Urban Sustainability and Spatial Quality: Urban Law in Medium-Sized Cities

Adriana Gelpi, Rosa Maria Locatelli Kalil, Tanise Spielmann, Acácio Dolci Rosalen

Abstract— This paper is about urban planning and sustainability of cities through their spatial organization and municipal laws. It selects parameters of urban sustainability and evaluates if the municipal master plan of a medium-sized city, in Brazil, already reviewed after the City Statute approval, considered them, under the conception and implementation of its urban master plan. After comparative study of master plan and the accomplishment of field survey, the research allows to assert that the implementation of sustainability parameters selected by work, qualify in spatial and environmentally the city of Passo Fundo, RS, Brazil.

Keywords— Planning, Urban Sustainability, Medium-Sized Cities, Passo Fundo, RS, Brazil.

I. INTRODUCTION

THE city of Passo Fundo approved, in 1984, a master plan that increased the height level of buildings downtown, considering them as a local of regional reference, encouraging the verticalization of the central area [1]. On the other side, this plan favored the indiscriminate population growth, the destruction of the historic heritage and urban memory, moving and disaggregating neighborhoods, suppressing recreation areas, compromising environmental sustainability and segregating peripherally, the poorest population. Following the debate promoted by the City Statute [2], law that defines urban norms which encourage sustainability, the social role of the property and the citizen participation, among other issues, in 2006, the city worked on the review of the city plan 1984, trying to reach more balance, urban accessibility and environmental quality. Therefore, the objective of this work is to evaluate the Master Plan of the Integrated Development of Passo Fundo – the PDDI [3], reworked in 2006, verifying if it presented, since it was accomplished through the review of the city plan already existent and after the promotion of the City Statute [2], advances or items related to the aspects of social justice and urban-environmental sustainability. This work intends to verify, by means of a field research, how the articles provided in law and identified by the research, have been implemented in urban space.

Manuscript received May 29, 2012: This work was supported in part by the University of Passo Fundo, by the National Council for Scientific and Technological Development (CNPq) and by Foundation for Research Support of Rio Grande do Sul (FAPERGS).

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II. IDENTIFYING PARAMETERS OF URBAN SUSTAINABILITY

According to Rossi [4], the ten key sectors for a environment global economy are energy supply, agriculture, construction, fishing, forests, an industry with energetic efficiency, tourism, transportation and waste and water management. Then, cities become the core of this issue. In this context, urban planning must go beyond a single technical practice and become a conscious act of the city improvement in order to avoid climate change and making global sustainability feasible.

In relation to parameters of urban sustainability, the 10 European Common Indicators for the Local Sustainability presented by the European Communities [5] approach the theme, by taking into account: 1) citizens satisfaction towards their local community, 2) local contribution to climate change, 3) local mobility and transportation of passengers, 4) accessibility to green areas and local services, 5) quality of local air, 6) house – school moving for children, 7) sustainable management of local authorities and companies, 8) noise pollution, 9) sustainable use of the territory, 10) sustainable products. According to Andrade [6], principles of sustainability associated with urban morphology and which have been observed in spatial planning policies and urban plan of European cities were identified, to wit: 1) balance between urban development and soil conservation dedicated to agricultural and forest activity, as well as to green areas used for idleness; 2) soil conservation, of ecosystems and natural surroundings; 3) mix of urban functions and balance between housing and work; 4) social diversity in the neighborhoods and in the buildings; 5) control of moving and traffic; 6) protection of air and water quality; 7) reduction of diseases caused by noise; 8) waste management; and 9) preservation of urban groups of interest and real state heritage.

Considering the nature load capacity and the advance towards social justice, urban sustainable principles of the European version Agenda 21 [7] may be applied: 1) use of renewable energies, 2) nature balance, 3) green spaces, 4) tradition balance, 5) social sustainability, 6) living, 7) accessibility, 8) human scale, 9) matrix of opportunities, 10) regional integration, 11) future vision, 12). The relevance of

the urban environment sustainability is emphasized as for its urban poverty relieve, by the offer of services of education, infrastructure and health with equal rights to the poorest and unfavorable social groups, that is, in such a manner of guaranteeing the equitable access to services for all citizens.

In the same sense, the objective of the urban environmental sustainability principle is to improve urban life quality, in the great metropolis mainly, through a balanced distribution of the land use, taking into account the sustainable development [8]. This principle requires conformity and rationalization of planning methods, safeguarding the natural environment and urban mobility.

