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Research Paper

An Assessment of Subjective Sidewalk Attributes and Trip Factors on Walking in Neighborhood

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Abstract

Walkability index is widely utilized based on objective attributes to assess potential of walking. However, researches discussed that objective attributes are self-evaluated and hence subjective measurements are required to better evaluate walkability. This study claims that self-evaluation of objective attributes differs among mandatory and non-mandatory trips. This suggest that while increase of walkability either objective or subjective potentially increase walking, it does not necessarily change behavior of mode choice in peak-time mandatory trips and hence may not be helpful for solving traffic problems. As a result, a more precise study is required if a more normative set of policy making is aimed.

A data collection was conducted in May 2023 in Kermanshah, Iran. A total of 623 participants answered a paper questionnaire. Two logistic regression models were developed to reveal the effective variables on walking choice for mandatory and non-mandatory trips. Results explored that safety, slope, pavement, tree existence and connectivity significantly affect walking choice in mandatory trips. Whereas non-mandatory trips are under the influence of safety, slope, pavement, tree existence, connectivity, furnish and width. Overall evaluating of the result suggests that encouraging more people to walk for mandatory (work and educational) trips requires a more comprehensive plan including diverse strategies beyond sidewalks enhancement.

Keywords: Subjective Walkability, Objective Walkability, Walking, Trip aim

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1. Introduction

After decades of ignoring walking networks in urban development, a worldwide attention has been drawn to walking as a dignified mode of mobility through sustainable development. This promises a more livable urbanization through less resource consumption, less mitigated emission and lower noise. Moreover, public health will improve by induced physical activities in a healthier lifestyle. Various strategies in local, city or national level have been applied to encourage more people to walk more (Winter et. al., 2017). Amongst is providing walkable pathways which target developing built-environment characteristics (e.g., lightening, slope, widths, pavement, existence of furniture, existence of tree) of the pathways. Herein a definition of walkability and a corresponding index (walkability Index: WI) have been proposed by researchers in a rather wide literature. WI can initially assess the walkability of a pathway in existing condition and finally suggest a defendable prioritization of investment for municipals. Most of the previous studies focused on objective characteristics (Schlossberg, 2006; Leslie et al., 2007; Lwin et al., 2010; Taleai and Sabzali Yameqani, 2017; Mayne et al., 2012; Weyman et al., 2008; Peiravian et al., 2014; Christensen et al., 2014; Sabzali et al.,2015). While environmental possibilities are prepared for walking, each individual values it in a personal manner. Hence, researchers (Ewing & Handy, 2009; Gebel et. Al., 2011; Zhou et. al., 2019; Blečić et al., 2020; Forsyth, 2015; Fancello et. al., 2020) considered further subjective/perceived variables to calculate the WI in order to gain a more precise index which can better reflect final decision of citizens to walk. Previous study in Iran revealed that Iranians are ready to pay extra tax for implementation of walkability policies that aim enhancing safety, social, spatial, and accessibility of pathways which were all measured subjectively (Qazimirsaeed, 2022). Considering factors previously discussed, raising the walkability of path will potentially attract more walkers. As Fancello et. al. (2020) mentioned, “Walkability is the potential of the built environment to encourage individuals walking.” This result is certainly a success because it can increase the public health and is the strategy which the World Health Organization follows in physical activity action plan in 2018–2030 (WHO, 2018). However, walkable spaces do not necessarily make citizen walk in their regular trips. Hence, transportation planners may not account on walkable pathways for solving the congestion problems. Different reasons can be discussed in this regard. First; it is not clear that (what percentage of) the additional walkers have replaced their motorized trips by walking, because they may simply do walk as a new leisure activity. Second; it is not guaranteed that new walkers behave similarly in their peak/mandatory trips and their off peak/non-mandatory trips. To clarify; trips which are accomplished in peak hour are usually mandatory (e.g., educational or work trips). These trips form the main part of the daily trips which are accused for congestion making. Thus, although number of walkers may increase, congestion may not necessarily reduce. Here a more comprehensive investigation that considers trip requirements as well, is required to uncover the motivating variables for walking in a manner that can reduce traffic problems. In this regard, for better understanding walking motivators/barriers, this study suggests to consider trip characteristics along with objective variables, valued personally in a self-evaluation process in modal choice. The concept of this idea is illustrated in figure 1.

The proposed perspective provides the opportunity to investigate how the infrastructure is valued by various potential walkers in different trip types. This approach is capable to better analyze walking choice that can further support policy making in a more comprehensive manner.

