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Exploring Women's Preferences and Perceptions on Walking along Taft Avenue: An Accessibility Map Based on Qualitative GIS

Raymund Paolo Abad[1], Gabriel Anastacio[2], Angelyn Ilagan[3*], and Maria Cecilia Paringit[4]
[1,2,3,4] *Gokongwei College of Engineering Graduate School of De La Salle University Manila*
**Corresponding Author: angelyn_ilagan@dlsu.edu.ph*

Abstract: Walking is an integral mode of transport for most users. Because of the prevalent gender inequality concerning safety, women tend to be of disadvantage in walking accessibility. To explore this issue, this paper aims to develop an integrated accessibility map along Taft Avenue through a combination of qualitative and quantitative studies. Qualitative analysis involved in-depth interviews with women, while quantitative methods involved the application of a weighted summation procedure in the QGIS software analyzed by GRASS GIS. Four spatial indicators were obtained through both studies–lighting, street connectivity, sidewalk obstruction, and land use, which were weighed and analyzed to develop an accessibility map with corresponding accessibility indices. The resulting accessibility map can serve to aid in the development of targeted strategies aimed at mitigating the accessibility disadvantages faced by women in terms of walking as a mode of transport.

Key Words: Walking, Women, Taft Avenue, Accessibility Map, Qualitative Geographic Information System

1. INTRODUCTION

1.1 Background of the Study

In the context of walkability, accessibility refers to the degree to which walking offers advantageous efficiency over other transport mode choices (Su et al., 2019). Litman (2010) defines walkability as the quality of walking conditions provided, including safety, convenience, and comfort.

Originally designed to accommodate pedestrians (Fillone & Mateo-Babiano, 2018), the narrow road networks within Metro Manila, such as Taft Avenue, are now congested by automobile traffic. As a significant road encompassing numerous commercial, educational, and residential areas in the southern part of the region, Taft Avenue is anticipated to receive considerable pedestrian traffic, especially during peak hours.

Urban life is frequently linked to the safety, security, and risk perceptions of women (Araya et al., 2022). Because active transport is most likely observed in densely populated public spaces, it is not uncommon for women to associate feelings of insecurity and fear of crime and violence with those walking in these areas. While numerous research has been conducted on active transport and accessibility in the Philippines, limited studies have explored such from a gender perspective.

Moreover, previous local studies on non-motorized transport have utilized Quantum Geographic Information System (QGIS) only to visualize results and survey stations. To date, this tool has received minimal consideration in exploring women's preferences and perceptions of walking as a mode of transportation as the research methodology.

1.2 Problem Statement and Objective

Walkability in a gendered context has

received limited attention in the local setting. Because the chosen study area, with Vito Cruz Station as the center point, is characterized by a dense mix of land use, narrow roads, and short trip distances, walking is an integral part of users' daily travel.

The study aims to explore women's preferences and perceptions of walking by combining qualitative and quantitative methods. Specifically, this paper seeks to identify physical and social factors that affect women's consideration of walking through the area, geolocate these factors transformed into spatial indicators to be mapped on QGIS, and develop an accessibility map through weighted summation of spatial indicators and generated accessibility indices.

1.3 Significance of Research

By combining qualitative data obtained through interviews and quantitative spatial data accessed through available repositories on QGIS, the resulting accessibility map of this paper shall give insights into transportation and urban planning. This study may help identify which factors are to be considered and which features are to be prioritized in promoting the walkability of women which shall further improve health and lifestyle, increase safety perceptions, and reduce travel costs of users.

1.4 Review of Related Literature

Fillone & Mateo-Babiano (2018) identified travel time, cost over travel time, safety perception, and accessibility as significant factors in pedestrian travel decisions. Safety concerns in the built environment can deter walking, limiting socio-economic engagement (Panter & Jones, 2010). Therefore, enhancing the physical environment is crucial to providing security, promoting active lifestyles, and encouraging sustainable mobility (Fillone & Mateo-Babiano, 2018).

Araya et al. (2022) highlighted affordability as a primary factor influencing transportation mode choice. Since walking is affordable and typically entails minimal expenses, its promotion is essential in transportation planning.

