# ID 1733 | ENVIRONMENTAL VERSUS URBAN PLANNING AND MANAGEMENT – A COMPARATIVE ANALYSIS BETWEEN METROPOLITAN AREAS OF FORTALEZA (BRASIL) AND LISBON (PORTUGAL)

Caroline Câmara Benevides[1]; Jorge Baptista e Silva[1]; Ana Paula Falcão[1]
[1]Instituto Superior Técnico
carolinecamara@tecnico.ulisboa.pt ; jbsilva@tecnico.ulisboa.pt ; anapmfflor@gmail.com

## 1 THE METROPOLITAN AREAS IN BRASIL AND IN PORTUGAL

The process of industrialization in Portugal, if compared to the rest of Europe, occurred belatedly, coinciding with the same period in Brazil, in 1940, 1950, 1960. During this period a large number of people migrated from the countryside to the major cities in search of better living conditions, and settled in the territory, in a continuous process for decades.

The public authorities' actions were quite limited in these two countries. However, in Lisbon between 1935 and 1948, one third of the city was expropriated by initiative of Duarte Pacheco, then Minister of Public Works and Speaker of the House in Lisbon. The centralizing policies comprised a strong territorial intervention in a period of intense population growth, the city was endowed by planning instruments that allowed to tame urban expansion. In Portugal until 1965, the public administration took over exclusively the planning and production of urban land, acting with some urbanistic coherence.

This fact was not observed in Brazil, considering that the instruments of urban management were created after the enactment of the Federal Constitution in 1988, decades after the great immigration. Thus, the population that migrated from the hinterland into the Brazilian state capitals, for the most part settled in remote areas, far from any infrastructure, often occupying conservation or risky areas in the proximity of railways or next to flammable activities.

The growth of the industrial economy and urban lifestyle sought by the vast majority of the world's population produced a dense urban network, comprised of municipalities linked by economic interactions. In this context Brazil's Federal Government created, through Federal Act No. 14, of 08 June 1973, nine metropolitans regions in Brazil: Fortaleza, Recife, Belém, Salvador, Rio de Janeiro, Belo Horizonte, São Paulo, Curitiba and Porto Alegre. In Portugal, the metropolitan areas of Lisbon and Porto were created two decades later, through Act No 44 of 2 August 1991, amended in 2003 (Law 10/2003).

The survey was conducted in the Metropolitan Areas of Lisbon and Metropolitan Region of Fortaleza despite their different economic, social, cultural, environmental, and urbanistic conditions, these areas have some similarities and both are coastal and comprise an equivalent number of municipalities. Moreover, they are the most densely populated areas in each country.

### 1.1 THE METROPOLITAN REGION OF FORTALEZA

Fortaleza is a Brazilian municipality, capital of Ceará State, located in the Northeastern portion of the country. It is located on the Atlantic coast, with an average altitude of sixteen meters, with 34 km of beaches. Fortaleza has an area of 313.140 sq. km and an estimated population of 2 609 716 inhabitants in 2016, along with the highest demographic density among the capital cities of the country, with 8 334.0 inhabitants per sq. km. The climate is tropical, hot, with an average annual temperature of 26.5°C. According to IBGE (Brazil's Census Bureau), the metropolitan area of Fortaleza boasted a GDP of R$ 80.4 billion in 2014 (corresponding to 8343€ per capita). This number has placed the Metropolitan Region of Fortaleza (RMF) as the third richest in the North-Northeast, behind Salvador and Recife - and the 11th in Brazil.

According to Ugeda Junior (2014), urbanization in Brazil occurred in an accelerated pace, even in the regions where the industrialization process was not so intense, as is the case in Brazil's northeastern

region, plagued by long periods with no rainfall, known as "droughts". In this region people are constantly migrating to the capital, in search of subsistence, which contributes to an increased population, as is the case of the city of Fortaleza.

In 1973, the city of Fortaleza, together with the municipalities of Caucaia, Maranguape, Pacatuba and Aquiraz constituted Fortaleza Metropolitan Area – RMF, with an overall population of approximately 1 million people. In 1991, RMF already had 2,292,524 inhabitants and in 2010 it exhibited a population of 3,615,767 residents. Currently it boasts four times the initial population, 4,019,213 inhabitants, of which 2,609,716 live in the city of Fortaleza, plus the eighteen municipalities that integrate RMF, known as the Great Fortaleza. It is currently the most populated area in northern and northeastern Brazil and ranks as the fourth largest metropolitan area in the country, and the 131th largest urban area in the world (Wikipedia).

Over the years one may observe that investments in urban mobility and the creation of new economic centers in the metropolitan area changed the economic and social dynamics, allowing for a greater balance in the relationships among the cities that make up RMF. The participation of the city of Fortaleza in the metropolitan area in 1970 was 82.75%, and in 2016 it dropped to 64.93%.

According to Souza (2015), the metropolis spread along with the process of industrial dispersal in neighboring municipalities of Fortaleza. First in the municipality of Maracanaú, following the creation of the Industrial District established in the late 1960s. As a consequence several housing complexes emerged, with the encouragement of housing policies, which corroborated the formation of a real estate metropolitan axis in tandem with the interests of the productive metropolitan axis.

