REVISTA DE
ARQUITETURA IMED

Population perception on the use of public transport and private cars: a solution for the sustainability of the motorized mobility system

Percepción de la población sobre el uso del transporte público y de los coches privados: una solución para la sostenibilidad del sistema de movilidad motorizada

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Revista de Arquitetura IMED, Passo Fundo, vol. 6, n. 1, p. 74-84, Jan.-Jun., 2017 - ISSN 2318-1109

DOI: http://dx.doi.org/10.18256/2318-1109/arqimed.v6n1p74-84

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Abstract

Public transport and private cars, when combined with urban planning, tend to contribute to the development of local sustainability. The objective of the research is to analyze the population perception regarding the use of public transportation and private cars in the city of Passo Fundo, RS, Brazil, seeking to understand the population's preference for private transportation and public transport. Methodologically, a 90% confidence interval and a 10% sample error were used to select the 68 questionnaires applied, where multiple choice questions were used. The results revealed that 66% of the interviewed people use public transport, but they evaluate it as of poor quality. As a proposal for the improvement of motorized mobility, the Car Sharing system of three organizations: ZipCar, ZasCar and Car2Go was carried out to suggest the implementation of the system in the city. The results of the study demonstrated the feasibility of the Car Sharing System as an alternative for improvements in sustainable urban mobility.

Keywords: Public Transport. Private Cars. Population.

Resumen

El transporte público y el automóvil privado, combinados con la planificación urbana, tienden a contribuir al desarrollo de la sostenibilidad local. El objetivo de la investigación es analizar la percepción de la población sobre el uso de transporte público y automóviles privados en la ciudad de Passo Fundo, RS, Brasil, buscando comprender la preferencia de la población por el transporte privado y el transporte público. Metodológicamente, se utilizó un intervalo de confianza del 90% y un error de muestra del 10% para seleccionar los 68 cuestionarios aplicados, en los que se utilizaron preguntas de elección múltiple. Los resultados revelaron que el 66% de las personas entrevistadas utilizan el transporte público, pero lo consideran de mala calidad. Como propuesta para el mejoramiento de la movilidad motorizada, se ha llevado a cabo el sistema de Autopartición de tres organizaciones: ZipCar, ZasCar y Car2Go para sugerir la implantación del sistema en la ciudad. Los resultados del estudio demostraron la viabilidad del sistema de compartición de automóviles como una alternativa para mejorar la movilidad urbana sostenible.

Palabras Clave: Transporte Público. Automóviles Privados. Población.

1 Introduction

Urban mobility, according to Liu, Dai and Derudder (2016) can be understood as the ease of pedestrian movement, with the use of various means of transport in the cities. Forrest and Wissink (2017), these forms of mobility are influenced by urban capitalism, responsible for the increase in the number of motor vehicles.

In Brazil, according to data from the National Transit Department (DENATRAN, 2016), the increase in the vehicle fleet in 2016 was 3.5% in relation to 2015, reaching the number of 93,867 vehicles in circulation in the country.

The document from the State of the world cities, of the UN (United Nations Organizations) (2006), emphasizes that the largest population growth occurs in small and medium-sized cities. Chrabąszcz and Mróz (2017) report that the increasing number of people in urban centers and the deficiency of public transport has been increasing the number of individual vehicles circulating in the cities, and as a result, the increase in gas emissions from Combustion of fossil fuels into the atmosphere.

According to Ferreto (2012), the urban agglomeration process of Passo Fundo/RS-Brazil took place in three phases: The first happened the route of the troops, begun in 1827, where there was a concentration of families in rural properties along the current Brazil Avenue, in the region where today is located the Boqueirão neighborhood. The second phase took place after the railway was established in 1898, which was a factor of extreme importance for the urbanization of the city, since it was from this railway that the formation of an urban center. The last phase, dating from 1950, deals with the horizontal expansion, through subdivisions in the peripheral areas and the verticalization of the central area of the city. Currently, the city of Passo Fundo has an estimated population of 197,798 inhabitants and an area of 783,421 km² (IBGE) (2016).

When comparing the evolution of the population in recent years, with the evolution of the fleet of automobiles and utilities, it is evident that the increase in the number of vehicles is considerably higher than the increase in population. According to Gnoatto and Neckel (2016), the population grew on average 1% while, the number of vehicles 9.4%.