Next section describes the methodology of research. In section 3, results of the model are reported. Next, results are discussed in section 4. Section 5, concludes the research and proposes suggestion for further research.

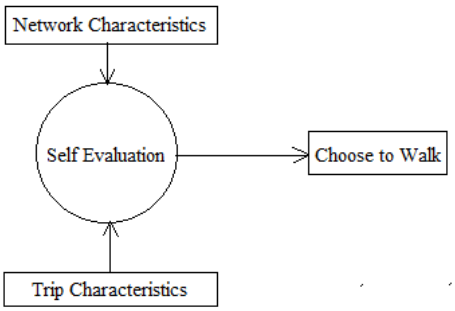


Figure 1. Concept of the model

2. Methodology

2.1. Study Area and Participants

As a case study, the model is applied in the city of Kermanshah. A neighborhood around a one-kilometer street named Sa'adi was chosen in this city. A mixed land use exists in the chosen area which gives accessibility in a short distance.

Two retail stores, tow fruit shops, two bakeries and two mosques were randomly chosen for data collection. These places are regarded as public places in a neighborhood to which residents usually refer for their daily requirements. Survey was conducted in morning and evening of an 18-days period starting from May 3rd 2022. Individuals were requested to fill in a paper questionnaire. Participating was voluntarily but was most welcomed at the bakeries where people usually need to wait for a period of time. A total of 623 filled questionnaires with missing data less than 20 percent were collected for further analysis.

It should be mentioned that the prominent mode use for transportation is personal car in the whole city as well as in the study area.

2.2. Questionnaire and Measures

A questionnaire was provided in a paper form. First part asked about demographic characteristics including age, gender, car ownership, driving license, employment, and educational status. Second and third part included individual perception about attributes of walking paths. Based on previous studies various attributes were included in this study. Self-evaluation on safety, security, connectivity, lightening, pavement quality, tree existence, furniture, slope and width. Appropriate condition of these variables was asked for mandatory (working/educational) and non-mandatory (shopping/leisure/other) trips separately. Responses were provided in a 5-point scale Likert type from 1 (very good) to 5 (vary bad). For the dependent variable, number of trips accomplished in the neighborhood and number of walking trips were asked for mandatory (work/educational) and non-mandatory (leisure/shopping/other) trips. It should be clarified that walking is considered as a competitable choice with motorized trips only in short distances. Herein mixed land use in neighborhood plays the most important role to provide acceptable trip distances for walking. Thus, putting aside long trips, this study focuses on those trips which are likely to be accomplished by walking, mostly accomplished in a single neighborhood based on the existing land use mixture.

A pilot survey was conducted with 37 participants. Any misleading questions, wording and grammatical errors were resolved through pilot survey.

Different parts of the questionnaire are summarized in table 1.

Table 1. Parts of the questionnaire

Part	Subject	Segmentations/ Attributes
1	Demographic characteristics	Age Gender Car ownership

Part	Subject	Segmentations/ Attributes
		Driving license status
		Employment status
		Educational status
2	Walking path characteristics (For working/educational trips)	Safety
		Security
		Connectivity
		Lightening
		pavement quality
		Tree existence
		Furniture
		Slope
		Width
3	Walking path characteristics (For shopping/leisure/other trips)	Safety
		Security
		Connectivity
		Lightening
		pavement quality
		Tree existence
		Furniture
		Slope
		Width
4	trip attributes	Mandatory trips (work/ educational)
		Total number of trips
		Number of trips by Walking
		Non-mandatory trips (leisure/ shopping/other)
		Total number of trips
		Number of trips by Walking

2.3. Data Analysis

Data analysis was accomplished utilizing **IBM SPSS 23** statistical software package. Two separate logit model were carried out to determine the odd-ratio of effective variables on walking for mandatory and non-mandatory trips.

3. Result

3.1. Statics of Demographic Characteristics

Statistics of demographic characteristics of respondents are reported in table 2. Participation of males and females were rather balanced (48.4 vs. 51.6). Respondents aged between 18 to 79 with a mean of 48.3. It should be noted that children and adolescents under 18 were available for data collection, specifically in supermarkets around school's finish time and parks around evening. However, they were not been asked for two reasons: First, their mode is usually chosen under parental supervision, hence modeling their choice requires including regarded variables (Mc Millan, 2005; Ehteshamrad et al.,2022). Second, aims of their trips are usually limited. Hence respondents of this study are limited to individuals over high school age.

