

The Impact of Housing Spatial Mismatch on Transportation Mode Selection for Job Access

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ABSTRACT

Low-income households far from employment opportunities experience restricted job accessibility owing to spatial mismatch. The study aims to identify geographical mismatch and evaluate the degree of employment accessibility for low-income workers residing and working on Penang Island, Malaysia. A quantitative survey was conducted with 306 participants from low-income households enrolled in the eKasih welfare program in Penang in 2016. The participants were selected by stratified random sampling based on a defined ratio. The study aims to analyze the factors affecting job accessibility, including the distance from the respondents' residences to their workplaces, the chosen mode of transportation, and the duration of the commute. The research findings revealed that the respondents in both urban and suburban areas predominantly depend on their personal vehicles. A substantial segment of the population depends on motorcycles to commute to their jobs.

Keywords: Spatial mismatch, Job accessibility, Low-income households, Workplace distance, Transportation modes

INTRODUCTION

The United Nations (2016) has recognized SDG 11 and SDG 3 as essential initiatives for promoting the development of sustainable communities in livable and sustainable cities. Low-income urban workers must be regarded as the focus of sustainable community development, necessitating the creation of sustainable and habitable cities for their residents. Consequently, they require optimal residential areas with excellent job accessibility, complemented by sufficient and effective public transport. The housing and transportation sectors need to cooperate in formulating comprehensive policies for creating sustainable and livable cities that include sustainable neighborhoods.

Wealthy nations have a broader range of sustainable transportation options and well-established public transit networks. The intricate interplay between housing and transit in emerging countries like Malaysia poses challenges in attaining work accessibility. Insufficient public transport services intensify these difficulties. Additional inquiry is required to analyze the complex relationship between housing and transportation issues in emerging countries, especially with inadequate public transportation systems.

The spatial mismatch hypothesis highlights the importance of balancing housing and employment accessibility to eliminate poverty by enhancing job access in low-income residential areas (Kain, 1968). This equilibrium is essential as it tackles low-income households' isolation from their neighborhoods' employment prospects, rendering them susceptible to unemployment and heightened deprivation. This matter is especially significant when evaluating the consequences for low-income individuals pursuing employment prospects.

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 center.

However, they noted that individuals with lower skill levels residing in the outer regions of the city center experience a lack of job accessibility due to residential segregation. In contrast, Slovic et al. (2019) conducted a study investigating 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 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 those using public transport and private cars. Furthermore, it was discovered that high-cost residential regions exhibit a more equitable distribution of employment accessibility than low-income residential areas.

This study aims to examine job accessibility for low-income groups residing in Penang Island, Malaysia. It will analyze factors such as the distance between homes and workplaces, transportation mode choice, and commuting duration to determine the existence of spatial mismatch in housing and evaluate overall job accessibility for this demographic.

LITERATURE REVIEW

The spatial mismatch hypothesis was introduced in 1968 to analyze the geographical barriers to employment encountered by African-American inhabitants in inner cities (Kain, 1968). Kain (1992) noted that it is geographically intertwined and embedded in the social framework rather than the physical structure. The ramifications of geographical mismatch adversely affected job opportunities for African Americans in the labor market (Ermagun et al., 2023). Consequently, it has been demonstrated to substantially influence vulnerable groups, encompassing extensive social and economic ramifications (Ihlanfeldt, 1994). Spatial mismatch impairs job accessibility due to extensive commuting lengths between workers' homes and their locations of employment (Cervero, 1989; Giuliano & Small, 1993; Wang, 2000). Moreover, prolonged commutes will increase transportation costs, intensify traffic congestion, and air pollution, and diminish employment productivity (Cervero, 1989; Giuliano, 1991).

The scarcity of affordable and accessible housing near high-quality employment centers often resulted in elevated transportation expenses and prolonged commutes for low-income workers, undermining their economic potential. Davis (2025) highlighted that the intersection of housing and job market discrimination creates compounded disadvantages, wherein individuals face challenges in accessing employment while enduring diminished housing stability and quality of life. Addressing these gaps requires a multi-faceted approach incorporating employment and housing policy measures.

Promoting affordable housing near employment hubs, the growth of public transit, and the provision of job training programs tailored to the requirements of low-income areas are vital to enhancing job accessibility and reducing residential segregation. Kain (2022) advocated for increased investment in inclusive urban planning and equitable housing policies that prioritize the needs of marginalized communities. Moreover, anti-discrimination legislation aimed at eradicating biases in job and housing markets is essential for guaranteeing equitable access to economic opportunities for all individuals.