The RMF municipalities are integrated by state and federal highways, which shape the road system, as the main transportation mode used by population in the municipalities. The metro line, completed in 2012, connects Fortaleza with only two of the cities that comprise RMF, Maranguape and Maracanaú, the largest cities after Fortaleza.

According to the Brazilian Census Bureau (IBGE 2010), water supply and sewerage networks in RMF, responded to 87.42% and 49.9% coverage, respectively in 2010, and since then there have been no substantial modifications in this scenario.

Fortaleza Metropolitan Area, currently with three times the original number of municipalities, has been losing institutional strength, until it was completely excluded from the plans of the State of Ceará, which operates with specific and unarticulated projects. There are no regional land use plans, and out of the nineteen municipalities that integrate Fortaleza Metropolitan Area, there are still four municipalities with no Master Land Use Plans.

The Metropolis Statute, approved by Federal Act No. 13,089, of 12 January 2015, establishes general guidelines for planning, management and implementation of public initiatives of common interest in metropolitan areas and in urban agglomerations created by the States. It also establishes the obligation to draw up and approve within 3 (three) years, the integrated urban development plan for metropolitan areas or urban agglomerations that were created until the date of entry into force of the law, through complementary state law, incurring the penalty of administrative improbity the governor who fails to take the necessary measures.

## 1.2 THE METROPOLITAN AREA OF LISBON

Lisbon Metropolitan Area (LMA) is equivalent to 3,015 sq. Km, has a maximum altitude of 528m, and an annual average temperature ranging between the maximum of 21,3° C to 13,1° C. The Metropolitan Area of Lisbon is home for the centres of decision of the country's economy, with a GDP of 64,010 million euros, 22.8 thousand euros per capita, representing roughly 37% of the national GDP and employing approximately 1,316 thousand people (29% of employment in the country), expressing an apparent labour productivity 1.3 times higher than that of the country as a whole (Lisbon, 2016).

Since the 20th century, LMA has been a continuous growth of the population in the country having nowadays more than a quarter of the country population (15% in 1940, 22.4% in 1970, 28.1% in 2011). The population value recorded in 1981 was the highest achieved by the city of Lisbon. In the 1980s, with

the intensification of metropolization, coupled with a stagnation of housing supply in Lisbon, the capital loses about 18% of its population to neighbouring municipalities. In the 1990s the situation remained, despite an increase in housing supply, and Lisbon lost more than 15% of the population, confirming a trend of population loss (REOT - LISBOA).

The rising price of real estate in Lisbon, as LMA expanded in the periphery, reinforced the migration to more affordable suburban land and housing. On the other hand, Lisbon has gradually lost population and is currently stabilized in the 550,000 inhabitants.

Lisbon is the traditional and symbolic centre of the LMA, which is the motor of the region's economy. The city daily sees the number of its users increasing from 547,000 to 925,000 people, a result of the commuting movements of home and work. Home-school. The number of people entering the city daily corresponds to 425,747 and the number of people leaving the city daily is 47,521, resulting in a balance of 378,226 people entering Lisbon (LISBON, 2016).

Lisbon and its metropolitan area have a very wide and modern transport network. The various modes of transportation, and their infrastructure, are arranged so as to substantially reduce automobile traffic in the metropolitan area, especially in its centre area. Circulation in the city of Lisbon is fast and efficient, for users within the city and people coming from the outskirts. The subway, trains and vehicles on light rail are the most important public transport.

Two bridges connect the city to the south bank of the Tejo river: Ponte 25 de Abril that connects Lisbon to Almada, inaugurated in 1966. And Ponte Vasco da Gama, with a length of 17.2 km,[4] the longest bridge in Europe and the fifth longest bridge in the world, which connects the Eastern area and Sacavém to Montijo (Wikipedia).

In LMA the population served with systems for collection and drainage of wastewater reaches around 91%, while the population served by the treatment systems is roughly 75%. According to INE, in the municipalities of Amadora, Cascais, Oeiras and Lisbon, the rate of coverage, both for the collection and drainage systems, as for wastewater treatment plants is 100 %. In the counties with lower service coverage for collection, disposal and treatment, the infrastructure is being completed in order to meet the current needs for wastewater treatment. (CCDR LVT, 2009).

The Regional Territorial Plan for Lisbon Metropolitan Area was prepared in 2002 by Central Government. The intermunicipal plan it is not mandatory however, all the municipalities that integrate LMA have Master Land Use Plans since 1992, and some have already been revised after 10 years. Only few of them have their Status Reports on Spatial Planning – REOT - finished.

## 2 URBAN AND ENVIRONMENTAL PLANNING AND MANAGEMENT

The urban policy envisaged in the Constitution of the Federative Republic of Brazil, regulated by the City Statute, as well as the Regional Planning and Urban Policy envisaged by the Constitution of the Republic of Portugal, and regulated by the Basic Law of Public Policy, Spatial Planning and Urbanism, granted extensive powers to municipalities to promote the adequate land use, establishing guidelines that govern the use of urban property for the collective good, the safety and well-being of citizens, as well as the environmental balance throughout the territory.

