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Accessibility for Pedestrians: Evaluation of school area in the Northern Zone of Manaus

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Abstract:

The pedestrian circulation system is composed about several structures and elements. These structures must be accessible so that every citizen, according with or without disabilities, it can safely travel and to exercise their rights for the people in this way to come and to go whatever place. In this sense, this article demonstrates the process about implementation of infrastructure of tours in a school area localized in the Northern Zon Manaus city, in order to meet the necessity found in the community. The lack of infrastructure of the locality causes pedestrians and vehicles to share the same space, with risks of eminent accidents. According the NBR 9050: 2015 lays down parameters of distances should be obeyed so that there is accessibility and mobility for all types of people, within the system of pedestrian circulation. The federal Law n. 12,587, dated January 3, 2012, established a policy for urban mobility in Brazil, whose purpose to integrate the different modes of transportation, improving accessibility and mobility among them. Throughout this work, for contribute to the development of the subject in question, both at the municipal and national levels, and that the public power be aware of the current problem and take measures to improve the lives about citizens.

Key words: Accessibility, Pedestrians, Pedestrian Circulation System, Sidewalks.

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1 INTRODUCTION

The Free Zone Model of Manaus (ZFM) was conceived by Federal Deputy Francisco Pereira da Silva and instituted through Decree-Law No. 288 of February 28, 1967, during the military dictatorship, under the policy of import substitution. Its objective was to promote the development of the northern region of Brazil, hampered by its great distance from the production centers and vulnerable to bordering countries due to its low demographic density and occupation.

In the most diverse cities of the world, extensive networks of circulation structures interconnect the most diverse environments. These traffic structures, along with other elements, such as traffic lights, walkways, pedestrian lanes, are responsible for the primary circulation of a city and thus form the Pedestrian Circulation System (SCP).

The SCP is composed of several elements, in which the walk, commonly known as sidewalk, is of fundamental importance, both for the circulation of the individuals, as for the drainage of rainwater, besides contributing in other aspects.

The walk, because it is a structure of circulation of practically all pedestrians and other means of locomotion, must present, besides safety and durability, dimensions that are consistent with the characteristics of pedestrian flow.

ABNT NBR 9050: 2015 establishes distance parameters to be obeyed so that there is accessibility and mobility for all types of people. Figures 1, 2 and 3 show the minimum distances in meters prescribed by the standard for free movement in a straight line.

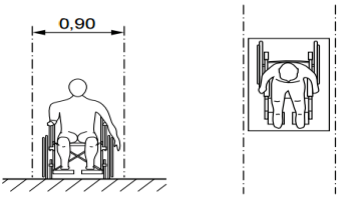

Figure 1 - A person in a wheelchair - Front view and Superior. Source: NBR 9050: 2015

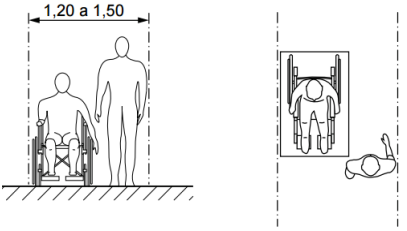

Figura 2 – Uma pessoa em cadeira de rodas e um pedestre. Vista Frontal e Superior. Fonte: NBR 9050:2015

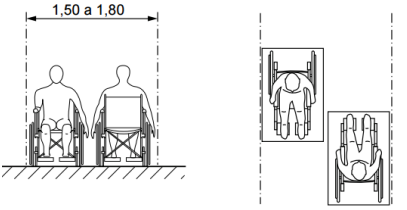

Figure 3 - Two people in a wheelchair. Front and Top View. Source: NBR 9050: 2015

The problem is that in many places the ride, or sidewalk, is not adequately as prescribed by NBR 9050: 2015. The walks have several irregularities, such as varying levels, smaller than minimum dimensions, lack of accessibility for wheelchairs, dumps and posts in the middle of the passage, among others. All these obstacles make the pedestrian get out of the ride and move on the road, a place intended for car traffic. According to data from the World Health Organization (WHO), approximately 1.3 million people die each year from reckless driving. Of the survivors, about 50 million live with sequelae. The survey was conducted in 2009 in 178 countries. In addition, traffic is the ninth largest cause of death on the planet. Brazil ranks fifth among countries in traffic deaths behind India, China, the United States and Russia. That is why the Pedestrian Circulation System needs to be in line with what recommends standards, anywhere, to prevent tragedy and provide dignity to its users. Industry, commerce, public

authorities, schools, universities, places of interest, residences and any other functional structure of a city are connected through this system, which is essential for all urban mobility. The accessibility of this system is an essential condition for all individuals to live in society (BAPTISTA, 2010).