Low-income groups are generally the most susceptible to disparities in job accessibility, leading to their segregation and discrimination in the employment and housing markets (Gobillon et al., 2007). Job accessibility varies significantly between urban and suburban areas. In particular, suburban regions experience a deficiency in transport infrastructure, leading to limited access to vital services and amenities (Criden, 2008). A significant body of research highlighted the challenges faced by low-income people in securing stable and lucrative employment. A confluence of factors such as geography, transit access, educational achievement, and social connections influences these obstacles. Low-income individuals are frequently situated in neighborhoods with restricted access to high-quality employment, particularly in urban regions. A study by Petersen et al. (2023) indicated that geographic location is a crucial factor in job accessibility, with lower-income neighborhoods being situated far from employment centers, hence intensifying transportation difficulties and restricting access to possibilities.

Research also underscored the impact of discriminatory housing policies and practices that exacerbate the segregation of low-income neighborhoods. Chavez et al. (2023) examined the impact of discriminatory zoning regulations, redlining, and the deterioration of public housing on racial minorities and low-income groups, hence exacerbating economic inequalities. Housing instability, typically from a deficiency of cheap housing, leads to job instability, as individuals are compelled to relocate repeatedly or struggle to sustain consistent employment.

Housing affordability is a significant concern for low-income households in urban regions, where fast gentrification, increasing property values, and limited affordable housing supply have driven up rent and property expenses. According to Bollinger et al. (2023), the affordability gap in large cities has increased dramatically, particularly in places with robust employment markets and extensive transit networks. Choi and Davis (2024) reported that nearly 40% of low-income households in major cities reported spending more than 50% of their income on housing, a threshold that considerably raises the chance of displacement. This “housing cost burden” is one of the key causes of the movement since individuals or families are sometimes pushed to move to neighborhoods with lower rent, even if those places are not as well-served by public transport.

A demographic of low-income households in urban areas is forced to relocate due to financial constraints, specifically, their inability to afford living and housing expenses, despite the availability of convenient transit options (Sun et al., 2022). These situations render low-income households unable to utilize public transportation for mobility, as they are transferred to locations with limited transit options until they acquire their own means of transportation. The absence of public transport in suburban regions compels households to depend on private vehicles, incurring extra expenses that may exacerbate their constrained financial resources. Klein and Woodward (2024) discovered that the escalating expenses of private transport, encompassing gasoline and car maintenance, frequently offset the savings from reduced rents in suburban areas, resulting in a detrimental effect on household finances.

Nonetheless, obtaining a vehicle may impose considerable financial strain on low-income families. Car ownership is a considerable financial burden, especially on individuals with limited means who must endure lengthy commutes to their professions, often requiring relocation to suburban areas (Ezike & Burrowes, 2020). Consequently, a spatial mismatch between residential areas and employment accessibility occurs, leading to a dependence on private vehicles, which exacerbates traffic congestion as the volume of vehicles on the roads escalates.

In Penang, the minimum affordable housing price is 53,166.22 USD, with a monthly mortgage payment of 224.15 USD (The Star, 2023). The minimum price of affordable housing is entirely unattainable for most low-income workers, given that the monthly minimum pay is USD 319.00 (Astro Awani, 2023). Since 1966, the Malaysian government has instituted social housing schemes to offer affordable housing options for low-income and disadvantaged households, facilitating their attainment of homeownership (REHDA, 2020).

The Penang state government offers inexpensive social housing at significantly subsidized prices and has established a rent-to-own housing scheme to promote homeownership among certain demographic groups (LPNPP, 2023). The state government is offering social housing rents for low-income households and single individuals to enable their residence in metropolitan areas adjacent to high-employment zones, namely in the northeast district (Bernama, 2023). Although the state government expresses sincere concern for homeownership among low-income populations in this area, its existing measures are unable to address the significant demand for social housing in urban regions. The limited availability of land for affordable housing in urban areas, coupled with the persistent rise in construction material costs, has resulted in the development of social housing projects in the suburban southwest district of Penang (Khalil et al., 2011). The mountainous topography in the designated region of the island serves as a natural barrier between the northeastern and southwestern sections, complicating the development of various types of infrastructure. The existing social housing estates are situated at a considerable distance from the main commercial areas and industrial zones that provide numerous employment prospects (Consumers' Association of Penang, 2019). It is primarily located in suburban regions that typically exhibit limited accessibility, especially concerning public transportation. As a result, residents are heavily dependent on private vehicles. The restricted availability of

public transport exacerbates the spatial mismatch resulting from the situation, impeding low-income inhabitants' access to employment prospects.

