Sidewalks as places for socialization: urban equity for people with reduced mobility

Calçadas como lugares de socialização: equidade urbana para pessoas com mobilidade reduzida

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Abstract

Given the reduction in the equity of uses and the guarantee of accessibility in cities, the general objective of the research is to evaluate the conditions of sidewalks for groups with reduced mobility, adopting road sections in the Centro neighborhood of Curitiba, Paraná, as study objects. With a multimethod, quali-quantitative, and exploratory structure, it was developed in four phases: local characterization, technical reading, perceptual analysis, and integrated evaluation. As responses to the investigative question about approximations and distances between practice and perception of these spaces, the results show the impossibility of confirming the guiding hypothesis that meeting specialized principles allows better perceptive qualifications, enhancing identification, belonging, and appropriation of sidewalks as places for socialization, not diagnosed in this case.

Keywords: local characterization; technical reading; perceptual analysis; integrated assessment; Curitiba, Paraná.

Resumo

Diante da redução da equidade de usos e da garantia de acessibilidade em cidades, o objetivo geral desta pesquisa é avaliar as condições de calçadas para grupos de mobilidade reduzida, adotando trechos viários do bairro Centro de Curitiba, Paraná, como objetos de estudo. Com estrutura multimétodos, qualiquantitativa e exploratória, ela foi desenvolvida em quatro fases: caracterização local, leitura técnica, análise perceptual e avaliação integrada. Como respostas à pergunta investigativa sobre aproximações e distanciamentos entre prática e percepção desses espaços, os resultados evidenciam a impossibilidade de confirmação da hipótese orientativa de que o atendimento a princípios especializados permite melhores qualificações perceptivas, potencializadoras de identificação, pertencimento e apropriação de calçadas como lugares de socialização, não diagnosticadas neste caso.

Palavras-chave: *caracterização local; leitura técnica; análise perceptual; avaliação integrada; Curitiba, Paraná.*

Initial considerations

Inadequate relationships between public spaces and their users disadvantage conditions of diversity, vitality, and functionality of the landscape in contemporary cities, decreasing equity in uses and guaranteeing accessibility, notably for people with reduced mobility (Lima and Machado, 2019). In the face of this problem, Cullen's (2015) argument stands out that the network of pedestrian paths transforms the city into a walkable structure (Aghaabbasi et al., 2019), connecting different locations and giving it a human dimension.

If the conditions for pedestrian mobility are assured, passers-by feel motivated to appropriate the places, reinforcing urban experience and strengthening social activity in the urbanized environment (Shimizu et al., 2022). In this sense, the functions of sidewalks should go beyond the simple fact of providing sufficient area for circulation, enabling direct contact between citizens and the social conditions of the surrounding area (Gehl, 2013; 2014).

As focal points of this research, individuals with reduced mobility, such as pregnant and breastfeeding women, or persons with a child in arms; the elderly; obese people, and citizens with disabilities tend to leave their homes less due to their mobility difficulties. At this juncture, Twardzik et al. (2021) comment that their problems of non-community participation can be worsened by deleterious characteristics of public sidewalks.

In Brazil, federal law n. 13,146/2015, which establishes the Statute of Persons with Disabilities, provides that these individuals have "for any reason, difficulty of movement, whether permanent or temporary, generating an effective reduction in mobility, flexibility, motor coordination or perception [...]" (Brazil, 2015, art. 3°, IX – authors' translation). In turn, federal law no. 12,587/2012 establishes the guidelines of the National Urban Mobility Policy, with the main objective of, through democratic planning and management processes, "contribute to universal access to the city, the promotion and implementation of conditions that contribute to the realization of the principles, objectives, and guidelines of urban development policy" (Brazil, 2012, art. 2° – authors' translation).

An accessible city is one that enables the autonomous and safe use of spaces, furniture, equipment, buildings, services, and transportation by any citizen, with equalization of opportunities and facilitation of movements (Gaglione et al., 2022). Solutions on the scale of urban design translate into their respective intervention locations the qualitative improvement in the lives of their users, in an active or passive, lasting or transitory way, making the urbanized environment fairer and more democratic (ABNT, 2020).

Given the presented problem, the research is based on the following investigative question: what are the approximations and distances between the practice and perception of sidewalks? This questioning leads to the guiding hypothesis that meeting specialized principles allows better perceptive qualifications, enhancing identification, belonging, and socialized appropriation of these spaces.

At this juncture, it is necessary to understand walkability as an experience in which pedestrians process a substantial

amount of sensory information provided by the surroundings of their places of passage, such as peripheral vision, notion of depth, speed and direction judgment, and recognition of sounds, for example, forming aspects of human perception in relation to the built space (Tuan, 2012). From this understanding, one can infer the importance of urban design solutions that, in their functionalities, allow several social activities to occur simultaneously on public sidewalks without conflicts between users (e.g.: vehicles, cyclists, and pedestrians) (Arefi and Aelbrecht, 2023).

From the perspective previously discussed, the general objective of the research is to evaluate the conditions of sidewalks for groups with reduced mobility, adopting road sections in the Centro neighborhood of Curitiba, Paraná, as study objects. This city is internationally recognized for its experiences in urban planning, and its central area is, in general terms, the most experienced in the urbanized area (IPPUC, 2023a, 2023b). To achieve this goal, the procedural steps adopted for the development of the investigation are set out below.

Methodological procedures

Aiming to achieve the proposed objective, the research, employing a multiple structure of methods, a qualitative and a quantitative approach, and an exploratory nature, was organized into four main phases. The first corresponded to the local characterization, with a preliminary selection of nine routes subject to analysis in the Centro neighborhood, based on the following criteria established on the master plan, notably the specific guidelines of the municipal policy on pedestrian circulation (Curitiba, 2015, art. 38): surroundings of public equipment; routes between the same locations (or landmarks) and public transportation infrastructure components (e.g.: terminals, tube stations, and stopping points); areas with an intense concentration of commercial activities and service provision; exclusive pedestrian pathways; and open spaces (notably squares).

To determine these segments, the premise of a maximum distance of 500 m was observed, through the itinerary established by the Google Maps program (2022-2023), thus respecting the physical restrictions of reduced mobility groups. Considering the principle of representing routes with similar characteristics, the total number of routes was reduced to six, two for each of these three situations: conventional roads – which simultaneously serve vehicle and public transportation traffic –; sidewalks for exclusive pedestrian use and public open spaces, in this case, corresponding to squares. By changing the determined criteria, a greater number of routes would increase the relevance of the research findings.

Next, the technical reading phase of the determined routes was carried out, subdivided into three stages: assessment of the quality level of the sidewalk (0 for the worst scenario described and 5 for the best possible situation); ordering of these indicators according to users' perception, based on the application of a specific form (1 for higher importance and 5 for lower); and sidewalk quality index, adapted from the proposal by Ferreira and Sanches (2001), considering the guidelines from the

Brazilian Standard (NBR) 9050 (ABNT, 2020) on technical parameters of accessibility. Grounded in urban mapping and on-site measurements, linked to cartographic data and local images, five basic criteria were inventoried:

a) accessibility – relative to the autonomous, independent, and safe use of sidewalks, accommodating different mobility conditions for the studied special social groups, with comfort, shelter, and protection, with the essential principles of wide access and easy circulation.

b) maintenance – related to the physical characteristics of pavement and covering types, as well as the floor adhesion for the comfort and safety of passers-by.

c) connectivity – referred to the continuity of the route, allowing the path to be covered, from start to finish autonomously by all special groups, without the need to avoid obstacles and without the impossibility of completing it due to the absence of level crossings or appropriate signage for different types of special needs.

d) security – pertinent to the real and perceived sense of safety by the pedestrians during their movement, provided by the co-presence of other social actors, the existence of spaces with adequate lighting and urban equipment to encourage public use without a premonition of imminent risk.

e) ambience – consistent with the interaction of landscape shapes with elements linked to the usualness and accessibility in the use and perception of sidewalks.

To contextualize the reality of each route with greater assertiveness and accuracy, and with the purpose of qualitatively measuring the previous criteria, they were rated on a scale from 0 (non-existent) to 5 (high-quality class). The average definition for each of the technical attributes provided their relationship to user perception in the subsequent stage.

These procedures allowed the diagnosis of strengths and weaknesses of formal aspects related to technical parameters of accessibility and mobility conditions on sidewalks and spaces for public use on the routes, established according to the precepts of NBR 9050 (ABNT, 2020). Functional aspects were also considered, relating to accessibility, maintenance, connectivity, security, and ambience, composing parameters for evaluating the functionality and environmental perception of those locations.

