

# Incremental Expansion: Examining user-initiated transformations in government housing in Manaus

Vasco Portugal <sup>a</sup>, Caleb Harper <sup>b</sup>, Layla Shaikley <sup>c</sup>

<sup>a</sup> MIT PP, PhD Sustainable Energy Systems

<sup>b</sup> MIT March

<sup>c</sup> MIT SMArchS

---

## ABSTRACT

### Keywords:

Low income housing  
High-density  
Resettlement program  
Incremental building

The principle aim of this paper is to examine the user-initiated transformations in the context of the PROSAMIM program in Manaus, Brazil. This resettlement program provides a good opportunity to discuss and analyze incremental construction for the low-income sector. The project offers a platform for comparison between the impacts of two housing designs in identical contexts. There have been two distinct phases in this resettlement program. The first phase offered a housing typology that, according to the local government, inadvertently encouraged owners to expand their units as a product of the architectural design. In response, the second phase had been deliberately conceived in an inflexible configuration. The intention behind the rigidity of the second phase had been to prevent the expansion that had emerged after the implementation of the first phase of housing units. This study seeks to understand the government's instinctive opposition to transformation in the built environment, to understand the motivation for adjustment from the first phase to the second, and to observe the impact of the decision to limit incremental expansion for the user. By surveying how and where users transformed their units and an elaboration of a comparative research analysis of the data collected, we mean to comprehend where the intentions of both government and users could benefit from an incremental housing proposal.

---

## Introduction

The IDB funded PROSAMIM program, located in the central business district (CBD) of Manaus in Amazonas, Brazil, focuses on providing infrastructure and housing options to low-income communities who reside in the palafitas. The palafitas are informal floating wooden settlements that surround the *igarapés*, or streams, of Manaus. Through in-situ upgrading, the program seeks to maintain pre-existing social and economic networks and preserve communal identity.

We have conducted an analysis of the range of informal expansions to the two typologies of government housing in the CBD and have derived questions and propositions for guiding future project designs.

Two typologies of settlement were extensively studied for similarities and differences. The first housing typology provides architecture to support incremental expansion, in discord with its legislating policy. The second iteration purposely rebuffs opportunities for expansion, concretizing in a more rigid typology. While there was evidence of incremental housing expansion in both

typologies, there was a direct correlation between the typology that adapted well to user-initiated expansion and the increased quality of life in the community. This became evident through personal surveys in both typologies, increased social life in the expandable typology, and decreased safety concerns in the more social settlements. Independent of typological variation, several factors remained consistent. Our key findings centralize on evidence of both formal interior and informal exterior expansion. Both methods of expansion illustrate the ability of the inhabitants to expand with high quality materials, despite governmental restrictions and without governmental support. Expansions materialized relative to individual desires of the inhabitant, but most notably in three categories: home based entrepreneurship, additional storage, and additional living space.

Considering the results of our analysis, we feel that there is a strong and substantiated urge for incremental expansion amongst local inhabitants – as seen in projects throughout the world. We provide evidence to

demonstrate how such provisions, when initially considered, are affordable and manageable for high-density low-income housing settlements. We also provide data to support a re-evaluation of current governmental policy in support of user-initiated incremental transformation for these settlements.

This paper concludes by suggesting ways to adopt incremental flexibility in high-density low-income housing design, the creation of architectural opportunities for user-initiated transformation, and suggestions for modification of current governmental policy to support participation and policy responsiveness to community needs, adding new dimensions to the existing literature.

### Context and elucidation

Like other Brazilian metropolitan areas, the city of Manaus expanded rapidly in the second half of the last century, growing by an average of 4.87% per year and outpacing nationwide growth following the creation of the customs-free zone in 1967. According to the Brazilian Institute of Geography and Statistics (IBGE), the population of Manaus grew from 311,622 inhabitants in 1970 to 1,802,525 in 2010. In 2007, the customs-free zone created 100,000 direct jobs and achieved annual output on the order of US\$23 billion. Given the job prospects it offered, the customs-free zone has made Manaus a pole of attraction for large and particularly low-income population contingents. While the city's population multiplied, Manaus had an insufficient urban infrastructure that had not been structured to receive swollen population growth. In addition, business and industry could not absorb the quantity of unemployed constituents, causing haphazard and often illegal occupation of urban areas. Low-income immigrant populations occupied areas on the banks of the *igarapés*, the small streams that traversed the Amazon when it covered the area that has been replaced by the metropolitan capital today. The end result has been a proliferation of informal housing in the downtown area, causing what is historically defined as the floating city. Every year in the rainy season (January to June), the *igarapés* are flooded by the Negro River, whose volume increases significantly leading to raised water levels. The settlements (*palafitas*) along the *igarapés* are flooded nearly every year with the accompanying human, financial, environmental, and social damage (Rojas & Magalhaes, 2007).

### The government's strategy

The current administration of the State of Amazonas Government has adopted a strategy of working with the *município* on a broad range of actions and interventions to address these problems (Lei Municipal n. 671, 2002). Total investments are US \$800 million over a 12-year period, calling for systematic planning and effective

community participation. At the same time, the *município* is acting to minimize the risk of new squatting in the *igarapés* through preventive policies based on increasing the supply of low-cost housing and through controlling vulnerable areas (IDB, 2005).

Aimed at resolving the local environmental and social problems of the *igarapés*, the government of Amazonas founded PROSAMIM (Programa Social e Ambiental dos Igarapés de Manaus) in 2003 to improve the quality of life for squatters.