Jon et al. (2022) found that the average walking distance in Metro Manila ranges from 680 to 872.5 meters, indicating Taft Avenue, with Vito Cruz Station as the central point, falls within the accepted walking distance relative to the study area boundaries.

Historically, women's transportation needs have been overlooked due to perceived indirect economic contributions and limited involvement in the planning process (Philpott & Mullin, 1995). However, recent years have seen increased recognition of the importance of addressing gender-specific transportation concerns.

Araya et al. (2022) outlined methods to alleviate the transport burden for women, including improving paths and tracks, aligning with attributes associated with active transport modes such as street connectivity, mixed land use, and infrastructure (Cervero, 1996; Cervero & Radisch, 1996; Frank et al., 2006).

Lighting significantly influences safety perception (Gargiulo et al., 2020), impacting travel behavior, especially at night, particularly for women facing safety concerns (Zhang et al., 2022). Jin et al. (2022) discovered that street obstructions, like streetlights and on-street parking, could influence pedestrians to choose longer routes. Potholes and inadequate drainage also affect pedestrian comfort, emphasizing the importance of walkway spatial quality (Jin et al., 2022).

Ajala & Owabumoye (2018) found that crime incidents increase with distance from police stations, highlighting the importance of municipal facilities like barangay halls and police stations in promoting safety and encouraging women's walking activities. Moreover, open views in residential areas with built-up structures correlate with higher user density and increased safety (Gargiulo et al., 2020).

Yuan et al. (2023) identified a significant concern among (young) women in urban spaces about encountering unfamiliar individuals, prompting them to adjust their presence to avoid discomfort influenced by gender dynamics. This factor was considered given the significant prevalence of street dwellers in the study area.

The "eyes on the street" theory by Jacobs (1961), foundational in safety and environment studies, suggests that increased human presence enhances safety through informal surveillance, potentially increasing women's feeling of safety and likelihood to walk (Sideris, 2004).

2. RESEARCH DESIGN AND METHODOLOGY

2.1 Research Locale

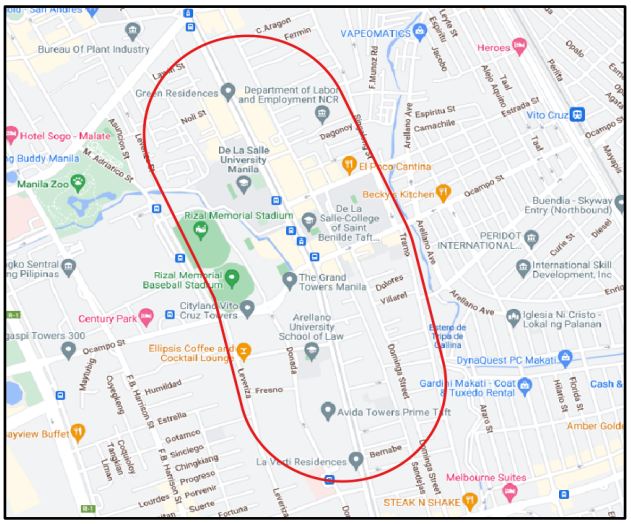

Figure 1. Area of study.

The study was conducted in April 2023 in a specific area surrounding Vito Cruz Station, along and across Taft Avenue. Specifically, the research focused on a 1.6-kilometer long, 0.7-kilometer vast stretch of area with STI College – Taft marking its northern boundary and La Verti Residences delineating its southern boundary (Figure 1).

2.2 Methodology

A sequential mixed model design, heavily influenced by Gargiulo et al. (2020), was employed to create an accessibility map for women's walkability along Taft Avenue (Figure 2). The indicators used in the study are summarized in Figure 3.

2.2.1 Qualitative study

2.2.1.1 Qualitative data collection

Fourteen random women walking alone in the area participated in go-along interviews to gather insights into their perceptions of walking along their frequent routes. Queries on factors influencing their decision to walk, including changes in weather, time of day, and presence of companions, were asked. The study encompassed a total of 10 routes.

