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[RESAPO_stage 1] METHOD OF ANALYSIS OF THE RESILIENCE AND ADAPTABILITY

IN

SOCIAL HOUSING DEVELOPMENTS

THROUGH

POST-OCCUPANCY EVALUATION AND CO-PRODUCTION

RESEARCH FINAL REPORT

FAUeD/UFU - JUNE 2017

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METHOD OF ANALYSIS OF THE RESILIENCE AND ADAPTABILITY IN SOCIAL HOUSING DEVELOPMENTS THROUGH POST OCCUPANCY EVALUATION AND CO-PRODUCTION

FINAL RESEARCH REPORT

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SUMMARY

FRAMES

TABLES

GRAPHS

PART 1
RESEARCH PROJECT PLAN

Title: **Method of analysis of the Resilience and Adaptability in Social Housing Developments through Post Occupancy Evaluation and Co-prodution**
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1.1 ABSTRACT

The current social and climatic changes observed require an urgent revision of urbanization strategies around the world, to reduce environmental and social impacts, as well as to develop the resilience of built environments. The main challenges are the use of constructive systems and appropriate materials, design techniques and construction for specific climatic zones, besides the existent habitational adaptation with new technologies. In developing countries, the low level of quality in architecture and urbanism increase the social vulnerability that affects millions of people who find it difficult to find adequate housing, which in turn is found in precarious conditions. When the governmental housing programmes try to balance out this deficit, the low quality of defined standards lead to highly inadequate houses for the residents, obligating them to make modifications to buildings which are not necessarily prepared for these adaptations, leading to the waste of material and the inefficient use of resources.

This Project will use advanced Post-Occupancy Evaluation (POE) techniques to develop methodological analysis procedures together with Social Housing Developments. The analysis will focus on the adaptive and transformative capacities alongside the resilience of the built environment in attendance to the necessities of the residents and the subsequent environmental impact caused by these ongoing transformations. The analysis will be centred on three elements: (i) BUILT ENVIRONMENT (building complex, taking into consideration the scales of the district, neighbourhood and unit, and the relation of impact between the built and natural environments; (ii) AGENTS (agents that interfere with the local social dynamic); (iii) USERS (residents of the complex). The evaluation will focus on social, functional, behavioural and environmental issues of the built environment. For verification, the methodological procedures developed will be applied to a case study in the city of Uberlândia – Brazil, specifically the undertaking of the governmental programme "*minha casa, minha vida*" located in the western area of the city.

The two study groups (**[MORA] housing research of FAUeD/UFU** and **[*People, Environment and Performance]* from the SSoA, Universidade of Sheffield - TUoS**) will share their respective knowledge in the areas of POE, adaptability and Resilience to develop an international understanding of the localized solutions. The project supplies bases for the preparation of study, structuring a fundamental partnership between the two institutions. Also, promoting the excellence of investigation and know how through the exchange of knowledge between the two POE groups in England and Brazil, including innovative methodologies in the prospection of cultural, environmental, technical and functional aspects of the built environment, particularly look at interdisciplinary aspects through a combination of architecture, social sciences and engineering methods.

The aim is, with the results from this research, to make information about social housing developments available, identifying aspects to be improved in new projects undertaken by the government with the intent to amplify the adaptive capacity and resilience of the built environment in question. This experiment can promote a real, practical, difference to residents in Brazil and protect the future, providing detailed guidelines for more adaptable, resilient, housing projects in a local context, proven through a study on POE. The understanding of different challenges, in both countries, can further help expand the field of knowledge for under-graduate, graduate and post-graduate students from each institution, through digital exchange, as well as providing new tools and techniques for housing managers for assisting decision making.

1.2 KEY-WORDS

Post-Occupancy Evaluation; Social Housing Developments; Technological Innovation; Resilience, Adaptability.

1.3 JUSTIFICATION

The current social and climatic changes observed require an urgent revision of urbanization strategies around the world, to reduce environmental and social impacts, as well as to develop the resilience of built environments. The main challenges are the densification of low density suburbs, the use of constructive systems and appropriate materials, design techniques and construction for specific climatic zones, besides the existent habitational adaptation with new technologies.

In developing countries, the low level of quality in architecture and urbanism increase the social vulnerability that affects millions of people who find it difficult to find adequate housing, which in turn is found in precarious conditions. When the governmental housing programmes try to balance out this deficit, the low quality of defined standards lead to highly inadequate houses for the residents, obligating them to make modifications to buildings which are not necessarily prepared for these adaptations, leading to the waste of material and the inefficient use of resources.

The low quality in the production of social housing developments

After the operational period of the *Banco Nacional de Habitação (BNH* -1964-1986), the housing policies implemented by the federal government of Brazil, went through a process of discontinuity, while states, and moreover municipalities, became overall responsible for providing housing to the low income population (CARDOSO, ARAGÃO e ARAÚJO, 2011). Only after 2003, was the attempt to construct a new, nationwide, housing policy taken up again, proposing to maintain the strategic role played by local authorities, articulated to other levels by means of the National Social Housing System or *Sistema Nacional de Habitação de Interesse Social* (SNHIS)[1].

In this context, and also in response to the worldwide economic crisis of 2008 (CARDOSO, ARAGÃO & ARAÚJO, 2011; ROLNIK & ROYER, 2014), in march of 2009 the *Minha Casa Minha Vida* (PMCMV) programme was launched. With a current mark of more than 4 million housing units contracted until September, 2015, among which 1.72 million belong to the first bracket of the programme[2] and 2.4 million were distributed to the contracted complex, PMCMV has generated a considerable impact on the economic, social and urban infrastructures of our country. Apart from the expressiveness of the numbers, recent research has found that there are still many challenges that need to be confronted in the production of Social Housing Developments (SHC) in Brazil, more specifically not attending, only, to the habitational demands, but constructing sustainable cities from an economic, social, environmental and cultural point of view (VILLA, SARAMAGO & GARCIA, 2015; AMORE, SHIMBO & RUFINO, 2015).

The expressiveness of production in the programme is present nationwide, including medium sized cities, like Uberlândia/MG. In the same year as the launch, the main form of production of SHC in the city, representing 85.3% of constructed units, was through PMCMV resources. In Succeeding years, with the exception of 2011, 100% of housing units were built using from the programme. According to city statistics from the Uberlandia city hall, until 2014, 9,238 habitational units (HU) were contracted and from that total, 6,348 (68.7%) belong to the bracket 1. Therefore, one of the consequences of PMCMV, according also to recent studies on the *Rede Cidade e Moradia*, refers to the demobilization of local housing actions in favour of a national one (OLIVEIRA, et al; 2015).

Furthermore, one question that deserves to be outlined here is the intensification of the insurgence of similar developments in adjacent areas, leading to the creation of larger undertakings. According to Rolnik & Royer (2014), although legally considered as different operations, from the point of view of urban impact, this represents one single intervention. Thus, the rules imposed by the federal government on the size of such undertakings – which is limited to 500 units – ends up being distorted (CARDOSO, ARAGÃO & ARAÚJO, 2011). And, in consequentially, such operations generate single-use, homogenous areas, not really qualified from an urbanism point of view – in view of this, the majority are lacking in adequate infrastructure, services and equipment (OLIVEIRA, et al; 2015).

Regarding the standards of implementation, beyond homogeneity, the low densification of these developments is also highlighted, in both local and national levels. This is because, Brazil, since the launch of the MCMV programme, 42% of HUs produced were single story housing, and in Uberlândia an even larger percentage: 50.7%. This type of occupancy demands the existence of large tracts – which, most of the time, are found in peripheral areas, where the price of land is more compatible with the financial values of the programme and more profitable for the constructors (SHIMBO & CERON, 2014). Some of the programme's undertaking, for example, were only made possible by the expansion of the city limits.

According to Villa, Oliveira & Saramago, 2013, the tendency to push the housing developments to the edges of the city increases their social and environmental vulnerability. To maintain the level of implantation of isolated houses on lots located in distant areas, such production imposes a model of circulation and mobility dependant on motorized transport, as well as demanding the creation of a series of infrastructures (connecting roads, public transport, healthcare and educational equipment, among others). The combination of these factors potentiates the negative effects of the climatic changes, as far as the lower ground permeability rate of the generated and the use of inefficient energy sources (RUBANO, 2008; ROLNIK, R.; NAKANO, 2009). Apart from this, both due to the omission of the authorities in the inspection of entrepreneurs regarding the provision of such basic infrastructure and due to their own inability to offer allotments appropriate to lower income groups perpetuates an urban insertion Social Housing model also unsustainable from a socioeconomic point of view. In other words, in the centres of our cities

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[1] Available at: http://portal.cnm.org.br/sites/6700/6745/cenario_politicas_habitacionais.pdf [Access January 3rd 2016].
[2] With the MCMV Programme, the main objective was the promotion of the construction or acquisition of new housing units for families with income income until R$ 5.000,00, with 40% of the housing units destined to families with income range between 0 and 3 minimum wages. Its actual goal is to produce 4 million residences for families with income range until 10 minimum wages, splitting in three income brackets, defined by setpoints: the first income bracket contemplates families with gross income until RS 1.600,00, the second between R$ 1.601,00 and R$ 3.100,00, and the third with income between R$ 3.101,00 and R$ 5.000,00. The subsidy varies according to the income rate. Available at: http://www.cidades.gov.br/index.php/minha-casa-minha-vida.html [Access January 17th 2016].

there are the opportunities, while the outskirts continue being deprived of urbanism (ROLNIK & KLINK, 2011). As a consequence of this, the lack of collective equipment and green spaces, together with the scarceness of economic and cultural opportunities, generally observed in these housing developments, make the appropriation of the place to its users difficult. Such appropriation is jeopardised by the aesthetic monotony of the buildings, composed of a repetition of low quality architectonic units (FORMOSO, LEITE & MIRON, 2011).

As far as the units produced, various authors have indicated the low functionality of these residencies, which, according to a minimum architectonic programme (living room, two bedrooms, bathroom, kitchen and laundry area), neglect the necessities of the differing family profiles of the residents. Presenting reduced, compartmented, spaces, the activities in different environments overlap, making the installation of basic furniture difficult, and also reducing the privacy and appropriation of the residents (LEITE, 2006; PALERMO, 2009; VILLA, SARAMAGO & GARCIA, 2015). Besides this, the options of possible constructive systems and finishes are quite limited for these people, being that all domestic demands should be able to be performed in units with a minimum space of 32m² (ground area, not calculated with laundry area) to 37m² (for apartments) (CEF, 2012). According to analyses from *Rede Maradia e Cidade* and for other studies on POE (VILLA et al., 2013), such situations are aggravated by the difficulties encountered in transformations and remodelling of the housing unit over time, demonstrating the lack of flexibility projected.

The previously mentioned factors result in the weakening: socially, economically and environmentally; of the residing population, becoming therefore, more vulnerable to the impacts, which can come in different forms:

i. **Climatic natural order** – Strong rains can cause damage to the housing, or even flooding, after long dry spells;
ii. **Physical-architectonic order** – In the houses, the precarious nature of the construction materials, and the electrical and hydro fixtures used, along with the standardisation of such programmes and their limited usable space, and the lack of adequate equipment for the control and tank testing;
iii. **Physical-urbanistic order** – typological monotony, lack of adequate infrastructure in the implanted housing developments, lack of equipment for leisure, culture, education, health, safety and security for the residents, alongside the lack for public transport;
iv. **Socioeconomic order** – Lack of opportunities in the local are for jobs and services in general.

According to Lemos, 2014, poverty and inequality are two of the most negatively impacting factors on vulnerability (UCCRN, 2011). Pockets of urban poverty are areas with serious deficiencies, in respect to physical aspects, in terms of infrastructure, services (including healthcare), environmental quality and vertical constructions, among others. Social and economic aspects of the urban system, are areas that concentrate a population with a deficient education and family income, limited local autonomy, and often in a violent area with no, or very little, presence of the authorities. They are areas and populations marked by social and physical-territorial segregation.

Such urbanization models have problematic characteristics, like open metabolism, unbalanced in relation to the input and output of energy, dependence on automobiles, generation of stress in the lives of the population, all resulting from the inadequate living and working conditions, insecurity and violence, among others. It brought to light again, the precarious conditions currently found in many of these social housing developments when referring to **urban space** – with an urban form inadequate for the climate, insalubrity, and lacking free, open, public, and green, spaces, presenting inefficient services, deficient equipment, and distributed by inequitable means, also the overstretching of, and dependency on, transport, often private-, does not refer to **housing** – inadequate physical conditions of the housing unit, location and housing density-, where we refer to **workspace** as much as **family and social structures** – Lacking in education and security, and overwhelmed with violence and unemployment, where the income is not enough to sustain a family. Fragile social networks and institutions and authorities a long way from the population. Such precarious conditions directly affect the resilience, and are amply associated with, socioeconomic inequality and poverty (LEMOS, 2014). The precious physical-territorial and social conditions amplify the vulnerability that inhibits resilient state of urban systems (SMITH, KLEIN & HUQ, 2003).

Lemos, 2014, further reinforces the argument on the construction of urban resilience, that reduces the vulnerability of cities, should be understood as a priority for socio-environmental sustainability. Sustainability therefore, should be understood as a goal that guides actions of adaptation to resilience. The concepts of sustainability are, without doubt, intimately connected. The first step for actuation in a complex world in transformation involves, the understanding that we all are part of interlinked systems composed of human beings and nature […]; those are complex adaptive systems; resilience is the key for their sustainability (WALKER & SALT, 2006).

Resilience and Adaptability

The concept of adopted resilience, in this study, is understood as an adaptive capacity or the faculty for recuperation from different impacts (natural, social, physical), important to achieve the adequacy and quality in social housing. The traditional concept of resilience is associated to the capacity of a system to withstand disturbances, reorganizing when subject to alterations, and at the same time capable of continuing its essential functions, structure, identity and mechanisms (WALKER et al., 2004; THACKARA, 2008). The term appeared in the area of ecology in the 1970s, being applied, Briefly, in relation to the capacity of a system to absorb, and even benefit, from impacts that act upon it, without causing permanent damage to the structure and functionality. Before this, the term was used in physics, attributing to the resistance of materials to deformation under the effect of determined impacts (BALTAZAR, 2010; LEMOS, 2014).