Accessibility is described, according to ABNT NBR 9050: 2015, as a possibility and reach condition for the use, with security and autonomy of the spaces, furniture and urban equipments of the buildings of the transport and of the systems and means of communication by people with deficiencies or with reduced mobility.

As we live in society, it is necessary that the environments are adequate and that they have easy access to all human beings and not only to a single individual.

Human beings are different in many characteristics, and according to BAPTISTA (2010), in addition to dimensional differences between humans, there is still a great variability of physical, sensory and cognitive abilities and restrictions. These variables are present in human life due to several processes, ranging from aging (child, adult, elderly), diseases, congenital malformation and also accidents that resulted in a loss or anomaly of an anatomical structure or function , physiological or psychological.

Knowing that people have the most diverse characteristics, and that the coming and going is a right for all, Brazilian law states that every person, including those with disabilities, has the right to access to education, health, leisure and work . In this way, people must be perceived with equality, thus leading to the recognition and attendance of specific needs.

Every day, thousands of people use the SCP moving from their homes to their daily activities (work, study, leisure). The most used modality for the displacement in this system is the pedestrian, since it constitutes the most natural and direct form of individual provision of means of transport, and

according to Vasconcellos (2001), represents the only human ability of displacement equally distributed, being the comfort and safety of foot movement mainly linked to accessibility of sidewalks and specific signaling of transverse routes.

The objective of this study is to analyze a place in the city of Manaus, with the purpose of evaluating and, if necessary, prescribing recommendations for improving accessibility, since it is a section that comprises 2 (two) State Schools and which has about 400 students, in turn, traveling daily, outside the other users of the road, whose lives are at risk, due to lack of infrastructure for pedestrians.

In addition, streets without gutters and gutters make rainwater accumulate and create holes in the pavement.

It makes with which the vehicles that travel in the lane deviate of the holes, directly threatening the pedestrians who are traveling by the way of rolling due to lack of infrastructure of the Pedestrian Circulation System.

The choice to carry out this article is to emphasize the importance of accessibility and urban mobility, thus promoting respect and dignity to the whole society. Without urban mobility there is no possibility of a city or community being developed, after all, everything is interconnected through transport.

Pedestrians and especially disabled people suffer from the lack of accessibility in various places, and with this their mobility is greatly impaired. If it is already difficult to walk the streets in a wheelchair, with obstacles and inaccessible structures, it gets much worse.

It is hoped that the topics discussed here contribute to improving the quality of life of the population of the analyzed place, that the subject be dissipated by the country, thus contributing to the improvement of the quality of life of all, besides serving as a basis for consultations , research and support material for technicians, technologists and future civil

engineers, who will certainly contribute in a positive way to social and technological progress in the formation of knowledge in our country.

2 BIBLIOGRAPHICAL REVIEW

2.1 Accessibility and Mobility

There are many concepts that these two terms can achieve. Although similarities, accessibility and mobility are two different things, however, interconnected existence of both.

> "In the literature one can often find a certain confusion regarding conceptualization and its measures of accessibility and mobility, especially when these measures relate only to the question of ease or impedance in the displacements. In this situation, accessibility is interpreted as an attribute that is solely dependent on the transport system without considering the degree of attraction of the opportunities offered in the potential destination zones, and the concepts of mobility and accessibility are mixed "(ULYSSÉA NETO and SILVA, 2004: p. 774).

According to ABNT NBR 9050: 2015, accessibility is the possibility and condition of reach, perception and understanding for the use, with security and autonomy of buildings, urban equipment, buildings, transportation, information and communication, including their systems and technologies, as well as such as other services and facilities open to the public, for public or private use for collective use, both in urban and rural areas, by persons with disabilities or reduced mobility.

