Between zones and urban plans: models mobilized in the Axes in São Paulo

Entre zonas e planos urbanos: modelos mobilizados nos Eixos em São Paulo

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Abstract

This paper aims to understand if there has been an "evolution" of the articulation between urban planning and mobility planning and how it developed. To accomplish this, it analyzed three regulatory sets of the city of São Paulo: the Master Plan for Integrated Development (1971) and zoning (1972); the Strategic Master Plan (PDE) (2002) and the Land Use and Occupation Subdivision Law (LPUOS) (2004); and the 2014 PDE and the 2016 LPUOS. The paper questions the concepts behind the proposals, the relationship between the origins of the ideas and the actors and public institutional designs, and the mobilization between zoning and urban design for transformation, through a comparative cartographic analysis between the regulatory sets and interviews with managers and urban planners.

Keywords: urban planning; regulatory set; zoning; urban design; structuring axes.

Resumo

Este artigo pretende compreender se houve e como se deu uma "evolução" da articulação entre o planejamento urbano e da mobilidade, a partir da análise de três conjuntos regulatórios de São Paulo – Plano Diretor de Desenvolvimento Integrado (PDDI) (1971) e zoneamento (1972); o Plano Diretor Estratégico (PDE) (2002) e a Lei de Parcelamento Uso e Ocupação do Solo (LPUOS) (2004); e do PDE 2014 e a LPUOS 2016 – questionando os conceitos por trás das propostas, a relação das origens das ideias com os atores e os desenhos institucionais públicos, e a mobilização entre zoneamento e projeto urbano para transformação através de análise cartográfica comparativa entre os conjuntos regulatórios e da condução de entrevistas com gestores e planejadores urbanos.

Palavras-chave: *planejamento urbano; conjunto regulatório; zoneamento; projeto urbano; eixos de estruturação.*

Introduction

Two ideas have motivated us to write this article: the realization that cities are urbanized around road axes and that planning also seeks to structure this model with proposals for its surroundings. The perception about the role transportation plays in guiding urban development is not new. Nigriello and Oliveira (2013) mention milestones in the study of this relationship by economists: from theories like the "location theory," which associates the location of uses and transportation costs, and the model of agricultural land use by Von Thünen (1826), to the "central place theory" (Lösch, 1954) that explains the distribution of economic activities as determined by three variables – economy of scale, transportation costs, and the need for quality farming space – which ultimately dictate that production be concentrated in a specific place. More recent milestone include Mitchell and Rapkin's (1954) argument that different types of land use seem to generate different transportation flows; or even the finding that transportation is the cause and consequence of land use (Wingo and Perloff, 1961), as argued in this introduction as we consider that there is a connection between urban planning and mobility and transportation planning. While these works were focused on investigating urban economics, this paper takes a different approach, from an urban regulation perspective and its attempt to engender certain forms of land use and occupation.

The municipality of São Paulo has historically associated urban planning and its road system. Several studies, for example, have explained the origins of its urbanization as a result of the implementation of a rail network that engendered occupation along its stations.

Yet this connection between territorial planning and transportation/mobility planning can be observed through the study of urban regulation, as intended here. The first verticalization rules established in São Paulo, between 1920 and 1935, connected building height restrictions with road width, as proposed for the central area of the city. Later, Mayor Prestes Maia (1938-1945) advocated for "[...] verticalization in the 'right places,' where the roads allowed" (Somekh, 1997, p. 53), proposing a different relationship in that sense. Maia argued that avenues should be the pillars – or axes – of an urban transformation in a model based on the combination of the large avenues, accessibility improvements, and new occupation patterns (Santoro and Wisnik, 2013).

In the 1950s, Anhaia Mello, concerned about excessive verticalization and overloading on roads and infrastructure, proposed a restriction of the occupied areas in São Paulo by establishing a maximum floor area ratio (FAR) of four times the area of the plot[1] – that is, a relationship between the area of the plot and the built-up area of the building. Regulation then gradually moves away from regulation of form, as it will no longer be limited to building height or landscape design rules, toward how much can be built up in a property, incorporating market language into land use and occupation regulations. Maximum FAR was created in 1957, establishing a ratio of six for commercial buildings and, for residences, a ratio of four times the area of the plot (Nery Jr., 2005).

From the 1970s on, other master plans have followed along the same lines, allowing more building densification around medium- and high-capacity mobility and transportation structure networks. The 1971 Master Plan for Integrated Development (*Plano Diretor de Desenvolvimento*

Integrado – PDDI)[2] proposed verticalization along existing or planned road axes to promote commercial or industrial activities close to developed poles, some of which were translated, by the 1972 zoning ordinance,[3] as densifiable zones. In the 2000s, the Strategic Master Plan (2002 *Plano Diretor Estratégico* – PDE)[4] created a structural network of axes and poles of centrality where further building densification would be possible, around road axes and neighborhood centralities. This network originally had a low maximum FAR, equal to twice the area of the plot, which could be increased through urban plans called Urban Intervention Areas (*Áreas de Intervenção Urbana* – AIUs), plans on a case-by-case basis (Costa, Lemos, and Santoro, 2021). The AIU instrument was not regulated, and the subsequent regulation to the 2002 PDE expanded the maximum FAR in the regional master plans, making densification possible through the 2004 Land Subdivision, Use, and Occupation Law (2004 *Lei de Parcelamento, Uso e Ocupação do Solo* – LPUOS.[5] More recently, the 2014 São Paulo Strategic Master Plan (2014 PDE)[6] and the 2016 Land Subdivision, Use, and Occupation Law (2016 LPUOS)[7] also proposed building densification along the medium- and high-capacity public transportation structure network through zoning rules, called "axes," which correspond to the Axes for Structuring of Urban Transformation (*Eixos de Estruturação da Transformação Urbana* – EETUs) in the 2014 master plan, which later became the Axis Zone for Structuring of Urban Transformation (Zona Eixo de Estruturação da Transformação Urbana – ZEU) in the 2016 LPUOS.

Considering that these three sets of regulations – from the early 1971/1972, 2002/2004, and 2014/2016 – have adopted a building densification strategy along mobility axes, this article aims to observe: are these proposals different from one another? What are those differences? Has there been an "evolution"[8] in recent decades and across proposed sets of regulations? What concepts originated and were adopted for each set? Are zoning regulations or urban plans and designs used to allow densification? We aim to understand whether there is an "evolution" in the conversation around the relationship between urban planning and mobility and transportation planning, especially considering the ZEUs proposal currently in force, which here will be called "Axes."

Regarding its method, this article looks into the connections between urban regulation and mobility structures in São Paulo through three sets of regulations: (1) the 1971 PDDI and 1972 Zoning Ordinance; (2) the 2002 PDE and 2004 LPUOS; and (3) the 2014 PDE and 2016 LPUOS, addressing the political-institutional contexts of these proposals; analyzing the original models that are seminal inspiration for or justify them; and the proposed urban regulations. For this purpose, the contents of urban regulations were analyzed and maps were produced showing the proposals and a comparison between them.[9] Semi-structured interviews were also conducted with urban managers, urban planners, and scholars who were in charge of the 2010s set of regulations.[10] Finally, two tables at the end of the paper summarize our main findings.