However, traditionally applied in physics and ecology, this meaning has also been applied in other fields such as human resources and urban dynamics. Resilience can be understood as the contrary state to vulnerability (IPCC, 2014). Vulnerability in a context of climatic threats, refers to the sensitivity of the system (structural conditions which, in the case of urban systems, translate to infrastructure, transport, urban equipment, etc.) in the face of specific threats (rains, droughts, rising temperatures, and following consequences), combined with the adaptive capacity of the population and exposed institutions, in other words, their condition to utilize available resources (information, technology, etc.) to react to the climatic event (LEMOS, 2014). To know what incidental threats are, finding what is exposed (material and population) and the place-specific vulnerability is the first determining step to adaptive actions that aim at resilience in an urban system (DAVOUDI; CRAWFORD & MEHMOOD, 2009).

However we would like to use a different definition, established by Maguire & Cartwright (2008). One that is more positive and evolutionary in relation to social resilience. The resilience approach identifies the resources and adaptive capacity that a community can utilise to overcome the problems that may result from change. The approach builds upon the inherent capacities of a community, rather than only relying on external interventions to overcome vulnerabilities. Social resilience is the capacity of a community to cope with disturbances or changes and to maintain adaptive behaviour. Social resilience has economic, political, spatial, institutional and social dimensions (ADGER, 2000). A resilient community is able to respond to changes or stress in a positive way, and is able to maintain its core functions as a community despite those stresses. A particular change may have vastly different consequences in different communities, and different communities will demonstrate different degrees of resilience to the change (KELLY, 2004). In this context, the resilience concept was used to recognise the complexity of community-environment interactions, and the complexity of change (MAGUIRE & CARTWRIGHT, 2008).

The role of social interaction in the environments reinforces the intended concept of resilience. In the international field, studies have strived to broaden the approach. For example, there is the resilient project in socio-ecologic-systemic (SES) terms, which in accordance with Biggs et al (2012) deals with how the human communities interact with their environment (STEVENSON e BARBORKSA-NAROZNY, 2015). Also, in 2015, the conference *Architecture and Resilience on the Human Scale* took place in Sheffield – UK, which centred on investigation, strategies and projects which are testing how local resilience can be built in preparation for large social challenges such as climate change, resource scarcity, a rise in extreme climatic events, demographic change and so on. During the conference the architectural possibilities and methodologies in architectural research, which contribute to the construction of local resilience, were discussed, specifically through the maintenance of a social, ethical and political dimension. The relevance of shared social action (co-producing) was also looked at as a key component for the activity: Resilience on a Human Scale, recognising that the university-community partnerships and notions of co-producing research have been increasingly frequent, with the belief that the knowledge needs to be created and driven with those who most need it. In the field of architecture and planning, this follows a long tradition of participation and, in turn, signals not only a movement in the direction of ethical ways to produce knowledge, but also new opportunities for collective action in the making of the city (TROGAL e PETRESCU, 2015).

Post-Occupancy Evaluation (POE)

The relevance of POE in achieving high quality in an architectural project has already been consolidated by many studies in civil construction as much in the national field (ELALI & VELOSO, 2006; ORNSTEIN, VILLA & ONO, 2011; VILLA & ORNSTEIN, 2013; VOORDT & WEGEN, 2013), as in the international field (LEAMAN; STEVENSON; BORDASS, 2010; PREISER & VISCHER 2005; MALLORY-HILL, PREISER & WATSON 2012). Relevant aspects in relation to process management of the Project, in which POE is inserted, and its role in the attending the constructed space, notably in housing, have also been amply studied (MELHADO, 2004; SILVA & SOUZA, 2003; ADESSE & SALGADO, 2006; VILLA, 2008; PREISER & NASAR, 2008; FINCH, 2012). As widely presented, the need for the narrow, yet deep, relation between the gauging of human behaviour in domestic spaces and the quality of housing was a way of raising satisfaction figures and the improvement of performance from idealized projects in this area. This improvement, apart from other aspects, also goes through assembly and observation, in part from the agents involved, from the

databanks fed by evaluations that include techniques of physical perception of the built environment, as well as the interaction between this environment and the behaviour of the users (VILLA, 2008; VILLA, SARAMAGO & GARCIA, 2015).

However, it is needed to reinforce the necessity of the development of research in the area of POE and Co-production on the resilience and adaptability of social housing developments with the intention to know, in depth, what incidental threats exist in the spaces, finding what is exposed (material and population) and the place-specific vulnerability.

Apart from developing a new approach to the evaluation of resilience and adaptability, the current study intends to broaden the discussion on new methodological possibilities in the area of POE and Co-production application through interdisciplinarity, the adoption of different methods and non-traditional approaches. The interdisciplinarity justifies itself, as much as in other sciences, apart from ones associated to architecture and urbanism, are relevant for a larger foundation of planned actions in POE (ORNSTEIN, 2005). In this study, specifically, interdisciplinarity is was found through a partnership between the Faculty of Architecture and Urbanism and Design (FAUeD / UFU), the Faculty of Computer Science *(FACOM/UFU)* and Sheffield School of Architecture – The University of Sheffield (SSoA-TUoS). The adoption of multiple methods in POE, qualitative and quantitative, is based on the possibility of the collection of different types of data, mainly allowing for, a counterbalancing of possible deviations/tendencies (bias) of the results (LAY e REIS, 2005; ZIMRING, 2001; BORDASS, LEAMAN & ELEY, 2006). And finally finding evaluation methodologies with unconventional approaches, which consider other components of the evaluation – not the physical gauging of the built environment, but those that deal with different perceptions of the characteristics that interfere with user behaviour – through the employment of digital tools, structured focal groups, among other tools compatible with the objectives of the evaluation (ELALI & VELOSO, 2004; LAY & REIS, 2003 & 2005; RHEINGANTZ, 2009).

In this manner, this research Project intends to continue the work already concluded, and in progress, in the scope of the two research groups involved ***MORA – housing research*** *(FAUeD-UFU/BR)* and **People, Environment and Performance** (SSoA-TUoS/UK) on Post-Occupancy Evaluation tools for housing.

About **MORA - pesquisa em habitação**[3] *(FAUeD-UFU/BR)*. Intending to be a space of knowledge open to criticism and reflection that searches for a more significant relation between the academic and practical means, through actions that effectively contribute to improvements in housing quality. Different approaches are proposed in the research undertaken: technological innovation, sustainability, special quality, Post-Occupancy Evaluation. The group has been dedicated to the production of knowledge in the area of POE, demonstrating its relevance in the obtaining of living quality[4] and the construction of more advanced, more efficient tools for POE, notably for social housing[5]. Such actuation has resulted in, in recent years, many research projects financed by funding agencies such as CNPq, FAPEMIG e IPEA.

For this project, it is intended to continue the work from other research projects on POE with digital interfaces[6], where the search for methodological improvement is based on technological advances in the area, with the use for example, of digital equipment. Due to this, depending on investigations on the main methodological advances in the area of POE, it has been identified that a large majority of studies undertaken in Brazil are restricted to the use of traditional resources in the application of techniques, such as a paper questionnaire. Even when research uses specific software for the application of surveys, online or not, they possess low levels of user interaction.

From the developments of previous research on POE in housing (VILLA, 2008; VILLA e SILVA, 2012; SARAMAGO et al., 2015; VILLA et al., 2015), other demands have been configured into inducing issues for the development of the present study: (i) the widening of the efficiency and trustworthiness of POE results obtained through quantitative methods; (ii) respecting the privacy of residents evaluated; (iii) the possibility of more interaction between the researcher and the resident under evaluation; (iv) the reduction of evaluation costs; (v) the amplification of efficiency in the tabling of the evaluation results; (vi) the graphic and multimedia capacity of the digital means enhancing interactions; (vii) the use of technology not only as equipment but also as a functional, integral part of the evaluation; and (viii) the capacity of the evaluation to be educational. Considering such aspects, integrating and utilizing digital media with the intention to minimize the deficiencies and problems identified, potentiating the evaluation methods and therefore obtaining a greater efficiency in results.

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[3] http://morahabitacao.com.

[4] Within various scientific article published in magazines and events, standing out is the published book "**Qualidade Ambiental na Habitação: avaliação pós-ocupação**", in co-organisation with Sheila Walbe Ornstein, *Oficina de Textos* Publishing Company, 2013.

[5] VILLA, S. B.; SARAMAGO, R. C. P. ; GARCIA, L. C. **Avaliação Pós-Ocupação no Programa Minha Casa Minha Vida: uma experiência metodológica**. 1. ed. Uberlândia: Universidade Federal de Uberlândia, 2015. v. 1. 152p .

[6] Funded Researches by FAPEMIG – Foudation of Research Support of the state of Minas Gerais (Universal Demand 2012/2013 and Universal Demand 2014/2015), entitled "**AVALIAÇÃO PÓS-OCUPAÇÃO EM APARTAMENTOS COM INTERFACES DIGITAIS**" and "**AVALIAÇÃO PÓS-OCUPAÇÃO FUNCIONAL, COMPORTAMENTAL E AMBIENTAL EM APARTAMENTOS COM INTERFACES DIGITAIS: APRIMORAMENTO DO SOFTWARE, INTERFACE E APLICAÇÃO**", developed in the scope [MORA] Housing Research in the Project Research Core of the Facyltu of Architecture and Urbanism and Design of the Federal University of Uberlândia (FAUeD/ UFU). Evolves around the development of methodologic procedures of functional, behavioural and environmental POE, trough design and use of digital interfaces.

About the group *People, Environment and Performance*[7] (SsoA-TUoS/UK). Aiming at situating sustainable design of architecture inside a bioregional context, integrating people, processes and places. This analysis is based on graduate and post-graduate research that establish a platform to explore sustainable design referring to the user of and sustainable housing as a typology. The research is centred around: low energy consumption design, the involvement of the user, and the ecological specification of materials and products. The group has developed an ample approach to the evaluation of projects and the construction of performance based on evidence (Building Performance Evaluation), including efficient tools for POE and Co-production. Inside this research scope, the understanding of how the people interact with technology and the applied project principals are interesting, in relation to specific cultural and physical environments (NICOL & STEVENSON, 2013; STEVENSON & BARBORKSA-NAROZNY, 2015; STEVENSON & LEAMAN, 2010).

From the justification, previously pointed out, this study aims at developing methodological procedures for Post-Occupancy Evaluation (POE) and Co-production in social housing developments focusing on their adaptability and resilience. For verification, the methodological procedures developed will be applied to a case study in the city of Uberlândia – Brazil. This study intends to subside reflections on how we can construct local resilience and adaptability in preparation for large social challenges such as climate change, resource scarcity, the rise in extreme climatic events, demographic changes and so on.

1.4 MAIN SCIENTIFIC AND TECHNOLOGICAL CONTRIBUTIONS AND ADVANCES OF THE PROPOSAL

The two study groups ("*Mora" da FAUeD/UFU* and "*People, Environment and Performance*" from the SSoA, University of Sheffield - TUoS) will share their respective knowledge in the areas of POE and Co-production, adaptability and Resilience to develop an international understanding of the localized solutions. The project supplies bases for the preparation of study, structuring a fundamental partnership between the two institutions. Also, promoting the excellence of investigation and know how through the exchange of knowledge between the two POE and Co-production groups in England and Brazil, including innovative methodologies in the prospection of cultural, environmental, technical and functional aspects of the built environment, particularly look at interdisciplinary aspects through a combination of architecture, social sciences and engineering methods.

From a POE point of view, the project intends to continue the research developed in the scope of the group [MORA] housing research on Post-Occupancy Evaluation with digital interfaces, in which looks for methodological improvements in technological innovations in the area, with the use of, for example, digital equipment.

The objective, with the results from this research, is the availability of information about social housing developments, identifying aspects to be improved in new projects undertaken by the government with the intention of amplifying the adaptive capacity and resilience of the built environment in question. This experience can promote a real, practical difference to the residents in Brazil and protect the future, providing detailed guidelines for a more adaptive, resilient housing project in a local context, proven through a POE and Co-production study. The understanding of the different challenges in both countries can help, still further, the expansion of fields of knowledge to undergraduate and post-graduate students of each institution, through digital exchange, as well as providing new tools and techniques for housing management to assist in decision making.

1.5 OBJECTIVES

Primary Objective: To develop methodological procedures for Post-Occupancy Evaluation (POE) and Co-production on social housing developments focusing on adaptability and resilience. For verification, the methodological procedures developed, will be applied to a case study in the city of Uberlândia – Brazil

Secondary Objectives:

● Research and delimit elements that compose the concepts of resilience and adaptability in the scope of this study;

● Analyse the adaptive, transformative and resiliency capacities of the built environment, attending to the needs of residents in the case study in question;

● Analyse the subsequent environmental impact of the ongoing transformations in the case study in question;

● Enhance the methodological procedures for the evaluation of built environments, as well as using digital tools;

● Establish databases for the study area, loading citizens and managers into the elaboration of public housing policies;

● Develop tool for the evaluation of resilience in commercial areas of social housing developments - how can we encourage a vibrant and evolutionary development of mixed use in local neighbourhoods? What tools can promote this?

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[7] https://www.sheffield.ac.uk/architecture/people/academic/fionn-stevenson.

1.6 OPERATIONALISATION/ METHODOLOGY

This study aims at utilizing advanced techniques in Post-Occupancy Evaluation (POE) and Co-production to develop methodological procedures for the analysis of social housing developments. The analysis will focus on the adaptive, transformative and resiliency capacities of the built environment, attending to the needs of residents and the subsequent environmental impact of the ongoing transformations. For verification, the methodological procedures developed will be applied to a case study in the city of Uberlândia – Brazil. Dealing specifically with a housing complex – Shopping Park; part of the government programme *"Minha Casa Minha Vida"* located in the western region of the city.

