

## Household Waste Management: a preliminary assessment of urban planning solutions

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**ABSTRACT:** Currently, there are numerous challenges regarding the management of household waste. Since the city is an important pole of consumption of raw materials, it is also the main environment where most of the activities related to the management of this waste are performed. With new requirements resulting from the increased demand for services and infrastructure, urban planning should be directed to meet those needs. Primarily, urban planning should support the organization of the urban environment in accordance with its various features. This article aims to analyze and discuss the possibilities of including criteria for household waste management in urban policies. For this an urban area in the municipality of São Paulo, was adopted as a case study object in order to assess potential solutions related to the stages of household waste management. The analysis showed that there is a close connection between urban equipment and services directed to household waste management with the urban planning. Besides, the Strategic Plan and the Land Use Act of the Municipality of São Paulo leave gaps about strategies for spatial adequacy and provision of equipment for the management of household waste in areas of urban density, such as a lack of estimates of new ecopoints, sorting centers or modification of the collection system. The Building Standards Code, in turn, in its current version, also leaves gaps about the requirement of specific enclosures for waste storage in ordinary buildings, while does not define their size criteria.

**Keywords** *Urban planning, household waste management, urban policy, intersectionality, urban parameters, building parameters.*

## **1 INTRODUCTION**

The intense generation of household waste is one of the great challenges in urban management today, demanding the fulfillment of a set of steps, where the coordination of urban public services, the supply of equipment and adequate urban infrastructure combined shows its importance. On the other hand, the management of household waste, regarding to storage, collection, transportation, treatment and disposal, have to be specific to the characteristics of each municipality.

According to Fresca (2007), one of the main reasons for the increase in waste generation is population growth and changes in consumer habits, which has led to levels of increased generation. The amount of waste generated can vary depending on many factors, but primarily due to population growth. Therefore, when there is a greater waste generation, proportionally, there is a greater demand for public facilities and waste management equipment, involving an entire legal and institutional framework to support the management.

In order to adapt the urban space to the conditions of household waste generation and management, it is important that urban planning is related to the demands of waste management stages (SOUZA and SOARES 2014).

Therefore, this implies a general understanding of the coverage and enforceability of the instruments that rule urban development, where these mechanisms should consider the urban space in an integrated approach. In this sense, Beatley (2011) reports that, over recent decades an increase in efforts to implement organic or natural models in the design of cities has been seen and, according to this author, cities are, in many ways, "similar to organisms, since they require input material for their survival and generators of wastes, forming an interconnected and complex metabolism".

Within this context, this article aims to analyze and discuss the possibilities of including in urban policy, criteria for the management of household waste. For that, an urban area in the municipality of São Paulo is used as a case study object, in order to assess potential solutions related to the generation of steps, storage, collection and transportation, processing, transshipment and disposal of Household Waste.

## **2 METHODOLOGY**

The study was developed based on the analysis of technical characteristics described by norms, rules and operational procedures regarding the household waste management. The main instruments of urban planning of the city of São Paulo were also analyzed, highlighting the guidelines of population density for the defined study area.

Then an appeal to the Urban Cleaning Municipal Authority of the City of São Paulo (Amlurb) was performed, targeting the specific operating procedures of collection services, transportation, treatment and disposal of household waste in the relevant field. Lastly, the compliance of waste management stages within the study area was verified, through visits and surveys performed on site.

### 3 HOUSEHOLD WASTE MANAGEMENT

According to Tchobanoglous (1977) and Miller and Zveibil (2001), operationally, the Household Waste management system integrates the generation, storage, collection, transportation, transfer, treatment and final disposal steps of solid waste. Vilhena (2010) points out the following steps: "generation, segregation, storage, collection (conventional and selective), storage, transportation, and final disposal."

The generation of Household Waste is natural and inherent consequence of human activities, according to the still current development patterns. For Logarezzi (2004), this production is due to the consumption of goods and services. The conditioning is the stage that precedes the collection and is defined as the act of packaging the residues in plastic bags or in specific containers according to the collection and transport system (Leite, 2006). In the generation and conditioning activities, the citizen is involved directly, while in all other stages their involvement is indirect (LOGAREZZI, 2004).