Table 2. Respondents' Statistics

Attributes	Sub-attribute	n	%	Mean	SD
Gender	Male	302	48.4		
	Female	321	51.6		
Age				48.3	14.7

Attributes	Sub-attribute	n	%	Mean	SD
Educational status	Diploma and below	298	47.83		
	Associate and B.S.	278	44.62		
	Master and PHD	47	7.55		
Car ownership				1.84	0.98
Employment status	Full time	227	36.44		
	Part time	122	19.58		
	Home maker/retired/unemployed	263	42.22		
	other	11	1.77		
Driving license	Yes	422	67.74		
	No	201	32.26		
Number of daily trips	Mandatory			0.74	0.25
	Non-mandatory			3.78	2.45
Number of walking trips	Mandatory			0.38	0.12
	Non-mandatory			1.24	0.87

Among the respondents, over 47 percent held diploma and below. About 45 percent of them held associate and B.S. and a minority of 7 percent held master or PhD degree. Additionally, more than half of the respondents were employed either full time (36.44 percent) or part time (19.58 percent). 263 respondents were either home maker, retired or unemployed. Moreover, about 68 percent held driving license.

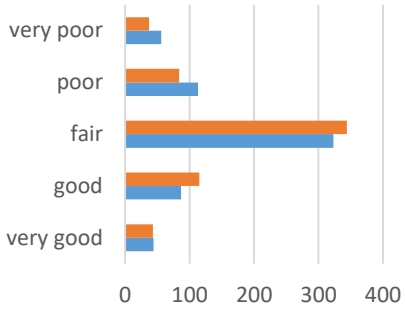
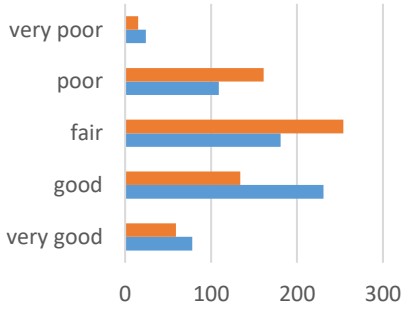
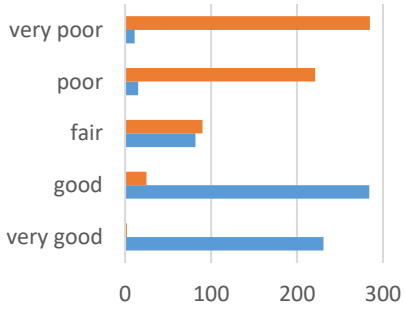
Mean number of daily trips in the neighborhood was 3.78 (SD=2.54) for non-mandatory trips and 0.74(SD=0.25) for mandatory trips. Of which 1.24 trip (SD=0.87) of non-mandatory and 0.38(SD=0.12) of mandatory trips were accomplished by walking. It should be noted that each couple of going and returning to home was counted as one trip. For example, a trip of a mother that escorts her child to school and returns home was considered as one trip.

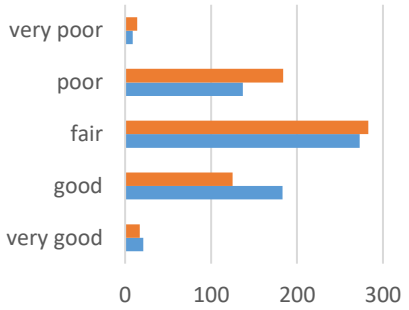
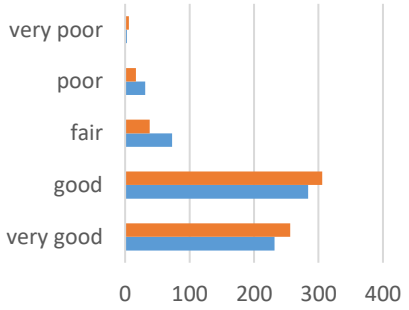
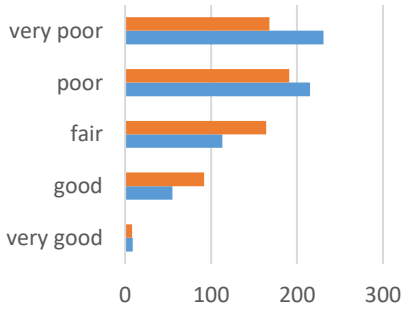
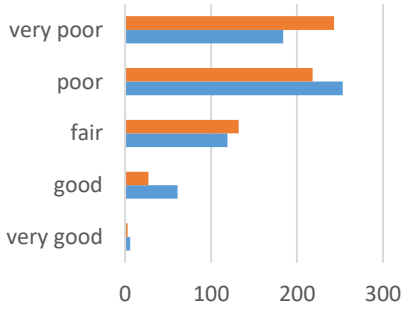
3.2. Statics Of Sidewalks' Attributes

