São Paulo Spatial Structure and Mobility from 1997 to 2012 and Beyond: Transformation through Urban Policies

Sabrina Harris
School of Architecture and Urbanism, University of São Paulo
Rua Maranhão, 88, 01240-000, São Paulo-SP, Brasil
a3695717@usp.br

Abstract
The spatial structure of an urban area is characterized by the travel patterns resulting from allocation of activities in the city. This structure is shaped by the interaction of urban policies and the socio-economical context that drives real estate industry. Many of those policies can be translated into land regulations, infrastructure investments, and taxation. The resulting spatial organization influences feasibility and economic efficiency of different transport modes, as well as their affordability and environmental impact. Hence, the analysis of spatial outcomes of those policies may provide guidance for the design of new policies in order to improve mobility in the urban area in the long term.
This work presents a critical analysis of the evolution of the spatial structure of São Paulo Metropolitan Area, bringing some possible directions of growth in order to increase spatial mobility. After presenting definitions and impacts of spatial structures, we provide an overview of the early growth of the metropolis, and transportation infrastructure and land regulations during the 21st Century. The evolution of the spatial structure is analyzed by means of data on allocation of activities and daily travels from origin-destination surveys during a period of 15 years, from 1997 to 2012. Accordingly, we present policies that have recently been approved for Sao Paulo that intend to impact the spatial structure in order to increase mobility.

Keywords
Urban spatial structure; monocentric; polycentric; mobility; land regulation

1. Introduction

The metropolis of São Paulo is the largest and most important urban agglomeration of Brazil and is among the ten larger urban areas in the world (UN, 2012). Its 20 million inhabitants account for 10% of Brazilian population, and generate 18% of Brazilian GDP. The capital municipality alone has 6% of Brazilian population, and generates 12% of Brazilian GDP (IBGE, 2014). However, the metropolis faces deep urban problems. Its congestion levels are estimated to cost 1% of Brazilian GDP annually, considering losses caused by pollution (Cintra, 2014).

This paper intends to study the evolution of the spatial structure of São Paulo Metropolitan Area, and discuss possible growth directions in order to improve spatial mobility. The main data supporting this analysis origin-destinations surveys from 1997, 2007 and 2012 (Metro, 2014). Data were grouped by zones and macro-zones as shown in figure 1, distance were estimated based on centroids of zones, and trip durations presented are the weighted average of all trips times originated in the zones.

At the next sections, we provide an overview of the processes that shape the metropolis and some basic concepts that are used in our analysis. Considering the characterization of spatial

structures, we discuss their impacts on major urban issues. Then, we provide a description of the changes on the spatial structure of São Paulo, focused on the time period of 1997 to 2012, bringing the idea of the dynamics and the urgency to deal with these issues. Based on this data, we present a critical analysis of some policies that are being implemented to reduce its problems.

2. *The City as a Process*

Cities are shaped in continuous iterative processes which are a result of individual decisions of land users: people and companies that perform their activities in the city. Their location choices are bound by their preferences in the tradeoff between location and travel and are affected by incentives provided by other agents, such as the real-estate industry, financial markets, and the public administration (Batty, 2013; Fujita and Thisse, 2013; Bertaud, 2004).

The allocation of activities determines the displacements of land users, and shows how the city is used. This information is usually described by the terms Urban Spatial Structure and Spatial Organization (Bertaud, 2004; Anas, Arnott, and Small, 1998).

On the other hand, the built environment where those activities and displacements happen has a much slower speed of change and is more permanent than the activities performed in it (Wegener, 2002). For example, fully developed areas of the city may be underused due to technological or social changes, while other areas may be more densely populated even if lacking proper infrastructure. Then, it is important to differentiate the analysis of the built city from that of the actual used city.

Describing the urban process, Hillier & Vaighan (2007) state that "The social city is either side of the physical city: it brings it into existence, and then acts within the constraints it imposes". This "social city" is also affected by non-urban form factors: characteristics of land users and incentives provided by other agents. Hence, it is the allocation of activities in space and the way people move to participate on those activities that may indicate the level of sustainability of the urban area.

Typologies of spatial structures can be defined as:

- Monocentric: one Central Business District (CBD) clearly more important than other existing centralities with strong pendulum movements towards the center.
- Monocentric with diversity of uses: one CBD clearly more important than other existing centralities, or compact polycentric structures with no clear geographical separation between different centralities. In this case, it is expected less pendulum movements towards the center.
- Polycentric: a number of relatively similar centralities, having high interaction with each other.
- Polycentric fragmented: a number of relatively similar centralities, having low interaction with each other.

The urban space is an arena where land is disputed. More compact spatial structures bring activities closer, therefore increasing that competition. Even though it generates a direct impact on land prices, built-up area can be expanded by building vertically, increasing supply and reducing demand pressure. Excluding environmental and cultural factors, there is a financial limit to that expansion, which is the cost of high-rise buildings in. On the other hand, more dispersed and decentralized structures reduce competition for land, making it cheaper but requiring large infrastructure investments to provide sanitation and good accessibility. So, the poorer population face ups and downsides in both kinds of spatial structure.

Monocentric areas are able to provide high productivity due to connectivity and proximity, which "seems to enable easier circulation of … non-standardized knowledge and ideas" (Meijers, 2013). This structure favors a peak of density at the main centrality, increasing competition for land and concentrating negative effects of agglomeration. Polycentric areas with high connectivity may provide a more advantageous relation between positive and negative aspects of agglomeration, but does not substitute the proximity enabled by monocentric areas. On the other hand, fragmented metropolitan areas are collections of small cities not providing those benefits. Such fragmentation arises from the failure of transport infrastructure on both monocentric and polycentric regions or by a deliberate planning towards polycentrality.

Monocentric structures and mixed uses, bringing population and jobs together, are considered more environmentally friendly because they reduce displacement and it consequences, favoring mass transportation and non-motorized transport. However, if the infrastructure is not properly planned and used, it can worsen problems as local pollution, congestion on private and public transportation and lack of accessibility. Polycentric fragmented structures also bring population and jobs together, within the centralities, but they reduce the benefits brought by the urban agglomeration. Connection by mass transportation and dense nodes are a way to avoid negative impacts of both structures above, but they require larger investments on transport infrastructure.