Our analyses show a long-standing connection between urban planning and mobility and address hypotheses including, (1) the fact that the inspiration for the proposals was connected to the actors who were involved and took part in government urban planning departments and the institutional changes these agencies have gone through. They

also consider that, (2) while the concept of Transit-Oriented Development (TOD) seems to be behind the current version of the axes, other models may have been used before it, including the "Curitiba model" or other policy models such as the bus rapid transit (BRT). And that (3) regulations oscillated, sometimes adopting zoning rules while other times using specific plans, resuming the discussion proposed by Feldman (2005) according to which, in São Paulo, zoning schemes replaced a comprehensive municipal plan. Adopting a zoning scheme is understood as advantageous compared to the lengthy and judicialized processes of approvals of urban plans in the city. In the future, we expect to conduct a fourth analysis, working on the hypothesis that has been formed at the end of this investigation, according to which, models have emerged more recently that not only involve zoning or urban design, but also public service management, such as Public-Private Partnerships (PPPs) and service concession arrangements that are also municipal planning grants.

The first set of regulations analyzed: 1971/1972

The 1971 PDDI and the 1972 General Zoning Ordinance were drafted by the General Planning Coordination Office of the City of São Paulo (*Coordenadoria Geral do Planejamento da Prefeitura de São Paulo* – Cogep).[11] The plan was drafted in a few months, as proposals were already being discussed since the 1968 Basic Urban Plan for São Paulo (*Plano Urbanístico Básico para São Paulo* – PUB), formulated with the consulting services of the Society for Graphic and Mechanographic Analysis Applied to Social Complexes (*Sociedade para Análise Gráfica e Mecanográfica Aplicada aos Complexos Sociais* – SAGMACS) (Leme, 1999; Anelli, 2007; Bernardini and Sato, 2021). It resulted in non-specific proposals (Feldman, 2005) that already aimed to promote population densification around existing or planned mobility infrastructure with the intention of implementing commercial or industrial activities close to developed poles and road axes (Canutti, 2020). As the plan was being drafted, zoning was already considered a relevant aspect and "verticalizing zoning" would not only lead to verticalization in central areas, but also around transportation axes across the city, boosted by federal housing programs (Somekh, 1997, p. 26).

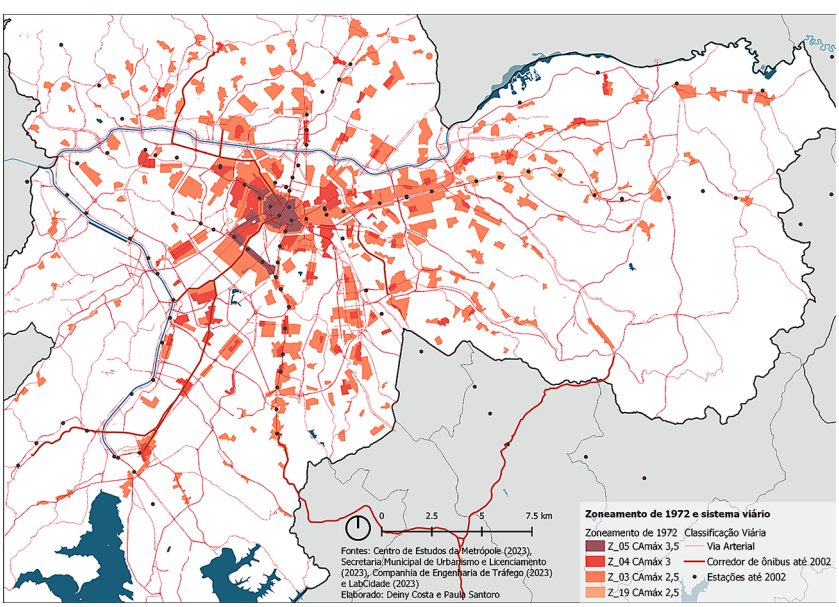
The 1972 zoning ordinance initially divided the city into 8 land use zones and, over the years, a number of additions and modifications were made, resulting in least 33 zones,[12] or 76 zone types in 2004 (Nery Jr., 2005). Zones Z3, Z4, and Z5 (identified in the following map from lightest to darkest shade of red), which have been included since the first version of the law, allowed densification with floor area ratios ranging between 2.5 and 3.5, possibly reaching up to 4 or more through the "Adiron Formula".[13] Silva (2014) argues that the real estate sector was unhappy with the reduction of the floor area ratio – from 6 to 3.5 – and the proposed solution to address this was to pass an article and a framework in the law,[14] which later became the "Adiron Formulla," which established a formula that allowed construction projects to have their floor area ratio increased if the occupation rate decreased (ibid., p. 207). The sector even accepted the possibility of paying for "Created Land" (*Solo Criado*), an instrument that was already being discussed[15]

and meant charging a compensation for intense urban land use. *Solo Criado* eventually led to the emergence of the Onerous Granting of the Right to Build, an instrument regulated by the City Statute[16] in 2001, which helped to spread it across the country.

One of the urban planners we interviewed,[17] who spearheaded the 2014 proposal of axes, argues that much of the building densification expected for the axes already existed in the 1972 Zoning Ordinance. In this article, to assess this hypothesis, we produced a map including only the densifiable zones in building terms and crossed this data with high-capacity mobility and transportation structures from the period. We noticed that possible densification occurred in areas around mobility axes that did not necessarily have a structural public transportation network, around areas that would have these systems built in the future, but was also concentrated in the central area as a whole and scattered across fragments within neighborhoods, allowing scattered verticalization to take place. The possibility of scattered verticalization in neighborhoods remained in force until the 2014 Strategic Master Plan, when the proposal of axes then aimed to promote concentrated densification.

The map in Figure 1 shows that densification followed road axes where the subway system was being built in the 1970s – the current axes of Lines 1 – Blue and 3 – Red of the São Paulo subway system, known at the time as North-South and East-West Lines[18] –, some bus corridors that already existed (such as those along Santo Amaro Avenue or Ibirapuera Avenue, in the South Zone), and several sections that did not have bus corridors, but which were on bus routes or run

Figure 1 – Densifiable zones in the 1972 Zoning Ordinance and road axes[19]



Source: CEM (bus corridors), São Paulo city government (1972 Zoning Ordinance and main roads). By the authors in 2023.

along major avenues, such as Voluntários da Pátria Street, in the North Zone, and others in the Santana and Tucuruvi areas.

The 1972 Zoning Ordinance was greatly amended while in force (until 2004), as shown by Nery Jr. (2005). The densification made possible after the creation of Z19 occurred in 1991,[20] defining the surroundings of the recently-opened Line 3 – Red subway stations Penha, Vila Matilde, Guilhermina-Esperança, Patriarca, and Artur Alvim, in the East Zone. This amendment combined zoning changes by the city planning sector and the formulation of urban plans through the Municipal Urbanization Company (*Empresa Municipal de Urbanização* – Emurb). They included, at the same time, proposals for zoning and urban planning, involving other mobility, urbanization, and reurbanization interventions.