Table 3 presents respondents' scores to sidewalk characteristics for walking in mandatory/non-mandatory trips in the neighborhood.

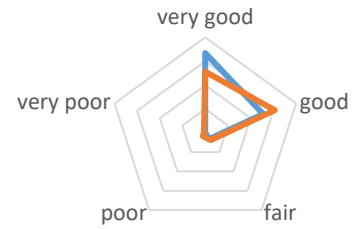
Table 3. Self-evaluation of pathway attributes for walking

Item	score	Mandatory		Non-mandatory		Comparison chart bar
		n	%	n	%	
security	Very good	334	53.61	256	41.09	
	Good	255	40.93	306	49.12	
	Fair	31	4.98	38	6.10	
	Bad	2	0.32	17	2.73	
	Very bad	1	0.16	6	0.96	

Item	score	Mandatory		Non-mandatory		Comparison chart bar
		n	%	n	%	
Safety	Very good	44	7.06	43	6.90	
	Good	87	13.96	115	18.46	
	Fair	323	51.58	344	55.22	
	Bad	113	18.14	84	13.48	
	Very bad	56	8.99	37	5.94	
Lightening	Very good	78	12.52	59	9.47	
	Good	231	37.08	134	21.51	
	Fair	181	29.05	254	40.77	
	Bad	109	17.05	161	25.84	
	Very bad	24	3.85	15	2.41	
Connectivity	Very good	16	2.57	15	2.41	
	Good	195	31.30	165	26.84	
	Fair	212	34.03	203	32.58	
	Bad	185	29.70	221	35.47	
	Very bad	15	2.41	19	3.05	
Furnish	Very good	231	37.08	2	0.32	
	Good	284	45.59	25	4.01	
	Fair	82	13.16	90	14.45	
	Bad	15	2.41	221	35.47	
	Very bad	11	1.77	285	45.75	

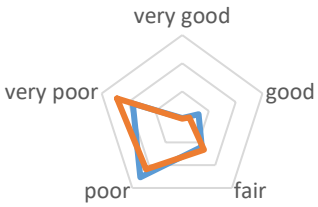
Item	score	Mandatory		Non-mandatory		Comparison chart bar
		n	%	n	%	
Tree existence	Very good	21	3.37	17	2.73	
	Good	183	29.37	125	20.06	
	Fair	273	43.82	283	45.43	
	Bad	137	21.99	184	29.53	
	Very bad	9	1.44	14	2.25	
Width	Very good	232	37.24	34	5.46	
	Good	284	45.59	57	9.15	
	Fair	73	11.72	251	40.29	
	Bad	31	4.98	184	29.53	
	Very bad	3	0.48	97	15.57	
Slope	Very good	9	1.44	8	1.28	
	Good	55	8.83	92	14.77	
	Fair	113	18.14	164	26.32	
	Bad	215	34.51	191	30.66	
	Very bad	231	37.08	168	26.97	
Pavement	Very good	6	0.96	3	0.48	
	Good	61	9.79	27	4.33	
	Fair	119	19.10	132	21.19	
	Bad	253	40.61	218	34.99	
	Very bad	184	29.53	243	39.00	

For a better comparison between responses to mandatory and non-mandatory trips, radar charts are provided on each item (Figure 2). These charts clearly compare responses orientation in scoring each item and the underlying differences between mandatory and non-mandatory trips.