The results of the application of these methodological steps served as the basis for the integrated discussion of other research products, particularly those related to the perceptual analysis of the target population, corresponding to the third phase facilitated by questionnaires surveys. For sample calculations, the Curitiba population aged 12 and over was initially adopted, that is, with a certain degree of maturity for critical analysis.

The sample was defined using the formula for an infinite population (Gil, 2019) for an approximate universe of 850,000 people (IBGE, 2022), an initial confidence level of 80%, an error rate of 5%, and a probable percentage of phenomenon verification equivalent to 50%. Although the sample calculation resulted in 164 questionnaires, 174 were applied, increasing the expected statistical reliability.

Thus, with this final total, for confidence levels of 90% and 95%, the estimated sampling errors are at most 6.2% and 7.4%, respectively. In this way, they are framed within the acceptable limits for studies in social sciences (Agresti, 2018).

This fact was derived from the intention of composing 29 respondents for each of the six selected routes, proportionally distributed among groups of people with reduced mobility, that is, a pregnant or a breastfeeding woman, or an person with a child in arms; seven elderly; nine obese people; twelve citizens with disabilities (three wheelchair users, three hearing impaired, three visual impaired and three with crutches, walking sticks, or similar devices). It is worth noting that the questionnaire is completely anonymized, without any possibility of identification of respondents by researchers or any other people. It is a form of opinion research and, given these peculiarities, does not involve ethical aspects that require its assessment by specific entities (CNS, 2016; Serpro, 2023).

The main justification for adopting this alternative is to encourage participation by eliminating fears of recognition and lack of confidence, allowing participants to feel comfortable and secure, thus providing open and honest answers, essential for the analysis of behaviors and preferences, for example (Agley et al., 2021; Murdoch et al., 2014; QuestionPro, 2023; Serpro, 2023).

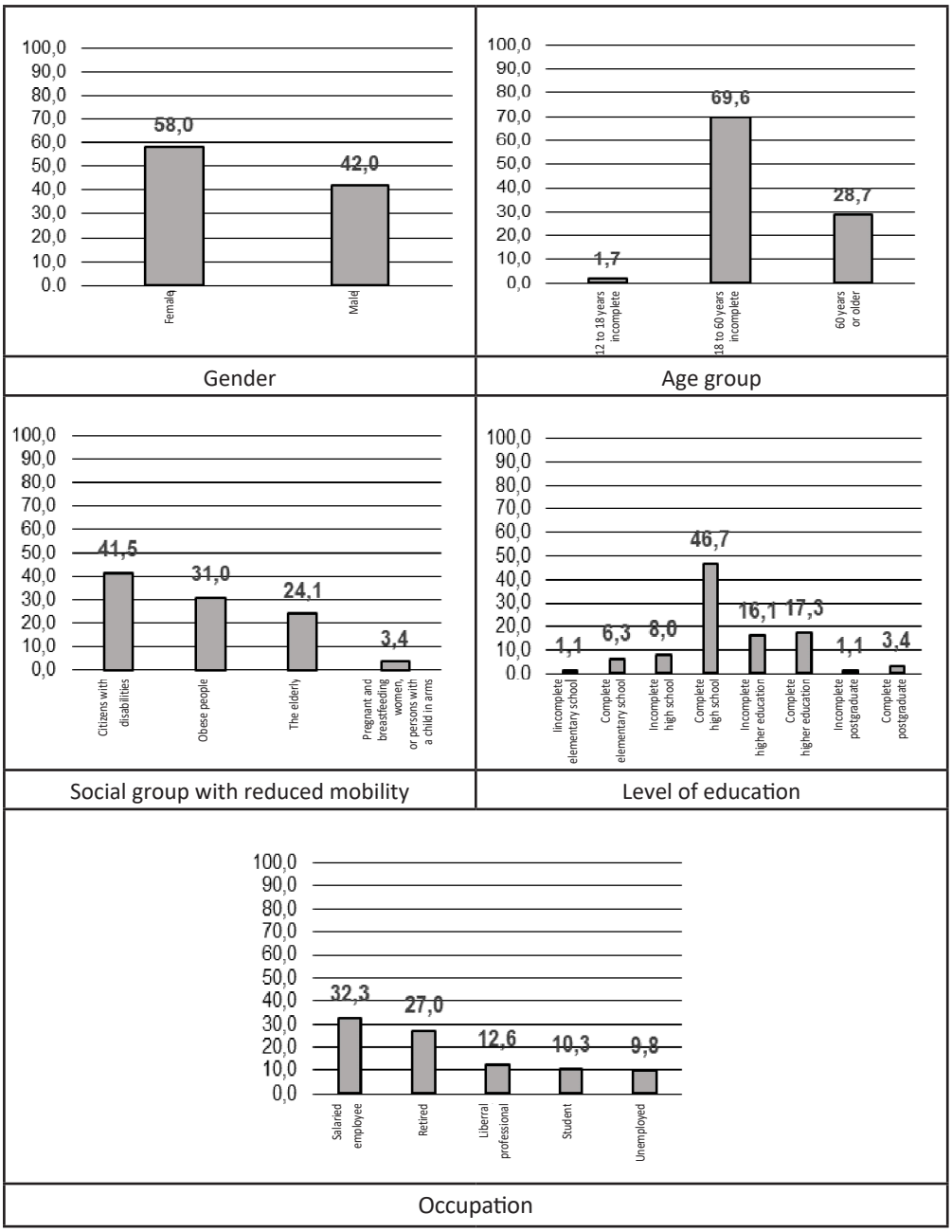
Under these conditions, the form was composed of main sections. The first – interviewees profile – included the anonymized recognition of sociocultural and economic conditions to identify basic characteristics, with information regarding gender, age group, special social group of reference, level of education, and occupation.

As illustrated in Figure 1, 58.0% of respondents are female, with 69.6% in the age group between 18 and 60 years old. The most represented social groups with reduced mobility are citizens with disabilities (41.5%), obese people (31.0%), and the elderly (24.1%). Regarding the level of education, 46.7% have complete high school, followed by 17.3% who have complete higher education. As for occupation, 32.3% claim to be salaried employees, followed by 27.0% of retirees.

The second section of the form – specific characteristics – included checking the of the period of residence in Curitiba, to assess the interviewee's knowledge regarding the city, and their main daily means of travel, to associate other modes with walkability. The frequency and major motivation for walking were also considered to align with parameters for the use of modal transportation and criteria for space utilization through urban mobility.

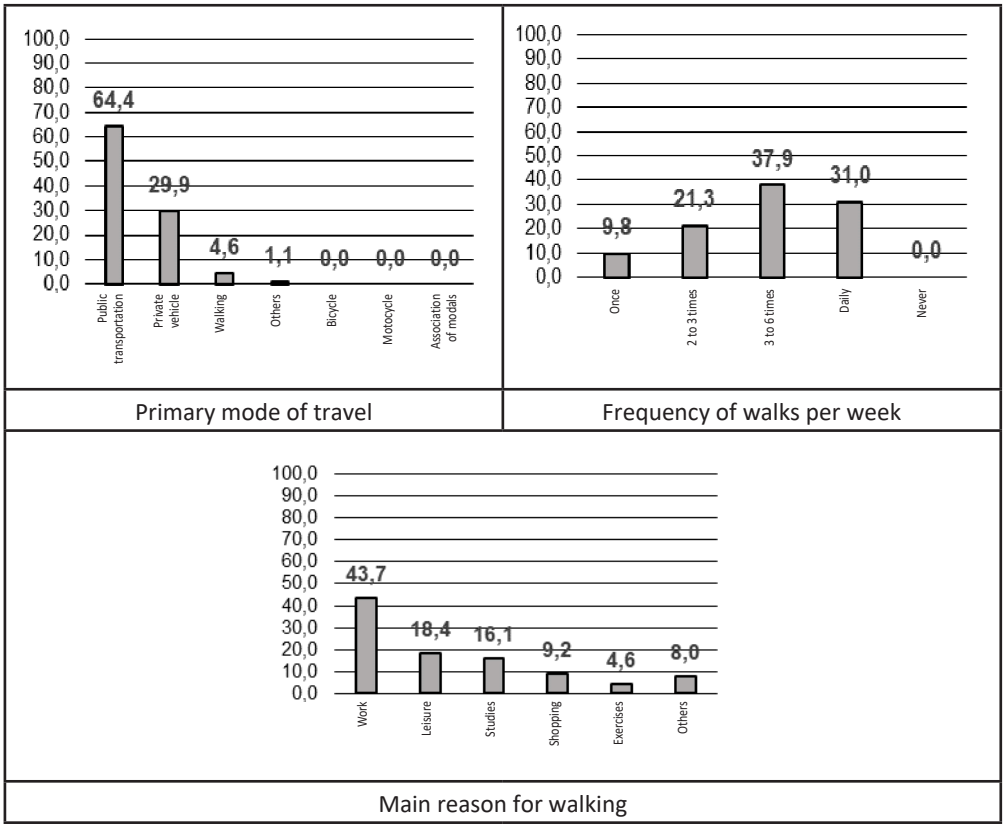
Figure 2 shows that the average length of residence of those interviewed is 33.4 years, ensuring a certain level of knowledge about the capital of Paraná. The primary mode of travel used is public transportation, via bus (64.4%), with a higher incidence among obese people, followed by the elderly; in second place is the private vehicle (29.9%). The highest frequency of walks (37.9%) is three to six times a week, with the main reason linked to work (43.7%).