Scussel [9], when evaluating these principles of sustainability, verifies that such urban patterns have always been present as structuring guidelines of cities space. Jacobs [10] already approached that diversity is a manner to keep urban structure alive and healthy, where the neighborhood must fulfill more than one primary function, and not being allowed mastering, and that the majority of the blocks must be short, with enough amount of streets, making the turn of corners feasible. The same way, the neighborhood must mix buildings which vary in age and conditions and are dense enough, regardless the time of the day, eliminating empty areas without urban anima. We may understand then, as one of the aspects of the sustainable city, the one that well distributes urban services and equipments, promoting urban diversification. It is in this sense that the city plan must contribute, searching to fulfill its instrument of expansion direction and urban renovation, in the management of investments and in the diversified implementation of equipments. In this work, as indicators of urban sustainability, we will approach the existence of urban centralities and sub-centralities that democratize urban accessibility, diversified zonings and urban indexes which allow water permeability, air and sun in the urban fabric. Therefore, they are parameters that contribute for a more sustainable city.

A. Urban centralities

Urban centralities, studied by Villaça [11], are centers and sub-centers (existent and encouraged), in the urban area of the city and that make part of its structure. The centers and sub-centers are understood as well distributed offer zone of urban facilities, defined by the zoning of land use which meets the community in its basic needs of work, education, business, services, transportation and leisure, democratizing the access to urban benefits and reducing the need for expensive moving and energy consumption.

According to Mladenovic [12], increasing the intensity of activities and people within an area is central to the idea of creating sustainable neighborhoods. More people are close enough to communal facilities to walk, and an efficient bus service can be made viable. Moreover, the critical mass of development contributes to the informal vitality of the streets and public places that attracts people to city centers, then contributing to energy efficiency.

B. Urban indexes

They are the guiding and allowable parameters of the form of construction and urban density. According to Freitas and Lombardo [13] studies on environmental quality planning bring a new paradigm of sustainable development, emphasizing what types of land use and occupation lead to different conditions of environmental comfort. In this sense, high temperatures are observed in areas where intense vertical growth, population density and small amount of vegetation is observed. To Edwards [14], the role that buildings and cities play is important to the ‘conception of sustainable planning and development.

III. Master plans and urban sustainability

In the Brazilian case, general guidelines of sustainability are pointed in the City Statute and federal law and in federal and state related legislation as Agenda 21 and environmental regulations. Local application occurs in master plans that cover areas of towns and urban areas, in the form of municipal law that must approach the principles of urban sustainability, based on technical studies and social participation of the community.

However, the European guidelines applied to the Greek experience establish more explicit or consolidated national regulations [8]. Master Plans are elaborated for the implementation of the legal framework. They prescribe a complete plan for the development of a region, including various productive sectors, transportation and social equipment, taking into consideration the protection of the environment, cultural heritage and the national regional planning policy as well. General Urban Plans fix rules concerning density, land use, general building conditions, protected sectors and sites, monuments and sectors of urban renovation. Finally, Local Urban Plans specify and apply rules over building height, the situation of constructions, the building coefficient, land and building use, parking areas and renovation sectors. The author also approaches how important it is to count on the community participation in the legislation elaboration.

It is essential to approach the importance of the master plan roles – municipal laws – as for the protection of the constructed ambient and the city landscape structure. The master plan, besides providing peculiarity to the city image, may contribute to the protection of natural and cultural environment of the city, fulfilling its function as a sustainable development agent. Thus, according to Tzika-Hatzopoulou [8], the master plans and plans for the protection of the environment may fundamentally determine directions of communities planning and development which objective is to reach a balanced expansion among the urban area, economic and rural activities and the preservation of farms and urban and rural

IV. Case study: Passo Fundo and its sustainable plan

Passo Fundo is a pole-city in the north of Rio Grande do Sul state, in the south of Brazil, with nearly 185.000 inhabitants. It is the second greater biomedical center in the south of the country and it has developed through the agro-industrial complex of wheat-soybean and later, because of poultry production and integrated swine [15]. In terms of logistic, the city has an important roadway connection between São Paulo and Buenos Aires, searching advantages for industrial, commercial and wholesale activities. Industry has a strong link with rural activities of the region, what has resulted in significant indexes of economic and population growth (Figure 1).

Fig. 1The city of Passo Fundo in the state of Rio Grande do Sul, in Brazil and in Latin America. Adapted from: Geographic guide of the Americas ©2011, [20] Embrapa/RS ©2011 and PMPF ©2010, all rights reserved [21].

