

Assessing accessibility and safety conditions in an urban environment: what do pedestrians perceive?

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Abstract. This study aimed to assess pedestrians' perceptions about accessibility and safety with an aim to identify factors that influence their choice of mobility in an urban environment in the Municipality of Tlaquepaque, Mexico. A survey was conducted of 299 people aged 18 to 72 years old. The study was undertaken in situ while the users were at transit on the place. Most of the participants pointed out the presence of obstacles to free access and over than 60% of the participants considered that the design of the road could imply problems to people with disabilities. In terms of safety, almost 80% of participants consider the lack of respect to pedestrians as the main fact that represents safety risks for them. Overall, the study allows recognising a series of elements of the urban space might be considered to create an age-friendly – safe and accessible - environment.

Keywords: Urban environment · Safety · Accessibility · Ageing · Pedestrians' perception

1 Introduction

Walking is an integral part of every travel chain and is an important component of one's mobility. It is recognised as the cheapest, most natural and sustainable mode of travelling [1]. In addition, walking comprises a series of benefits ranging from physical and psychological to social aspects [2]. Alfonzo [3] proposes a socio-ecological model consisting of a hierarchy of five levels of needs in the decision-making process of walking namely: feasibility, accessibility, safety, comfort, and pleasurability. This study stands on the view that a feasible, accessible and safe journey needs to be guaranteed before pedestrians decide walking. Lack of accessibility and pedestrians' perception of safety risks might affect their decision to walk or even their choice to use some streets [4].

The term accessibility used to refer to the relationship between a person's capabilities and demands generated by the design of the physical environment. At present, it is a term more oriented towards usability, defined as the 'usability of a product, service, environment or facility by people with the widest range of capabilities' [5]. Although accessibility has gained importance and interest to fulfil the needs of both older and disabled people, there are still some gaps to be bridged. The World Health Organization [6] highlights that, in both developed and developing countries, people think that their city was not designed for the elderly. In Mexico, previous studies have drawn attention to the presence of physical and social barriers in urban environments that prevent people from using roads as pedestrians [7, 8].

According to the World Health Organization [9], the number of road traffic deaths on the world's roads is unacceptably high. Accidents involving pedestrians, cyclists and motorcyclists comprise more than half of those traffic deaths. The rate for road fatality varies between countries by income. The risk of road accidents is three times higher in low-income countries than in high-income countries. In 2016, the number of road traffic fatalities in Mexico was estimated to be 16,725, with a rate of 13.1 deaths per 100,000 populations [9]. According to the official statistics, pedestrians account for around 29% in Mexico, but results from a different study suggest that pedestrians represent nearly 48% of the deaths associated with road injuries [10]. Pedestrians are the most vulnerable group of road users and traffic accidents involving injuries to them are a major societal concern.

The local governments in Mexico have made continuous efforts to improve accessibility and safety, especially in urban environments. However, most of those interventions lack participation from road users. Understanding people's needs for walking plays an essential role in designing a better road. Consequently, the objective of this study was to assess pedestrians' perceptions about accessibility and safety in an urban environment with an aim to identify factors that influence their choice of mobility.

2 Methodology

2.1 Site Selection and Participants

The study was conducted in cooperation with the municipality of Tlaquepaque, one of the eight towns within the Metropolitan Area of Guadalajara, Mexico. For this study, five blocks of a road in the headquarters of Tlaquepaque was chosen for evaluation. The specific road is *Juarez Avenue* from *Niños Heroes Avenue* to *Herrera y Cairo Street* comprising of shops, restaurants and tourist attractions (Fig. 1). This specific location was chosen for evaluation because the local government has a plan to improve roads in this area. The Department of Mobility was especially interested in understanding how this built environment could be improved for better pedestrian accessibility.

A total of 299 participants were involved in this study. A random criterion of selection was utilised which consisted of inviting a person every three people passing on the road at the time of the survey. Road users were included after obtaining their acceptance. Additionally, it was required to be aged 15 years old or over with sufficient

language and cognitive abilities to allow them to provide informed consent and response to the survey. The age of the participants was registered by ranks between those who were under 18 years of age, from 19 to 29, from 29 to 59 and over 60 years of age. Participants were informed of the study objective, confidentiality of participating, the time needed for the survey, and the right to withdraw at any time if decided. The data were collected in three weeks in July of 2017. The intention was to cover different times of the day. Therefore, collection times were morning and evening hours during weekdays, evening hours on Saturdays and morning hours on Sundays.