The methodology for intervention in PROSAMIM manifests itself in four ways, two corrective and two preventive:

- 1) The implementation of macro and micro drainage systems to regulate the impact of rainfall and flooding due to the Rio Negro;
- 2) The resettlement of the population, occupying the *igarapés* in land suitable for housing and equipped with all the basic services;
- 3) Creation of boulevards and parks in the areas most vulnerable to illegal invasions;
- 4) Establishment of a general master plan and increase of the supply of land for housing, by means of a greater control and surveillance;

In order to achieve these goals, it was necessary to eradicate the locally established *palafitas* through implementing a method of resettlement for the squatters. The options to relocate the families set out in the Operational Guidelines of PROSAMIM (UGPI, 2012) are:

- i) Building new housing units, as Figures 1 and 2, further prioritizing the resettlement of families from the reclaimed land along the *igarapés* (the focus of our research) and ensuring access to services and existing social infrastructure;
- ii) Monitored resettlement, subsidizing and supporting the resettlement of families to housing in the local and regional market through the delivery of housing bonus of R \$ 21,000.00;
- iii) Resettlement to affordable housing programs offered by the State Government and the City of Manaus;
- iv) Independent relocation, i.e. compensation in cash, in accordance with the IDB policy, which applies to owners who present conditions to initiate their own relocation process;
- v) Housing allowance as a monthly supplement to families that were previously renting in the squatters or have no other option to stay close to where they previously lived.

### The pre-existing and the process of incremental

The wooden *palafitas* that occupy the *igarapés* has historically been the most typical solution for squatters in Manaus, especially in areas close to the city center. For this exploration, we delimited our search scope to the *palafitas* deployed along the margins of the *Igarapé Quarenta*. These specific *palafitas* stood alongside new

residential parks, which facilitated access to the existing squatter settlements. In addition, the *palafitas* had already been subjected to an extensive assessment from the government which simplified our work in terms of socio-economic characterization. Fundamentally, we sought to understand the original context of this population. This would allow us to appreciate the social and household characteristics established, and we were able to comprehend the relevance of the *palafitas* in the context of Amazonian culture. Through an understanding of the *palafitas*, we looked for indications of the local culture to understand how the architecture of the *palafitas* would affect the integration into the new housing typologies of the resettlement program.

It is challenging to categorize the physical characteristics of the *palafitas*, but there are patterns of uniformity in certain formal characteristics and usage. We observed that the *palafitas* are used mainly for residential purposes, but often function as the basis for home-based enterprises (HBE) and a subsequent source of income. Structurally the *palafitas* are supported by stakes at approximately 1.5 meters above the ground, so that they are protected from water during the flood season. When the water level is lower, some of the locals use the space underneath their houses as either living or commercial spaces. In terms of construction, there are explicit differences, such as diversity of shapes, sizes, material and quality of construction.

The material used in the construction ranges from unit to unit, although there is a predominance of wood as a natural consequence of the proximity to the forest and a common pattern within the traditional architecture of the Amazon. Less commonly but still prevalent were concrete slabs, ceramic brick and metallic plates. The roof, in most cases, had been made of wood frames and roofing cement or zinc.

The interiors of the dwellings usually exhibit one central space that is further divided through the use of furniture. However, some houses employed interior partitions to separate bathrooms and kitchens. The interior walls are usually made of wood and independent from the exterior structure, indicating the user preference toward some degree of flexibility to adjust space according to need. Regardless of the conditions of these structures, internally most structures had been guided by organization, creativity and hygiene. However, paradoxically, the exterior had been consistently dominated by garbage and contaminated water.

The facades of the *palafitas* clearly express some concern with aesthetics, regardless of their informal condition and independent of the fact that they had usually been built using construction debris or scavenged materials. We found a variety of construction details, such as wood mouldings, an array of colors and paintings, small gardens and detailed carpentry.

As part of our research activities, we deliberately accompany one of the squatter families as they resettled

from the *palafitas* to the housing units in the residential park Gilberto Mestrinho. We observed that while the family moved their possessions from *palafita* to the PROSAMIM government units, neighborhood residents were already salvaging construction materials from the freshly abandoned *palafita*. While the *palafita* had been scrapped, the materials were being used to erect or expand a *palafita* elsewhere. Several authors advocate (Jacques, 2004) (Tuhus-Dubrow, 2009) that informal settlements should be understood as a living body in constant development. In these settlements, as in the majority of cities, there are no standard units and no single solution to respond to the dynamics of these continuous transformations. This particular context, when combined with the geographical features of a river peninsula and peculiarities that the local climate shows through floods and droughts, configures an extremely irregular framework. Extreme climatic events and changes can lead to significant structural changes in the informal units, aggravating the precarious nature of the existing conditions. The process of informality responds to several of these changing pressures, by adding structures, densification or expansion of the settlements, the occupants change, family grows, a rental market emerges, sections may be demolished, and others gradually consolidated, but that is the nature of the informal settlements (Turner, 1972). For centuries, the inhabitants of Amazonas have depended on their own capacity to respond to their own housing needs (Oliveira Júnior, 2009). Considering the array of key issues that the informal sector has to deal with, built environment in the physical sense is not a major concern to Manaus's informal sector. As observed, this self-built household sector is characterized not only by informality, irregularity and illegitimacy, but also by its flexibility and resilience. The occupants in the *palafitas* adapt their households to personal needs; as the family grows or needs to create an informal business, the unit responds and adapts by re-appropriating adjacent spaces.

## Methodology

The methodology was established from a combined application of subjective methods (qualitative assessment) and objective methods (quantitative assessment), based on our field research. The objective methods were focused on the physical constructions, population surveying and collected data. The subjective methods were based on ethnographic research, derived from the visits to the site and empirical observation.

We started by gathering data from the combination of the analysis of documents and material available on the different phases of PROSAMIM. We furthered our understanding of the information obtained through interviews of the various stakeholders, from the coordination of the program to the users of the housing units. This allowed us to have a basis for comparison with

the data collected during our field study. In the field study, detailed information had been gathered through observation and survey of the interior and exterior of the housing units.

