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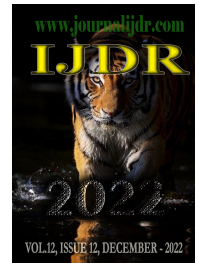
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RESEARCH ARTICLE

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TRAFFIC ANALYSIS ON URBAN CROSSINGS ON THE URBAN PERIMETER OF BR-153 IN GURUPI -TO

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ABSTRACT

The present research results in the observation of a certain stretch of urban crossing used by pedestrians and/or cyclists in the municipality of Gurupi-TO. The municipality is cut perpendicularly by the BR-153, with the conflict between pedestrians who need to use this area and passenger and cargo vehicles. Usually, cities cut by stretches of highways have one side with greater development than the other, resulting in a constant flow of residents of the region, leaving these crossings dangerous due to the lack of elements that ensure the lives of the population. In a large population increase simultaneous with the disorderly growth of cities, pedestrian crossings, motorized and non-motorized vehicles become increasingly dangerous. As prevention and safety measures are necessary for users of these stretches, onegreater fluidity when traveling in the mentioned space The study aims to identify, through the quantitative method, the difficulties encountered by users in relation to crossings from one side of the city to the other, and seeks specific answers for the case that can be compared to the generic answers of other locations mentioned in the bibliography.

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INTRODUCTION

Croad crossings inside cities are common for the population that lives in cities that are located on the margins of the roads that pass through the country. These intersections usually divide cities into two parts, that is, a certain part of the population must move from one side to the other, since there are day-to-day situations involving work, health, commerce in general that require this flow. According to Junior and Ferreira (2008), deficiencies in urban territorial planning, as well as the lack of articulation between the different spheres of power, federal, state and municipal, make it difficult to adequately deal with problems related to the presence of highways in urbanized areas. According to Rodrigues (2006), the transformations between economy and society instigated the growth of cities and influenced new forms of employment, lifestyle, economic distribution and consumption. This form of growth occurred in conjunction with the transport axes and caused the spatial expansion of cities, which began to receive more people, economic activities and urban displacements of residents. According to Freire (2003), the road network extended across the country forming strategic transport corridors, promoting socioeconomic growth in regions and transforming cities. The linear growth along these cities was linked to the road on which it was tangent, motivating an increase in local

commerce and industry, attracting new investments, more residents and valuing the areas that were located closer to the road. Urban crossings on highways, whether federal or state, are risk areas because they share space with local traffic, operational traffic, pedestrians and cyclists. Most of the time, pedestrians are the most affected, having to travel greater distances to reach their destination. In addition, there is almost always a lack of adequate equipment to assist the crossing and the lack of effective policies that seek to solve this problem (ALVES, 2015). Municipal bodies are primarily responsible for finding alternatives to urban imbalance, providing accessibility to urban occupations; and the road agency is responsible for ensuring the efficiency, safety and fluidity of the highway (SILVA JÚNIOR, 2007). Junior and Ferreira (2008) point out as a solution to the problem the integration of the highway to the urban landscape, providing spaces for crossing local traffic and pedestrians. The focus is more on urban life than road traffic. As stated by the author Junior and Ferreira (2008), it is necessary to have more viable measures for pedestrians during the crossings of certain stretches mentioned, in this way, enabling a possible improvement in socioeconomic conditions, within the city chosen for carrying out the survey. search. The theme is developed with a focus on the difficulties that pedestrians encounter when crossing certain stretches on the BR-153, urban perimeter of Gurupi - TO. The research aims to collect information regarding vehicle traffic

and accessibility difficulties for pedestrians, cyclists and drivers who use this stretch of road.

METHODOLOGY

The study was carried out through field research using an inductive method of approach, with the intention of analyzing the local reality, which can be defined with particular data and possible resolutions for them. In field research, the quantitative method is used, seeking to collect data from a significant sample, with the intention of guaranteeing the accuracy of the work carried out and leading to results without margins of distortion (DALFOVO, et. al., 2008). The research was also based on bibliographic and documentary concepts carried out in the field, in which crossings were observed for the purpose of traffic analysis, which are the main connections between two sides of the city. For three days a week in a day of 12 consecutive hours, the days determined were: Mondays, Wednesdays and Fridays; during the period of 3 months (days such as: holidays, commemorative dates, among others were dispensed with). With the survey and analysis of data on existing conditions and crossings, a diagnosis of the situation can be made and then the best treatments and measures can be identified to ensure safety, accessibility and use of the physical space.