For ample attention to the proposed objectives, the following steps will be carried out: (i) bibliographical research – theoretical founding and definition of terms and used concepts; (ii) exploratory research – collection of data and information from the subject of study and (iii) applied research – development and application of POE and Co-production in the study case.

Research clippings

The analysis will be centred on three elements: (i) BUILT ENVIRONMENT (building complex, taking into consideration the scales of the district, neighbourhood and unit, and the relation of impact between the built and natural environments; (ii) AGENTS (agents that interfere with the local social dynamic); (iii) USERS (residents of the complex). The evaluation will focus on social, functional, behavioural and environmental issues of the built environment.

Operationalisation

Both research groups ("Mora" da FAUeD/UFU and "*People, Environment and Performance*" from SSoA da University de Sheffield - TUoS) will act in the development of research in a complementary way from their own abilities and interests, therefore seeking a better operationalisation and methodology as previously explained. The work will be divided into 5 parts, in which each researcher from the team will act more intensely:

i.   GENERAL CHARACTERISTICS

Analysis items: State of the art, description of the housing programme, general characteristics of the city of Uberlândia and the study subject;

ii.   CLIMATIC NATURAL ORDER

Analysis items: vegetation, soil, water sources, flows, weather statistics, pollution, waste, topography, shortages (water, power, food), stretched dry seasons, warmer.

iii.   PHYSICAL-ARCHITECTONIC ORDER (housing and non-housing)

Analysis items: format, construction system and materials, services (electricity, water, sewage, IT/electronics, cost+suplly), internal layout, adaptation.

iv.   PHYSICAL-URBANISTIC ORDER

Analysis items: Land-use, social facilities (leisure, sport, culture, safty, security), infrastructure, transport, density, commerce/business (income generation), violence, food (agrocity), income.

v.   SOCIOECONOMIC ORDER

Analysis items: demographics, social-economic data-analysis, violence, safety, policy, NGO's (3RD sector), education, health, other agents.

Stages of work

1. Research the definition of the concepts used in the work: adaptability, resilience, post-occupancy evaluation, Social Housing developments;
2. Recognizing the basic aspects of the study area: preliminary information - general characteristics;
3. Research plan (draft);
4. Meeting with the group in Sheffield – UK (TUoS), for the definition of the methodological procedures to be used in the research;
5. Additional data on the study area;
6. Development of the methodological procedures to be used in the research, defining methods and tools;
7. Planning the application: definition of the resources, samples, and the approval of permissions, timeline and actions;

8. Application of POE tools to the case study;
9. Meeting of the Uberlândia group for the preliminary analysis and planning of the systematisation of the results;
10. Systematisation of the POE results;
11. Elaboration of the reports on activities – diagnosis of the area and recommendations for future research;
12. Forwarding of products generated through the research – scientific articles, etc.

1.7 ACTIVITIES TIMELINE

This research project will last for 11 months (mach, 2016 to January, 2017) where the involved researchers will work in a complementary way to their respective abilities.

Stage	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan
1. Research and definition of concepts	▨										
2. Recognizing the basic aspects of the study area	▨	▨									
3. Research plan (draft);		▨									
4. Meeting with Sheffield group		24-30									
5. Additional data on the study area			▨								
6. Development of methodological procedures			▨								
7. Planning the application				▨							
8. Application of POE tools				▨	▨						
9. Group meeting in Uberlândia						6-12					
10. Systematisation of POE results							▨	▨	▨		
11. Elaboration of activity reports							▨	▨	▨	▨	
12. Forwarding of generated products											▨

1.7.1 Santander Exchange Research Week: Sheffield 24th April – 1st May 2016

Simone Barbosa Villa and Fernando Garrefa visiting Fionn Stevenson

DAY	ACTIVITY
24/04	12:00 – Arrival to Sheffield
	19:00 – Dinner – with Fionn
25/04	9:00am -10:30am -Introduction - Arts Tower Meet Tariq and Christie.
	6:00pm –700pm - SELA Energy Systems Project – Final Project Event Diamond Workroom 1
	Establish Research Plan
26/04	12:00 pm-1:30 pm – Project Presentation to the SSoA Staff
	2:00pm – 6:00pm - 2nd Santander Session
	Establish Initial Scope
27/04	2:00 pm – 4:30pm working on research project
	4:30pm – 6:00pm - 3rd Santander Session with Fionn
	Analysis Site
28/04	9:00am – 1:00pm 4th Santander Session with Fionn
	2:00pm – 6:00pm – working on research project
	Analysis Houses
29/04	9:00am – 1:00pm 5th Santander Session with Fionn
	2:00pm – 6:00pm 6th Santander Session with Fionn
	Return visit Objectives
30/04	9:00am-4:00pm – Visiting Peak Disgtrict
	7:00pm -9:00pm - Albion Choir. Holy Trinity Church
01/05	12:00 pm Depart to Uberlândia

1.7.2 Santander Exchange Research Week: Sheffield 06th - 12th August 2016

Fionn Stevenson visiting Simone Barbosa Villa and Fernando Garrefa

DAY	ACTIVITY

06/08	9:40am – Arrival to Uberlandia
	4:00pm – Sightseeing inUberlandia
	7:00pm – Dinner – with Fernando and Simone
07/08	10:00am-11:30am – 2º Co-production session
	12:00pm-1pm – Visiting the neighbourhood and houses
	1:30pm – Lunch
08/08	9:00am-10:00am – Welcome from the University Research and Post-Graduation Dean
	10:00am-12:00pm – Visiting UFU-Santa Mônica University Campus
	12:00pm-2:00pm - Lunch
	2:00pm-5:00pm – Work Meeting with the Uberlandia Team Presentation of the Team members; Updating the Research Status; Presentation of the main results (so far)
	7:00pm- 10pm - Dinner (at the NGO Estação Vida)
09/08	9:00am-12:00pm – Work Meeting with the Uberlandia Team Identifying the data to be complemented; Revising or complementing the research methods
	12:00pm-2:00pm – Lunch
	2:00pm-5:00pm – Work Meeting with the Uberlandia Team Future Steps for Santander Projects (with only Simone and Fernando)
10/08	10:00am-12:00pm – Meeting with the Uberlândia expanded Team (Viviane, Giovanna, Elza, Plínio, Letícia, Ivone) Planning for actions after the Santander Project; Possible institutional partnership
	12:00pm-2:00pm – Lunch in our home
	2:30pm-4:00pm – Fionn's Lecture: "*Sustainable Housing, Resilience and Social Learning*"
11/08	10:00am-12:00pm Visiting NGO "Estação Vida" at Shopping Park Neighbourhood
	12:00pm-2:00pm Lunch
	2:00pm-5:00pm – Meeting with FAUeD academic staff Brief presentation of research interests by FAUeD members Presentation of SSoA Live Project experience; Possibilities for future collaboration;
	7:00pm – Dinner/ Cultural Samba session
12/08	10:00am – Depart to Sheffield

1.8 EXECUTING TEAM AND DETAILING OF ACTIVITIES

Being an ample, interdisciplinary research project, that involves two institutions (FAUeD/UFU and SSoA - University of Sheffield - TUoS), the study will be divided into three subprojects that will be developed, complementarily, in parallel. Such procedures aimed at a clearer definition of the proposed objectives for the general project and its constituting parts. As stated, the work of the whole team will be integrated, however, some stages will be developed with a priority by determined researchers, depending on their graduation and speciality. The project counts, initially, on the executing team, presented above and described below. However, it intends to broaden the participation of fellows and research groups from master's and other funding organisations.

A. Supervising Professor: Professor **Fionn Stevenson** (Climatic natural order and Socioeconomic order).
- Responsible for the general supervision (theoretic-conceptual) of all stages of the research;
- Accumulated experience in the area of BPE (*Building Performance Evaluation*), Post-Occupancy Evaluation in housing, energy efficient evaluation of built environments, analysis and design for resilience (*Design for resilience integrated with the BPE*) and Social learning (*Social Learning and Action Research Integrated*);
- Acting, on stages 2 and 5, focusing on socioeconomic and environmental evaluation;

- Responsible for the development of evaluation tools that contemplate the socioeconomic and environmental aspects of the research in terms of housing units;
- Responsible for the activity report, contemplating socioeconomic and environmental aspects of the research in terms of housing units, such as the elaboration of products generated by the research in this approach;
- Responsible for the revision of the activity report contemplating all the aspects of the research.

B. Responsible Professor: Prof Dr **Simone Barbosa Villa** (Physical-architectonic order and Socioeconomic order).

- Accumulated experience in the area of BPE (Building Performance Evaluation), Post-Occupancy Evaluation in housing, evaluation of functionality and behaviour of built environments, development of tools of evaluation with digital interfaces and technological innovation;
- Acting on stages 1, 2 and 5, focusing on functional and behavioural aspects of the evaluation in terms of housing units;
- Responsible for the development of evaluation tools that contemplate the functional and behavioural aspects of the research in terms of housing units;
- Responsible for the application of POE in the case study;
- Responsible for the activity report contemplating the socio-economic, functional and behavioural aspects of the research in terms of housing units, and also the elaboration of products generated by the research in this approach;

C. Researching Professor: Prof Dr **Fernando Garrefa** (Physical-urbanistic order and Climatic natural).

- Accumulated experience in the area of urban planning, commercial spaces, Post-Occupancy Evaluation of commercial spaces;
- Acting in stages 1, 3 and 5, focusing on functional and behavioural aspects of the evaluation;
- Responsible for the development of evaluation tools that contemplate the functional and behavioural aspect of the research in terms of urban insertion and commerce and services;
- Responsible for the application of POE on the case study;
- Responsible for the activity report contemplating the functional and behavioural aspects of the research in terms of urban insertion and commerce and services, as much as the elaboration of products generated by the research in this approach;

STAGE	DESCRIPTION		RESPONSIBLE
1.	GENERAL CHARACTERISTICS	State of the art, description of the housing programme, general characteristics of the city of Uberlândia and the study subject;	Simone Barbosa Villa Fernando Garrefa
2.	CLIMATIC NATURAL ORDER	Vegetation, soil, water sources, flows, weather statistics, pollution, waste, topography, shortages (water, power, food), stretched dry seasons, warmer	Fionn Stevenson Fernando Garrefa
3.	PHYSICAL-ARCHITECTONIC ORDER	format, construction system and materials, services (electricity, water, sewage, IT/electronics, cost+suplly), internal layout, adaptation.	Simone Barbosa Villa
4.	PHYSICAL-URBANISTIC ORDER	Land-use, social facilities (leisure, sport, culture, safty, security), infrastructure, transport, density, commerce/business (income generation), violence, food (agrocity), income.	Fernando Garrefa
5.	SOCIOECONOMIC ORDER	Demographics, social-economic data-analysis, violence, safety, policy, NGO's (3RD sector), education, health, other agents.	Fionn Stevenson Simone Barbosa Villa

1.9 EVALUATION

The research will be developed throughout 2016 complementarily and in parallel with the two involved institutions (FAUeD/UFU and SSoA of the University of Sheffield – TUoS) through three forms of communication: exchanging of emails; video conferences and face to face meetings. The exchange of emails will be constant, since there will be just two face to face meetings - one in each country (April – England, and June - Brazil).

In relation to the continuation of the research in each institute, there will be weekly meetings with involved researchers for the definition of activities to be developed by the respective countries (Brazil and England). In these meetings, an evaluative process will be carried out, allowing for a better supervision of the planned stages in the execution timeline and identification, in advance, of any adjustments that may be necessary.

Concerning the application stage of the developed system, the involvement of the researchers, as well as the external community; will be important for the evaluation and enhancement of the material produced through the work. Therefore, throughout the application of the POE methods and techniques, the researchers can observe which aspects need to be improved, as much asking for suggestions and criticism from the users, on the applied procedures.

1.10 DIFFUSION OF PROJECT RESULTS

The results from the research can be disseminated and discussed through:

(i)   Participation in conferences, seminars, technical symposiums in the area, with an elaboration of scientific articles and panels;

(ii)   Publication of main results in indexed and specialised periodicals, in national or international circulation;

(iii)   Disclosure, through digital means, of the results on open platforms (site of research group or FAUeD);

(iv)   Exposure in journals/newspapers and magazines to society in general;

(v)   Transfer of knowledge to agents in the real estate market and users of the buildings studied, through making the databases available, by means of lectures, seminars and meetings.

PART 2
THE AREA OF STUDY: THE SHOPPING PARK NEIGHBOURHOOD - DATACOLLECTION

INTRODUCTION

Located in the city of Uberlândia – Brazil, *Shopping Park* became an area destined to the production of over 3.000 housing units from the *Minha Casa, Minha Vida* Programme, within the income bracket 1 (0 to 3 minimum wages) during the 2010-2013 period.

Unfortunately, two years after, the conjunct gives clear signs of inefficiency and failure in comparison with the original purpose. The initiative of giving people a "dignified living" fell under a mix of various constructive, social and environmental problems. However, the resilience of the environment and the human being seems to coexist within cracked walls, bumpy roads, and streams clogged with litter. Thousands of people inhabit this space and search each day for ways to make it better. Meaning that, besides the deprived conditions of its houses and facilities, families are actually happy to live there.

Over these questions above, we intend to investigate this space to understand its dynamics and present a diagnosis in four approaches:

  (i) Look over the housing units (functional problems of the design, relation with the allotment, expansion possibilities, ways to use the lot)
  (ii) Look over the commercial and service activities (commerce and service spaces created in the neighbourhood and from housing units)
  (iii) Look over free spaces (landscape, streets, green areas, squares, etc.)
  (iv) Look over communitarian equipment (leisure areas, culture, health, education)

2.1 GENERAL CHARACTERISTICS

2.1.1 MINHA CASA, MINHA VIDA PROGRAMME

2.1.1.1 HOUSING HISTORY IN BRAZIL

The housing problem is not a recent case in Brazil, in fact, it is a result of changes and new conditions imposed on society mainly around the 19th century, with the appearance of the first industries, the abolition of slavery and European migration (VILLA, 2010). The lack of quality in the implantation of these houses together with inefficient public politics made the social housing supply a problem that perpetuates in the national territory until nowadays.