As a result of the increase in motor vehicles, problems related to urban mobility at the local level can be perceived, for Resende and Souza (2009), this problem becomes more visible when the population faces congestion, generators of consumption expenditures Fuel and stress by user waiting time (drivers and passengers) on urban routes.

It is important to remember that the problems related to urban mobility require research that will bring solutions. According to Magagnin and Silva (2008), it is necessary to minimize the lack of urban mobility, analyzing and searching for new solutions aimed at improving flows of motor vehicles in Brazilian roads.

In this relationship, Vasconcellos, Carvalho and Pereira (2011) describe in their researches the need for studies that may contemplate and assign solutions that favor urban mobility, thus improving the population's quality of life. Therefore, the importance of studying the urban mobility of the city of Passo Fundo/RS-Brazil.

In view of the sharp increase in the fleet of vehicles, according to IBGE (Brazilian Institute of Geography and Statistics) (2015) in recent years, the fleet increased by 9.4%, together with the lack of public transportation.

In this scenario, alternatives are needed that can minimize the problems in the increasing number of vehicles circulating in the city. In addition to encouraging the use of alternative means of locomotion, such as the bicycle, appears as a proposal to reduce the number of individual vehicles, the implementation of the Car Sharing System.

The Car Sharing System, according to the Institute for Transport and Development Policy (ITDP, 2014), emerged in the 1980s in Switzerland and Germany. Currently, the service exists in more than 1000 cities around the world.

The same is true of the idea that the number of vehicles to meet the demand of a group of people becomes smaller when shared (KATZEV, 2015). Based on the assumption of a reduction in the number of vehicles circulating, the system emerges as an innovation to keep the car as a means of locomotion, but in a way that contributes to the sustainable development of the city.

On sustainable development, according to the Brundtland Report (1987, p. 32) we understand the "how current generations meet their needs without, however, compromising the ability of future generations to meet their own needs." The same must consider the environmental, social and economic scope.

Still on sustainability in urban mobility, one has as the capacity that the trips within the urban space happen in order to consume the minimum of possible energy and causing the least environmental impact.

The general objective of the research is to analyze the population perception regarding the use of public transportation and private cars in the city of Passo Fundo/RS-Brazil. Thus, we sought to understand in a specific way the preference of the population, regarding the use of private transport, suggesting solutions that allow improvements in the quality of the public transport system.

In this sense, comparative analyzes were carried out between the three organizations of Car Sharing System in order to establish guidelines for its implementation in the city of Passo Fundo-RS/Brazil, as an alternative that allows the use of the individual vehicle as a form of locomotion. Collaborating in this way, for the sustainable development of the city.

2 Methodology

For this work, an exploratory research was carried out, based on a case study, which "investigates a contemporary phenomenon (the "case") in depth and in its real world context" (YIN, 2015, p. 17).

According to IBGE (2016), of 122,343 vehicles, of which 77,333 are automobiles, 17,062 are motorcycles and only 388 are buses. Thus, the concern of this research turned to the analysis of users' attitudes towards public and private transportation.

Thus, a quantitative study was carried out through approaches to a portion of the urban population, which, through a sample calculation, with a confidence level of 90% and a sampling error of 10%, were applied 68 questionnaires.

The questionnaires were applied to the population aged 15 to 25 years, from 26 to 35 years, from 36 to 45 and above 46 years, for both sexes and all levels of schooling. The questionnaires were applied in a 10-day interval, in strategic places, with great population and commercial density, causing intense flows in public transport and private cars in the following routes studied: Avenida Brasil, Rua Moron and Rua Coronel Chicuta.

The initial questions were given to guide the parameters such as: age, sex and schooling. Subsequently, the following questions were applied: Do you own a car? What do you usually use for locomotion? How often? It's because? At the end of the day, they went to study the public service in Passo Fundo: How do you evaluate the public transportation of the urban buses in Passo Fundo? In your opinion, what items need to be improved on public transportation? Then, the analysis and then the description of the results obtained through the applied questionnaires were performed.

Afterwards, a comparative analysis of the car sharing system of three organizations was made by choosing the three by their different systems (fixed stations or floating system), being able to compare them in terms of costs, environment and mobility:

- The first ZipCar has a station-based system and serves the US, UK, Spain and Canada;
- The second ZazCar has a system of stations that serves the city of São Paulo - Brazil;
- The third Car2Go, has a floating system and serves the USA, Germany, Canada, UK, France, Holland and Australia.

Based on these analyzes, a proposal was made to implement the Car Sharing system in the city of Passo Fundo, RS - Brazil, considering the possibilities of analyzing the implementation spaces in different points of the city.