Theoretical Foundation: The passing traffic that crosses urban centers causes inconvenience both for vehicles that travel along these roads, as well as for pedestrians, cyclists and other users, forced to live with this mixed traffic on a daily basis within their city. The population starts to transit in this interface between city and highway, with alteration of the urban environment causing accidents of users who need to cross the highway, risks to the health of the population due to the gases produced by the burning of the fuel, in addition to the noise pollution caused by traffic (GUERINO FILHO, 2014). Means of transport are essential for economic development, as they expand the borders of trade and work, reduce the isolation of rural areas and allow an increase in the quality of life of people who need to move for work or leisure (BARA, 2012). In certain stretches of intersections within urban perimeters, there are several irregularities committed in the construction of these perimeters. According to Matos and Lobo (2021), this scenario, a reflection of the historical adoption of policies that sought to favor motorized (and individual) transport to the detriment of other modes, comprises a series of obstacles to the accessibility and spatial mobility of the population, especially in metropolises and in big cities, marked by enormous traffic and traffic disruptions. According to Guerino Filho (2014), the development of the economy and population growth, the number of vehicles transiting on the streets and roads increases every day. And over time, vehicles tend to wear out, parts to deteriorate and produce more and more noise when used, especially on urban roads where the concentration of vehicles is greater and urban activities are incompatible with heavy traffic, such as the presence of schools, housing units, etc. According to Cuppolillo, Portugal and Braga (2007), there are numerous traffic moderating measures for urban crossings that can be used depending on the objective to be achieved: reducing dissent, reducing speed or reducing the flow of passage depending on the section to be treated. According to the National Department of Transport Infrastructure - DNIT (2010), urban crossings are characterized by stretches, generally arterial, that provide road continuity through cities, can cross the urban area from one side to the other or simply connect to another arterial road also connected to the national road system.

Historical context of urban sections of the city of gurupi – to:

With the intense Brazilian urbanization that took place in the last century, many highways, previously rural, were involved by cities and became important urban transport axes. They are now part of the urban road system and have an intense participation in the development of the local economy (MENEZES, 2001). The Gurupi community is located in the south of the State, the city is approximately 200 kilometers from the capital Palmas and 500 kilometers from Brasília - DF, capital of Brazil. Along the BR-153 (Belém-Brasília road). Gurupi is the third largest city in Tocantins

and the regional center of the entire southern region of the state. The main sources of income in the municipality are livestock and agriculture. The streets of Gurupi are named after Brazilian states, the most important being Avenida Goiás, while the streets, although renamed in honor of historical figures, continue to be named according to their numbering (PREFEITURA DE GURUPI, 2022). According to the City Council of Tocantins de Gurupi (2022), it is possible to argue that it is impossible to talk about Gurupi without linking it to BR--153. This is because the history of the municipality is closely linked to the construction of Belém-Brasília, the birthplace and development of many other cities along its length in the former north of Goiás. Thus, it is clear that the BR-153 is part of the historical construction of that city, being important in the urban development of the city.

Br-153: Crossings in the urban perimeter and the barrier effect:

The growth of the urban population, combined with the facilities associated with access to vehicles, led some cities to expand towards rural areas, normally bordering the highways. This meant that highways, designed mainly to serve passing traffic, in general with an intense presence of freight vehicles, now have new users: vehicles that make local trips, pedestrians and cyclists circulating on their banks and making crossings (MELLO, 2008). The population of cities began to live with interfaces between the city and the highway. Inhabitants of bordering regions (located on the border between rural and urban areas) perform activities on both sides of the highways and need to cross it to perform their daily functions, running all the risks associated with traffic (BRASILEIRO et. al., 2014). Ferraz (2001), places mobility as a guiding element of urban development, where providing adequate mobility for all social classes is a fundamental action in the socioeconomic development process of cities. When it comes to intra-urban travel, it is imperative not to mention that the highway becomes of great value for socioeconomic development. According to Junior and Ferreira (2007), the highway, one of the main drivers of population growth and local economic development, has become almost an obstacle to intra-urban displacements. Although statistics point to the human factor as the most relevant factor in the occurrence of most accidents, the problem of insecurity is found in the system as a whole and not just in the user. Studies show that the road safety level depends as much on its construction, maintenance and operation, as on the safe behavior of its users (BRANCO, 1999). From these locations and physical configurations, it is noted that the structure of a highway does not involve the safe displacement of pedestrians or other modes of locomotion in an exclusive space, even if the highway crosses an urban area. This dynamic of appropriation shows conflicts of land use and urban flows and the configuration of the highway as a place that presents reduced security for users of non-motorized modes of transport, since it does not have, in its typical section, the necessary infrastructure to offer such displacements of properly, such as sidewalks (CASTRO, 2015 apud JIANG; PENG, 2012). As Andrade and Tavares (2017) state, accessibility focuses on the population's difficulties in making their daily trips for routine activities, considering the alternatives of infrastructure and transport services available. On the other hand, the analysis of mobility conditions focuses on the quality of travel (time and safety), whether in motorized transport or by active means.