3. São Paulo Metropolitan Area

São Paulo Metropolitan Area (SPMA) is an administrative classification that consists in 39 municipalities, and the largest and richest is the capital city, São Paulo (figure 1). Although the urban area is continuous, the municipalities have independent administrations. The metropolitan area was created in the late 60's, but now there is not an integrated development agency. Transport infrastructure is a result city of planning and investments carried on by individual municipalities, municipal consortiums and the state.

(a)

(b)

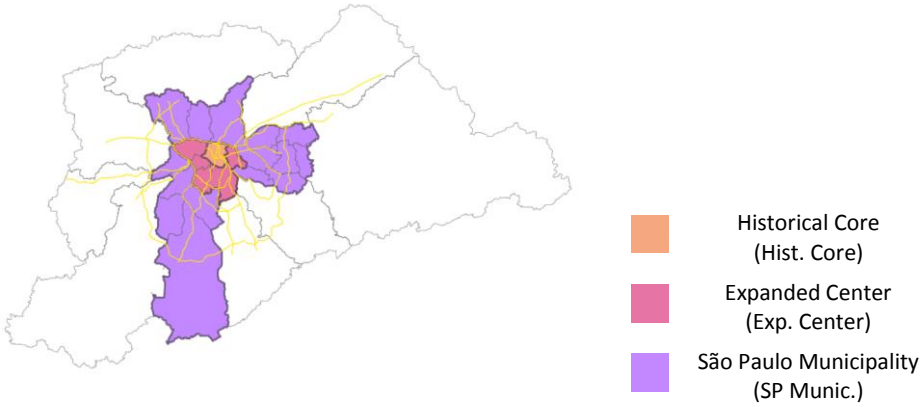


Figure 1: São Paulo Metropolitan Area. (a) At the satellite image, it is possible to notice the river network (in blue), which was essential to the establishment of São Paulo as a trade center connecting the countryside to the coast. (b) The map shows zones and macro-zones considered in this study, and the current road infrastructure in yellow.

Source: Prepared by author. Data: Metro (2014). Background image (a): Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Image Landsat.

3.1. Growth: 16th to 20th Century

The urban nucleus that originated the metropolis was established in the mid-16th Century, on a plateau between the junction of Tamanduateí and Anhangabaú rivers, 700 m above the sea level and 70 km into the continent. Its topography and hydrography enabled the development of waterways and roads, connecting the nucleus to the coast. By the mid-19th Century, São Paulo was established as regional trade area concentrating religious, administrative and commercial activities due to its strategic location on crossroads.

As Brazilian´s coffee exportation increased during the 19th Century, the economic influence of the state of São Paulo increased as well as its capital. Its tradition as a trade center turned also that urban nucleus into a nodal point of transportation, attracting massive investments on infrastructure as railways, paving the way for Brazilian industrialization that took place at the end of that Century. By this time, rich farmers and industrialists moved to the city to enjoy urban life and to do business, while poor peasants sought work in factories.

The historical core, that used to mix all city function, became a business and upper class commercial and entertainment area, consolidating the first CBD of the metropolis, while other uses expanded horizontally. Richer population went west, avoiding congestion and poor sanitation conditions of the historical core, urbanizing lands with better topography. Factories and poorer population went east, following the railways which provided easy transportation and also had cheaper land that had been avoided due to its flooding hazard.

For one Century, the economy of São Paulo grew mainly based on its industries. A high number of national and international immigrants were attracted to work on factories, making the city's population grow 130 times from 1890 to 1980 (figure 2).

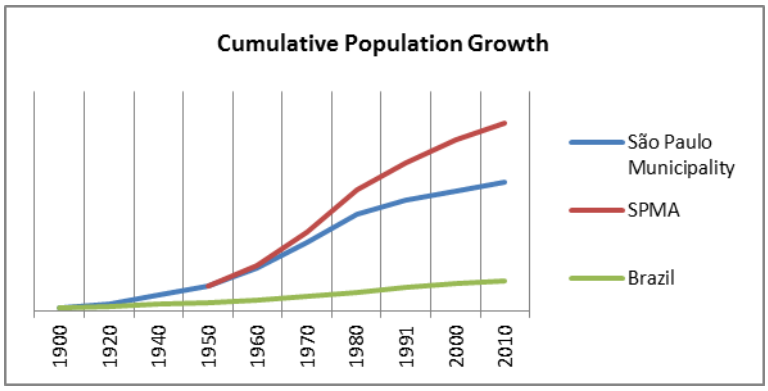


Figure 2: Cumulative population growth in São Paulo Municipality, SPMA and Brazil, through the 20th and 21st Centuries.
Source: Census (IBGE, 2014).

In the first half of the 20th Century, the CBD grew in size, expanding vertically and horizontally towards southwest. In that process, the historical core lost its affluence and became known as "Old Center", while a "New Center" that served upper classes emerged towards southwest (Villaça, 2001). Other new commercial sub-centers destined to poorer population emerged further from the CBD. Residential areas closer to the CBD grew vertically as well. Upper classes lived in the southwest and poorer population lived at the CBD and east, close to the factories and at increasingly peripheral areas. The railways also enabled factories to be located outside São Paulo municipality and ABC region (at southeast) became the strongest industrial cluster outside São Paulo municipality.

Road transport had a high impact on transport of people and freight. Until the 1900s, animal traction streetcars were the only providers of mass urban transportation, but in the beginning of the 20th Century, the operation of electric tramways enabled an initial sprawl of the urban area. From the 1920's on, road modals became the focus of development policies and railways and electric tramways were gradually deactivated or underinvested. That led automobiles and buses to become the main providers of transport at the same time that the electrical tramways were abandoned. Road transport provided more flexibility for the urban tissue's growth in all directions, but it also meant more congestion, pollution, bigger avenues and the decadence of public realm. The road modal also changed the location of factories, which located near new high-speed avenues.

The urban expansion did not happen contiguously. Parcels of land and urbanized lots were left empty, while lots at peripheral areas were sold to poorer population. It was expected that, when there was enough population density, bus lines and other infrastructures would be extended to those areas, making the empty lots between them and the consolidated urban tissue more valuable. That process led to a sprawled morphologically fragmented growth of the city (Bacelli apud Barbosa, 2001).