In 2006, and following the debate promoted by the City Statute, the town worked on the review of master plan 1984, activity which was achieved with the community innovative participation, which was a demand imposed by the new legislation [2].

The new master plan was ruled by the search for more social justice, balance and environmental quality for the city. This intension becomes clear when we analyze basic guidelines that guide the speech and Law nº 170/06 of the Integrated Development Master Plan of Passo Fundo, implemented in 2006 and that approaches [3]: I – reduction of social inequalities, through the offer increase of urban land, housing, sanitation, infra-structure, transportation, public services, work, income, culture and leisure of citizens; II – public interest supremacy over the individual interest; III – sustainable municipal and regional development; IV – participation and social control on public policies; V – municipal autonomy and federal cooperation. In article 4°, which approaches the guiding principles of local development, the social function of the property is considered the basic core of the right to property, searching fulfillment of a sustainable city by harmonizing economic development with environmental preservation, participative planning and the enforcement of social rights.

In this first analysis, we can observe that the social issue, sustainability, and the citizen participation, are factors that are observed in the public speech and in the law which governs the town.

To Villaça [16] “Decade 1990 was selected as the end of a period in the history of the Brazilian urban planning because it marks the beginning of its politicization process, result of the advance of population awareness and organization. This politicization became clear from elaboration methodologies and the content of some plans to the debates in and out the legislative, in several important cities of the country”.

But according to the author, master plans, in Brazil, have a not much encouraging history of master plans that started to be elaborated in the country from the decade of 1960, and in its majority, did not reach the objectives which they were proposed to. In certain period, plans began to work by themselves, not because of their results, working as an intellectual product mainly, out of reality, being included in the production of a huge arsenal of ideas about the city and about urban planning, and that feed on them, not having any link with reality.

In this context, how can we evaluate if the politic speech and guiding law of the municipal development of an average-sized city, in the country of Rio Grande do Sul, will contribute to the adequate expansion and development, implementing fairer social, environmental and urban guidelines?

Through research accomplished and comparative studies of urban indexes among master plans, we could deepen this issue a little more.

V. Comparative Study Among Master Plans

A. Rigid zoning x diversification of land use

Master Plan 1984 [17] recorded a well-defined Business Central Zone and four commercial axes that followed the main road axes of the city towards four business sub-centers, but which not contain many expansion areas of diversified use, transversal to the roads. Surrounding these business zones and axes, you went right to areas that were predominantly residential. It was a planning based on a very rigid zoning.