Figure 1 – Proportionality graphs of interviewees profile conditions
2017-2023



Source: elaboration based on the responses from the questionnaires applied in 2017 and the consolidated data in 2023.

Figure 2 – Proportionality graphs of specific characteristics of respondents 2017-2023



Source: elaboration based on the responses from the questionnaires applied in 2017 and the consolidated data in 2023.

The third section of the form – perception of sidewalks – addressed the valuation of personal experience in each route, to qualitative and quantitative measures of the users' impressions regarding the criteria of accessibility, maintenance, connectivity, security, and ambience of the routes (on the same previous scale from 0 to 5); these parameters served for subsequent comparison with the formal and functional evaluation in the section of analytical results.

In addition to these topics, open questions were answered to interpret subjective sensations perceived and commented on by the interviewees, as well as their impressions. In this context, three positive and three negative points got that during walking along the routes were listed, relating them to the same five criteria previously assessed. The qualitative interpretation of these free responses was carried out through the formation of networks, using the Ucinet 6 for Windows software and the NetDraw tool for visualization.

These procedures led to the integrated evaluation of the results. This last phase of the investigation consisted of two main parts: an interactive synthesis of technical reading and perceptual analysis, and a summary of fundamentals for urban management. The initial products are focused on contextualizing the city and the neighborhood under study, with the selection of road sections for analytical examination, according to the content presented below.

Local characterization

Located in the Southern Region of Brazil, Curitiba, capital of the State of Paraná, has a territorial extension of approximately 435 km², distributed in 75 neighborhoods grouped into 10 regional administrations (IPPUC, 2023c). In 2022, it was home to 1,773,733 people, with a population density of about 4,078 inhabitants/km² (IBGE, 2022).

Among the sectoral planning objects foreseen by the municipal master plan (Curitiba, 2015), urban mobility and integrated transport stand out. Despite recent diagnoses of topics such as cyclability, pedestrianization, and accessibility (PMC, 2022a, 2022b), government actions are still derived from the guidelines proposed in the 2008 Mobility Plan (PMC, 2008).

These guidelines predict the expansion and improvement of accessibility in the municipality, considering that, for daily travels of up to 5 km, compatible with non-motorized modes, the participation of walking represents 63.4% of the total (IPPUC, 2022a). Six years later, the Sidewalk Strategic Plan (PMC, 2014) was published, incorporating criteria for the (re)construction of sidewalks in specific locations outlined in municipal decree no. 1,066/2006 (Curitiba, 2006).

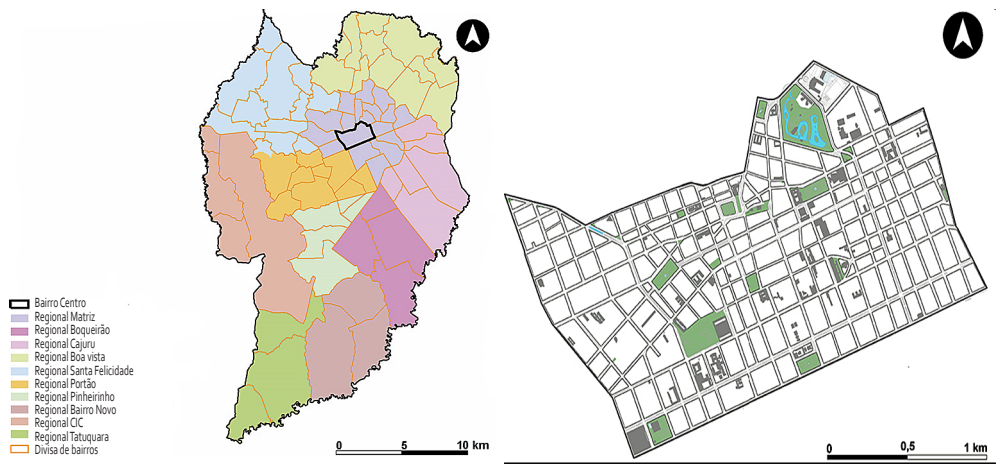
Since 1986, there have been municipal consultancies or secretariats linked to people with disabilities dealings. In 2019, the Department of the Rights of Persons with

Disabilities was established, with its main task focused on exercising their full citizenship (PMC, 2023).

The Centro neighborhood of the capital of Paraná (Figure 3), which is the case study of this research, is included with 17 others in the Regional Matriz, located in the center-northern region of the city. Its territorial extension of almost 328 hectares corresponds to 8.3 % of Curitiba's territory, accommodating approximately 40,000 inhabitants (IPPUC, 2023c). In addition to its population representation and its shelter to several of the city's historic landmarks, it is an important polarizer in offering a wide range of urban equipment and commerce and service options. It also enables intraurban and metropolitan connections linked to municipal public transportation. Its mobility characteristics stand out among the best in practically all aspects recently analyzed in a specific diagnosis (PMC, 2022).

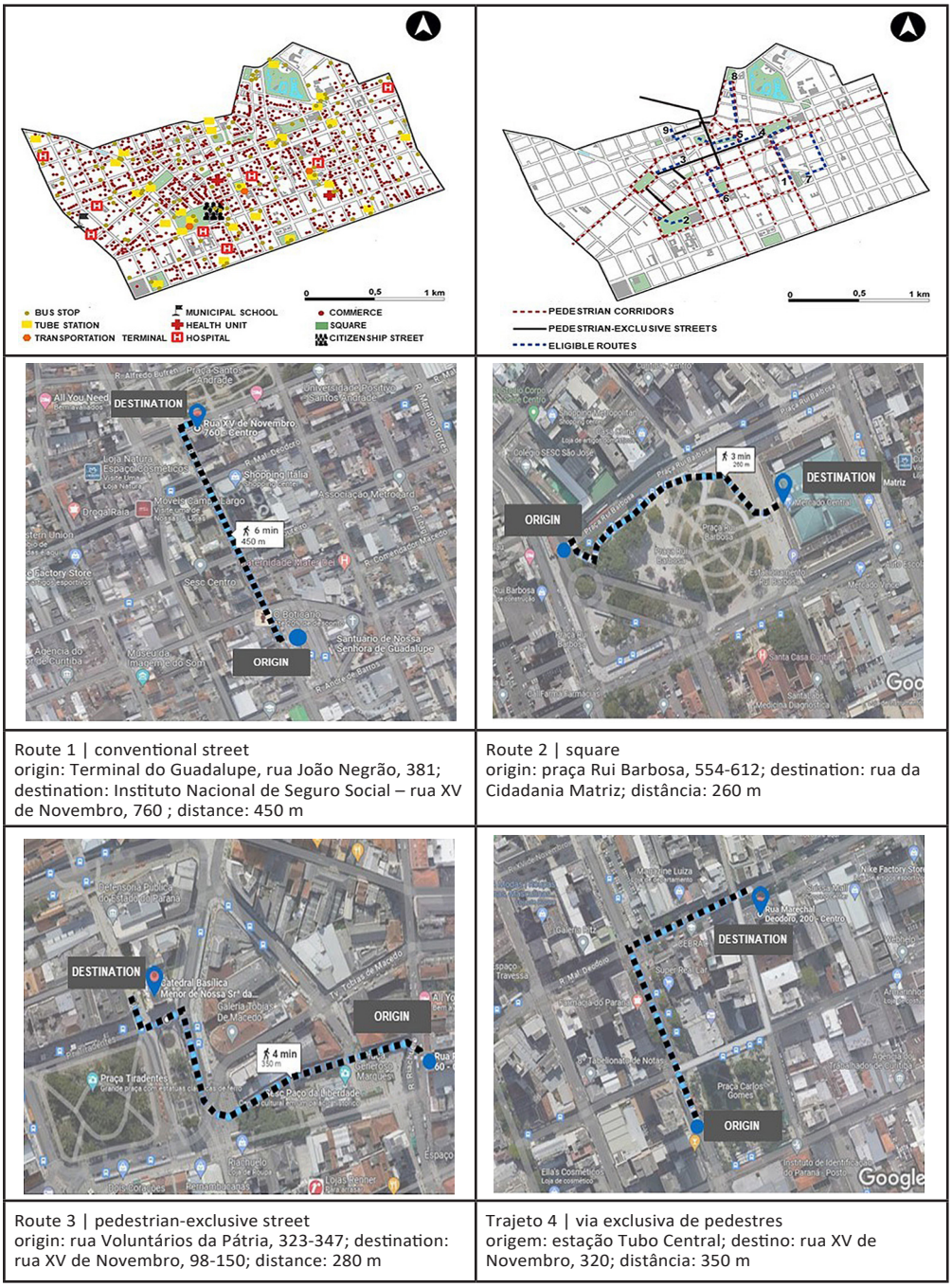
It is also worth mentioning that the zoning of land use and occupation (municipal law no. 15,511/2019) established the Special Preferential Pedestrian Sector (Sepe) in the central region of Curitiba. This area comprises "land with access to public roads, totally or partially blocked to vehicle traffic" (Curitiba, 2019, art. 96 – authors' translation).