The combined use of methods had the main objective of extracting conclusions about the housing units edified and their socioeconomic impact. We were interested in understanding the impact on the immediate surroundings and the city of Manaus as a whole, with particular interest in the units that had been informally extended in the new PROSAMIM housing projects. We were also interested in the reasons that motivated the adjustments and expansions to the original design.

We have used a comparative research methodology (Tipple, 2000) (Tipple & G.Willis, 1991) (Landaeta, 1994) to evaluate and relate the many variables of the resettlement program, from the first phase of the program (PROSAMIM I) to the second stage intervention (PROSAMIM II).

#### Field research

The field research took into account the need for integration within the lifestyle of the community. We wanted to avoid interfering with the everyday life during our research. Therefore, the best way to enter the community was by previously scheduling the contacts with residents' associations and community leaders, with the support of the office of PROSAMIM social intervention. Once the initial contact with the community leadership was made, we proceeded to our visits to the community. To facilitate the process of integration with the community, our field team consisted of a small group (usually entailing the 3 of us plus 2 local students). The field team also counted with the help of a local guide indicated by the neighborhood association whose main role was to facilitate the surveying in the settlements, also acting as a liaison between the team and the inhabitants of the neighborhood and helping identify locations.

#### Survey of users and building expansion

In order to evaluate the use and modification in the housing units and to trace the social economic characteristics of the population living in allocated habitation units (HU's), we applied a total of 125 questionnaires semi-structured to the local community, based on the model proposed by Gattoni and Goethert (Gattoni, et al., 2011).

We used the sampling method defined as non-probabilistic accidental sample, where those who responded to the survey were the people present at the time when the survey was conducted and who agreed to be surveyed. It is to say that the study interviewed one person for each dwelling, therefore, one representative sample per household. We established five sampling

points, 25 questionnaires being implemented in each of the PROSAMIM residential parks:

Residential parks(RP's)	HU's	Program
Manaus I	567	PROSAMIM I
Manaus II	252	PROSAMIM I
Jefferson Péres	150	PROSAMIM I
Mestre Chico	498	PROSAMIM II
Giberto Mestrinho	372	PROSAMIM II

Table 1 - Residential parks (RP's) built by the PROSAMIM program and quantity of housing units (HU) per RP.

The research was restricted to these specified parks primarily since these were the areas whose homes have already been delivered and because they were in the center of Manaus, which was relevant for our study while providing us with greater ease of access to the area. The study took place in the summer of 2012. In addition to the questionnaires, the survey consisted of informal conversations with people. For statistical analysis of the questionnaires and survey, a comparative analysis was employed (Tipple, 2000).

#### Examining user-initiated transformations

The significance of understanding the design of a house from its extensions is that it allows us to see beyond the problems of spatial and physical nature. Especially when one observes that the current problems that social housing programs face seem to be particularly of the residents' individual nature. Thus, the breakdown of this study focuses on the user-initiated transformations made to the housing units, that ultimately turn out to be descriptive vectors of the residents own needs. Outcomes that allow us to affirm that the design of the building and houses directly influences the behavior of residents and directly impacts the web of social relationships, status, and integration into the city, while explicit the impact of the government choices. Understanding the dimensions of the residents conduct after the distribution of the houses and the impact that different typologies may have on them, allows us to begin understanding what should be the role of the government in a resettlement project of this nature, either by understanding when they should be present and when they need to remain absent.

#### Housing typologies

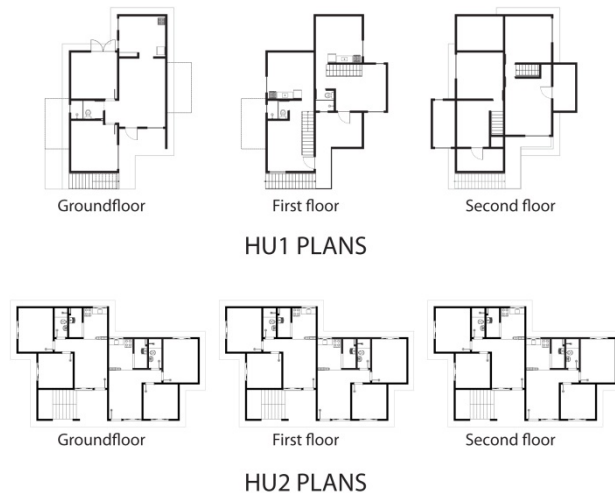
The design of the housing blocks from PROSAMIM I (HB1) comprises three HU, a ground floor and two duplex apartments on the top floor. Each HU have similar plans with slight variations among them the most prominent is a 180 degrees rotation from floor to floor to create a cantilever to produce shaded areas on the ground floor and balconies (cantilever roof) in the duplex units. What ultimately results in two patios in the ground floor, one near the entrance and another at the back of the house. The duplex units in the upper floor gain also two

balconies, one that provides access to the households and an additional on the second floor of the duplex in one of two rooms found there.

The housing blocks from PROSAMIM II (HB2) is a three-storey walk-up building of 6 apartments (two per floor) horizontally stacked on top of each other, with a floor area of 48 square-meters apiece. All the apartments have the same plan layout. Access is through a common staircase, and there are no additional balconies or patios.

Despite the differences the two typologies have a number of interesting features and share common elements, both are built of ceramic brick load-bearing walls and fiber cement roof. None of the mentioned materials could be considered local or traditional, but a new industry had been created to supply the work being done for the PROSAMIM program. In order to meet budgetary constraints imposed by the available funds, the internal finishes were exclusive responsibility of the residents. Given the social character of the project and existing budget, there is a consensus that material options were adequate thermally and formally.

With regards to layout (Figure 1) of the interior spaces, both phases are well designed with a good functional configuration. All HU's have a kitchen, a bathroom, a living room and two bedrooms. Entrance to the interior of the dwellings is gained through the balconies or patios.