According to Massukado (2004), in Brazil, the collection is mostly performed by the system "door to door", that is, the waste is collected at source, in each household. The collection team gathers the waste that are disposed along the way, placing it directly in the vehicle collection. In this model, also known as manual collection, the collector vehicle is obliged to pass through a set of routes, collecting the household waste in a local, linear and distributed way.

The transfer preprocessing (separation for reuse or recycling, for example) and/or treatment (composting), are further steps which can be performed in an urban environment, including the range of the neighborhood or district. According to Mansur and Monteiro (1991), transfer or transshipment stations are places where the collection vehicles unload their cargo in vehicles with greater capacity so that, later, it is transported to the final destination. For Vilhena (2010), the transshipment or transfer stations are intermediate points where the collected waste is transferred from the medium-sized vehicles, used in the collection, for larger vehicles. This infrastructure equipment is justified when there is a great distance to be traveled between the collection area and the waste disposal site, causing a reduction in productivity of the vehicles due to the idle time spent in commuting to the point of discharge and return to the sector. Therefore, in such case, the purpose of these stations is to reduce the time and transportation costs.

Monteiro and Zveibil (2001) define the treatment of household waste as a series of procedures that reduce the amount or the pollution potential of solid waste, by preventing the disposal of this waste in the environment or inappropriate site or turning them into inert or biologically stable materials.

In Brazil, the three usual disposal of waste forms are the illegal landfills, controlled areas and sanitary landfills. Among them, compared with the definitions and requirements of the National Solid Waste Policy, established by Federal Law No. 12,305, dated 02 August 2010, only sanitary landfill is considered an environmentally appropriate manner, the others will be extinct by 2014 in the country (BRAZIL, 2010).

In this regard, it appears that several stages of management of household waste are held in the urban environment. Thus, there is the need to develop strategies and solutions in

urban planning tools that support this management, especially in case of population density, since this factor will result in an increased amount of waste.

#### 4 DIAGNOSIS OF THE APPLICATION OF THE URBAN PLANNING GUIDELINES AND HOUSEHOLD WASTE MANAGEMENT IN BELENZINHO DISTRICT, SÃO PAULO CITY

The study area is located in the Belenzinho neighborhood District of Belem Subprefecture of Mooca, East Zone of São Paulo (SP). The perimeter of the area includes Av. Celso Garcia, Av. Salim, then follows parallel the subway line that connects the east of the city with the center and finally follows the Bresser Street. The study covers an area of 188.5ha with a total population of 20,000 inhabitants (IBGE, 2010a). Figure 1 below shows the boundaries of the study area (red line) and its location relative to the city of São Paulo.



Figure 1 – Case study area: Belenzinho neighborhood, in Sao Paulo

Source: Authors (2016)

It is an urban area with a variety of land use. On the one hand, it includes many obsolete buildings, like old manufacturing facilities, which at present are in disuse (Figure 2). Moreover, due to its location next to the city center, and due high capacity urban transport availability in the region, the area in question goes through an accelerated process of real estate development and vertical integration. Currently, multi-family buildings of high standard as shown in Figure 3 below have already taken some blocks. Nevertheless, the region includes a large number of single-family residential properties in use, mainly in the area around Av. Salim Farah Maluf. The area also has road infrastructure already consolidated, with paved roads and in good storage conditions, predominantly classified as non-structural (SÃO PAULO, 2014, Paragraph 2.).

From the point of view of urban planning instruments, Belenzinho neighborhood is located in the Eastern Arc of the Metropolitan Structuring Macroarea, according to the São



Paulo Strategic Master Plan (PDE), established by the Municipal Law n° 16,050, of July 31, 2014 (SÃO PAULO, 2014). The sectors constitute territory levels for which there are specific goals of urban development, besides having strategic role in restructuring the municipality for having great potential for urban transformation.



