Inclusive Urban Sanitation Stories

Sanitation in unauthorized areas, Brazilian cases

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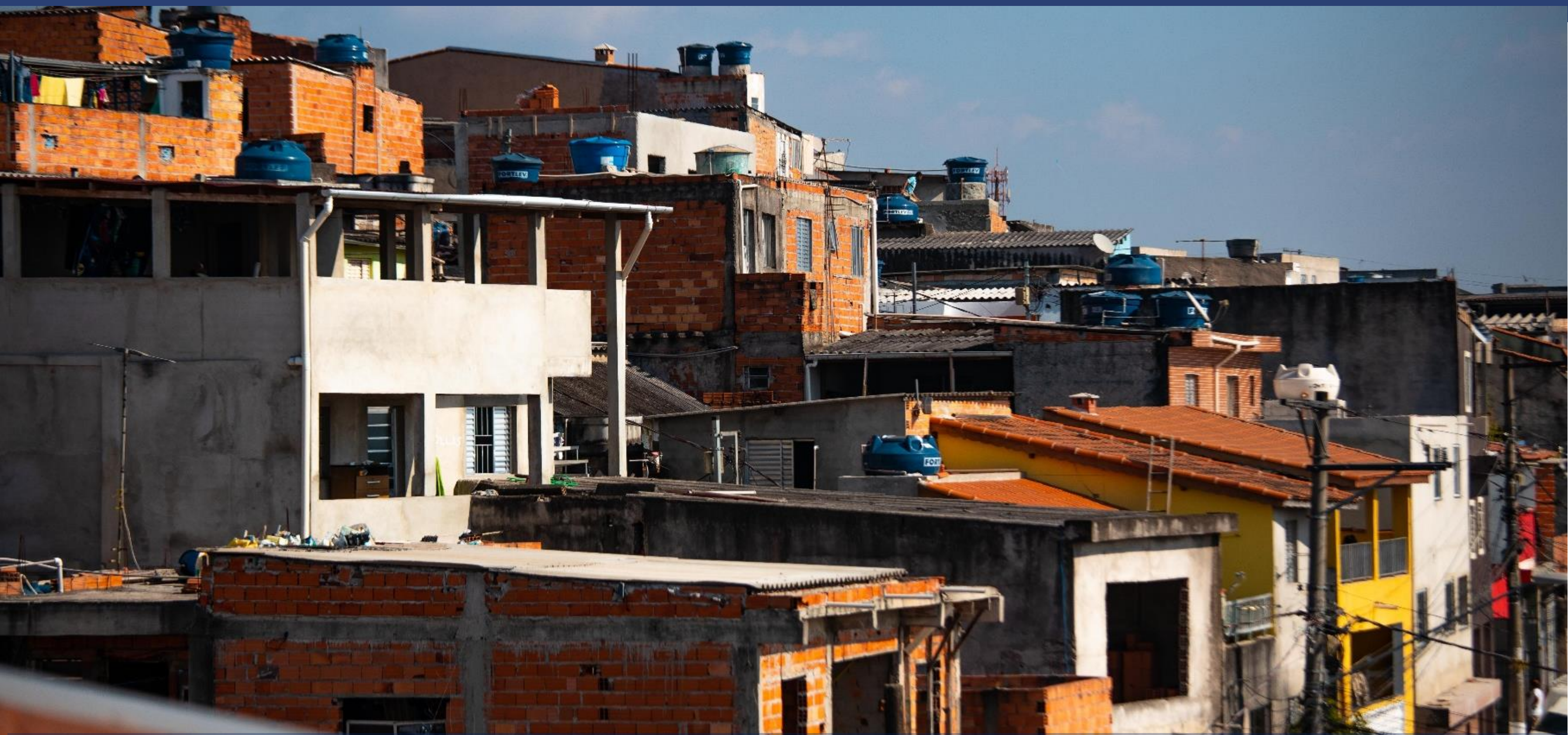