At the second half of the 20th Century, São Paulo's "Old Center" decayed even more, and there was an increase in number of slum tenements. Commercial and business activities expanded beyond the "New Center", with more technological buildings and the widespread of shopping malls.

During the two last decades of the 20th Century, the economy of SPMA became increasingly based on business to business services, such as financial services, IT services, consultancies,

law firms, and publicity agencies (Meyer, Grostein and Biderman, 2004). The city provided a highly diverse environment, with many potential clients and specialized workforce. As the economy of São Paulo shifted from industrial based to services based, industrial cities of the metropolitan area became dormitory towns, while factories gradually relocated to smaller urban agglomerations in the inner state.

3.2. Transport in the 21th Century

The road system of SPMA is organized in a number of rings centered at the historical core (figure 1b). It is the basis for the main transport modals throughout the metropolis: automobiles for richer population and buses for the poorer. A road metropolitan ring is also being implemented in order to divert road traffic between the inner state and the coast from the metropolitan core, but it has also being used for internal trips in the metropolitan area.

In the beginning of the 21st Century, mass transportation received large amount public investments on transport systems. However, much of those investments were spent on subsides instead of increasing transportation capacity (Rolnik and Klintonwitz, 2011). In the 15 years analyzed, there was an increase in 72% in length and of 90% in trips for subways, and an increase of 76% in trips in railways (figure 3).

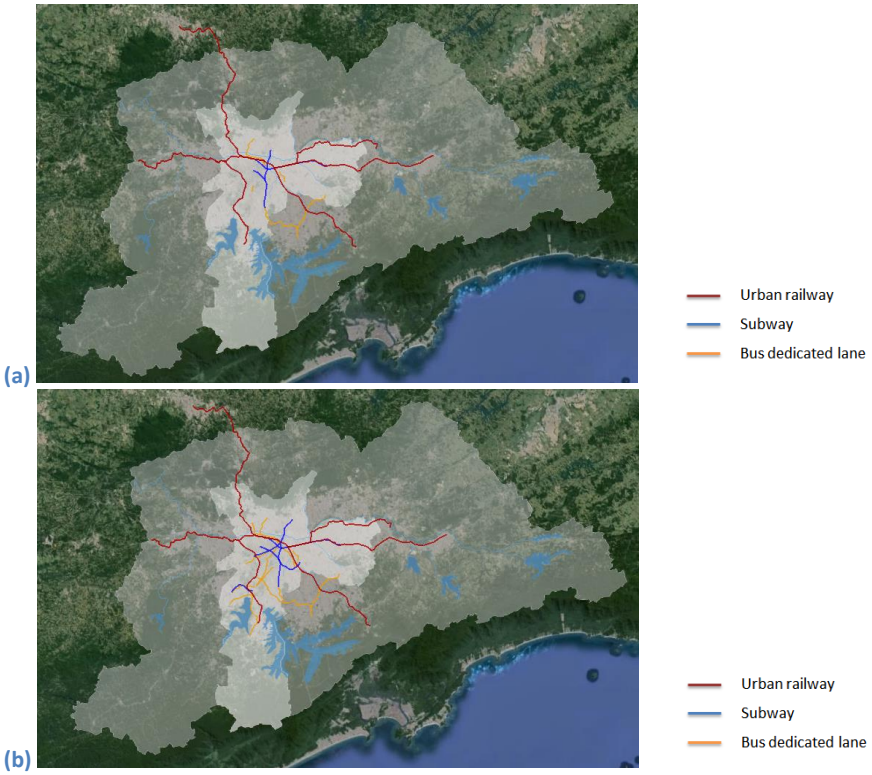


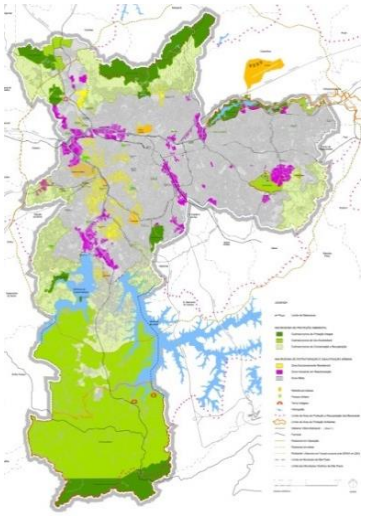
Figure 3: Transportation Infrastructure in 1997 (a) and in 2012 (b).
Source: Prepared by author. Data: SPTRANS (2014); Metro (2014); EMTU (2014); CPTM (2014). Background image: Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Image Landsat.

3.3. Land Regulations in the 21th Century

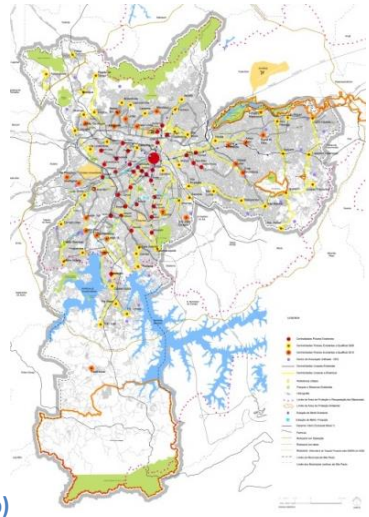
Throughout its history, land regulations in São Paulo were focused on its central and richer areas. It intended to exclude unwanted uses from those areas and formalize existing land uses, instead being used to shape a different future (Rolnik, 1997).

In 1997, São Paulo municipality settled the zoning approved in 1972, allowing higher density and mixed uses around the New and Old center, where most of the tertiary activities were located until the 1960's, and at the east, where there was a larger amount of poorer population and factories. That zoning also restricted density and uses towards the west, where richer population were located (Feldman, 2005).

In 2002 and 2004 a new master plan and zoning (figures 4 and 5) were approved, keeping higher densities along main avenues and transportation lines (grey). It still protected areas where richer population was located (yellow), while providing more flexibility to more peripheral areas.