METHODOLOGY

Penang state's existing housing and transport situation reveals a distinct geographical mismatch among low-income populations in the area. This study was undertaken on Penang Island, Malaysia, to perform a spatial analysis of the conditions of spatial mismatch in urban and suburban areas and its effect on employment accessibility for low-income urban workers in this state.

The study utilized a quantitative methodology by distributing a survey in Penang's northeast and southwest districts, both situated on the island. Alongside the quantitative survey, geocoded location data for each respondent's residence and workplace were also acquired.

The study region comprises the island portion of Penang state, encompassing the northeast and southwest districts, as seen in Figure 1. Penang is a state located on the northwest coast of Peninsular Malaysia, comprising an island and an adjacent rectangular land area on the mainland. Penang is regarded as a site of substantial development within Malaysia, offering a diverse array of career opportunities. The quantitative methodology was utilized to gather data through the distribution of questionnaires to 306 respondents. The participants in this study were selected by stratified random selection based on the ratio of low-income households enrolled in the welfare program eKasih in Penang state in 2016. The eKasih program is a Malaysian Government initiative designed to support designated low-income demographics. Consequently, the low-income groups engaged in the eKasih initiative will receive social aid through the program. The participants of the eKasih initiative in Malaysia are recorded in the national poverty database. This database was established to aggregate information on individuals living in poverty, irrespective of their rural or urban location within the country. All participants selected for this study were employed in urban areas within the geographical confines of Penang Island. The respondents mostly resided and worked on Penang Island. The respondents were appropriately selected owing to their age and consistent commuting patterns within the geographical confines of Penang Island, which includes the distance from their residences to their workplaces.

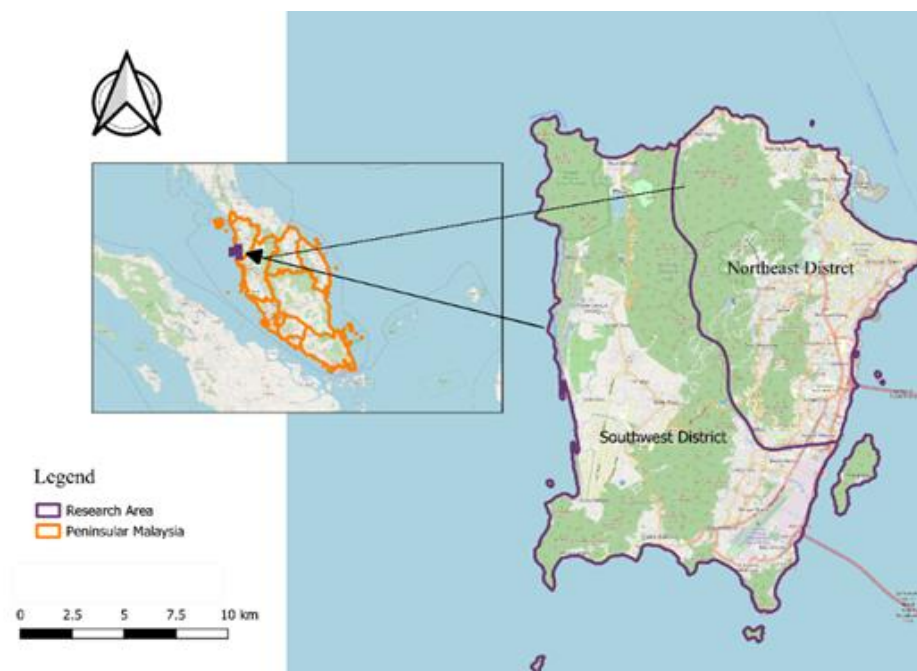


Fig. 1. Research Area

RESULTS AND DISCUSSION

The collected quantitative data was analyzed statistically using descriptive statistics and cross-tabulation methods. The demographic characteristics of the respondents aligned 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 indicated that a significant proportion of respondents were married, specifically 28.44% in the northeast district and 29.08% in the southwest district.

