport in Malaysia. The Social Sciences, 6, 24-33. https://dx.doi.org/10.3923/sscience.2011.24.33.

2)  Astro Awani. (2023, June 30th). Gaji minimum RM1,500 majikan kurang lima pekerja kuat kuasa esok. Retrieved from Astro Awani: https://www.astroawani.com/berita-malaysia/gaji-minimum-rm1500-majikan-kurang-lima-pekerja-kuat-kuasa-esok-426147. Accessed on 30th September 2023

3)  Bernama. (2023, September 19). 500 unit rumah sewa khas dibina di Pulau Pinang. Retrieved from Astro Awani: https://www.astroawani.com/berita-malaysia/500-unit-rumah-sewa-khas-dibina-di-pulau-pinang-438043. Accessed on 8th October 2023

4)  Cervero, R. (1989). Jobs-Housing Balancing and Regional Mobility. Journal of the American Planning Association, 55(2), 136-150. doi:10.1080/01944368908976014

5)  Chee, W., & Fernandez, J. (2013). Factors that Influence the Choice of Mode of Transport in Penang: PSU-USM International Conference on Humanities and Social Sciences (pp. 120 – 127). Georgetown: Procedia - Social and Behavioral Sciences 91 (2013).

6)  Chiu, B.-y., & Guerra, E. (2023). What predicts motorcycle ownership, mode choice, and use for utilitarian travel? A literature review. Transport Reviews, https://doi.org/10.1080/01441647.2023.2205177.

7)  Chiu, B.-y. (2023). Relationship between motorcycle travel and the built environment: Evidence from Taipei, Taiwan. Journal of Transport Geography 110, 103607. https://doi.org/10.1016/j.jtrangeo.2023.103607.

8)  Consumers' Association of Penang. (2019, July 29th). Housing for Workers Should be Mandatory. Retrieved from Consumers' Association of Penang: https://consumer.org.my/ms/home-malay/. Accessed on 30th September 2023

9)  Criden, M. (2008). The Stranded Poor: Recognizing the Importance of Public Transportation for Low-Income Households. Washington D.C.: National Association for State Community Services Programs.

10) Eurostat. (2020). Majority commuted less than 30 minutes in 2019. Retrieved from: Eurostat: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20201021-2#:~:text=Average%20commuting%20time%3A%2025%20minute s,Luxembourg%20(both%2029%20minutes). Accessed on 7th October 2023

11) Ermagun, A., Janatabadi, F., & Maharjan , S. (2023). Inequity analysis of spatial mismatch for low-income socially vulnerable populations across America. *Transportation Research Part D 118*, 103692. https://doi.org/10.1016/j.trd.2023.103692.

12) Ezike, R., & Burrowes, K. (2020, August 12th). Are Cars a Necessity? During COVID-19, Low-Income Households May Consider Public Transit Alternatives. Retrieved from Housing Matters: https://housingmatters.urban.org/articles/are-cars-necessity-during-covid-19-low-income-households-mayconsider-public-transit. Accessed on 30th June 2023

13) Free Malaysia Today. (2018, August 13). Chow: Don't expect Penangites to only use public transport. Retrieved from Free Malaysia Today: https://www.freemalaysiatoday.com/category/nation/2018/08/13/chow-dont-expect-penangites-to-only-use-public-transport/. Accessed on 10th October 2023

14) Gerguri, F. (2022). Commuting to Work: The Ideal Distance. Retrieved from Employee Experience Megazine: https://www.emexmag.com/commuting-to-work-the-ideal- distance/. Accessed on 7th October 2023

15) Gobillon, L., Selod, H., & Zenou, Y. (2007). The mechanisms of spatial mismatch. Urban Studies, 44(12), , 2401–2427. https://doi.org/10.1080/00420980701540937.

16) Giuliano, G. (1991). Is jobs-housing balance a transportation issue? (Transportation research record, no. 1305, pp. 305–312). San Francisco: The University of California Transportation Center.

17) Giuliano, G., & Small, K. A. (1993). Is the journey to work explained by urban structure? Urban Studies, 30(9), 1485–1500.

18) Ihlanfeldt, K. (1994). The spatial mismatch between jobs and residential locations within urban areas. *Cityscape, Vol. 1, Issue 1*, 219-244.

19) Kain, J. F. (1968). Housing segregation, negro employment, and metropolitan decentralization. Quarterly Journal of Economics, 82, 175-197.

20) Kain, J. F. (1992). The Spatial Mismatch Hypothesis: Three Decades Later. Housing Policy Debate, 3(2), 371-460. doi: 10.1080/10511482.1992.9521100

21) Khalil, S., Mariyappan, R., & Ismail, M. (2011). Environmental and social issues of land use planning (LUP) in property development. Universiti Utara Malaysia.