In both countries, the control over urban development does not involve the possession of the land by the public authority. When it comes to occupancy of land, a limited natural resource, we are faced with the issue of the distribution of this important commodity, which happens in a very disproportionate way, particularly in Brazil, since the private sector becomes the main actor responsible for the transformation and production of urban land.

During a period of about 30 years, the Portuguese cities had an urban growth similar to that of Brazil, in which the private sector is charged with the production of urban land, and with the subdivision operations and the construction of infrastructure, causing a dysfunctional growth, guided by operations that do not comply with any development plan. This finding resulted in significant alterations in urban planning in Portugal.

## 2.1 PLANNING AND MANAGEMENT IN FORTALEZA

In Brazil, out of the instruments provided by the City Statute, the Master Plan is the basic tool for city planning and urban management, through an urban policy integrated with the city planning system. The multi-year plan, the budget guidelines act and the municipal budget law should be guided by the fundamental principles, general objectives and strategic priorities contained in the Master Plan.

The Master Plan for the Municipality of Fortaleza (PDP), Law No 62 of 02 February 2009, sets out the principles and objectives of urban policy, guidelines and strategic actions. To comply with the guidelines for regional planning, the territory was subdivided into Urban Macrozoning and Environmental Protection. The city of Fortaleza is considered as 100% urban, excluding the demarcations of Macrozone of Environmental Protection, intended for the conservation of ecosystems and natural resources, subdividing into zones according to:

> *"I - the environmental systems consisting of the water network, the waterfront, mountain vegetation, remnants of vegetation, mangrove forests, riparian forests, dunes and permanent preservation areas;*
> *II - the morphological and typological characteristics of the built environment;*
> *III - the systems of environmental sanitation, installed and planned;*
> *IV - the mobility system;*
> *V - the areas of trade, services and industry;*
> *VI - public areas, green and leisure areas;*
> *VII - the urban infrastructure and public facilities;*
> *VIII - the areas intended for housing."*
> *In the quest for the attainment of the objectives, the PDP defines differentiated urban parameters for each of these areas, to be followed by the owners for new subdivisions, uses and land occupancy, and these procedures must still meet other requirements. For example, we have the parameters for the Preferential Occupancy-2, ZOP-2, which is characterized by partial availability of infrastructure and urban services and areas with limited availability of density; and the intensification of land occupancy.*
> *"Art. 85 - parameters4 of Zop 2 are:*
> *4The utilization index is one that, multiplied by the area of the land, results in the computable construction area.*
> *I – Basic utilization index :2.0;*
> *II- maximum utilization index :3.0;*
> *III - minimal utilization index :0.2;*
> *IV - permeability rate:30%;*
> *V - occupancy rate:60%;*
> *VI - occupancy rate of subsoil:60%;*
> *VII - Edification Maximum Height: 72m;*
> *VIII – Plot minimum area size: 125m ;*
> *IX - Minimum Front Size: 5m;*
> *X - Plot Minimum depth: 25m."*

In turn, the public managers should make use of the instruments for plan implementation, established by the City Statute to which the urban property must comply with its social function. Thus, Fortaleza Master Plan makes use of these instruments in accordance with the objectives proposed for each of the specific areas.

> *“Art. 86 - The following instruments shall be applied in the area of preferential occupancy 2 (ZOP 2),:*
> *I – Compulsory subdivision, construction and utilization;*
> *II – Progressive IPTU (property tax);*
> *III - Expropriation upon payment by public debt securities;*
> *IV- Right of pre-emption;*
> *V - Right to surface;*
> *VI - Granting right to build;*
> *VII - Transfer of the right to build;*
> *VIII - Urban operation in consortium;*
> *IX - Real estate consortium;*

*X - Neighbourhood impact study (EIV);*
*XI - Environmental study (EA);*
*XII -Special Area of Social Interest (ZEIS);*
*XIII - Instruments of land regularization."*

According to Muniz (2006), Brazilian cities are experiencing the abandonment of strategic planning. The urgency to heal the daily problems replaces the medium and long term planning. Another reason for abandoning strategic planning is the concern of the municipality annually to prepare its budget in order to guarantee funds from the federal and state government, as well as external financing for the execution of its projects, which are, in most cases, punctual projects.

The Statute of Cities, Master Plans and other urban legislation are instrumental that require a policy that implements and manages them. The absence of policies and the way to manage cities with a short-term vision render urban planning instruments inefficient, demonstrating extreme resistance in the acceptance by the public power that uses them in extreme cases to make feasible punctual projects.

The process of land use and occupancy starts with the licensing of the land subdivision (Land Subdivision processes), the procedure of dividing the land into legally independent units, with their own individuality, for purposes of edification, and can be done by subdivision and dismemberment. All subdivisions, should be integrated into the existing urban structure by connecting with the existing road system and the networks of public services, both existing and planned.

The quantification of areas to be donated to the municipality of Fortaleza, must comply with Law No. 5532/81, Codes of Works and Postures of the municipality, which sets out a total of 45% regardless of the activity and of zoning area in which the property is inserted, of which 20% will be intended for the street network, 15% for open areas (plazas, parks, gardens), 5% for institutional areas, and 5% for the land fund (housing of social interest), the latter may be donated at a different location.