In 1976, the urban planner Cândido Malta Campos Filho[21] became the head of the Cogep and was tasked with "formulating and reformulating land use and occupation legislation across all intervention areas" (PMSP and Metrô, 1979, p. 13) along the East--West subway line. A working group defined a perimeter around the subway line as a special zone for the study of land use regulation, the East Subway Zone – *Zona Metrô Leste* ZML (ibid., p. 38). Urbanization and reurbanization plans then start to be formulated to define the public interventions drafted with the newly created Emurb, including part of the CURA Program (Urban Communities for an Accelerated Recovery – *Comunidades Urbanas de Recuperação Acelerada*),[22] aiming at creating centralities around public transportation stations. The studies carried out were not implemented and ended in 1985 with the extinction of the National Housing Bank (*Banco Nacional de Habitação* – BNH) that funded the program (Lucchese, 2004). The Brás-Bresser CURA Project was one of the most developed projects, but other areas did not take off. Z19 thus incorporated the possibility of densification, without an urban project.

From this period, the institutionalization of Cogep and its structuring seem important for understanding the "evolution" of the proposal for building densification along the axes. The urban planner Cândido Malta Filho, the head of Cogep, had recently presented his doctoral dissertation on structuring the planning around metropolitan corridors (Campos Filho, 1972) and created working groups that conducted studies on the load capacity of the roads that ultimately led to the design of a Land Use and Transportation Model (Modelo de Uso do Solo e Transporte – MUT) and, later, investigated models that aimed to assess the densification capacity of urban infrastructure. Several urban planners who later influenced the proposal of the axes, like Nabil Bonduki, were working at Cogep at the time, discussing, in these groups, concepts and instruments that are used in urban planning today, such as the concepts of Created Land, Progressive Tax on Idle Land, and housing programs.[23]

The second set of regulations analyzed: 2002/2004

Three decades after the 1971 PDDI/1972 Zoning Ordinance, another set of regulations is passed. In the meantime, there were discussions around several plans.[24] The 1985 proposal was coordinated by the urban planner Jorge Wilheim, head of the Urban Planning

Department between 1983 and 1985, who would return to office in 2001 until 2004, drafting and implementing the 2002 PDE. Some[25] address the 2002 plan as the result of a draft Wilheim first started to work on in the 1980s. While Bernardini and Sato (2021) consider the 1985-2002 period as a gap in terms of approval of plans, as neither of them became laws, the authors state that, "gradually, some urban planning instruments based on the principles of urban reform were drafted from the perspective of the democratic transition period, in view of the advance they proposed at a time of democratic transition [...]" (ibid., p. 8).

The path taken by Wilheim in public management is deemed crucial to understand the proposed densification along road axes,[26] especially considering his participation in the formulation of what became known as the "Curitiba model." The 1966 Master Plan of Curitiba,[27] funded by the Federal Housing and Urban Planning Service (*Serviço Federal de Habitação e Urbanismo* – Serfhau) under the military government, already proposed densification along road system axes, around bus corridors; while the 1985 proposed plan for São Paulo proposed densification along major avenues without necessarily connected it public transportation.

The Structural Sectors of Curitiba are rapid-transit road structures with exclusive bus corridors on their central axis – bus rapid transit (BRT) – and provided for scaling up the maximum allowed height of the buildings, in which taller and denser buildings should be near the road axis and lower and less dense buildings should be in the inner areas of the blocks (Pilotto, 2010). Curitiba's densification proposal along axes was widely promoted as a quick solution that would organize the expansion of dedicated bus lanes, a Latin American example of the implementation of the BRT agenda. While it is very popular, criticism has emerged since the 2000s about it for promoting uneven development and deepening socio-spatial inequality through social homogenization of higher income strata in the more vertical areas along those axes (Pilotto, 2010; Stroher, 2014; 2017).

The "Curitiba model" seems to have been brought by Jorge Wilheim to São Paulo for the conception of the 1985 Bill and, later, for the set of regulations including the 2002 PDE and the 2004 LPUOS. The 2002 PDE is one of the first plans formulated after the City Statute was passed[28] in the country incorporating its instruments, including the Onerous Granting of the Right to Build, promoting the discussion about having one floor area ratio of one time the area of the plot for the entire city.[29] The Marta Suplicy administration (2001-2004) was also marked by significant advances in São Paulo's urban mobility, including the implementation of *Bilhete Único* (Unified Ticket).[30] The expansion of the public transportation network structure at the time was greater for bus corridors than for the subway network. Bus corridors were implemented on Rebouças Avenue, Francisco Matarazzo Avenue, and the *Fura Fila* guided bus project (2007), while the first Line 15 – Silver subway station was being delivered.

The 2002 PDE created a network structure of axes and poles of centralities defined as Urban Intervention Areas (*Áreas de Intervenção Urbana* – AIU) that provided for building densification around road axes. The AIUs were supposed to be activated through a specific law in which the urban parameters would be defined (Art. 221), but were never implemented.

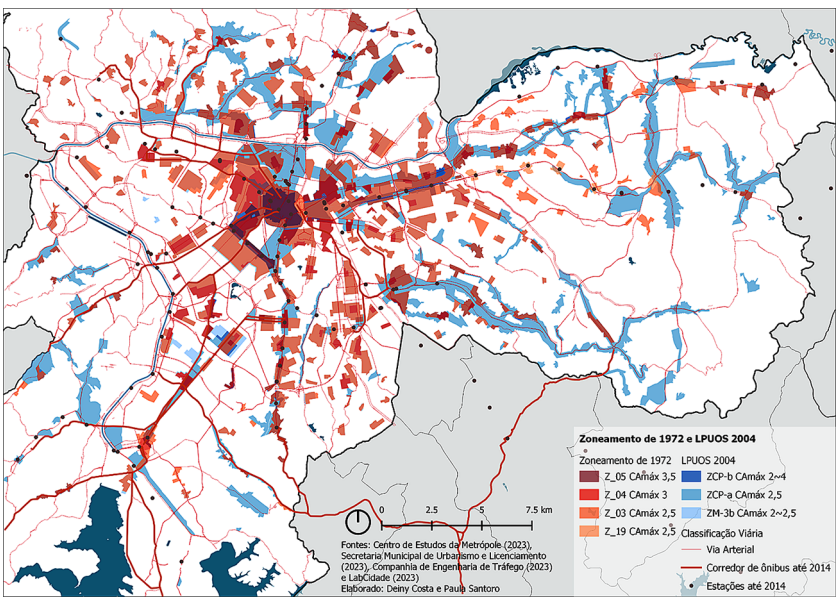
One of the challenges was the change in urban parameters, considered a change in zoning that, therefore, should be established by law, following democratic proceedings.

While the AIUs were not formulated, densifiable zones were defined in the 2004 LPUOS allowing a maximum FAR of 1 to 4[31] – Zone of Polar Centrality (ZCP-a and ZCP-b) and Mixed-use Zone (ZM-3b) –, where ZCP-b was the most densifiable zone.

Again, as we produced a map showing only the densifiable areas in building terms according to the 2004 Land Subdivision, Use, and Occupation Law and crossed this data with higher-capacity mobility and transportation structures from the period, we observed that areas that were already densifiable in the 1972 Zoning Ordinance remained, coincidentally perpetuating previous densification zones. For example, the Z3 from the 1972 Zoning Ordinance became ZM-3b in 2004 (see Figure 2).