3 Results and discussions

In order to evaluate the public transport and private car service in the city of Passo Fundo/RS, the harmful substances released into the atmosphere by motor vehicles were also taken into account, according to Carvalho (2011), a bus carrying 70 passengers, is equivalent to 50 cars on the road, traveling with an average of 1.5 people per vehicle. Thus, public transport results in less pollution per passenger.

The planning and urban management of the city of Passo Fundo directly interfere in the performance of the transportation system. Some measures, such as lowering the cost of gasoline and lowering car taxation, lead to negative environmental results.

According to Campos (2006), the incentive to use public transport contributes as a strategy for sustainability, making it possible to reduce the use of private cars and reduce their impacts, such as air pollution, noise pollution and bottling, giving priority to investments in mobility and efficiency of services provided.

Regarding the questionnaires applied, it was noted that 58% were male and 42% female, and both had a complete secondary education, the number of people who owned cars was divided by 50% in relation to the people who used to use the public transport. But 66% of the interviewees use public transportation, but they rated it as poor quality, while 34% of the population rated it as good.

This is because people are aware that public transportation is not only a means of transportation but a place where they can feel happy and secure in their choices at the moment they need to get around. In order to compete with the private car, public transport must offer a comfortable.

3.1 Car Sharing System Analysis

The three organizations chosen for analysis, two have a system based on fixed stations (ZipCar and ZazCar), and the third one a floating system (Car2Go). The fixed station system is the most common, and works from spaces intended for parking of vehicles, in general, the user who uses the system needs to return the car to the same place where it was withdrawn.

However, the floating system has no fixed location, so the user can pick up the car wherever it is available and leave it after use, where convenient, within a predefined area (ITDP, 2014).

Thus, when analyzing the three systems it is realized that the ZipCar works through stations available in cities of several countries, its points are in strategic places like airports, universities, metro, summed up are 12,000 vehicles. The use happens through an application register, where the user finds the vehicle and the place where he wants to remove the car and previously, they already define where he will return it, not

necessarily where it has been removed (ITDP, 2014). The use of the car can be for hours or per day, depending on the user's reservation. Your fare covers fuel, insurance, and miles to travel.

As for ZazCar, the same works from stations in the city of São Paulo (SP). In total the organization has 45 points, the same was inspired by ZipCar. The user manages usage through an application, where he finds available cars and stations, selects what he wants and uses. After use the return of the vehicle must be done in the same station in which it was withdrawn (ITDP, 2014). The use can be made per hour or fraction of an hour, the rate is charged per hour and per kilometer, thus seeking to encourage efficient use of the vehicle, and varies according to the car model.

Already, the Car2Go, different from the two others analyzed, works with floating system, having the cars available in streets and lots around the cities. Car viewing is by map available in the organization's application. Cars can be taken without prior reservation and can be returned anywhere (ITDP, 2014). Fares vary according to the model of the vehicle and the city, and are charged by time of use and mileage.

3.2 Comparison between the three analyzed car sharing organizations

Comparing ZipCar, ZazCar and Car2Go in relation to: 1) costs; 2) environment; And 3) mobility it was possible to verify that, second Boyacı, Zografos and Geroliminis (2017):

1. on costs both organizations are equal, both the costs to implement the organization (cost of vehicles, operating costs, insurance, parking fees, marketing), as well as costs to users, so that fees are charged Same way regardless of whether it is a floating or station.
2. The user who adopts the system in detriment of his private car saves on paying for parking and maintenance of the vehicle. Regarding the environment, the Car Sharing system, regardless of its operation (floating or fixed), is an alternative for the reduction of emissions of pollutants in the atmosphere, so that vehicles are manufactured recently, and in this way have lower emission rates, and electric cars can still be used, increasing efficiency.
3. On urban mobility, the shared car system reduces the number of vehicles circulating in the streets, which confirms an improvement in the mobility of cities, reducing congestion, increasing street space, especially in organizations with a system of stations, So the cars do not get parked on the street.

Regarding the individual mobility of the user, the floating system is more attractive for short trips, because the user can after using the vehicle, leave it parked in a vacancy available on the street, where it is destined, without a pre-established location.