In Fortaleza, the parceling of land has no relation with density, and is limited to an indication of the plots, the blocks, the road system and the areas to be donated to the state. In this stage, it should exclusively be informed the type of predominant use the subdivision is intended to; it is not necessary to submit any building design. The entrepreneur will carry out the approved subdivision and will be charged with the costs and construction of the entire infrastructure (except sewage treatment), but will not contribute for their maintenance. Finally, each plot in the approved subdivision is registered and notarized.

When the subdivision is duly registered, the entrepreneur will, in due time, assign use and occupancy of the property, and will define the activity and its size, provided that it adapts to the road system in which it is inserted and meets urban parameters for the area. It is common to have plot merging, approved normally with a minimum area, for the implementation of large-scale projects. It should be noted that once the project is approved and the building is erected, at any time a new use and occupancy may be approved, provided that the activity adequates to the road system, and meets the urban parameters.

Figure 1 shows the current scenario of a city portion inserted in Preferential Occupancy 1, proposed in the draft bill to be one of the Special Areas of Urban and social and Economic Dynamics - ZEDUS, which aims to introduce and/or intensify social and economic activities. This area is characterized by the availability of infrastructure and urban services and by the presence of buildings, not used or underused; and the intensification and acceleration of land use and occupancy. The scenario was devised using CityEngine software, with database of the city of Fortaleza.

The constructions, in their majority, represented in the color blue, are residential unitswith 1 to 2 floors. The buildings in yellow, are intended for commercial use, in general small stores. The color magenta depicts the public facilities, which are university, churches, hospitals, schools.

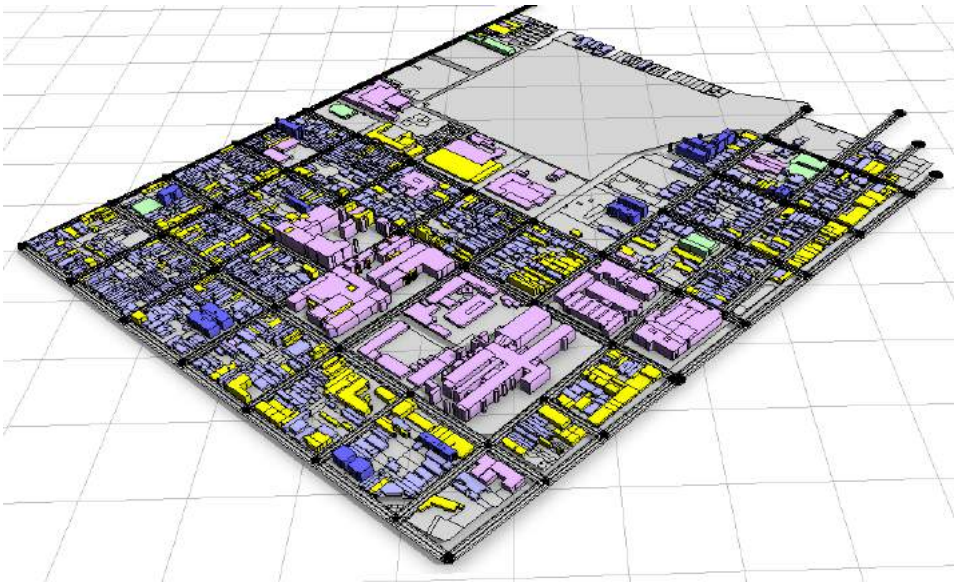

Figure 1 – Existing scenario

A simulation was performed, using the maximum urbanistic levels, given the rules of urban planning, in which only the public buildings have been preserved. The plots for small dwelling units and stores were unified, to allow for large-scale housing projects, with heights ranging from forty-eight (48) meters to seventy two (72) meters, complying with the setbacks of ten (10) meters mandated by the legislation for this activity. As a result, we have a large concentration of residential buildings a common feature in the neighbourhoods of the city that have been the object of urban development. In this area, the groundwater level averages a 2.00m depth, thus there should be a lowering of the water table in this whole area.