22) Khazanah Research Institute. (2023). Decent shelter for the urban poor. Kuala Lumpur: khazanah Research institute.

23) LPNPP. (2023). Lembaga Perumahan Negeri Pulau Pinang. Retrieved from Lembaga Perumahan Negeri Pulau Pinang: https://www.lpnpp.gov.my/ms/. Accessed on 30th September 2023

24) Luintel, S. (2023). Distance from work to home: how far should you live from work. Retrieved from Time Tracko: https://timetracko.com/blog/distance-from-work-to-home/.Accessed on 7th October 2023

25) Malaysian Automotive Association. (2021). Malaysia number of motor vehicle: annual: P Pinang. Retrieved from CEIC: https://www.ceicdata.com/en/malaysia/motor-vehicles- registration/number-of-motor-vehicle-annual-p-pinang. Accessed on 2nd October 2023

26) Ministry of Transport Malaysia. (2018). National Transport Policy (2019- 2030). Putrajaya: Ministry of Transport Malaysia.

27) New Straits Times. (2022, April 23). Penang visit marred by poor public transport services. Retrieved from New Straits Times: https://www.nst.com.my/opinion/letters/2022/04/791111/penang- visit-marred-poor-public-transport-services. Accessed on 10th October 2023

28) Norhisham et al., S. (2022). Performance of bus services in urban areas: a case study in Penang, Malaysia. IOP Conf.Ser. Earth. Environ. Sci. 9710122018.

29) Penang State Government. (2022). Penang in Numbers 2020/2021.Georgetown: Penang State Government.

30) Pinto , D., Loureiro, C., Sousa, F., & Motte-Baumvol, B. (2023). The effects of informality on socio-spatial inequalities in accessibility to job opportunities: Evidence from Fortaleza, Brazil. Journal of Transport Geography 108, 103577. https://doi.org/10.1016/j.jtrangeo.2023.103577.

31) Rasagam, G. (1999). A "step" towards sustainable transport: a case study of Penang, Malaysia. In Transport and Communication Bulletin for Asia and the Pacific, 68 (pp. 33-47). New York: United Nations.

32) REHDA. (2020). Social housing in Malaysia. Retrieved from International Housing Association: https://www.internationalhousingassociation.org/fileUpload_detail .aspx?contentTypeID=3&contentID=2549 56&subContentID=710 658&channelID=38488. Accessed on 30th September 2023

33) Slovic, A., Tomasiello, D., Giannotti, M., Andrade, M., & Nardocci, A. (2019). The long road to achieving equity: Job accessibility restrictions and overlapping inequalities in the city of São Paulo. Journal of Transport Geography 78, 181-193.https://doi.org/10.1016/j.jtrangeo.2019.06.003.

34) Sun , F., Jin, M., Zhang, T., & Huang, W. (2022). Satisfaction differences in bus traveling among low-income individuals before and after COVID-19. Transp Res Part A Policy Pract. 160 , 311–332. doi: 10.1016/j.tra.2022.04.015. Epub 2022 Apr 28. PMID: 35502331; PMCID: PMC9046078.

35) The Star. (2023, June 12th). 'Home prices in Penang still too high'. Retrieved from The Star: https://www.thestar.com.my/news/nation/2023/06/12/home-prices- in-penang-still-too-high

36) The Star. (2023, August 16). Penangites can't wait for end to traffic jams. Retrieved from The Star: https://www.thestar.com.my/news/nation/2023/08/16/penangites-cant-wait-for-end-to-traffic-jams. Accessed on 9th October 2023

37) United Nations. (2016). The 17 Goals. Retrieved from United Nations: https://sdgs.un.org/goals

38) United States Census Bureau. (2023). Measuring America's people, places, and economy. Retrieved from United States Census Bureau: https://www.census.gov/. Accessed on 7th October 2023

39) Ward, P., Huerta, E., Grajeda, E., & Velazquez, C. (2011). Self-help housing policies for second generation inheritance and succession of "The House that Mum & Dad Built". Habitat International 35, 467- 485. http://dx.doi.org/10.1016/j.habitatint.2010.12.005.

40) Wang, F. (2000). Modeling Commuting Patterns in Chicago in a GIS Environment: A Job Accessibility Perspective. The Professional Geographer, 52(1), 120-133. doi:10.1111/0033-0124.00210

41) Xiao, W., Wei, Y., & Li, H. (2021). Spatial inequality of job accessibility in Shanghai: a geographical skills mismatch perspective. Habitat International 115, 102401. https://doi.org/10.1016/j.habitatint.2021.102401.

42) Zhu, L., & Shi, F. (2022). Spatial and social inequalities of job accessibility in Kunshan city, China: Application of the Amap API and mobile phone signaling data . Journal of Transport Geography 104, 103451. https://doi.org/10.1016/j.jtrangeo.2022.103451.