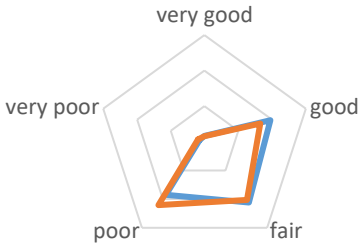


Security

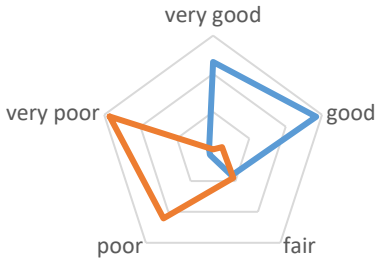
Safety



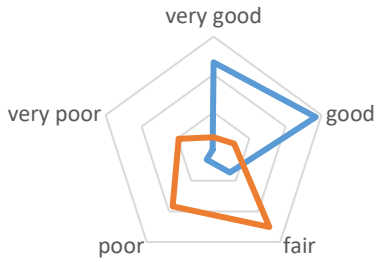
Pavement



Connectivity

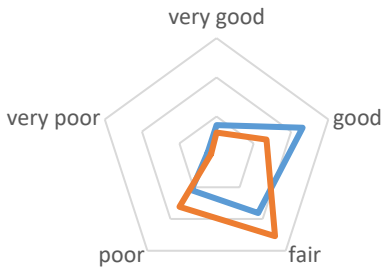


Furnish



Width

Tree existance



Lightening

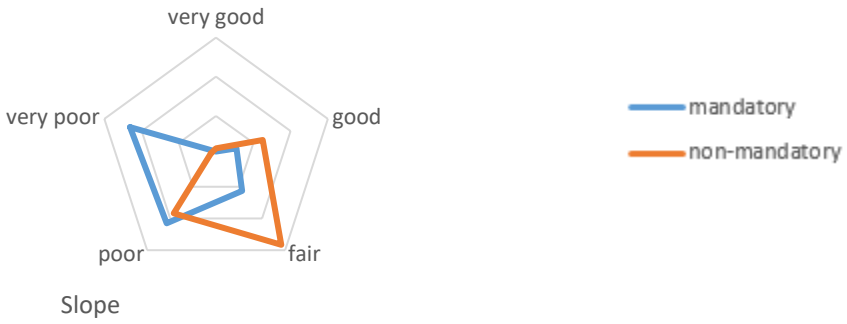


Figure 2. Radar charts of each attribute scoring for mandatory and non-mandatory trips

Most of the respondents stated that the security level is good to very good. However, safety was scored lower, mostly bad to good. This result was in line with the scores for connectivity. Any disconnection in sidewalk lead to pedestrian and vehicle mixture which can reduce safety sense considerably. Moreover, lightening was assessed mostly fair for non-mandatory trips and mostly good for mandatory trips. Most respondents agreed that furnish of pavements are is poor for non-mandatory trips but good or very good for mandatory trips. This result represents respondents' tendency to sit and rest during non-mandatory trips. Also, tree existence was evaluated mostly fare among respondents for both categories. Moreover; width of the pathways was assessed poor to fair for non-mandatory trips but good to very good for mandatory trips. Additionally, respondents evaluate slope of the pathway bad to fair for mandatory trips but fair for non-mandatory trips. This result suggests that coming to slope, respondents were strict to choose walking in mandatory trips, times that they are usually in a hurry, meanwhile they ignored slope for non-mandatory trips.

3.3. Logistic Regression Model

Logistic regression Model was utilized in order to determine the log odds of walking versus other modes, mainly personal car. Worth to mention that public transportation (bus, train) is not provided in the study area. Other types of active transport (biking, scootering, jogging) are not in the pool of choices in this city. Likewise, motorcycles are rare. The only remaining mode is taxi which usually shares ridership among residents. Two logit models were separately developed to predict walking choice in mandatory and non-mandatory trips. Demographic and network attributes contributed in the model to determine the underlying relationship with odds. Additionally significant coefficients of two models are comparable to determine the effects of different variables on walking in both two types of trips. Acceptable significance level was considered 0.9. Results are summarized in table 4.

Personal characteristics reveal that the odd of selecting walking was significantly higher among women both for mandatory (OR = 1.23) and non-mandatory (OR=1.48) trips. Age was not recognized as a significant effective factor on walking in mandatory trips. Nevertheless, older individuals contribute more in walking for non-mandatory trips (OR=1.09). Higher educated were less likely to walk for mandatory trips (OR=0.18 and OR=0.27). Associate and B.S. holders were less likely to walk in their non-mandatory trips, however there was not sufficient evidence to show that M.S. and PhD holders significantly differ in their walking choice for non-mandatory trips. Higher car ownership significantly reduced walking in both mandatory (OR=0.21) and non-mandatory trips (0.11). Moreover, walking was more likely among individuals without driving license for mandatory trips but no difference or significance was determined in non-mandatory

trips. Additionally, individuals with occupational status rather than full time were significantly more likely to walk in both mandatory (OR=1.17, OR=1.13, OR=1.14) and non-mandatory trips (OR=1.17, OR=1.04, OR=1.21).