JONES (1981) relates accessibility with the opportunity that an individual possesses to participate in an activity in a given place, being such potentiality made available by the transportation system and the use of the ground, which would allow different types of people to develop their activities.

SATHISAN & SRINIVASAN (1998) point out that accessibility is associated with the ability to reach a particular place, while mobility is related to the ease with which the displacement can be achieved.

2.2 Pedestrian Flow Characteristics

Similar to vehicle flow parameters, pedestrian flow parameters are defined according to HOEL, (2011):

• **Pedestrian speed:** This is the average walking speed of the pedestrian which is generally about 1.2m / s, but varies with the age and purpose of the walk.

• **Pedestrian flow:** Refers to the number of pedestrians crossing a line across the width of an infrastructure perpendicular to the pedestrian route per unit of time (p / min). The pedestrian flow / unit width is equal to that of pedestrians divided by the effective width of pedestrian infrastructure in pedestrian / min / m (p / mm / m) units.

• **Pedestrian Density:** It is calculated as the average number of pedestrians / unit area of pedestrian infrastructure (w / m²)

• **Pedestrian space:** Refers to the average area available for each pedestrian. It is equal to the inverse of the density, expressed in units of square meters / pedestrian (m² / p).

The parameters quoted above are related to each other. The greater the number of pedestrians using the infrastructure assigned to them, the lower the traffic speed, causing possible congestion, if the dimensioning of the width of the infrastructure is done in the wrong way. This relationship is known as Service Levels.

2.3 Service Levels for Displaced Pedestrians

The service levels are classified as follows:

• **Service Level A** - Free Flow (Density 0.2 p / m2, Flow 16 p / min / m)

Pedestrians move along the desired path without being forced to alter their movements by the proximity of others. Their velocities are freely chosen and there is little likelihood of conflict.

- **Service Level B** - Fairly free flow (Density 0.3-0.2 p / m2, Flow 16-23 p / min / m)

Pedestrians freely choose their speeds, but their paths already demand attention from others.

- **Service Level C** - Stable Flow (Density 0.5-0.3 p / m2, Flow 23-33 p / min / m)

Pedestrians can move at normal speed and overtake other pedestrians in the same direction. Opposite flows and changes in trajectories begin to cause conflict. There is some reduction in flows.

- **Service Level D** - Flow near instability (Density 0.7-0.5 p / m 2, Flow 33-49 p / min / m)

Pedestrians have their speed restricted and find it difficult to overtake other pedestrians. Opposite flows and trajectory changes greatly increase the likelihood of conflict. One can still consider a reasonable fluidity in the displacements.

- **Service Level E -** Unstable Flow / Capacity (Density 1.3-0.7 p / m2, Flow 49-75 p / min / m)

Pedestrians are often forced to adjust their speeds. The available space is insufficient to allow the passing of more leisurely pedestrians. Movements of contrary currents and changes in trajectories are extremely difficult. At the limit of this level, the displacement is dragged, with stops and interruptions of the flow.

- **Service Level F** - Forced Flow (Density 1.3 p / m2, Variable Flow w / min / m)

The movement of pedestrians is dragged. Physical contact is frequent and inevitable. Changes in trajectories and flows of opposing meanings are virtually impossible. The flow is sporadic.

The distribution of pedestrians more closely resembles groups awaiting opportunity to move than to a moving current.

Figure 4, below, exemplifies the service levels quoted above:

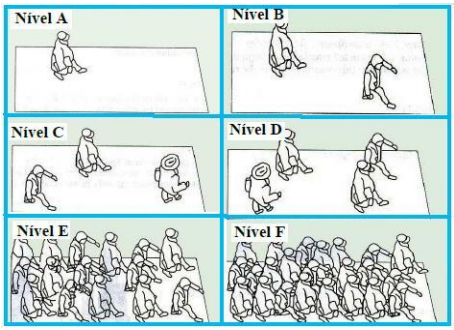

Figure 4 - Service levels for pedestrians on the move. Source: Adapted from HCM 2000.

2.4 Ways

The road is the surface where vehicles, people and animals travel, including the road, the sidewalk, the road. HOEL (2011) reports on the characteristics of the roads of any type of transport whose dependence of the vehicle and of the human characteristics associated to any modality.