Figure 1 – Foto tirade na regiao do Grajau. Source: Danilo Alvesd

Summary

The city of São Paulo has 11,451,245 inhabitants and is the largest state capital in Brazil, according to the IBGE Census (2022). Its metropolitan region has about 22 million inhabitants, but there are still many areas with informal urban occupation, not legally authorized by municipal governments. In the capital of the State of São Paulo alone, there are about one million inhabitants in these areas of unplanned urban occupation, that is, informal settlement. Providing sanitation services has been a major challenge, not only because it depends on the regularization of the ownership of these areas, many of which are invaded, but also as a sanitation engineering solution. Techniques are needed that go beyond the usual Brazilian engineering standards. Two real cases are presented here: the implementation of a sanitary

sewage collection network in the Pinheiros River Basin and a rainwater drainage solution in Jardim Piratininga. Both occupations are in the municipality of São Paulo, but the sewage treatment plant is located downstream in the metropolitan municipality of Barueri, which receives sewage from a large part of the city. The organized participation of the population was fundamental in making it possible in both cases to install both the sewage collection network in the Pinheiros River Basin and the rainwater drainage system in Jardim Piratininga. The contracting process of the works and their unit costs are also briefly presented. The photo shows an example of informal occupation next to a canal that forms part of the Tietê river, the largest that runs through the São Paulo Metropolitan Region.

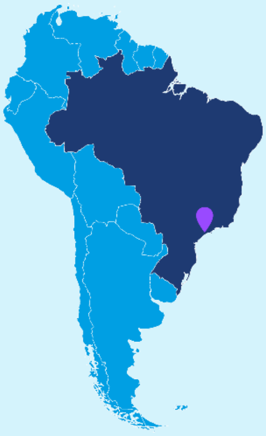
Overview

Geographical information

Country: Brazil

City: São Paulo

City population: 11,451,245



Problem

- São Paulo had less than 100,000 inhabitants around 100 years ago, but with industrialisation, the population grew very sharply. Basic sanitation infrastructure (water supply, sanitary sewerage, urban solid waste, and rainwater management) has not kept up with this growth.
- A few hundred thousand inhabitants who do not have a sewage collection network, so they live in an environment of polluted waters and are subject to waterborne diseases. In addition, this population suffers from flooding problems, because in general they have occupied vulnerable areas such as floodplains of the Tietê river and its tributaries.

Solution

- Traditional engineering solutions, adhering to Brazilian standards, are applied in planned urban areas, requiring resources for sanitary sewage collection networks.
- Social mobilization in informal urban areas before surveying, with input from social workers and sociologists, leading to iterative design changes based on field contingencies.
- Design of drainage networks to solve the surface runoff.

Problem

The Pinheiros river is one of the main tributaries of the Tietê river and drains an area of about 300 km^2 where about 4 million people live Figure 2. Around 1 million live in unplanned areas without sewage collection; therefore, sewage is untreated and discharged directly into the water network of the river basin. This population is divided into 533,000 residences that now have their sewage sent to the Barueri treatment plant (ETE Barueri). Although it was close to planned urban areas and had a sewage collection network, the population did not have access to it, so they lived with these polluted and contaminated waters, jeopardizing their health. The irregular street layout, the occupation of the banks of the water network and the lack of space made it impossible to implement the usual engineering solutions, so it was necessary to go beyond the usual techniques to serve this disadvantaged population.