2.3.1.2 Qualitative data analysis

Physical factors are those related to the types of sites, while social factors are those related to nearby

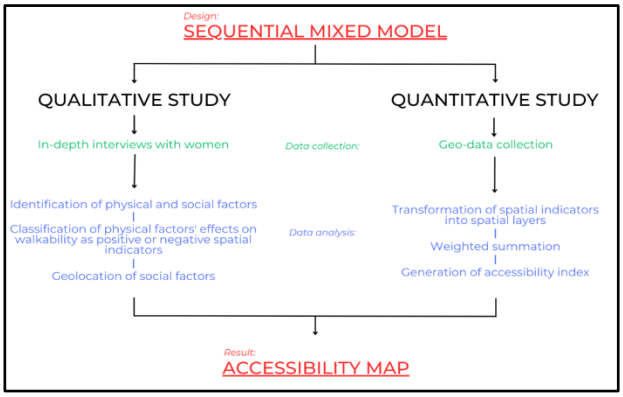

Figure 2. Methodological approach: own elaboration of sequential mixed model design.

users. Qualitative data analysis involved identifying physical and social factors related to accessibility, classifying their effects on walkability as positive or negative, and geolocating them on a map. These factors were grouped into spatial indicators, including lighting, street connectivity, sidewalk obstruction, and land use, with subcategories such as residential areas, commercial/institutional establishments, and municipal facilities. Positive relationships were identified for factors like lighting, street connectivity, and the presence of specific land uses, while negative relationships were associated with sidewalk obstruction and the presence of street dwellers.

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2.2.2 Quantitative study

2.2.2.1 Quantitative data collection

Data for the map was sourced from OpenStreetMap for consistency in coordinate reference systems (CRS). Lighting data was acquired from Google Earth, supplemented by on-site visits for additional accuracy. Street connectivity data was obtained from QuickOSM, refined by researchers to limit the study area's extent, and augmented with manually added streets for realism. Sidewalk obstruction data was collected and similarly verified through interviews to identify relevant obstructions. Municipal facilities, residential, and commercial/institutional establishments representing

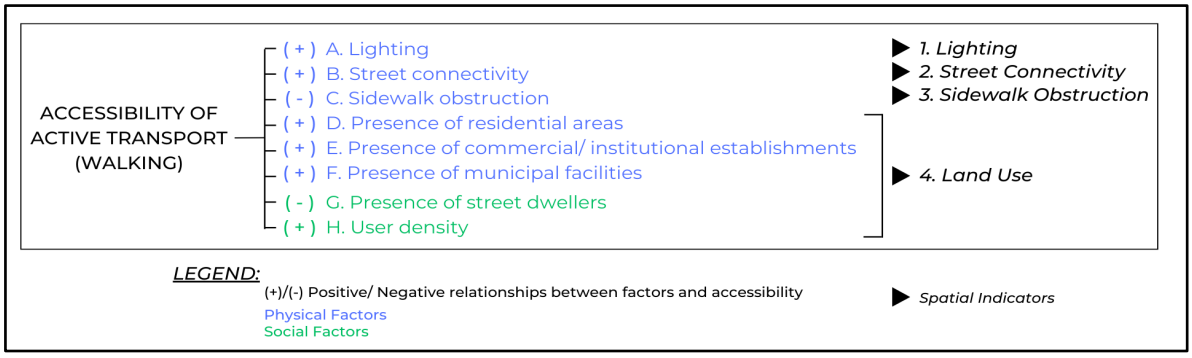

Figure 3. Accessibility of active transport with different land use, physical factors, and spatial indicators

land use were obtained using filters and verified using Google Earth (Gargiulo et al., 2020).

2.2.2.2 Spatial data analysis

Quantum GIS™ was used by mapping the data collected in different vector layers. These layers were rasterized and rescaled to assign a certain weight for each indicator. GRASS GIS™ was used to perform a weighting summation procedure, which factored in all the layers involved. (Shit et al., 2016). Lighting data, represented as points indicating lamp posts and other light sources, were rasterized and rescaled.

