

Evaluation of Accessibility of Wheelchair Users to the Belo Horizonte Collective Transportation System

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Abstract- Throughout the world, it is notorious that the concern with mobility and accessibility is growing. This fact can be seen through public transport, which has undergone a constant evolution towards and improvement in the care of people who have reduced mobility. Even with all the technology applied so that these users can have a better quality of life in relation to their locomotion, it was perceived through researches that there is still much to do, taking into account the length of the laws and regulation of the transport.

Keywords- *Accessibility, Mobility, Transport*

I. INTRODUCTION

According to the latest census conducted by the Brazilian Institute of Geography and Statistics - IBGE, in 2010, about 29.9% of the population has some type of disability, whether it is visual, hearing, mental or motor; this number represents more than 45.6 million Brazilians. Motor deficiency was the second with the largest number of people, behind only the visually impaired, with about 7 million people, which is equivalent to about 13.2% of the Brazilian population [19].

Given this scenario, discussions about accessibility, urban mobility and the inclusion of people with disabilities are present and the problems surrounding this issue are growing every day, often due to the lack of infrastructure in cities that, in most cases, are not prepared to ensure quality of life for all people.

Public transportation is one of the main challenges when it comes to accessibility and mobility in Brazilian cities. Some factors that influence transport precariousness are the lack of planning and transparency and the lack of investments. In addition, there are daily complaints about the lack of accessibility of transport, preventing people with disabilities from having the same mobility conditions as the others [16].

Taking into account the need for these people to have their rights ensured, the first law for people with disabilities came into force in the 1980s; Law 7853/89, which establishes general rules to ensure individual and social rights for persons with disabilities. From then on, other norms and laws were established in order to improve the lives of these people.

To solve this problem, it is necessary not only temporary measures, but a complete planning, which involves three fundamental principles, which are: to plan and design with accessibility, to adapt spaces and support equipment, besides investing in technology to meet the needs of users [26].

Considering all this scenario that involves many cities in Brazil, this work seeks to point out the main issues that involve the mobility of these passengers and the difficulties encountered in the day to day.

This study is justified by the need of transportation meet all the criteria of standards of accessibility and mobility, seeking a better quality of life for people with disabilities.

Therefore, this article has the objective of carrying out an analysis in the city of Belo Horizonte, observing if these norms and laws have been fulfilled aiming at the question of elevating platforms. For this it was necessary, (i) to identify the lines with the greatest problems; (ii) verify the user's perception of the quality of transportation; (iii) to point out the causes of the problem and finally (iv) to propose improvement actions.

II. MATERIALS AND METHODS

The research project was defined as a case study, which is the intense and in-depth study of one or more objects [17].

The methodological processes were initiated through surveys with data from the IBGE, which indicated the population with some type of disability, progressing to work through a questionnaire answered by people with physical disabilities, which confirmed the need for an analysis focused on the improvement of public transport for wheelchair users.

III. THEORETICAL REFERENCE

A. *Stories of urban transport*

One of the great factors for the evolution of public transportation was the Industrial Revolution in the nineteenth century. This happened with the appearance of the trams (vehicles that moved on rails), in the city of New York, in the year of 1832.

In 1890 the first buses (name given to mechanically driven vehicles driven by gasoline) were developed, which were first used by the population of Germany, England and France. Because of its great advantages - such as low cost, greater locomotion and great flexibility - the trams were soon replaced by buses [8].

In Brazil it was no different. Soon after the Industrial Revolution period, with the great concentration of the population in the great urban centers, it was necessary to create a plan to reduce the impacts caused by this phenomenon.

As a result, the Brazilian population also benefited from public transportation, which was done through trams, facilitating the arrival of people from the countryside to the big city, in order to transit in and out of urban areas. But this means of transportation at the beginning, because of its cost, was for the exclusive use of the middle class, a situation that reverted with the passage of time with the arrival of the diesel bus.