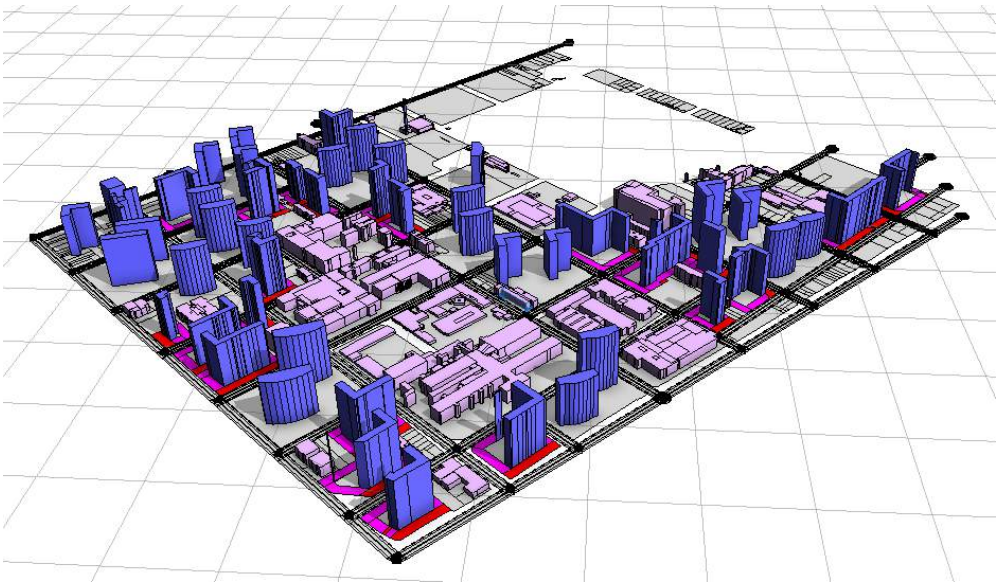

Figure 2 - Simulation

The large-scale initiatives illustrated in Figure 2, must be environmental licensing, in accordance with the environmental legislation Law nº 208, dated July, 15, 2015. The law classifies the works according to its size and its impact, and considers the conditions of the terrain, including the level of groundwater and the urban area in which it is inserted. For each type of work there are specific procedures for environmental licensing that are linked and have priority over urbanistic permits.

Environmental licensing is one of the instruments of the National Environmental Policy, Law no. 6,938, dated August 31, 1981, which allows the public to intervene preventively in carrying out works, plans and activities that could endanger the environment, requiring the prediction of potential damage and the

creation of conditions to minimize them, when unavoidable. It is, therefore, an instrument of preventive control, which can be accompanied both by the public and by society.

## 2.2 PLANNING AND MANAGEMENT IN LISBON

The establishment of a democratic regime in 1974 and the creation of the Local Authority after the enactment of the new Portuguese Constitution in 1976 was followed by a difficult period of legislation changes and planning practices at the local level. In the early 1980s it was obvious that the issue of clandestine occupancy and illegal urbanization had become a problem. It was clear that the legal system of production of dwellings at LMA was not coping with the influx of migrants from the hinterland and the former colonies, for whom urban growth was dysfunctional.

Only after the integration of Portugal to the European Economic Community (EEC) in 1986, in which a new law (DL69/90) mandated the municipalities to draw up Master Plans (PDM), a period of effective planning control, construction and urbanization supervision began. That Act was a milestone in Portugal, since it established that, for the municipalities to enter into contracts and programs with the government, with access to European funds for the implementation of infrastructure and facilities, they should have their Master Plan approved by the local planning authority.

After the new instruments were in place, one may observe the intervention of public administration, with the supervision and control of regulatory compliance with planning regulations for licensing. The city administration began enforcing the laws and regulations dictated by the plans. In general, besides these efforts in conducting the process, citizen participation was very limited.

The new Law of Bases of Public Policy, Planning, and Urban Development - LBPOTU defines the system of land use through land classification and dedication. Land dedication determines the use a given development is targeted for, and the distinction between rural and urban land use. Rural land is the one which, by their recognized vocation is destined for agricultural use, farming, forestry, conservation, enhancement and exploitation of natural resources, geological resources, or energy resources, as well as the land intended to become natural spaces, cultural, tourism, recreation and leisure activities or protection from risks, even if it is has infrastructure. Urban land is the area that is already fully or partially developed or built and, as such, has to have a territorial master plan for urban development.

Land dedication defines the content of exploitation by reference to the development potential of the area. The area of the Municipality of Lisbon, considers the degree of urbanization of land and the degree of morphological or typological consolidation, featuring the following categories: consolidated spaces and spaces to consolidate.

According to PDML (the Master Land Use Plan for Lisbon), land dedication is carried out through an integration of the following land categories, depending on the predominant use, mapped on the plan for dedication of urban space: central and residential spaces; areas for economic activities; green spaces; areas of special use for equipment; areas of special use for infrastructure; spaces of special use on the river waterfront.

In the Municipality of Lisbon, the Mayor's Office is charged with urban planning and urban licensing. Urban planning includes the implementation of the Municipal Master Plan, Urbanization Plan and the Detailed Plan, the latter may be by initiative of the public or private sectors and should produce regular reports.

The State, the Autonomous Regions and local authorities may acquire or dispose of real estate property to pursue the purposes of public policy. Among the plans implementation instruments envisioned in LBPSOTU, we have: the right of preference, right to surface, demolition, expropriation, and forced sale.

The operations of subdivisions may be carried out by public or private initiative. For the purposes of legalizing existing buildings, the operations of conversion of the Urban Areas of Illegal Origin (AUGI) will be a municipal initiative, or any modification of a subdivision licence issued prior to PDML entry into force. A Municipal Regulation approving the System of Incentives for Urban Operations with Municipal Interest is expected to pass in the future.

In 1998, the Law of Bases of Public Policy, Planning, and Urban Development - LBPOTU (Law 48/98, 11 August) introduced the principle of fairness in planning policy and urban development. In this context, equalization appears as a goal to distribute the benefits and costs of the plans among the owners and private promoters and local public administration. Decree 380/99, as Legal Regime of the instruments of Urban Management - RJIGT regulates the equalization and specifies the rights and duties with respect to plan implementation.