(a)



(b)

	Zones	Maximum densification coefficient[1]
(a)	Exclusively residential zones	1
	Industrial zones in restructuring	1,5
	Mixed use zones	1 to 2.5
(b)	Existing polar centralities	2.5 to 4
	Future polar centralities	
	Existing linear centralities	
	Future linear centralities	

Figure 4: Land uses (a) and densification nodes and axes (b) defined by São Paulo's master plan.
Source: Município de São Paulo (2002) and Município de São Paulo (2004), modified by author.

3.4. Spatial Structure of São Paulo in the 21th Century

Population

The population of SPMA has been experiencing a slower pace of growth, going from 1.5% per year from 1997 to 2007, to 0.5% per year from 2007 to 2012 (figure 5). During the last 15

[1] Proportion to lot size. For example, a coefficient of 2 means that it is allowed the construction of a building that has 2 times the lot's area.

years, it was observed an increase in population on the three lower income brackets, while the upper classes reduced. For instance, the income bracket 4 (from USD 613 to USD 1,226) increased 77% from 1997 to 2012, while the income bracket 2 (from USD 2,451 to USD 4,596) reduced 23% in the same period (Metro, 2014).

This change of scenery is also observed when employment opportunities are observed. From 1997 to 2012, there has been an increase of 41% in jobs, while the population increased 19% (figure 6). The facts that jobs are increasing in comparison to population and that the population is becoming poorer may indicate an emigration of richer population. However, that problem requires a deeper analysis that exceeds the scope of this paper.

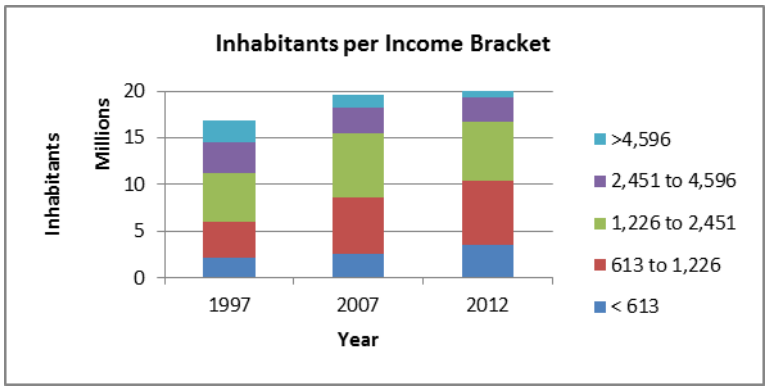


Figure 5: Inhabitants of SPMA per monthly income bracket (in UDS of Oct. 2012).
Source: Prepared by author. Data: Metro (2014).

	Employment	Inhabitants	Employment / Inhabitants
1997	6,959,394	16,792,421	0.41
2007	9,065,736	19,534,620	0.46
2012	9,813,373	20,011,703	0.49

Figure 6: Employment and Inhabitants of SPMA.
Source: Prepared by author. Data: Metro (2014).

An immediate consequence of these changes is the urban settlement. By 1997, the historical core and expanded center city were characterized by high density levels of population density. Ten years later there was a reduction of population density and in another five years, it turned to grow again, reflecting the complex dynamic of the city (figures 7, 8 and 9). The opposite pattern was observed in some zones of peripheral areas.

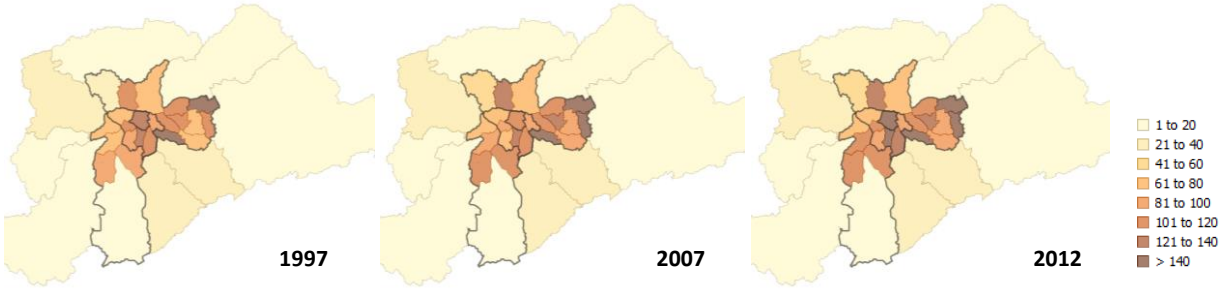


Figure 7: Population density at SPMA (inhabitants per hectare)
Source: Prepared by author. Data: Metro (2014).

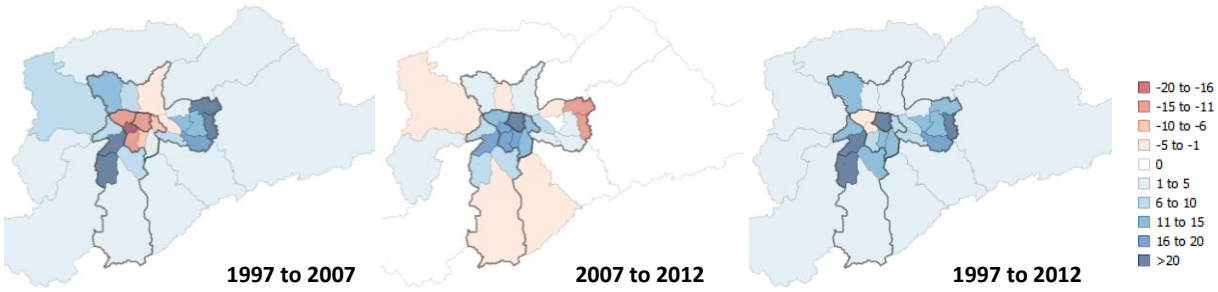


Figure 8: Differences in population density at SPMA (inhabitants per hectare).
Source: Prepared by author. Data: Metro (2014).

