

# DISTANCE MEASUREMENTS BASED ON ROAD INFRASTRUCTURE INDICATORS CHARACTERISTICS AFFECTING PURCHASING DECISION OF AFFORDABLE HOUSING IN NORTHERN STATES OF PENINSULAR MALAYSIA

**Muhamad Hilmi Mohamad @ Masri<sup>1\*</sup>, Mohd Farid Sa'ad<sup>2</sup>,  
Najma Azman<sup>3</sup>, Mohd Hasrol Haffiz Aliasak<sup>4</sup>, Mohd Khairul Afzan Mohd  
Lazi<sup>5</sup> & Mohammad Fitry Md Wadzir<sup>6</sup>**

**\*Corresponding Author**

*<sup>1,2,3,4,6</sup>Programme of Estate Management, Department of Built Environment  
Studies and Technology, College of Built Environment Studies  
Universiti Teknologi Mara, Perak Branch, 32610,  
Seri Iskandar, Perak, Malaysia*

*<sup>5</sup>Geotechnic and Transportation Department, Faculty of Civil Engineering,  
Universiti Teknologi Malaysia, 81310, Johor Bahru, Johor, Malaysia.*

[muhamadhilmi@uitm.edu.my](mailto:muhamadhilmi@uitm.edu.my)

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## ABSTRACT

*The research is aimed at distance measurements based on road infrastructure indicators characteristics affecting the purchasing decision of affordable housing in northern states of Peninsular Malaysia. The objectives of this research are to measure road infrastructure indicators relating to distance and affordable housing and to analyse the relationship between road infrastructure indicators on distance and affordable housing. Structural Equation Modelling was utilized in this research for analysis and findings whilst discussions conducted on significant level measurement based on each indicator. The significance of the research is to help everyday commuters in making better decision-making processes to purchase affordable houses that they are comfortable with in their daily travels. Affordable houses at a closer rate therefore can contribute significant positive effects on pollution*



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*emissions by private vehicles travelling long distances daily thus achieving greener results.*

**Keywords:** *Road Infrastructure, Distance, Affordable Housing, SEM, Northern States*

## INTRODUCTION

This research aims to gather information relating to distance measurements based on road infrastructure indicators characteristics affecting the purchasing decision of affordable housing in northern states of Peninsular Malaysia. Road infrastructures are aspects that affect everyday commuters, as these commuters must travel long distances between their houses and their workplaces. The main scope of the research utilized case studies on urban areas in Malaysia, and therefore the research was specifically tailored towards the Northern States in Malaysia and was hoped to give a better understanding for both researchers and the readers of this paper. Mitra and Saphores (2019) in their research already showed that commuters need to commute long distances from their houses to their workplaces, and this is due to them trying to get the best houses that can be bought. The researcher sees this as a statement that can be supported by a general hypothesis that houses that are further away from the city centre and urban areas tend to be lower in price and can be bigger in terms of their built-up area and land area. Houses in urban areas were typically seen as vertically built and comprised of high rises that offered smaller built-up areas with no available land area for their owners. This statement was also supported by (Paetzold, 2019) as the theory is that preferable and comfortable houses have a trade-off in terms of their distance that was further away and results in longer commuting time daily. This urban sprawl theory is happening all over the world, including various Western, developed, developing and third-world countries as shown in the research of Babin & Anderson, (2014), Bachmann et al., (2022) and Huang et al., (2018). Based on these studies, the researcher wants to see and measure the condition in the local context of the country of Malaysia and gather data on areas that were usually not researched before. These were highlighted in previous research such as Jaff & Hamsa, (2018) which conducted their research in the Klang Valley specifically Kuala Lumpur and found out the traffic levels, number of commuters and the stress level faced by these commuters. Other than that

Saleh et al., (2017) and Majid et al., (2014) also gives good input relating to level of affordability of houses, stress level faced by commuters, and distances measured commensurate with both the above indicators. This study began with conducting a comprehensive literature review of previous research and examined the indicators and factors that may be utilized and evaluated in the northern parts of Peninsular Malaysia. It then identified a void or the limited attention to the northern states. Thus, the study aims to address this deficiency by conducting case studies. Four primary cities were chosen: Ipoh, Taiping, Georgetown, and Sungai Petani.