Table 4. Parameters of effective variables on walking in logistic regression model

Variable	Walking for Mandatory trips			Walking for Non-mandatory Trips		
	Coef.	**S.E.**	**OR**	**Coef.**	**S.E.**	**OR**
Constant	-2.54***	1.65		-1.83**	1.11	
Demographic characteristics						
Gender (Ref.: male)						
Female	0.24***	0.17	1.23	0.27**	0.07	1.48
Educational Status (Ref.: Diploma and below)						
Associate and B.S.	0.18**	0.21	0.08	0.07***	0.19	0.13
M.S. and PhD	0.27***	0.08	0.11	0.13	0.24	1.04
Car ownership (number)	-0.23**	0.13	0.21	-0.11*	0.12	0.11
Employment status (Ref.: Full time)						
Part time	0.08***	1.15	1.17	0.12**	0.23	1.17
Home maker/retired/unemployed	0.11***	1.21	1.13	0.14*	0.16	1.04
other	0.10**	1.13	1.14	0.11***	0.08	1.21
Driving License(Ref.: No)						
Yes	-0.16**	0.24	0.08	0.12	0.22	1.13
Age (Year)	0.19	0.12	1.11	0.08**	0.17	1.09
Security	0.8	1.23	1.12	0.11	0.18	1.14
Safety	0.12*	1.16	1.08	0.16**	0.18	1.11
Connectivity	0.14*	0.08	1.17	0.13**	0.06	1.12
Furnish	0.08	0.18	1.16	0.17**	0.13	1.22
Lightening	0.09	0.12	1.21	0.15	0.14	1.24
Tree existence	0.13**	0.18	1.08	0.18**	0.21	1.13
Width	0.17	0.14	1.11	0.14**	0.21	1.08
Slope	0.14***	0.19	1.13	0.14***	0.18	1.11
Pavement	0.11**	0.23	1.09	0.12***	0.24	1.17

*** $p \leq 0.1$, ** $p \leq 0.05$, * $p \leq 0.001$

Furthermore, attributes of sidewalk changed the odd ratio of walking for both mandatory and non-mandatory trips, but in different manners. Among attributes, security and lightening were not recognized as significant variable on walking, neither for mandatory nor for non-mandatory trips. On the other hand, safety ($OR_{mandatory}$=1.08,$OR_{non\text{-}mandatory}$=1.11), connectivity ($OR_{mandatory}$=1.17,$OR_{non\text{-}mandatory}$=1.12), tree existence ($OR_{mandatory}$=1.08,$OR_{non\text{-}mandatory}$=1.13), slope ($OR_{mandatory}$=1.13,$OR_{non\text{-}mandatory}$=1.11) and pavement ($OR_{mandatory}$=1.09,$OR_{non\text{-}mandatory}$=1.17) were qualified to change walking choice for both mandatory and non-mandatory trips. Additionally, while respondents ignored furnish and width in their walking for mandatory trips, they preferred wider (OR=1.08) and more furnished (OR=1.22) sidewalks for walking in non-mandatory trips.

4. Discussion

Walking facilities are the main requirements for walking. Better qualification of sidewalk in this regard is considered as basic motivator for walking. This study in line with several previous studies (Gao et al., 2022; Lucchesi et al., 2021; Yameqani and Alesheikh, 2019; Guzman et. al, 2022) discuses that personal valuing changes the effectiveness of objective variables on walking choice. Thus, the effect of subjective measurements of pathway

characteristics was determined on walking choice.

Based on results, perception of security was not qualified neither for mandatory trips nor for non-mandatory trips. This variable was previously reported as a significant variable in several research (Mertens et al., 2019; Zhao and Chung, 2017), however a few studies did not care about security due to low criminal rate in study area (Gao et al., 2022). A same situation exists for the area of current study. In a same manner lightening, which is regarded as a security provision tool, did not significantly affect on walking choice. In addition to low rate of criminal actions, there is no clear changes of lightening in the study area which can better explain the non-significancy. Steady situation of security perception and lightening assessment by respondents were reflected through descriptive analysis in previous section, which were mostly assessed as "good" and "very good". This result is in line with previous result reported by Gao et. al. (2022). However, street lightening is suggested for upgrading security specifically in sidewalks with numerous trees (Basu, 2022).