3.3 Car Sharing System Applicability

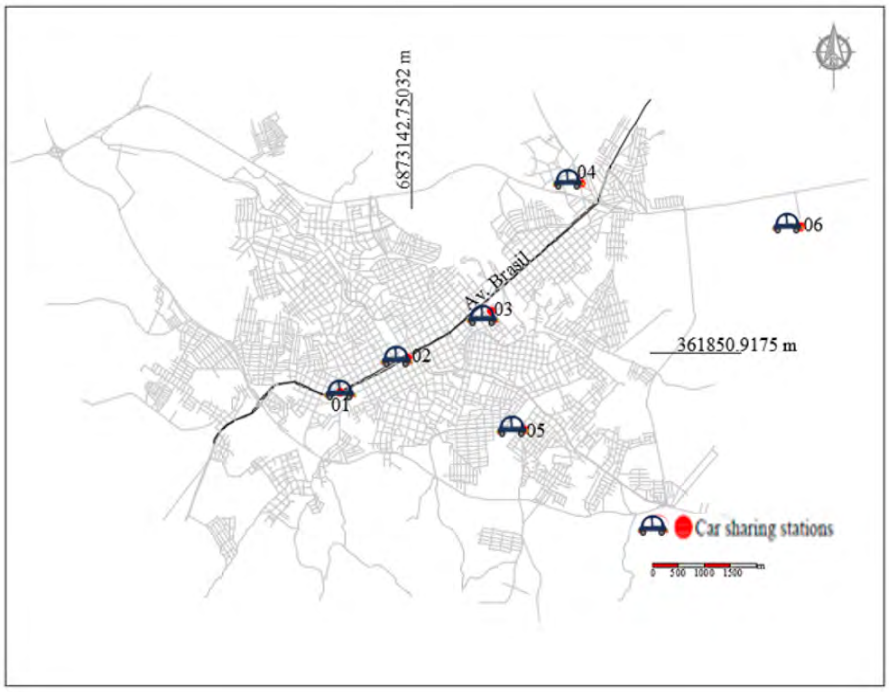
Based on Car Sharing system analyzes and the three organizations (ZizCar, ZazCar and Car2Go), the possibility of implementing the shared car system for the city of Passo Fundo/RS was analyzed as an alternative for improvements in mobility and Sustainable development of the city, so that it suffers from the excess of individual vehicles circulating in the streets. The consequence of a poorly structured public transport system (TANIGUCHI, 2011).

This implementation would happen through a system of fixed stations in strategic points of the city of Passo Fundo/RS. The user would remove his vehicle according to his needs at one of the stations and after use he would return it to the station that was most convenient to him, not necessarily the one in which he removed the vehicle (as it does in the analyzed ZizCar organization).

For the installation of the vehicle comparability system, public authorities could create a tax incentive, through a reduction in taxation of taxes and also, in relation to the rates for parking of vehicles in the areas established as stations.

Six points were defined in the city for the implementation of fixed car stations (Figure 1): 1 - Bairro Boqueirão; 2 - Centro (Shopping Bella Citta); 3 - Bus Station; 4 - Bairro São José (University of Passo Fundo - UPF); 5 - Bairro São Cristóvão; and 6 - Airport.

Figure 1. Proposal of shared car stations in the city of Passo Fundo/RS



Source: City Hall, adapted by the authors (2017).

The implementation of the Car Sharing System will enable improvements in urban mobility, being one of the challenges for planning and research in the

next decades (GEUM; LEE; PARK, 2014). According to Rybarczyk and Wu (2010), Taniguchi (2011), Geum, Lee, Park (2014), Boyacı, Zografos and Geroliminis (2017), the development of a transport system that allows urban movements, without increasing congestion rates as, for example, the user will be traveling using public transport, being increasingly necessary for city planning.

4 Final Remarks

The research demonstrates the importance of thinking about alternatives that can minimize the problem of the increasing number of vehicles circulating around the city. From the analysis of the Car Sharing system, its variations and benefits, it was possible to verify the viability of its implementation in the city of Passo Fundo, RS, due to the large number of people that circulate in the city, considering the population fluctuating. It stands out as already existing problems in relation to the consequent mobility, the large amount of individual cars in the streets.

The creation of future scenarios, according to Geum, Lee and Park (2014) is fundamental for the implementation of systems that guarantee local sustainability. Therefore, the importance of thinking the Car Sharing System, to suit the population growth, which is constant.

For future studies, the analysis of the number of stations will be deepened, in addition to their interaction with the existing system of shared bicycles. And also, the feasibility of taking the Car Sharing system to cities in the region, allowing the intermunicipal movement, through the system of sharing vehicles.

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