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CREATING WALKING LED TRANSIT STATIONS FOR WOMEN IN MALAYSIA

Yong Adilah Shamsul Harumain[1], Nur Farhana Azmi [2], Suhaini Yusoff[3]
[1,2,3]Faculty of Built Environment, University of Malaya,
Kuala Lumpur, Malaysia

E-mail: adilah_shamsul@um.edu.my

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ABSTRACT

Transit stations are generally well known as nodes of spaces where percentage of people walking are relatively high. The issue is do more planning is actually given to create walkability. Creating walking led transit stations involves planning of walking distance, providing facilities like pathways, toilets, seating and lighting. On the other hand, creating walking led transit station for women uncover a new epitome. Walking becomes one of the most important forms of mobility for women in developing countries nowadays. Encouraging women to use public transportation is not just about another effort to promote the use of public transportation but also another great endeavour to reduce numbers of traffic on the road. This also means, creating an effort to control accidents rate, reducing carbon emission, improving health and eventually, developing the quality of life. Hence, in this paper, we sought first to find out the factors that motivate women to walk at transit stations in Malaysia. A questionnaire survey with 562 female user of Light Railway Transit (LRT) was conducted at LRT stations along Kelana Jaya Line. Both built and non-built environment characteristics, particularly distance, safety and facilities were found as factors that are consistently associated with women walkability. With these findings, the paper highlights the criteria which are needed to create and make betterment of transit stations not just for women but also for walkability in general.

Keywords: *Transit Stations; Walkability; Walking; Women Transport*

INTRODUCTION

Walking is the primary means of movement to do any activity and it is the most natural way for most people to go about their daily lives. However, as technology evolves people find and invent ways to acclimatize the fastest ways to get from point A to point B. As a result, currently people find walking not as the best way to move but as another option of movement other than using some kind of a vehicles. But, why is it imperative to apprehend motivations of women to walk? In the world we live now, the percentages of women population are higher in many developing countries. In addition, more women are involved in activities outside their comfort homes to help upgrade the financial status of their families. More women are seen leading in companies, working in factories, studied until higher institutions level and getting involved in the community events. As a result, more women are seen travelling outside their homes and thus it is important to understand how, why and what motivates women to walk.

The ability to walk among men and women is hard to prove with a small sampling especially if we are trying to make an important statement about walkability. A woman may be fit for walking but for a certain reason related to safety, women choose not to walk. According to Jensen et al. (2017), males always outnumbered females in choosing walking as a mode of transportation. This is further supported in Hatamzadeh et al. (2017) study where girls are less motivated to walk compared to boys in all age groups. According to Abley (2005). walkability can be defined as "the extent to which the built environment is friendly to the presence of people living, shopping, visiting, enjoying or spending time in an area". Per Gebel, K. et.al (2009), walkability refers to how 'friendly' an area is for pedestrians. Compact, connected urban environments with a mixture of densities and land uses create shorter distance between desired destinations, thus, this encourages people to walk for transportation. People tend to walk if it is easier, faster, or cheaper than to drive. In a high-density area, people are inclined to walk instead of driving when the road is congested and lacking of parking spaces. People tend to walk in a low-density area if the area is near water; the natural surroundings are quiet, and the view changes continually (Untermann, 1984).

Factors affecting walkability usually consist of land use mix, street connectivity, residential density, and visual appeal. As supported by Golan et al. (2019), walkability is influenced by built environment features such as pedestrian amenities, land-use mix, cleanliness and proximity to destinations. Adlakha et al. (2015) further highlighted built environment features that are attractive and diverse will support walking and eventually, the use of public transit. Hence, this the more reason to support compact city growth and mixed uses development. Other than these physical built environment characteristics, intangible factors including safety, security and sense of being presence in a place where hundreds of eyes watching also do influence people walkability. It is unlikely where places are gloomy, dark and quiet motivate people to walk. The influences of these non-built environment factors however have not received adequate attention in the literature (Adkins et al. 2017). As argued by Golan et al. (2019), urban walkability is largely influenced both by built environment features and non-built environment factors such as pedestrian demographics. The authors further argued that factors influencing women's walkability differ from those affecting the men's. Ton et al. (2019) study also demonstrated that both physical and non-physical determinants do influence walking. This paper attempts to address this gap by examining both built and non-built environment surveys factors that influence women to walk at the transit stations. The objective is to understand the built environment criteria of the transit station, what is important and what needs to be improved. This is crucial as street improvements enhance the number of female pedestrians (Jensen et al. 2017). The aim is to promote walking among women when travelling instead of driving personal vehicle. Indirectly, this research further attempts to promote sustainability and the nation aspirations in intensifying the percentage of public transport users, while establish a reference for better understanding toward the needs in promoting walkability especially at transit stations.