In contrary, perception of safety showed to be a positively significant predictor of walking choice both in mandatory and non-mandatory trips. Significance of safety perception was widely reported by previous studies (Aceves-González et al., 2020; Ferreira et. al., 2022). Result of this study emphasizes that for all trip purposes, safety is expected as a substantial factor for travelers in their walking choice. Worth to mention that inappropriate lightening potentially reduces safety perception (Ferreira et. al., 2022; Arellana et al., 2020; Li et al., 2020) specifically in poor pavements.

Pavement quality was also assessed as an effective factor on walking choice. Decreased comfort and safety are recognized as the result of poor pavement which contributes to walking unsuitability (Mascio, 2020). Respondents assessed the pavement unsatisfactory for both mandatory and non-mandatory trips. Two main reasons are recognizable in pavement condition in the study area. The first one is non-uniformity of paving material and un-even surface of the sidewalk and the second reason is frequent damages of equipment installation which are left sometimes for months. However, regular maintenance operation can successfully manage an optimized pavement condition.

Moreover, result explored that perception of connectivity positively effects on walking choice. Connectivity is also regarded as main factor to provide accessibility that along with high density and land use mix is considered as a main walkability factor at neighborhood level (Lee and Park, 2023). This variable was recognized as significant variable effecting on walking in several previous studies (Lee and Park, 2022; Ferreira et al., 2022; Gao, 2022). This study clarifies that individuals care about connectivity for both mandatory and non-mandatory trips while deciding for walking. Worth to mention that several alleys and streets intersect the main street of the study area. Intersection points cut the pathways and mean while no footbridge, sign or crossline is provided for crossing the street. This not only disconnects the pathways but also reduces the safety perception among pedestrians.

While there was not enough evidence to show that furnish effects walking choice in mandatory trips, it was recognized as positively effective factor for non-mandatory trips. Furnish is considered to determine Comfort Index as a factor of walkability index of streets (Labdaoui et al., 2021). For non-mandatory trips, furnish showed to be a motivator for walking. Furnish can increase comfort for walkers by providing resting areas. For elderly and also children, furnish can play an important motivator role. Additionally sitting areas could add a social role to the pathways which can induce more walking trips. However, these walkers are usually walking for leisure, eventually non-mandatory trips. In contrast, during working or educational trips, usually time limitation makes travelers finish their trips

in the least time, hence they don't care about furnish existence, because they regularly do not sit or rest during their mandatory trips. This result clarifies that adding furnish to sidewalks cannot increase walking in peak time period.

Additionally, results reflect that existence of trees increases walking in both mandatory and non-mandatory trips. Urban vegetation was previously recognized as effective factors in walkable environment (Ulme et al., 2016). It is a motivator among children for walking to school (Litman, 2003) and a promoter for recreational walk. Furthermore, Lee (2021) reported that crime rate in walkable streets increases, however tree canopy can moderate the relationship of crime and walkability and hence is a solution to offset negative influence of walkable neighborhoods. Worth to emphasize that respondents of this study considered vegetation of their pathways in their mandatory trips as well. This clarifies that even in mandatory trips, people seek for enjoyable sights, breathing clear air and utilizing the comfort of the shadow of trees. Even existence of birds can affect the noise of the adjacent traffic and hence would be another motivator of walking.

Significant coefficient of width reflects the positive effects of proper perceived width on walking. This result was repeatedly reported by previous researchers. Width is regarded as a substantial factor in assessing walkability in several research (Arellana et al., 2020; Majumdar et al., 2021; Mulyadi et al., 2022). While proper width provides sufficient space for free walking activities, it was recognized as significant variable only in non-mandatory trips in this study. A proper explanation is that non-mandatory trips such as leisure and shopping are more frequent to be accomplished by walking in the area of this study in comparison with working and educational trips. Thus, crowded pathways are usually experienced in off-peak times of the day when non-mandatory trips are made. Hence, trip makers of non-mandatory trips better understand the width requirements for free walking. In contrary, in peak times of the day, streets usually experience congestion and sidewalks are not usually crowded. Rare walkers are making their mandatory trips on the sidewalks who assess the width far enough for free walking. Hence, width was not recognized as a significant factor on walking for mandatory trips.