The country has in its historic a huge metropolisation process, that resulted in a big housing deficit, stimulated around 5.461 million in 2013 by the Syndicate of Industries and Civil Construction of Sao Paulo (SindusCon – SP) and by the Getúlio Vargas Foundation (FGV).

The Minha Casa, Minha Vida (MCMV) – translated literally as "My House, My Life" is not the government first initiative to try solving the housing deficit. Historically the Housing National Bank (BNH) was one of the first and most important initiatives of mass construction of social housing in Brazil, coming from the urgent housing demand. The project financiers were the FGTS (Service Time Guarantee Fund) – responsible for the houses of the low-income families, and the SBPE (Brazilian System of Savings and Loan) – responsible for the "market range" families (ARRETCHE, 1990). The project generated huge extension until the started of the 70th decade, however, the petroleum crisis in 1974 and the consequent slowdown in the global economy, forced the project to focus on the medium and high social classes, which meant having no government direct intervention. In that way, the private initiative began to control the housing financing, production, and distribution. With this, the initial purpose was left

behind and the housing deficit was no longer combated. The BNH ends up extinct in 1986, and nowadays BNH's assignments are assumed by the Caixa Econômica Federal (Federal Bank).

Although the BNH was an important government plan, it deeply altered the country's urban configuration. It caused the peripheralization of the housing developments and loss of design and execution quality over real estate speculation and market economy, as well as the lack of more active and incisive public politics. This process is happening again in the MCMV Programme, making evident the need for changes.

2.1.1.2. *MINHA CASA, MINHA VIDA*

Under the responsibility of the Caixa Econômica Federal (Federal Bank), the programme gave continuity to the extinguished BNH's (National Housing Bank – created in the 60´s) purpose of attending the country's housing demand and to combat the housing deficit by targeting a specific segment of the population, divided into social housing (0 to 3 minimum wages) and medium income range (until 10 minimum wages). The programme shows the Federal Government effort to address the housing problem and make dynamic the economy of an increasing market. However, it suffered along the way several critics about its hiring process, guidelines, planning and execution for providing neither the quality nor location expected for the houses.

The Minha Casa, Minha Vida (MCMV) was then created to attend the housing demand, by making it easier to the population to start the acquirement and construction of a house. According to data from the Caixa Econômica, in the first phase of the programme 1 million contracts were assigned and, until 2014, there was a prediction for 2 million. The programme can be implemented in capitals, cities with more than 100 thousand inhabitants, and, in a special condition, cities with 50 to 100 thousand inhabitants, according to the housing deficit.

The sector destined to the social housing works with a subsidy, applied in partnership with the cities according to their demand, in addition to using important public investments funds operated by Caixa Economica. The other sector (of medium range) offer non-onerous resources to families of income range until 6 minimum wages, and onerous resources paid in parcels from the FGTS (Service Time Guarantee Fund), with reduced interest rate and easier access to credit.

How the process works:

Figure 1 - MCMV Programme Functioning
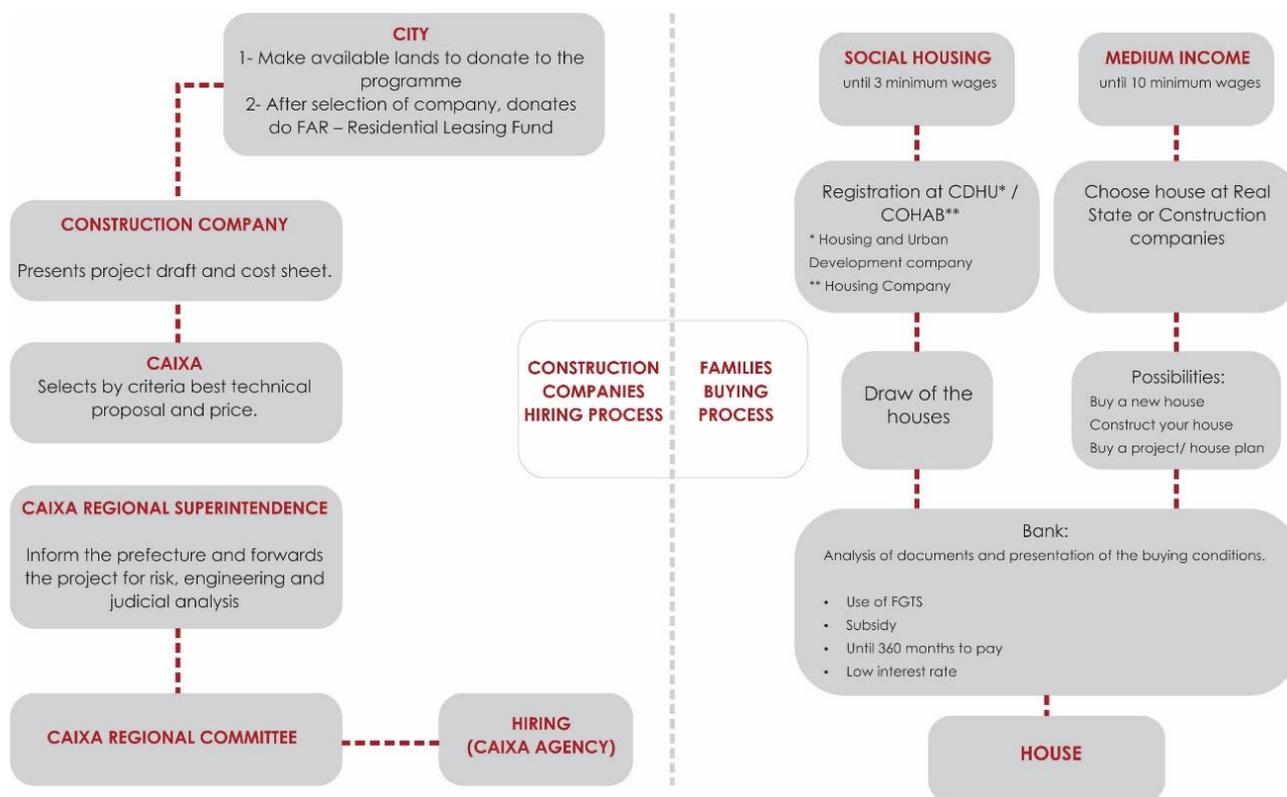
Source: http://www.caixa.gov.br/ (Edited by Author)

Unfortunately, this process is following the real estate market, becoming profit-based instead of focusing on the house quality. This creates an opportunity for big investments with a low budget that prioritises cost over quality. This results in allotments in the peripheral areas of the city (because of the land's low price) disconnected from the urban space and without any consolidated or pre-established infrastructure (FERREIRA, J. 2012; ROLNIK, R., CYMBALISTA, R. e NAKANO, K. 2002; MARICATO, E.2000).

The programme defines two typologies in the architectonic project: a ground house of 26m² and an apartment of 42m². The guidelines define a ground plan as well as the constructive system, materials, and coatings. The type we will be dealing with in the Shopping Park neighbourhood is the Type 1, which is shown. Typology 1 Guidelines – Ground House:

Figure 2 - House Unit Typology
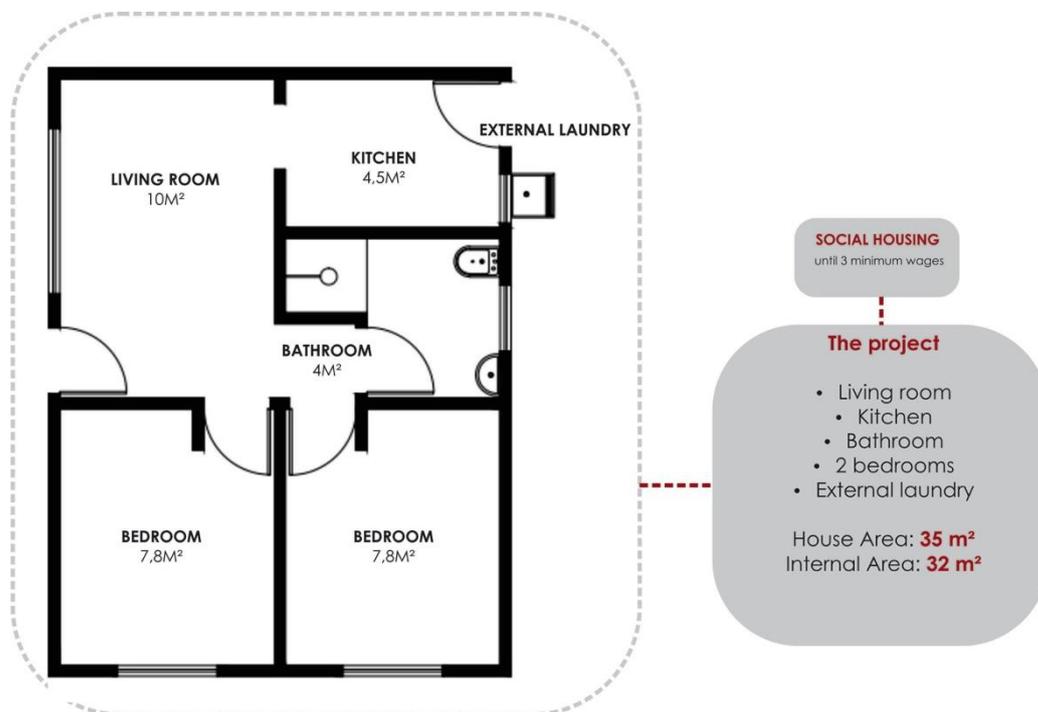
Source: http://www.caixa.gov.br/ (Edited by Author)

Responsibility of the *Caixa Econômica Federal* (Federal Bank), the programme gave continuity to the extinguished BNH's (National Housing Bank) purpose of attending the country's housing demand and to combat the housing deficit by targeting a specific segment of the population, divided into social housing (0 to 3 minimum wages) and medium income range (until 10 minimum wages). The programme shows the Federal Government effort to address the housing problem and make dynamic the economy of a heated market. However, it suffered along the way several critics about its hiring process, guidelines, planning and execution for not providing the quality expected for the houses.

Figure 3 - MCMV Housing Developments

Source: http://www.minhacasaminhavidainscricao.com/

2.1.2. THE CITY OF UBERLÂNDIA

2.1.2.1. GENERAL ASPECTS

The City of Uberlândia, founded on August 31st, 1888, is located in the Triângulo Mineiro region, in the Minas Gerais state, in the Southwest region of the country. The city has an area of 4115,822 km², with 219,00 km² of urban area

and 3896,822 km² of rural area. This area is divided between the main district (Uberlândia) and four others: Miraporanga, Cruzeiro dos Peixotos, Tapuirama and Martinésia. It is considered the second most populous city in the state, with estimated population of 662.362 inhabitants (IBGE 2013) and density of 160,93 people/km².

Figure 4 - Uberlândia Location

Source: Author, 2016.

The city location is directly connected with its development history. Located in the west of the state's capital (Belo Horizonte) by around 556km, its geographic position allows access to the main urban centres from Midwest and Southwest regions (such as Brasília, São Paulo and Rio de Janeiro). This directly affects the economy, transforming the city into an important centre of wholesale and logistic, followed by the industrial sector, with a GDP: R$ 25 774 947 mils and a GDP per capita: R$ 39 857,78 mils.

As a consequence of its location, the city became an important industrial pole around the second half of the 20th century, presenting exponential population growth between 1940 and 1970. This ongoing growth since then reflects itself in the demand for housing and infrastructure. Moreover, determinant changes in the urban network around 1970 (CORRÊA, 2001.) altered the city's social and spatial organisation, resulting in a great amount of people from a low economic class living on the city's outskirts, under the rules of a profit led real estate market.

2.1.2.2. UBERLÂNDIA HOUSING HISTORY

Uberlândia was home for a process of early spreading, which was driven by the housing production in its outskirts. The growth that started around 1940, as consequence of the implementation of the industry and increasing work labour, generated a high housing demand. In that manner, the first worker's villas appeared, located near industries and train stations, and, consequently, being far from the city centre (Arantes apud Moura & Soares, 2009.).

After that, there was the creation of the Fundação Casa Popular (Popular House Foundation) in 1946, in response to the city's expansion. The initiative produced two housing developments, with 130 houses in town. Unfortunately, they were constructed in isolated areas, creating big urban vacant spaces that stimulated the real estate market and made expensive and difficult the establishment of any equipment and infrastructure. Later, around the sixties and eighties – with the urban spreading still growing steady – the main housing programme was the BNH mentioned earlier. The programme constructed around 10 thousand housing in housing developments with more than 60 residential units. As mentioned, the objective was to have construction companies responsible for the house execution, so that they would be finished in a short time, while the public sector would take responsibility for the infrastructure, which would be delivered gradually. This resulted in houses isolated from the city because of their location, as well as a low quality of life as the infrastructure always took too long to be implemented.

The programme wasn't enough to supply the residents' necessity, especially the ones from more deprived classes, generating a new process of auto construction with poor materials in public land around rivers, rail lines and highways. This resulted in 2554 families living in slums around 1983, the same period BNH was decaying – which meant that the city's prefecture was now responsible for supplying the housing demand. So the prefecture started to

provide housing for those families living informally trough joint effort by citizens – act that became popular at that time – obtaining a result of 1770 units constructed.

In 1990, the PAIH (Housing Immediate Action Plan) entered in action, the period of the biggest social housing production. The programme worked trough a joint effort between private companies and prefecture, but the houses were still being constructed in the city's periphery and presenting low architectonic quality (SOBRINHO, 1995 apud VILLA et. al. 2014). Following that, there was the arrival of the MCMV, programme that is still active and is expected to deliver 13.683 housing units according to the Prefecture's Housing Department. Unfortunately, the actual scenario is a city full of vacant spaces and lots in good locations that exist solely for real estate speculation, while the housing demand has to be supplied by lands on the outskirts of the city, with few or none preexistent infrastructure.