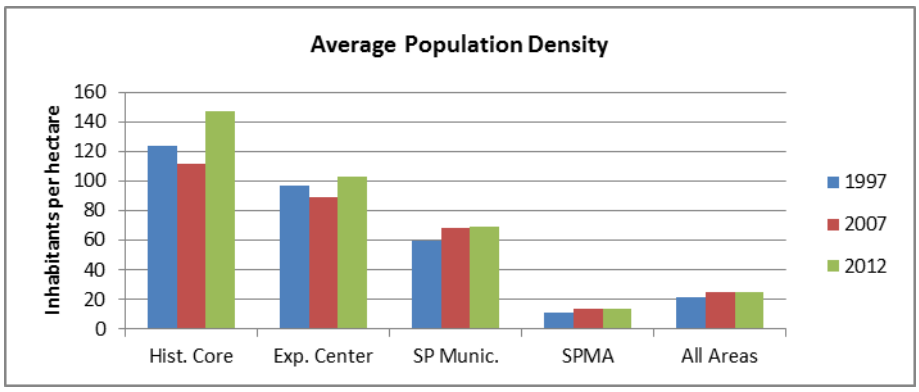


Figure 9: Differences in population density at SPMA (inhabitants per hectare). Data exclude internal areas previously mentioned.
Source: Prepared by author. Data: Metro (2014).

The analysis of the changes in settlement standards for each income bracket reinforces the idea of the impoverishment of the city (figure 10). Richer population (income brackets 1 and 2) experienced a reduction in density, more intense at the first decade whilst population with middle and lowest income increased in density in most areas.

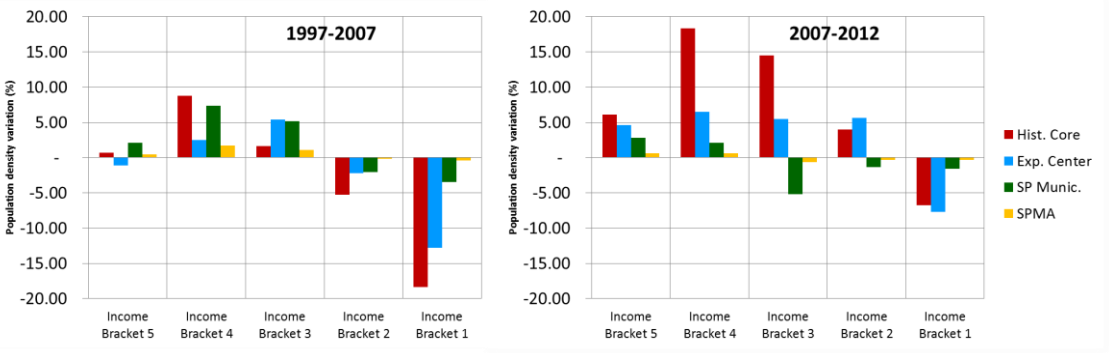


Figure 10: Differences in population density at SPMA (inhabitants per hectare).
Source: Prepared by author. Data: Metro (2014).

Through the analysis of two representative groups it is possible to notice similar tendencies during the periods of 1997 to 2007 and 2007 to 2012. Richer population (income bracket 2) moved towards peripheral areas at the first moment and returned to more central areas after 2007, particularly at high income neighborhoods (figure 11). Lower income population (income

bracket 4) presented the same pattern, but with less intensity and locating closer to the historical core (figure 12).

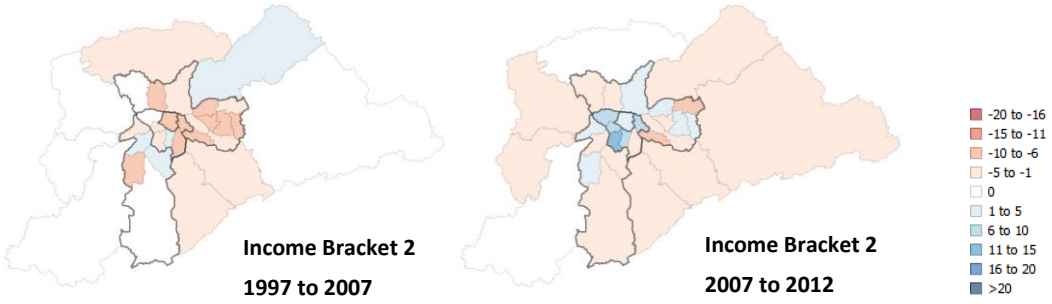


Figure 11: Differences in population density at SPMA (inhabitants per hectare) – Income bracket 2 (USD 2,451 to 4,596/month).
Source: Prepared by author. Data: Metro (2014).

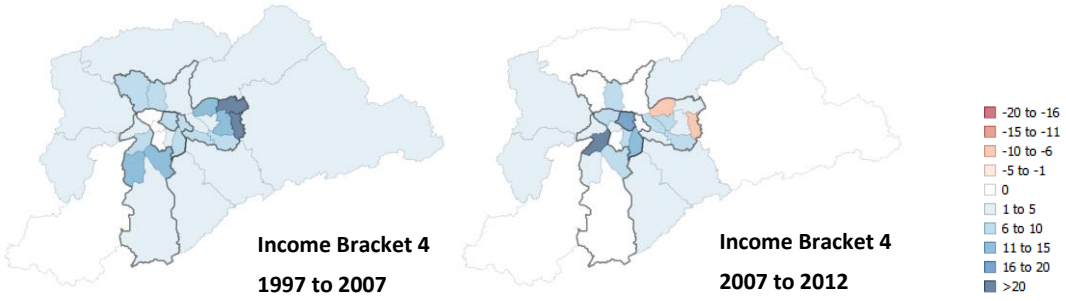


Figure 12: Differences in population density at SPMA (inhabitants per hectare) – Income bracket 4 (USD 613 to 1,226/month).
Source: Prepared by author. Data: Metro (2014).

Economy and Jobs at SPMA

Since the 1980's, the economy of SPMA increasingly concentrated in the third economic sector. In 2011, 54% the GDP generated by the tertiary sector was almost 3 times the GDP generated by the secondary sector (IBGE, 2014). However the metropolis still has a significant concentration of industries: 11 of the 100 more industrialized municipalities of Brazil belong to SPMA, and it produces 13% of Brazilian industrial income (IBGE, 2014).

Employment at SPMA is mostly concentrated at the expanded center (figure 13) where it has been increasingly growing (figure 14) mostly due to the increase in jobs in the tertiary sector. Jobs in the secondary sector suffered a small reduction throughout SPMA, being substituted by dwellings. That happened mainly in the last 5 years (2007-2012), particularly in areas experiencing a growth of lower income population, such as in the south of São Paulo municipality (Metro, 2014).