In view of this situation, it was necessary to create a transport planning that would serve the population in a general way, in order to provide everyone with a quality service, accessible and, over the years, has evolved in a way positive. This fact is due to the studies and researches made so that this means of transport has significant improvements [28].

B. Accessibility

Accessibility is understood as the inclusion of people with disabilities in daily activities, that is, it is able to have access to services, information and products as any individual.

The first discussions around the issue began in the United States at the end of the Second World War. This is because countless soldiers returned mutilated from the war and it was necessary that there was a suitable environment to receive them [12].

In Brazil, only in 1989 began to emerge the first initiatives around the theme. Many are the difficulties faced by people with disabilities or with reduced mobility, in the day to day. The obstacles faced range from physical barriers, lack of awareness of people, not respecting their rights, such as reserved spaces in certain environments and the prejudice faced in schools, on the streets and especially in the labor market.

As far as physical barriers are concerned, one should highlight the architectural barriers, which are those found in buildings that in some way impede the access of people with disabilities, are the greatest impediment to these people to enter the labor market, in public places, schools and leisure places [22].

It is important to note, too, that there are several problems in cities such as balconies and box office, sidewalks, footpaths with holes, apart from the lack of ramp and elevators in many buildings, including the public.

In the case of collective public transport, problems with lack of accessibility happen all the time. It is indispensable that

the means of transport take care of all the displacement in the city, being this displacement safe and autonomous.

Federal Decree No. 5.296 / 2004 establishes certain points to be followed, in which it is worth mentioning: boarding without level, without steps, to facilitate the embarkation of people with short stature, elderly, wheelchairs and difficulty of locomotion, as well as the collectives must have space for people with wheelchairs and seats for people with low mobility, and it also emphasizes that transportation is accessible when it has all its components adapted following the concept of universal design, promoting total use with safety and autonomy for the entire population.

C. Urban mobility

Urban mobility is understood as the displacement of people within the urban space, whether by bus, car or even walking.

The establishment of a model of urbanization with an emphasis on mobility has been compromised with every passing day, due to the great concentration of people, cars and consequently public transportation in urban centers, which has diminished and the quality of people's mobility [6].

The quality of public transport service, is among the challenges of urban mobility should understand the needs of its users, so that, from there, to be made and changes the system to function properly [16].

Belo Horizonte, which has a population of 2,375,151 people, according to the sense of 2010, is no different and, due to its large population, there are problems with traffic daily. In view of this, the urban mobility plan was created between March 2008 and August 2010, in order to guide individual, collective and non-motorized transportation actions. This plan mapped out and diagnosed the main problems and their points, thus proposing improvement plans.

It is also important to emphasize that the concept of urban mobility is concerned with social inclusion, environmental sustainability, participatory management and democratization of the public space. Therefore, it is necessary that all people be cared for in the same way, be it deficient or not, assuring their right to come and go.

D. Transport regulations

The decree of the prefecture of Belo Horizonte regarding the regulation of collective transportation is the decree number 13.384. It was approved on January 18, 2008 and serves as the basis for standardization and improvement of bus quality.

In this decree are contained ten chapters, where 163 articles are found, all related to the quality of transportation and duties of the concessionaires and bodies responsible for each function.

All ten chapters cover, in a very specific way, topics such as: transportation safety, operational nature, operators' rights and duties, use of available technology, types of inspection, among others.

In the regulation, we also have specific articles dealing with issues related to mobility and accessibility of people with reduced mobility.

Articles 9 and 29 presented in Chapter II can be highlighted, which speaks of the space that should be reserved not only for disabled people but for all passengers with some kind of priority or special need and also addresses specifications for the use of gratuity of the same.

Therefore, the regulation of transportation serves as a guideline for companies to follow a standard of quality and seek to adapt more and more to their prerequisites, which are contained in the articles, evolving every day, so that it becomes an accessible and safe transport for its users.