Figure 3 – Maps of neighborhoods and regional administrations (left) and of the Regional Matriz and Centro neighborhood (right) – 2023



Source: elaboration based on IPPUC (2023b).

Figure 4 – Maps of routes in the Centro neighborhood within the selection criteria (above left) and pedestrian circulation corridors (above right) and aerial images of selected routes (below) – 2022-2023



Route 1 | conventional street
origin: Terminal do Guadalupe, rua João Negrão, 381; destination: Instituto Nacional de Seguro Social – rua XV de Novembro, 760 ; distance: 450 m

Route 2 | square
origin: praça Rui Barbosa, 554-612; destination: rua da Cidadania Matriz; distância: 260 m

Route 3 | pedestrian-exclusive street
origin: rua Voluntários da Pátria, 323-347; destination: rua XV de Novembro, 98-150; distance: 280 m

Trajeto 4 | via exclusiva de pedestres
origem: estação Tubo Central; destino: rua XV de Novembro, 320; distância: 350 m

Route 5 | square
origin: rua Riachuelo, 60; destination: Catedral Basílica Menor Nossa Senhora da Luz (near the praça Tiradentes); distance: 350 m

Route 6 | conventional street
origin: praça Carlos Gomes, destination: rua Marechal Deodoro, 200; distance: 450 m

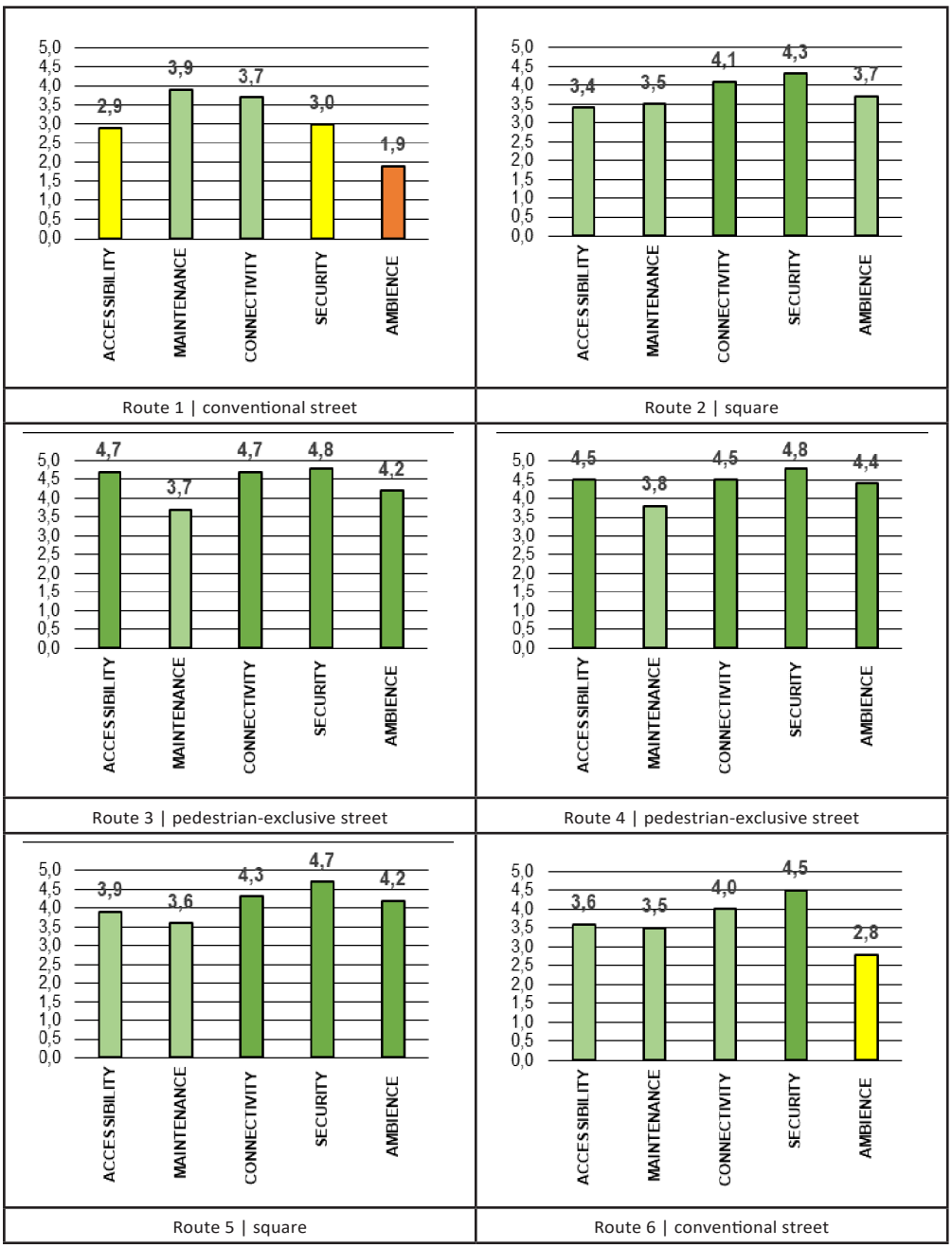
Note: Routes 7, 8, and 9 not classified for final analysis.
Source: elaboration based on Google Maps (2022-2023) and IPPUC (2023b).

The selected routes had their delimitations defined according to the criteria previously specified, initially totaling, as mentioned, nine routes (Figure 4). Its mapping was superimposed on that of pedestrian circulation corridors, with the aim of reducing to six routes representing two samples of stretches in each of the situations: conventional streets, used with vehicles and public transportation; pedestrian-exclusive streets; and squares. This contextualization of the study region supports the discussion of the main findings of the work, analyzed in the subsequent section.

Analytical results

For the selected routes according to the determined criteria for technical reading, the quality level of the sidewalks was evaluated based on the score of each section, in conformity with the performance of the established parameters. The summary of which is shown in Figure 5. From its interpretation, there is a predominance of worse results for Route 1 (conventional street), with an overall average of 2.4 (middle class).

Figure 5 – Average score graphs of the technical evaluation criteria of the selected routes in the Centro neighborhood – 2017-2023



Scale: 0,0 a 1,0 = lower | 1,1 a 2,0 = lower-middle | 2,1 a 3,0 = middle | 3,1 a 4,0 = upper middle | 4,1 a 5,0 = upper

Source: elaboration based on field surveys in 2017 and the consolidated data in 2023.

From the analysis of *accessibility* based on the trend line (Figure 6), among the six evaluated stretches, there is a convergence of higher indices, very close to the ideal scenario, for Routes 3 and 4, represented by rua XV de Novembro, that is, through the pedestrian promenade (pedestrian-exclusive street).

The lowest averages occur in situations where traffic is shared with private motor vehicles and public transportation (Route 1 – conventional street). Thus, reinforcing the fact that when these axes prioritize vehicular traffic over walkability, they offer lower accessibility conditions to their passers-by.