2.1.2.3. THE SOUTH SECTOR

The South Sector has around 20.000 inhabitants and 17 neighbourhoods, being Shopping Park the broadest, with 7km and 1.595 residents. The sector is known for its "elite" profile, however, the true is that it represents just a small part of the whole sector. This is reflected in the fragmented space according to social class, resulting in the exclusion suffered by more deprived neighbourhoods, be it by their geographic location or lack of infrastructure, and the real stated speculation of the vacant areas.

2.1.3. THE SHOPPING PARK NEIGHBOURHOOD

The Shopping Park Neighbourhood is the biggest social housing undertaking ever constructed in the city of Uberlândia, located in the south region of the city. It is an Integrated Neighbourhood composed by following allotments: *Parque dos Ipês, Shopping Park I and II, Gávea Sul, Parque dos Jacarandás I* and *II, Residencial Xingú, Tapajós, Sucesso Brasil, Vitória Brasil, Villa Real* and *Villa Nueva.*

Figure 5 - Sector, Neighbourhood and Allotments division
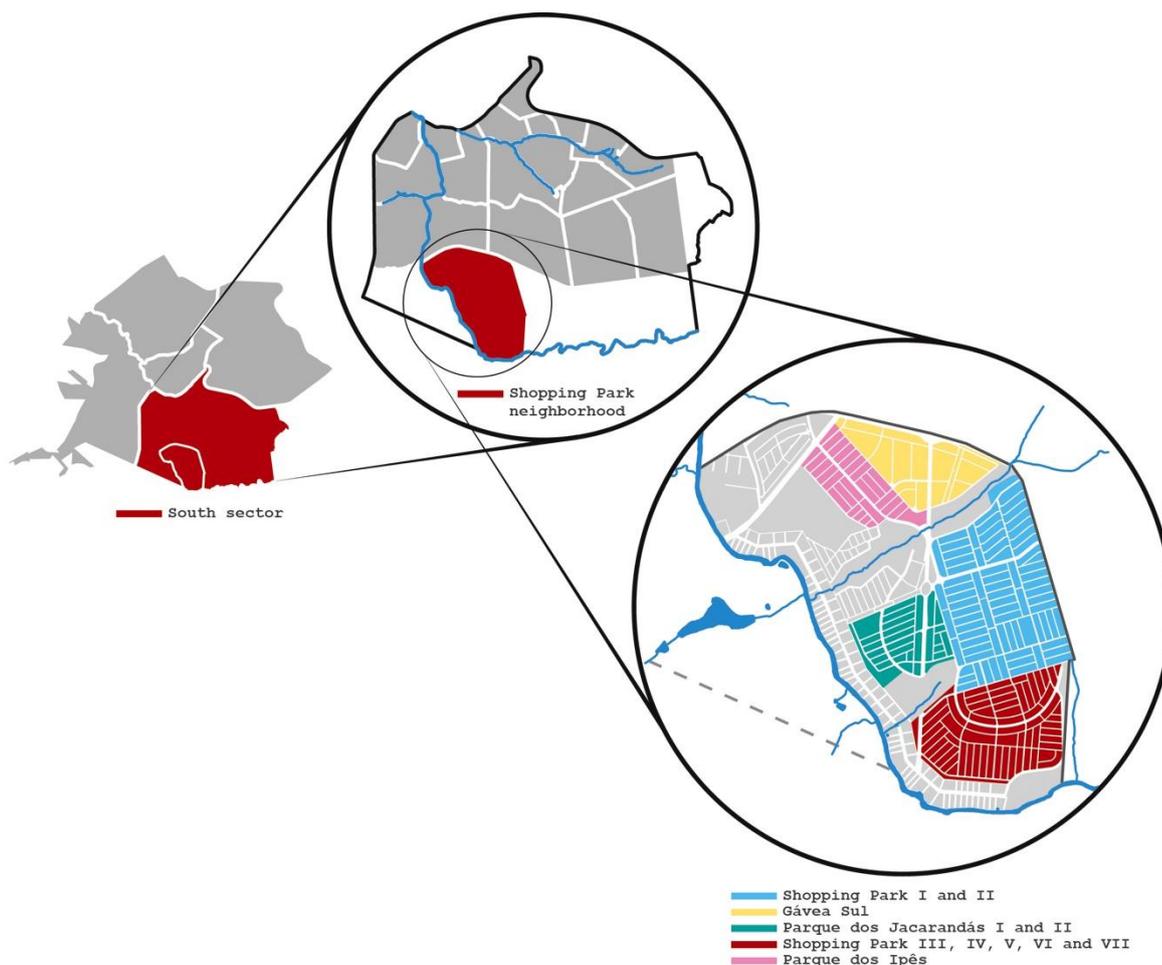
Source: Author, 2016.

The neighbourhood started around the 90th decade, where Carlos Sabagg, a farm owner, started two allotments illegally. The prefecture didn't want to formalise the allotment, appointing the lack of environmental impact studies

and the no indication of Permanent Preservation Area; no adequacy to the soil use law; and transport demand not predicted. Even so, the allotment ended up being approved in 1992 without realising the necessary changes.

The investment first targeted a high social class, however, because of its geographic location the lots ended up being sold at low prices. Consequently, a lot of lands were bought with the intention of starting a speculation process. That is why Shopping Park I and II present so many empty lots spread within the constructed ones.

The neighbourhood establishment had a slow start, for example, only in 2001 the first school was constructed. However, from 2004, when Shopping Park was just starting, until nowadays, there has been an exponential growth. The main turning point was between 2007 and 2009 when the Neighbourhood starts to go through a new dynamic, resulted from investments and speculative activities in its surroundings. These main factors were the planning of a new Shopping, construction of luxury condominiums and the construction of social housing units through the Minha Casa, Minha Vida Programme – being the last one the main factor of our analysis.

Figure 6 - Neighbourhood Timeline
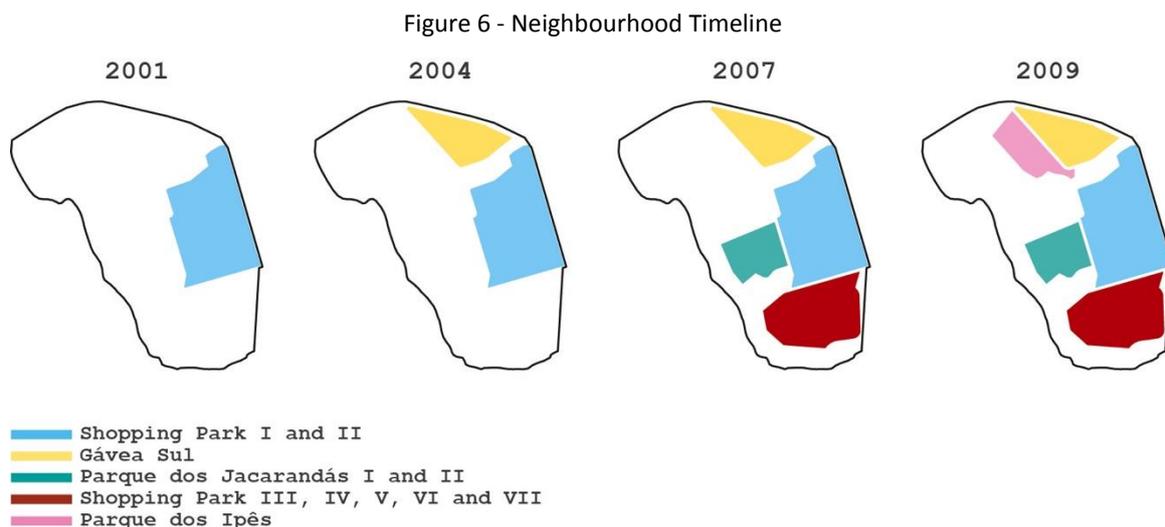
Source: Author, 2016.

As the social housing units are the focus of this research, the area of study will be the one identified below, involving the following allotments: Xingú, Tapajós, Sucesso Brasil, Vitória Brasil, Villa Real and Villa Nueva. They, together with Jacarandá I and II, constitute the Shopping Park Residential, which englobes the Minha Casa, Minha Vida allotments in the Shopping Park Neighbourhood.

Figure 7 - Shopping Park Neighbourhood Study Area
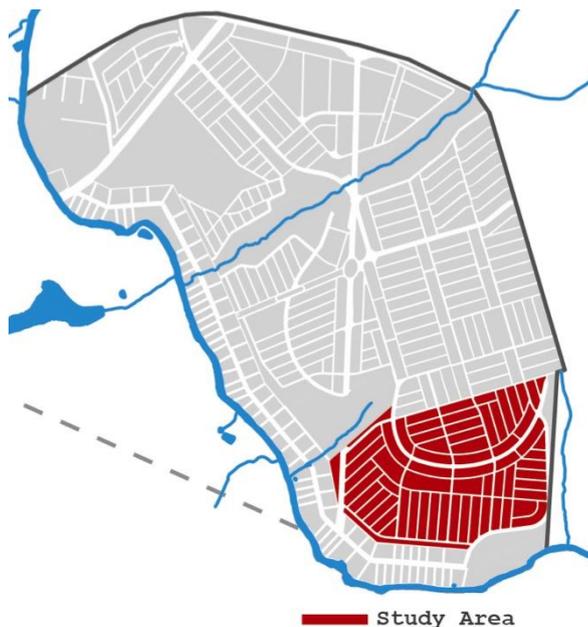
Source: Author, 2016.

Figure 8 - Photomontage: Shopping Park Neighbourhood Quarters and House Units

Source: Google Maps, 2016.

2.2 DEMOGRAPHIC AND ECONOMIC DATA

2.2.1 GENERAL INFORMATION

The big investments that started around 2007 and 2008, stimulated population growth, increasing the demand for more infrastructure and equipment. However, as much investment these undertakings received, the neighbourhood itself did not, creating a space deprived of enough infrastructure and equipment – fact that will be shown through the data presented below.

The population number of the Shopping Park Neighbourhood solely is yet unknown. What is known – according to the IBGE (Brazilian Institute of Geography and Statistics) census of 2010 – is that the population of the Shopping Park Neighbourhood together with the population of the Condominium Bosque Karaiba is of 4.098 inhabitants.

2.2.2. THE SHOPPING PARK RESIDENTIAL

As mentioned earlier, the Shopping Park Residential represents all the allotments of horizontal social housing created under the *Minha Casa, Minha Vida* Programme, formed by a characteristic profile of families of low income. According to the Prefecture's Housing Department, the undertaking attended a total of 3.632 families with income range until R$ 1.850,00, and each housing unit was delivered (September 2012) at a cost of R$ 39.790,00.

Table 1 - Allotments family number s and investment value

ALLOTMENT	NUMBER OF FAMILIES	INVESTMENT VALUE (R$)
JACARANDÁS I	500	296.321,40
JACARANDÁS II	498	295.136,11
SUCESSO BRASIL	141	80.370,00
TAPAJÓS	607	296.000,01
XINGU	386	291.892,92
VITÓRIA BRASIL	500	296.000,01
VILLA REAL	500	285.000,00
VILLA NUEVA	500	296.947,61

Source: Municipal Prefecture of Uberlândia, 2016.

Table 2 - Housing Units (H.U.) facts and figures

ALLOTMENT	AREA (m²)	STANDARD H.U. 37,91m²	ADAPTED H.U. 38,15m²	TOTAL OF H.U.
JACARANDÁS I	249.935,78	484	16	500
JACARANDÁS II	249.993,45	483	15	498
SUCESSO BRASIL	246.967,60	138	3	141
TAPAJÓS	249.211,87	582	25	607
XINGU	180.573,36	376	10	386
VITÓRIA BRASIL	-	488	12	500
VILLA REAL	237.660,56	478	22	500
VILLA NUEVA	233.820,00	488	12	500
TOTAL OF H.U (Housing Unit)		3.517	115	3.632

Source: Municipal Prefecture of Uberlândia, 2016.

2.2.3. SOCIOECONOMIC FACTS AND FIGURES

The residents of these allotments have a similar family profile. The table below indicates some facts and figures provided by interviews realised with the residents.

Frame 1 - Families' Facts and Figures

ALLOTMENT	SUCESSO BRASIL	TAPAJÓS	XINGU	VITÓRIA BRASIL
TOTAL OF HOUSES INTERVIEWED	106 houses out of 141 - 75%	287 houses out of 607 - 47%	386 houses out of 386 - 100%	396 houses out of 500 - 79%
GENRE	female - 81% (86 interviwees) male – 19% (20 intervwees)	female - 75% (216 interviwees) male – 25% (71 interviwees)	female - 78% (288 interviwees) male – 22% (80 interviwees)	female - 76% (302 interviwees) male – 24% (94 interviwees)
AGE	The majority are adults between 30 and 40 years old (47%), followed by adults between 41 and 59 years old (19%).	The majority are adults between 30 and 40 years old (48%), followed by adults between 41 and 59 years old (20%).	The majority are adults between 30 and 40 years old (47%), followed by adults between 41 and 59 years old (22%).	The majority are adults between 30 and 40 years old (48%), followed by adults between 41 and 59 years old (23%).
RACE	The interviwees declared themselves: pardos – 42% / white – 30%/ black – 23%	The interviwees declared themselves: pardos – 42% /white – 35% / black – 18%	The interviwees declared themselves: pardos – 45%/ white – 30%/ black – 21%	The interviwees declared themselves: pardos – 33%Q white – 45%/ black – 18%
CIVIL STATE	33 (34%) declared 39hemselves single; 26 are married and 29 have a stable union; 11 are divorced and 7 are widowers.	69 (24%) declared 39hemselves single; 118 are married and 81 have a stable union; 14 are divorced and 4 are widowers.	109 (29%) declared 39hemselves single; 134 are married and 91 have a stable union; 21 are divorced and 10 are widowers.	139 (35%) declared 39hemselves single; 125 are married and 96 have a stable union; 27 are divorced and 9 are widowers.
ORIGIN	70% are from Minas Gerais State, being the majority (52%) from the city of Uberlândia.	70% are from Minas Gerais State, being the majority (114) from the city of Uberlândia.	59% are from Minas Gerais State, being the majority (132) from the city of Uberlândia.	72% are from Minas Gerais State, being the majority (179) from the city of Uberlândia.
EDUCATION	45% complete Elementary School and 33% High School. Only 5 residents have higher education.	44% complete Elementary School and 43% High School. Only 15 residents have higher education.	50% complete Elementary School and 39% High School. Only 3% residents have higher education.	47% complete Elementary School and 42% High School. Only 11 residents have higher education.
FAMILY PROFILE	The majority are nuclear families, however it is also significant the number of single-parent families,	The majority are nuclear families, however it is also significant the number of single-parent families,	The majority are nuclear families, however it is also significant the number of single-parent families,	The majority are nuclear families, however it is also significant the number of single-parent families,
MENSAL INCOME	The majority (69%) has mensal income range until 2 minimum wages (until R$ 1.356,00).	The majority (56%) has mensal income range until 2 minimum wages (until R$ 1.356,00).	The majority (65%) has mensal income range until 2 minimum wages (until R$ 1.356,00).	The majority (68%) has mensal income range until 2 minimum wages (until R$ 1.356,00).