E. Laws and regulations

Currently there are several laws and regulations that ensure rights and quality of life for people with disabilities, but this has not always been the case. According to the Brazilian Institute for the Rights of Persons with Disabilities (IBDD, 2011), the first law in which the Brazilian State assumed obligations in relation to persons with disabilities was enacted in 1989, Law 7853. Thereafter, other laws were emerging so that these people could be included in all social spheres, guaranteeing transportation, education, health, sports, among others [18] [9].

Over the years, other laws have been emerging for all levels of disability, such as auditory, visual and motor. With regard to motor deficiency and wheelchair users, there are a lot of laws and regulations, but there is still a lot to be done.

The following laws may be highlighted; Law No. 10098 of December 2000, which establishes general standards and basic criteria for persons with disabilities and reduced mobility, removing barriers and obstacles in roads and public spaces, in urban furniture, in the construction and renovation of buildings and in means of transport and of communication. This Law aims at the possibility and condition of reaching, with security and autonomy, in the transportation, edification, urban furniture, among others, by the disabled and with reduced mobility [10].

Law No. 13146 of July 8, 2015, establishes the Brazilian law of persons with disabilities, whose purpose is to ensure and promote equality for persons with disabilities, as well as to promote social inclusion and citizenship. In this law, rights are envisaged in all social spheres, in instances such as public health, education, housing, and work, among others [11].

It is also important to highlight the NBRs, which establish rules, guidelines and guidelines for spaces and services.

NBR 13994 refers to lifts for the transportation of persons with disabilities, setting conditions in the design, installation

and manufacture of passenger lifts, so that these people can move about without the help of third parties in buildings. The NBR 9050, which establishes criteria and technical parameters to be taken into account in the design, construction, installation and adaptation so that the buildings meet the accessibility standard. The purpose of this standard is to enable the use of a secure, autonomous and independent way by all users [1]

Due to the context of the present work, it is also important to highlight the NBR 14022 - Accessibility in vehicles of urban characteristics for the collective transport of passengers. The purpose of this standard is to promote accessibility with safety to the greatest number of passengers possible, with the predominance of users' autonomy. This standard establishes the places of stop and terminals, and should be analogous to NBR 9050, besides defining other complementary parameters. Among several other items, the standard emphasizes the requirement of preferred places for chairs and guide dogs and also preferential seating for people with disabilities and reduced mobility [2].

F. Public transportation in Belo Horizonte and the metropolitan region

The city of Belo Horizonte has been growing steadily every day and today it is made up of 34 municipalities. Due to this fact, the demand for public transportation has been increasing significantly, causing new bus lines to be created and new technologies made available to its users.

In order to serve its users, metropolitan transportation has 740 bus lines and 3,000 vehicles that cover a 643,000-kilometer journey per day. These lines serve approximately 890 thousand passengers per day and the average amount charged of the fare is R\$ 4.00. These lines are divided by seven transport concessionaires, and are represented by Sintram (Union of Metropolitan Passenger Transport Companies) which was created in 2001.

BRT corridors and metropolitan terminals were created with the objective of optimizing the displacement of public transport, which resulted in reduced travel time for passengers and increased the number of trips during the day, as well as being a system with much more accessibility than the others, since it counts on accessible platforms, all the equipped buses besides the ramps of access to the platforms.

The responsibility of the public transport of passengers inside is the municipality, but not all municipalities carry out this function. Only 18 of the 34 municipalities have their own collective transportation system. The table below lists the 13 largest metropolitan public transportation systems, with the number of respective lines of each and also the number of passengers that these lines carry daily:

TABLE I. NUMBER OF BUS LINES AND PASSENGERS PER DAY OF MUNICIPAL TRANSPORTATION SYSTEMS

County	Number of Lines	Passengers/Day
Belo Horizonte	324	1,769,744
Contagem	46	227,555
Betim	45	124,198
Ribeirao das Naves	24	25,145
Santa Luzia	22	17,669
Nova Lima	18	2,836
Sabara	18	8,693
Vespasiano	17	5,564
Pedro Leopoldo	12	8,732
Lagoa Santa	10	6,841
Caete	9	3,711
Brumadinho	7	489
Ibirite	7	9,953

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The responsibility for transport and traffic management in the capital of Belo Horizonte is from BHTRANS (Transport and Transit Company of Belo Horizonte), which was created in 1991.