Figure 2 - Obsolete buildings (Celso Garcia Avenue)

Source: Authors (2016)



Figure 3 - High standard multi-family buildings (Cotegipe Street)

Source: Authors (2016)

The Belenzinho neighborhood also participates of the existing and planned Urban Transformation Structuring Axes, which includes tracks of influence of the structural system of collective transport, crossing the macro areas (SÃO PAULO, 2014). These PDE directives lead to greater population density of the study area, evidently justifiable when considering the current population density (Figure 4) is low, compared to the availability of installed infrastructure and proximity to the central regions of the municipality.

Regarding the household waste management, according to Amlurb (2016), the region is served by the concession holder Environmental Logistics (Loga), contracted by the Municipality of São Paulo to carry out the home collection service (conventional and selective/differential) in the northwest grouping of the municipality, which includes the area of study. With respect to conventional collection, the study area includes two sectors collection with daily frequency and operation at night. In the selective collection, a single sector covers the study area and a few adjacent streets, are held every Wednesdays, during the day (AMLURB, 2016). In addition to collecting door to door the study area has two ecopoints, which are voluntary waste delivery sites. The first is located on Bresser Street and occupies an area on the side of the Viaduct Bresser, the second is in Arthur Mota Street, under the viaduct Guadalajara (SÃO PAULO, 2016b).

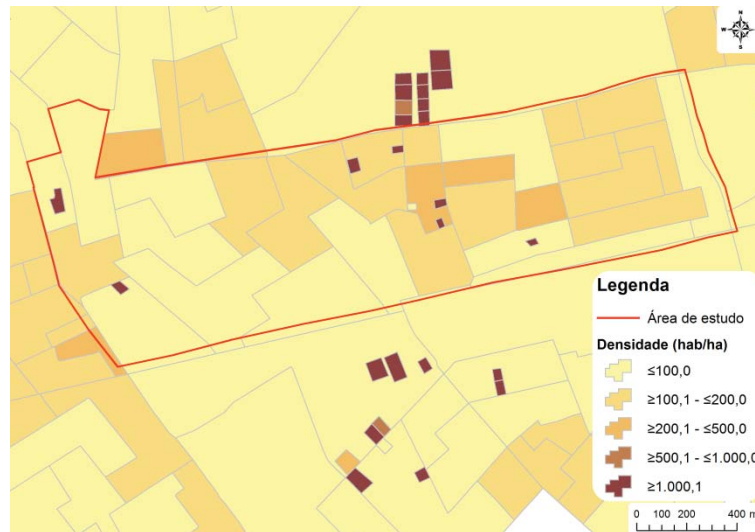


Figure 4 - Current Demographic density in the study area

Source: Authors, based on IBGE (2010b)

In conventional collection after gathering the waste these are transported by the collection truck to the Transshipment Ponte Pequena, located on State Avenue # 300, Bom Retiro neighborhood, Sao Paulo city, about 9 km away from the study area where are subsequently transferred to higher capacity equipment that will lead the residues to the sanitary landfill “Caieiras Solid Waste Treatment Center”, located at km 33 Bandeirantes Highway, approximately 28 km away from Transshipment Ponte Pequena (AMLURB, 2016).

In the selective collection, recyclable residues are sent directly to 21 waste pickers cooperatives associated with the City of São Paulo (AMLURB, 2016).

#### 4.1 Diagnosis of potential solutions in urban planning for the household waste management in Belenzinho the district of São Paulo

The population density leads to a larger amount of generated waste, which needs to be administered in urban space. According to the Municipal Integrated Plan of Solid Waste of São Paulo (SAO PAULO, 2014b), in the North West group, which belongs to the study area, the per capita generation of waste is 1.23 kg / person per day. That is, every day, 24.6 tons of waste is generated in the study area, which must be properly conditioned during the period that elapses between collections, according to their physical characteristics of subsequently they are collected and transported to the correct locations of treatment and disposal.