Table I. Demographic Characteristics

Demographic Characteristics	Northeast District		Southwest District	
	Total	Percentage (%)	Total	Percentage (%)
Age				
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

A cross-tabulation was performed to analyze the relationship between the distance from respondents' residences to their workplaces and the corresponding commuting time. Figure 2 evaluates the standard metric of the optimal and average home-to-work distance. The data reveal that 37.58% of respondents travel distances between 1 and 15 kilometers, all within 30 minutes. Consequently, it may be inferred that low-income urban workers in Penang Island exhibit comparable average commuting distances and durations to those of urban workers in European and American nations. Nonetheless, a significant percentage of respondents, reaching 1.63%, indicate commute distances of under 15 kilometers to their workplace. Notably, despite the relatively short distance, these individuals saw prolonged travel times of 61 to 90 minutes, likely due to significant traffic congestion. Significant traffic congestion on various routes inside Penang Island can prolong a 10-minute trip to as much as 45 minutes despite the short distance involved (The Star, 2023). The statement articulates the ongoing challenges of traffic congestion faced by urban workers on Penang Island during peak travel periods.

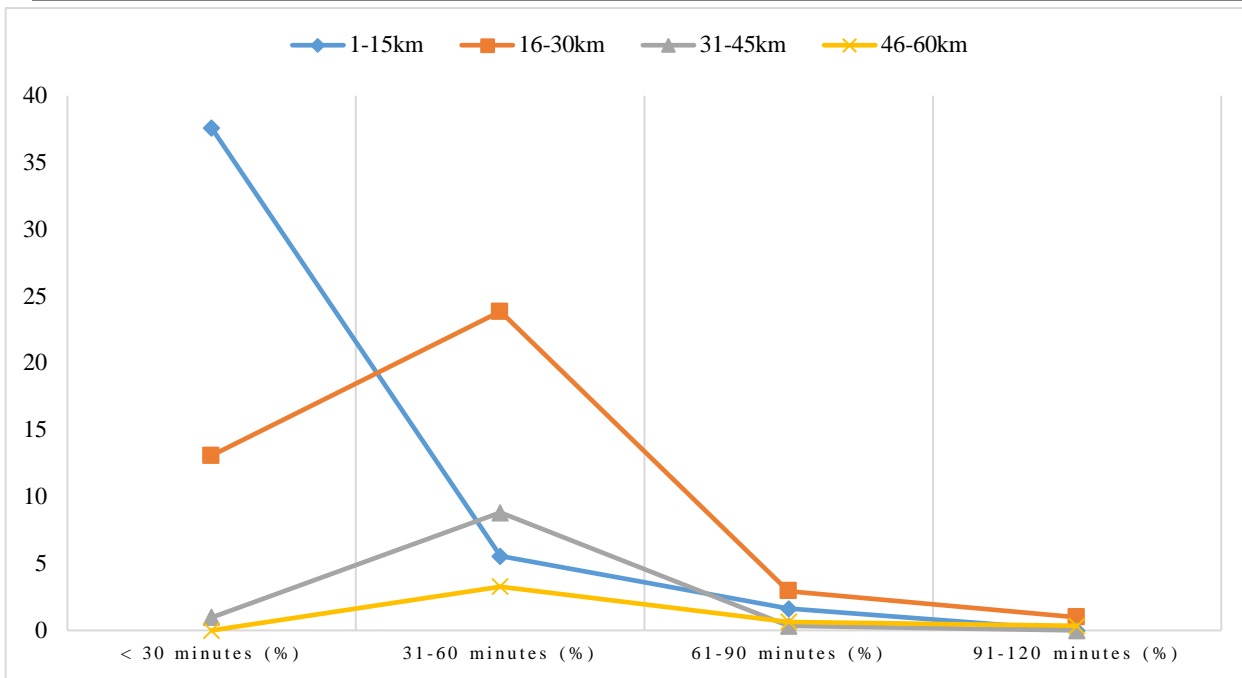


Fig. 2 Distance from Home to the Workplace with the Commuting Time

All geocoded location data acquired from the quantitative survey was mapped with QGIS software. Figure 3 illustrates the spatial distribution of respondents utilizing QGIS mapping, depicting the distance between their homes and workplaces. The low-income urban workforce residing in the southwest district evidently faces restricted employment accessibility. The southwest district is situated in suburban areas marked by minimal development. Low-income households living in publicly funded social housing must navigate a hazardous topographical setting characterized by hilly terrain to access the urban center, industrial zones, and other commercial districts. The respondents' workplaces are primarily centered in the northeast district.