## **LITERATURE REVIEW**

As highlighted in the above introduction, the researcher first of all needs to outline the suitable indicators that can be adopted in the research, and therefore, a thorough literature review needs to be conducted. Masri et al., (2022) have provided a comprehensive literature review regarding the road infrastructure indicators in their Systematic Literature Review, and the researcher has decided to adopt the indicators available inside the research into this paper. The seven main themes that will be used are traffic number, cost of commute, vehicle mobility, travel time, workplace distance, road network distance, and lastly, house desirability. Besides these indicators, the researcher also needs to conduct a review of other previous research conducted to give a better perspective on the upcoming methodology and analysis as well as the findings of the research.

The first indicator adopted was the traffic number and amongst researchers that have looked into this issue were Zhao & Wei, (2019), (Rahim et al., 2023) and Ossokina & Verweij, (2015). The first author states that house prices were dictated by high traffic numbers in the city centre. The researcher sees this with the agreement as urban areas with a higher number of traffic resulted in congestion, and commuters will be more likely to be stressed out which affects their cognitive decision-making process, and be weary physically and mentally afterwards. This is one of the main reasons why this research was conducted, as human beings living in urban areas may not have a choice in terms of traffic number, road infrastructures, and expressway provision available to them as this was not under their direct control in the first place (Mohamed Anuar & Abdullah, 2022). The

second author Ossokina & Verweij, (2015) states that urban house prices can increase by around 1.4% if traffic density were reduced by 50%. This statement was mainly suited by urban areas in perpetual gridlock, and suddenly received traffic reduction for factors such as higher public transport usage and opening of new roads and expressways nearby. Nonetheless, reducing traffic density may need to be implemented at the executive level of the country or state, and may not yield results in short amounts of time (Saleh et al., 2017). One of the best options for humans to purchase houses is to find affordable houses at a longer distance than they have to commute. This was also supported by M. H. M. Masri et al., (2021) that showed commuters prefer to have larger houses, with good neighbourhood qualities with lower traffic for a sense of privacy.

Another set of themes worth considering is the actual cost of commuting daily. Fluctuating global fuel prices, adoption of green renewable energy vehicles such as electric vehicles, fuel subsidies, toll prices, cost of private vehicles service and maintenance, and the availability of public transport in Malaysia a major indicators of the cost of commute, and worthwhile to be included in the literature review discussion. Memon et al., (2021) have suggested that in their research for the cost of commute to be lowered, public perception of public transport must be improved and their ridership increased. But this statement may not be suitable for the Malaysian context, as fuel subsidies were still high and public transport provided may not be as efficient as were available in developed countries. Shokoohi & Nikitas, (2017) also stated that public transportation in Malaysia needs to be improved, for green transportation such as cycling can be incorporated together. Therefore, the researcher sees that private vehicle ownership and usage in Malaysia is still high as they provide comfort, ease of mobility and personal space to the users, thus affecting a large amount of their daily expenditure for travel. This was evidenced by the statistics generated by M. H. Masri et al., (2022) and (M. H. Masri et al., 2023) stating that private vehicles amount to 69% of the total number of human population in Malaysia.

The third theme to be examined is the vehicle mobility in Malaysia. The country possesses a lot of expressways such as the North-South Expressway, West Coast Expressway, East Coast Expressway, and various federally managed routes such as Route 5 that provide good intercity

connectivity. In urban areas such as the Klang Valley, the availability of smaller scale expressways such as AKLEH, DUKE, MEX and various others also contributed towards the high private vehicle usage and ownership (Mohamed Anuar & Abdullah, 2022). Koryagin, (2018) states that private vehicles will always be more advantageous in car-centric policies inside developing countries unless they are reduced in terms of their mobility such as traffic congestion. Theisen & Emblem, (2021) in their research also highlighted vehicle mobility through the opening and upgrading of expressways helps to disburse traffic placement in urban areas to the outer areas, thus helping commuters purchase houses that were further away before, but deemed to be more desirable when they can use their vehicles in higher mobility now.

