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Public park policies and Carsharing Systems

Políticas de estacionamento público para sistemas de compartilhamento de veículos

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ABSTRACT
This article addresses the topic of car sharing and public policies related to the regulation of parking areas for the system. The article aims to identify the practices that contribute to a better performance of sharing systems and the legal frameworks of the metropolitan region of Rio de Janeiro that can regulate their implementation..

Keywords: Sharing economy, carsharing, urban planning, parking policies, integrated planning

RESUMO
Este artigo aborda o tópico de compartilhamento de carros e políticas públicas relacionadas à regulamentação de áreas de estacionamento para o sistema. O artigo tem como objetivo identificar as práticas que contribuem para um melhor desempenho dos sistemas de compartilhamento e os marcos legais da região metropolitana do Rio de Janeiro que podem regular sua implementação.

Palavras-chave: economia compartilhada, compartilhamento de carros, planejamento urbano, políticas de estacionamento, planejamento integrado.

1 INTRODUCTION

In England, the Department of Transport for London (TFL) has launched an action plan by 2021 (Improving the Health of London, 2014), considered the only one of its kind in the world. The

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document considers the streets, the environment and transport as influence to the quality of life of the inhabitants and argues that 38% of the time during the day is spent on trips in cars or taxis. The plan is to encourage the use of other models of transport improving the quality and safety of public spaces, encourage non-motorized displacements and introduce a healthier lifestyle to people through transportation. The document provides rich information about the transformation of the bus fleet in a hybrid fleet, the increase in routes dedicated to bikes, tax exemption for electric delivery vehicles and electric bicycles, the planting of new trees increased air quality and increased activities physical.

In Paris, France, the municipality established that, up to 2020, the city center will be free of cars, transforming the four central districts as an area free of vehicles, liberated exclusively for pedestrians, bicycles, taxis and bus. Only local inhabitants will have permission to circulate in this region, but will be subject to a time schedule. One of the goals is to decrease the city pollution using support policies with the offer of carsharing with electric cars, bikesharing e and even free public transportation. (Arch Daily, 2015)

In Brazil, the urban mobility crisis has traditionally still been a matter of road infrastructure, large investments are generated to allow travel over long distances.

The creation of the City Statute through Federal Law #10.257 of 2001, has as its general objective to guarantee the right to the city through guidelines such as the promotion of sustainable urban mobility, articulating actions at the national, state and municipal levels. From the approval of the principles and guidelines of this statute by the Council of Cities in 2004, we can observe the resumption of urban planning, in relation to sectorial policies such as housing, sanitation, mobility and the environment (Ministério das Cidades, 2004; Brasil, 2001).

The City Statute establishes the Master Plan as the main urban planning instrument for cities above 20 thousand inhabitants. One of the planning axes is the local urban mobility plan.

From the creation of the National Urban Mobility Policy (NUMP), instituted through Law # 12,587 of 2012, guidelines for sustainable urban development were established, considering as its objectives, the integration between the different modes of transport. The NUMP's main instrument is the Sustainable Urban Mobility Plan (SUMP) developed by the municipalities in an integrated manner with the Master Plan (Brasil, 2012).

However, prior to the creation of the NUMP in the city of Rio de Janeiro, we have, in the metropolitan scope, the Urban Transport Master Plan (UTMP) of the Metropolitan Region of Rio de Janeiro, which had its first publication in 2003, and its last update in 2015.

The UTMP is the instrument that guides collective and individual transport actions at the state and municipal levels. The policies resulting from this plan will serve as guidelines for public

investments in transport infrastructure, with the purpose of integrating all existing modes (Rio de Janeiro, 2013).

With the creation of the Urban Transport Master Plan - UTMP, from Decree # 43.333 of 2013, the document that guides public policies for investments in public transport infrastructure is instituted in the Metropolitan Region of Rio de Janeiro (Rio de Janeiro, 2013).

Finally, at the municipal level, we have the Sustainable Urban Mobility Plan (SUMP) for the city of Rio de Janeiro - created to guide public investments in the necessary infrastructure for transportation in the city of Rio de Janeiro. Its main objective is to integrate motorized and non-motorized modes, establishing the priority for the public transport system, walking and cycling.