In the operations of subdivision, the land surface is intended for private use, and should comply with the rules for consolidated areas and areas being consolidated, which are specific to the Central and Residential Areas, and to the Areas of Economic Activities defined by law. The area is measured in sq. m., susceptible of construction, excluding those that will be transferred to municipal ownership, such as infrastructure, roads, green spaces, and areas of collective use. The donated areas are related to the built areas, therefore at this stage the architectural projects and building specifications must also be submitted for approval.

Land transfer to the municipalities for social facilities (due in the case of private subdivision projects), must comply with rules inscribed in each Municipal Land Use Master Plan or should follow what is prescribed in a general regulation that imposes approximately a quantity of land of 63sq.m. per dwelling for open and green spaces and other public facilities.

In the Master Land Use Plan of the Municipality of Lisbon, the Art. 88 says:

"1 - The parameters for measuring the areas to be transferred to municipal domain, for green spaces and collective use, in an area not covered by the detailed plan or per unit of execution that implement the equalisation mechanisms, are listed in the following table:

| | Area to yield per 100 m2 area of floor |
|---|---|
| Consolidated spaces, urban polarities (POLU) and areas of economic activities to consolidate | 30sq.m |
| Spaces to consolidate | 50sq.m |

Table 1 - Land transfer - Lisbon

However, among the 18 municipalities of LMA, there are a great variety of values for that parameter which is related, in part, with different land needs for social facilities and also with some competitiveness between municipalities struggling to attract investment.

Once approved the subdivision, it may be subjected to alterations, as long as they do not change the project's original concept. This ensures that the donated public areas are proportional to the density, ensuring the maintenance of the characteristics of the surrounding areas of the property, minimizing real estate speculation.

In Lisbon, the urban plans and programs are subject to an environmental assessment, in compliance with European Union policy 2001/42/EC. The preparation of an environmental assessment at the planning and programming levels ensures that environmental impacts are taken into account during the preparation of a plan or program and before its approval, thus contributing to the adoption of innovative and more effective and sustainable solutions, and control measures to prevent or reduce significant negative environmental impacts arising from the implementation of the plan or program (Decree-Law no. 232/2007).

According to Verocai (2002), since 1985, the European Union obliges all member countries to adopt and incorporate general standards of environmental impact assessment into their legislation. The goal was to solve a problem of competitiveness: the economy of some countries benefiting from environmental requirements that are less stringent than others. Until then, Portugal did not include environmental assessment procedures in the country's legislation.

The planning and environmental licensing is under the responsibility of the Portuguese Environmental Agency, which since 1985 is under the influence of the directives of the European Union, which took environmental management to a scale that was higher than urban management. The Municipal Land Use

Master Plans, the Urban Development Plans and the Detailed Plans are now subject to environmental assessment, thus ensuring the operations of subdivisions.

## 3 RESULTS

Planning and urban management in Fortaleza presents a flexible model of city, allowing changes in the use and occupancy at any time, after subdivisions occurred.. The small dwelling units make room for large projects, whenever there is an upgrade of an area due to infrastructure works, for example, which increases the buildings' value making them vulnerable to real estate speculation.

The lack of a demand for a definition of buildings in housing developments, makes this type of transaction a simple procedure, favouring a rapid growth of the city's urban mesh, including the areas devoid of sanitation infrastructure. In Fortaleza and in its metropolitan area, the lack of such infrastructure produces serious environmental impacts. Wastewater does not receive adequate treatment in places where there is no public collection and often they are discharged in lakes or rivers, thus polluting the environment. In poor areas, wastewater accumulates next to the housing units, and cause disease outbreaks and contaminate the resident population.

The public areas transferred at the time of the subdivision of land operations in Fortaleza and Lisbon under different rules, let's look at their application in an area of 10 Hectares:

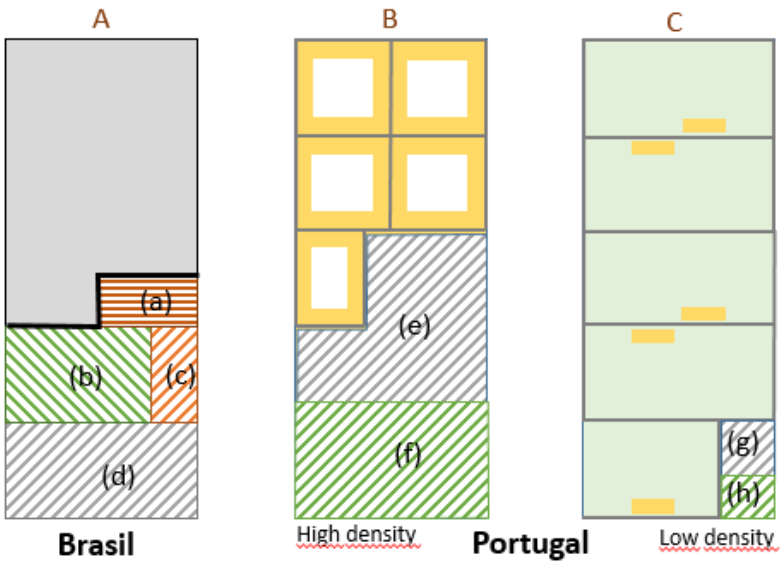


Figure 3 - Different quantities of land dedication which is required for the approval of the development by the local planning authority

Figure 3 illustrates a subdivision in Fortaleza. The remaining area is 55% and the area to be transferred to the municipality is 45%, where "a" corresponds to 5% of Land Fund, "b" corresponds to 15% of Green Areas, "c" corresponds to 5% of Institutional Area and "d" represents 20% of Road Network.

