



Proposal of urban mobility model from the modal integration Santa Maria do Leme river basin: subsidies for the expansion at São Carlos city, São Paulo State, Brazil

Speakers:

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Abstract: *The appropriate solution proposals to traffic problems requires dynamic view of the particularities of a region associated with the pursuit of innovation and good practice applied in other locations. This project aimed to identify and analyze the current situation of the transport on São Carlos city, located in São Paulo State, Brazil, and propose the diversification of urban mobility searching for integration of transport modes. Currently there is an increase in the visibility and recognition of the importance of mobility in Brazil, evidenced by the establishment of the National Policy on Urban Mobility in January 2012 (Law No. 12,587), which aims at the integration between different modes of transport and improving accessibility and mobility of people and loadings in the territory of the municipality. This study aimed to obtain datas to allow current quality assessment of urban public transport services, to develop a diagnosis and proposed actions, exposing solutions that encourage integrated multiple modes of transportation reconciled with wide accessibility and democratic, social inclusion. The work suggests the structuring of quality and alternative ways, in addition to prioritization of non-motorized, collective and sustainable modes of transport.*

Keywords: *Urban mobility, modal integration; transportation systems; sustainable transport.*

INTRODUCTION

The urban mobility includes the accessibility to the public transport systems, the quality of transport services, the range of mobility possibilities, and the possibility to provide displacement on universal bases inside a territorial area.

Great part of the configuration of existing cities is centralized in the primacy of individual transport, overlapping the collective transportation and the non-motorized, such as bicycles and pedestrians mobility. Such way of urban organization sets a traffic problem, where it is common to associate the road infrastructure to individual motorization (HILDEBRAND, 2012).



Reach a level of high range and quality of the transport systems goes through actions such as: articulation of planning the land use and occupation, improvement of the road system and transports, development of economic and fiscal instruments; development of studies and analysis of the current situation; investments in new technologies; implementation of adjustment proposals to the dwellers – present and future – demands for mobility; as well as the availability of a range of integrated transport modes.

The resolution of the urban transport and mobility issues promotes the improvement in the citizens' quality of life, considering that, through this action, it is possible to: drive up the economy (once the hours wasted in traffic jams are reverted to productivity), display the potentialities of development for a location (considering that, once the transportation issue is solved, actions may be directed to seek the adjustment of other problems and invest in means of socio-economic growth), improve the esthetic aspect of the city (through the decrease/elimination of traffic jams), and ensures the flow of people - indispensable aspect for the promotion of urban vitality and the cultural development, providing the creation of a singular identity for the city.

Provide the ways for people to walk around and circulate, within a diversified and interconnected system of transport (where the citizen can decide the best way to travel, or the best transportation to use, according to his will) is not only about having the options and possibilities, actually, it is an individual right, an expression of freedom and social inclusion.

Obtaining the data to assess the quality of urban public transport service, as well as the condition of the roads and other traffic areas, is relevant for mobility studies in several urban centers, including cities in expansion process, corresponding to those located in the countryside of São Paulo' state, Brazil.

The city of São Carlos is one of those cities, has an area of 1,137.332 square kilometers, the populations totalizes 221,950 inhabitants and the "Índice de Desenvolvimento Humano Municipal" (IDHM - Municipal Index of Urban Development) value is 0.805 (IBGE, 2010). São Carlos process of expansion has demanded challenges of studies, planning and feasibility of the transportations modes.

The urban mobility current situation in one of the main avenues in the city (Miguel Petroni Avenue) - located in Santa Maria do Leme watershed within this city) already demonstrate several impacts, such as the excess of vehicles, intense flow in rush hours and the lack of diversified infrastructure of transport modes.

Besides that, the urban mobility configuration at this avenue does not match the resolutions and guidelines from the "Política Nacional de Mobilidade Urbana" (National Policy for Urban Mobility) (BRASIL, 2012), and it is notable that the current organization of the existent transportation is at odds with the paths proposed by this Policy, making it essential to present measures which boost the resolution of mobility and circulation impasses, combining the



attendance to the legislation, and proposing an alternative model of urban mobility from the desirable integration of the transport modes at this avenue.

OBJETIVES

The purpose of this study was to analyze the current situation of the transport modes of Miguel Petroni Avenue (located in Santa Maria do Leme watershed, in São Carlos City, in the countryside of São Paulo state, Brazil), aimed a plan proposition for diversification of urban mobility, enabled by the modal integration of urban transport to this city.