For the implementation of the SUMP, data produced for the UTMP of 2013 were used, considering primarily the data for the city of Rio de Janeiro.

> The Sustainable Urban Mobility Plan, developed by the City of Rio through the Municipal Transport Secretariat (SMTR), will guide public investments in the city's transport infrastructure for ten years, starting in 2016. SUMP should integrate motorized and non-motorized in a cohesive and sustainable system, prioritizing public transport, walking and cycling and considering greenhouse gas emissions.
> The work uses data from the Metropolitan Urban Transport Master Plan (UTMP -2013), focusing on the city of Rio de Janeiro. At the end of ten months, a document will be prepared with the main conclusions and proposals of the study for the scenarios of 2021 and 2026 (with different degrees of investment). All measures will be in accordance with the recommendations of the Master Plan of the City of Rio de Janeiro (Complementary Law # 111/11), the Municipal Policy on Climate Change (Law # 5,248 / 11) and the National Policy on Urban Mobility (Law # 12,587 / 12).

The City of Rio de Janeiro's Sustainable Urban Mobility Plan (SUMP) was developed since 2014 and instituted in 2019, as the main instrument for implementing urban mobility policies. The main objective of the SUMP is to guide municipal actions towards transport modes, services and infrastructure suitable for urban mobility and integrated with other urban policies (Rio de Janeiro, 2019).

The Urban Mobility Plan is responsible for adapting the necessary infrastructure for transportation, such as streets, sidewalks, bike lanes and transport corridors, thus including the adequacy of parking spots on public roads and making SUMP the instrument for the creation and regulation of parking areas for carsharing systems.

2 WHAT IS CARSHARING?

The collaborative use of vehicles is a common system in countries like United States, Canada and Europe. Considered as a hybrid alternative of public and private transport. The system is known

in the USA as Carsharing and as CarClub in England and offers the benefits of personal motorized mobility without the need to own a vehicle.

The system concept can be understood and organized as a short-term car rental, possible taking into consideration the logic of the sharing economy and new technologies of GIS and IT. Usually participants sign up to use the service (customers) and pay a fee every time they use a vehicle. (Shaheen, Sperling, Wagner, 1999). The programs have different operating systems, different technologies and even different goals, but they all have the following in common:

- A group of participants organized as a club;

- One or more vehicles;

- A decentralized network of parking lots, located in centers of interest or integrated with other modes;

- The possibility to book in advance;

- The rent of these vehicles for short periods, an hour or less;

- Self-service;

- The costs of vehicles are included in the rate, fuel, maintenance, insurance and taxes;

- The service can be accessed 24 hours a day, 365 days a year

The system concept allows a variety of modes of operation. These business models can be divided into three categories:

- Round Trip: The vehicle must return to the station where they was picked up. (D. Jorge e G. Correia, 2013)

- One way: The Vehicle may be dropped off at any station. (D. Jorge e G.Correia, 2013)

- Free floating: The Vehicle enables one-way journeys within a specified geographic zone (La Vine et al, 2014)

The fees charged by operators may vary in accordance with the following data:

- For distances;

- By the time reserved;

- Administrative fees;

- Late cancellations, misuse of the system and parking in prohibited places.

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3 INTEGRATION WITH OTHER TRANPORT MODALS

Car sharing is considered a complementary element to modal systems, for example, when it is necessary to reach a destination where public transport does not reach or is irregular. A good strategy is to locate carsharing stations next to metro, train stations, BRT stations, shopping centers, bus terminals, and bicycle sharing stations.

In some European cities, for example, carsharing operations have cooperation with public transport, making it possible to buy metro tickets at car sharing stations. In Paris, Autolib (an electric car sharing service) complements Velib (the French capital's bicycle sharing system)

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The TCRP Report 108(2005) shows that the benefits caused by carsharing can be divided into three different layers Transport systems: Reduction of parking areas, and optimization of individual motorized travel.