Assuming a larger population density, which is foreseen in urban planning instruments of the City of São Paulo, the amount of waste to be managed in this urban area will certainly be greater, increasing systemically the need for equipment, infrastructure and appropriate services for the new generation standards.

In the packaging step, the enclosure for the waste conditioning is the urban equipment assigned to the management of household waste, which must be ruled through urban planning tools. In the conditioning step, the structure for packaging the waste is the urban equipment assigned to the household waste management which must be ruled through

urban planning tools. In the neighborhood of Belenzinho, there is a high number of multi-family residential buildings, where it is observed that the enclosures for the custody of household waste have different design characteristics, location and access. Some of these enclosures or rooms presents interferences, such as other urban equipment installed in the path, resulting in an obstruction to access the collection services, such as bus stops, trees and parked cars. From the point of view of regulation, the Building Standards Code of the City of São Paulo is the instrument responsible for regulating the design and construction of buildings, but does not provide specific guidelines for the construction of cover and standardization of these enclosures and rooms, according with the characteristics of solid generation in the respective projects (SÃO PAULO, 1992). The Law of the Sidewalks (SÃO PAULO, 2011), and the Parceling and Land Use Act (SÃO PAULO, 2016), which are the main setting instruments of urban road space also not explicit about the conditions for adjustment facing requirements or storage conditions or collection of household waste. In Figure 5 and Figure 6 some of these enclosures, their differences and obstructions can be seen.



Figure 5 - Enclosures of buildings for RD conditioning within the study area

Fonte: Source: Authors (2016)





Figure 6 - Enclosures of buildings for RD conditioning within the study area

Source: Authors (2016)

Regarding the domestic garbage collection, the largest generation of residues will certainly also affect the collection project. According to Carvalho (2001), "the collection project is dynamic and should be regularly monitored aiming observe whether there is variation of waste generation in each sector". Lastly, considered that operating sectors are sized based on the capacity of residues collection equipment, the population density will lead to the reduction of the perimeter of the collection sectors in each region and consecutively to increase the number of sectors because the region will have a greater amount of residues to be collected, increasing possibly the operating cost of the service

## 5 CONCLUSION

It is noted that there is a close connection between the urban infrastructure and services geared towards management of household waste with the planning of urban areas because all steps that waste will experience mandatorily happen within cities.

The PDE and the Parcelling and Land Use Act of the Municipality of São Paulo, despite being clear about the objectives of encouraging the population density near the mass transport routes, thus improving urban mobility at the same time, fail not presenting any strategies to the impacts of such densification in the management of household waste.

The Building Standards Code, in turn, has not been amended in accordance with the guidelines and objectives of the PDE and the Land Use Act yet. Its current version, however, leaves gaps to only establish the obligation of construction of these shelters in buildings for custody of household waste in the period that elapses between collections. This shelter must minimally have their space dimensioned according to the stage that precedes packaging, ie the generation, but this does not happen in current scaling. Moreover, aiming at a better use of waste regarding its different fractions, the shelter construction features must be integrated into the collection services performed in the



study area, requiring that they be designed and constructed to accommodate minimally waste for conventional and selective collection.

Finally, as the urban planning instruments establish the population density of the study area, as well as many other urban neighborhoods in São Paulo, the PDE should also indicate guidelines regarding the number of ecopoints increase in region and / or existing retraining, since both urban equipment for the voluntary delivery of waste to the effect of densification, will become insufficient.

In this case, the challenge is a new redistribution of ecopoints within the study area, following some specific criteria, since there is a cause and effect relationship between the urban parameters and the management of household waste in the study area.

The first criterion to be followed would be the positioning of ecopoints. The urban equipment has a maximum radius of influence, as from a distance, due to excessive displacement, the generator will not lead over their waste to the same and, therefore, the planning process should be considered the location of equipment, establishing a maximum distance limit between ecopoints.

The second criterion to be observed by the urban planning instruments would be the equipment area, which should vary as a result of population density of the area of influence, where it is understood that the greater the number of people served by the location, the greater the need for usable area for packaging waste.

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