Nowadays, with the advancement of technology, many of these lines rely on affordable vehicles, but most of the time they do not serve their users with special needs as they really ought to be, but are still considered a great achievement, because a few years ago there was no concern regarding this great problem in the production of vehicles for public transportation.

Therefore, for the public transport system to improve significantly, the thematic chamber advocates that it be treated as a social policy, how education, health and social assistance are treated [5].

IV. RESULTS AND DISCUSSION

In order to recognize the lines with the main problems and their causes, a research was done through a questionnaire. However, what was possible to realize is that you can not point a specific line as bigger problems as shown in table 2.

According to this table, it is possible to notice that some lines have the same problem, that of missing the platform or it is damaged.

Through the research also, it was possible to realize that the majority of people who are wheelchair users and use public transport are women, and women use transportation daily and face difficulties every day, as shown in the figures 1-3.

TABLE II. PERCEPTION RESEARCH

Bus line	Number of users	Observations
1140	2	Ok
1300	2	Some do not have or are damaged
1290	2	Ok
1191	2	Ok
1003	2	Ok
1200	1	Ok
1230	1	Ok
33	4	Ok
2980	1	Ok
Circular 01	5	Some do not have or are damaged
4301	1	Ok
1505	1	Ok
1505R	1	Some do not have or are damaged
202	2	Some do not have or are damaged
9250	2	Some do not have or are damaged
9205	1	Usually do not have
4201	1	Ok
2151	1	Ok
204	1	Ok
2104	1	Ok
61	1	Ok
205	2	The old ones are the ones with the biggest problems
2190	1	Ok
3052	1	Ok
3051	1	Some do not have or are damaged
3050	1	Ok
304	1	Some do not have or are damaged
4103	9	Ok
1502	8	Ok
83Direta	2	Ok
801	1	Ok
4105	1	Some do not have or are damaged
4155	1	Some do not have or are damaged
113	1	Ok
4110	1	Ok
4115	1	Ok
4145	1	Ok
5201	1	Ok
614	1	Ok
50	1	Ok
618	1	Ok
52	1	Ok
6573	1	There is no on-board agent
705	1	Ok
809	1	Some do not have or are damaged
811	1	Some do not have or are damaged
815	1	Some do not have or are damaged
8501	1	Most do not have a lift.
3501b	1	Ok
4108	1	Ok
9202	1	Ok
9407	1	Some do not have or are damaged
5102	1	Some do not have or are damaged
4034	1	Ok
9210	1	Ok
2980	1	Some do not have or are damaged

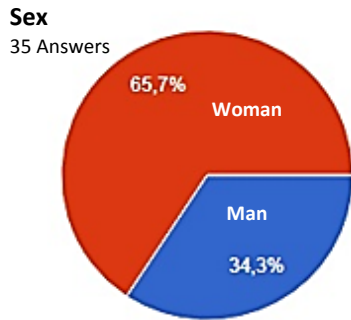


Figure 1. Gender. Source: Author's archive, 2017



Figure 4. Platform in operation (source: Author's archive, 2017)

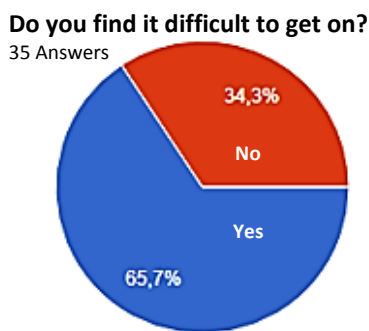


Figure 2. People who have difficulties to get through. Source: Author's archive, 2017

However, one of the main problems is related to urban infrastructure, where sidewalks are not designed to serve users with special needs, which makes access difficult, since they are often full of holes and have some steps, making it difficult for the wheelchair user to access the bus.