JOBS	Majority of the resident's jobs are related to the low education level, being most of them general services (cleaners, bricklayers, etc.).	Majority of the resident's jobs are related to the low education level, being most of them general services (cleaners, bricklayers, etc.).	Majority of the resident's jobs are related to the low education level, being most of them general services (cleaners, bricklayers, etc.).	Majority of the resident's jobs are related to the low education level, being most of them general services (cleaners, bricklayers, etc.).

Source: Activities Report – PTTS, Municipal Prefecture of Uberlândia, 2014. (Edited by Author)

As seen above, the Shopping Park Residential as a whole presents a somehow characteristic profile of its residents, in nuclear families of low income and low education level. It is important to highlight that, according to the Department of Statistics and Socioeconomic Studies (DIEESE) in December 2013, the minimum wage capable of meeting the basic needs (according to the price of the basic food basket) was of R$ 2.765,44.

Unfortunately, the low conditions these families live in are not compensated by the infrastructure and public facilities present in the neighbourhood. Although the Shopping Park Neighbourhood does have schools, health establishments, social entities and cultural activities, they are not enough to attend the population demand, especially putting into context its historic of fast growth.

Researches and the prefecture social initiatives mentioned earlier show the residents need for qualified free spaces. There are no properly equipped leisure areas, nor parks or squares with adequate landscape treatment. In addition, it is clear the undercapacity of daycares and schools to supply care and education for all, making children travel long distances to have access to education. In fact, the prefecture had to provide around 12 buses in each turn to take approximately 300 children to other schools outside the neighbourhood.

There are some positive sides, as this fast growth attracts more undertakings and social initiatives. Even so, this unbalanced dynamic asks for a more efficient social network that can bring together the population needs as well as positive initiatives and solutions.

2.2.4. VIOLENCE AND SAFETY

One of the main issues found during this data collection was the inexistence of any kind of police station in the Neighbourhood. Shopping Park, as many other deprived neighbourhoods, suffers from social exclusion, which makes drug use and traffic the main dangerous components, as the drug traffic is a form of social mobility and empowerment. Nowadays the present types of violence are the robbery in general, along with verbal threats.

The data above was sent by the Military Police, showing different types of actions from 2014 until July of 2016.

Graph 1 - Drug Traffic
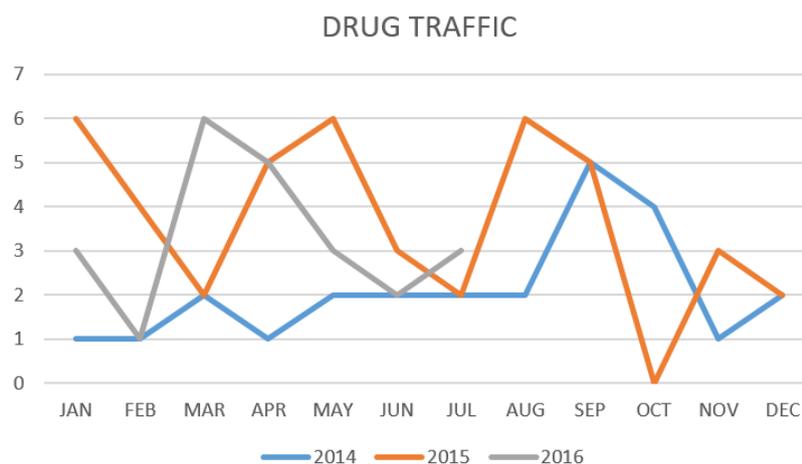
Source: 9th Military Police Battalion

Graph 2 - Homicides

HOMICIDES
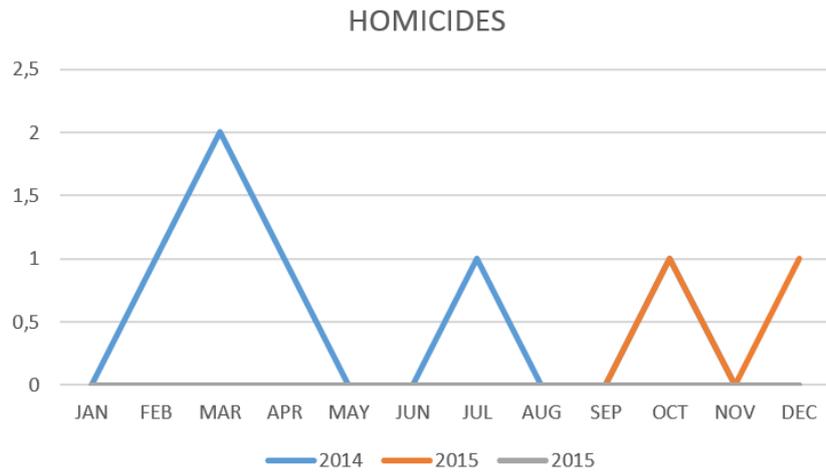
Source: 9th Military Police Battalion

Graph 3 - Robbery
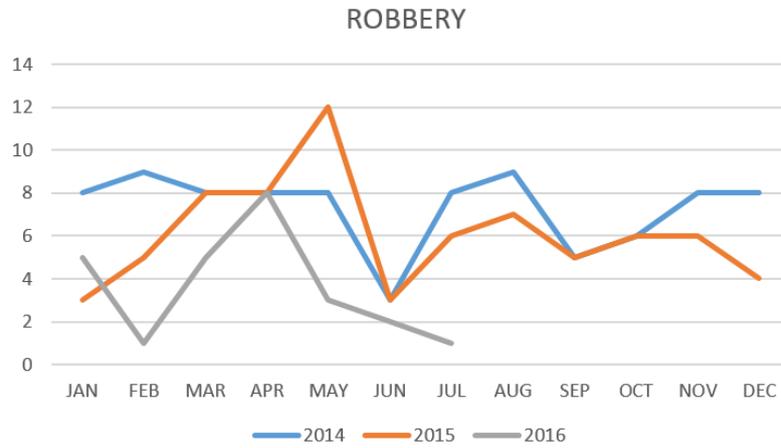
ROBBERY

Source: 9th Military Police Battalion

Graph 4 - Residence Robbery

RESIDENCE ROBBERY
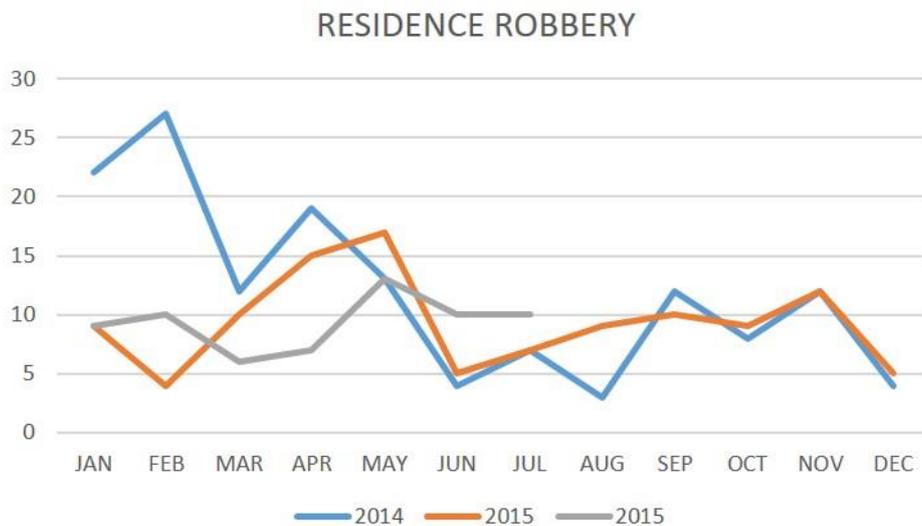
Source: 9th Military Police Battalion

Graph 5 - Bodily Injury

BODILY INJURY
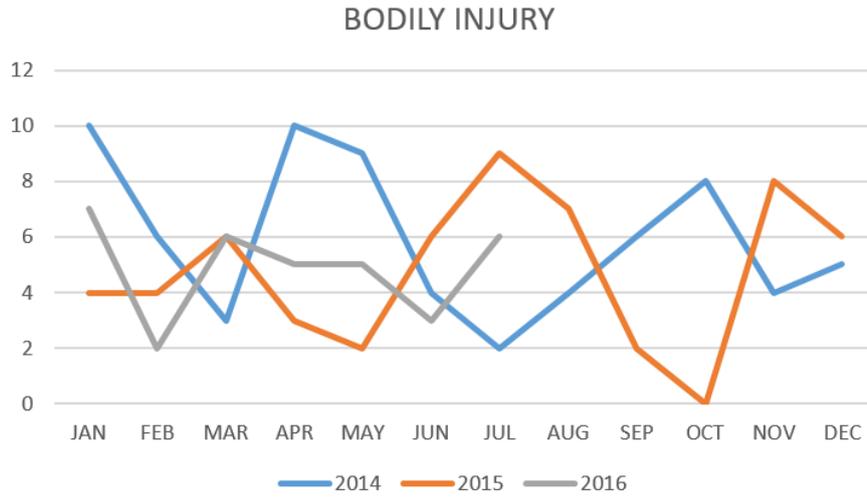
Source: 9th Military Police Battalion

Graph 6 - Threats

THREATS
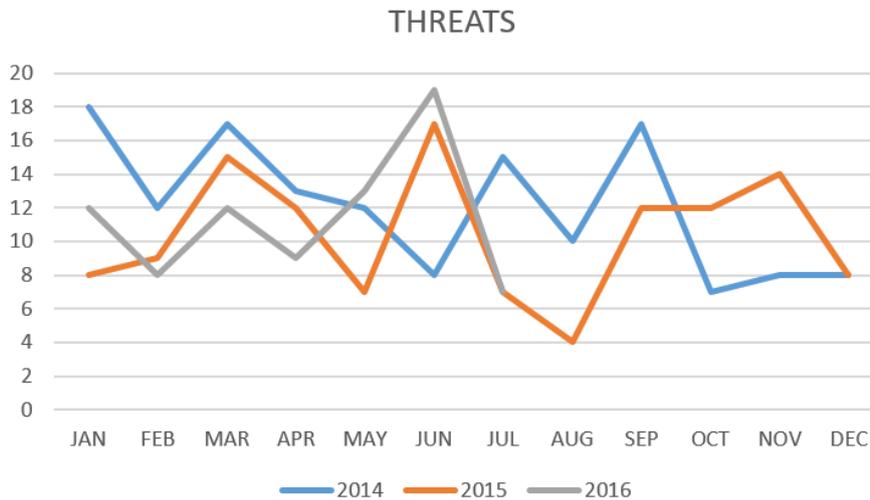
Source: 9th Military Police Battalion

2.3 THE SOCIAL NETWORK – *PTTS*

A Social network is indispensable when thinking about enhancing resilience. The Government of Uberlândia started the establishment of a social network through an initiative called TTS – Social Technical Work, seeking improvement in the residents' life. These initiatives are crucial to understanding the social profile of the neighbourhood, which are the active social organisations and their influence power, as well as understanding how the residents feel about their neighbourhood, and which are their main needs and demands.

As the main objective was to establish an articulated network of social assistance, the responsible companies (Diefra, ASP and Arco Verde) established "Actions" to create a gradual development process, until the leaderships residents could deal with this on their on. This "steps" started with the mapping of the social institutions; interviews and meetings between theirs leaders and the residents association in order to create a closer relationship within the neighbourhood; voting for new representatives for each quarter seeking to create a more efficient committee to take the residents claims to the prefecture; educational events to instruct residents about health and environmental issues, professionalization courses, etc.

Through these actions and their reports, it was possible to create a clear vision of how this specific area of the Shopping Park neighbourhood is now, what it lacks, how it can improve, and how willing are the residents and active leaderships about improving their neighbourhood.

2.3.1. FACILITIES, SOCIAL ENTITIES AND LEADERSHIPS

The following map and table indicate the public equipment, NGOs and associations whose leadership had great participation and influence in the process of a social network establishment, guided by the prefecture.

Figure 9 - Shopping Park Neighbourhood Social Entities and Leaderships Map

Source: Author, 2016.

2.3.2 HEALTH

Shopping Park presents three Basic Health Units called *UAPSF* (Units of Primary Care for Family Health) – Shopping Park UAPSF I, Shopping Park UAPSF II, Shopping Park UAPSF III. The services offered are General Doctor, psychologic assistance, social assistance and nursing care, attending from Monday to Friday, from 7am until 5pm.

Figure 10 - Shopping Park Neighbourhood health facilities

Source: Author, 2016.