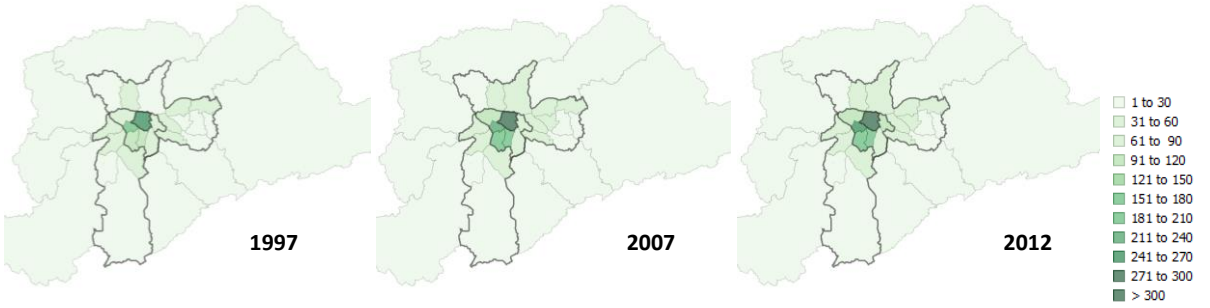


Figure 13: Employment density at SPMA (jobs per hectare)
Source: Prepared by author. Data: Metro (2014).

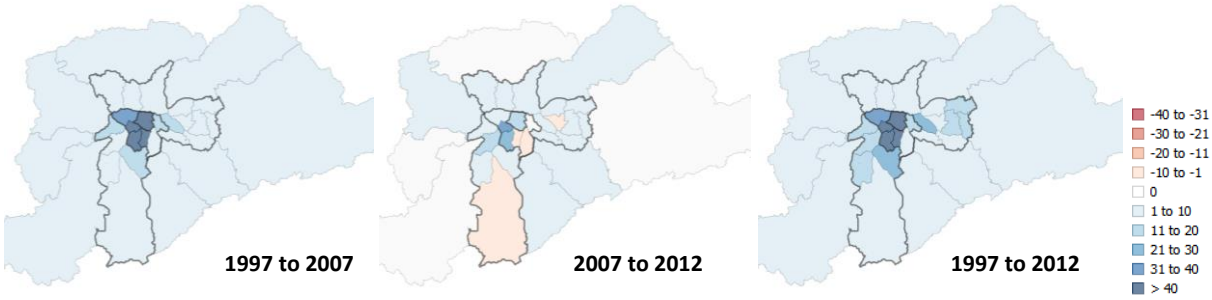


Figure 14: Differences in employment density at SPMA (inhabitants per hectare).
Source: Prepared by author. Data: Metro (2014).

This situation leads to high density of jobs per inhabitants at the expanded center, whereas this density is smaller at peripheral areas (figure 15). The changes observed however, follow a quite distinct tendency towards both periods analyzed. Between 1997 and 2007, there was a significant increase in the number of job opportunities per 100 inhabitants but this tendency reduced from 2007 to 2012 (figure 16), due to the increase of population at the expanded center which was not followed by a proportional growth in job opportunities.

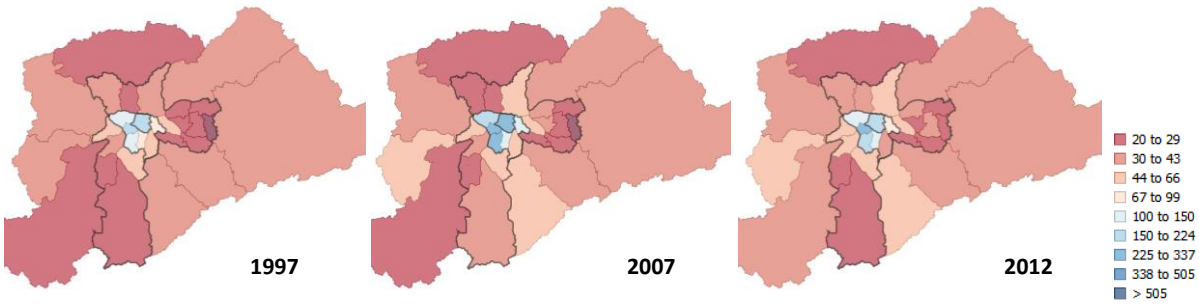


Figure 15: Employment per 100 inhabitants at SPMA (jobs per hectare)
Source: Prepared by author. Data: Metro (2014).

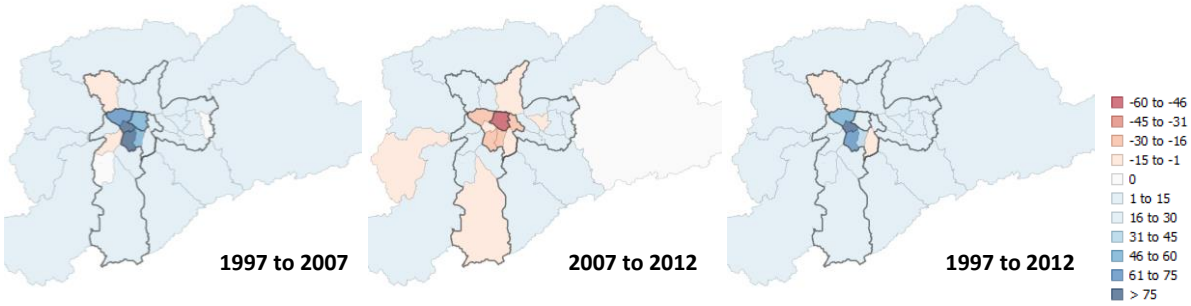


Figure 16: Differences in employment per 100 inhabitants at SPMA (inhabitants per hectare).
Source: Prepared by author. Data: Metro (2014).

Travel patterns at metropolitan area

A third descriptor of the spatial structure of the city is the travel pattern of trips performed daily. The differences in these patterns are, once more, directly connected to the income brackets. Figure 17 shows that population with higher income prefer using individual transport, even when trips are originated at more central areas. However, at the historical core, there is a higher use mass transportation by that population. By its turn, lower income population makes more use of mass transportation at the historical core and expanded center. whereas non-motorized transport is more significant in peripheral areas.

