

## Urban housing design by the Educandos Igarape, in Manaus, AM

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**ABSTRACT:** Housing problems in Brazil are complex and widely recognized, requiring a direct focus on cities and especially the metropolitan area, where disarticulated processes of occupation reflect socioeconomic inequality and relate to with environmental and human challenges on urban space. Housing design cannot be limited to the housing unit itself: it ought to consider the resident's needs, culture and relationship with place and, at the urban scale, integrating with other actions on land use, mobility and environmental sanitation. In the urban area of Manaus, the unplanned occupation of the margins of igarapes -- small navigable rivers in the Amazon region -- has been occurring without the provision of sanitation infrastructure, the preservation of vegetation cover and of soil permeability. All of those measures would be necessary for preventing the flooding of rivers, whose pollution exacerbates the problems at the extremes of flooding and drought. Despite the traditional cultural importance of the neighborhood in the southeastern region of the city, local people in the district of Educandos have been losing their relationship with the igarape as well as their culture and values. In addition, housing units have decreasing levels of thermal comfort, healthiness and habitability, being mostly located in the flood risk zone, devoid of sanitation. The study presents and analyzes a reformulation project and housing design developed for a portion of the margins of the Educandos igarape, in view of its potential to promote a better quality of life for local residents and make a positive impact in the city.

**Keywords** *Educandos igarape. Urban housing design. Flood risk zone.*

## 1. INTRODUCTION

The complexity of the housing issue in Brazil is widely recognized and requires a more direct focus on cities and especially the metropolitan areas, where disjointed processes of occupation spatialize the socio-economic inequality and are associated with enormous human and environmental challenges (Morado Nascimento; Tostes, 2011; Sampaio & Pereira, 2003; Grostein, 2001). However, the urban management tools, while essential, do not guarantee design quality by themselves. Housing design cannot be limited to the housing unit itself: it needs to consider the residents, their needs, culture and relationship with place. In addition, it must – on an urban scale -- combine the other actions on land use, mobility and environmental sanitation (Barros, 2015).

Manaus, AM is the metropolis of the largest state in the country, with great importance due to its extensive conservation areas and water resources, as well as the indigenous, caboclo-riverside and urban cultural values. Manaus gained prominence during the rubber boom and, later, the emergence of the Zona Franca and Industrial Pole. The current scenario is established from the demographic boom coupled with the disorderly growth of the city. A few decades ago, the banks of the Igarapes (streams, "canoe paths") were occupied by stilt houses and houseboats sparsely distributed. The caboclo-riverside people used to take from the river their living (fishing), leisure, baths and transport.

But the city has experienced changes in infrastructure and landscape around creeks that cross through its central area. Annual flooding produces, in the period of ebb, the proliferation of various diseases caused by accumulated waste near the houses, which was dragged away during the high-water period of Rio Negro (Silva & Ferreira, 2010). The uncontrolled occupation of banks of creeks in the Manaus urban area has taken place without the provision or extension of the sewerage infrastructure, and without the preservation of vegetation cover and soil permeability required for preventing the silting up of rivers. The river's pollution exacerbates these problems at the extremes of floods and droughts.

The Educandos Basin is fully integrated into the urban fabric, the southeastern portion of the city being a contributor to the Rio Negro Basin. Educandos Igarape is the last stream of the basin and thus receives pollution from all the other neighborhoods. In the current situation, it ceased to be the city's postcard landmark. Despite the traditional cultural importance of the Educandos neighborhood, the relationship of the riverside people with the river is being lost, as well as the caboclo-riverside culture and its values, in addition to the impairment of the Riverside housing, movement and access salubrity. Most of the houses on stilts are in preservation or flood risk areas, and devoid of sanitation infrastructure, with the impossibility of agrarian regularization (Santana, 2014; Almeida, 2005). The cultural shock between the riverside and urban cultures becomes clear in the houses. Because of its practicality and, above all, because they add "status" to the resident, natural building materials were replaced by industrialized ones. Such replacement has compromised the thermal comfort of the households.

In this context, the current work has the goal of presenting a housing design project for a critical stretch of the Educandos Basin, which aims to contribute to the promotion of the quality of life of local residents, with a positive impact on the city.