The next theme to review is the travel time for commuters using their private vehicles. Ewing et al., (2015) in their research showed that in the United States, townships with good accessibility result in shorter travel times between them. In Malaysia, this situation was seen as not suitable especially in the Klang Valley as townships were located near to each other, and even though the distance in kilometres was small, their travel time was higher due to congestion levels in these townships. This statement was further supported by Koryagin, (2018) that places that are further away from the city centre result in higher travel time as compared to housing neighbourhoods near city centres. These situations can be shown and evidenced nowadays by navigational software such as Waze and Google Maps, showing the traffic congestion level, and the actual time needed to traverse from the inner city to the outskirts of the city centre. Tokunova (2018) also states that due to higher distances, and not well-supported public transport connecting them, results in higher social tension for people living in further away places.

The next aspect to be considered as part of the indicators were the workplace and road network distance. This is an important element to be considered as the study aims to ask respondent about the actual distances travelled between their houses and their workplace, thus this issue needs to be reviewed first. Rahman et al., (2021) in their study showed there were significant relationships between transportation accessibility and the actual rent needed to be paid by renters. Other than that, the threshold for affordable housing in Malaysia was also seen at around RM300,000 and with a household income of around RM5,000, but this greatly differs among

the states (Sohaimi, 2022). For the context of this research, the indicators were suitable to be incorporated and adopted for potential house buyers in the higher distance range houses. Another research conducted by Hamdan et al., (2014) also showed that living further away erodes the residents' quality of life. The researcher agrees with this as urban areas that are further away require more effort to travel, and daily, may be detrimental long term towards their wellbeing, not to mention the effect towards the environment with pollution from fossil fuels being combusted by private vehicles. This has led the researcher to adopt both indicators as they were deemed to be important and can be improved in the future by policymakers in the country. All the above indicators were reviewed, discussed, and then compiled into the theoretical framework in Figure 1 below.

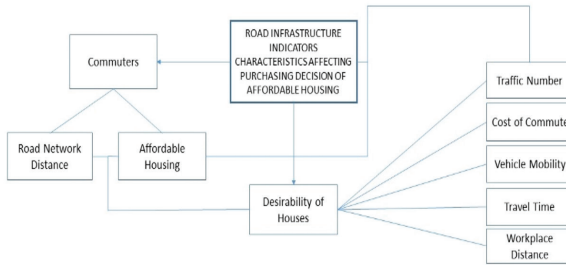


Figure 1. Theoretical Framework from Literature Review

Source: Author

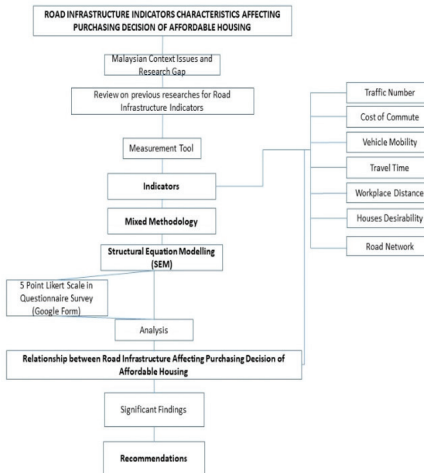


Figure 2. Research Design Process

Source: Author

In figure 2 above, the whole research design process was outlined to compile and collate all the data and analyse them to measure the relationship between road infrastructure affecting the purchasing decision of affordable housing in the northern state of Malaysia. The states being sampled were Perak, Penang, and Kedah. The urban townships where the survey was distributed were Ipoh, Taiping, Georgetown, and Sungai Petani. The research focuses on these four townships as they were the main city centres in the northern part of Peninsular Malaysia. This is also due to the limitations in terms of time, logistics, and financial means. Based on this, the sampling conducted was deemed sufficient to obtain significant results. The sampling obtained was based on the inclusion criteria of daily commuters travelling from their houses to their workplace. A pilot study of around 50 respondents was also conducted before and obtained significant results needed to further the research into this paper. The total number of respondents for this paper is 246 respondents, and the main instrument being used is a questionnaire survey with the utilization of a 5-Point Likert Scale. The collection process includes going on-site on the four townships and asking respondents directly to fill in the Google Form format of the questionnaire survey. To supplement the number of respondents, the survey was also distributed online on social media platforms of residents in the townships. The overall questionnaire utilizes the seven main themes highlighted above, The data collection process takes about six months to be completed and subsequently were analysed by using the Structural Equation Modelling protocol. SEM was generated by using the AMOS Graphic software, and the relationship between variables was able to be generated and shown its significance. The main variables being analysed were traffic number, cost of commute, vehicle mobility, travel time, workplace distance, house desirability and the road network. Based on the relationship found from the analysis, the significant relationship was discussed in the findings and resulted in recommendations for the research to be proposed.