WALKABILITY FACTORS

One of the main criteria in promoting walkability is the walkaways. According to Nelson (2015) pedestrian walkways, the design of road networks and public facilities are vital in ensuring that people walk around an area. What is more, the minimum size of pedestrian walkways in a

residential area should be at least 1.5 meter (5 feet) to provide a comfortable walking place for walkers to walk. In neighbourhood centre areas or high-density areas, the size of pedestrian walkways should be bigger than the recommended size of pedestrian walkways in a residential area (Golson et. al, 1974). Pedestrian walkways also should be equipped with natural landscapes and big trees to give shade to walkers when walking. In addition to this, Park et al. (2015) highlight walkaways amenities as one of the crucial elements that create more walking-conducive walkability which eventually increase the chance of people choosing walking over driving to the transit station. The pedestrian connectivity must be a continuous network. Additionally, the location of curb also should be decreased so that there are many 'free barrier' pedestrian walkways provided. As supported by Adkins et al. (2017), barriers to walking should effectively be removed to improve walkability.

In addition to the design, other eminent benchmark to motivate walking is safety. Safety is vital in walking especially for women depending on age. This is described in many cases; especially incidents related to women while walking alone are worrying compared to cases involving men. Among the reported cases are theft, harassing, grabbing and sometimes this happens even when the women are together with their spouse or friends. Due to this, security of transit stations has been improved to give more safety and security. The approach of 'crime prevention through environmental design' (CPTED) is an example of crime prevention through built environment and it can be used to reduce the crime rate in an area. In Malaysia, this approach can be referred to in the 'Guidelines for Crime Prevention through Environmental Design' published by the Federal Department of Town and Regional Planning of Malaysia (2012). Moreover, a 'free barrier' walking surroundings also can encourage people to walk. Accessibility is another factor that influences walking. Increasing attention provides interaction between land use planning and travel behaviour, especially the role of heightened accessibility. The elements, which need to be considered in improving safety in walking include road design, traffic intensity, and speed, will continually change pedestrian pathway, the physical and mental state of both pedestrian and drivers, weather condition, and time of day (Krambeck 2006; Ton et al. 2019). Bauman, et.al. (1996) found that perceived safety was one of the most important environmental qualities for walking. Although Hawthorne (1989) stated that safety from crime was one

of the most appealing features for walking, dangerous street crossings were perceived as an unappealing factor.

Individual behaviours are based on a wide variety of variables including time, effort, gender, weather, distance, topography, and built environment factors (Spoon, 2005). Women spend more time scanning the sidewalk than men. The study also reported that pedestrians grant more space to other pedestrians if walking in a group than if they walk individually. Moreover, male pedestrians require more space to walk than female pedestrians. A study by Krizek and Horning (2012) showed that there were four socio-demographic characteristics that might influence walkability; length of stay, gender, age and household income. In addition, the length of residence in an area do influence perception of walking distance. In terms of gender, women perceive walking distance differently than males. Besides, age also do influence the user's perception. Age also influences walking time and speed, which will influence the measured accuracy of individual perception. Walking behaviour has a close interrelationship with walkability. Walking behaviour can be considered as one of the most important factors in measuring walkability level (Fehr and Peers, 2015). According to Shahrol Mohamaddan (2010), walking behaviour refers to how people perform their walking in terms of time taken for moving from one place to another, deciding the walking direction, avoiding collisions, and other behaviours that can arise during the walking period. Different types of people have different types of walking behaviour.

A transit service is ideally to be located within 10 minutes of walking time or 800 meters of walking radius, while, a bus stop should be located within 5 minutes walking time or 400 meters of walking radius (Spoon 2005). A strategic location for transit services is a high-density residential area with mixed land use that focuses on a main road and centralized parking spaces that can encourage the usage of public transportation. According to Barton et al. (2003), the average walking journey is 1 km, and not many people walk more than 2 km. Therefore, it is possible that walking motivation declines due to the distance between the station and destination.

METHODOLOGY

The methodology used in identifying walkability factors that motivate women to walk at transit stations in Malaysia involved a review of literature on the built and non-built environment features that influence walkability. Different kinds of materials used include journals, books, official documents published by government, and other mass media outputs. The review is subsequently complemented by a questionnaire survey. The survey was conducted around Light Railway Transit stations along LRT Kelana Jaya Line for about 3 months. 562 questionnaires were distributed, and the researchers had the opportunity to meet with the respondents face to face. Stratified random sampling was used to select female LRT users of any age and races. The survey was conducted during morning and evening peak hours to get a good number of sampling who were willing to participate. The answers in the questionnaire survey were analysed using Statistical Package for the Social Sciences (SPSS) software. The important questions that this paper seeks to address are on the influence of distance, safety and women's needs in the public transportation on walkability. This paper used independent-samples T-tests to evaluate the statistically significant difference correlations between the variables. T-test analyses were also used to compare the groups' means. T-test analysis interprets statistically significant differences value using p-value (Sig(2-Tailed) value). The rule is if the p value is equal or less than .05(p= <.05), there is a significant difference in the mean scores between the two variables. If the p value is above .05 (p= <.05), the situation is reversed.