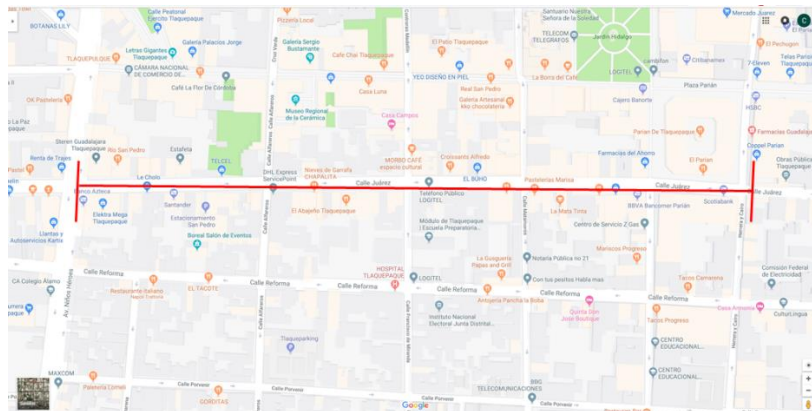


Fig. 1 Evaluation site (marked in red)

2.2 Materials

The questionnaire used in this survey was study-specific and was based on previous literature, but some questions were introduced based on the interests of the Department of Mobility. The questionnaire included two sections. The first section was to register the participants' demographics and journey characteristics. The second section aimed to collect participants' perceptions regarding safety risks and accessibility. This section comprised a series of statements to be answered using tick boxes and two open-ended questions to enter opinions from participants. These questions had the intention to corroborate and complement what participants were responding to the closed-ended questions. A five-point scale with agreement alternatives was used for those statements. These options were: 'strongly disagree', 'disagree', 'neither', 'agree', and 'strongly agree'. The rating scale was from one to five, where one represented the negative values and five the positive ones. For the analysis, ratings of four and five were considered as positive perceptions of safety and accessibility; in contrast of one to three which were considered as the lack of these attributes. The questionnaire is shown in Appendix 1.

Data collection was conducted by three senior researchers and ten junior researchers who had training for two weeks. Two pilot studies were carried out, which served to refine the questions of the survey and to evaluate the rating scale.

2.3 Data Analysis

Quantitative data collected were analysed using, SPSS (v. 21). A process of screening and cleaning was undertaken before analysing the collected data. Some data were missing for each variable mostly due to the participant not responding to a question. Data were analysed descriptively for the preparation of this report. Qualitative data from the open-ended questions were captured and thematically analysed using Nvivo (v11). An inductive approach was used for the analysis, which means the categories identified are strongly linked to the data themselves [11].

3 Results

3.1 Participants and Journey Characteristics

A total of 299 pedestrians were involved in the survey. Majority of the participants were aged between 30 and 59 (41%), male (52%), and Mexican nationality (95%). Eleven per cent of participants reported suffering from chronic illness or disability. Thirty-three per cent of the respondents was in the place for tourism or entertainment. Forty per cent of the participants were either working (27%), or residing (13%) in the survey area, suggesting that they visit the place regularly. Ten per cent of participants visited the area for the first time. Most of the people arrived on foot (40%), by car (32%) or by bus (22%). These results are listed in Table 1.

Table 1. Demographics and journey characteristics of participants.

Participants' Characteristics	Frequency (%)	Journeys' Characteristics	Frequency (%)
Gender		Frequency of visit	
Female	142(48)	2/3 times per year	38(13)
Male	156(52)	2/3 times per month	51(17)
		2/3 times per week	58(20)
Age group		Daily	121(40)
Less than 18	31(10)	First time	31(10)
From 19 to 29	109(36)		
From 30 to 59	121(41)	Mode of transport to get the place	
60 and over	38(13)	Walking	119(40)
		Bicycle	12(4)
Nationality		Motorbike	4(1)
Mexican	283(95)	Bus	64(22)
Foreigner	16(5)	Car	95(32)
		Other	2(1)
Chronic illness or disability		Reason for using the road	
Yes	32(11)	Tourism and fun	97(33)
No	267(89)	Work in the area	80(27)
		Live in the area	40(13)
		Shopping	44(15)
		Other	37(12)

3.2 Pedestrians' perception of safety and accessibility

Fifty-six per cent of participants in the survey either 'agreed' or 'strongly agreed' that it was safe crossing roads in the area where the survey was undertaken (Table 2). Approximately sixty-two and sixty-seven per cent 'agreed' and 'strongly agreed' that the width of sidewalks was enough and lighting was adequate, respectively. Regarding accessibility, over 57 per cent responded that the design of the roads did not consider the needs of disabled people. Likewise, sixty-three per cent indicated the lack of rest areas in the road.