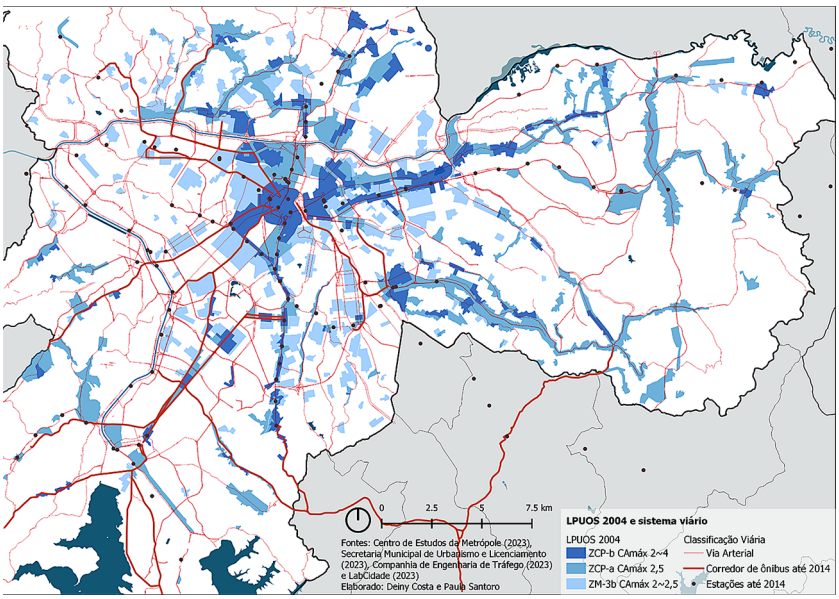
There is also an expansion of densifiable areas toward an intermediate ring of the city, which is less intense in the West Zone (see ZCP-a in Figure 3). The new densifiable areas follow along the road axes, prioritizing areas with bus and public transportation corridors, showing greater adoption of the proposal of the axes, but not exclusively. There were also roads with bus corridors, yet not densifiable, and previously densifiable zones that were not included as densifiable zones in the zoning ordinance. Z19 in the 1972 Zoning Ordinance, for example, is later excluded from the 2004 LPUOS, eliminating the expectation of densification around a section of subway

Figure 2 – Overlap of the 1972 Zoning Ordinance over the 2004 LPUOS



Source: CEM (bus corridors), São Paulo city government (1972 Zoning Ordinance, 2004 LPUOS, and main roads). By the authors in 2023.

Figure 3 – Densifiable zones according to the 2004 Land Subdivision, Use, and Occupation Law and main roads and bus corridors[32]



Source: CEM (bus corridors), São Paulo city government (2004 LPUOS and main roads). By the authors in 2023.

stations (from Penha to Patriarca, Line 3 – Red). Densification will also be possible around Dr. João Ribeiro Street, in Penha, where there is no public transportation infrastructure.

The third set of regulations analyzed: 2014/2016

The context leading up to the 2014 Strategic Master Plan is helpful to explain the strength of the Axis proposal in the structure of the plan. Different people we interviewed recalled the huge protests staged in June 2013, the first year of the Fernando Haddad administration (2013-2016), as a moment when the mobility agenda, the struggle for better transportation conditions, and the public transportation and active mobility systems strongly emerged. The term "axes" itself had been included in Haddad's political campaign program the year before, as he ran for mayor, in which the connection between development and mobility was being discussed.[33]

Lemos (2021) already saw the power of this movement to put mobility at the center of the political agenda. She argued that the first year into the Haddad administration was shaped by the June protests, triggered by the public transport fare hike. In addition to having successfully overturned the fare hike, these protests "put the transportation and overall urban mobility agenda at the center of the conversation" (ibid., pp. 228-229).

Mayor Haddad was also supported and influenced by cycling activism. The cycling agenda had been growing and gaining relevance in previous decades, penetrating institutional structures with activist public managers, through institutional activism (Abers, Sefafim, and Tatagiba, 2014) that shifts the place of active mobility to a "subaltern regime" in relation to the car-centric "ruling regime"[34] (Lemos, 2021).

Another important context was the institutional restructuring itself and the new makeup of public managers dedicated to urban and mobility planning. The Fernando Haddad administration (2013-2016) counted on the architect Fernando de Mello Franco, who had a background in urban designs as the head of the Department of Urban Development, in addition to many other relevant figures.[35]

According to our interviewees, there was a cohesive and aligned group of elected and technical officials who made it possible for discussions to progress. The axes were designed not only by the Department of Urban Development and Transportation,[36] but also by a team at SP Urbanismo[37] where, according to some of our interviewees, a group was formed including architects, economists, and legal professionals to conceive urban typologies and urban design for the many different urban scales (including micro) of the axes, to be implemented especially with bus corridors, for which the city government is responsible. This group also included "transporters," managers coming from the mobility agenda, to be involved in urban planning.

While the axes are the proposed structure of the 2014 PDE/2016 LPUOS, there is no convergence among interviewees regarding where the inspiration for the axis proposal came from. Our initial hypothesis, according to which it was supposedly influenced by the concept of Transit-Oriented Development (TOD), was not confirmed. Some claim that the idea of building densification along transport axes had already been conceived in previous decades, since the 1972 zoning ordinance, or influenced by plans inspired by the "Curitiba model." Others argue that the inspiration was much more drawn from the BRT agenda responding to the mobility demands of the political context explained earlier, which actually counted on the mix of technicians infiltrated in urban planning. There are those, however, who say that managers had contact with international studies (some mentioned the inspiration coming from urban and mobility designs from New York City, USA) and with the concept of Transit-Oriented Development (TOD)[38] promoted by international funding agencies' guides, framing the proposal around a new concept/acronym compared to previous sets of regulations, but partially incorporating TOD aspects, selecting some of its characteristics, but not all of them (Costa, Lemos, and Santoro, 2021). We then conclude that, perhaps, its conception is precisely the result of a combination of: the different experiences the managers involved in the urban discussion had, the flow of these actors into the public administrations that tested some models, and the inclusion of new methods to build urban proposals, such as modeling, as we will present below.

Unlike the previous set of regulations, the proposed 2014 PDE presented to the Executive branch had a short time frame to be drafted: studies and an assessment of the previous plan began in January; public discussions were held for a few months; and in six months the PDE bill was already introduced to the São Paulo City

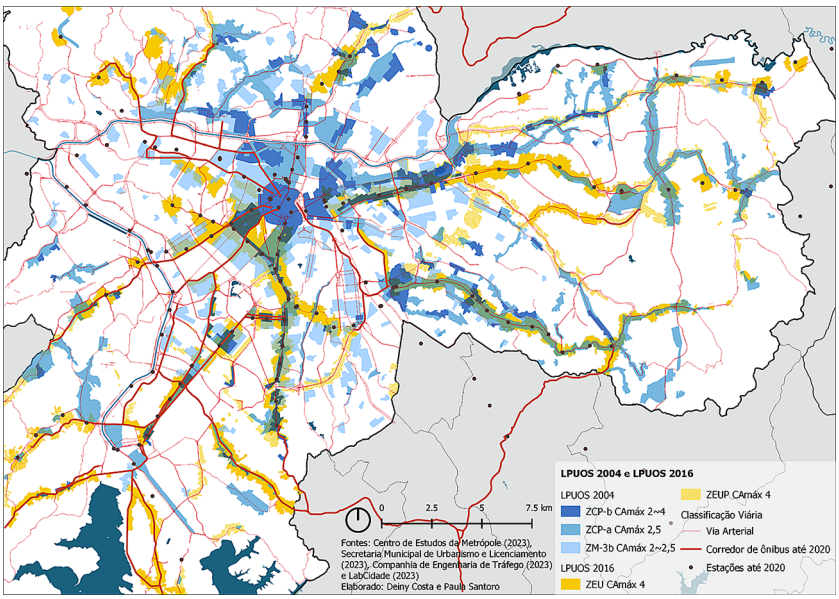
Council,[39] where it was discussed for nearly a year. While the 2014 PDE was going through the legislative process, a zoning scheme was being prepared, involving economic-financial and legal modeling, and later introduced to the City Council in 2015.