METODOLOGY

In order to obtain a precise diagnostic for the determination of the scope of transport systems (as well as the demands and shortages, establishment of priority sites for investment in infrastructure and improvements), relevant data source for the research were consulted, and the followed procedures were employed:

- (a) Technical site visits to collect data about the displacements profile at Avenida Miguel Petroni. The Manual Count methodology ("Manual de Estudos do Tráfego" - DNIT / Manual Traffic Studies, BRAZIL, 2006) allowed us to determine the variation in traffic volumes (or Traffic Flow), quantity, direction and vehicles flow composition traveling along Avenida Miguel Petroni, based upon a characterization of the Average Daily Volume ("Volume Médio Diário" - VMDd).
- (b) Information provided by the Municipal Transport and Traffic ("Secretaria Municipal de Transporte e Trânsito"- SMTT) of the São Carlos' Municipality, which contains the city bus stop location.
- (c) Maps about the displacement in São Carlos city (SP), obtained from the Destination Origin O/D of the Final Report of Shifting Patterns in the City of São Carlos - SP (SÃO CARLOS, 2011) conducted between the years 2007/2008 by the Department of Transportation of the Engineering School of São Carlos, University of São Paulo (USP).
- (d) Consultation of the revision of the Director Plan of the São Carlos Municipality (SÃO CARLOS, 2011) process. Seeking to determine the guidelines for urban mobility set out in Roadworks Guidelines chapter.

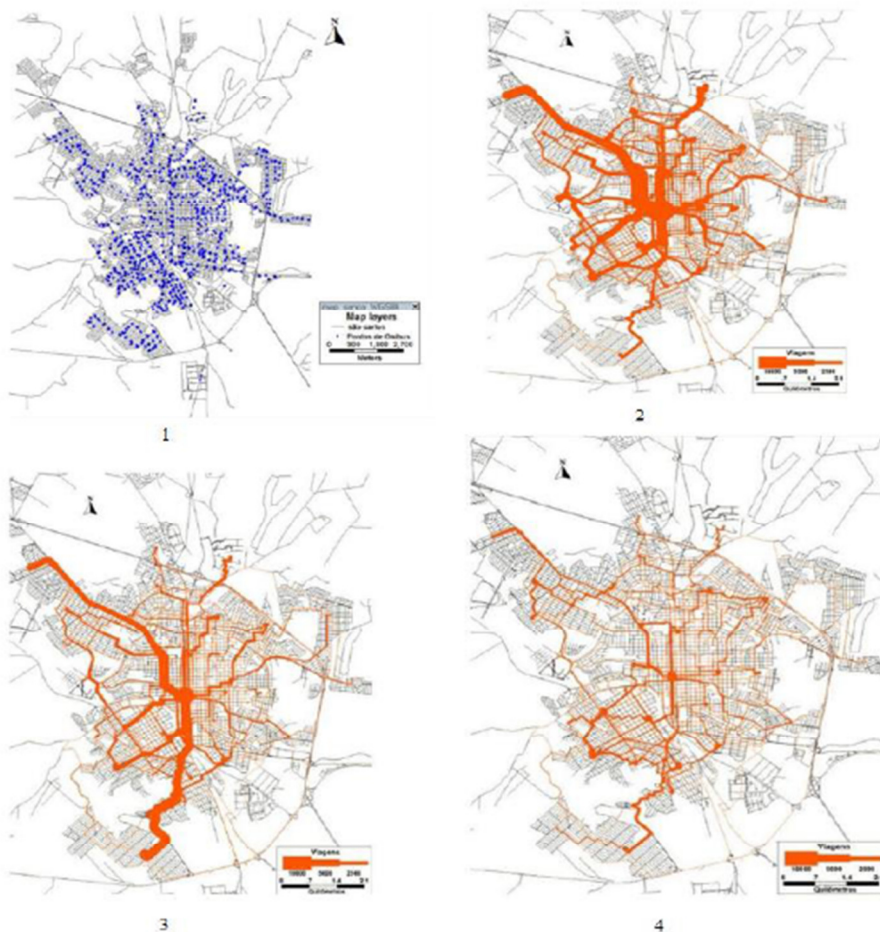
RESULTS

Figure 1 shows the bus stop location of São Carlos city and it was provided by Municipal Transport and Traffic of the São Carlos' Municipality, SP (PIANUCCI, 2011). However, the