According to the Traffic Code - CTB, the open roads are classified according to the application:

- **Urban roads:** Are streets, avenues, or roads open to public circulation, located in the urban area.
- **Arterial:** Characterized by level intersections, usually controlled by traffic light, with accessibility of secondary and local routes, facilitating traffic between city regions.
- **Collector's Way:** Intended to collect and distribute the traffic that needs to change fast traffic routes or in arterial ways, allowing traffic.
- **Local Way:** Characterized by unmarked intersections intended only for local access or in restricted areas.

The study site was characterized, through critical analysis, as a

local route, because it is within a neighborhood, has unsealed intersections, as well as the traffic capacity of the road that is not large.

Figure 5, below, shows an excerpt from the pathway of the study site, located between the two schools.

Figure 5 - Public thoroughfare at the study site. (Av. Santa Marta, Jesus me Deus Community, Colônia Terra Nova, Manaus, Amazonas). Source: Own Author.

2.5 Tours

According to the Brazilian Traffic Code (CTB), the sidewalk is a part of the sidewalk or the runway, separated in the latter case by painting or separating physical element, free of interference, intended for the exclusive circulation of pedestrians and, exceptionally, of cyclists.

They are associated with a public road system and in them also different signs are implanted, favoring a safe and accessible environment for the mobility of all the people.

The rides must be continuous, without abrupt level changes or inclinations that impede the safe transit of pedestrians, observed, whenever possible, the immediate levels of the neighboring rides already executed.

They should comply with the accessibility standards, in particular ABNT NBR 9050: 2015, offering possibility and condition of reach, perception and understanding for use with

safety and autonomy, with a continuous, clear and signaled path. The location of ramps to be accessed by pedestrians must be approved by the Municipal Planning Department and comply with the accessibility regulations, Code of Postures and current Municipal Legislation.

Another possible unevenness between the walk and the ground (such as access ramps, steps or leveling) should be accommodated inside the property, ie after the limit of alignment. No steps can be taken on the ride, except when the slope permits.

There are also several conditions so that the tours are actually accessible and also promote real mobility to people, such as not having obstacles such as poles, residential and commercial dumps, trees, be in good state of conservation, among others. This is a major challenge for large cities and the study site because there is no real control of how the infrastructure of the pedestrian circulation system is located in all areas of the city, especially those farthest from the central perimeter.

In addition to contributing directly to urban mobility, the sidewalks also contribute to the surface runoff of the waters because, through their proper slopes, both longitudinal and transverse, they lead the water to other runoff elements. Its role in surface drainage is of fundamental importance.

2.6 Superficial drainage

The surface drainage of a road has the objective of intercepting and capturing the waters coming from its adjacent areas and those that precipitate over the body, safeguarding its safety and stability (BRASIL, 2011).

Some elements that make up the superficial drainage are described below, in order to clarify and identify such elements that are in some way associated with pedestrian circulation structures.

2.6.1 Guides and Cables

According to the norm of DNIT 020/2006, the yarns are physical limiters of the road platform, with several purposes, in which we can highlight the function of protecting the edge of the runway from the effects of erosion, which is caused by the water runoff precipitated on the platform that, due to the transverse slope, tend to pour on the slopes of the embankments. In this way, the midwires have the function of intercepting this flow, leading the deflúvios to the points previously chosen for launch. Also in the norm DNIT 020/2006, the guides are devices with the function of limiting the area of the platform of the marginal lands, mainly in segments where it becomes necessary the orientation of the traffic as: central bed, intersections, works of art and other singular points, thus fulfilling an important safety function, besides guiding surface drainage.

2.6.2 Gutters

According to standard DNIT 018/2006, gutters are longitudinal drainage devices constructed laterally to the runways and staging platforms, intended to intercept the deflúvios, that flowing by the slope or marginal lands, can compromise the stability of the slopes, floor integrity and traffic safety, and generally have triangular or semicircular shape for safety reasons.

It is worth mentioning that the walks, together with the guides and the gutters must fulfill an entire path so that the rainwater has correct destination throughout its trajectory. The topography has a fundamental role, because it is through it that the necessary services will be realized to obtain the desired result for rainwater.