Unlike the previous draft, the 2016 LPUOS did not start from decentralized regional plans, but rather discussed the city as a whole, in a centralized manner. The city government was very active during the discussions around the PDE bill at the City Council.[40] Technicians therefore played a central role in the design of the set of regulations, and decisions were more centralized, having a different kind of public participation than the one involved in the previous set (2002 PDE and 2004 LPUOS).

In addition to the mobility crisis previously mentioned, the public discussion around this set of regulations was clearly critical of the effects of the verticalization model that sparked a massive conversation with different narratives in the media.[41] The public discussion challenged the idea of verticalizing anywhere scatteredly through blocks in the middle of the neighborhoods. This agenda explains the decision to "concentrate densification along the axes of the 2014 PDE/2016 LPUOS, an innovation compared to the previous regulation" (see figure 4) and a consequent "reduction of the possibility of densification in the middle of the neighborhoods" (Santoro et al., 2023).

To put it simply, the axes (EETUs) are the areas where there may be greater densification – with a floor area ratio limited to 4 times

Figure 4 – Overlap of 2004 LPUOS (blue) over 2016 LPUOS (yellow)



Source: CEM (bus corridors), São Paulo city government (2004 LPUOS, 2016 LPUOS, and road system). By the authors in 2023.

the area of the plot and the possibility of reaching 6 times in specific cases –, while the rest of the city or "middle of neighborhoods" was limited to a maximum FAR of 2.[42] This simple and unified densification rule for all public transportation axes did not take into consideration the territorial differences affected by zoning regulations,[43] reflecting differences in the urban transformation along these different axes. While there was an intention, from the beginning, to establish differences between them, as reported by some interviewees, that did not happen as there was limited time to conduct studies to draft the proposal, and it was even more difficult to do so when drafting the 2016 LPUOS, as it could mean reducing floor area ratios, a setback that would make it harder to pass the zoning ordinance bill.

By mapping the 2016 LPUOS over the previous 2004 LPUOS (see Figure 4), we can see that, while the possibility of densification in many areas reduced, it increased in areas on the outskirts of the city.

Looking at the northern area of the city, the yellow areas show an expansion toward the Northwest, around Pirituba (railway) and Brasilândia (plans for subway Line 6 – Orange, under construction) and, toward the Northeast, to Tucuruvi, around the planned expansion of subway Line 1 – Blue. We can also see a reduction of previous densifiable areas (blue in Figure 4), several of which were incorporated into the urban plans around the Tietê River and the center of the city, therefore densifiable if they have an urban plan approved by law for them, based on an Urban Intervention Project.

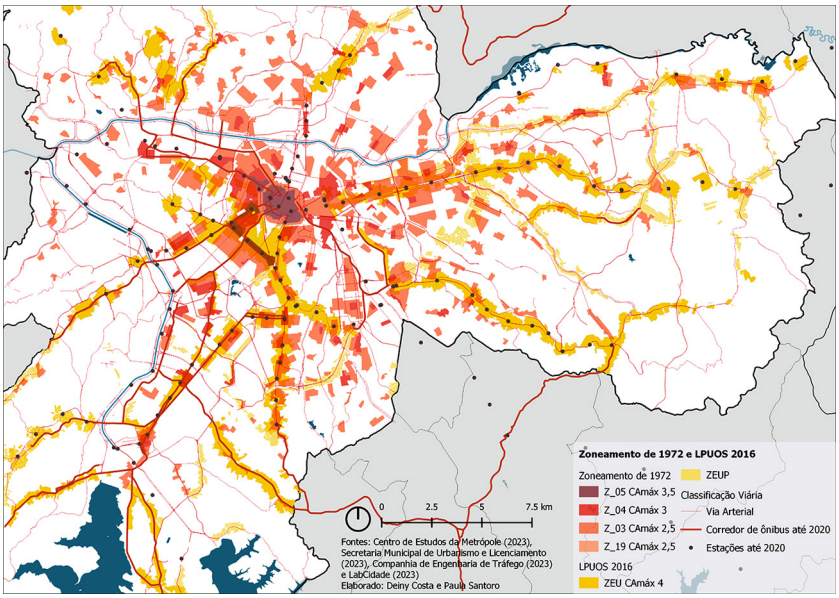
In the South Zone, the subway line has expanded all the way to Capão Redondo, so there is the possibility of densification across the entire area around subway Line 5 – Lilac, including Capão Redondo. Densification along the ABD Corridor is included, structuring a possible metropolitan densification toward this direction, along subway Line 5 – Lilac that has a section in Capão Redondo; and also along relevant avenues in the South Zone, including Atlântica Avenue and Rio Bonito Avenue, both of which running between reservoirs.

In the West Zone, there was expansion along subway Line 4 – Yellow, as well as along Cerro Corá Avenue, or along the subway line that runs across Perdizes and Vila Romana.

In the East Zone, the old densifiable areas in the middle of the neighborhoods were reduced, including in Tatuapé, as well as along Jacu-Pêssego Avenue and in sections of the Southeast. But there was also an expansion of the densifiable area, in an expanded return of the old Z19 (see Figure 5) included in the 1972 Zoning Ordinance, in addition to axes included along Aricanduva Avenue, for example, train stations "east of the East" (Canutti, 2020). Interestingly, the surroundings of the Monorail line were already subject to densification in 2004.

The downsizing and expansion observed in this period show signs of a decision to promote transformation via urban designs (reducing the Tietê Arch perimeter and the Central Sector, for example), and mostly promote densification through zoning, in areas where a short-term transformation was desired, which did not require the production of infrastructure, by defining the boundaries of the axes. The Urban Operation Consortium model was showing signs of depletion[44] and the decision to undertake 2002 PDE AIUs, which required an urban design and regulation for the definition of urban parameters, proved to be inefficient, as none was regulated. The

Figure 5 – Overlap of 2016 LPUOS 2016 over 1972 Zoning Ordinance



Source: CEM (bus corridors), São Paulo city government (1972 Zoning Ordinance, 2016 LPUOS, and road system). By the authors in 2023.

fact that urban designs are difficult to do helps to explain the decision to go with zoning, as it is "self-applicable" and would enable rapid transformation. The challenges of urban mobility required short-term responses, observing a political timing.

While transformation was not carried out through urban design, that did not mean there was no urban design. The regulation of the axes aimed at a built-up volumetric "design," obtained by a combination of urban incentives, an urban typology based on the "basket of incentives" of non-computable built-up areas. This basket, as described by one of our interviewees, proposes a design for a public fruition interface between public and private areas, active façades, lot fencing restrictions, and sidewalk widening, and incentives for social diversity and active mobility through a solidarity quota and locker rooms for bicycle users. The "basket of incentives" was built by the urban and mobility planning team, resulting in volumetric studies (which also work as economic-financial-legal models) with more profitable forms than others, leading to a relatively homogeneous building typology across several axes of São Paulo.