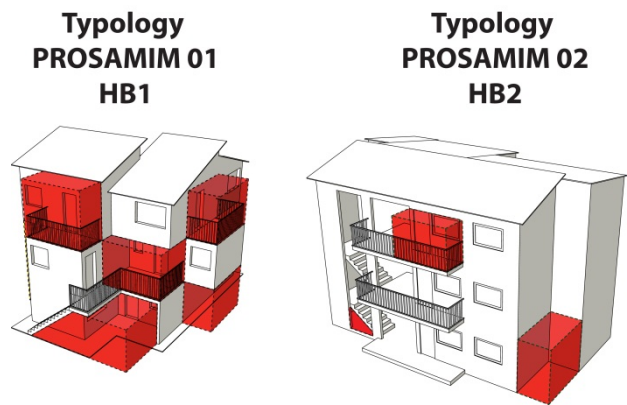


**Figure 1** - Housing Units (HU's) plans from both phases of the PROSAMIM program.

There are some aspects that have been improved from the first to the second typology, particularly in the roof of the HB1 that was relatively weak and responded poorly to the unforgiving heat and rain of Manaus. There were also some improvements in the services and bathroom display. However, the main reason for the change was essentially linked to governmental requirements rather than resident desires.

It is interesting to perceive that the prime reason that led the government to opt for a different typology in the second phase is directly linked with the appropriation of

the adjacent spaces in the initial project. In the opinion of those responsible for the program, the building design urged residents to expand their homes and occupy spaces that were appointed to be open spaces for communal leisure and circulation. The government has chosen to create a more rigid model, where the housing units are stacked on each other, and with less communal circulation space. While the HB1 has some extra communal circulation space, in the HB2 the vertical and horizontal communal space was reduced to its minimum. This amendment, in addition to being highly inflexible with respect to extending the apartments, directly affects the sociability amongst neighbors. The extra communal area that we can find in HB1 generates spaces that also serve to eat, talk, relax and increase sociability in the neighborhood as a whole. Something felt instantly upon initial contact with either neighborhood is a tremendous difference between how the two neighborhoods socialize. Even though we have no quantitative data to substantiate such a claim, we can confirm this same fact through observation and daily contact with both neighborhoods during our field work.



**Figure 2**- Habitation Block's (HB's) from the 2 phases of the PROSAMIM program. HB1 is the typology from the PROSAMIM I stage; HB2 is the typology from the PROSAMIM II. a) In red are the opportunities for expansion in both HB's.

When reflecting on the ability of this project to integrate and blend within the rest of the city, we feel that despite there is some typological variety, particularly in the HB1, ultimately is unable to avoid drawing a monotonous urban picture. Even if the quality of urbanization was quite satisfactory, the quality of the project follows a strong and recognizable pattern, which ultimately reflects the social condition of its residents. In this program, the design and scale of houses or blocks are very simplistic. This is not necessarily incorrect, but produces a repetitive urban landscape, which differs from the expected assortment of a city and highlights visual prejudice and segregation against this new context (Magalhães & Villarosa, 2012).

Best features HU	Typology I	Typology II
Natural light	8%	1%
Ventilation	2%	0%
Material quality	11%	21%
Electricity	16%	12%
Area	23%	5%
Sanitation	37%	39%
None	3%	22%

**Table 2** - Survey results for the question "The best feature of the new house"

With the aim of developing a more consistent profile of both typologies, we developed two forms (table 3; table 4), where residents identify the best and worst qualities of both, so that we could create a truthful diagnosis of the connection between the built environment and its residents.

Worst features HU	Typology I	Typology II
Natural light	1%	4%
Ventilation	0%	2%
Material quality	5%	11%
Space to dry clothes	38%	26%
Area	3%	34%
Services	32%	10%
Rear of the building	0%	13%
None	21%	0%

**Table 3**- Survey results for the question "The worst feature of the new house"

There is a general dissatisfaction on how HU are arranged, different from the preceding arrangement in the squatters and unlike the traditional practice from the Amazonian culture, which is the vertical stacking of the units. There is also some disappointment concerning the areas of the HB2 typologies. The HB1 typologies have additional 8 square meters of area per unit. But if we consider just what useful space is, this does not have great relevance, particularly in the duplex units, whose interior stairs ultimately subtract that portion of extra space.

Residents were unhappy with the inflexibility of the HB2 plans. The HB1 had two extra balconies per HU and additional communal space, these additional spaces allowed its residents to do amplifications and make improvements to the houses. On the other hand, in the HB2, despite there were also communal spaces, they were reduced to its bear minimum, which make it difficult to extend and transform the households without directly interfering with the neighbors from the same block.

The lack of space to dry clothes is also a common protest in both typologies. In general, residents were happy with the quality of construction materials, but it is interesting that most of the people that identified materials as the worst feature lived on the 3rd floor, due to the heat retention on the roof. Although not significant in percentage, some residents mentioned natural light as the best feature of the house. The units have proper glazed areas as fenestration, particularly in the HB1 that

have large glazed walls next to the entrance, adding to the 2 balconies for each duplex unit. This generates a pleasant natural interior lighting and provides opportunities for natural ventilation in all HU. Ventilation seems to have little significance to the tenants. However, there is a curious fact we should highlight. The 2% that specified ventilation as the most positive aspect resided on the ground floor.

The most significant feature for both typologies was sanitation. Residents of both units reported that the greatest improvement from being resettled from the palafitas was access to basic sanitation, such as clean water and a sewage system. Adversely, there were also many complaints concerning services by both typologies. This particularly happened as residents were stating different aspects of the services. The criticisms had more to do with the quality of services and not with the service itself – even though the houses were new, they posed several problems of infiltration and degradation of materials. The percentage that identified electricity as the most positive feature referred particularly to the capacity of purchasing appliances, air conditioning and multimedia.