RESULTS AND DISCUSSIONS

Distance

This paper presents the findings of a study by examining distance as a main element to determine walking motivation to transit stations. A study by Barton et al. (2003) defined the distance as catchment area radius (walking radius). It was found that 52% was the highest percentage for distances less than 100 meters from home to transit services or public transportation. The results show that distances of 101 to 500 meters recorded 42.2 %, with 5.9 % for distances over 500 meters (Table 1).

Table 1: Distance Walking to LRT Stations

Distance	Frequency (N)	Percentage (%)	Valid Percent	Cumulative Percent
<100m	292	52.0	52.0	52.0
101m-500m	237	42.2	42.2	94.1
>500m	33	5.9	5.9	100
Total	562	100	100	-

Source: Author

Per the results in Table 1 above, distance is also closely related to how far women will walk to transit services from their origin or destination. From the result, it can be concluded that majority of the respondents choose to walk around the area. Some of them felt that walking around an area is a popular physical activity. However, distance walking depends on the elements that contribute and encourage women to walk, such as good facilities, barriers, transit, and easy accessibility for the purpose of trips. This also depends on the presence or lack of obstacles such as space, pedestrian space, and visual appropriateness. The time taken for walking will be shorter if the space to walk is free from barriers. This result corresponds to Adkins et al. (2017), Adlakha et al. (2015) and Golan et al. (2019) where they stated that lively and barrier-free streets inspire more walking.

Safety

In Table 2, the observed frequencies from the current data file are presented, showing that 98 out of 562 (17.4%) respondents felt very safe when walking at transit stations. The second variable shows 379 (67.4%) respondents reported feeling fairly safe while 85 (15%) felt very unsafe. In this case, 187.3 cases were expected for whole level of safety, while 98 were observed.

Table 2: Distance Walking to LRT Stations

Level of safety	Frequency (N)	Percentage (100%)	Expected N	Residual
Very safe	98	17.4	187.3	-89.3
Fairly safe	379	67.4	187.3	191.7

Very unsafe	85	17.4	187.3	-102.3
Total	562	100	-	-

Source: Author

The test statics in Table 3 reports the results of the Chi-Square Test, which compares the expected and observed values. The results show statistical significance at a value p = <.000. According to the previous subtopic, safety plays an important role as it encourages people to walk around an area especially for the purpose of a trip. Based on the results, the majority of the respondents chose fairly safe because it is lacking in proper lighting at the pedestrian pathway that connects the stations with the buildings and areas. As argued by Jensen et al. (2015), poor amenities make a street low-walkable and attract fewer pedestrian. The on-going construction nearby the LRT stations further decreases visibility, especially during the night, while temporary construction barriers isolate certain areas from the main road. Furthermore, there is a lack of direct connectivity and flow with the pedestrian pathways to guide pedestrians from any point of direction to the station, except for buildings that are located nearby stations.

Table 3: Distance Walking to LRT Stations

	Level of safety
Chi-Square	294.601a
df	2
Asymp. Sig.	.000

Source: Author
*0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 187.3.

KH Coder is an analysis tool based on the Co-occurrence network that describes the relationship between the key words that analyse words related to the survey key objectives. This method of analysis highlights high-frequency words to represent greater insight into relationships and interconnections with the rest of the network. The results show that co-occurrence network quantified the importance of women's needs in the public transportation based on the key words that reflect women walking at the transit stations. Based on the results, researchers revealed that the red circle has a strong relationship with and is significant for key words such

as safety, women, provide, facilities coach, security and efficient (Figure 1). A larger node or size of circle shows higher frequency words. This is because the lines or edges are thick and connected between each element. Furthermore, another circle consisting of systematic and timeliness also shows a strong relationship and is significant to women's need. This clearly indicates that safety and security are important for women walking for the purposes of trips such as work and social activities. The LRT station has provided various facilities for the convenience of women riders such as space to put strollers or trollies for shopping and extensions for telephone charging. However, it still needs improvement based on the safety requirements. Furthermore, street pathways and safe pedestrian cross play important roles in term of safety, security and comfortable while walking around an area.