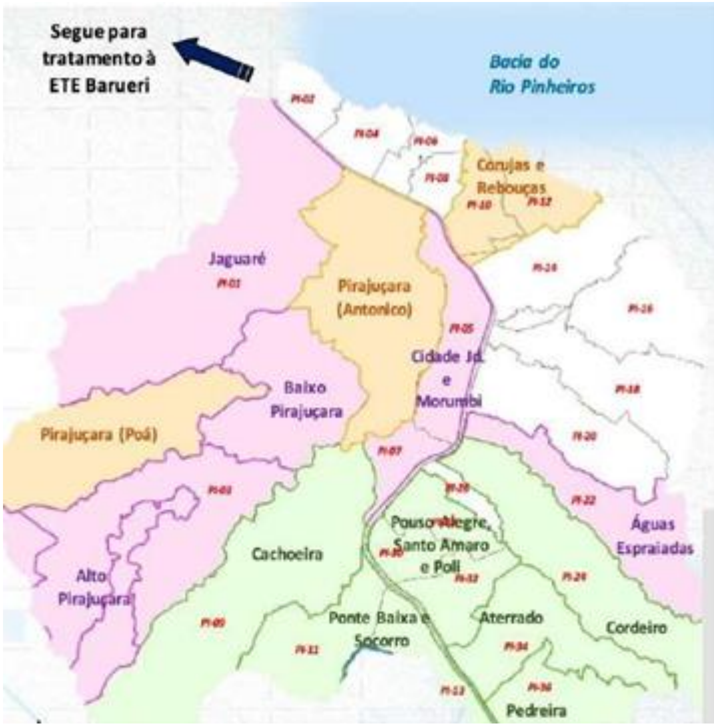


Figure 2 – Pinheiros river basin. Source: Sabesp.

In Jardim Piratininga, which has a sewage collection network, there are problems with water pooling and flooding. Studies by the Mackenzie School of Architecture and Urbanism (FAUM) team indicate that the flow generated by the neighbourhood is of the order of 1.0m^3/s, so that the study design, also prepared by the same team for micro-drainage, shows that the conventional design is sufficient. In other words, implementing surface and underground micro-drainage, consisting of manholes and culverts, in the stretches determined by the design study is enough to handle the rainwater generated in the neighbourhood itself. The studies also indicated that if compensatory techniques such as small retention and infiltration basins were used, it would be possible to reduce conventional microdrainage.

The position of the neighbourhood in the floodplain of the Tietê river, at a low level in relation to other neighbouring lands, also indicates that there is still a third water souce: the one that comes from the high points and, in this case, the Cangaíba hill Figure 3. The team's hydrological studies have shown that there are four rainwater drainage basins that produce maximum flows to Jardim Piratininga that vary from around 2 up to 13 m^3/s, when considering the contribution of the four basins that make up the Cangaíba hill.

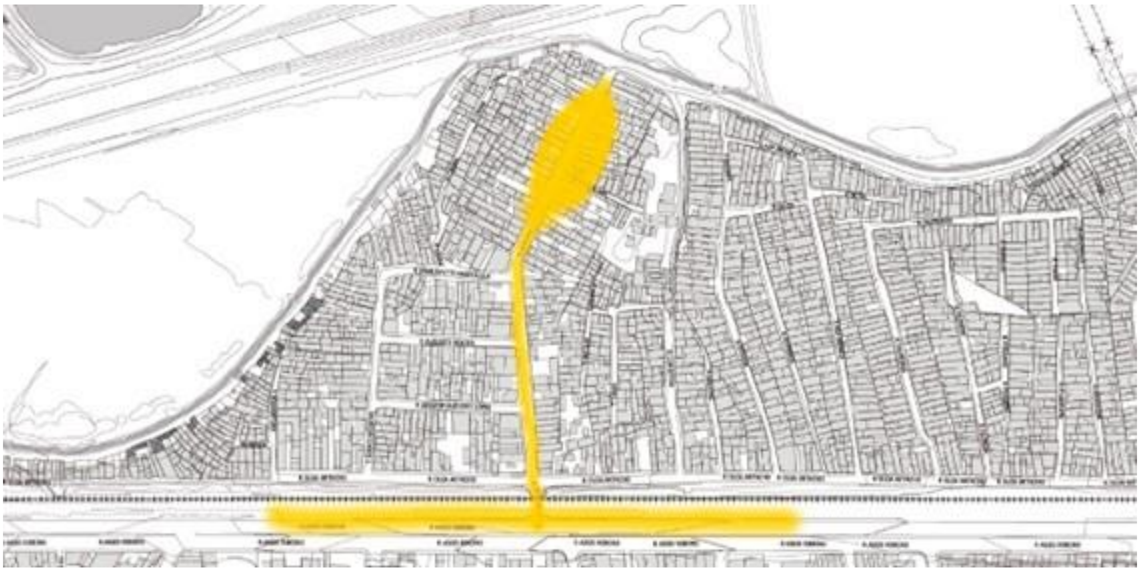


Figure 3 – Area that suffers from floods coming from the Cangaíba hill. Source: FAUM research team.