A gap between buildings in the HB2 was identified by 13% as a negative feature. The way in which buildings had been organized in the residential park created a dark alley between the rear of a building and the next one, leading residents to complain that these hidden alleys commonly attract the practice of illicit operations. Residents disliked the insecurity manifest by this spatial adjacency. Despite being more of an urban problem than a housing concern, residents reported that the issue is emphasized by the fact that the HU do not have a back door in the ground floor, which is found in the original typologies of HU1. This makes it impossible to monitor what goes on in that space, since access to that space is limited. In addition it obstructs the appropriation of that space by the residents, an area that could be used to dry clothes, as recreational space or expansion of the units.

#### Characterization: User-initiated transformations

User-initiated transformations	Parque Igarapé Manaus		Parque G.Mestrinho	
	Total	%	Total	%
Total HB	273	100	62	100
Total HU	819	100	372	100
Total Extensions HB	174	64	24	38
Total Extensions HU	193	24	76	20

**Table 4** - User-initiated transformations in the habitation blocks (HB) and habitation units (HU) total and percentage.

The residential park from the Igarapé Manaus has a total of 277 housing blocks (HB), and each of these blocks holds 3 housing units (HU) with one ground floor unit and two Duplex HU. From the 273 existing HB, 174 had already been changed by their residents, which amounts to 64% of present HB.

In the park Gilberto Mestrinho, there are 372 HU with 76 (20%) have already suffered some sort of transformation resulting in 38% of HU transformed.

As mentioned before, the HB1 offers more “opportunities” for extensions of units; the verandas, balconies, communal space and courtyards have been extended in a wide variety of designs (Figure 2) and proportions from the simple extension of a veranda to the expansion of about 25 square meters of the house. Yet, it is clear the desire to expand and transform in both typologies. Where space allows, there is an obvious tendency to create additional rooms, particularly on the ground floor and specially for commercial purposes. In some cases, this is simply achieved by erecting a boundary fence with an entrance to the street.

An initial analysis of the objectives of PROSAMIM to improve the quality of life for squatters of the palafitas through the establishment of Residential Parks was clearly achieved successfully. However, the program did not anticipate the settlement of one hundred and twenty seven (PEPAC, 2007) micro and small businesses, which were previously sources of income for some of the residents. Moreover, it is interesting to understand the benefit of mobility in relation to the contractual clause that prevents homeowners from selling the new property during a period of ten years.

We have identified three main triggers for the propagation of user-initiated transformations in the new households. Most transformations are related with informal trade purposes, followed by creation of additional living space and storage requirements.

Types of expansion	Parque Igarapé Manaus	Parque G.Mestrinho
HBE	62%	38%
Living space	28%	41%
Storage	10%	21%

**Table 5** - Percentage of expansion types in the settlements Igarapé Manaus and Gilberto Mestrinho

Room renting and the establishment of small private businesses is a strong advocate for transformation and expansion of the space of the household, the dwelling is one of the few resources that they have for generating income. If we take into account the prime localization, we easily recognize that renting is not just convenient but also very profitable for local standards. Yet the main reason for expanding the area of the dwelling is the establishment of illicit home-based enterprises (HBE), where in the Manaus Park 62% of houses have been extended to make room for a diverse number of services ranging from catering and mini markets to teaching and bicycle rental. It has a critical relevance for many of the residents, who without such services would be forced to spend more time and money on journeys to adjacent neighborhoods. This would result in undercapitalization of a context that by itself suffers from numerous financial difficulties. Most importantly is that it generates renumbered jobs, cheaply

created, absorbing a number of residents who probably would otherwise be unemployed and a burden to society.

#### Extension materials

Most of the HB1 transformations followed the same selection of materials used to construct the buildings. This created some difficulties to recognize some of the transformations in the houses, such as the degree of formality, that we had to resort to the original plans numerous times to survey the extensions. On the contrary the extensions in the HB2 often resorted to cheaper materials or have extended without permanently closing the space, as can be seen in the 22% additions without walls. Which we end up classifying as extensions, either because residents paved the ground, conquered space by placing their personal items or put metal or plastic covers. In any case, the major conclusion that can be drawn by observing these tables is that there is a clear difference of formality in the materials nominated to extend the houses in both typologies.

Percentages	Parque Igarapé Manaus	Parque G.Mestrinho
Cement blocks	4%	0%
Bricks	37%	27%
Corrugated metal	0%	2%
Metal bars	59%	49%
None	0%	22%

**Table 6** - Wall materials used in extension construction in percentage.

The HB1 presents a far more formal arrangement and superior finish as opposed to the HB2. Even though it is risky to establish a direct link between the design of the houses and the behavior of residents, we dare to say that the preference for cheaper materials and unpretentiousness in the HB2 has mostly to do with understanding that the houses where they live were specifically designed to abolish transformations, which means that residents who do choose to extend tend to do it in a more ephemeral approach, perhaps anticipating that sooner or later someone will remove them, or as a preventive measure, by not making it clear that they can be classified as extensions of the house.

Percentages	Parque Igarapé Manaus	Parque G.Mestrinho
Corrugated metal	71%	15%
Plastic	4%	2%
Fabric	0%	24%
Roof tiles	8%	0%
None	12%	59%

**Table 7** - Roof materials used in extension construction in percentage.

Percentages	Parque Igarapé Manaus	Parque G.Mestrinho
-------------	-----------------------	--------------------

<b>Fabric</b>	3%	1%
<b>Concrete</b>	68%	86%
<b>Ceramic</b>	29%	13%

**Table 8** - Floor materials used in extension construction in percentage.

These differences between materials also affect market perception on the house values. Some households come out valued others devalued due to cheap materials and low-cost extensions. Even if both occupy the same area with extensions, materials play a very important role in perception not only in terms of value but also of status.