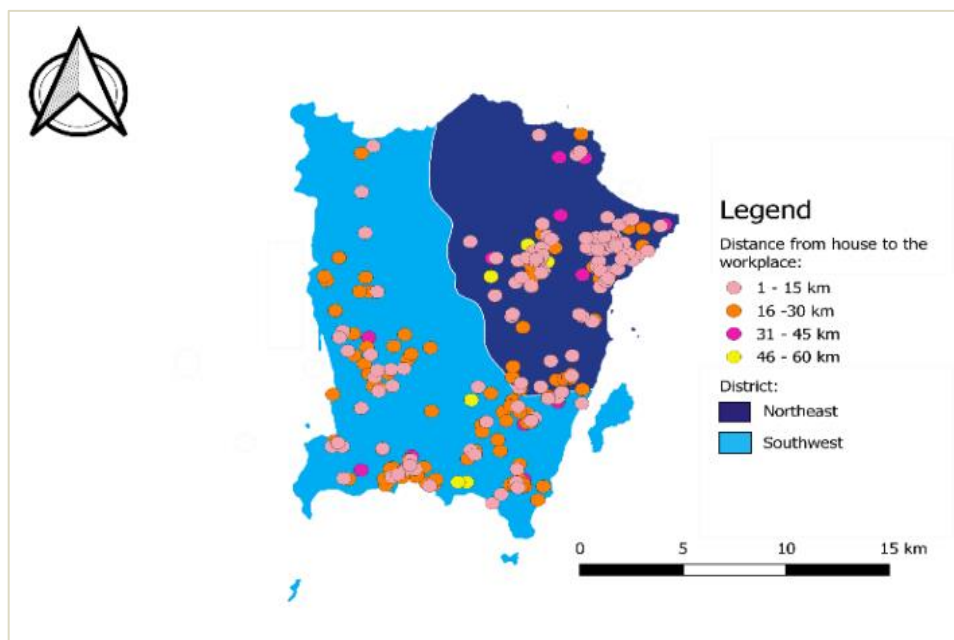


Fig. 3 Spatial Distribution of Respondents' Distance between House and Workplace

Figure 4 illustrates the percentage of respondents' predominant mode of transportation to the workplace, categorized by different districts. The data indicated that in the northeast district, the respondents employed several forms of transportation for their daily work commutes, including public buses, motorcycles, cars, and employer-provided vehicles such as buses or vans. Motorcycles and cars are solely categorized as private vehicles in vehicular classification, while the other two groups lack this distinction. The study's findings

revealed that motorbikes were the preferred means of transportation among the respondents. Specifically, 29.08% of respondents from the northeastern area and 42.81% from the southwestern district indicated that they utilized motorcycles for commuting to their professions.