Table 2. Pedestrians perception regarding safety and accessibility (n=299)

Statements	Unsafe and not accessible			Safe and accessible	
	1 No (%)	2 No (%)	3 No (%)	4 No (%)	5 No (%)
Crossing roads in this area is safe.					
Sidewalks are wide enough	29(10)	29(10)	29(10)	77(26)	77(26)
Lighting on this road is adequate	43(15)	43(15)	43(15)	88(30)	88(30)
The design of the roads considers people with physical and mental disabilities.	57(20)	57(20)	57(20)	58(20)	58(20)
There are enough rest areas on this road (benches, shadows).	26(9)	26(9)	26(9)	123(42)	123(42)
Using this road is comfortable	32(11)	32(11)	32(11)	82(30.4)	82(30.4)
There is enough vegetation on this street.	53(12)	53(12)	53(12)	100(37)	100(37)
I feel comfortable with the number of people who use this road.	17(6)	17(6)	17(6)	75(25.7)	75(25.7)
The information provided by signals is adequate.	21(8)	21(8)	21(8)	49(17)	49(17)

1=Strongly disagree; 2= Disagree; 3= Neither; 4= Agree; 5= Strongly agree
 *Percentages may not add due to rounding

3.3 Reasons behind safety perception

Pedestrians were asked to state the main reason based on what they responded to the question regarding the extent of agreement in being safe crossing the roads in the area. Participants expressed a total of 321 reasons, approximately seventy-five per cent (239) were on safety problems. The fact that drivers do not respect pedestrians was the most mentioned negative issue (80 mentions), followed by lack of traffic lights (34 mentions) and the presence of too much traffic (31 mentions). It must be highlighted that negative reasons were raised even by participants that agreed with the statement "crossing the road in this area is safe". Positive comments on safety were led by the fact of drivers respecting pedestrians (39 mentions), followed by cars travelling at a low speed (15 mentions) and the presence of traffic lights (9 mentions).

Table 3. Positive and negative reasons behind of perceived safety

Positive Reasons	Number	Negative Reasons	Number
Drivers respect pedestrians	39	Drivers do not respect pedestrians	80
Cars at low speed	15	Lack of traffic lights	34
There are signals	9	Too much traffic	31
Presence of police officers	7	A poor culture of road safety	21
Space to cross the roads	4	Cars parked in places that obstruct the visibility and mobility of pedestrians	19
Others	8	Cars in high speed	16
		Lack of signals	15
		Lack of police officers	7
		Lack of bumps	3
		Presence of holes or obstacles on the pedestrian way	3
		Others	10
Total	82	Total	239

3.4 Pedestrians' suggestions for improving safety and accessibility

At the end of the survey participants were asked for any suggestions to improve this road. More than fifteen categories were raised from the thematic analysis. Table 4 shows the top five recommendations. Pedestrianisation of the road and/or widening the sidewalks was most frequently (48) suggested followed by the proposal to ban parking of cars in the street (41) and removing any obstacles on the walkway and crossing points (31).

Table 4. Pedestrians' top five recommendations for improving safety and accessibility.

Level	Recommendation	# mentions
1	Convert the current road to a pedestrian road and/or widening the sidewalks	48
2	Do not allow cars to park in the road	41
3	Remove obstacles from the walkways and crossing points	31
4	Install pedestrian traffic lights (with audio)	25
5	More signals and information	25

4 Discussion

4.1 Perception of Accessibility Issues

This research has focused on investigating the pedestrians' perception of accessibility and safety in an urban area in the Metropolitan Area of Guadalajara, Mexico. Results

indicate that over half of participants (168) did not agree with the statement of “the design of the roads consider people with physical and mental disabilities”, which suggests that the obstacles might prevent or impose difficulties for these group of users. In accordance with the results, a previous study has found accessibility and usability problems for older people when using the roads in Guadalajara [8]. Removal of obstacles from the walkways and crossing points is one of the top five suggestions for improvements, which reveals the relevance of accessibility issues for all pedestrians and not only for older and disabled road users.

In addition, two-thirds of the pedestrians reported that there are not enough rest areas on the road. Spaces and furniture for resting along with enough vegetation have been suggested as an important physical factor promoting walking behaviours [12]. This finding is consistent with that of Alfonzo’s model [3] regarding the level of comfort required for walking. These facts suggest that the current state of the road may prevent some pedestrians avoid using the facility either for the lack of convenience or because some pedestrians - especially most vulnerable users - may have a self-perception of not being able to move through the road.

4.2 Perception of Safety Risks

Results in this study indicate that 57% of pedestrians (129) did not agree with the statement of “crossing the roads in this area is safe”. This finding contrast with the percentage of negative reasons explaining the safety risks (75%). The difference may be explained by the fact that some pedestrians who “agree” with this statement also provided negative comments on safety. Only some of those who “strongly agreed” (88) did not provide any negative comments. Beyond these differences, the results are consistent in showing pedestrians concerns on safety. These results may be explained by the fact that the number of road traffic injuries and fatalities is too high in Mexico. It may be due to the reason that the perceived safety is highly associated with the number of road fatalities. Perceived safety concerns have been reported previously in the context of Guadalajara [8].