When evaluating *maintenance*, there is a linear convergence towards average scores (between 3.5 and 3.9) on the analyzed routes since they all have pavement and a certain level of conservation. Almost entirety, it is possible to find some old paving stones in *petit pavet* and granite slate, generating problems for the movement of people with limited mobility. The presence of paver and, in a lesser extent, other types of concrete blocks is also identified, mostly serving the free circulation lane in opposite directions.

For *connectivity* results, again Route 1 (conventional street) reveals the lowest quality indication, followed by Routes 6 (conventional street), 5 (square), and 2 (square). Therefore, a certain fragility of connection for these spaces is evident.

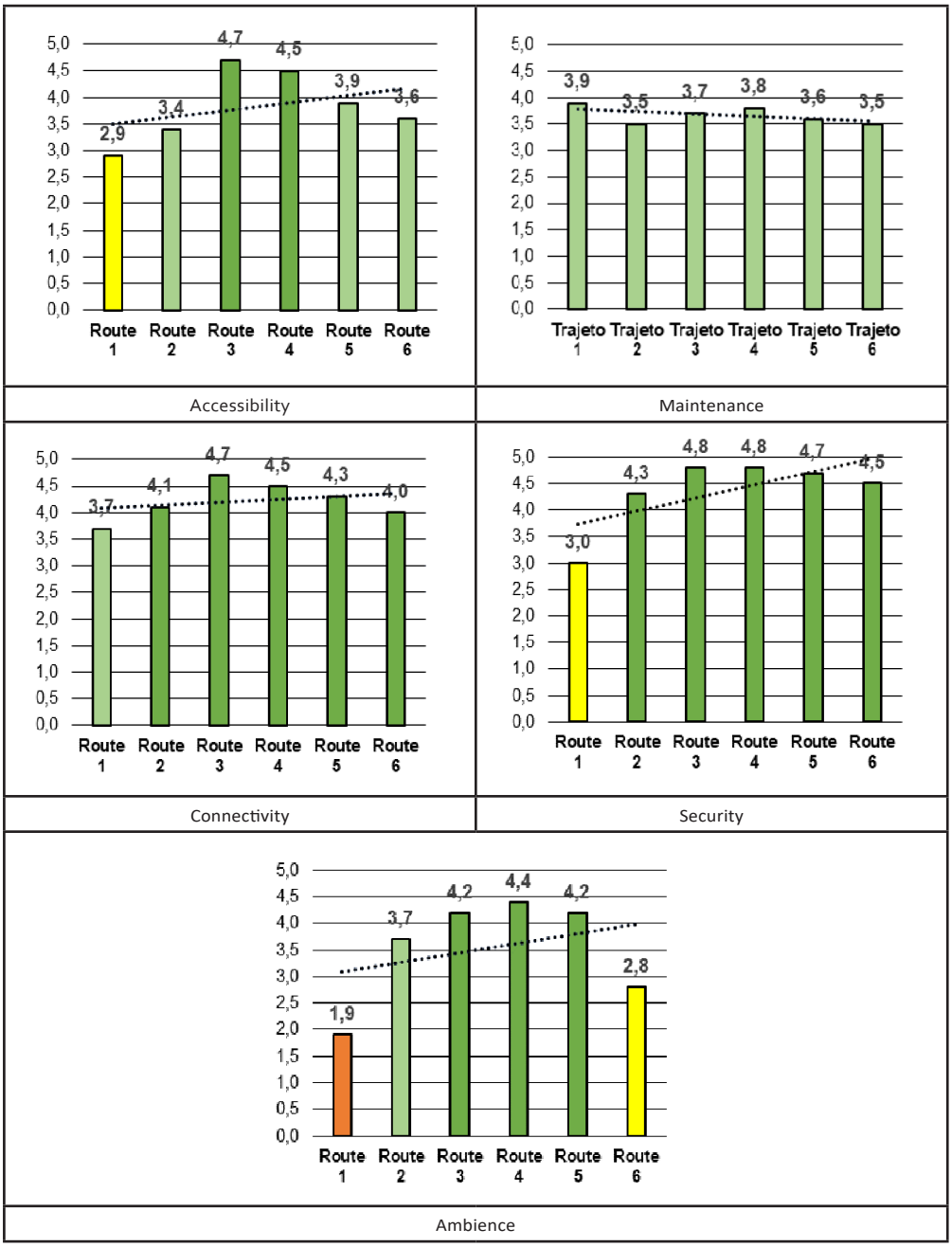
There is also a convergence of high *security* assessments for five of the six routes, justified mainly by the intense presence of pedestrians and commercial areas, as well as spaces with segregation of vehicular traffic. These situations apparently provide a greater sense of safety for passers-by. It is worth highlighting that the exception is once again for Route 1 (conventional street).

Characteristics of *ambience* for promoting social interaction and coexistence are present in the stretches of roads exclusively used by pedestrians, which, in general, offer better opportunities for the development of social interactions. These are places that, due to their landscape and comfort conditions, encourage staying and enjoying the place. In contrast, Routes 1 and 6 (conventional streets) present lower values than the others, testifying the lack of encouragement for staying and socializing in these areas.

Based on these technical reading results, the need for balance in the mobility system is diagnosed, through the search for rational use between travel modes, rethinking the use of automobiles and restoring urban spaces to pedestrian accessibility. For Baobeid, Muammer and Al-Ghamdi (2021), it is crucial to consider the forms of spatial utilization to improve the quality of life and walkability conditions, considering attributes of health, sustainability, and habitability.

During their movements, pedestrians choose comfortable routes or those attracted by adequate maintenance conditions. When they don't feel comfortable, they deviate from their route to safer routes. Elements such sidewalks width, people flow rates, presence of obstacles, and paving unavailability are some factors that significantly influence the non-use of certain urban circulation areas (Almeida, Hardt, and Hardt, 2015; Corazza, Mascio, and Moretti, 2016; Wicramasinghe and Dissanayake, 2017).

Figure 6 – Trend score graphs for the evaluation criteria
for the selected routes in the Centro neighborhood – 2017-2023



Escala: 0,0 a 1,0 = baixa | 1,1 a 2,0 = média baixa | 2,1 a 3,0 = média | 3,1 a 4,0 = média alta | 4,1 a 5,0 = alta

Notes: 1 = conventional street | 2 = square | 3 = pedestrian-exclusive street | 4 = pedestrian-exclusive street | 5 = square | 6 = conventional street
Source: elaboration based on field surveys in 2017 and the consolidated data in 2023.

Continuity is particularly important for multimodal integration, ensuring efficient connectivity between pedestrianism and transportation systems. Malatesta (2017) emphasizes that this aspect goes beyond the use of sidewalks, highlighting the indispensability of special attention to be given to crossing points among passers-by and motorized vehicles.

For a walk to be suitable, safety requirements must be met, as pedestrians need to perceive real security levels, free from conflicts or accidents with vehicles. Malatesta (2017) highlights the danger experienced in areas where the space is divided between vehicular and foot mobility, such as crossings, where most pedestrian accidents occur, for example.

However, other factors can put pedestrians at risk or cause them to feel insecure, such as possibilities of falls on sidewalks, usually caused by inadequate maintenance situations; presence of setbacks or areas of poor visibility; and sections segmented by high walls that hinder visual connection. On the other hand, the feeling of safety can be guaranteed when there is the presence of other people, police vehicles, surveillance cameras, and active facades, among other factors that attract walkability and consequent vitality (Lima and Hardt, 2019).

Ambience and legibility improve the quality of environments, offering attributes of visual stimulation, generating distinctive image provided by memorable scenarios, that favor a sense of orientation. How people perceive space, their memories may be conditioned by landscape preferences (Gavrilidis et al., 2016).

Based on the results of the technical reading of the evaluated spaces, it is possible to summarize the following observations for the formal and functional quality of sidewalks for public use in the Centro neighborhood of Curitiba:

a) pedestrian-exclusive streets, followed by squares, have a lower incidence of impedance factors corresponding to elements that can interfere with passers-by flows and free circulation, such as vegetation, signposts, and urban furniture, in both directions.