2.7 Topography

According to DOUBEK (1989), Topography aims to study the instruments and methods used to obtain the graphical

representation of a portion of the terrain on a flat surface.
It is of basic, fundamental importance, the contribution of Topography in any work of Engineering, Architecture and other branches of activities. With regard to Engineering and Architecture, in a summary way, a correct study and knowledge of the terrain where the future work is to be implanted is indispensable. (ALMEIDA et al., P.2).

A planialtimetric topographic survey was carried out in the study area, in order to obtain real data for the elaboration of projects for abstraction and drainage of surface waters, projects for asphaltic recapping, signaling for pedestrians, among others, since the study site is located in a region of many hills and curves.

2.8 Concrete and its Characteristics

According to Chust (2001), the concrete is obtained by means of the appropriate mixture of cement, fine aggregate, aggregate and water. In some situations are incorporated chemicals or other components such as polymers, microsilica. Additions have the purpose of improving some properties, such as: improving workability and strength.

The standard governing the designs of concrete structures is ABNT NBR 6118: 2014, and through it, preliminary data were obtained that will appear in the structure of the pavements. These data are of paramount importance as they are a guarantee of the durability of the structures over time if they are performed correctly.

Concrete is the most used material in civil construction due to its excellent water resistance, practicality in handling and easy to obtain in the construction market. The characteristic resistance of concrete to compression (fck) is one of the main properties of concrete. Since it is associated with the curing time of the concrete. The cure is the last step of the concrete production process. The concrete must be well

executed, because the greater the care with concrete curing, the better its mechanical performance and its resistance to the aggressive agents of the environment. (CRISTINA et al., 2014)
NBR 6122: 2010, which establishes criteria for foundations, says that the minimum resistance to be adopted for foundation structures is 20MPa. As the sidewalks can be considered as foundations, because they are supported directly on the ground, then this minimum resistance value is adopted for the concrete to be used in the project.

3 MATERIALS AND METHODS

3.1 Technical Assumptions

3.1.1 Technical Reference Standards

For the development of this article, we adopted the quantitative and qualitative method where field surveys were carried out to evaluate the implementation of pedestrian infrastructure. Table 1 below identifies the main standards used in the preparation of this article.

Rules	Title
ABNT NBR 9050: 2015	Accessibility to buildings, furniture, spaces and urban equipment
ABNT NBR 6118: 2014	Concrete Structures Project - Procedure
ABNT NBR 6122: 2010	Foundation Design and Execution
ABNT NBR 12655: 2006	Portland cement concrete - Preparation, control and receipt and acceptance - Procedure

Table 1 - Technical Reference Standards. Source: Own Author.

3.2 Topographical Survey

A topographic survey was carried out to delimit the project area. Three sections were defined that require intervention in the structures of the Pedestrian Circulation System (SCP). With this improvement, users and locals will have improved accessibility and mobility. The students of the State School Rafael Henrique and the Educational Center of Integral Time (CETI) Dr Zilda Neumann, will also benefit. It is worth mentioning that the track will have to go through maintenance processes to improve the infrastructure of the site.

Figures 6, 7 and 8 below show the stretches in which the walks will be constructed.

Figure 6 - Excerpt delimitation 1. Source: Adapted from Google Maps

- Length: 460,87m
- Width of the walk: 1,20m

Figure 7 - Outline delimitation 2. Source: Adapted from Google Maps

- Length: 206,65m
- Width:2.20m

Figure 8 - Delimitation of the Section 3. Source: Google Maps

- Length: 85.13m
- Width: 2.20m

The total data of the project sections can be seen in table 2, below:

PARTS	Length (m)	Width of the Walk (m)	Height of the Walk (m)
Part 1	460,87	1,00	0,10
Part 2	206,65	2,20	0,10
Part 3	85,13	2,20	0,10

Table 2 - General data of the project sections. Source: Own Author.

3.2 Executive Processes

The actions to be taken to carry out the project will be divided into 4 stages, described and summarized below, for better clarification:

3.2.1 Preliminary Services

The preliminary services to be executed for the realization of the project, are included in the Installation of the Job Board and the sidings.

- Plates = 2 units
- Tapes Length = 752,65m
- Height of the Tapes = 1,20m
- Total Area of Tapes = 903,18m²

The work board must be digitally printed on canvas, to identify the work, containing the information necessary for its characterization and installed in a place of easy visualization to all users of the public highway.