## 2. METHOD

From researches on the region, the Educandos neighborhood (Fig.1a) was selected as the object of study for presenting so exacerbated those already presented problems related to the disordered occupation of stream banks, with most of its residents settled in risk areas (Fig.1b). The section selected for intervention is situated in the northeastern portion of the district, on the border with Santa Luzia neighborhood (Fig.1c). It is above the flood quota of 30m, has approximately 3.12hectares-ha and about 150 housing units-UHs, setting up a density of 48.08UHs/ha or 192.31people/ha, considering an average of 4 people by UH. Such density is much smaller than that of the adjacent and densely occupied area, of around 580UHs in 5.8ha, setting up a density of 100UHs/ha or 400people/ha.

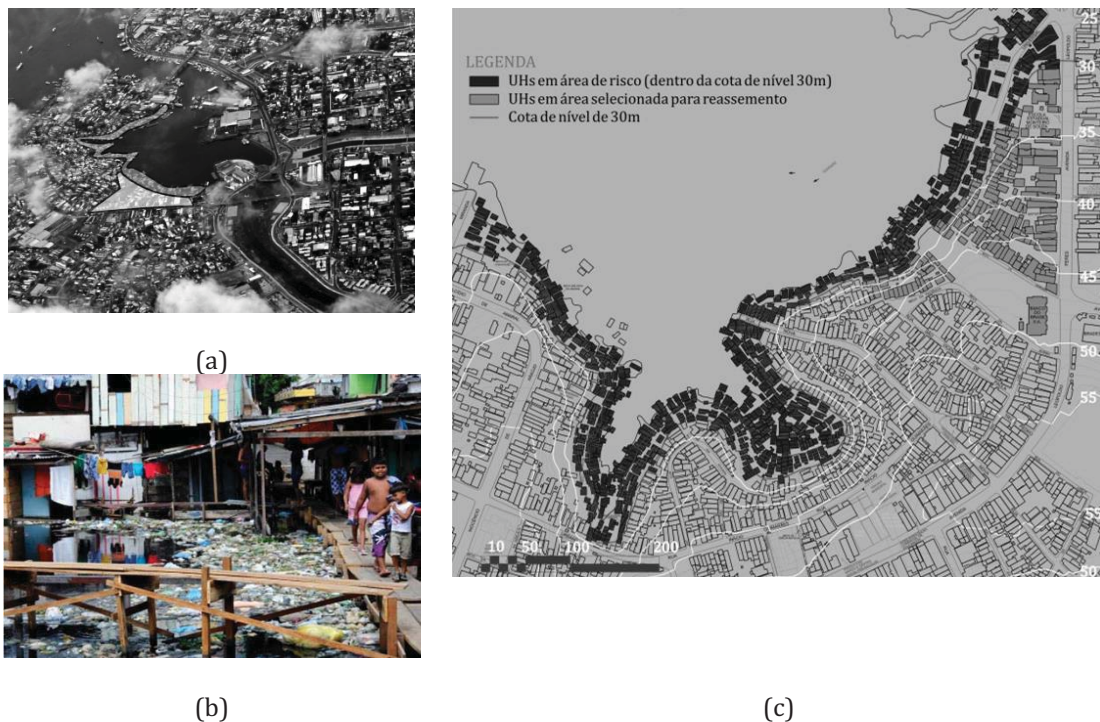


Figure 1: (a) Igarape and highlighted selected area in Educandos neighbourhood. Source: Tim Bray (2011); (b) Photo of existing houses around the margins area. Source: Pedro Martinelli (2011); (c) Existing houses in risk area (black) and in relocation area (dark gray). Source: Santana (2014)

Questionnaires were then prepared and given to local residents in order to better understand their reality and the place where they live from various points of view. From the consideration of such reports a design approach was established, which aimed, as a matter of priority, to keep in the area selected for resettlement as many of these residents as possible.