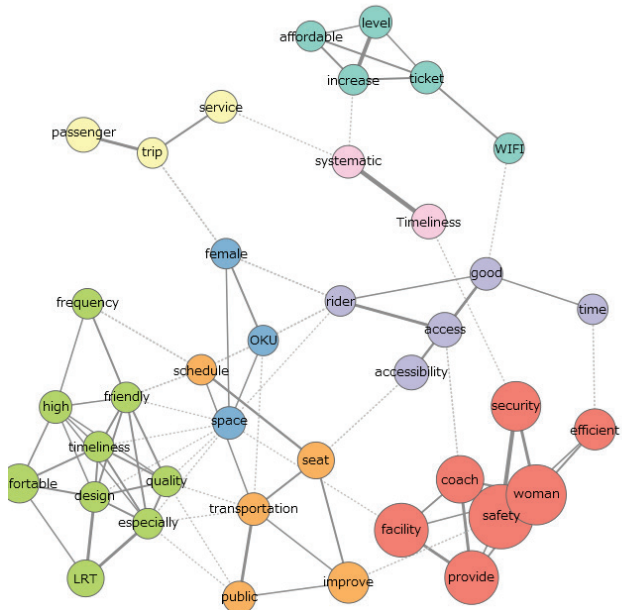

Figure 1: Higher Frequency Words with Larger Nodes Included Women, Security, Provide, Safety, And Coach
Source: Author

The analysis shows a significant and strong co-occurrence network relationship between certain words. Coaches should be considered as an

important aspect. Women using the public transportation such as LRT appreciated ladies' coaches for their convenient and safe environment for female riders. Based on the behaviour and perception on women's mobility in the case study, it was found that most female riders need more separated coaches because female riders felt insecure in the presence of male riders in the LRT. Terms referring to other circle or nodes in the analysis including improving, comfortable, personal and lighting also had strong relationships and connected key words to describe the strength of each elements. As mentioned previously, safety is one of the most important elements in the context of the factors used to measure walkability among women. This should be strongly considered for future transit development. Supporting the strong relationship between the safety and security in the result co-occurrence network based on the Figure 1, the researcher observe that there are several issues on safety and overcrowding at the LRT station that may influence the risk of being victims while using the public transportation, especially among women riders.

Facilities for Women

Women's walkability is significant and closely related to behaviour that encourages women to walk. Their walkability in daily life maybe differs from men (Golan et al. 2019) because women prefer to walk for many purposes, including house errands, services, and social activities. Based on the survey, the results of a co-occurrence network analysis have shown that a majority of the respondents highlighted words related to facilities in the LRT. This demonstrates that facilities in the LRT should be improved and that a privation of facilities also would contribute to the level of comfort of riders. For example, non-functional lighting or not enough lighting at the station caused a high level of risk to women safety and security. This is in agreement with Park et al. (2015) who highlighted walkaways amenities as crucial element that create more walking-conducive walkability which eventually increase the chance of people choosing walking over driving to the transit station.

CONCLUSION

The development of transportation systems has long been recognized as crucial, not only in terms of enabling individuals to travel further and faster to their destination of choice, but also in terms of the impacts it has on societal and economic growth. A better-connected transportation system provides opportunities for travelling across various locations, thus removing physical boundaries for individuals to access and connect to their destinations of choice. Fewer women than men have ownership of or access to private vehicles, and less access to better public transportation modes. As a result, women's travel modes may be limited to public transport with poor service, and with higher incidences of crime. Women who work in places with less availability and access to public transport are more vulnerable to victimisation. In conclusion, how do these findings really change anything? Creating a walking led transit stations for women is not just about providing necessities. But it is an eye-opener to the researchers that there are a lot of happenings at transit stations that need more than just planning standards and guidelines. This research found fundamental issues related to built environment are vital in changing behaviour to walk. Criteria of distance are not confined to quantitative measures but they also involve visibility and creating pathway design that is able to walk. Design of pathways also is not just about size and pathway materials but also include lightings because people still walk at night. Fear of crime affects women's travel patterns. Women adapt their travel behaviour to avoid or minimise the risk of being victimised. In order to encourage the use of public transportation, the safety needs of women must be addressed. In addition, safety criteria are also vital in creating walking led transit stations as it changes perception and giving confidence to use public transportation. It is crucial to design better transit stations that can advocate safety and motivate walking. It can be determined that the average women taking transit is willing to walk a quarter mile to access public transportation services and operate with higher frequencies and over longer distances. Recognizing that walking is the primary mode for accessing transit and other services, stakeholders should effectively improve accessibility for women by making improvements to pedestrian infrastructure within the typical walking distances around transit stations.

Due to the uniqueness of travel characteristics among women which include travelling with dependents and relatively more trips made for

multiple tasks performed, and giving priority to facilitate women mobility, as a result this will significantly support the national policies on model split with priority on the usage of public transportation. Malaysian adult women, in general, are multi-taskers, and it has become the most recent trend especially in the urban setting such as in Kuala Lumpur, the primate and capital city of the country. Furthermore, the modern lifestyle with high living costs in the urban areas transformed the traditional roles of women from merely performing home duties, to the role of a working women in order to share the financial burden.

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