Another complaint concerns the unpreparedness of employees, especially on Sundays and holidays, where there are no on-board agents in the buses, so that whoever operates the lift is the driver who has often had no training in handling the equipment, and can make it work. Often, some will not even stop, so you do not have to operate the equipment. In the figure below, it is shown how the equipment is handled and controlled by an onboard operator

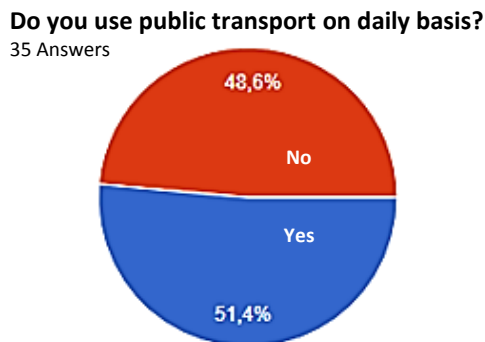


Figure 3. Use of daily transport. Source: Author's archive, 2017

Through the questionnaire answered by the wheelchair users, and in some cases by the companions, because they are children, the buses, for the most part, provide the lift platform, however some of them have problems of operation. As shown in the following figure, we can see how the operation works.

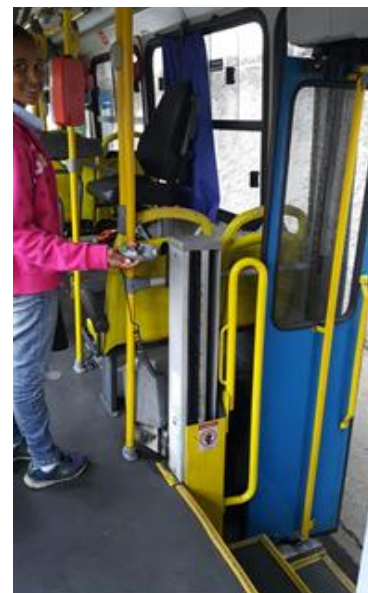


Figure 5. Demonstration of the operation (source: Author's archive, 2017)



Figure 6. Lift control (source: Author's archive, 2017)

In relation to the driver also another complaint was because some did not wait for the passenger to buckle the belt, starting with the vehicle, putting at risk the person. It should also be noted that some drivers still stand far from the sidewalk, which also makes access difficult.

Another point raised, are the seat belts, which are often with the lock damaged, putting at risk the safety of the user.

In addition to complaints of functionality, there are other factors that interfere with passenger satisfaction, which are linked to lack of respect, agility, solidarity within the vehicles at the time of boarding, and the lack of maintenance and modernization of transportation.

During the research, it was highlighted the fact that in each bus there is only one seat for wheelchair users, since in the transport regulations it is described that at least 5% of the total accents intended for this purpose should be used.

V. CONCLUSION

After the research conducted, the conclusion reached is that despite the developments in relation to accessibility and the growing concern in making laws that include people with reduced mobility, there is still much to be done, since these people still find many difficulties to have their rights respected.

In the case of collective transportation, it is notorious that much still needs to be done, so that they can have quality and independence to transit in the city. It is essential that 100% of the fleet makes available all the existing resources that are required in the regulation of transport.

It is critical that the platforms be tested before the buses leave the garage, avoiding the inconvenience of not working when a wheelchair is boarded.

It is also necessary to seek new technologies in order to facilitate the access and movement of passengers, so that the service is done in a fast, efficient and safe way. Routine maintenance is needed to ensure compliance is met. In order for this quality to be achieved, it is fundamental to have professionals trained and trained in the collective, and to do a work to raise awareness of the population in general.

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