The TCRP Report 108(2005) mostra que um dos beneficios causados por sistemas de Parking Policies For Carsharing Systems

The access to a parking space, as well as its cost are decision features in the choice of an individual motorized transport and the role of the municipalities is to calculate the rates and legislate about the use of soil in areas designated for parking lots in public ways or in commercial and residential enterprises. Besides an infrastructure necessary for circulation, a car needs two parking spaces, one at its origin and another at destination, creating a demand for parking lots, which may be divided in three categories (MTI REPORTS , 2012):

1.   Parking areas outside public ways: These are parking lots where a fee is charged for the limit of permanency. The management of these areas may be from the public of private sector.

2.   Non residential private parking lots out of the public ways: These are parking lots for commercial buildings or trade centers, where the access is only allowed for proprietors or building employees.

3.   Residential parking lots: These are parking lots from residential buildings, where the access is allowed only for dwellers.

Originally, the rate of public parking spaces was calculated from a minimum number of spaces, prepared to meet the demand for existing vehicles; A new vision suggests that public transport policies must be in line with urban planning and, as such, achieve the following objectives:

- Make the urban centers attractive for commercial activities;
- Reduce individual transport ownership motorized;
- Develop the integration of different public transportation systems;
- Reduce   the   environmental   impacts   produced   by   the   individual   motorized

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transportation;

- Guarantee the access to public transportation for all social levels.

Under this scenario is created a new policy of parking lots articulated with the sustainable urban mobility strategies:

- Parking sharing: Under the optics of shared consumption the parking places reach the maximum usage index. In the USA, the site www.parkcirca.com can be accessed and the users may offer a parking space or search a parking space.

- Park and Ride: Park and ride operates by removing from city downtown the car flow. Drivers drive towards park-and-drive areas and then access public transportation.

- Maximum number of parking spaces: The maximum number of parking spaces is the evolution from the model of minimum spaces. This maximum number may be applied in commercial or residential enterprises.

- Increase of parking fees in the downtown areas: Considering this, the use of a public transportation becomes more attractive and part of the collecting of these charges may be used for the maintenance of the public transportation.

- Use of management technology and supervision of parking areas: With the present technology it is possible to record vehicle data which violate regulations inside the parking areas and provide real time orientation systems which help to orient the search of parking places being offered. In some cities in Europe this system is already being used for parking spaces on the streets.

- Demand monitoring: When the demand begins to exceed the offer in a certain street, the parking may be forbidden and the offer of parking spaces may be changed.

- New legislation for the land occupation and use: These new laws extinguish the need for minimum parking lots in residential enterprises. The advantage of this procedure is the reduction of the enterprise cost, with a better use of the land and the induction to the use of public transportation.

- *Carsharing*: The reduction in the possession of vehicles reduces the demand for parking lots.

The regulation of parking lots for the carsharing system are important since they define the organization of the network and allow its visibility by the public, operating like asset that the cities may offer to the operators to reduce the costs and help to increase the operations. Some legal or institutional barriers may come up along the development of the parking policies. As a general view inside North America some elements were identified as fundamental (MTI report, 2010):

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- Allocation of parking spaces to operators made through a combination of formal and informal processes by the public agents.

- Limit of parking spaces for each operator. The number of forecasted parking spaces may be determined by the number of members of each operator.

- An annual or monthly license determining the quantity of hours that each operator may use each parking area.

- Horizontal and/or vertical signaling to identify the space as well as the responsibility of maintenance of each operator, to guarantee the conformity with the local legislation.

- Supervision and operation controls, such as tickets or towing, to guarantee that vehicles out of the system cannot have access to the parking spaces.

- Documentation of social and environmental impacts by the operator

The following tables show the parking objectives and policies adopted by cities around the world. The policies and objectives created in different cities can serve as an example for the creation of the parking infrastructure necessary to implement car sharing systems in the city of Rio de Janeiro.

4 PARKING POLICIES – CITY BENCHMARKS

The Table 01 gives some examples of cities around the world where carsharing system was identified as part of the local transport policy requiring legal subsidies and urban infrastructure.