3.2.2 Earthwork

Grounding must comply with the following sequence of operations, so that there is no interference in the processes, thus avoiding wastage of material and time.

- Cleaning
- Manual Excavation of Land
- Regularization and Compression
- Reallocation of Poles
- Landfill of excavated areas

The first step of the work on land consists of clearing the land with a backhoe, removing the roots, debris, and materials that may disrupt the execution of the rides. After cleaning, excavate the land with pickaxes and xibancas, throughout the length of the sidewalks, for future settlement of the guides and gutters and future relocation of the posts.

At the end of the manual excavation, regularization and compacting of the terrain, either manually or automated, preferably with steel sockets, should be carried out throughout the area of the pavements, until sufficient resistance is not present posts.

With all the post holes made and compacted, start the process of withdrawing the 14 posts of section 1 and installing them in section 2. This process of reallocation of the posts happens because 'Section 1' is only one meter wide for execution of the tour. If there are posts in this section, the tour will be unviable for pedestrians, as recommended by ABNT NBR 9050: 2015. Figure 9, below, shows the current situation of section 1:

Figura 9 – Postes sobre o passeio (Trecho 1). Fonte: Google Maps

This service must be performed by the electric utility, with prior request prior to construction, for the safety of all users of the public highway. At the end of the relocation, finish the movements on land with the backfill of the open spaces of the open ditches, up to the level of the walk.

3.2.3 Rides and Drainage Elements.

The services of this stage consist of running the tours, with their proper inclinations, heights, exits and signs, as prescribed by ABNT NBR 9050: 2015, as well as to install the guides and gutters, to improve the surface drainage of the place, as prescribed by the standards of the National Department of Land Infrastructure (DNIT).

Lay the guides one by one, aligned with the track, spaced 3 centimeters apart. The guides should be 13 cm below the floor level, as shown in figure 10, below:

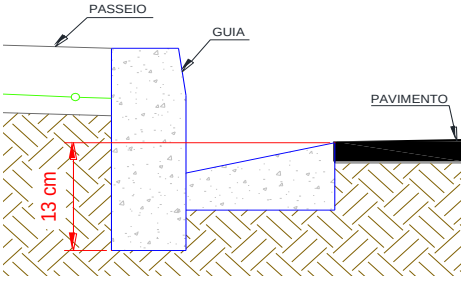

Figure 10 - Level for laying the guides. Source: Own Author.

After the guides have been fully laid, make a cement and sand mortar joint to connect the elements.

The process of making the gutters begins, in locu, applying concrete on the ground, in order to obtain a difference of 4cm from the level of the pavement to the guide, in all the extension of the pavements to be constructed, according to figure 11, below:

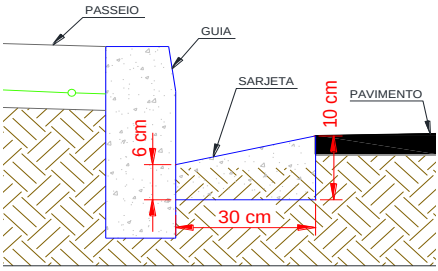

Figure 11 - Trasnversal Section of Gutter. Source: Own Author.

Immediately after the construction of the gutters, install the forms of the sidewalks, obeying the slopes defined in item 6.12.3, letter b, of ABNT NBR 9050: 2015, of 3% in the cross section, according to figure 12,

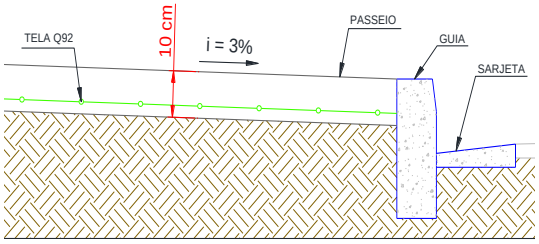

Figure 12 - Transverse inclination of the sidewalk. Source: Own Author.

With the forms in place, position the welded screens, according to figure 12, obeying the cover necessary so that they do not come in direct contact with the ground, which, in this case, is 4.5 cm, as prescribed in NBR 6118: 2014, for elements in direct contact with the ground.