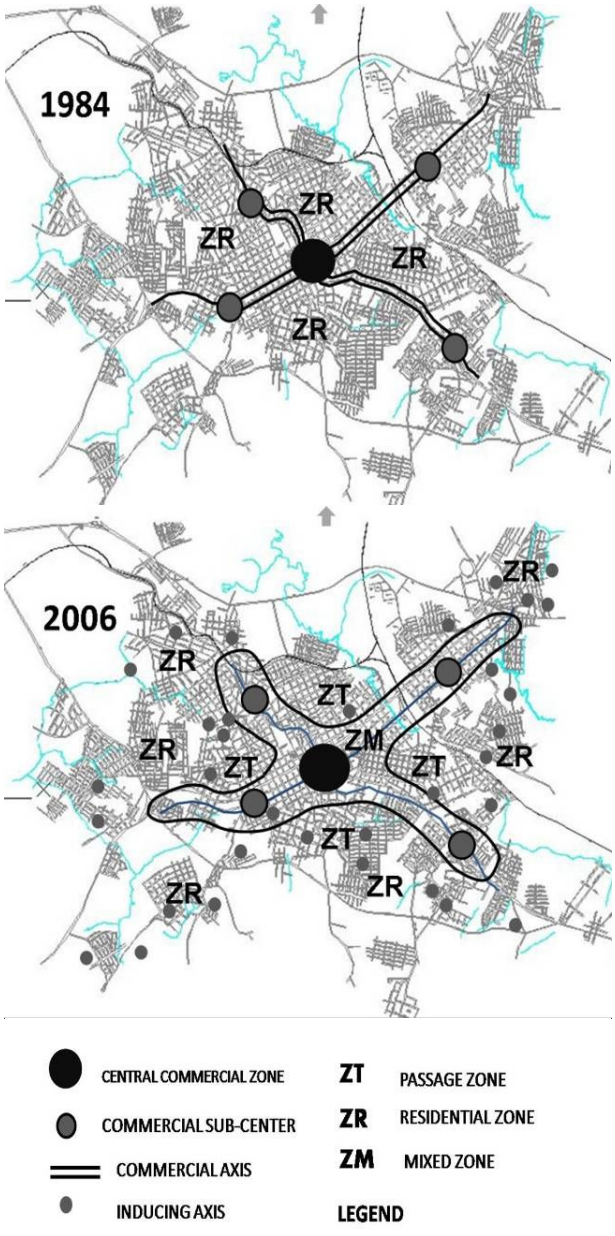

Fig. 2 Comparative study of land use on schematic map of master plans of Passo Fundo in 1984 and 2006. Source: Adapted from PMPF, ©2011, all rights reserved.

Comparatively, master plan 2006 [3] expanded and changed the Central Business Zone of Mixed use, and enlarging the diversification of land use, subdivided the axes of urban expansion into two complementing zonings: Mixed Zone and Passage Zones (Figure 2).

B. Inducing axes as new elements of urban dynamism

In master plan 2006, around 50 "inducing axes" are proposed, they did not exist in the plan of 1984, and that are comprised of urban plots that surround, cross or follow Mixed and Passage Zones. They are urban projections created to stimulate areas significantly inhabited, but away from the Central Zone. These inducing axes, implemented through routes where public transportation works, connect traffic and urban equipments to neighborhoods and greater centralities. Their objective is to stimulate and expand the use of diversified soil, integrating the railway system and urban functions, distributing and democratizing the access to transportation and benefits of the city (Figure 3).

Fig. 3 Inducing axis of Coronel Miranda street. Source: The authors, ©2010, all rights reserved.

C. Constructive indexes

Master Plan 1984 [17] contributed significantly to the population growth and verticalization of the downtown area of Passo Fundo. The allowance of high occupation taxes, with lower pavements covering all lot, to at minimum, 12 m height, led to the lacking of minimum spacing among buildings – lateral spacing among buildings, not allowing aeration, ventilation and adequate insulation among buildings. More than that, soil waterproofing through massive construction has already turned urban drainage difficult, significantly, flooding several areas after tropical floods (Figure 4 and 5).

Fig. 4 Image of building and it schematic representation of projection on the lot, Master Plan 1984. Source: The authors, ©2010, all rights reserved.

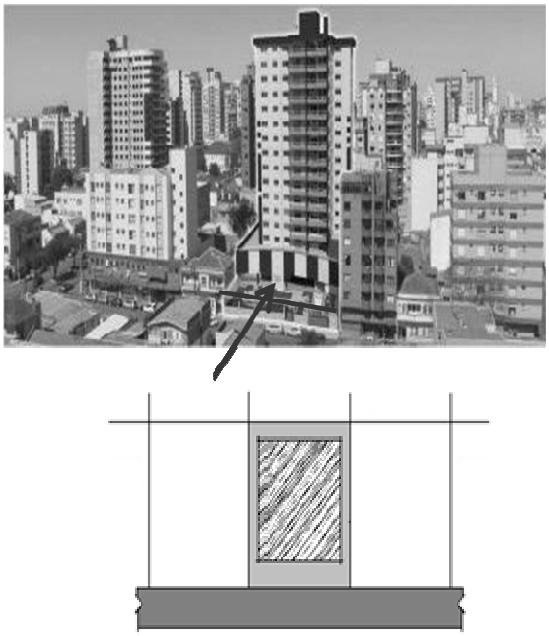

Fig.5 Image of building and it schematic representation of projection on the lot, Master Plan 2006. Source: The authors, ©2010, all rights reserved.

Master Plan 1984

a) Schematic representation of the front view of the lots in Master Plan 1984, with 100% use of the area built in the Central Business Zone of Passo Fundo. Occupation allowed by MP 1984.

Master Plan 2006

b) Schematic representation of the front view of the lots in Master Plan 2006, with 60% use of the area built in the Business Central Zone of Passo Fundo. Occupation allowed by MP 2006.

Fig. 6 Schematic representation of comparative study on the occupation of lots by buildings, among Master Plans 1984 and 2006. Source: The authors ©2010, all rights reserved.