Plates B and C of Figure 3 illustrate an area to be subdivided in LMA (considering the rules of the general law) in areas with high density (about 80 dwellings/Hect) and low density (3 dwellings/Hect), respectively, in which the areas to be transferred are proportional to the built area, being 35 sq.m/120sq.m for Social Facilities 28m2/120m2 for Green Spaces. In drawing B, the areas assigned "e" and "f" are 52.5%, with the remaining area of 47.5%. In drawing C, the areas "g" and "h" totalling 5%, and the remaining area are equivalent to 95%.

Land donations in Fortaleza are equal to those of Lisbon, when they occur in areas of high density; however in Fortaleza the utilization index in some areas can reach a value 3.0, which means that it can be built three times the land area, while in Lisbon, the utilization index does not exceed the value of 1,5. Thus, the areas granted in Fortaleza are undersized when compared to those in Lisbon, especially when the neighbourhoods increase in value and go through subsequent changes of use in buildings.

In Lisbon, the availability of infrastructure in the municipality, the unchanged density and characteristics of buildings in areas already built, the predictability of density in other areas favour a more accurate urban planning. The plans and programs are subjected to environmental assessments, which safeguards the operations of subdivisions, and it is not necessary to issue an individual environmental license to each building.

The urban planning, carried out in a 1:20,000 scale in Brazil, does not distinguish natural characteristics of the terrain, when making the definition of urban and zoning parameters. In turn, the lack of a definition of activities, their size, building typology and urban form, in the Land Subdivision Processes hamper the environmental assessments and make extremely difficult any planning tentative to control / guide or influence a more general and comprehensive urban form. Environmental licensing is done separately for each large size development, not allowing for an integrated larger scale view, which is essential for the analysis of environmental impacts. Lowering the waterbed in a plot may not cause consequences, but on a larger area it may cause irreparable environmental impacts, as well as damage in surrounding buildings, as is the case of Fortaleza, in which public services, such as hospitals and universities are in place.

As a result of the transformation in regions that have experienced real estate appreciation in Fortaleza, one may observe a large concentration of residential buildings, shaping a common scenario in the neighbourhoods of the city, once the adequacy of activities is related to street classification. The 10-meter setback requirement for these large-scale developments creates private leisure facilities and reduces the need for the use of public spaces, resulting in a loss of identity of the region and decreased community interaction.

In Lisbon, the buildings are approved in tandem with the operations of subdivisions and are under the responsibility of the developer, therefore the areas to be subdivided become smaller than in the city of Fortaleza. The smaller the area of urban intervention the greater the accuracy of planning and distribution of public areas and the best is the management of these areas.

The planning models of the municipalities that comprise the metropolitan areas have similar urban planning systems and environmental issues as those of the capital cities, following national guidelines. The legal and licensing procedures are similar in Lisbon and Fortaleza, thus exacerbating the urban problems, and causing environmental damage in an even larger scale.

## 4 CONCLUSIONS

Lisbon metropolitan area and the metropolitan area of Fortaleza present historical, economic, social, environmental, and geographic differences related to the integration with their municipalities, but the comparison of these two areas allowed for an understanding that enhancing the integrated urban planning and environmental management will result in a more balanced relationship between the cities that integrate those areas.

The low investment made in Fortaleza Metropolitan area reflected quickly in the reduction of the participation of Fortaleza in its metropolitan area, with a trend to a slight drop in population growth in the metropolis. In Lisbon, the population is currently stabilized, which in turn intensified the economic and housing activities in the neighbouring municipalities, thus demonstrating how Portugal responded to the great immigration caused by industrialization, which occurred in the same period in the two countries; Portugal is ahead in planning and urban management when compared to Brazil.

There are great cultural differences despite their common origin, in Brazil cities are recent and seem to have a stronger liberal attitude in terms of urban control, perhaps due to US proximity and cultural influence which makes a low preocupation to the control of urban form. Moreover there are the very high migration flows, from the rural interior to cities and consequently, the difficulty to control land use and respond to the social needs of affordable housing producing it very quickly, in short periods of time, by local authorities or private entrepreneurs.

In view of those findings, we sought to deepen our research in the city of Fortaleza, where the lack of an integrated urban and environmental planning brings conflicts in the administration of the territory, by means of licensing, supervision and control. The territory of Fortaleza, which is a result of so many

subdivisions could bring down the scale of urban planning and prioritize interventions in areas where there is a greater trend for transformation and urban development.