## 3. DESIGN DEVELOPMENT

First, the reformulation of the place through a proposal of mobility (Fig.2). A wide platform connecting the houses was established for pedestrians' routes and for kiosks for regional products trade. From this platform comes two broad walkways as main axes, linking to the other side of the river in two strategic points: the first to an existing, recently designed green

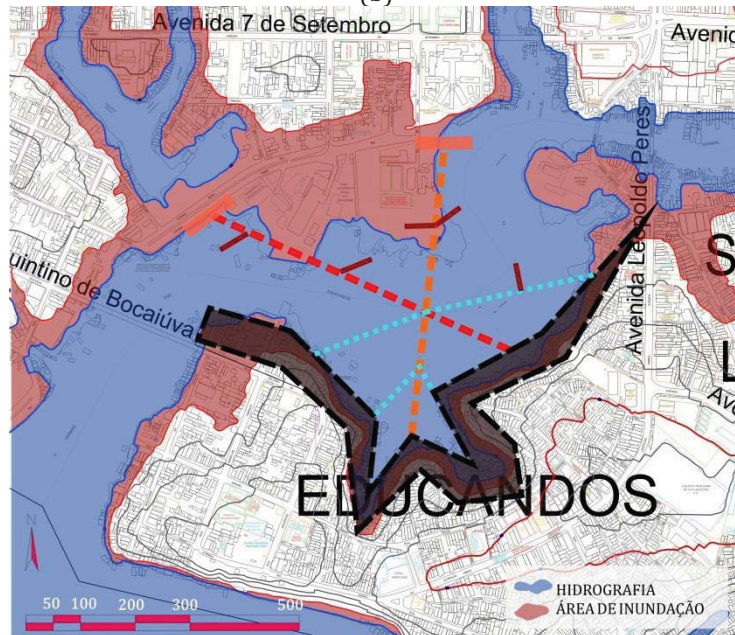
park, reinforcing the recreation area, and the second to a sports area with football fields, which is a valued leisure for riverside culture: riverside community gatherings in moments of relaxation. Secondary axes, as smaller walkways, act as gathering routes, connecting distant homes to the main axes, decreasing distances.



(a)



(b)



(c)

Figure 2: (a, b) Views of platforms, bridges and ramps. (c) Mobility plan. Source: Santana (2014).

In order to break the linearity on the walkway's design, observatories were proposed as a local attraction for residents and tourists, highlighting the beauty of local landscapes (Figs 3a-b). Ramps were laid out giving access to lower points, as access to the soil in dry season and the boats in flood season, improving mobility along with the intermodal stops created for boat and bus, viable in flood season, strengthening local culture and prioritizing public transportation.