Slope was also recognized as a significant predictor on walking for both mandatory and non-mandatory trips. Worth to mention that the study area has sloped streets and alley and, in some sections, stairs are provided. Results reflect that walkers care about the slope of pathways for both mandatory and non-mandatory trips. Slope which influences the comfort of walking can significantly reduce walking which is in line with previous research (Rahman, 2022; Rhoads et al., 2023). Meeder et al. explored that each 1 percent increase in slope can decrease walking for 10 percent (2017).

In summary, safety enhancement (through providing cross lines, foot bridge, speed limits in adjacent streets), reduction of slope or providing appropriate stairs, pavement quality enhancement (through regular maintenance operation), increase vegetation along sidewalks, increase connectivity (providing sidewalks along the streets in where sidewalks are not provided yet, providing cross lines, speed limits, revising traffic lights regulation to give priority to walkers at intersections) are of actions which are expected to increase walking for both mandatory and non-mandatory trips. Moreover, enhancement of furnishing and increasing the width of existing sidewalks will increase walking share in non-mandatory trips but they are not likely to increase walking odd in mandatory trips. Hence if increasing walking for mandatory trips (usually peak-hour) is considered, policies to increase width of the sidewalks or furnishing will lose their priorities. overally, results of this study explored that individual assess attributes of pathways differently based on the aim of the trips they are making. This result enlightens that general

recommendations on sidewalks' upgrading cannot necessarily influence mode choice behavior of all kinds and hence cannot necessarily be helpful for congestion reduction. As a result, aiming each category of trips, policy makers require to set precise and normative strategies if a real behavioral modal change is expected.

However; as result showed, side walk enhancement that is evaluated in different manners for different trip aims would not be adequate for a total behavioral change. This result was similarly discussed in previous researches in developed countries in which walkability policies were limited to sidewalks enhancement. They claimed that successing in sustainable transportation requires a macro approach which includes different items such as quality of services and urban infrastructure, public transport, and related technologies in urban development plans and comprehensive transport plans (Abu-Eisheh et al, 2020; Mahapatra, 2021). Similarly, various strategies in the study area could be followed along with sidewalks enhancement. Namely, educating people in order to inform them about the many individual and social benefits of walking, mixed land use in further development plans of the area, stopping motivating plans such as infrastructure enhancement for private car use (which is still continuing in the city of study area), providing other modes particularly cycling which can provide a more friendly environment for walking as well, are of related suggestions.

5. Conclusion

In summary, results of this study clarify:

1- Choose to walk or other modes is under the influence of a) aim of trip and b) walking facilities which are valued in personal assessment.

2- Mandatory and non-mandatory trips are affected by different influential factors.

3- Safety, slope, pavement, tree existence and connectivity significantly effects walking choice in mandatory trips.

4- Non-mandatory trips on the other hand are under the influence of safety, slope, pavement, tree existence, connectivity, furnish and width.

5- Providing more furnish and widening the sidewalks will not result in more walking for mandatory trips.

6- While upgrading sidewalks' characteristics can increase total walk choice, it can better encourage non-mandatory trip makers to walk, such as leisure and shopping trips. Encouraging more people to walk for mandatory (work and school) trips requires a more comprehensive plan including diverse strategies beyond sidewalks enhancement. Educating individuals, mixed land use, stopping motivating plans for private car are a few guidelines.

Limitations of the study

This study encountered some limitations, including:

1- Stairs without proper ramps exists in the case area of this study that clearly make wheelchairs movements impossible. Hence, disabled people who have difficulties in mobility are disregarded in this study.

2- Data collection was conducted in May when the weather is best appropriate for walking. There is no annoying coldness or hotness, sunshine, rain or snow. Such a weather can make walking enjoyable, however weather can significantly affect on walking choice which was disregarded in this study.

3- As statistics clearly show, mandatory trips are rarely accomplished by walking. Indeed, many mandatory trips may be long-distance-trips which were out of the scope of this study. Hence respondents that scores the qualification of the pathways for walking in mandatory trips may never have walking in their pool of mode choice substantially. This study utilized their data equivalent to those

data from respondents who were likely to walk for their mandatory trips as well.

4- While students were excluded from this study, aiming this category of population will result in considerable success. It may result in forming the habit of walking not only in the students but also in the family members and for other aims of trips rather than educational trips as well. Additionally, as the next generation of driving license holders, good experience of walking may affect their decision making for walking rather than using private car.

Next research can go beyond the limitations of this study in order to a more precise modelling which can better enlighten a normative and efficient set of actions for policy makers.

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