The lack of front spacing approached high buildings of narrow traffic routes, causing shading for buildings and

sidewalks and leading to the phenomenon of "wind tunnel", not allowing adequate air dispersal, resulting in discomfort to dwellings and pedestrians. When comparing Master Plans, especially with respect to the central zone of the city, we may note that Master Plan 2006 [3] proposes a restriction of the constructive indexes and rates of soil occupation. Compulsory lateral and front spacing were implemented, favoring environmental urban quality through a greater aeration, ventilation and insulation. Also, it was proposed a "Permeability Rate", prohibiting total waterproofing of the lot through total occupation, allowing the absorption of pluvial waters inside the urban lot, avoiding erosion and damage of the heritage built.

Master Plan 1984.

Master Plan 2006.

Fig. 7 Comparative images of buildings of Master Plans. Source: The authors ©2011, all rights reserved.

In Figure 6, we illustrate photographs of buildings in Passo Fundo through a schematic study represented in the previous image. It is recorded, in a first moment, the buildings that cover 100% of the urban lot, situation allowed in the Master Plan 1984 and which made urban drainage difficult when preventing absorption of pluvial waters from happening, among other issues.

In the second moment, images obtained from buildings are recorded, one still in construction, where the effects of legislation 2006 approaches lateral and front spacing and where rates of urban permeability are already observed (Figure 7).

VI. Conclusions

Before comparative analysis of master plans and field survey accomplished we can conclude that the review of the master plan of Passo Fundo , implemented in 2006 [3], tried, through its general norms, to observe urban democracy and greater social justice by means of several norms, guidelines and indicators. This work defined and analyzed some parameters of urban sustainability, and in a comparative state, it is possible to assert that the review of the document brings proposals that qualify and democratize, theoretically, urban life.

The decentralization of land use, tries to distribute urban benefits and equipments more adequately, connecting peripheral areas to inducing axes of development and sub-centralities, then approaching neighborhoods and distant poorer residential areas, from areas well provided with urban facilities and equipments.

In fact, the result of the new master plan takes into account sustainable aspects of the city development presented in other studies, like the solution to discharge the pressure on the center by applying the decentralized settlement model.

This model gives priority to the development of several urban sub-centers or densely built-up settlements (providing housing, services, employment opportunities, recreation) that would function almost independently along public transport lines. In such a way, the dispersed suburban housing pattern of mainly detached one-family houses would become more densely built-up and improved by a better supply. The city would grow along densely built-up axes with centers linked with a rapid public transportation system. The green intermediary spaces would enable transversal communication between landscape elements and would preserve the integrity of urban units. [18]

In designing new or upgraded communities, the existing construction should be taken into consideration as well as the existing central surfaces in the smaller suburban agglomerations. New or improved central surfaces would represent the central part of the development areas and settling around them should be designed as an autonomous unit within walking distances where functions are intermixed (shops, services, public use of space, housing, etc.). Within such a framework, new job programs would be feasible, as well as new residential areas. The key aspect of the concept is to create a lively urban community within walking distances. The central backbone of such model is the public transportation system. [18]

With respect to constructive indexes, although small, there was general restriction to the built mass, in the central area mainly, already full of buildings. Frontal and lateral spacing, restricting constructive indexes were proposed and

implemented. Yet, a new important rate of urban permeability was standardized and implemented, searching for a greater absorption of pluvial waters and the reduction of floods, inside urban lots, bringing in urban quality and benefits for the entire population.

Mixed permissible uses decentralize, approach and reduce distances, thus a more diversified land use contributed to a fairer, more sustainable and accessible life, not demanding much need for moving, promoting and improving the neighborhood, therefore, they will be more equipped and provided with transportation.

This corroborates Latin American studies [19] which show that sustainable development depends on the actions that are taken in cities, since that, as urban areas concentrate a great number of people and are complex systems that consume vast resources and generate multiple flows that have to be properly controlled. Sustainable urban development should have, as critical mission, the promotion through a democratic planning, and quality the balanced, sustainable and equitable growth of cities.

In its various forms, the organization or the urban space and the physical configuration of neighborhoods have been both and expression of community's social, political and economic relations within the city, and also a factor impinging on its development. And also in cities of the developing world, the legacies of residential differentiation and rigid zoning have continued to exacerbate stark inequities, further compounding exclusion and alienations for a majority of urban residents **Error! Reference source not found.**.

This way, we may assert that urban qualification of cites begins from an organized legislation in such a participative manner, which improves the diversification of urban structure and the form of the city. Then, it also necessary that this legislation is met and its implementation monitored by the organized civil society, and that this later fulfills, through its municipal council, the norms proposed.

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