The group of public managers, which included architects, economists, and legal professionals, conceived urban typologies and morphologies that translated into econometric models, providing new methods of regulating space and densification, compared to those produced by the managers of previous sets

of regulations. They structured economic--financial-legal models of what could be produced by the real estate market based on certain rules that were incorporated into the regulation, some as mandatory rules, others as encouragements for producing a certain urban form. This urban form was not only guided by urban parameters that had historically guided the relationship with roads – such as building heights in relation to the width of the road, setbacks, etc. –, but by using the basket of urban incentives that adopts the right to build as a "language," as a "bargaining chip" for certain urban results (Santoro, 2021, p. 81; Stroher et al., 2023).

The incentives that translate into non-computable built-up areas for the purpose of calculating the Onerous Granting of the Right to Build are not new in São Paulo urban planning – they have emerged since the 1950s plans, although restricted to some areas. The 1970s set of regulations – 1971 PDDI and 1972 Zoning Ordinance – already defined areas that would not be included in the calculations of the total built-up area of development projects.[45] The 2014 PDE and 2016 LPUOS restricted non-computable built-up areas defining a 59-percent cap of the total built-up area for areas including parking lots, internal circulation areas, balconies, and technical areas.

By choosing to create zoning regulations, public managers ultimately did not incorporate agendas related to the urban design to improve active mobility, several of which had been promoted by the TODs, showing signs of an incomplete incorporation of the agenda. Proposals were restricted to encouraging the widening of sidewalks, public fruition, and active façade, not effectively yielding an urban design. They also did not incorporate the climate change agenda or efforts to reduce air pollution from transportation, which has become one of the main topics to spread the concept.

Meanwhile, the proposed zoning scheme did not include the need for environmental impact assessment typically found in urban designs, accelerating urban transformation.

Final remarks

Considering that the three sets of regulations – from the early 1971/1972, 2002/2004, and 2014/2016 – adopted a strategy to promote building densification along mobility axes, this investigation observed differences in each of their proposals over the decades and proposed sets of regulations. The analyses conducted until the conclusion of this article point to a long-standing connection between urban planning, forms of land use and occupation, and mobility and transportation planning. We noticed an "evolution" of the discussion around the relationship of urban planning with mobility and transportation planning, especially considering the ZEUs proposal currently in force, which here are called "Axes."

What concepts originated and were adopted for each set? Answering the questions initially raised, the interviews and analyses of institutional historical contexts, models utilized, and proposals for urban regulation lead us to our first hypothesis for this work, according to which the conception of the model that inspires the theoretical-conceptual basis of São Paulo's EETUs/ZEUs in the 2014 PDE/2016 LPUOS may be precisely the result of a combination of: the different backgrounds of

the managers involved in the urban discussion, the flow of these actors into the public administrations that tested some models, and the inclusion of new methods of building urban proposals, such as economic-legal-financial modeling. Their origins would thus be in the circulation of actors and planners involved in the structuring of public planning agencies. There is no convergence among interviewees on where the inspiration for the axis proposal came from. Our initial hypothesis, according to which it was supposedly influenced by the concept of Transit-Oriented Development (TOD), was not confirmed.

One of the moments in which the circulation of ideas resulting from the circulation of the planners involved in the conception of densification along mobility infrastructure seems to happen is the movement of those who preceded the first Zoning Ordinance of 1972, in the discussions regarding load capacity along mobility axes formulated within the scope of these public teams to guide densification, formulated within the scope of Cogep between 1968 and 1971. Later, another moment shows signs that these ideas migrated, internationally guided by the "Curitiba model" and the proponents of this model, as is the case of Jorge Wilheim as the head of the São Paulo Department of Urban Development, who coordinated the draft of the 2002 PDE. And a third moment incorporates technicians with a background in urban development planning, but also in mobility and transportation planning and in the company that produces and manages urban designs. A structure was created in city management that simulated the desired transformation, through urban, economic, and financial models, "designing" the EETU regulation in 2014. The continuity of architect Nabil Bonduki in two different moments of formulation of regulations also shows continuity and maintained trends. The models adopted seem scattered and the combination of these trajectories, with new public managers who draw inspiration from US and European BRT models and the TOD concept, in addition to trajectories in urban design, produce "model" typologies and urban designs transforming them into building incentives, translating that into rules that speak the "language of planning" centered around the right to build as a "bargaining chip" for modeled, designed densification.

The empirical analysis of the maps of densifiable areas in the three different moments of formulation of regulations investigated here shows that, in the first sets of regulations we looked into, particularly the first set, densification occurs along road axes that are not necessarily related to the public transportation network structure, and in areas that would have these systems implemented in the future. Densification was mostly concentrated in the central area as a whole and scattered across different sections within neighborhoods, allowing scattered verticalization to occur.

The second set of regulations maintains areas that were already densifiable in the 1970s, coincidentally perpetuating the previous densification zones. There was an expansion of densifiable areas towards an intermediate ring of the city, along road axes and, in some cases, connected to public transportation, pointing to a movement of ideas regarding what would eventually be implemented in the next set of

regulations. We observed that there are non-densifiable roads where there are corridors and previously densifiable zones that were not included in densifiable zoning rules.

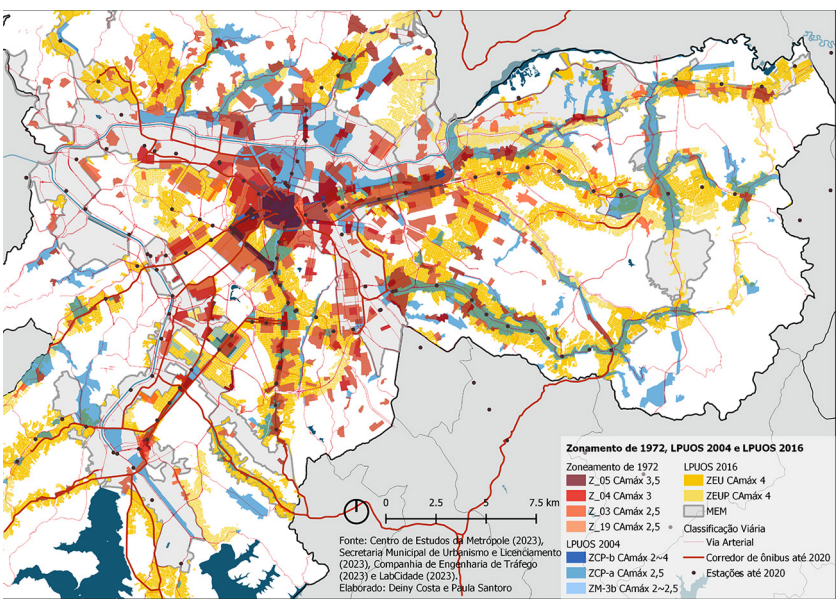
The third set shows building densification permissions concentrated along transportation axes, and verticalization in the middle of neighborhoods was reduced or restricted. A combination of the densifiable zones of the three regulatory frameworks is presented below (Figure 6) and a summary of the ideas covered is presented in two tables in the annexes below. This downsizing and concentration, along with growing real estate production in recent years, explains the scale and intensity of ongoing transformations.