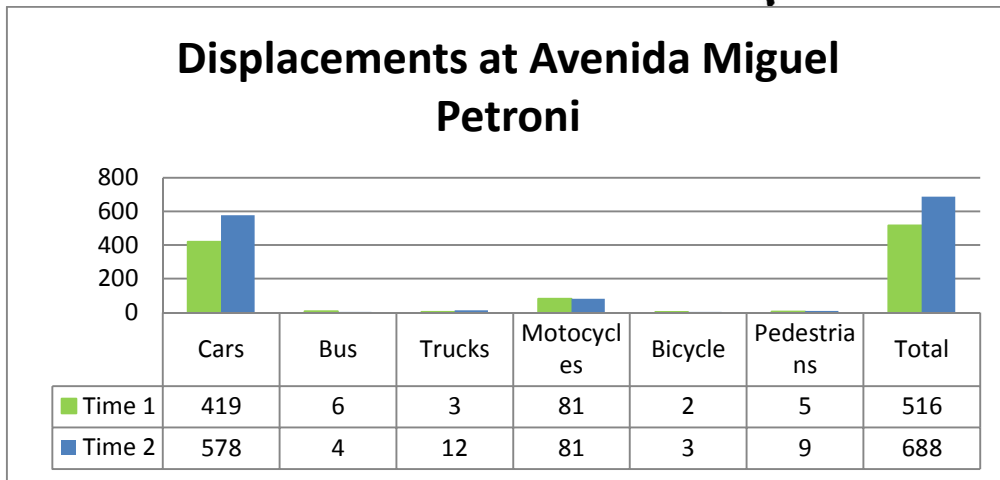
figures 2, 3, and 4 were obtained through the Destination Origin O/D of the Final Report of Shifting Patterns in the City of São Carlos from 2007/2008 (SÃO CARLOS, 2011). From these data, it is possible to make the following appointments:

The number of bus trips it is not consistent with the availability of local access to this type of transportation (stopping points); and the use of automobiles in the city, although significant, it is not predominantly the only way of locomotion. However, the data obtained substantiate the conclusion that the individual forms of transport, such as light vehicles and motorcycles, predominate in relation to collective ways of transportation and displacement of pedestrians and cyclists, as can be observed on figure 5.

It is noteworthy the importance of improving the quality of the road network and diversification of it, considering that, with the economic growth and the city's occupation expansion, transport demand will increase and there should be strategies to meet this future demand through the promotion and inclusion of other types of transportation, such as bicycles, allowing a diverse transportation options with quality, with accessible routes and integration.



Figures 1, 2, 3, and 4. Bus stop locations of São Carlos City, SP, Brazil; allocation of trips made by bus (1), automobile (2), and on foot (3). (PIANUCCI, 2011 (1) and 2007/2008 O/D Research (2, 3, 4)).



Figures 5. Displacement on Miguel Petroni Avenue. (Elaborated from the author's collected data through the Volumetric Counting Sheet).

From the data obtained, it was possible to make a diagnosis of the situation of vehicular traffic in the region and, thus, formulate alternatives to the main demands of shift and improvements in the construction of transport infrastructure. With this, a Conflict matrix and Urban Mobility Convergences were constructed (Figure 6), making easier to establish the guidelines indicated to manage the issues raised.

| CONFLICT AND CONVERGENCE OF URBAN MOBILITY | | | | | |
|--|--|--|---|--|--|
| Aspects | Conflicts | Potential | Guidelines | | |
| Transport | Public | The area does not have enough bus lines | Trend of increasing demand for public transportation system | Desing the transportation system according to local demand | |
| | Particular | Large flow of cars decreasing or suppressing the public área for pedestrians and public transport collective | | Encourage non-motorized individual transport and public mass transportation through bike paths and bus lanes | |
| Urban Mobility and | Recovery and conservation of sidewalks | Sidewalks in poor condition | Conditions for improvement of sidewalks | Revitalize the sidewalks, adapting them to technical standards | |
| | Acessibility | Irregularity of the layout of | Internal displacement | Enlarge the sidewalks, | |

| | | | | |
|---------------|-----------|------------------------------------|--|--|
| Accessibility | | the streets, very narrow sidewalks | mainly on foot or by bicycle | improving conditions for user comfort |
| | Signaling | Poor or non-existent signage | Conditions for improvement of signalling | Improve signage to maintain a speed consistent with safety |

Figure 6. Conflicts matrix and Convergences.