Table 01 - Goals of the cities around the world

Goals of the cities around the world

	Reduction of CO_2	Reduction of vehicle ownership	Prioritize public transport	Reduze Parking
Germany, Bremem	Yes	Yes	Yes	No
Australia, Freemantle	No	No	No	No
Austaália, Port Phillip	Yes	Yes	No	No
Australia, Stonnigton	No	Yes	No	No
Australia, Sidney	No	No	Yes	Yes
Belgium, Flanders	No	Yes	Yes	Yes
Brazil, São Paulo	Yes	Yes	Yes	No
Spain, Madrid	Yes	Yes	No	No
Canada, Toronto	No	No	Yes	Yes
USA, Pasadena	No	No	Yes	No
USA, Portland	Yes	Yes	Yes	Yes

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USA, San Francisco	No	Yes	Yes	No
USA, Washington.	No	No	No	No
France, Paris.	Yes	Yes	Yes	Yes
Netherlands, Amsterdam.	Yes	Yes	Yes	Yes

Source: Made by the authors

Each one of the mentioned cities have different characteristics in relation to population, geography and location, but they will assume the objective to reduce the CO_2 levels, the vehicle property, give priority to the public transportation and reduce the private parking areas. Based on data supplied by these city municipalities, three tables were prepared with examples for the understanding of parking spaces' support policies for parking spaces for the carsharing systems:

- Integration with public transportation (table 02)

- Documentation for system monitoring (table 03)

- Support actions provided by local authorities (table 04)

Table 02 - Integration with public transport.

	Integration with public transport			
	Tickets and combined rates	Carsharing stations may issue tickets for the public transport	Acess to modal	Carsharing as part of the public transport system
Germany, Bremem	Yes	Yes	Yes	Yes
Australia, Freemantle	No	No	No	No
Australia, Port Phillip	No	No	No	No
Australia, Stonnigton	No	No	No	Yes
Australia, Sidney	No	No	Yes	Yes
Belgium, Flanders	No	No	Yes	Yes
Brazil, São Paulo	No	No	Yes	No
Spain, Madrid	No	No	Yes	Yes
Canada, Toronto	No	No	Yes	Yes
USA, Pasadena	No	No	No	No
USA, Portland	No	No	Yes	Yes
USA, São Francisco	No	No	Yes	Yes
USA, Washington.	No	No	Yes	Yes
France, Paris.	Yes	Yes	Yes	Yes
Netherlands, Amsterdam.	Yes	Yes	Yes	Yes

Source: Made by the authors

Integration with modal systems as part of public transport is a premise found in 80% of exemplified cities, the evolution of this concept for sustainable urban mobility can be seen in cities like Bremen, Paris and Amsterdam where tickets and fares can be removed in carsharing stations with

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rates combined offering greater convenience to its users. Meira Maia (2010) argues that to integrate cardsharing systems with modal systems the location of their parking lots is essential.

Table 03 - Documentation for monitoring system usage

	Documentation for monitoring				
	Documentation about the use of parking spaces	Vehicles docume-ntation	Documention about the emissions	Environmental certifications	Public partici-pation
Germany, Bremem.	Yes	Yes	Yes	Yes	No
Australia, Freemantle.	No	Yes	Yes	No	Yes
Australia, Port Phillip.	No	No	Yes	No	No
Australia, Stonnigton	No	No	Yes	Yes	No
Australia, Sidney.	No	Yes	Yes	Yes	No
Belgium, Flanders.	No	No	Yes	No	No
Brazil,São Paulo.	No	No	No	No	No
Canada, Toronto.	No	No	Yes	No	No
Spain, Madrid	No	No	Yes	No	No
USA, Pasadena.	Yes	Yes	Yes	No	Yes
USA, Portland.	Yes	No	No	No	Yes
USA, São Francisco.	No	No	Yes	Yes	Yes
USA, Washington.	Yes	Yes	No	No	Yes
France, Paris.	Yes	Yes	Yes	Yes	No
Netherlands, Amsterdam	Yes	Yes	Yes	Yes	No

Source: Made by the authors

The integration of cardsharing with urban planning is a relatively new concept, studies in Europe have concluded that there is no reason to prevent local governments to incorporate the system as a tool to promote sustainable urban mobility (Solman et al, 2005). Ryde'n and Morin (2005) report that the use of cardsharing decreases the rate of emission of a single driver from 39% to 54%.