## **ANALYSIS AND DISCUSSION**

The researcher has compiled and analysed all the relevant data collected from all 246 respondents, through the Google Form Questionnaire Survey disseminated in the locality of Ipoh, Taiping, Penang, and Sungai Petani, and has obtained the following results. All the relationships that were derived in

the theoretical framework were measured, and their overall results including the level of significance were outlined in Figure 3. The relationship level was then compiled together as an SEM analysis report in Table 1. From the analysis reported in the table, the researcher has gathered findings on variable relationships that were significant and serve as an indication of changes that will happen if areas were improved and changed.

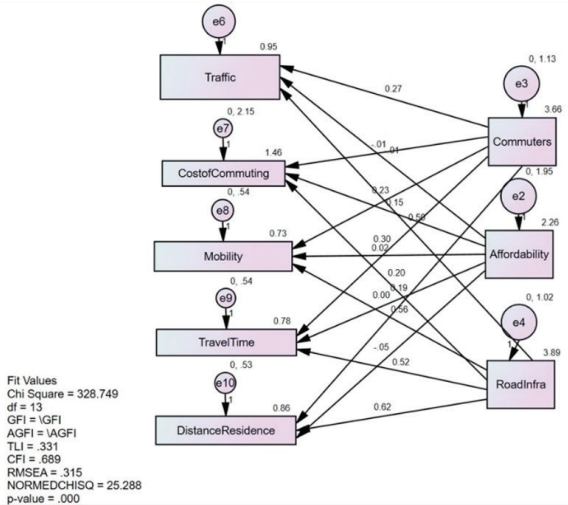


Figure 3. SEM-AMOS Relationship Diagram

Source: Author

Table 1. SEM Analysis Report

Construct	Item	Loadings	AVE	CR
Traffic	Commuters	.273	.108	.181
	RoadInfra	.500		
	Affordability	-.005		
CostofCommuting	Affordability	.152	.022	.038
	Commuters	-.014		
	RoadInfra	.203		
Mobility	Affordability	.022	.123	.200
	Commuters	.229		
	RoadInfra	.561		
TravelTime	Affordability	-.002	.119	.201
	Commuters	.299		
	RoadInfra	.518		
DistanceResidence	Affordability	-.054	.142	.183
	Commuters	.193		
	RoadInfra	.621		

Source: Author



The researcher has compiled and analysed all the relevant data collected from all 246 respondents, through the Google Form Questionnaire Survey disseminated in the locality of Ipoh, Taiping, Penang, and Sungai Petani, and has obtained the following results. All the relationships that were derived in the theoretical framework were measured, and their overall results including the level of significance were outlined in Figure 3. The relationship level was then compiled together as an SEM analysis report in Table 1. From the analysis reported in the table, the researcher has gathered findings on variable relationships that were significant and serve as an indication of changes that will happen if areas were improved and changed.

The first relationship that was measured in the table was the number of commuters and the number of traffic that produced a significant level of 0.273. The analysis showed that when the variables labelled Commuters go up by 1, Traffic goes up by 0.273. This indicates that the respondents believe that daily commuters using their private vehicles from their houses and workplaces, will contribute towards traffic levels that were higher. This condition was already shown in the literature review conducted above, and the researcher believes that the relationship between the two will ultimately affect the commuter's decision-making in purchasing houses that were considered affordable to them. The result also showed that the perception of people using private vehicles will contribute towards higher congestion levels and put further strain towards the road infrastructure available in the northern region of peninsular Malaysia. This perception goes well with urban sprawling theories and was shown and measured not only in Malaysia but all over the whole region experiencing rapid urbanization and transformation of rural areas into sub-urban or urban areas. In Malaysia, the urban mainstream media have already reported that higher ownership of private vehicles, will mean that commuters will use these vehicles daily, especially on their travels to workplaces. This finding helps strengthen this theory and can be adopted by the stakeholders in the country.