Solution

In order to implement a sewage collection network, preliminary actions were prepared for the Residents' Assocition, so the detailed social work preceded the engineering project. A preliminary assessment was made of how many sewer connections should be made; then, through strong social activity, the local conditions were verified, and solutions were discussed so that the engineering project could then be developed and implemented. Even during the execution of the work, it was common to return to the office to adapt the project, and usually this office was located at the construction site itself. Therefore, the sequence of implementation of the sanitary sewage collection network was not followed, in which the topographical survey, soundings and then the project were carried out first. Irregular occupation as shown in Figure 4 and 5 is very dynamic and depends on social conditions, so the design and execution of the work need to follow it.

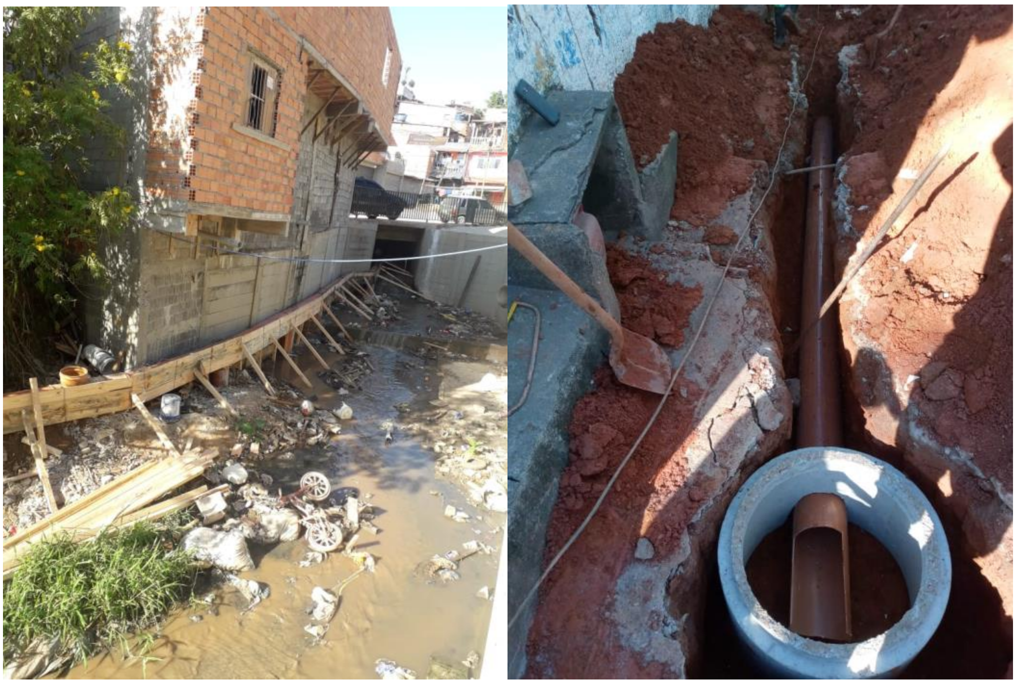


Figure 4 – Irregular occupation and implementation of a sewage collection network. Source: author