Similarly, street obstructions were depicted as polygons due to their broader coverage area (Khanduri et al., 2023). Street data sourced from OpenStreetMaps were rasterized and rescaled to reflect accessible roads and paths. Land use indicators were represented by polygons to cover the relevant area, with their placement impacting street accessibility (Ajaj et al., 2023). A weighted summation procedure was applied, considering each layer's interaction (Figure 4) within the study area (Wong, 2006). Layers beneficial to existing streets received a +1 value, while counterintuitive layers were assigned -1, using a binary scale approach. All raster layers share the same pixel size to ensure consistency (Gargiulo et al., 2020).

3. RESULTS AND DISCUSSION

The researchers integrated women's perceptions and various layers through weighted summation, producing an accessibility map with index values ranging from -1 to 4. Negative values denote extreme inaccessibility, while positive values indicate extreme accessibility. Each index value was derived by summing positive and negative physical factors identified through qualitative study. The consistency between the integrated map and quantitative visuals confirms the adequacy of the physical factors

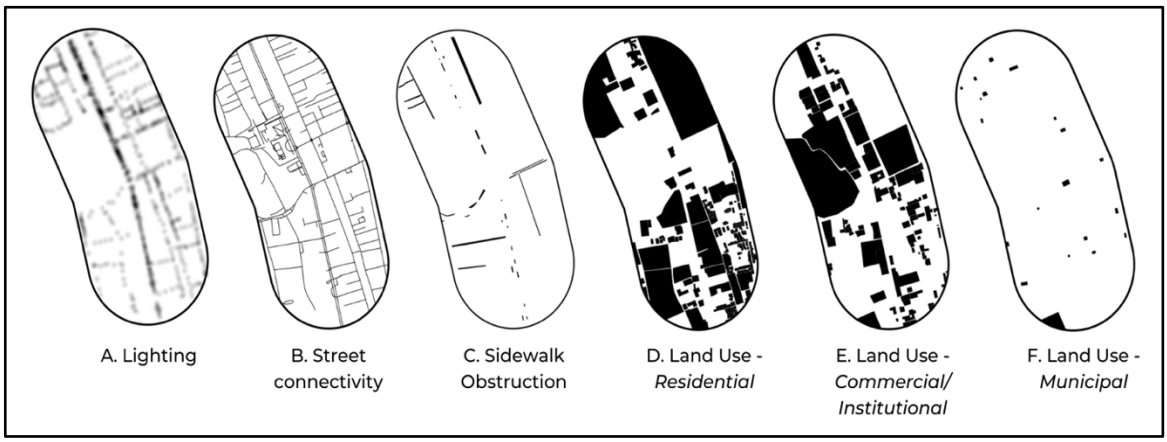

Figure 4. Spatial layers generated by computing spatial indicators using own elaboration with QGIS