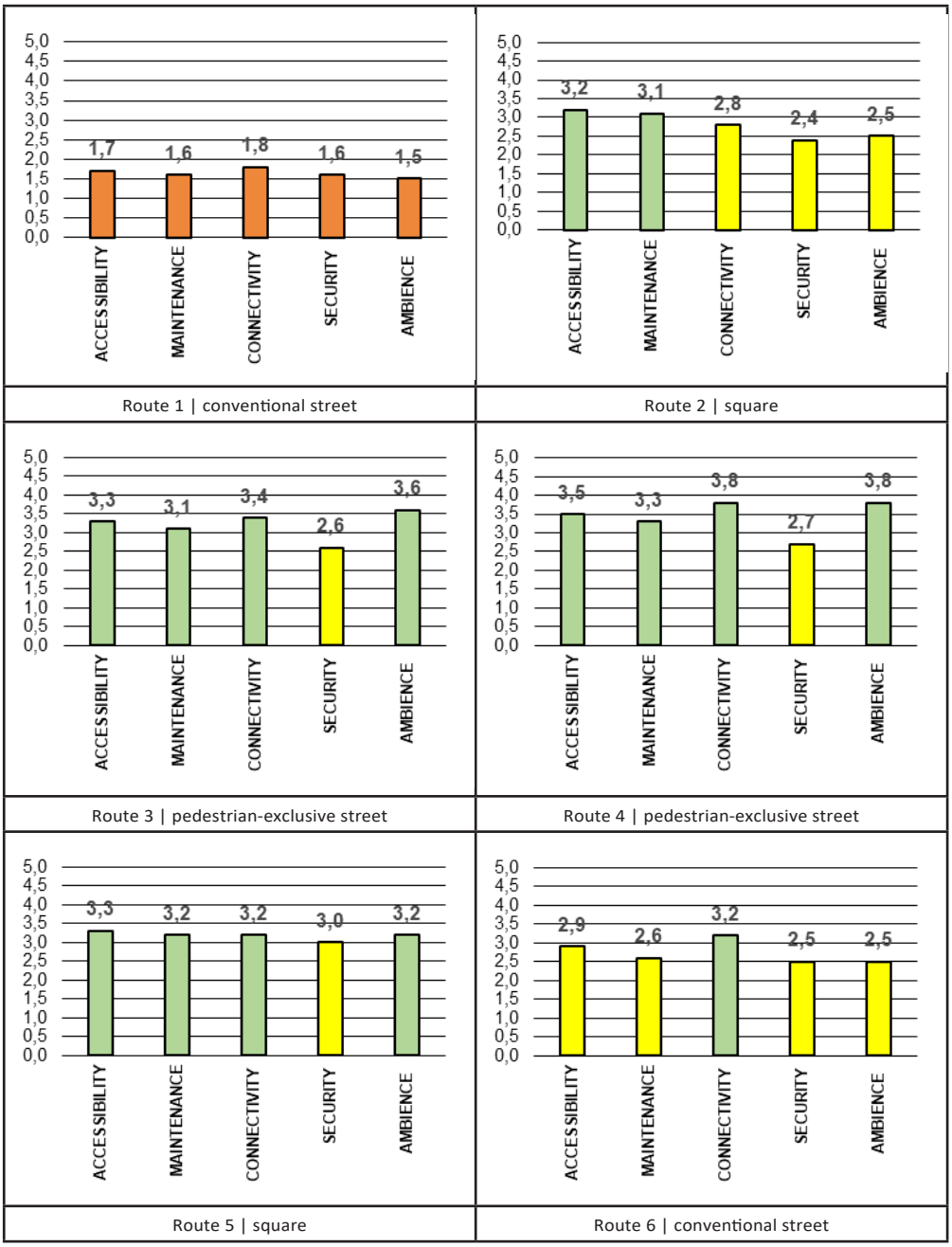
b) ambience factors have the lowest overall average, despite their effects on the general quality of the environment, with incentives to stay local due to positive visual attributes and spaces for coexistence that promote vitality to the city. Thus, by bringing together such elements, pedestrian-exclusive streets and squares provide better general conditions for the ambient.

c) the maintenance criterion also has a reduced average compared to the others, since the degradation of public space, insufficient conservation of areas, and inadequacy of works interferes with the qualitative characteristics of the built environment and the safety offered to passers-by.

This set of information obtained from the technical reading of the selected segments is compared with the perceptual analysis of users. To equalize and make the results more reliable, 29 of the total of 174 people with reduced mobility walked each of the six routes, being distributed proportionally, as previously specified.

In terms of perception of sidewalks for public use, the relevant results regarding the scoring of the experience on the routes, with an evaluation of 0 to 5 points on the criteria of accessibility, maintenance, connectivity,

Figure 7 – Average score graphs of the perceptual evaluation criteria of the selected routes in the Centro neighborhood – 2017-2023



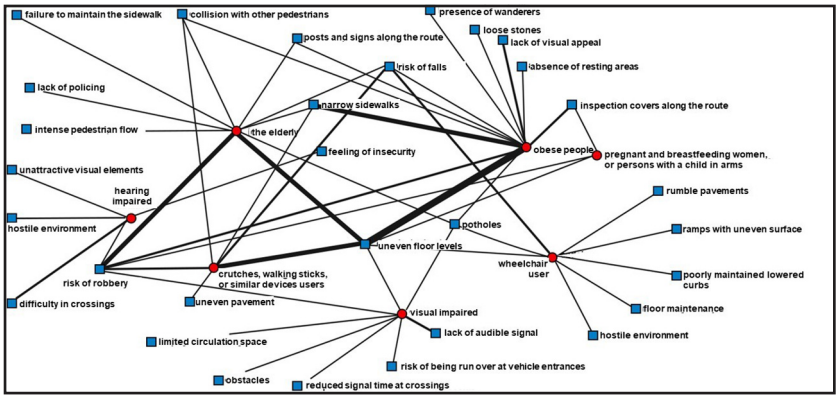
Scale: 0,0 a 1,0 = lower | 1,1 a 2,0 = lower-middle | 2,1 a 3,0 = middle | 3,1 a 4,0 = upper-middle | 4,1 a 5,0 = upper

Source: elaboration based on the responses from the questionnaires applied in 2017 and the consolidated data in 2023.

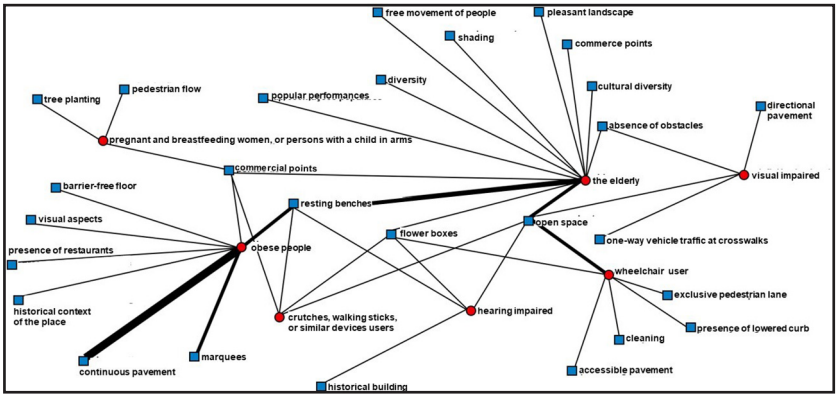
security, and ambience, are shown in Figure 7. A noticeable qualitative reduction is observed compared to the technical reading, with the most critical situation revealed for Route 1 (conventional street).

In responses to open questions, interviewees cited three positive and three negative points perceived during their journeys on each stretch, inferring that they are not able to remember the qualities perceived on these routes. On the contrary, when asked about the unfavorable perception, the networks illustrated in Figure 8 demonstrate that each group, according to its needs or mobility capacity, points out different variables.

Figure 8 – Schematic representations of the most representative examples of interaction networks of negative and positive points indicated by groups with reduced mobility – 2017-2023



Route 1 | conventional street: negative aspects



Route 4 | pedestrian-exclusive street: positive aspects

Legend: = groups with reduced mobility
= negative and positive points

Source: elaboration based on the responses from the questionnaires applied in 2017 and the consolidated data in 2023.

Thus, there is a reaffirmation of the statement of Jeffery (2019), which advocates that the cognitive process related to the city, with values, interpretations, and meanings attributed to the built environment, is conditioned by psychological issues. These aspects can be associated with different body postures and mobility difficulties for everyone.