The final proposal for the road system (Figure 7) in Santa Maria do Leme watershed aims to present a solution to the limit situation in which it is the traffic on Miguel Petroni Avenue (with saturated routes by the large flux of vehicles), suggesting new routes and adopting alternatives to transportation planning through the insertion of bicycle path and revitalization/construction of sidewalks, prioritizing the mobility of pedestrians to the detriment of cars and also paying special attention to the issue of public transport, the focus of current public policies and directions in the country.

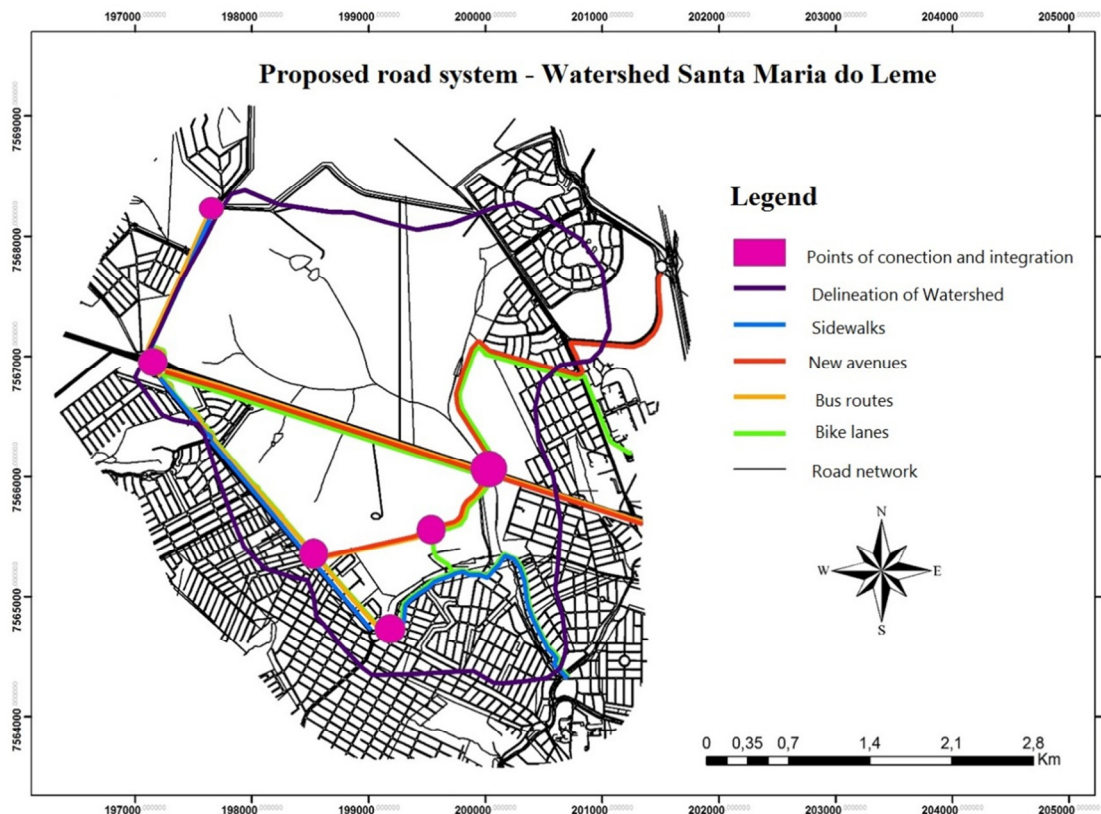


Figure 7. Thematic map of the proposal for the Road System in Santa Maria do Leme Watershed.

FINAL REMARK



By promoting discussion about the current situation of the transportation at Miguel Petroni Avenue region, there was a search for the conciliation of incentives for multiple modes of integrated transportation with the accessibility, social inclusion, and structuring quality alternative routes and may contribute to improvements in the transport system of the region.

The proposal presented on this project aimed to provide a short-term solution, which had as a guiding support the urban growth and the increase in demand for transport as well as offer new alternatives for locomotion through the expansion of the road network and improvement of the mesh existing.

The prioritization of adequate transportation contributes to sustainability because, within this conception, priority is given to balance the preposition of ways to optimize the existing transportation system and identify the best ways to expand this network road without compromising the system support ability, facilitating the application of the principles of sustainable urban mobility.

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