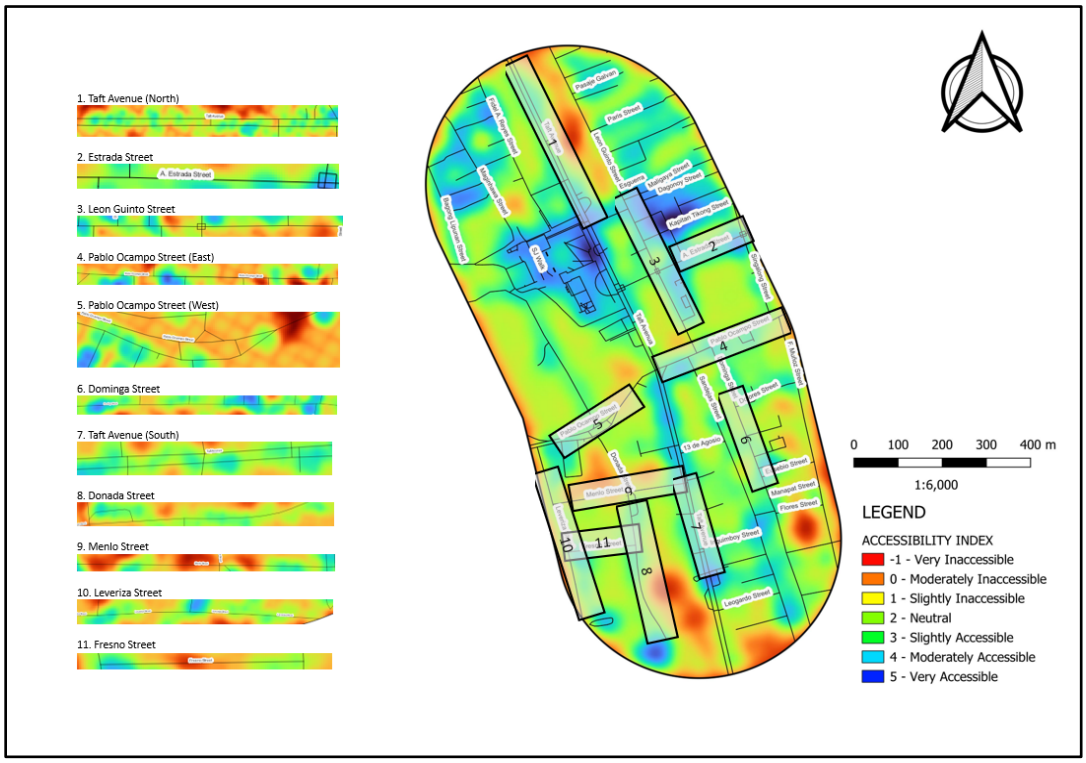

Figure 5. Accessibility map obtained from GRASS GIS

considered. Meanwhile, positive and negative social factors are reflected in the paragraphed perceptions.

The results generally align with initial perceptions, particularly along main roads like Taft Avenue and Pablo Ocampo Street, where the presence of numerous light posts and establishments contribute to higher accessibility indices. Most areas exhibit a neutral accessibility index of +2, indicating satisfactory fulfillment of their purpose. Notably, areas around De La Salle Campus and municipal facilities show higher accessibility indices. However, Pablo Ocampo Street displays lower indices, suggesting a need for reconstruction and improved lighting. Addressing street obstructions, particularly related to settlements in the area, is also essential for enhancing accessibility.

Figure 6 summarizes the combined results of qualitative and quantitative studies. Estrada Street emerged with the highest accessibility index (4), attributed to the presence of all indicators, particularly municipal facilities. Despite not being a major road, it proved most accessible for women due to better sidewalk quality and increased "eyes on the street," a social factor not captured quantitatively.

Southern routes exhibited fewer indicators, mainly due to higher user density in the Northern area, driven by mixed land use, primarily commercial and institutional establishments. Safer streets can positively influence women's walking decisions, thus enhancing their accessibility to various locations.

4. CONCLUSIONS

An accessibility index map was developed to explore the relationship between physical factors influencing women's walking decisions and their perceptions along Taft Avenue. Qualitative data from go-along interviews with women walking along the selected routes provided insights into both physical characteristics (mappable) and social-environmental perceptions. Spatial indicators, including lighting, street connectivity, sidewalk obstruction, and land use (residential, commercial/industrial, and municipal facilities), were plotted to assess their impact on women's walkability.