#### Increase in size and value by transformation

Another aspect of user-initiated transformations in the built environment is that they also express the personality and socioeconomic status of each resident. Indications lead us to consider that the house represents the image of the owner itself and therefore it comprises also a classification of status and social values. It is important for social groups that inhabit a particular place to build reference values and socio-cultural meanings around their households. The house, represents to its occupant's a conception of social status, which is supposed to make them different while approaching to their near social environment. Through the construction and transformation of their houses residents show their competence to climb the ladder of socio economic growth, which impact their neighborly relations, contact and reassurance of a personal and social identity. The home is a personal and social identity, the realization of their desires, their projects, while it is the protection of the bodily self.

In the last five years, the housing market has shown progressive growth in Manaus. With the rise of the construction industry and competition in areas for the deployment of new residential developments, the market value of land in the capital rose. A significant change has been in the price per square meter in Manaus, which is valued amongst the most expensive in the country (Oliveira, 2012).

<b>Area per type -Square meter-</b>	<b>Parque Manaus</b>	<b>Parque G.Mestrinho</b>
<b>HBE range</b>	3-25	0-6
<b>HBE average</b>	14 Sq. meter	3 Sq. meter
<b>Living space range</b>	5-25	3-15
<b>Living space average</b>	15 Sq. meter	9 Sq. meter
<b>Storage Range</b>	3-16	0-4
<b>Storage average</b>	9.5 Sq. meter	2 Sq. meter

**Table 9** - Size of extension, range and average.

This ultimately makes the residents even more engaged with transformations in the house, because now is not only utilitarian issues that lead residents to expand their homes, there is a second variable, each square meter

conquered to the public space happens to be a commercial valorization of the house itself.

Looking at table 9 there is an obvious disparity between the expanded areas of the two typologies. In large part, the difference in size of the expansions ends up being legitimated by the physical form of both HB's. The HB1 provides more opportunities for growth, which end up inadvertently inviting users to take possession of the balconies and spaces that can be found under the cantilevers to create additional space in their houses. The HB2 also has balconies and communal space, but it would be impossible to close that space since it would interfere with the access to personal space as well as access to the neighbors' houses. In the HB2, most of the storage spaces were highly informal, where the owners would make a fence of cardboard boxes or fabric in order to close that space. Similarly in most HBE in the HB2, it was impossible to increment the ground floors as in the HB1, where users could go up to 25 square meters closed with bricks, metal bars and fiber cement roofing. In the HB2, users had to give up their living rooms to have micro businesses. Users also appropriated the exterior spaces by covering the space with a textile roofs.

#### Discussion

Typically resettlement and social housing projects are conceived based on cost-benefit studies, often excluding the assessment of indirect social costs. Frequently neglected, but with a substantial relevance, particularly if it intends for more than merely providing shelter. Assuming that there is also an urgent need to improve the social condition of the inhabitants, such a study may be far more significant than a simple cost analysis. Our investigation has shown that a better understanding of the value given to design elements and a detailed study of the inhabitant's desires can point out opportunities for the introduction of policy improvements while reducing the cost per dwelling unit. Therefore, we recommend a constructive approach to encouraging and supporting transformations in the built environment. A division of responsibility for construction and development of the dwellings between the government and residents, and an approach that allows for gradual investments in improvements to the house, are important steps which include the occupants in the conception of their own spaces and avoid unjustified investment from the government. A structured and transparent decision-making process is needed in social housing programs to provide a link between design criteria and user desires, giving voice to end-users and avoid inadequate solutions (Kowaltowski & Granja, 2011). Based on the research work presented in the preceding chapters, we conclude with a set of strategies that should be taken into account when drafting the already approved third phase of the PROSAMIM resettlement program. Strategies with application in two major sectors: Policy and built environment.



## Policy for Increments

Along the various interviews we undertook with officials of the program, we realized that there is no policy to address the changes that have occurred in the buildings delivered, nor allude to future changes. It is clear that the program and the local government do not support the practice of an incremental policy and that their approach has a strong resistance to change. Soon we confirmed this position in our first meeting, where we were told that there were no changes to any of the housing blocks. Although, even before any survey, we could easily detect that this does not match to reality. Regardless of this opposition, changes occurred in fact, and in such magnitude that the government was forced to silently consent. It was impossible to monitor all the dwellings, proceed with all the heavy bureaucracy involving demolishing the illegal extensions and they did not want to cause a general dissatisfaction among residents. Thus the program opted to overlook the changes in the first typologies built, and build housing blocks with a far more rigid structure and with fewer opportunities to "increment" in the second phase of the program. An incorrect approach, according to our analysis, because not only failed to inhibit the transformations but also resulted in several extensions with an informal character, causing a condition that they were indeed trying to avoid. Consequently, our proposal begins precisely by appealing to a policy that considers the geneses of their residents. If the reality of their original settings lies in the flexibility and adaptability of the built environment, the local government and the program should devise a special policy and incentive plan to support it legally, financially and technically. All three components should be integrated in one policy.

**Legal condition:** The first step should be to improve the legal condition of the extensions and transformations to the HU. Essentially, the illegal status of the increments to the house makes it unmanageable for the government or program to monitor and support the changes. Without clear legal status regarding what is allowed and what is not, the residents will never be encouraged to report their upgrades to the built environment. Especially if residents feel that the changes made are in permanent risk of being demolished or are not legally recognized, makes it harder to expect them to invest in quality and lasting transformations. Consequently extensions may result in informal structures as seen in the HB2 example.

**Financial sustenance:** The units from PROSAMIM were offered for free, this ends up influencing the behavior of the occupants towards the houses. It is not only highly unsustainable as an investment but also results in a permanent dependence on the government, since residents never really felt like homeowners. They revealed to be unable to take initiative and carry out maintenance to their houses as they feel it should be a program duty.