The Master Plan of the Municipality of Fortaleza envisions the creation of Special Areas of Urbanistic and Socioeconomic Dynamics - ZEDUS, through a delimitation of portions of the territory for

the deployment and intensification of social and economic activities taking the local diversity into account, and pursuing the principle of sustainability.

The Master Plan recognizes the ZEDUS as areas with potential for the deployment of plans and strategic projects of socioenvironmental development. Therefore an opportunity for an integrated planning, in which the public authority can use the instruments for land management provided by the legislation, that is, expropriation, the environmental impact studies; instruments of land regularization; right of pre-emption; right to surface; urban operation in consortium; real estate consortium; granting the right to build.

The research will proceed with experiments in SIG3S, using software of Geographical Information Systems, including Arcgis, and urban simulation, Esri CityEngineTM, software for three-dimensional modelling expertise in urban environments, by means of survey data, on-site observations, technical studies and research in areas proposed by the administration to become ZEDUS.

The use of the GIS3D appears in this case as an important planning tool, allowing from an expert point of view:

- Improve the rules of construction and urban development defined in the plan, through simulation and its technical validation of its 3D impacts in the urban form;
- Improve the integration of these rules with environmental rules, which often involve restrictions on land use or construction;

And from the public participation point of view:

- Improve people awareness of the 3D effect of the proposed urban and environmental rules, allowing their comparison and verification with the current occupation (licensing) that is taking place.

## BIBLIOGRAPHIC REFERENCES


Ugeda Junior. Landscape planning and urban planning: REFLECTIONS ON THE BRAZILIAN urbanization, Mato-grosso Magazine of Geography - Cuiabá - v. 17, No 1 - p. 101 - 116 - jan/feb 2014

Muniz, P. Agatha. 2006. The master plan as a management tool in the city. Dissertation (Masters Degree in Architecture and Urbanism) - Federal University of Rio Grande do Norte. Fortress, 2006.

De Souza, Eudes André Leopoldo. 2015, the expansion region of Fortaleza: shafts, levels and scales in the production of space. Universidade Estadual do Ceará - UECE. Available in File:///D:/My%20Documents/Downloads/543-3583-1-PB.pdf. Free in February 2017.

The Metropolitan Region of Fortaleza. In: Wikipedia: the free encyclopedia. Available in: Https://pt.wikipedia.org/wiki/Regi%C3%A3o_Metropolitana_de_Fortaleza. Free in February 2017.

Brazil. Institute of Brazilian Geography and Statistics (IBGE). Preliminary Synopsis of Demographic Census 2010. Rio de Janeiro: IBGE, 2011.

Brazil. Status of the Metropolis approved by the Federal of 13,089, 12 January 2015. Available in Http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/l13089.htm. Free in May 2017.

Mayor of Lisbon. 2016. The economy of Lisbon in 2016 numbers. File:///D:/My%20Documents/Downloads/economics do Rosário DE LISBOA_FIGURES_2016_issuu.pdf. Free in February 2017.

Higgins (Portugal). In: Wikipedia: the free encyclopedia. Available in: Https://pt.wikipedia.org/wiki/%C3%81rea_metropolitana_(Portugal)

Mayor of Lisbon. 2009. Report of the State of Spatial Planning REOT 20 January 2009 Preliminary version. Available in Http://habitacao.cm-lisboa.pt/documentos/1238771502H3wEM6vm9Gj06TH8.pdf Free in February 2017.

CCDR LVT. 2009. "Finding the water supply sector, wastewater sanitation and solid waste management" available at http://www.ccdr-lvt.pt/pt/plano-regional-de-ordenamento-do-territorio-da-area-metropolitana-de-lisboa/54.htm. The procedure in February 2017.

Fortaleza. Participative Master Plan (PDP) of the alder fortress, Law No 62 of 02 February 2009. Available at http://portal.seuma.fortaleza.ce.gov.br/fortalezaonline/portal/legislacao/Alvara_Funcionamento/PDPFOR.pdf. Free in May 2017.

Fortaleza. Design of complementary law of fragmentation, land use and occupation of the city of Fortaleza. 2016. Available at https://urbanismoemeioambiente.fortaleza.ce.gov.br/images/urbanismo-e-meio-ambiente/servicos/projeto_de_lei_de_parcelamento_uso_e_ocupacao_do_solo.pdf. Free in May 2017.

Fortaleza. Law No. 208 of 15 July 2015. Features on the environmental licensing, creates the environmental licensing, simplified the licensing by Self, the characterization, and takes other measures. Available at: http://portal.seuma.fortaleza.ce.gov.br/fortalezaonline/portal/legislacao/Isencao_Construcao/LEI_208-2015_LICENCIAMENTO%20AMBIENTAL.pdf. Free in May 2017.

Brazil. National policy on the environment, Law No 6938 of 31 August 1981. Available at: http://www.planalto.gov.br/ccivil_03/LEIS/L6938.htm. Access on 10 Jan. 2017.

Verocai, Iara. 2002. Environmental licensing in other countries.Disponível em: http://www.mma.gov.br/estruturas/DAI/_arquivos/iaraverocai2.pdf, acesso em Fevereiro de 2017.