2.3.3. EDUCATION

The neighbourhood has six educational establishments, varying between daycare, public school and educational centre. There are four public establishments, and two NGOs working as Child Educational Centres. The public facilities are the following ones: Shopping Park Neighbourhood *EMEI* (Municipal School of Child Education), attending children from 4 to 5; Shopping Park Municipal School attending students in elementary school; *Presidente Itamar Franco* Municipal School, also attending students in elementary school; and *Felisberto Carrijo* State School, attending elementary and high school. The two NGOs are *Irmã Odélcia Leão Carneiro* Child Educational Centre and the *Carlos Cesar da Silveira Nunes* Educational Centre, both attending from kindergarten until primary school.

Figure 11 - Shopping Park Neighbourhood Educational Facilities
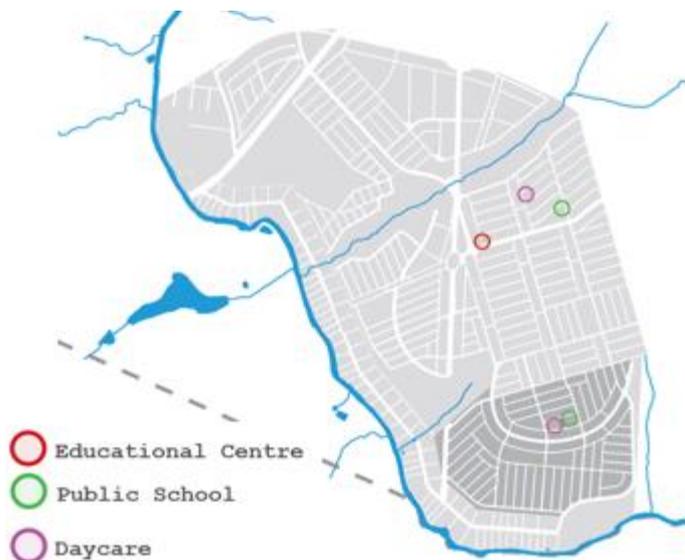
Source: Author, 2016.

2.3.4. SOCIAL ASSISTANCE

There are two Public Social Assistance units in the Neighbourhood. They are called *CRAS* (Reference Centre for Social Assistance), attending the population with more social vulnerability, offering different kinds of help trough a team of Social Assistants, Psychologists, and Management Assistants. The main programmes offered are: *Bolsa Família* Programme; PETI – Child Labor Eradication Programme; *ProJovem* – National Programme for Young Inclusion; Social fare for electricity and water bills; Families Social and Psychological Monitoring; Professional help to strengthen the families' bond.

Figure 12 - Shopping Park Neighbourhood Social assistance facilities

Source: Author, 2016.

2.3.5. NGOs AND OTHER AGENTS

There are four main Philanthropic Institutions in Shopping Park: *Estação Vida* NGO, *Missão Sal da Terra*, *Imaculada Conceição* Church, and the Shopping Park Neighbourhood Residents' Association.

Figure 13 - Shopping Park Neighbourhood NGOs and other Agents
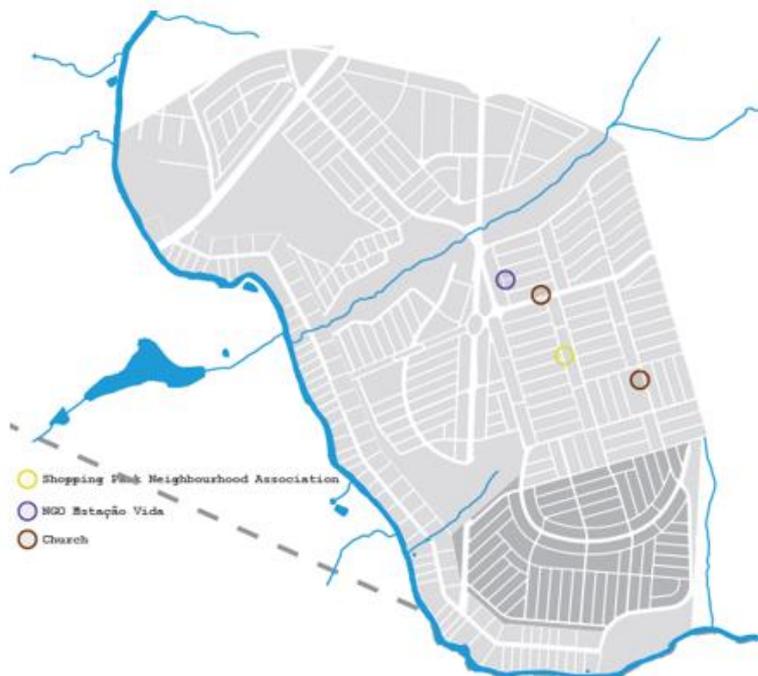
Source: Author, 2016.

The *Estação Vida* NGO is the most influent and important in the area. Founded in March of 2004, it nowadays attends around 150 children and teens in a social vulnerability situation. It counts with a staff of 15 people, offering different types of activities such as Arts and crafts workshops, Seamstresses Cooperative, Capoeira lessons, Ballet Lessons, Football lessons, Percussion and guitar lessons, Theater lessons, Computing lessons, Community garden.

Figure 14 - *Estação Vida* NGO

Source: http://www.projetoestacaovida.com.br/

2.3.6. SPORTS AND LEISURE

The Neighbourhood has an important public facility that offers different kinds of activities, the *CEU* (Unified Sports Centre). It was the first Leisure facility of the area, born from an agreement between the Municipal Power and the Culture Ministry. It was opened on august of 2014, counting with a multiuse space for social assistance and cultural activities and an external area with a square and a sports court.

Figure 15 - CEU

Source: Author, 2016.

2.3.7 THE *PTTS*

The following table shows the data gathered about these facilities during the TTS (Social Technical Work) that took place in the Shopping Park Neighbourhood. Through this, it is possible to create a more clear perspective about the facilities, their influence, and its positive and negatives aspects, giving us as a "north" on what we should investigate more in the next steps of the research.

ENTITIES	TYPE	TARGETED PUBLIC	PROJECTS	DIFFICULTIES	POSITIVE ASPECTS/ POTENTIALITIES
CRAS – Reference and Social Assistance Centre	Public Social Assistance Equipment	Residents of the neighbourhoods: Shopping Park, Lagoinha, Patrimônio, Vigilato Pereira.	.*Bolsa Família* Programme/ .PETI – Child Labor Eradication Programme/.*ProJovem* – National Programme for Young Inclusion/ .Social fare for electricity and water bills / .Families Social and Psychological Monitoring/ .Professional help to strengthen the families' bond	.Change the residents mentality about family monitoring importance/ .Lack of residents awareness about the CRAS existence	.Good relation with other entities, especially schools and the NGO *Estação Vida*
Children Education Centre Sister Odelcia	Daycare	Children from 4 months to five years old.	.Attends 150 children.		
Estação Vida	NGO	Children and teenagers between 6 and 16 years old.	.Training Centre/ .Arts and crafts workshops/ .Seamstresses Cooperative/ .Capoeira lessons/ .Ballet Lessons/ .Football lessons/ .Percussion and guitar lessons/ .Theater lessons/ .Computing lessons/ .Community garden	.Lack of contact with parents/ .Financial Struggles – depends on partnerships and events to cover costs/ .Lack of contact between all the neighbourhood entities/ .Overloaded (around 300 people on the waiting list) – need of extension or creation of new NGOs.	.Good relation with other entities, especially schools and CRAS/ .Safety is not an issue in the NGO
Shopping Park Municipal School	School	Elementary School and *EJA* (Education of Young and Adults).	.Psychological Monitoring/ .Adults literacy/ .Music lessons		
Felisberto Carrijo State School	School	Elementary School, High School and *EJA* (Education of Young and Adults).	.Attends 42 classes.		
President Itamar Franco State School	School	Students from 1rst to 5th year.	.Capoeira lessons	.Lack of general neighbourhood infrastructure/ .Lack of safety/ .Litter accumulation in improper places, hindering the passage of students and staff at the school entrance.	Families are very participative in the school events Will to create a community garden for students and their families
Shopping Park EMEI* *Children Education Municipal School	School	Children from 4 months to five years old.		.Overloaded – need of more EMEIs	
Carlos César da Silveira Nunes Educational Centre	Educational Centre	Children from 1 year to 4 years and 11 months old.	.Attend 160 children		
Shopping Park Neighbourhood Association	Neighbourhood Association	Shopping Park Residents	.Football Club	.Lack of funds to extend the Association headquarters (in order for social projects to happen)/ .Lack of participation by the residents	Possibility of extension of the number of sports played, by future partnerships with some enterprises.
Basic Health Unit I	Public Health Equipment	Shopping Park Residents	.Physical activities for the residents		
Basic Health Unit II	Public Health Equipment	Shopping Park Residents	.Physical activities for the residents		
Basic Health Unit III	Public Health Equipment	Shopping Park Residents	.Physical activities for the residents		
Missão Sal da Terra	Christian Church	Shopping Park Residents	.Young apprentice course/ .Jiu Jitsu lessons/ .Meetings with teens and young to develop citizenship/ .Social Assistance/ .Visits to families		
Imaculada Conceição Catholic Church	Catholic Church	Shopping Park 1 and 2	.Catechism/ .Pastorals/ .Visits to families/ .Basic Food Basket Distribution/ .*Ninar Project*(distribution of newborns clothes)	.The only catholic church – lack of space to attend all the residents/ .Few realised events due to lack of space and initiative	
Police Station *inactive	Public Safety Equipment				Interest in developing the GEPAR Project (Clustering of Risk Areas)
CEU	Sports and Culture Square	Shopping Park Residents			

Source: Activities Report – PTTS, Municipal Prefecture of Uberlândia, 2014. (Edited by Author)

Figure 16 - Photomontage: Social interaction

Source: Tolentino, 2012.

A great part of the institutions and the residentials' representatives agree that the residents' majority does not participate in the Neighbourhood Association, nor have a complete knowledge of all the services the present institutions have to offer within the neighbourhood. However, these actions showed a will to change this reality, as they were able to establish a proper claim to be taken to the prefecture trough their new chosen leaders. Although each residential had their outcome, it is fair to say that the difficulties faced by the residents were mainly the same.

Frame 3 - Main residents' demands

AREA	DEMANDS
TRANSPORT	Increase bus lines and improve their distribution; A more flexible timetable; Put a roof in the bus stops; Improve the neighbourhood accessibility.
STREET LIGHTING	Improve the street lighting.
ENVIRONMENT AND URBAN CLEANING	Increase the number of manholes; Improve drainage and sewage system; Lack of Ecopoints for recycling; Cleaning of the vacant lots due to litter accumulation; Selective Collect; Improve the campaign against Dengue.
SAFETY	Reopen the Police Station; Improve ostensible policing; Specific combat to violence and drug traffic; Provide mobile security for the neighbourhood.
EDUCATION	Construction of more daycares and public kindergartens; Provision of training courses in the neighbourhood; Improve scholar transport.
HEALTH	Creation of a UAI (Unity of Integrated Treatment); Improve the conditions of the Basic Health Units; Provide Dental treatment.
TRAFFIC	Improve traffic signalling in the whole neighbourhood; Create raised crosswalks in front of schools and roads of fast flow; Improve traffic surveillance.

SERVICE/ COMMERCE	Gas Station; Improve Telephone Services; Public telephone booths; Hypermarket; Lottery.
SOCIAL SERVICE	Create units of special care for drug addicts and their families; Enable the social projects in the NGOs and other entities that were not developed yet; Create a project towards drug combat, specially targeting the youth; Family monitoring by social assistants.
SPORT/ RECREATION	Provide proper spaces for physical activities and recreation for the whole neighbourhood; Create a multi-sports gym.

Source: Activities Report – PTTS, Municipal Prefecture of Uberlândia, 2014. (Edited by Author)

As expected, Shopping Park residents, have a lot of demands and a major part of it is related to the basic infrastructure, which should have in fact existed from the beginning. It is noticeable that the organisations, main the schools, daycares and NGOs suffer from this deficiency and sometimes are unable to further develop because of that. As the actual leaderships prove themselves eager to engage more the community into the neighbourhood matters, and some of the organisations have already a big and positive influence in the area, Shopping Park's social network proves itself to be a big (if not the most) positive factor for resilience improvement.

The outcome showed that these entities have a great interest in establishing solid partnerships in order to create a social assistance network, as they all agree that the territory is deprived of proper public spaces and health/ educational/ social equipment. They see in this new bond a chance to connect entities and residents so that the residents can be aware of all the benefits their neighbourhood has to offer, as well as to unite forces to claim their right of better infrastructure in all aspects.

2.4. URBAN INSERCTION

Due to the need of acquiring lands with low value, the allotments were located really far away, being around 10km far from the city centre. In addition, the Shopping Park Residential development did not show much thought into the urban design, as its road network has no connection with the existent roads, isolating itself from the city.

The area was divided into 8 allotments (*Jacarandá I, Jacarandá II, Residencial Xingú, Tapajós, Sucesso Brasil, Vitória Brasil, Villa Real* and *Villa Nueva*) that present the same design, with rectangular allotments of 200m², lack of vegetation, and road hierarchy of local roads and collector roads. This research area of study will involve the followings allotments:

Figure 17 - Shopping Park Residential Allotments

Xingu Residential
Tapajós Residential
Vitória Brasil Residential
Sucesso Brasil Residential
Villa Real Residential
Villa Nueva Residential

200 0   200 400 600   1000m

Source: Auhtor, 2016.

The area of study, composed of the 8 allotments, presents a density level of 0,01 people/m². To find this data it was taken into account the existing houses and also the extensions in the back part of the lot, considering 3 people for each housing and 5 people for extended housing units. In addition, it was identified the current land use in the area, along with the intended use for the areas not yet constructed or consolidated.

Figure 18 - Study Area Density

HOUSING UNITS
(TOTAL – 3632)

EXTENSIONS
(TOTAL – 449)

IT WAS TAKEN INTO
ACCOUNT 3 PEOPLE
FOR EACH HOUSING
UNIT, AND 5 PEOPLE
FOR EXTENDED
HOUSING UNITS.