The second relationship that were measured in the table were the road infrastructure and the number of traffic that produced a significant level of 0.500. The analysis showed that when the variables labelled RoadInfra go up by 1, Traffic goes up by 0.500. It was already established that this is a significant level of relationship, and it was shown with the higher loading number. The discussion on this is that when key stakeholders such as the

government or private operators of expressways increases the capacity and infrastructure of the road network system, respondents believe that this will also increase higher traffic level. This situation seems counterproductive with the goal of stakeholders in providing better road networks with higher capacity, but it shows how private vehicle-centric residents in the country can be. The findings also showed that respondents were inclined to use their private vehicles if they felt their travel was justified and improved with all road infrastructure additions, but the actual result proved differently than the anticipated effect. In this case, the concept of Transit Oriented Development will be much better in reducing the effect of higher traffic levels, and the push for public transportation usage should be increased, thus improving this situation long term.

The third relationship that was measured in the table was vehicle mobility and road infrastructure that produced significant level of 0.561. The analysis showed that when the variables labelled Mobility go up by 1, RoadInfra goes up by 0.561. This result also showed consistent results with the perception above in that the stakeholders will be providing more road network systems and capacity when private vehicles increased in terms of their mobility. This situation and perception sit nicely for respondents in the northern states of peninsular Malaysia, as many areas were still considered rural areas, and travelling into the city centres requires higher mobility for commuters. Respondents feel the need for road infrastructure to always correspond with their travel ability, and this in turn helps to open rural areas for development into urban areas. With this situation, eventually, these rural areas will turn into urban areas, but the stakeholders of developers and the authorities need to anticipate the increase in residents' number, and providing more infrastructure that will be leaned heavily into public transportation. If this situation can be anticipated and taken proactive measures earlier, the urban problems findings highlighted above can be reduced and benefit residents positively in the future in their affordable housing decision-making.

The fourth relationship that was measured in the table was the travel time and the road infrastructure which produced a significant level of 0.518. The analysis showed that when the variables labelled TravelTime go up by 1, RoadInfra goes up by 0.518. The analysis conducted showed the upcoming development of the country, especially in the northern states as the stakeholders such as developers and the government try to open more

areas for development in the outskirts of the city centres and do affect the respondent's perception of this relationship. This situation can also be attributed to the lower cost of development to open rural areas as compared to improving urban areas for development, but the situation is countered with more emphasis on the road networks and infrastructure that were increased for the commuters.

The fifth relationship that was measured in the table was the workplace distance and the road infrastructure which produced a significant level of 0.621. The analysis showed that when the variables labelled DistanceResidence go up by 1, RoadInfra goes up by 0.621. This last relationship being analysed and discussed showed a significant relationship between distances needed to be travelled, and how the road network and infrastructure were increased. This is in due part to Malaysia as a developing nation, and the survey was carried out in the northern states that have further distances between their city centres. Rural areas in the northern states were still abundant thus it showed as an important factor for the respondents there to have better accessibility even with higher distances needed to be travelled daily.

## **CONCLUSION**

Based on the results above, it can be shown that the northern states of peninsular Malaysia experienced development and growth that were different from the rest of the country, especially when compared with an urban area of the Klang Valley. Findings showed that commuters in this part do not mind travelling greater distances with higher costs if it is compensated with better road infrastructure networks. The subject of decision-making in purchasing affordable housing was not affected much by distances travelled here. Therefore, the researcher can give the conclusion that the main highlight of the research showed that if affordable housing can be provided, the residents would not mind travelling long distances, paying higher costs, and travelling on roads with higher commuters and congested. Another finding also highlighted the positive effect of lower emissions by private vehicles when houses were closer in terms of their distance from the workplace.

The recommendation for further research is that the indicators and variables from this research can be adopted and measured by the residents of Klang Valley in the future. The researcher also recommends that a higher sampling be conducted, with the application of specific city centres such as Shah Alam, Kuala Lumpur, Petaling Jaya, Subang Jaya, Klang and others to be incorporated into future research. Based on this, the initial objectives to measure road infrastructure indicators relating to distance and affordable housing, and to analyse the relationship between road infrastructure indicators on distance and affordable housing were achieved and the results and reporting were reported as in the above section. All the efforts of the team members and the responses given by respondents were much appreciated.

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## **AUTHOR CONTRIBUTIONS**

All authors contributed to the design of the research, the questionnaire, and the write-up. The online survey, data cleaning and tabulation was undertaken by Universiti Teknologi MARA. All authors have read and approved the final manuscript.

## **CONFLICT OF INTEREST**

The authors declare no conflict of interest.

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