This can be avoided with an approach in which residents become legally responsible for the completion and expansion of homes, stimulating a sense of identity and ownership in residents while sharing the cost per unit built. This additional cost can be further supported through various types of public-private solutions. Our study clearly indicates that families are perfectly able to increase their residences through personal investment, nevertheless in situations of lack of personal currency, alternatives can be generated. Solutions like housing subsidy programs and micro-loans have been used successfully on similar projects (Ferguson & Smets, 2009). The poorer population normally has difficulties getting formal housing finance support, but through a coalition between the government, banks, resident associations and tenants an agreement can be established to support incremental house improvement. By means of micro-loans for house extensions, the upgrade of the houses can be done in a faster and more permanent way than through own investment.

Also the integration of Home Based Enterprises (HBE) is an additional aspect that should be taken into consideration as a solution. The HBE were excluded from the built environment planning (PEPAC, 2007) of the previous phases of the program, which has not prevented residents from setting up their micro-businesses, but there is no reason for the absence of legal status and not be part of the housing scheme. The HBE is a main trigger for social condition upgrade, an excellent resource to generate income and foster a sustained finance. Therefore, it is essential to facilitate the establishment of a diverse micro-economy and encourage economic activities. Local entrepreneurship should have more economic viability and operate formally.

**Sense of ownership:** Finally, implementing of this new policy results in an enhanced sense of ownership and gratification. It strengthens the sense of belonging of the occupants and they feel that the changes made are secure, a consequence of their own effort and investment. What ultimately results in improvements to the spatial quality of the built environment and will lead to healthier living conditions for all the residents (Soto, 2003).

## **Built environment: A design to enable increments and anticipate transformations**

A housing design is so contingent on other factors that it is not possible to provide a single solution but rather a set of guidelines that can drive the elaboration of a residential block. The design role in terms of adaptability should be more of a facilitator as opposed to determiner. The starting point for the habitation unit process should consist on defining a base unit to provide what homeowners cannot do for themselves – i.e. building frame, sewerage, electricity, etc. To then establish an approach to simplify what they can in fact do by their own. A possible solution may perhaps comprise a single

multi-use room with a vertical distributed sanitary core plus electricity connections, coupled to one or more adjacent spaces providing solutions for the increment of housing space. To increase housing density, three or six units could be coupled to a main frame serviced with staircases and balconies to generate housing blocks. Such approach would allow future homeowner to finish the house at their will and possibilities while reducing the cost per unit allowing the government to increase the number of units built. The design of HB1 is a good sample of how one can design a building with a degree of flexibility for change. These blocks even if unintentionally had a number of voids on its structure that could be understood as hints for an incremental process. The truth is that the extensions we observed never exceeded the perimeter of these voids, which leads us to conclude that these areas are not only important because they invite residents to expand, but also they allowed setting subliminal limits to the transformations. An important aspect is then the integration of such voids in the design of a HB. A space that is suggestive of the way that it may be changed and tailored to multiple uses. Per unit and with the areas equally dispersed, the design should intentionally provide spaces for appropriation, without determining their exact use or configuration. Thus, by creating visual clues in the building form of how expansion over time can be accomplished. Both HB1 and HB2 have load bearing walls, which leaves little room for flexibility beyond the annexed areas. Also the use of non-loadbearing exterior and internal partitions might facilitate the alteration of the original design to other possible layouts from which future tenants could choose. Lastly, also the foundations should anticipate an increased load from the expansions.

Support system for transformations: A housing support system should be created in order to assist the transformations of the houses. A support system is a physical space with tools and equipment needed to support the implementation of the transformations in homes. Such system would be responsible for the permission to build, advice in design and structural problems assist through the process of construction and guide the method of sponsoring. The aim is to ensure that changes are made with a formal character and with the best quality possible. Consequently quality will attract more economic opportunities to the area and will lead to higher densities. This space should be created not only to facilitate the implementation of transformations but also ensure that homeowners can learn and acquire skills both personal and professional. The space should be supervised by trained professionals capable of supporting and teach construction techniques. The system ultimately benefits both the government and the residents, since it ensures that buildings are well monitored and executed while teaching new skills to the inhabitants. This generates education and job creation, two important social dimensions that need to be integrated into the social structure of the housing residents. This technical support

should focus on finding the right methods to build the house extensions at affordable prices, with easy maintenance, sustainability and using local employment opportunities. Such support aims to contribute to a better infrastructure that will not only enhance the economic value of the area but will also help to close the gap between poor and middleclass. The support system should not only promote the use of quality building technology that is suitable for the local context, but also facilitate the transfer of available more traditional knowledge on house construction to individual families, mutual building groups and local communities. Finally, it also may help to change the public perception of the resettlement housing areas.

## Conclusions

There are three questions that we wanted to answer that make this research paper unique. First, we aimed to understand the resistance toward an incremental approach in the built environment. Why should a user be hindered from taking control of his space and identity? Second, what were the benefits of a new design conceived precisely to prevent the first signs of expansion in the first units of the program? And lastly, where can we find a consensus between government objectives and the beneficiaries of the houses? If this understanding can be done within an approach that considers flexibility and identity of residents, the role of those impacted most heavily in the project is emphasized.