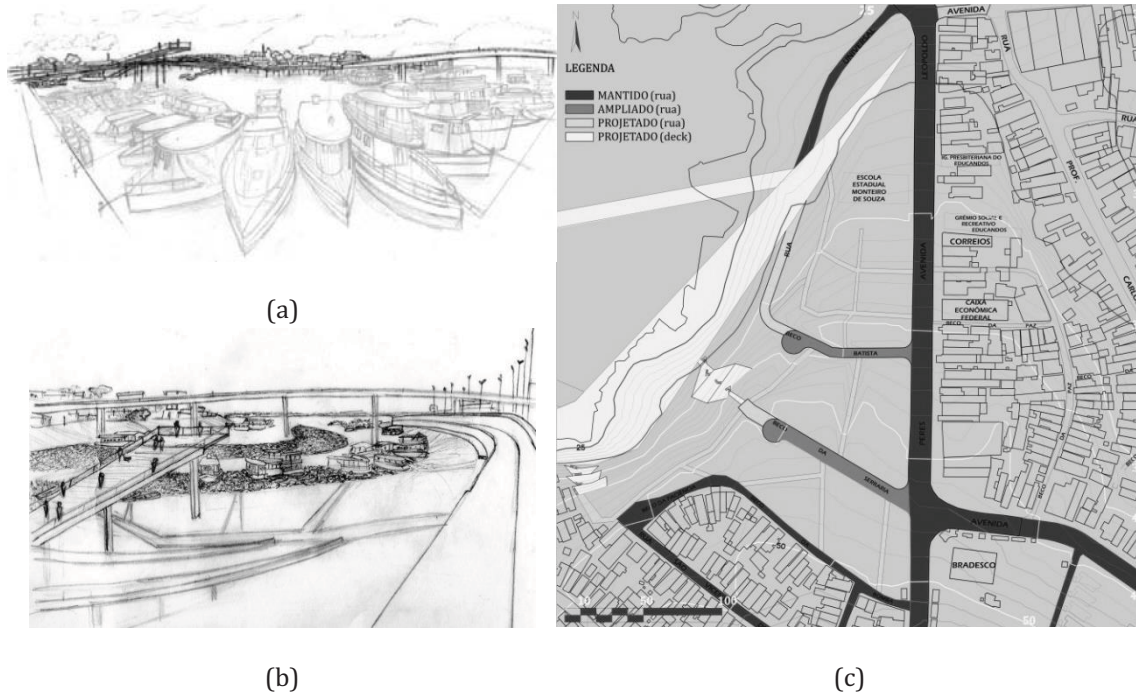


Figure 3: Views of ramps and observatories in (a) flood and (b) dry seasons. (c) Design proposal for local circulation: streets, walkways, deck. Source: Santana (2014)

The proposal for local circulation in the section selected for housing (Fig.3) keeps the existing alleys and extends two main ones to improve access of vehicles and public services. It also establishes new paths that connect according to the topography and declivity, increasing the communication between neighbors. In places of greater declivity, plateaus were proposed with access by stairs. They also act as observatories, meeting places and other uses that do not interfere in the circulation and structure.

Three housing types were proposed, which aggregate in rows. The site planning aims to reconcile the best solar orientation and prevailing winds -- East and Southeast -- with the views to the stream, the accessibility and legibility of spaces, the relation to the avenue and to the existing alleys (Fig.4).

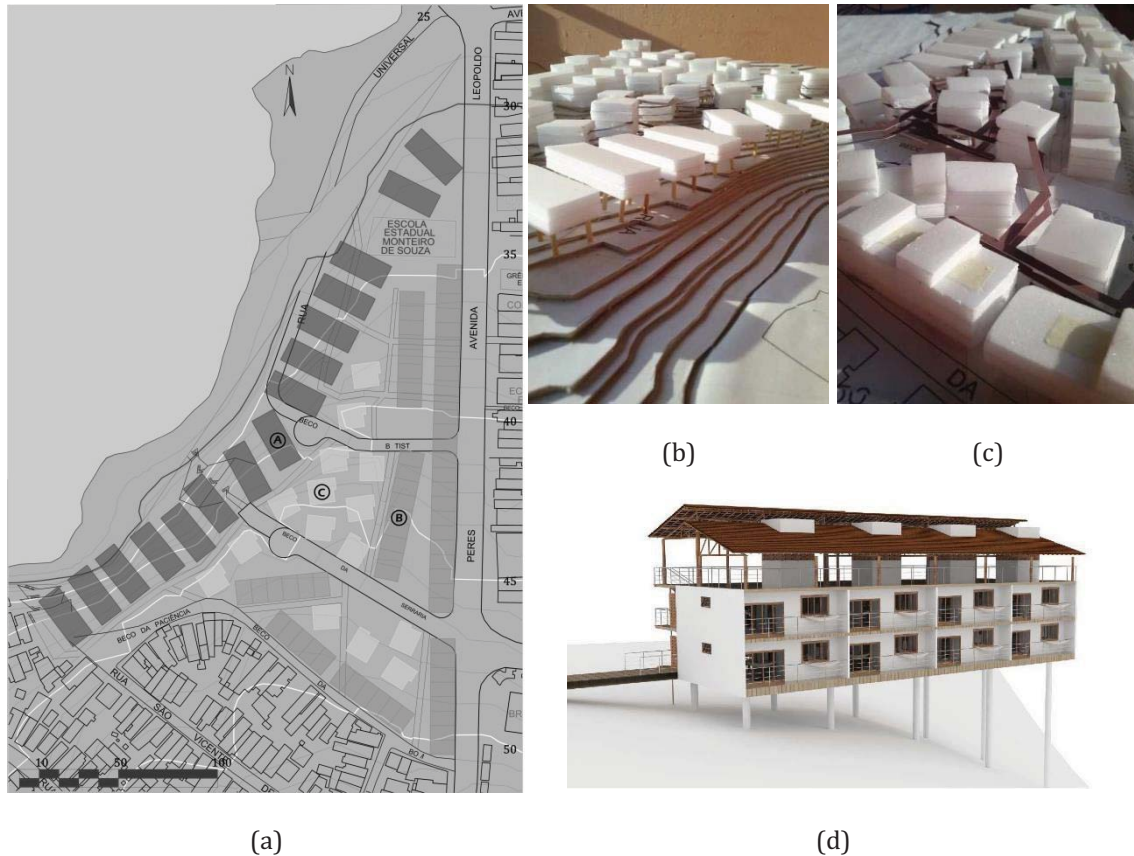


Figure 4: (a) Site planning of housing types “A”, “B” and “C”; (b, c) Views of physical model; (d) View of virtual model. Source: Santana (2014)