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Table 04 – Supporting actions

	Supporting actions			
	Street parking concession	Parking provided exclusively for trade?	Facilities to approved new parkings.	Marketing support
Germany, Bremem.	Yes	No	-----------------	Yes
Australia, Freemantle.	Yes	No	----------------	Yes
Australia, Port Phillip.	Yes	No	No	No
Australia, Stonnigton.	Yes	Yes	Yes	No
Australia, Sidney.	Yes	Yes	Yes	Yes
Belgium, Flanders.	Yes	No	No	Yes
Brazil, São Paulo.	Yes	No	No	No
Spain, Madrid	Yes	No	No	Yes
Canada, Toronto.	Yes	Yes	Yes	Yes
USA, Pasadena.	Yes	No	Yes	Yes
USA, Portland.	Yes	No	Yes	Yes
USA, São Francisco.	Yes	No	Yes	Yes
EUA, Washington.	Yes	No	Yes	No
France, Paris.	Yes	No	----------------	Yes
Netherlands. Amsterdam	Yes	No	----------------	Yes

Source: Made by the authors

Marketing facilities, concession of new parking areas facilities to approve dedicated car parking spaces are policies adopted in most cities around the world. Granting vacancies exclusively for commerce is not a common practice.

5 CONCLUSION

Cities around the world has been using car sharing as a way to combat the crisis of mobility, among the devices found is car sharing, understood as a system capable of making the connection between public transport and private individual transport and with ability to decrease vehicle ownership rates. Rio de Janeiro, in particular, does not have a regulatory framework for the system. These public policies for the allocation of carsharing parking areas, integration with public transport systems and monitoring of environmental, economic impacts can be created via UTMP and SUMP that are the norms for public investments in infrastructure and transport in the city of Rio de Janeiro and metropolis.

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REFERENCES

La Vine Scot ,Zolfaghari Alireza ,Polak John - Carsharing: Evolution, Challenges and Opportunities - Centre for Transport Studies, Imperial College London, 2014-Archdaily , disponivel em http://www.archdaily.com.br/br/773666/paris-proibira-a-circulacao-de-veiculos-no-dia-mundial-sem-carro-2015. Acessado em 24/11/2015

ABRAMO, P. Mercado e ordem Urbana. Rio de Janeiro: Bertrand do Brasil, 2001

BORSDORF, Axel. Como modelar el desarrollo y la dinâmica de la ciudad latinoamaricana. EURE (Santiago). Santiago, v29, n 86, mayo 2003. Disponivel em http;// www.eure.el, último acesso em 17/09/2015.

BRASIL. Instituto de Pesquisas Econômicas Aplicadas (Ipea). Notícias. Brasília, 2012. Disponível em: <http://www.ipea.gov.br/portal/index>.

Brasil, Decreto n.° 12.715, DE 17 DE SETEMBRO DE 2012, Regulamenta os arts. 40 a 44 da Lei nº 12.715, de 17 de setembro de 2012, que dispõe sobre o Programa de Incentivo à Inovação Tecnológica e Adensamento da Cadeia Produtiva de Veículos Automotores, Diário Oficial [da] Republica Federativa do Brasil, Brasilia , DF,18 de novembro de 2012 SEÇÃO I

Diana Jorge, Gonçalo Correia - Carsharing systems demand estimation and defined operations: a literature review – Artigo – European Journalof Transport and infrastructure research Vol 13Coimbra, 2013

IPCC (Intergovernmental Panel on Climate Change) –Guidelines for national greenhouse gas inventories. IPCC/OECD/IEA, Paris. 2004

IPEA (Instituto de Pesquisasa Econômicas Aplicadas) Indicadores de mobilidade Urbana –PNAD, 2012.

