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# LATITUDES INTERNATIONAL DESIGN CHALLENGE 2015-16

Better quality  
spaces between  
and in buildings:  
The case study of  
Paraisopolis favela

São Paulo 23°30'S  
Design Challenge



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Thematic Area:

Adaptation Design

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# Better quality spaces between and in buildings: The case study of Paraisopolis favela

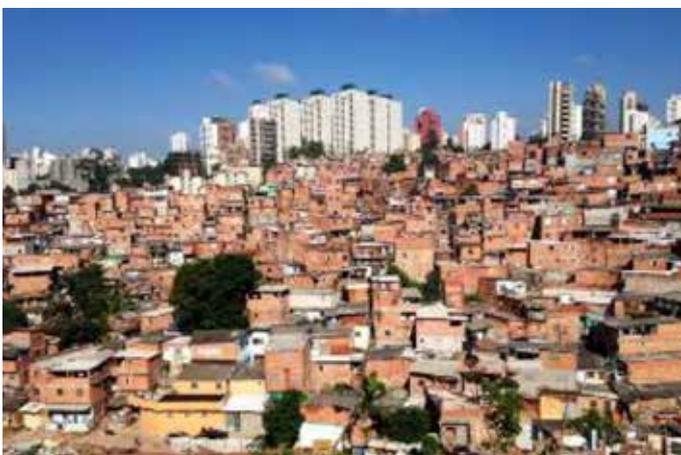
**Introduction** The city of São Paulo is the richest city in Brazil, accounting for more than 12% of the national GDP, offering employment opportunities for the countries' middle class as well as for the poor. As a result, approximate 2 million people live in slums with deficient urban infrastructure. The growth of urban slums in Sao Paulo is associated with the increase of its population density, adding pressure on the precarious infrastructure and impoverishing even more the living conditions.

On the other hand, the system of open spaces in Brazilian slums creates urban opportunities for urban mobility, public activities, income generation and ultimately community cohesion, whilst defining the environmental quality of indoor and outdoor spaces. From this panorama a question emerges: how to improve the quality of open spaces in the slums, keeping the informal use of the urban spaces and the essential physical characterization of its built environment? Favela Paraisopolis is the

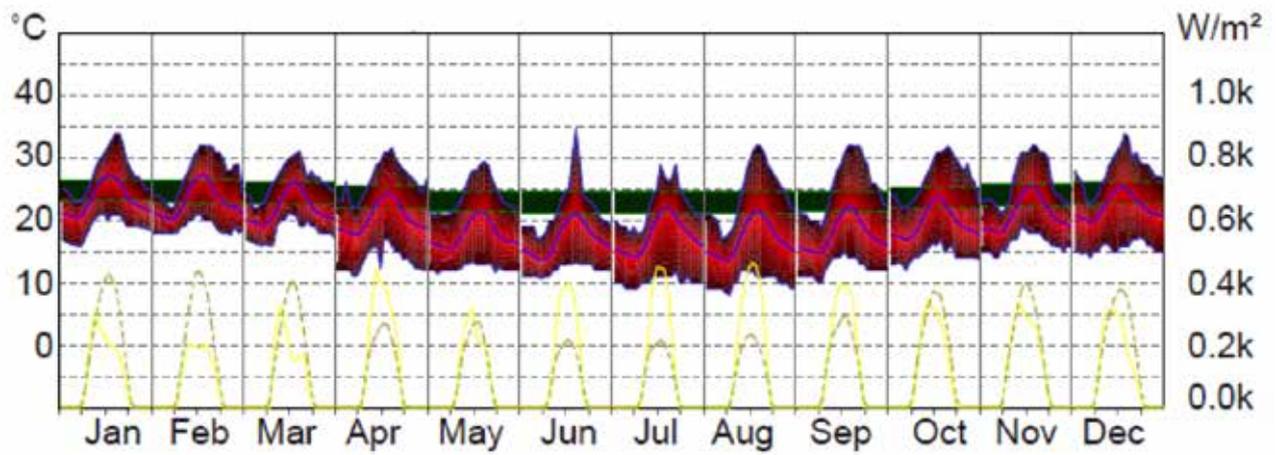
second biggest slum in Sao Paulo, with almost 60.000 inhabitants living over 100 hectares (1.000.000m<sup>2</sup>), resulting in approximately 600 people/ha. The key problems for the quality of life are found in the lack of open spaces and in the environmental conditions of the residences.

**Climate** is likely to be achieved for approximately 70% of the year (ASHRAE, 2009). The climate offers sunny winter days, when direct solar radiation is a key factor for thermal comfort, especially in outdoor spaces, and partially cloudy days in summer, when the main strategy for thermal comfort is solar protection combined with natural ventilation.

The mean air temperature in the summer months stays at around 23oC, whilst humidity can easily reach 80 per cent and above (figure 3). However, it is worth highlighting that in the hot periods of the year, thermal comfort indoors and outdoors is highly dependent on shading strategies and proper ventilation. Winters are



Figures 1 and 2: Overview of Paraisopolis, the 2nd biggest slum of Sao Paulo, in cityscape of the city



**Figure 3:** Monthly average temperatures of the climate of Sao Paulo with incident radiation.

mild, with mean air temperatures between 16°C and 18°C, though even in winter relative humidity stays high. The heating demand is small and for short periods of the year, being easily solved by passive means as solar gains and occupation (internal gains).