When we look at the three sets, a lot has remained. Conversely, the maps show that there is a concentration of densification along the axes of the 2014 PDE/2016 LPUOS, which seems to be an innovation in relation to the previous regulation, according to which scattered densification was possible in the middle of neighborhoods, while now we can witness a "downsizing" of the possibility of densification in these areas.

Are zoning regulations or urban plans and designs used to allow densification? The analysis of the different periods showed a decision to use zoning schemes, due to several factors. Due to the crisis/criticism of current urban designs, the delay/inefficiency to have them passed by the City Council, but also in view of the context in which mobility has gained a central role in the public discussion.

While the decision to use zoning schemes has not meant an absence of urban design, it did take a new place in urban regulation modeling obtained through the calibration of the basket of incentives.

Figure 6 – Overlap of 1972 Zoning, 2004 LPUOS, and 2016 LPUOS



Source: CEM (bus corridors), São Paulo city government (1972 Zoning Ordinance, 2004 LPUOS, 2016 LPUOS, and road system). By the authors in 2023.

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Notes

(1) Law n. 5621 of 1957.

(2) Law n. 7,688, of July 4, 1971.

(3) Law n. 7,805, of November 1, 1972.

(4) Law n. 13,430, of September 13, 2002.

(5) Law n. 13,885, of August 25, 2004.

(6) Law n. 16,050, of July 31, 2014.

(7) Law n. 16,402, of March 22, 2016.

(8) Evolution here does not mean that proposals have improved, but rather that some rules have been tested and modified over time.

(9) Whenever possible, the mobility network was detailed at each moment of analysis, using the bases available at closer dates. We were not able to show or distinguish precisely what was in operation/under construction and what was planned.

(10) The authors' investigations used as the basis for this article are approved by Plataforma Brasil (CAAE: 73827423.9.0000.5390). The following people have been interviewed until the production of this article: the architect Fernando de Mello Franco, then head of the Department of Urban Development (2013-2016); the urban planner Kazuo Nakano, Director of the Urbanism Office of the São Paulo City Department of Urban Development (2013-2014); Nabil Bonduki, then member of the São Paulo City Council and rapporteur of the 2014 PDE (2013-2016); the architect Marcelo Ignatios, Superintendent of Project Structuring (2013-2016); the architect and engineer Alexandre Seixas, Senior Technical Advisor (2013); and the architect Tácito Pio, Senior Management Analyst (2001-current).

(11) While the Cogep had powers as a "super-department," with roles including coordination and advising in urban planning and management activities across sectors and municipal agencies, its relevance lies in the institutional framework for zoning management (Feldman, 2005). The 1971 plan and the 1972 zoning ordinance were conceived and implemented during the administration of Mayor José Carlos de Figueiredo Ferraz (1971-1973).

(12) Data processed by the authors.

(13) Law n. 7,805, of November 1, 1972, Article 24.

(14) Law n. 7,805, of November 1, 1972, Table 2.

(15) In 1976, the instrument was discussed in a Solo Criado Seminar organized by the Mayor Faria Lima Foundation, addressing the legal and urban aspects of the concept.

(16) Federal Law n. 10,257/2001.

(17) Interview with Nabil Bonduki, 2023.

(18) Part of the lines planned in 1968 are different from those that were implemented, especially Line 3 – Red (Isoda, 2013; Lisboa, 2019; Viégas, 2020).

(19) Map observations: Z3 is a predominantly medium-density residential area, FAR=2.5; Z4 allows medium-high density mixed-use FAR=3; Z5 allows high-density mixed-use, FAR=3.5; Z19 (along public transport) allows mixed use predominantly with commercial and service establishments, FAR=2.5. The Adiron Formula (Art. 24 of the 1972 Zoning Ordinance) allowed increasing the FAR for Z3, Z4, and Z5 up to FAR=4.

(20) Law n. 11,158 of December 30, 1991.

(21) Cândido Malta Campos Filho was the head of the Department of Planning and Cogep coordinator from 1976 to 1981.

(22) In addition to mobility interventions – road projects on Radial Leste Avenue, in the Tatuapé and Aricanduva neighborhoods –, urbanization, and building of several housing projects in Itaquera.

(23) Information collected during the interviews.

(24) Master Plan for Integrated Development II (Plano Diretor de Desenvolvimento Integrado II – PDDI II) – 1982, drafted during the administration of Mayor Mário Covas (1982-1985) –, a 1985 bill that was not passed by the City Council (Bill 254 of 1985). In 1991, under Mayor Luiza Erundina (1989-1992), a master plan was discussed, coordinated by the then head of the Department of Planning Raquel Rolnik, and was also not passed.

(25) See website page on the legacy of Jorge Wilheim. Available at: http://www.jorgewilheim.com.br/legado/Cargo/visualizar/116. Accessed on: April 1, 2023.

(26) Information collected in the interviews.

(27) Law n. 2,828, of July 31, 1966.

(28) Federal Law n. 10,257/01.

(29) A recent article looks back on the legal discussions around Solo Criado and the building of the "patrimonialization theory of the right to build" (Pinto, 2010 apud Martins and Magami, 2022).

(30) Card used in the public passenger transit system in the city of São Paulo that enables the integration of the public transport system.

(31) Zoning regulations were formulated through discussions in different territories in the subprefectures, where the decision-making process included workshops organized in the subprefectures and defined through Regional Plans. This is why FARs varied from territory to territory within the same zone.

(32) Map observations: ZCP-a means zone of polar centrality with minimum FAR of 0.20, basic FAR of 1, and maximum FAR of 1–2.5; ZCP-b means zone of polar centrality with minimum FAR of 0.20, basic FAR of 2, and maximum FAR of 2–4; ZM3-b means high building density mixed-use zone with minimum FAR of 0.20, basic FAR of 2, and maximum FAR of 2–2.5. ZM-3a is also a zone that allows densification with a maximum FAR of 2.5. Its location in the territory is mainly concentrated in what is currently the Macro-Area for Metropolitan Structuring, where densification is made possible through Urban Intervention Projects, therefore it was not included in the map.

(33) Interview with Fernando de Mello Franco, head of the Department of Urban Development, in 2023.

(34) On the dominant and subaltern regime, see Geels and Kemp (2012). According to the authors, from a niche segment in the car-centric dominant regime, pressured by protests or disruptive and counter-hegemonic actions, it eventually takes on a place in the regime, albeit subaltern.

(35) With the urban planner Kazuo Nakano as the director responsible for the city government's proposal for a Master Plan, and the urban planner Nabil Bonduki acting as member of the City Council and rapporteur of this plan (he had already acted as rapporteur for the 2002 PDE bill). In the transportation and mobility area, Jilmar Tatto, a historical cadre of the Workers' Party, held the position of head of the Department of Transportation; Ciro Biderman, an economist and urban planning researcher, was Chief of Staff of the São Paulo Transport Company (SPTrans); and Ana Odila Paiva de Souza was the director of Transport Planning spearheading the city's mobility plan (PlanMob).