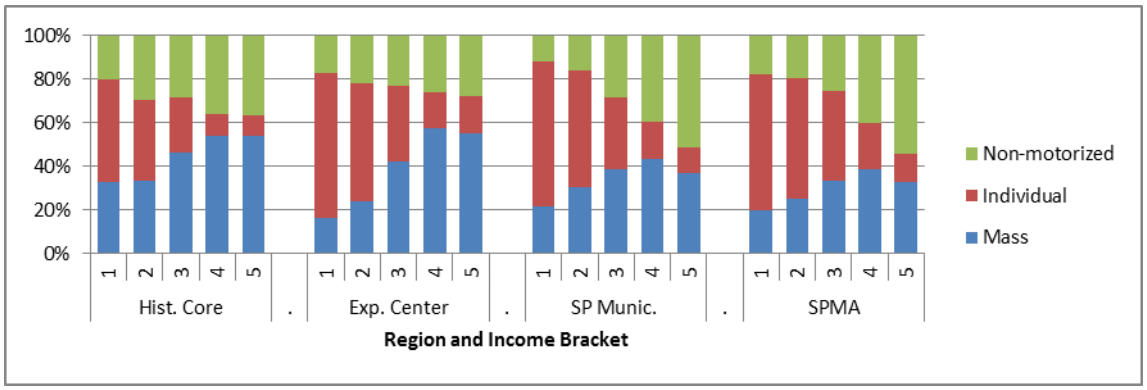


Figure 17: Modal share at SPMA in 2012 by income bracket and region where trip is originated.
Source: Prepared by author. Data: Metro (2014).

Due to the concentration of jobs at central areas, it can be noticed intense pendulum movement from peripheral areas to the expanded center, both in mass and private transport. In 2012, mass transportation trips were strong between expanded center and east and south of São Paulo municipality. It was also observed that private transport was more used for trips within each region and that long trips among zones trips were rather performed by mass transportation (figure 18).

(a) (b)

Figure 18: Trips at morning peak in 2012 (5:00 a.m. to 8:00 a.m.) – 80% of the most significant routes. (a) Mass transportation. (b) Private transport. The thickness of each arrow is proportional to the density of flow.

Source: Prepared by author. Data: Metro (2014).

There is a wide dispersion in travel times for the same distances traveled, which is higher for mass transportation. Mass transportation presents smaller average travel times while maximum times area higher (figure 19).

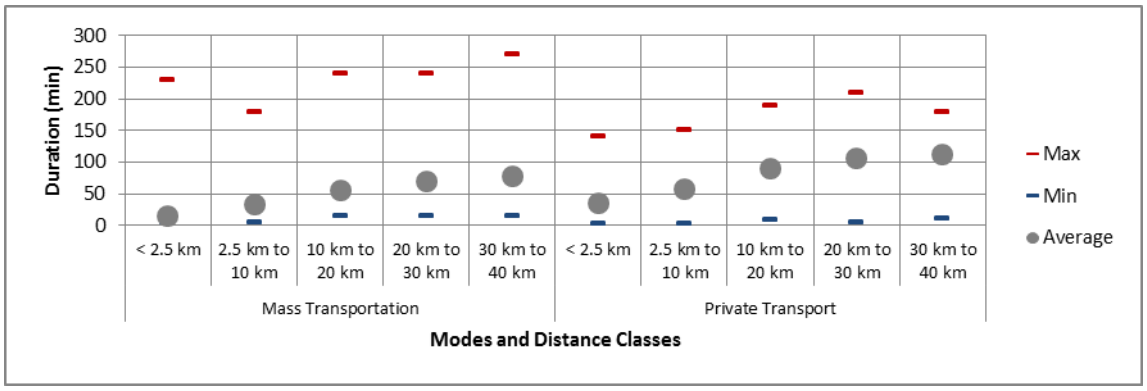


Figure 19: Trip durations (min) per distance classes and modes in 2012.

Source: Prepared by author. Data: Metro (2014).

4. *Improvement through Policies*

The current spatial structure presents a monocentric configuration at a metropolitan level and there are geographical growth constraints for the metropolis, turning real polycentricism unrealistic for SPMA.

The city has recently approved a new master plan that sets basis for policies and regulations for the city's development through the next 16 years. One of the main issues dealt by that master plan is the direction of growth that will be allowed in the municipality. Its main objectives towards the spatial structure of the city are:

- Contain horizontal growth (sprawl)
- Promote densification of underutilized areas with infrastructure
- Reduce displacements, balancing the relationship between local employment and housing

This plan intends to keep higher densities - maximum densification coefficient of 4 - along mass transportation lines, following a more transit-oriented approach than previously (figure 20). Outside those areas, the maximum densification coefficient is 2. However, those coefficients are similar to the previous regulation.

Nonetheless, the new master plan brings some innovative instruments on the densification axes:

- Incentives for mixed-use buildings and non-residential uses on ground floor of residential buildings, making transit more interesting and providing commercial spaces.
- Requirement and incentives for buildings to donate part of its lot for public uses, in exchange of larger built area above the donated part, increasing space for transit.
- Minimum amount of units per lot, what reduces the decrease of expected density due to the construction of larger units.
- Restriction in number of parking spaces not considered in the total built area allowed.

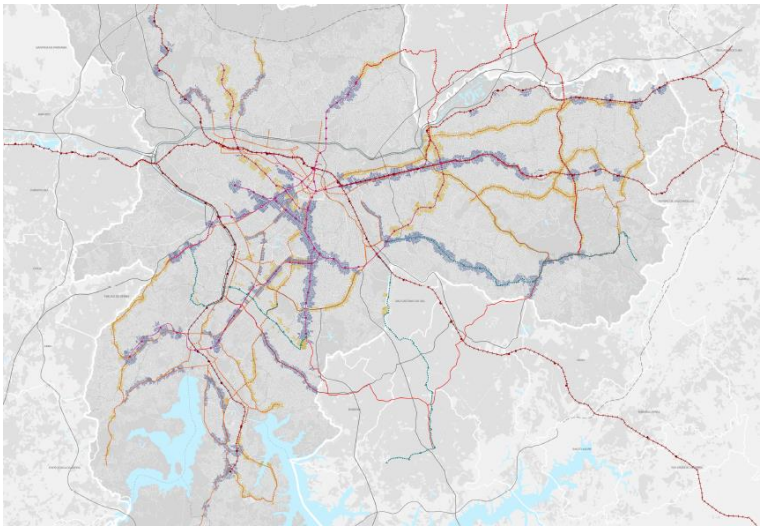


Figure 20: Densification axes proposed at the Master plan for São Paulo of 2014. Existing and future growth axis and nodes are shown, where it will be allowed a maximum densification coefficient of 4.
Source: Município de São Paulo (2014).