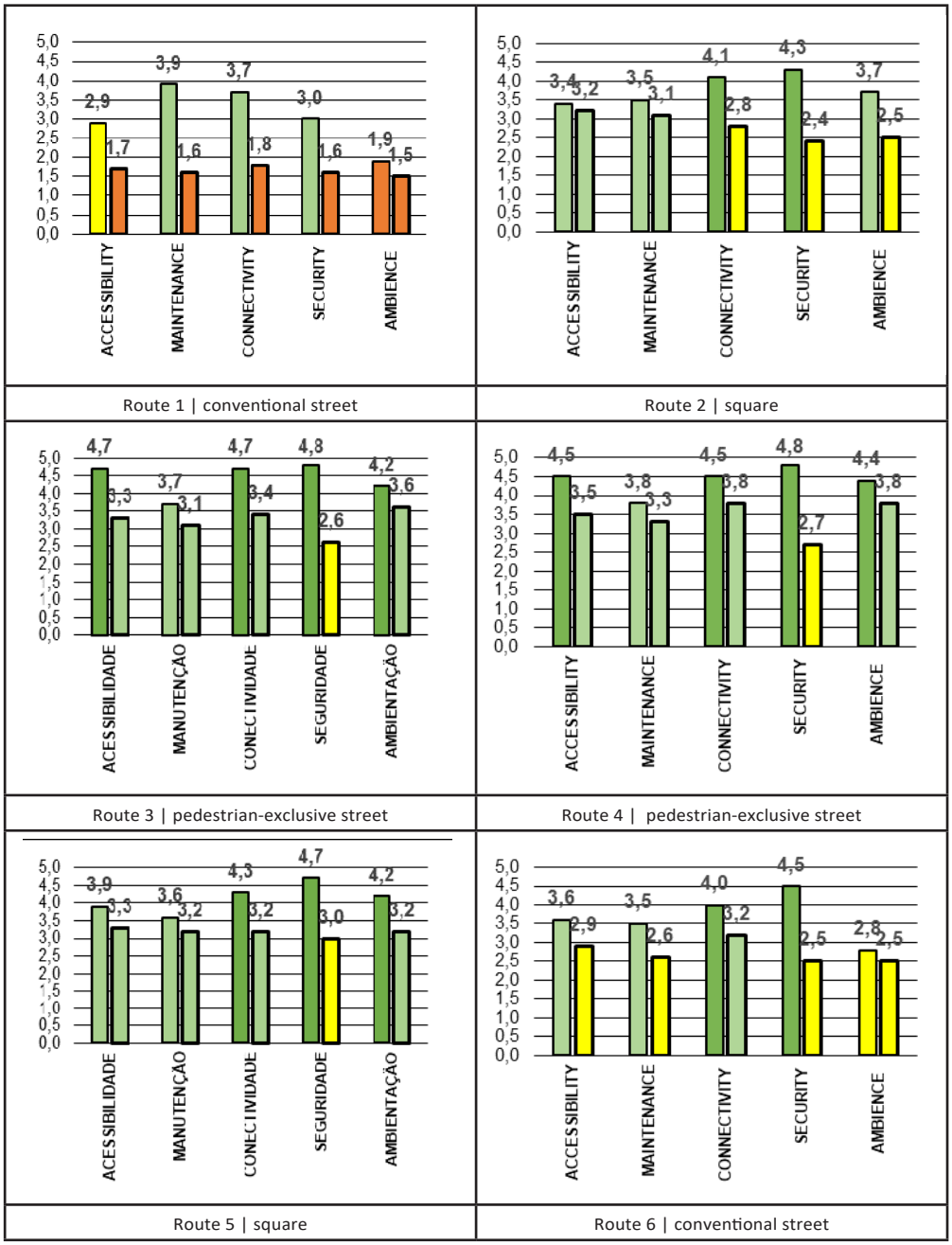
For wheelchair users, factors such as fall risks related to insufficient maintenance of pavements, such as the presence of openings, ramps, and level differences, as well as failures in the conservation of lowered curbs, are seen as the most critical. There is also a convergence towards paving uneven, exposure to theft and narrowing of the sidewalk, especially for the elderly and obese people. These conditions factors, called "urban barriers" (Strohmeier, 2016), characterize difficulties for the movement of these special groups in urbanized spaces.

Through the integrated assessment, the results of the technical and perceptual analyzes of groups with reduced mobility are compared regarding the selected routes, aiming to recognize patterns of approximations or discrepancies. However, it is important to note that the accessibility of these people is linked to their ability to move, and the sidewalk plays a crucial role in providing this possibility to pedestrians (Duarte, Sánchez, and Libardi, 2012). This argument reinforces the principles of federal law n. 12,587/2012, which establishes the guidelines of the National Urban Mobility Policy (Brazil, 2012) with the aim of contributing to universal access to the city through equity in the use of public space.

From Figure 9, it can be inferred that, in Route 1 (conventional street), the technical evaluation distances deviates from the perceptual process of the interviewees, except for the criterion of ambience. This reinforces the principle that even when the city offers accessibility conditions according to current standards, the ways in which groups with reduced mobility experience and interact with the environment follow an opposite direction, confirming the need to understand the perception and spatial appropriation by these social segments (Nanchen et al., 2021). In a generic sense, the greatest discrepancies between technical reading and perceptual analysis are recorded for Route 1 (conventional street).

When comparing the set of data from the technical assessment with the perception of the groups studied, the concept is reinforced that exclusive pedestrian roads, followed by open spaces, in this study represented by squares, offer better physical and psychological conditions to passers-by (Table 1), allowing greater autonomy in movements and enhanced incentive to spatial enjoyment. Gehl (2013) emphasizes that, for there to be encouragement of social and recreational activities, the external environment must offer maximum advantages and minimum inconveniences.

Figure 9 – Comparative graphs of the average score of the criteria of technical reading and perceptual analysis of the selected routes in the Centro neighborhood – 2017-2023



Legend: = technical reading
= perceptual analysis

Scale: 0,0 a 1,0 = lower | 1,1 a 2,0 = lower-middle | 2,1 a 3,0 = middle | 3,1 a 4,0 = upper-middle | 4,1 a 5,0 = upper

Source: elaboration based on field surveys and the responses from the questionnaires applied in 2017 and the consolidated data in 2023.

Table 1 – Comparative data on relationships between scores attributed by technical reading and perceptual analysis of selected routes – 2017-2023

Routes	Criteria	Technical reading	Perceptual analysis	Averages by criteria	Averages by routes
1 (conventional street)	Accessibility	2,9	1,7	2,3	2,4
	Maintenance	3,9	1,6	2,8	
	Connectivity	3,7	1,8	2,8	
	Security	3,0	1,6	2,3	
	Ambience	1,9	1,5	1,7	
2 (square)	Accessibility	3,4	3,2	3,3	3,3
	Maintenance	3,5	3,1	3,3	
	Connectivity	4,1	2,8	3,5	
	Security	4,3	2,4	3,4	
	Ambience	3,7	2,5	3,1	
3 (pedestrian--exclusive street	Accessibility	4,7	3,3	4,0	3,8
	Maintenance	3,7	3,1	3,4	
	Connectivity	4,7	3,4	4,1	
	Security	4,8	2,6	3,7	
	Ambience	4,2	3,6	3,9	
4 (pedestrian--exclusive street	Accessibility	4,5	3,5	4,0	3,9
	Maintenance	3,8	3,3	3,6	
	Connectivity	4,5	3,8	4,2	
	Security	4,8	2,7	3,8	
	Ambience	4,4	3,8	4,1	
5 (square)	Accessibility	3,9	3,3	3,6	3,7
	Maintenance	3,6	3,2	3,4	
	Connectivity	4,3	3,2	3,8	
	Security	4,7	3,0	3,9	
	Ambience	4,2	3,2	3,7	
6 (conventional street)	Accessibility	3,6	2,9	3,3	3,2
	Maintenance	3,5	2,6	3,1	
	Connectivity	4,0	3,2	3,6	
	Security	4,5	2,5	3,5	
	Ambience	2,8	2,5	2,7	
Averages		**3,9**	**2,8**	**3,4**	**3,4**

Scale: 0,0 a 1,0 = lower | 1,1 a 2,0 = lower-middle | 2,1 a 3,0 = middle | 3,1 a 4,0 = upper-middle | 4,1 a 5,0 = upper

Source: elaboration based on the results of the technical reading of the selected spaces and the perceptual analysis of social actors from the data consolidated in 2023.

During this study, on-site visits allowed the identification of the sense of appropriation and permanence in pedestrian-exclusive streets, with people resting in seating areas; the elderly gathered to talk and observe the movement; and individuals standing in front of shop windows or watching events on the street. The same occurred in the squares, but with less intensity.

The dynamics observed in these two spatial typologies are not the same as those identified on conventional streets, where pedestrians were just passing through, as there were no incentives or infrastructure conditions for their stay. Lima and Hardt (2019) discuss planning for vitality as that capable of stimulating a diversity of uses and citizens, promoting the population's identification with external environments.