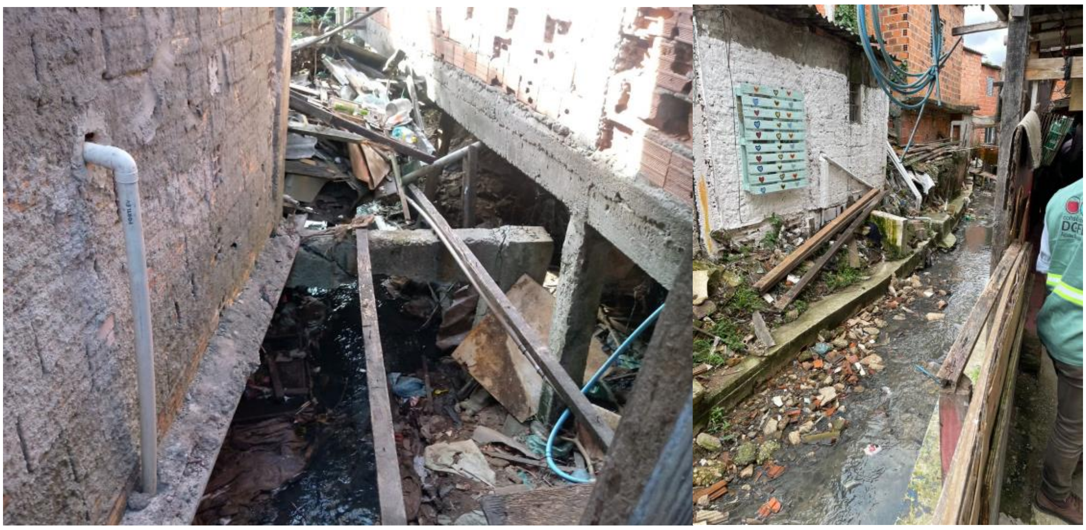


Figure 3 – Irregular occupation and implementation of a sewage collection network. Source: author

The implementation of the collection network took place when the field conditions allowed. A bidding process was made for the execution of the works and the construction companies would be paid according to the performance clause, that is, they would receive bonuses for achieving the goals of building connections executed, but also for the reduction of organic load measured by the Biochemical Oxygen Demand (BOD) in the watercourses.

The investments were in the order of R$1.7 billion, which corresponds to about R$3,000 per residence connected to the Sanitary Sewage System of the Pinheiros river basin. This figure includes five Quality Recovery Units (QRU), which are nothing more than treatment plants installed in the watercourses themselves, given that in some situations urban occupation has left no space for the installation of a collection network or trunk collectors.

A drainage solution was dimensioned and budgeted, considering as alternatives the entire contributing watershed and only the neighbourhood itself.

- Alternative 1, the entire hydrographic basin, from the watersheds on the Cangaíba hill, a 200m concrete channel cast ‘in situ’. A unit cost equal to R$5,000 per meter was preliminarily submitted. Total cost: R$1,000,000.
- Alternative 2, contribution area of Jardim Piratininga only. The design led to an all-round prefabricated reinforced concrete with a diameter of 1.0m and a length of 800m. A unit cost equal to R$300.00 per meter was preliminarily submitted. Total Cost: R$ 240,000.

The differences are significant, so that the diversion of water from the Cangaíba hill is essential to avoid the problems arising from rainwater faced by the population of Jardim Piratininga.

The origin of these funds is from the municipal budget and the work is in the approval phase, but social participation proved to be fundamental for the necessary progress to be made. During the working out of the engineering project, it was presented, discussed and approved by the residents and their leadership. The university's participation in technical support and contribution to social mobilization was fundamental, so that the usual logic of engineering projects was reversed: first the solutions and the design of the rainwater gallery were discussed with the population, and then the project was developed.

Lessons learned

The implementation of rainwater and sanitary sewer networks brings many more challenges and difficulties in unplanned urban areas, one of the main causes being their flow regime, that is, by gravity as a free conduit. Often there is no space in the low-lying grounds other than to pass through the watercourse bed or through galleries, alleys, etc. Engineering solutions need to respect the intense social dynamics that occur in these areas occupied without planning, unlike regular areas such as defined urbanization, to which it is possible to apply Brazilian engineering standards. Social participation and a process of consultation and proposition are necessary for the solution to be actually implemented, which meets the objective of universalizing the provision of sanitary sewage services. University institutions have a key role in the social validation of sanitation solutions with a view to their impartiality and independence. It is also their responsibility to disseminate the solutions that are effective so that they can be applied in other cities in the most diverse countries.