Once the screens have been installed, begin the concrete casting process. Concrete must be cast so that it can be rolled and drawn. After concrete pick time, the wood forms must be carefully removed and then the concreting is completed. Obey concrete curing time for release of ride use. Observe the ambient temperature, and if it is very high, the temperature of the concrete should be softened by water, thus avoiding cracking of the concrete by the effect of retraction.

3.2.4. Cleaning and Finishing

At the end of the concreting, before the time of picking the concrete, to begin a process of 'polishing' the same, in order to make its surface less rough, which facilitates the life of wheelchairs, for example, that can come to use the rides.

Last but not least, start the process of final cleaning of the work, removing and depositing the material in dump collection boxes, in order to provide the correct disposal of the garbage, without aggression to the environment.

4. RESULTS AND DISCUSSIONS

4.1 Comparative results between the years 2016 and 2018.

The photographic report below shows a comparative of the excerpts in the years 2016 and 2018, of the place of study and serves as a basis for analysis of the result. The photos will be paired, for comparison of similar passages.

Figure 13.1 - Section 1 (left) and 2 (right). Next to the State School Rafael Henrique. Source: Own Author. Year: 2016.

Figure 13.2 - Section 1 (right) and 2 (left). Next to the State School Rafael Henrique. Source: Own Author. Year: 2018.

Figure 14.1 - Section 1 (right) and 2 (left), near the Rafael Henrique School. Source: Own Author. Year: 2016

Figure 14.2 - Section 1 (right) and 2 (left), near the Rafael Henrique School. Source: Own Author. Year: 2018

Figure 15.1 - Section 1 (left) and 2 (right) near the Church of the Saints of the Last Days. Source: Own Author. Year: 2016.

Figure 15.2 - Section 1 (right) and 2 (left), near the Church of the Saints of the Last Days. Source: Own Author. Year: 2018.

Figure 16.1 - Section 3 (right), near CETI Dr. Zilda Neumann. Source: Own Author. Year: 2016.

Figure 16.2 - Section 3 (right), near CETI Dr. Zilda Neumann. Source: Own Author. Year: 2018.

Figures 13.1 and 13.2 present the same excerpts and we can see that there were changes, but nothing significant. The pedestrians still continue to travel on the road, since the rides still do not have continuity.

In figures 14.1 and 14.2, a clear change can be noticed, since in the period of the photos (2016 to 2018) a shed was erected near the school, and with that, the company made the infrastructure in front of its land. Of course this helps in parts, but it is not a definitive solution to the problem, since the poles are still present on the tour, and the rides still do not have continuity along their route.

What is portrayed by Figures 15.1 and 15.2 is also interesting. Pedestrians use tract 2 much more to travel, since it has dimensions closer to what NBR 9050: 2015 determines. Pedestrians even walk on the ride without the proper infrastructure. In 2016 (Figure 15.1), there were no indications that there would be continuity in the existing ride at that time. Now in 2018, it can be seen in figure 15.2, that in the extension of the wall up to a certain distance, one already has the projection of where the tour will be and how it will help to improve the mobility of the users of the system.

Figure 16.1 and 16.2 show section 3, which is practically unchanged. In 2016, the existing tour in Figure 16.2 already

existed, and it was not continued until CETI Dr Zilda Neumann.

4.2 Accessibility Assessment Worksheet

Next, Tables 3 and 4 present the Worksheet for Assessing the Accessibility of the excerpts from the study site and the Result of the excerpts.

This worksheet will indicate some results, through questions developed in accordance with what NBR 9050: 2015 recommends. These results will serve as a basis for discussion of the final outcome.

ITEMS TO BE CHECKED (BY SECTION)
Is the stretch paved?
Is the floor of the stretch regular?
Does the deck have holes?
Does the stretch have steps?
Does the stretch have a transverse slope less than 3%?
Does the longitudinal inclination of the section follow the slope of the street and does not exceed 8.33%?
The smallest part of circulation has free width, without obstacles of 1.20m (minimum)?
Is it possible to navigate the passage without encountering obstacles?
If there are obstacles, are they marked with tactile floor for the visually impaired?
Throughout the excerpt are there signs with tactile alert and directional flooring to guide the visually impaired?
In the rainy season in the stretch, is there any point of flooding?
Are there ramps in the stretch?
Is the minimum ramp width 1,20m?
Is the slope in accordance with NBR 9050: 2015?
Are there pedestrian lanes to assist in crossing the road?
Are the sidewalks lowered along the pedestrian crossings?
Are there sidewalks on the corners, on the court yards, and on the slopes?
Are there sidewalks recessed on both sides of the track to allow people in wheelchairs to pass through the safety strip?