At least four of the negative reasons for safety concerns are directly related to the interaction between pedestrians and car drivers. In general, the interaction between pedestrian and vehicle drivers are mediated and affected by several factors including social and behavioural, for example, compliance of rules and social norms which have been identified to play the central role compared with formal rules [13, 14]. Having ease of movement without any challenging situation with other motorists found to be an influential factor in the perception of safety. This in line with Šucha [15] who found following behaviours from the car drivers: approaching a crossing at an inappropriate speed, not yielding to pedestrians and not yielding when turning right/left at a junction, among others have a negative influence on pedestrians’ perception of safety. In contrast, car drivers perceived mainly pedestrians to have the following unsafe behaviours before an accident: an infraction of some traffic rule, not respecting traffic lights and not crossing in the appropriate zones. At any case, car drivers’ respect for pedestrians could be manifested by attending to speed limit, observance of the right of way and use of the designated parking spaces, also, by the consideration to pedestrians with diminished mobility which are more vulnerable while crossing the street.

Another factor described in the literature as part of pedestrian-car drivers interaction and identified by participants among the negative reasons for safety perception is the physical infrastructure, manifested in the presence or absence of signals, traffic lights, road geometry and type of pedestrian crossings [13, 16]. Furthermore, when asked for suggestions for improving safety and accessibility, participants' most recurrent answers were related to having exclusive areas for pedestrians, whether that be pedestrian-only roads or extended sidewalks, as well as forbidding parking of cars on the sidewalks. These results suggest that there is a need to improve interactions between the pedestrians and vehicle in a holistic way, including social aspects of the interaction and improving the infrastructure.

4.3 Potential interventions

The suggestions from the participants seem to be an excellent starting point for possible countermeasures. The recommendations comprise ideas for both accessibility and safety improvements. Pedestrianisation of the road along with widening the sidewalks was the most voted idea for intervention. This means no access to motorised traffic and the prioritisation of the use of the road only for pedestrians. It should be noted that pedestrianisation has an overall positive environmental effect [4].

Interestingly, the suggestions made by the road users corroborate well with the literature and are within the international guidelines for pedestrian safety [4], which indicates that pedestrians have a good sense in recognising the problems and ability to see the solutions. Furthermore, this study highlights the relevance of including pedestrians' participation for a more human-centred design of our cities.

5 Conclusion

The overall aim of this study was to assess pedestrians' perceptions about accessibility and safety in an urban built environment with a view to identifying factors that will encourage walking as a choice of the commute. The study found that walking needs in terms of accessibility and safety are not fully guaranteed in the evaluated location. A considerable proportion of participants had the perception that crossing roads in that site is not safe, but they also pointed out that the design of the road does not consider the needs of older and disabled people. Car drivers' action towards pedestrians was one of the main reason for the negative perception of road safety. Participants suggested several recommendations that have the potential to impact positively on the decision-making for walking. Finally, it is relevant to state that more research is needed for getting a better understanding of accessibility and safety conditions of urban spaces. However, the collaboration between the road users and local authorities for developing a safe and accessible zone is even more needed for increasing pedestrians walking rates.

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Appendix 1. Questionnaire



Aspects included on the questionnaire



1. Internal control		
a. Questionnaire number:	b. Time:	c. Date:
d. Place:	e. Name of the researcher:	

2. Demographics and travel characteristics					
a. Gender	b. Nationality		1) Mexican	2) Foreigner	
c. Age	1) Less than 18	2) from 19 to 29	3) from 29 to 59	4) 60 and over	
d. Any chronic illness or disability?	1) Yes		2) No		Name it _____
e. How frequent do you use this road?	1) 2/3 times per year	2) 2/3 times per month	3) 2/3 times per week	4) Everyday	5) First time
f. How did you get to this place?	1) Walking	2) Bicycle	3) Car	4) Bus	5) Motorbike 6) Other

3. User perceptions on safety and accessibility					
a) Please tell us how much you agree or disagree with the following statements:					
Statements	1 Strongly disagree	2 Disagree	3 Neither	4 Agree	5 Strongly agree
Crossing roads in this area is safe.					
Why?					
Sidewalks are wide enough					
Lighting on this road is adequate					
The design of the road considers people with physical and mental disabilities.					
There are enough rest areas on this road (benches, shadows).					
Using this street is comfortable					
There is enough vegetation on this road.					
I feel comfortable with the amount of people who use this road.					
The information provided by signals is adequate.					
Do you have any suggestions to improve this road?					