The implementation allowed resettlement of most of the dwellings that were in the risk area to the area selected for the new project, above the flood level quota (Figs 1c, 4a). It was possible to settle 419UH in 3.12ha, with a density of 134.30UH/ha or 537.20People/ha, in addition to 18 commercial spots. Thus, the density of the selected area for resettlement was almost tripled. For those residents who could not be resettled in this same location it is recommended to ask the city government for a swap option for a nearby property or in city regions of interest to those residents, through the already existing legal instruments.

Non-bearing internal walls in all of the proposed housing types allow for changes in layout. The generous common circulation area includes a semi-open service area to promote contact between the residents (Fig.5).



Figure 5: Typical plans for housing types “A” and “B”. Source: Santana (2014).

The types adopt strategies from ABNT guidelines (2005) for the Bioclimatic Zone 8, hot and wet:

- Cross-ventilation: houses with double orientation; lower inner walls allow the hot air outlet;
- Large openings shaded by eaves;
- Ventilated attic;
- Dehumidification of the environments: permanent openings with mosquito net for indoor air renewal;
- Pivoting vertical windows;
- Shading of the facades;
- Artificial cooling to ease thermal heat discomfort.

Part of these strategies can be observed in Figure 6.

The structural design adopts free spans between the soil and the buildings, improving natural ventilation in a similar way to the stilt houses. The grating in reinforced concrete (ribbed slab in 2 dimensions) reduces the number of pillars for the first slab and supports the different typologies suspended from the ground. The remaining slabs make up conventional structural system with pillars in alignment. Figure 6 represents the type "C" and also demonstrates the bioclimatic strategies adopted.