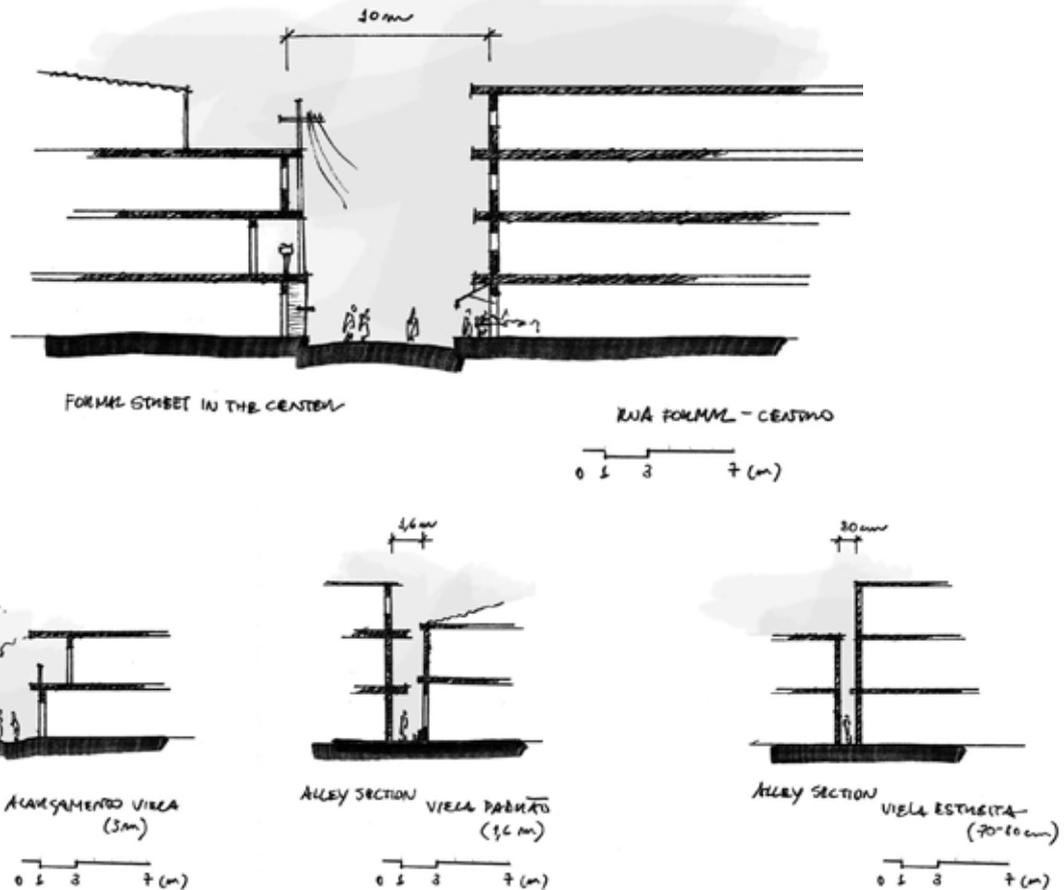
In addition to the characteristics of the natural climate, the city presents a huge variety of urban microclimates, influenced by the multiple aspects of the urban form and human activities and characterized by problems with air quality, urban heat islands, poor urban ventilation, urban noise, among others, which affect the quality of both open spaces and buildings, typical in the slums.

Moreover, it is important to consider that, in the residential units, high occupation density coupled with insufficient air changes, due to small windows, compromise the internal environmental conditions in the warm days of the year.

**Urban fabric** The socioeconomic momentum of the slum leads to informal and uncontrolled horizontal and vertical growth of buildings. Originally, the urban fabric of both case studies (as in the majority of slums in Sao Paulo) developed on top of a formal parceling of the territory (figures 4 and 5). As a consequence, main roads were kept within their original size (10 meters long), whilst a complex grid of alleys grew within the urban blocks to give access by foot to the internal and smaller residential units (figures 4 to 7). As a result, the built environment is characterized by a diversity of open spaces with contrasting environmental conditions in need of improvement. The compactness of the urban blocks leads to lack of vegetation and space to the accommodation of urban and living activities, which are either castigated by solar radiation or deprived of daylight and air flow between buildings due to the rather narrow canyons. The biggest open space is the area reserved for the football camp, present in every informal settlement in the country.



**Figures 4 and 5:** The urban environment in Favela Paraisópolis. On the left, the canyon and socioeconomic activities on the pavement of the main street. On the right, the appropriation of open space of the alley.



**Figures 6 and 7:** Sections of the typical canyons in the slums of Sao Paulo. Above, two of the main streets, shared by pedestrians and cars. Below, the alley only for pedestrians' access.

**Outdoor environment** Measurements of environmental variables in the streets of Paraisopolis included air temperatures, surface temperatures, relative humidity and air movement. Comparing the results found in the streets with those from the alleys, the fieldwork showed the significant positive impact of the shading and shaded mass in reducing surface temperatures and by consequence the air temperature in hot days. The unshaded street presented surface temperatures as high as 50°C and air temperature reaching the mark of 36°C. In contrast to that, within a short period of time, the protected space of alley had higher air temperatures around 36°C but significantly lower surface temperatures showing figures around 28°C, which have a major favourable impact on pedestrians' comfort and on the thermal conditions within the rooms facing the alleys. Air movement also varied from higher than 2 m/s in the main street to around 1,5 in the alley, in the best scenario. Nevertheless, insufficient daylighting is obvious.

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