ROUTE	AVENUE/ STREET	AT NIGHT TIME	POSITIVE FACTORS	NEGATIVE FACTORS	INDEX VALUE	DESCRIPTION	WOMEN'S PERCEPTIONS
1	Taft (North)		ABE H	C G	2	Neutral	(P.23) "The area is very exposed to the 'marginalized'; if I have company I'd walk even at night; I don't wear my ID off-campus because I feel like it attracts crime" (R.27) "I'll still choose to walk (short distance) even if it's flooded because of high trike fare" (K.21) "I'd rather walk here than R3 at night because lighting is better here"
2	Estrada		ABDEF H	C G	4	Moderately accessible	(P.23) "I'd rather walk here than R1 because there's more chance of company" (A.53) "I don't go out at night, most routes are the same so I just choose the shortest distance" (R.27) "Except at night, sometimes I prefer this over R1 because there's less foot traffic"
3	L. Guinto		BD H	C G	1	Slightly inaccessible	(N.53) "Some street dwellers are armed, there are more of them in R1 so I pass by here; there are barangay watchmen around so I feel safer here" (J.24) "I was once tackled by a crazy street dweller here in broad daylight so that caused me trauma—I won't walk here again; this street is floody so I ride the jeep along R1 but never the trike because it's costly"
4	P. Ocampo (East)		BEF H	C G	3	Slightly accessible	(R.27) "I pass by this side because I feel safe with guards and riders in the commercial establishments; aggressive beggars scare me off; with heavy rain at night there are even less people; I won't walk here" (A.53) "I don't mind street dwellers as long as it's still daytime" (K.21) "Non-aggressive street dwellers are fine, sometimes I give them change; this area tends to flood during rainy days, so I just ride the trike or Angkas when I really need to go out; walking at night is okay as long as I have company" (K.21) "It frustrates me how flooded this street gets, causing more foot traffic; it's okay for me to walk here at night so long as I have company"
5	P. Ocampo (West)		BE H	C G	1	Slightly inaccessible	(T.23) "There are more food stalls and other establishments here than R7 so I prefer this route" (A.22) "I prefer this over R7 because there are more people here—I feel safer"
6	Dominga		BD H	C G	1	Slightly inaccessible	(K.21) "This place gets sketchy at night because there are always a lot of male by-standers"
7	Taft (South)		BEF H	C G	2	Neutral	(R.27) "There's not much attractions (t)here so I have no reason to go (t)here" (N.24) "The difference in lighting here and in R1-4-5 at night is very noticeable. It's so dark here at night; sidewalks here are so narrow and some residents even occupy these sidewalks so sometimes I choose to cross to the other side"
8	Donada		BD		2	Neutral	(T.23) "I prefer walking here than R7 since they're equally lit but there's wider walkways here; I don't have to overtake street obstructions here" (A.22) "There are more residents here than in R5-7 so I prefer walking through this street" (M.33) "I walk here because this is the shortest route to my destination"
9	Menlo		BD H	C G	1	Slightly inaccessible	(A.22) "It gets flooded badly here on heavy-rain days, I'd have to ride a trike to get to/from home"
10	Leveriza		BD		2	Neutral	(M.33) "I choose this path over R8 at night because there are more residents here"
11	Fresno		BD H	C G	1	Slightly inaccessible	(M.33) "This area gets a little floody so in those times, I choose to pass through R10"

LEGEND	SPATIAL INDICATORS	
PHYSICAL FACTORS	A. Lighting B. Street connectivity C. Sidewalk obstruction	D. Presence of residential areas E. Presence of commercial/ institutional establishments F. Presence of municipal facilities
SOCIAL FACTORS	G. Presence of street dwellers H. User density	

Figure 6. Integrated accessibility map of 11 routes with general accessibility index and personal perceptions.

The majority of the studied routes indicate a slight negative bias in terms of accessibility for non-motorized transport, mainly walking in low-light conditions. This suggests that the study area may not be highly accessible for pedestrians, considering the strong correlation between women's walking choices and safety in the built environment.

Visual results from quantitative studies indicate that Taft Avenue within Manila's jurisdiction is more accessible compared to the section within Pasay City, primarily due to better street lighting and the presence of residential and commercial/institutional buildings. This underscores the need for Pasay City planners to prioritize initiatives that promote user behavior and enhance perceptions of non-motorized transport safety.

The quantitative study assigned equal values to all physical factors, potentially causing variance from real-life scenarios where these factors have different impacts on walking decisions, as indicated by the qualitative study and literature. Future research employing a similar methodology should consider these limitations.

It is recommended to explore similar approaches for determining accessibility maps of specific areas, incorporating additional spatial data from sources such as LIPAD's DTM for elevation and criminal activity hotspots as negative indicators of safety and accessibility. Shade and time of day should also be considered, with data readily available from sources like Google Street View or Google Satellite, to treat indicators independently and accurately reflect varying conditions.

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