Useful links

https://cidades.ibge.gov.br/brasil/sp/sao-paulo/panorama

https://www.sabesp.com.br/site/Default.aspx

https://novoriopinheiros.sp.gov.br/

https://www.abnt.org.br/

Further reading and references

- Associação Brasileira de Normas Técnicas. (1986). NBR 9649: Projeto de redes coletoras de esgoto sanitário. Rio de Janeiro, Brazil.
- Brazil. Law No. 11 445 of 5 January 2007. Establishes national guidelines for basic sanitation. 2007. Brasilia, Brazil.
- IBGE. (2010, 2022). Census Tracts. Brazil.
- Giansante, AE and Pauli, DR. (2018). Ligações na rede em assentamentos precários: o caso do Jardim Piratininga, AIDIS, Guayaquil.
- Instituto Trata Brasil. (2015). Pesquisa Saneamento Básico em Áreas Irregulares do Estado de São Paulo. São Paulo, Brazil.
- Obraczka, M. and Leal, IF. (2015). Relação entre as ligações domiciliares de esgoto e a real abrangência do sistema de coleta: o estudo de caso de Barra do Piraí, RJ. XXI Simpósio Brasileiro de Recursos Hídricos. Brasilia, Brazil.
- Saito A and Claro M. (2017). Planos de Bairro: a democracia participativa no planejamento urbano do município de São Paulo. XIII Jornada da Iniciação Científica, Mackenzie Presbyterian University, São Paulo, Brazil.
- SABESP. (2015). Norma Técnica SABESP 217 – Ligação predial de esgoto. São Paulo, Brazil.
- Santos, IPF dos. (2014). Estudo de alternativas para concepção de sistema de esgotamento sanitário em áreas isoladas, conforme metas 35, 36, 37 e 38 do Plano de Saneamento Básico de Florianópolis/SC. Final course work. Florianópolis, 2014.
- São Paulo. (2009). Law No. 14 934 of June 2009. Creates the municipal fund for Environmental Sanitation and Infrastructure. Prefeitura Municipal de São Paulo, São Paulo, Brazil.
- Sâo Paulo. (2012). Government sanctions law creating the Se Liga na Rede programme. Available at http://www.saopaulo.sp.gov.br/spnoticias/ultimas-noticias/governo-sanciona-lei-que-cria-o-programa-se-liga-na-rede-1/ Accessed 20 May 2018.

- São Paulo. (2017). Decree no. 57 776 of July 2017. Regulates Law No. 16 642, of 9 May 2017, which approved the Construction and Building Code of the Municipality of São Paulo; defines the members of the Buildings and Land Use Commission – CEUSO. Prefeitura Municipal de São Paulo, São Paulo, Brazil.

About the author

Antonio Eduardo Giansante is a civil and physical engineer. Master and PhD in Water Resources and Sanitation Engineering. Full Professor at FAU Mackenzie and FESPSP (MBA in Environmental Sanitation). Visiting Professor at the University of Metz (France) and Politecnico di Bari (Italy). Author of about 50 technical articles. Technical Responsible and Coordinator of studies and projects in the area of environmental sanitation and water resources such as basin plans, municipal basic sanitation plans, executive projects of water supply, sanitary sewage, solid waste and urban drainage

About the institution / organisation

FAUM: Mackenzie School of Architecture and Urbanism. Undergraduate and postgraduate programmes. Research on urban planning and informal occupations. https://www.mackenzie.br/en/universidade

FESPSP: Foundation School of Sociology and Political Science of São Paulo. School with 90 years of activity working in public policies. Research in the area of sanitation, among others, and MBA in Environmental Sanitation in partnership with London College University. https://www.fespsp.org.br/

About the IWA Inclusive Urban Sanitation Initiative

IWA's Inclusive Urban Sanitation initiative responds to a huge and growing public need - safe sanitation in combination with access to safe drinking water and hygiene underpins good health. The aim of this initiative is reshaping the global urban sanitation agenda by focusing on inclusive sanitation service goals--and the service systems required to achieve them - rather than the traditional singular focus on expanding sewer networks and treatment works. This forms part of IWA's larger agenda to promote inclusive, resilient, water-wise, and sanitation-secure cities.

About the Inclusive Urban Sanitation Stories

The Inclusive Urban Sanitation stories are documenting some of the policies, practices, and approaches that demonstrate how stakeholders especially those in urban areas (e.g., public sector, operators, academics, regulators, and other key actors) are taking part or contributing to Sustainable Development Goal 6 which require water and sanitation concepts and norms to look beyond technology and the usual focus on building infrastructure. Increased focus is on safety, inclusion, environment, public health, and multiple technology solutions tailored to different geographies and socio-economic contexts for building climate-resilient cities. The stories aim to inspire urban stakeholders to discuss ways for advancing inclusive urban sanitation, especially in low- and middle-income countries.

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