Similar instruments have been proposed and used in a number of cities in order to improve transit and restrict automobile use. However, they will only be effective in the long run, and require other issues to be addressed, such as:

- Safety on non-motorized transport
- Overload of transport infrastructure and slow development of new infrastructure
- Inclusion of lower income population on central areas

The new master plan plants the seed of inclusionary zoning, by requiring large real estate developments to build the equivalent of 10% of its built area in social housing at places close to the expanded center, or to donate 10% of the lot's value to the public administration to do that.

5. Conclusion

The metropolitan area of São Paulo suffers from lack of mobility and its adverse effects. At a metropolitan level, São Paulo presents a monocentric travel pattern, in which people from peripheral areas of the metropolis and the capital city travel daily to the expanded center. This area presents the largest amount of jobs per inhabitant, tendency that is being increased over the years. Although being improved during the period of analysis, the mass transportation system still suffers from and historical delay and the poorer population face long and uncomfortable trips on this crowded infrastructure. Meanwhile, higher income population

lives closer to jobs and uses more frequently individual motorized transport despite having access to a better mass transportation infrastructure.

In order to increase mobility through the spatial structure, integrated actions are proposed. The increase in share of dwellings within the expanded center, by means of increasing density, and increase in non-motorized trips within that area would reduce overcrowding inside public transportation system. Besides that, the improvement and growth of peripheral structure around transportation infrastructures would enable intermodal trips – both with individual vehicles or non-motorizes ones, encouraging higher income population to change from individual to mass transportation in the crowded central areas.

Further studies on the topic may concern: a deeper analyzes of changes in land policies and their effects on the spatial structure of SPMA; test the hypothesis that the reduction in quality of life provided by mobility may have caused an emigration of richer population; and test the hypothesis that lack of mobility led to an increase in population density in central areas at the period of analyses.

References

Anas, A. Arnott, R., & Small, K. A. (1998). Urban Spatial Structure. *University of California Transportation Center*. UC Berkeley: University of California Transportation Center. Retrieved from: http://escholarship.org/uc/item/835049q3

Barbosa, E. (2001). *Evolução do Uso do Solo Residencial na Área Central do Município de São Paulo*. (Masters dissertation). Retrieved from: http://www.teses.usp.br/teses/disponiveis/3/3146/tde-29052003-051458/pt-br.php

Batty, M. (2013). *The New Science of Cities*. MIT Press.

Bertaud, A. (2004). The Spatial Organization of Cities: Deliberate Outcome or Unforeseen Consequence? *Institute of Urban & Regional Development*. UC Berkeley: Institute of Urban and Regional Development. Retrieved from: http://escholarship.org/uc/item/5vb4w9wb

Cintra, M. (2014). Os custos dos congestionamentos na cidade de São Paulo. *Textos para Discussão*. FGV Sao Paulo School of Economics.

Feldman, S. (2005). *Planejamento e Zoneamento: São Paulo 1947-1972*. São Paulo, SP: Editora da Universidade de São Paulo/ Fapesp.

Fujita, M. & Thisse, J. F. (2013). *Economics of Agglomeration: Cities, Industrial Location, and Globalization*. New York, NY: Cambridge.

Glaeser, E. L. (2007). The Economics Approach to Cities. *National Bureau of Economic Research*. Retrieved from: http://www.nber.org/papers/w13696

Glaeser, E. L., & Gottlieb, J. D. (2009). The Wealth of Cities: Agglomeration Economies and Spatial Equilibrium in the United States. *Journal of Economic Literature*, 47(4): 983-1028.

Hillier, B., & Vaughan, L. (2007). The city as one thing. *Progress in Planning*, 67(3): 205 - 230. Retrieved from: 10.1016/j.progress.2007.03.001

IBGE (2014). *Banco de Dados Agregados*. Retrieved from: http://www.sidra.ibge.gov.br/

Meijers, R. (2013). Metropolitan Labor Productivity and Urban Spatial Structure. In Klaesson, J.; Johansson, B.; Karlsson, C. (Eds.), Metropolitan Regions: Knowledge Infrastructures of the Global Economy (pp. 141-166). Springer Berlin Heidelberg.

Metro (2014). *Números e Pesquisas*. Retrieved from: http://www.metro.sp.gov.br/metro/numeros-pesquisa

Meyer, R. M. P, Grostein, M. D., & Biderman, C. (2004). *São Paulo Metrópole*. São Paulo: Edusp/ Imprensa Oficial.

Rolnik, R. (1997). *A cidade e a lei: legislação, política urbana e territórios na cidade de São Paulo*. São Paulo, SP: Studio Nobel/ Fapesp.

Município de São Paulo (2002). Plano Diretor Estratégico do Município de São Paulo.

Município de São Paulo (2004). Zoneamento da Cidade de São Paulo.

Município de São Paulo (2014). Plano Diretor Estratégico do Município de São Paulo.

United Nations. (2012). *World Urbanization Prospects, the 2011 Revision.* Retrieved from: http://esa.un.org/unup/CD-ROM/Urban-Agglomerations.htm

Villaça, F. (2001). *Espaço Intra-urbano no Brasil*. São Paulo: Studio Nobel.

Wegener, M. (2002). Overview of land-use transport models. In Hensher, D. A.; Button, K. (Eds.), *Transport Geography and Spatial Systems. Handbook 5 of the Handbook in Transport* (pp. 127-146). Kidlington, UK: Pergamon/Elsevier Science.