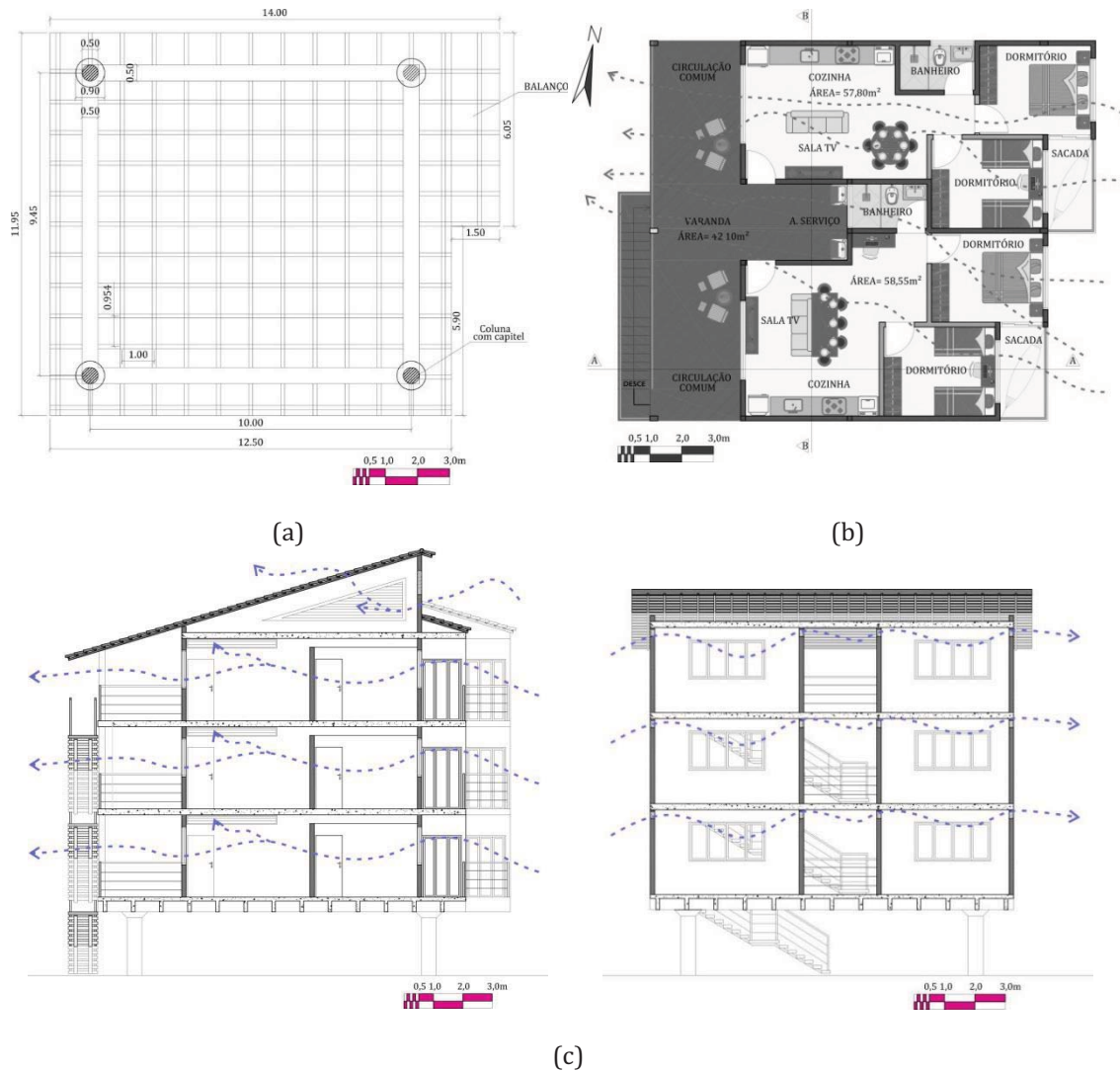


Figure 6: Housing type “C”: (a) Structural conception; (b) Plan; (c) Sections. Source: Santana (2014).

A study on the possibilities of a sanitary sewerage network for the area selected for resettlement has shown the economic unfeasibility of such a network below the quota of 30m level. In this way, a network was outlined above this limit level. The collection of sewage is resolved with the declivity of the terrain. The network adopts buried pipelines directed to a collection point (Fig.7). The point connects to the existing lift station E5B-Santa Luzia, located about 120m East of this point.

Quantitative data allow estimate: considering 4People/UH, there are 419UHs totaling 1678people. If 150Liters/person, 251,700Liters of sewage/day. The collection volume was calculated with the forecast of an increase of 3% of the daily volume, percentage within the capacity of the lift station E5B-Santa Luzia.





Figure 7: Preliminary sanitary sewerage network and proposal for collective spaces. Source: Santana (2014).

At the same time, the design hosts collective spaces and urban furniture that maintain and promote interaction between residents and the neighborhood (Fig.7), including:

- Arena for presentations and events: bring back "Brincadeira de Boi", a cultural tradition that was born in the neighborhood of Educandos. Space may be used by nearby school;
- Multipurpose equipment for all ages, including calm and agitated spaces;
- Community garden for personal use or to generate extra income for residents;
- Football field to entertain young people and to rescue culture of gathering the neighborhood;
- Bike racks to encourage cycling and parking spaces for 10% of dwellings;
- Garbage collection points located in the streets that give access to services.

#### 4. CONSIDERATIONS

This work presented a housing project that prioritizes the shelter of the residents who already live on the site and most of those living in the area of risk. The main motivations for the development of the project were the recurrent negligence of local government regarding the riverside population in risk areas and the challenge of getting out of the professional comfort zone of the architect-urbanist.

The project aims to promote and recover the local identity and the importance of the river; improve mobility and accessibility for residents, service providers and visitors; provide the selected area with sanitation infrastructure and the houses with thermal comfort. Such intentions eventually represented conflicting challenges that were reconciled along the design process.

The strategies adopted are considered to have potential for contributing to future projects and interventions in the context – rivers and cities in view of the desired reconciliation (Gorski, 2010). In conjunction with the implementation of public policies that allow the transformation of these communities into environmental and socially sustainable, such strategies can mitigate the environmental problems identified and promote quality of life for local residents, with a positive impact on the city.

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