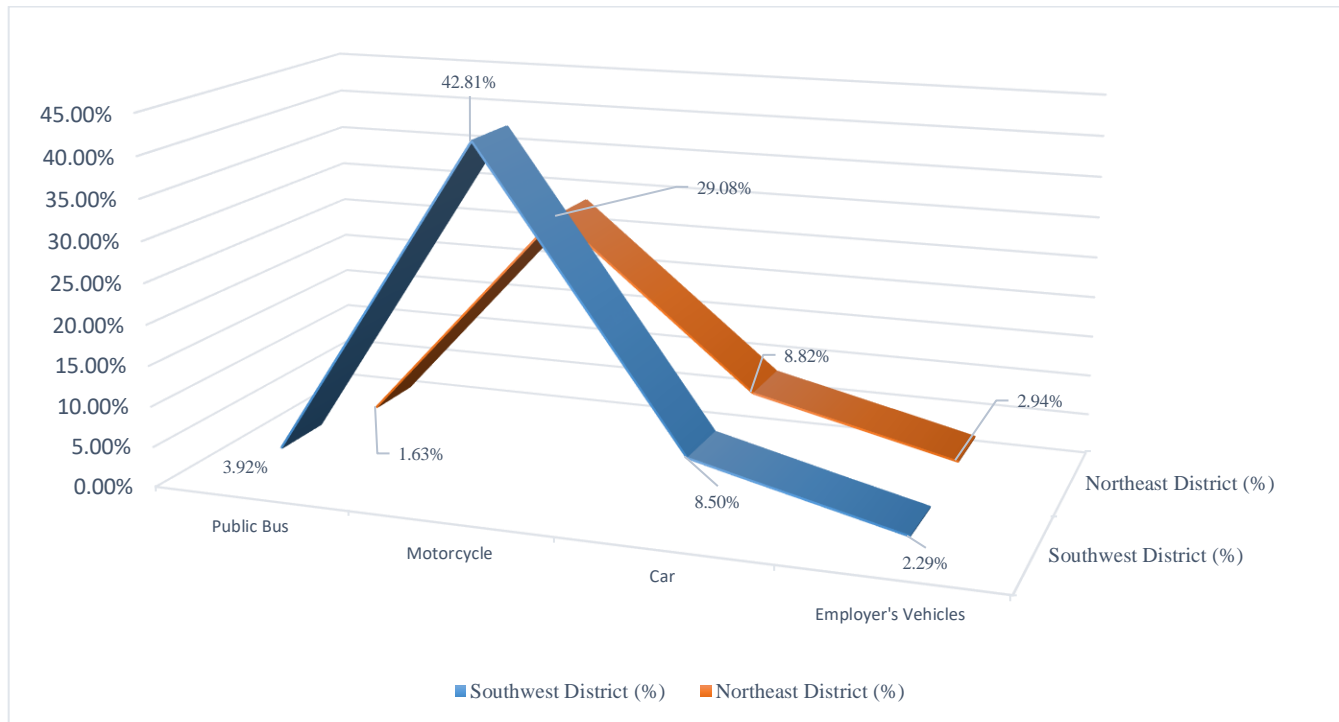


Fig. 4 Percentage of Dominant Transport Mode Choice to Work

Chiu (2023) examined the relationship between motorbike travel and the built environment. The study’s findings indicated a positive correlation between motorcycle ownership and its selection as the principal method of transportation, influenced by population density, distance from residential areas to core business districts, and distance from residential areas to metro stations. This finding indirectly corroborates the study’s conclusions by illuminating the impact of population density in Penang and the spatial distance between residential or workplace sites and public transport stations on the preference for motorcycles as the primary mode of transportation. Chiu and Guerra (2023) clarified that motorbikes are chosen as a method of transportation based on characteristics such as income, age, commute duration, and commuting expenses, relative to other transportation options. This remark indirectly clarifies the study’s outcomes, highlighting the influence of socioeconomic position, especially low-income conditions, on the preference for motorbikes as the primary method of transportation to reduce both trip time and costs.

Additionally, given that public transport is not the primary means of transportation for many respondents, the distance from their residences to the nearest bus stops was examined, as illustrated in Figure 5. A majority of 25.49% of respondents in the northeast district and 39.54% in the southwest district resided approximately 0.5 to 5.0 km from the nearest bus stop. This data indicated that, despite the nearest public bus stop being located 0.5 to 5.0 km from the dwelling, there was a reduced tendency to utilize public bus transit. It is unrealistic to anticipate universal adoption of public transit in a city, even in a highly efficient public transport system like Singapore, as barely 40% of the population utilizes it (Free Malaysia Today, 2018).

The justification for utilizing the public transport system is undermined by the deficiencies in the public transport infrastructure on the island of Penang. The public bus system on Penang Island demonstrates deficiencies in its payment mechanism, which solely accommodates cash transactions and lacks intuitive technology for bus tracking, particularly the Rapid Penang Journey Planner Pulse App (New Straits Times, 2022). The majority of Penangites, particularly those residing on the island, declined to utilize it due to its ineffectiveness. Chee and Fernandez (2013) reported in their research on transport mode selection in Penang, Malaysia, that only 26% of respondents prefer public transport due to negative perceptions surrounding it, and most expressed dissatisfaction with the overall quality of the bus service.