(36) The drafting of the Urban Mobility Plan of the Municipality of São Paulo (PlanMob) in 2015 (Decree n. 56,834 of February 24, 2015) stands out in the period. The plan provides guidance regarding actions to ensure better urban mobility conditions over a 15-year horizon and is the result of the National Urban Mobility Policy (Política Nacional de Mobilidade Urbana – PNMU) – Law n. 12,587 of January 3, 2012 –, which established the creation of mobility plans for municipalities with population above 20,000 and metropolitan areas with population above 1 million.

(37) At the time, it was coordinated by the architect Gustavo Partezani Rodrigues (who has a background in urban and mobility design); the the architects Marcelo Fonseca Ignatios (who also worked with real estate assessment) and Alexandre Seixas Rodrigues (who holds a doctoral degree in urban mobility planning); the economists Bruno Borges and André Kwak; and counsel José Apparecido, who has a background in urban design and planning.

(38) Transit-Oriented Development (TOD) was a concept promoted by urbanism in the United States, aiming to overcome car-centric, low housing density suburban growth. It is expected to change the model based on road transportation, as it is highly polluting and environmentally predatory, considered "distant, dispersed, and disconnected" (Evers et al., 2018) and unsustainable. One strategy adopted is to strengthen the structure of public transport systems and, in the areas surrounding lines and stations, promote the increase of building and population density, the diversity of uses of the space, and social and housing typology diversity. These measures would generate more demand for public transportation, value active mobility (walking or cycling), and promote the building of quality public spaces (Cervero, 1993). Densification is expected to happen with changes in the modes of transportation (from individual to collective modes), encouraging the use of collective transportation and a change in the internal flows of the cities, which has rarely occurred.

(39) Bill n. 688/2013, submitted in September 2013 to the City Council.

(40) Highlights include the architect Weber Sutti, the SMDU chief of staff, as well as other cabinet managers, who were active throughout the process.

(41) By resistance movements formed by associations of residents of verticalized areas impacted by this verticalization accessed by cars and with vehicular traffic; or by groups who resisted the destruction of urban fabrics of cultural and environmental value which are non-designated heritage assets; or by movements in favor of verticalization known as YIMBY ("yes in my backyard"). More recently, another group has emerged aiming to show that, more than being on opposite sides, the ongoing discussion regarding verticalization is a fallacy, because it conceals the interests of the real estate market and finance in producing these changes (Rolnik et al., 2021).

(42) Except for areas of the Macro-Area for Urban Structuring that could have their FAR increased up to 4 if they turn into an Urban Intervention Project or if they were already Urban Operation Consortium areas; and the Special Zones of Social Interest (ZEIS), which also have a FAR of 4.

(43) A broader research hypothesis believes that a reading of location, base, and land structure, the available urban mobility structure, and real estate production, identifying different producers (real estate agents) and the different products produced by them, can be helpful to understand the differences between the proposals and what has been implemented along the axes so far.

(44) Criticism about the fact that the instrument does not involve (or has a limited character to) democratic participation and management; criticism about the interventions produced, for being elitist and exclusionary and being essentially road- and infrastructure-oriented; the cost of Certificates of Additional Construction Potential (Cepacs) compared to other areas of the city where compensation for building rights is cheaper, easier to get, and less controlled by investors (Santoro, 2021).

(45) Defined by the dimensions of the common area of up to 4 sq.m per housing unit and a caretaker's housing unit of up to 60 sq. m. (Art. 15, Par. 4).

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ANNEXES. Summary tables of the sets of regulations

Chart 1 – Organization of Master Plans and the topics addressed in the article

	1971 PDDI	2002 PDE	2014 PDE
Political context in the country	Federal govt.: Dictatorship	Post-democratic transition after 1988 Constitution	June 2013 protests
Political context in the city	Little/low public participation in the formulation of plan and zoning Mayor: José Carlos de Figueiredo Ferraz Director of the Administration Department: João Alberto Guedes	Plan with significant public participation and decentralized definitions Mayor: Marta Suplicy Head of the Department of City Planning: Jorge Wilheim Rapporteur in the City Council: Nabil Bonduki	Plan designed by technicians, centralized discussion Mayor: Fernando Haddad Head of the Department of Urban Development: Fernando de Mello Franco Rapporteur and member of the City Council: Nabil Bonduki
Historical and institutional context	Structuring of public planning agencies (Feldman, 2005) After Zoning: public technical teams formed. Involved in studies of road load capacity (Cândido Malta, head of the Planning Department 1976-1981)	Decentralization attempts through Subprefectures, adoption of democratic planning processes First master plan after the City Statute was passed and following the building of the "Curitiba model"	Verticalization crisis in the car-centric model. Downsizing in the middle of neighborhoods and focus on axes Public technicians involved with economic--financial and legal modeling for transformation via zoning
Background	Sagmacs consulting services that originated the 1968 Basic Urban Plan for São Paulo (PUB) (Leme, 1999; Anelli, 2007; Bernardini and Sato, 2021)	30 years of zoning rules operating in place of plan (1972 Zoning Ordinance) (Somekh, 1997) Expansion of the "Curitiba model" in the 1990s	The Urban Intervention Area (AIU) instrument of the 2002 PDE that was not regulated or implemented The "Curitiba model" and the concept of Transit--Oriented Development (TOD)
Sets of regulations	1971 PDDI and 1972 Zoning Ordinance	2002 PDE and 2004 LPUOS (includes Regional Plans that defined land use and occupation)	2014 PDE and 2016 LPUOS
Type of regulation adopted	Zones Z3, Z4, and Z5 Medium-to-high density mixed-use or predominantly residential zones	Zoning Ordinance + urban design made possible through urban transformation instrument Through AIU (2002 PDE) and centrality and mixed-use zones	Zoning Ordinance PDE EETUs and LPUOS ZEUs

Source: The authors in 2023.

Chart 2 – Urban Regulation

	1971 PDDI and zones Z3, Z4, Z5, and Z19 of the 1972 Zoning Ordinance	2002 PDE AIU and 2004 LPUOS ZCP and ZM	2014 PDE EETU and 2016 LPUOS ZEU
Location	Z3, Z4, Z5: scattered around the city Z19: around 5 Line 3 – Red subway stations	Central Areas: central areas and regional sub-centers characterized by the coexistence of residential and non-residential uses Mixed-use Zones: territory of the Macro-Area for Structuring and Qualification intended for mixed use	Collective transport axes and poles, including bus corridors, subway, train, and monorail stations
Mobility structure	Road system and neighborhood centralities	Road system, centralities, and regional sub-centers	Along bus corridors and around subway and train stations
Floor Area Ratioo	Z3: predominantly medium-density residential with FAR of 2.5 Z4: high-density mixed-use with FAR of 3 Z5: high-density mixed-use with FAR of 3.5 Z19: mixed-use predominantly with commercial and service establishments with FAR of 2.5 Adiron Formula (Art. 24) allowed Z3, Z4, and Z5 to reach a FAR of 4	ZCP-a: zone of polar centrality with min FAR of 0.20, basic FAR of 1, and max FAR of 1–2.5 ZCP-b: zone of polar centrality with min FAR of 0.20, basic FAR of 2, and max FAR of 2–4 ZM3-b: mixed-use zone with high building density and min FAR of 0.20, basic FAR of 2, and max FAR 2–2.5	ZEU: min FAR of 0.5, basic FAR of 1, and max FAR of 4 ZEUa: min FAR NA, basic FAR of 1, and max FAR of 2

Source: The authors in 2023.