Based on the peculiarities of each reduced mobility group, regarding the criteria of technical reading criteria and the main aspects perceived by the interviewees, it is possible to highlight some indications for planning sidewalks and spaces for public use for adequate urban management. In general, pedestrian-exclusive streets offer better accessibility conditions, due to factors such as the presence of directional tactile paving, level crossings, and homogeneous pavement without slopes or obstacles on the route. However, this parameter is understood in a particular way by people, according to their own desires.

Maintenance is directly linked to accessibility, with a trend of average qualification for this aspect, both in technical and perceptual analysis. This result is because the city's central sidewalks have paving and indicators of relative conservation.

In turn, *connectivity* is attributed lower perceptual evaluations compared to the previous criteria, which is justified by the situation that, when performing the routes, respondents mentioned alternative paths that would provide greater safety and autonomy until reaching the destination. It is inferred that pedestrians often take longer routes to reduce the possibilities of incidents.

Security receives the lowest evaluation values in the perceptual analysis, mainly related to the risks of thefts and robberies, in places with greater crowds of people, as well as falls, especially for visual impaired individuals, the elderly, and persons who use support devices to locomotion.

Perceived differently among the groups, the *ambience*, as expected, is not highly valued by citizens with visual impairments. However, it is more appreciated by older adults who associate this criterion with the image of urban design and the enjoyment of the city.

In this sense, the sidewalk landscapes as places for socialization is not only linked to accessibility criteria and their technical standards, but is integrated with maintenance, connectivity, security, and ambience. This adequate interaction allows for various forms

of appropriation of urban space and the experience of cities with quality of life for their citizens (Arefi and Aelbrecht, 2023).

Thus, the purposes considered in the previous findings should guide the planning process of urbanized landscapes, which, in short, cannot do without the participation of different strata of society in its diverse stages, valuing human experience in citizen decisions about their living spaces, whether daily or sporadic (Cohen-Blankshtain and Gofen, 2021). Based on the results achieved, it is possible to formulate differentiated subsidies for public management associated with the implementation of sidewalks as places for socialization. Thus, the promotion of accessibility through functional urban design stands out, meeting the needs of different groups with reduced mobility.

Also worthy of mention is the requalification of spatial morphology, favoring spaces focused on the human dimension and the enjoyment of places, generating possibilities for socialization, as well as the realization of measures related to the safety and physical integrity of citizens. Likewise, it is worth mentioning the encouragement of walking on short distance routes, providing conditions for ambience, such as benches for standing, shading for comfort, and attractions for visual pleasure, among others. These issues must be congruent with society's awareness to increase respect and empathy for people with mobility difficulties.

Therefore, within the scope of urban planning and management processes, citizens' aspirations and activities must be analyzed (Becker et al., 2023), based on socio-spatial conditions. In summary, not only technical requirements must be considered, but also visual communication, landscaping components, and characteristics related to the perceptual process and creation of mental maps for everyone. These postulates provide conclusive reflections on the conducted investigation.

Final considerations

Within the scope of the methodological approach, the methods and techniques employed in the research made it possible to technically evaluate the selected routes and analyze the perception of social groups with reduced mobility. As a corollary, they result in the qualitative and quantitative integration of criteria, such as accessibility, maintenance, connectivity, security, and ambience, for assessment of sidewalks for public use.

In terms of the theoretical dimension, it appears that there is abundant material on the quality of sidewalks and walkability indices, along with a wide variety of concepts related to morphology and urban design, as well as the city’s image. It is also possible to note copious references regarding environmental

perception with a view to spatial appropriation linked to the identity of places in the landscape management.

However, in parallel, there is a noticeable gap in scientific production regarding the appreciation of the associations between technical reading of sidewalk use and the perceptual analysis of their users, especially among the elderly, obese people, and pregnant women. These aspects should be further explored in future research, in alignment with gender perspectives trends.

In the empirical context, the characterization of the case study in the Centro neighborhood of Curitiba allowed for the delimitation of six routes based on a set of subsidies. The mapping of data relating to public facilities, transportation components, commercial and service areas, and pedestrian flow corridors facilitated the determination of the evaluated segments.

During the field surveys, roads with signs of lower walkability were observed, as well as spaces originating from revitalization projects, presenting, in this case, better conditions compared to the six examined routes but did not meet the selection criteria defined for this work. Evidently, a larger number of segments would enhance the significance of the findings, recommending this expansion for further research, covering other neighborhoods in the capital of Paraná, as well as other Brazilian cities, in line with the guidelines of the master and mobility plans, contributing to the integrated municipal planning process.

From another perspective, documentary information made it possible to diagnose urban planners' concerns with encouraging sidewalks use, making them inclusive to their users. Nonetheless, specialized analysis reveals problems in the practical implementation of the planned guidelines.

For walkability to be a viable alternative for commuting, areas dedicated to this purpose must have an adequate level of quality. In this regard, adapting methods for the evaluation of places intended for pedestrian use allows the identification of routes where passers-by are more susceptible to the risk of accidents and physical and psychological discomfort, among other adversities.

At the same time, the results found demonstrate that technical reading does not always align the desires and particularities experienced by everyone in their movements and experiences in the city. Therefore, the importance of understanding the environmental characteristics of the occupied space is highlighted in association with the comprehension of motor accessibility and the sensations and emotions experienced by social actors who have special mobility needs.

Although there are municipal guidelines for configuring sidewalks, aimed at meeting the circulation needs of pedestrians and with accessibility criteria in line with current standards, technical measurements show that much remains to be accomplished in this regard. In these circumstances, it is recommended to create accessible routes

between certain urban components, such as university areas, government agencies, tourist attractions, and commercial points, for example, as well as facilitated access to public transportation, with special attention to people with disabilities and those individuals who travel daily. This reinforces the contribution of work in the development of public policies focused on walkability, emphasizing on the human dimension and more active mobility.

In turn, the perceptual analysis of the studied routes allows understanding the interviewees' relationships with feelings of belonging, appropriation, and inclusion in the spaces in their daily activities. However, the suitability of increasing the sample population for future investigations is indicated, with a view to achieving the highest possible statistical significance.

Among the main difficulties encountered during the application of the questionnaires, the insecurity of people regarding the space itself and the inefficiency of infrastructure for respondents to sit, both to rest and to answer the questions, are highlighted. Once again, the importance of creating spaces for ambience and city experience is evident.

The crossing of urban design data with the perception of reduced mobility groups for qualitative and quantitative integration of technical and perceptual results on sidewalks for public use with the conditions of accessibility, autonomy, comfort, and safety, systematizes some foundations for the management of the socialized landscape. The results obtained by the integrated assessment reaffirm the relevance, not only of observing technical requirements related to urbanistic functions but also their interaction with socialization phenomena in urbanized scenarios, where, in principle, spaces are enjoyed and perceived by all.

Thus, for future opportunities, it is suggested to interpret the influences of walkability on the landscape concerning the possibility of structuring management guidelines for the construction of sidewalks and spaces that consider not only conventional accessibility criteria but also connectivity, security, and ambience for social actors. These issues should focus on the occupation and appropriation of the urbanized environment.

In summary, this study contributes with indications for improvements in the formulation of accessibility policies and in the more assertive definition of concepts related to the landscape of contemporary cities, supporting new municipal master plans and their respective instruments. Paradoxically, there is a relative impossibility of confirming the guiding hypothesis that meeting specialized principles allows better perceptive qualifications, enhancing identification, belonging, and appropriation of sidewalks as places for socialization, as were not diagnosed in the case studied.

In this sense, the analytical results demonstrate that the quality of sidewalks reaches higher levels than those obtained by the perceptual interpretation of the interviewees. It is also clear that different social segments, according to their needs, desires, and limitations, have distinct perceptions, leading to diverse demands for the appropriation of public space.

Even with the achievement of the general objective of the research of evaluating the conditions of sidewalks for groups with reduced mobility, it is acknowledged that the adopted procedures focus, in their empirical cut, only on the Centro neighborhood of Curitiba. Therefore, the recommendation is reiterated that other studies invest in greater spatial coverage and include evaluation techniques for urban zones with differentiated uses.

Finally, it is worth remembering that the continuity of investigations is advisable to generate bases for broader analyzes and to deepen the theme and related subjects, associating the appropriation of urban spaces with the perception of different strata of society, such as contribution to city management. This guidance enhances the possibility of creating sidewalks as places of socialization to ensure equity for reduced mobility groups.

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