The adoption of facilitating measures for pedestrian mobility should be broad, capable of making them less exposed to the negative externalities produced by traffic, such as accidents and various types of environmental pollution (MELO, 2005). When accessibility and mobility encounter difficulties, it generates a phenomenon called the Barrier Effect, which, according to Ancaes (2015), occurs when the traffic infrastructure obstructs pedestrians and cyclists. On city streets and roads, the speed and volume of traffic act as an obstacle that prevents or significantly hinders local walking or cycling and the availability of goods and services, which endangers the well-being of the population. According to Spagnollo and Almeida (2021), the set of aspects represented by the characteristics of flow and operation of roads, organization by social hierarchy and the urban environment in which both are inserted, are crucial to identify the

barrier effect and its intensity in each situation. The impacts directly condition the accessibility to places/services and, above all, the displacement in the intra-urban space. The barrier effect decreases the amount of displacement. This fact is reflected in the drop in mobility of the individual, who has their mobility restricted, and the consequent drop in accessibility to places and establishments (present “on the other side” of the road to be crossed) (MOUETTE, 1998). We can consider as elements that influence the phenomenon the attributes of the urban environment and the population. The barrier effect results from the characteristics of traffic and roads in a given region, as well as the attitudes and conduct of different population classes and the environment in which they are inserted (SOUZA, 2009).

RESULTS AND DISCUSSION

In cities crossed by highways, crossings become crucial for the development and movement of people from one side to the other, since their commercial center is only in one part of the municipality. The research structure chosen allows us to observe the flow of pedestrians, motorized and non-motorized vehicles, which is an important data collection to solve the proposed problem. During the process of research and data collection, it was possible to observe the danger posed by pedestrian crossings, as the Trevo Sul does not have the simplest type of walkway, on the same level as the road, meaning that residents have to put themselves in danger to be able to carry out the crossing of the highway. With motor vehicle traffic as a priority in the current situation of crossings in Gurupi, a barrier effect is created which pedestrians and non-motorized vehicles face on a daily basis, increasing the crossing time and also the risks of having to pass between cars and trucks.

HORARIO	PEDETTRES	BICICLETAS	VEICULOS SEM N MOTOS	AUTOMÓVEIS	ÔNIBUS	CAMINHÕES
06:00-07:00	30	150	2	230	385	12
07:00-08:00	20	132	1	280	475	10
08:00-09:00	20	75	0	250	410	5
09:00-10:00	20	70	0	260	410	6
10:00-11:00	25	30	0	265	412	8
11:00-12:00	30	160	1	280	440	5
12:00-13:00	45	115	0	250	380	8
13:00-14:00	25	75	0	210	250	5
14:00-15:00	20	50	0	210	260	4
15:00-16:00	30	60	0	200	280	8
16:00-17:00	35	130	0	275	450	11
17:00-18:00	35	140	1	280	500	14

Figure 1. Pedestrian crossing the Highway



Figure 2. South interchange with interaction between cyclists and motor vehicles

After obtaining data for 3 (three) months of research, they were filtered and analyzed to verify the time of greatest traffic. The criteria used were: greater flow of vehicles in a month, week and day. With the data in the table below, the intense flow of non-motorized vehicles and pedestrians is visible at all times of the survey, showing that intervention is necessary to improve the safety infrastructure of the most fragile users. The research was carried out during business hours to verify the barrier effect, and its transposition becomes a meticulous journey. It was found that peak hours have a greater flow, as expected, causing a lot of

inconvenience to the population. It was possible to observe that there is a lack of support in the stretches of road crossings that cut certain cities in half, specifically the city of Gurupi - TO. When analyzing the images and data collected, it is a determining factor that security must be a priority for quality public management in a municipality. Ferraz (2017) states that within the scope of Road Engineering and Traffic Engineering, the main actions to improve traffic safety are: projects for new highways and expressways with an emphasis on safety, treatment of critical locations, improvement of road maintenance, improvement of signage, definition of operating conditions with an emphasis on safety (reduction of the speed limit, prohibition of dangerous turns, etc.), use of measures to reduce speed (bumps, lane narrowing, etc.), use of electronic inspection devices (radars, red light detectors, etc.), improvement of lighting in places with a high incidence of accidents at night, etc. All these alternatives for improving traffic come to offer safety and comfort to road users who need to cross.



Figure 3. Sample of Daily Traffic

CONCLUSION

In view of the above, aiming at improving the conditions of locomotion for pedestrians and cyclists in the section studied, it is necessary to implement new structures that aim to increase safety when crossing the highway. It is suggested that elevated walkways be implemented, since the implementation of walkways eliminates pedestrian/vehicle conflict by building a structure at a higher level than the road. Thus, safety will be greater and cyclists and pedestrians will have a single space to carry out the crossing, that is, enabling regulations for innovation and investment in public safety in this urbanized section of the BR-153. In order to solve the problem found in the research, Figure 03 presents a possible way of innovation and accessibility for people who use these stretches, so the safety of the place would be guaranteed.



Figure 4. BR-101 Footbridge Project

Footbridges have the following advantages when compared to underpasses: they do not interfere with underground public services, they are more hygienic and aesthetically pleasing for pedestrians, they convey a greater sense of security, and they are much less expensive (they can cost 90% less) (DNIT, 2005). In addition to minimizing accidents with pedestrians, the walkway

offers comfort and a sense of security when crossing the road, knowing that you don't have to risk crossing it. From the present research, it is necessary to emphasize the importance of continuing the discussion on the subject in the referred region. Factors such as the behavior of pedestrians, the rate of accidents at the site and the risks of highways inserted in the urban space make up essential subjects for future studies.

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