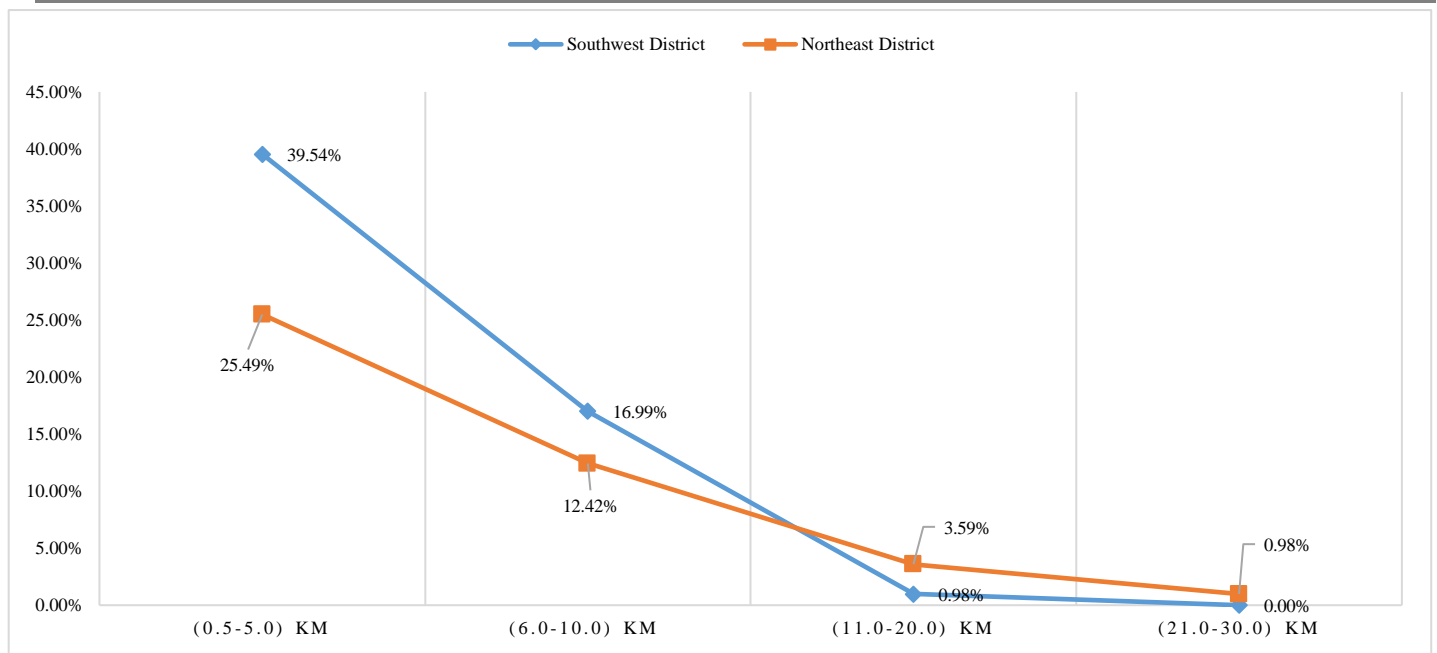


Fig. 5 Distance from home to the nearest public bus stop

CONCLUSIONS

The study’s findings indicated that job accessibility for low-income urban workers in Penang Island has clear patterns of geographical congruence in the northeast district and spatial dissonance in the southwest district for this demographic group. A considerable percentage of low-income urban workers in the northeastern district reside near their employers, largely since the area is the state capital where the city center is situated. Although several residents live near their businesses, the modest distance results in an extended commuting duration. The above situation may develop due to traffic congestion during individuals’ workplace commutes. Penang is characterized by significant traffic congestion, particularly during weekday peak hours. The motorbike is clearly the predominant mode of transportation for most low-income workers in both regions. The distance of the nearest bus stop from an individual’s home does not substantially influence the choice made by most low-income urban workers to utilize public transit for their commute to work. To improve transport alternatives for low-income urban workers, it is essential for employers in both the public and private sectors to collaborate and provide transit solutions linked with a location-based mobility-on-demand system. This is especially vital in Penang, where traffic congestion is a persistent problem during peak working hours. Consequently, there will be a reduction in the number of private vehicles employed by urban workers during peak hours. In conclusion, the spatial alignment of residential and working sites is crucial for enhancing employment accessibility. Improving the sustainability of low-income urban homes can be accomplished by executing specialized social housing initiatives, hence promoting the establishment of sustainable communities. The integration of a strategic approach that acknowledges the connection between the housing and transport sectors is essential for developing effective policies. Facilitating employment access for low-income families residing in suburban regions is critically important. The creation of synergy is crucial for building sustainable communities by constructing livable cities that physically link housing and transportation.