Table 3 - Accessibility Assessment Worksheet. Source: Own Author.

GENERAL EVALUATION OF THE ARTICLE
Fully accessible section. (All conditions accepted)
Excerpt with barriers that are easy to remove
Excerpt with severe barriers and difficult to remove
Inaccessible Excerpt

Table 4 - Final Results. Source: Own Author

4.2.1 Results of the Accessibility Assessment Worksheet

The study excerpts (1, 2 and 3), when confronted with the questions in Table 3, present several irregularities.

Although they are paved, they have uneven holes and surfaces during the whole course. The stretches of access to the walks do not have ramps for wheelchair users. The transverse and longitudinal inclinations are in accordance with NBR 9050: 2015.

It is possible to walk in some parts of the sections without finding obstacles or something that can intervene in the normal process of pedestrian circulation, but, due to the lack of continuity, when it is shown in figure 17, it is impossible to continue traveling on the walk, especially for those who have less favorable mobility conditions.

Figure 17 - Excerpt 1 - Lack of continuity of the ride and several obstacles on it. Source: Own Author. Year: 2018

It can be seen from Table 3 that the pedestrian circulation system of the study site differs greatly from what is expressed in the legislation and in the other documents referenced at the beginning of this article, not presenting in its entirety many of the attributes such as: accessibility to promote user mobility, continuity of tours, lack of basic infrastructure, among other aspects that are listed in Table 3.

We have as a result that the places of study do not meet the minimum accessibility conditions, prescribed by law, and must be immediately recovered, so that the items in table 3 and other items that NBR 9050: 2015 recommends are respected.
They are classified, according to Table 4, as sections with severe barriers and difficult to remove, which are, in this case, the posts.

3 CONCLUSION

This article evaluated the accessibility of the pedestrian circulation system in the study section, based on the application of the accessibility assessment worksheet. Considering the current characteristics of the study section and the data collected from the spreadsheet, it is clear that it does not present minimum conditions of accessibility and mobility for individuals who travel daily at this location.

It is necessary to adapt the study section with due urgency, so that students can use it for the good use and benefit of the population.

It is observed that the works in execution in the study section are contributing to the mobility, but they are still not sufficient to supply the needs of the place. Note that because the place is uninhabited, it still does not have the free range of pedestrian circulation, which forces the user to circulate next to the vehicles. Thus, it is indicated the elaboration of a term of adjustment of conduct between the city halls and the constructors, so that measures based in accordance with the NBR 9050: 2015, that they value for the safety of the pedestrians circulation are established. The accessibility assessment carried out on the route pointed out deficiencies in the pedestrian circulation system of the avenue, but many of the users' indications came to collaborate with this result.

Through the application of the questionnaire it was verified that the users do not qualify positively the condition of the route in the way, due to the lack of sidewalks, walks and signs.

In order to address such issues, it is recommended that an urban mobility plan be developed and implemented for the accessibility of pedestrians, such as: accessibility and infrastructure of sidewalks, signaling, and that there is considerable free movement of pedestrians and sidewalks, so that the free track is not obstructed by weeding according to the figures above.

Regarding the limitations faced during the research, it is worth highlighting the transformations through which the Avenue is passing through works, which in the future provokes the emergence of new circulation structures, a fact that occurred the field research in need of constant updates.

Given these possibilities, we can see that there is still a lot to do in order to improve the accessibility of the public space, and a planning that incorporates these issues is necessary, since it is necessary to promote efficient spaces that bring quality, comfort and safety.

As a step after this work, we intend to study and continue the evaluation of the place of study, and not only this one, but of other places of the city of Manaus that need accessibility, in order to enrich the themes discussed here, serving as information base / consult all interested in the topics covered here.

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