CET-SP (Companhia de Engenharia de Tráfego de São Paulo) – Pesquisa de monitoramento e fluidez-Volume e Velocidade. São Paulo, 2013

CHAUNCY D. HARRIS; EDWARD L ULMAN-–The nature of cities – artigo, 1945.ENOCH, M. Supporting Car sharing Clubs; A Worldwide review. Third mobility services for urban sustainability (Moses) Meeting. London, U.K. 2002

CORRÊA, R. L. O Espaço Urbano. 2 ed. São Paulo. Ed. ÁTICA, 1993.

LITMAN, T; BURWELL, D. Issues in sustainable transportation. Journal global environmental issues, v4, n. 4, p 331-347. 1999

MTI REPORT(MINETA TRANSPORTATION INSTITUTE)- Carsharing and
PublicParking Policies:Assessing Benefits, Costs, and Best Practices in North America, Susan A. Shaheen, Caroline Rodier,Gail Murray,Adam Cohen,Elliot Martin. São Jose, California, 2010.

MTI REPORT(MINETA TRANSPORTATION INSTITUTE)- Residencial on-site carsharing and off street parking policy in the San Francisco bay area, Charles Rivasplata, Zhan Gu, Richard Lee, David KeyonLuis Schloeter. São Jose, California, 2012.

MEIRA, L. H ;MAIA. **Desafios ao desenvolvimentoe expansão do coneito de carsharing no Brasil.**Universidade Federal de Pernambuco- UFPE- Associação Nacional de pesquisa e ensino em transportes –ANPET. 2010.

Matthew Barth and Susan A. Shaheen - Shared-Use Vehicle Systems Framework for Classifying Carsharing, Station Cars, and Combined Approaches - TCRP Report 1791, 2002

NEWMAN, P; KEWORTHY, J.R.(1989) Separata de: Lima Bezerra, M; Alves Gentil, C. Elementos da Forma urbana ralacionadas à mobilidade sustentavel. Cadernos de arquitetura e Urbanismo v20, n 26,p 136. 2013.

SILVA, G. J. A; ROMERO, M. A. B: Urbanismo Sustentável: A construção de indicadores para a avaliação da qualidade do espaço urbano no Distrito Federal, Brasil, Brasilia: PPG-FAU-UNB, 2007.

SHAHEEN, S; Sperling, D; Wagner, C: Carsharing in Europe and North America: Past, present and future. Transportation quarterly, 1999. v52, n 3 p. 35-52.

SILVA, G. J. A; ROMERO, M. A. B: Urbanismo Sustentável: A construção de indicadores para a avaliação da qualidade do espaço urbano no Distrito Federal, Brasil, Brasilia: PPG-FAU-UNB, 2010

SOLMAN, D; ENOCH, M. UK moses consortium. Integration of carsharing (city car clubs) into urban planning and management. London: Loughborough University, 2005

RYE, T; Gestão de estacionamento, uma contribuição para cidades habitáveis: Eschborn, Aalemanha, 2004 p01.

RYDÉN, C; MORIN, EMMA MORIN. Mobility services for urban sustainability. Environmental assessment. Report WP 6. 2005

ROGERS, R E GUMUCHADJIAM, P. Cidades para um pequeno planeta, São Paulo: GG Brasil, 2001

SMTR ,Secretaria Municipal de Transportes, Rio de Janeiro,. Plano de Mobilidade Urbana Sustentável,2013

SOLMAN, D; ENOCH, M. UK moses consortium. Integration of carsharing (city car clubs) into urban planning and management. London: Loughborough University, 2005

VASCONCELLOS, E. A. A cidade, o transporte e o trânsito. São Paulo; Prolivros 2005. 1

VILLAÇA, Flavio. Espaço intra-urbano no Brasil. São Paulo: Studio Nobel: FAPESP(2001)

WHO (World Health Organization) – Global status report on Road safety supporting a decade of action. WHO PRESS, Luxemborgo, 2013

Transport for London, Mayor of London - Improving the Health of London(Tranport action Plan) 2014 . Disponivel em https://tfl.gov.uk/

TCRP Report 108 – Car Sharing : Where and how it succeeds- Transit Coorperative Research Program, Washington, 2005