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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. Bollinger, C., Harris, K., & Mills, J. (2023). The affordability gap in major cities: Implications for low-income renters. *Urban Economics Review*, 35(1), 14-35.
5. Cervero, R. (1989). Jobs-Housing Balancing and Regional Mobility. *Journal of the American Planning Association*, 55(2), 136-150. doi:10.1080/01944368908976014
6. Chavez, J., Granger, H., & Thompson, L. (2023). Housing policies and their effects on racial segregation in American cities. *Urban Affairs Review*, 59(1), 7-29.
7. 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) .
8. 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>.
9. 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>.
10. Choi, T., & Davis, M. (2024). Housing cost burdens and displacement in urban centers: A comparative study. *Housing Studies Quarterly*, 31(3), 201-218.
11. 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
12. 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.
13. Davis, A. (2025). Housing instability and its impact on labor force participation. *Housing Policy Debate*, 35(1), 121-140.
14. Eurostat. (2020). Majority commuted less than 30 minutes in 2019. Retrieved from: Eurostat: [https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-202010212#:~:text=Average%20commuting%20time%3A%2025%20minutes,Luxembourg%20\(both%2029%20minutes\)](https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-202010212#:~:text=Average%20commuting%20time%3A%2025%20minutes,Luxembourg%20(both%2029%20minutes)). Accessed on 7th October 2023
15. 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>.
16. 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-may-consider-public-transit>. Accessed on 30th June 2023
17. 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
18. Gerguri, F. (2022). Commuting to Work: The Ideal Distance. Retrieved from Employee Experience Magazine: <https://www.emexmag.com/commuting-to-work-the-ideal-distance/>. Accessed on 7th October 2023
19. Gobillon, L., Selod, H., & Zenou, Y. (2007). The mechanisms of spatial mismatch. *Urban Studies*, 44(12), 2401–2427. <https://doi.org/10.1080/00420980701540937>.
20. 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.
21. Giuliano, G., & Small, K. A. (1993). Is the journey to work explained by urban structure? *Urban Studies*, 30(9), 1485–1500.
22. Ihlanfeldt, K. (1994). The spatial mismatch between jobs and residential locations within urban areas.

- Cityscape, Vol. 1, Issue 1, 219-244.
23. Kain, J. F. (1968). Housing segregation, negro employment, and metropolitan decentralization. *Quarterly Journal of Economics*, 82, 175-197.
 24. Kain, J. F. (1992). The Spatial Mismatch Hypothesis: Three Decades Later. *Housing Policy Debate*, 3(2), 371-460. doi: 10.1080/10511482.1992.9521100
 25. Kain, J. F. (2022). The spatial mismatch hypothesis: A decade of research and policy responses. *Journal of Urban Economics*, 80, 1-15.
 26. Khalil, S., Mariyappan, R., & Ismail, M. (2011). Environmental and social issues of land use planning (LUP) in property development. Universiti Utara Malaysia.
 27. Khazanah Research Institute. (2023). Decent shelter for the urban poor. Kuala Lumpur: khazanah Research institute.
 28. Klein, R., & Woodward, L. (2024). Transportation costs and relocation patterns of low-income households. *Urban Affairs Review*, 60(2), 245-265
 29. 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
 30. 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
 31. 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
 32. Ministry of Transport Malaysia. (2018). National Transport Policy (2019- 2030). Putrajaya: Ministry of Transport Malaysia.
 33. 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
 34. 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.
 35. Penang State Government. (2022). Penang in Numbers 2020/2021. Georgetown: Penang State Government.
 36. Petersen, J., Rivera, R., & McDonald, B. (2023). Job accessibility in urban areas: Barriers for low-income workers. *Urban Studies*, 60(2), 335-352.
 37. 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>.
 38. 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.
 39. REHDA. (2020). Social housing in Malaysia. Retrieved from International Housing Association: https://www.internationalhousingassociation.org/fileUpload_detail_s.aspx?content_TypeID=3&contentID=254956&subContentID=710658&channelID=38488. Accessed on 30th September 2023
 40. 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>.
 41. 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.
 42. 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>
 43. 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
 44. United Nations. (2016). The 17 Goals. Retrieved from United Nations: <https://sdgs.un.org/goals>
 45. 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

46. 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>.
47. 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
48. 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>.
49. 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>.