Of the interviews and conversations we had with the different stakeholders, the conclusion is that the instinctive opposition to any kind of flexibility or expansion of the houses has to do with the concern that it might lower the standards that they have set for the housing projects and that ultimately they could be backing the erection of a new slum. However, we feel that the flaw starts in the delineation of these same pre-set standards. The fact is that this definition of what is standard in social projects ultimately results in dwelling units designed with the minimal acceptable conditions. It could even be argued that this specific project was above that minimum, yet the inability to improve or expand their future houses lead the owners to a perpetual condition of resettled from the palafitas. The development of a monotonous standard housing blocks repeated adjacent to each other differs from the diversity we are supposed to appreciate in cities, leading to preconception and visual segregation against the so-called Residential Parks. It was easy to anticipate what would happen in these parks and that the new residents of these units would feel the need to expand and re-adapt the granted houses, especially if we take into account that Manaus is a city with a large and rapidly growing low-income population and with an accelerated birthrate. These could be considered the main triggers for the house expansions, the absolute need to improve the financial situation of its inhabitants and family planning,

in which the house and its flexibility have an important role to encourage entrepreneurship, plus in a city like Manaus it is critical to project houses anticipating that the number of inhabitants per household will necessarily be changing, especially when they cannot afford to seek other alternatives. And so it does not seem surprising that in such a short time of existence there are already so many clandestine expansions to the houses. Neither it is surprising to see houses overcrowded with people, either because the family has grown or they sub rented one of the rooms for subsistence.

This research demonstrates that none of the inhabitants of these areas enjoys living in informal lodgings, and that the former dwellings were only informal due to lack of practical and financial conditions. In fact the ability to build formally was unequivocally confirmed through our research, in many of the extensions we analyzed, it was nearly impossible to distinguish from the original building, looking like they were part of the original design itself, such was the construction precision and material selection. Given the facts that we observed, we believe that a fairer model should allow the residents to be able to deliberate and develop their own space according to their resources and will, and that the government's role should be to guide, support and establish the rules of how it could be done. Providing many different ways of accomplishing the same end, this abolishes the latent lack of identity of the allocated houses and promotes a better integration within the city. Especially when considering the prime location of the parks. And it is here that we seek to intervene, on defining a framework that helps policy-makers to establish a support system for a different and more flexible approach. Because we consider that every problem has more than solution and that one beginning could have a number of ends.

### Acknowledgements

We are grateful to Prof. Reinhard Goethert for being such a resourceful and rigorous researcher. The completion of this research would not be possible without his guidance and support. Acknowledgments and thanks are due to the PROSAMIM program team, Concremat, Construtora Andrade Gutierrez, IDB, UBRA and SUHAB. We also would like to thank Abraham Frank Lima, architect Luiz Fernando Almeida Freitas, Dr. Fernanda Magalhães, Professor Jaime Kuck and Lúcio Rabelo for their general support.

### References

(SCHR), S. C. f. H. R., 2004. *The Sphere Handbook*, Geneva : The Sphere Project.

Cummings, J. L. D. D. & K. M. E., 2002. Measuring the consequences of promoting inner city homeownership. 11(4), pp. 330-359.

Ferguson, B. & Smets, P., 2009. Finance for incremental housing; current status and prospects for expansion. *Habitat International*, 34(3), p. 288–298.

Gattoni, G., Goethert, R. & Chavez, R., 2011. *Self-Help Housing and Incremental Housing: A Discussion on the Likely Directions for Future Housing Policy*, Washington: IDB.

Greene, M. & Rojas, E., 2008 . Incremental construction: a strategy to facilitate access to housing. *Environment and Urbanization*, 20(1), p. 19.

Hamdi, N., 1995. *Housing Without Houses: Participation, Flexibility, Enablement*. s.l.:Practical Action.

IDB, 2005. *Proposal for a Loan for a Social and Environmental Program for the Igarapés in Manaus*. [Online]

Available at:  
<http://www.iadb.org/projects/Project.cfm?project=BR-L1005&Language=English>  
 [Accessed 2012].

Jacques, P. B., 2004. *Estética da ginga*, s.l.: Casa da Palavra.

Kowaltowski, D. C. & Granja, A. D., 2011. The concept of desired value as a stimulus for change in social housing in Brazil. *Habitat International*, 35(3), p. 435–446.

Landaeta, G., 1994 . *Strategies for Low-income Housing: A Comparative Study on Nicaragua, Mexico, Guatemala, Cuba, Panama, Costa Rica and El Salvador*. 1st edition ed. Lund : Lund Univ., Division of Architecture and Development Studies.

Lei Municipal n. 671, 2., 2002. *Plano Diretor Urbano e Ambiental de Manaus*. Manaus: s.n.

Magalhães, F. & Villarosa, F. d., 2012. *Slum Upgrading – Lessons Learned from Brazil*. 1st Edition ed. Washington: Inter-American Development Bank.

Oliveira Júnior, J. A. d., 2009. *Riverine architecture on the waters of the Amazon: the habitat in complex environments*. São Paulo: Universidade de São Paulo.

Oliveira, A. S. L. d., 2012. *Indicadores IBGE*, s.l.: SINAPI.

PEPAC, 2007. *Plano de participação comunitária PROSAMIM*, Manaus: PROSAMIM.

Rojas, E. & Magalhaes, F., 2007. Facing the Challenges of Informal Settlements in Urban Centres: The Re-urbanization of Manaus, Brazil . In: *Brazil: International Development Bank* , p. 18 .

Soto, H. D., 2003. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. 1st edition ed. s.l.: Basic Books.

Tipple, G., 2000. *Extending Themselves*. Liverpool: Liverpool University Press.

Tipple, G. & G.Willis, K., 1991 . *Housing the Poor in the Developing World*. 1st edition ed. s.l.:Routledge.

Tuhus-Dubrow, R., 2009. Learning from slums. *Boston Globe*, 1 March , p. 1.

Turner, J., 1972. Housing as a verb. In: & R. F. John F. C. Turner, ed. *Freedom to build* . New York: Macmillan, p. 148–175.

UGPI, 2012. *Regulamento Operacional*. [Online]  
Available at: <http://prosamim.am.gov.br/wp-content/uploads/2012/09/ROP-4%C2%AA-Revis%C3%A3o-junho.2012.pdf>  
[Accessed 5 October 2012].