11.794 Inhabitants
0,01 people/m²
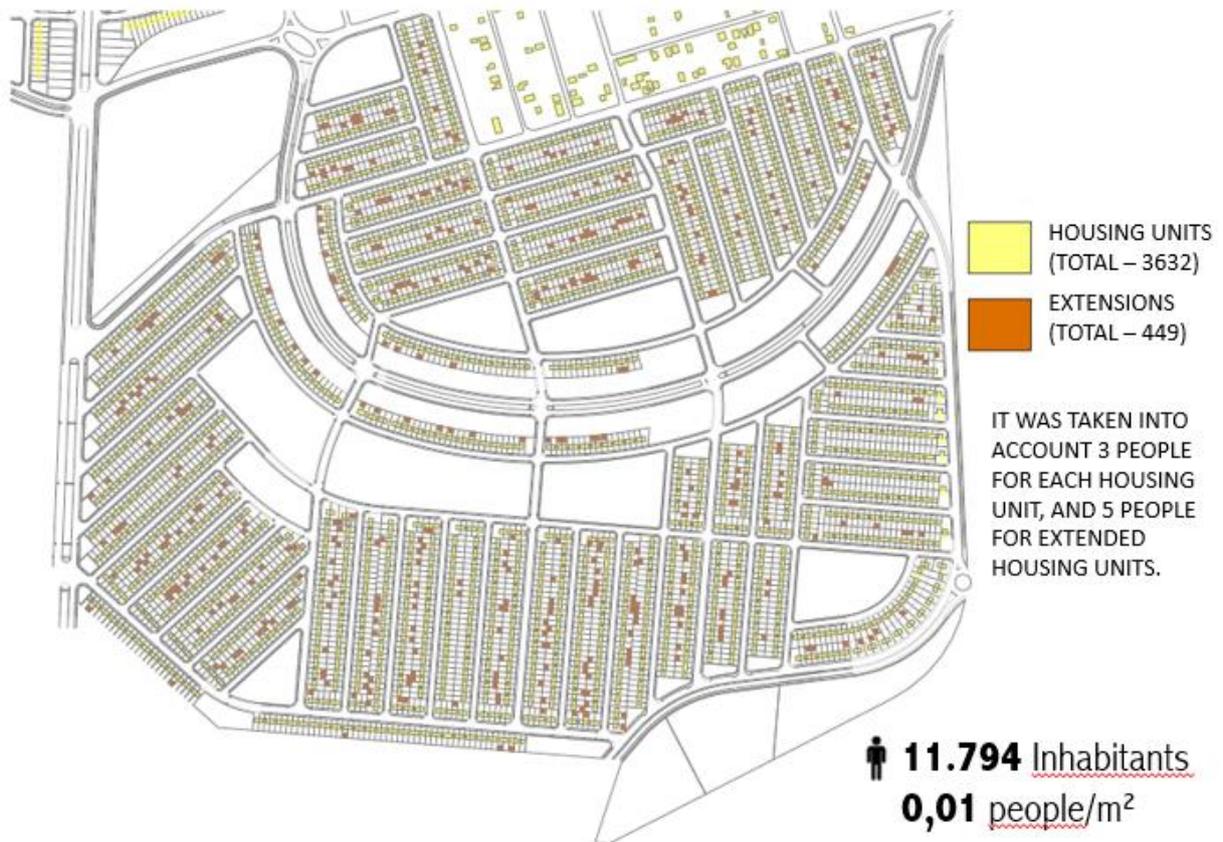
Source: Auhtor, 2016.

Figure 19 - Land Use Mapping

CURRENT USE

RESIDENCES

INSTITUTIONS

COMMERCE

SERVICES

LEISURE

INTENDED USE

COMMERCIAL AREA
NOT CONSOLIDATED

INSTITUTIONAL AREA
NOT CONSOLIDATED

RECREATIONAL AREA
NOT CONSOLIDATED
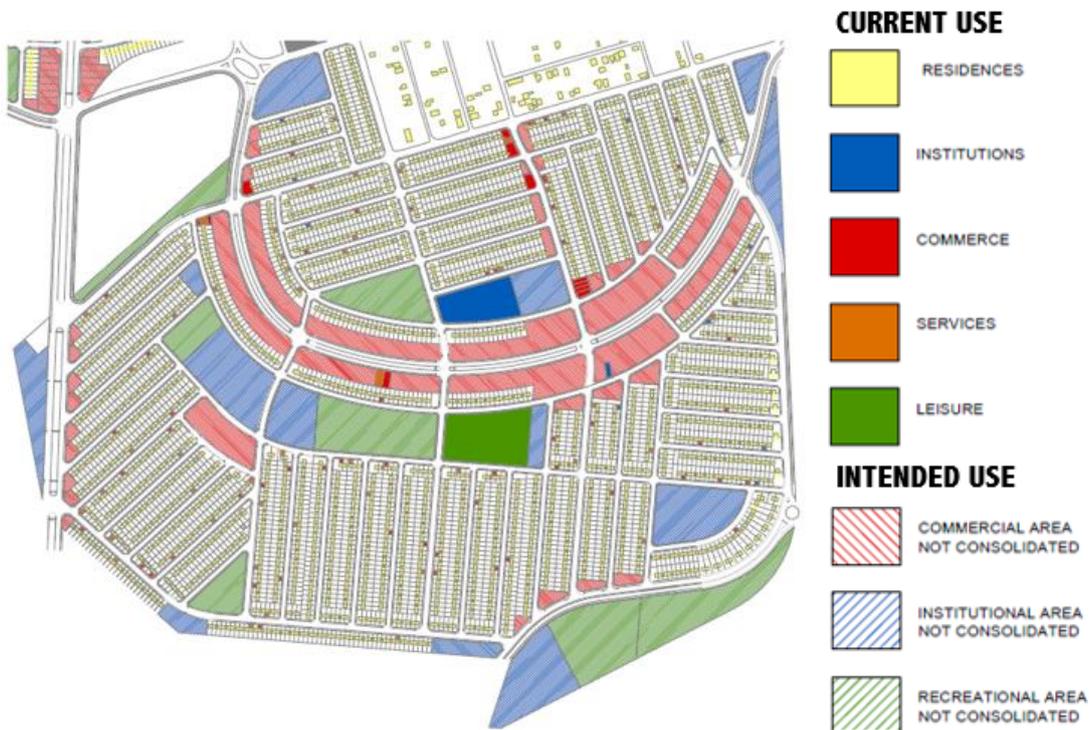
Source: Auhtor, 2016.

Listed below are some facts and problems identified in the area of study. The data below was mainly taken from the studies and analysis realised by Juliana Arantes in her Graduation Final Project "*Minha Casa, Nossa Cidade*" ("My House, Our City").

2.4.1 URBAN RESTRICTIONS

Shopping Park is mainly a residential area, with commercial and service activities growing steady.

Some lots are an exception towards the zoning presented. They allow almost any time of commercial and services activities specified in the law. They are the ones with façade turned towards Nicomedes Alves dos Santos Avenue, between Rondon Pacheco Avenue and Vinhedos Avenue, including the lots with façade towards Alameda dos Pinhais and, Presidente Médice Avenues, Francisco Galassi Avenue and Rafael Marino Neto Road.

Figure 20 - Shopping Park Neighbourhood Zoning Map
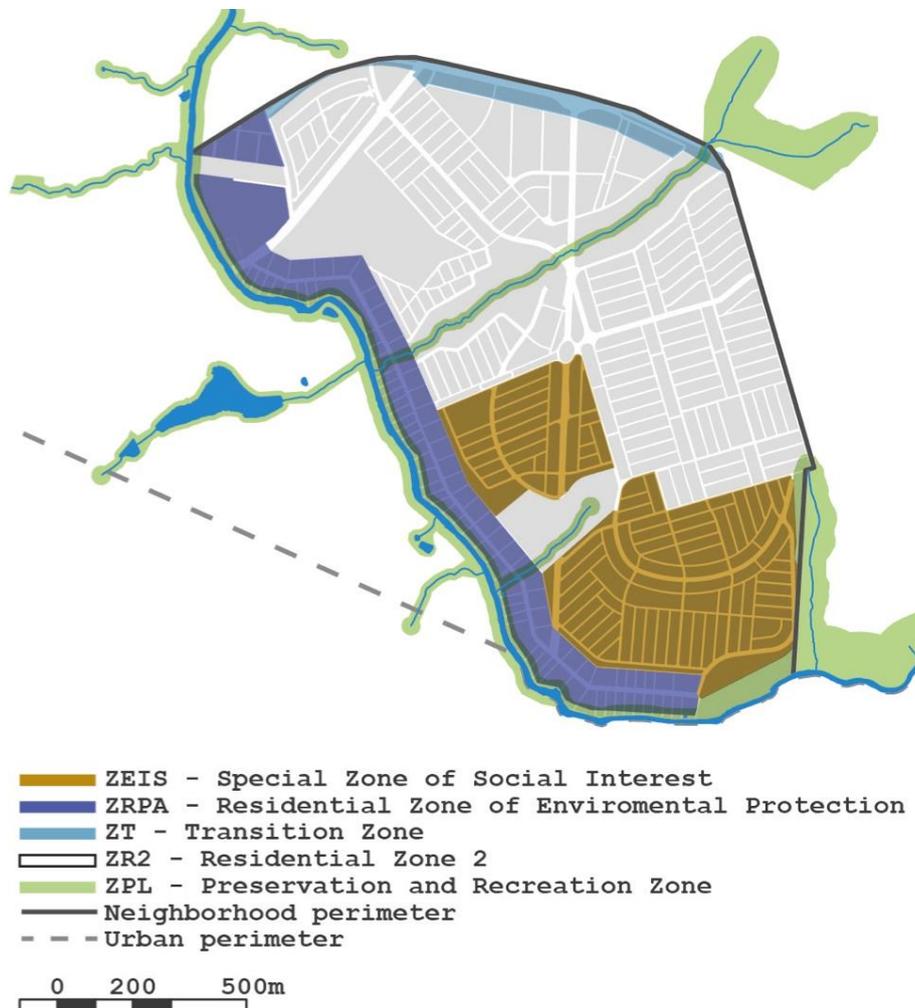
Source: Author, 2016.

- Residential Zone 2: Housing and low and medium scale activity, compatible with this use.
- Zone of Social Interest 1: Non-divide regions destined to social housing.

Table 3 - Urban restrictions

Zone	Maximum Occupation Tax (%)	Maximum Coefficient of utilisation	Minimum Front Setback (m)	Minimum Lateral and Back Setback (m)	Minimum FrontSize (m)	Minimum Area of the Lot (m²)
ZR2	60	2,75	3,0	1,5	10	250
	H2 > 4 storey 40					
ZEIS 1	80	2,5	3,0	1,5	8	200

Source: Municipal Prefecture of Uberlândia, 2016.

2.4.2 ACCESS AND PUBLIC TRANSPORT

It is clear that Shopping Park presents a fragmented road network that strangles the access to the neighbourhood, isolating it from the city and its main points.

Figure 21 - Shopping Park Neighbourhood Road System Map
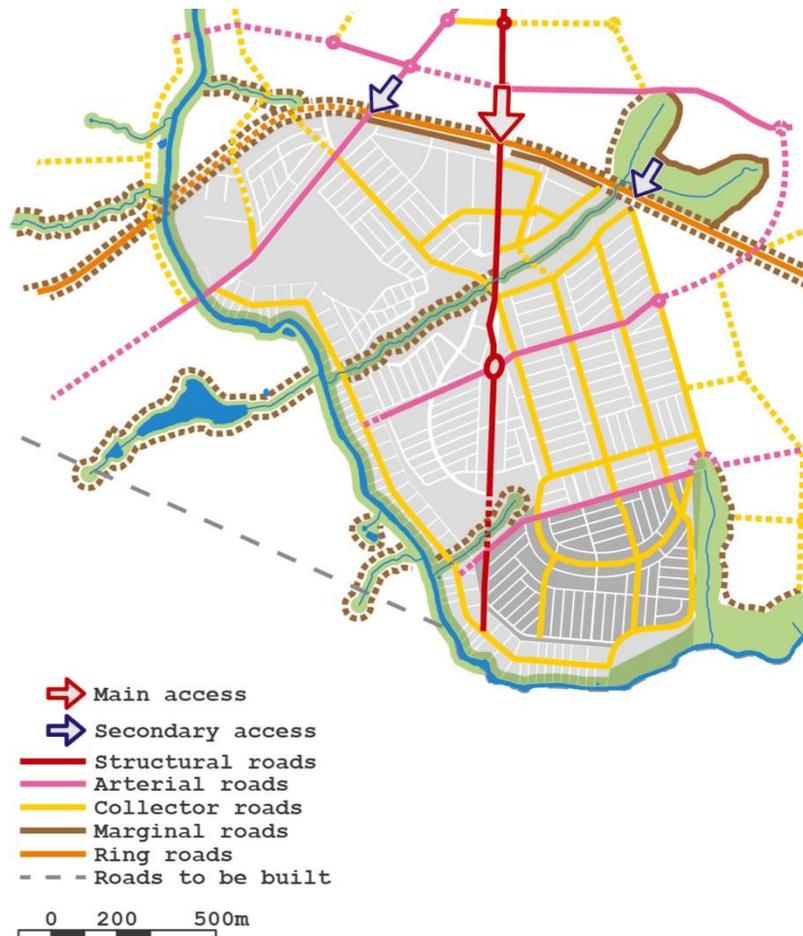
Source: Author, 2016.

2.4.2.1. BUSES

There are four bus lines circulating in Shopping Park. However, they are not enough to attend the neighbourhood's demands and do not reach the whole area, making residents walk long distances to have

access to the few existent buses. This comes also as a consequence of the disconnected network that strangles the access to the area.

Looking closely, it is noticeable that the bus lines shown above are quite restricted towards where you can get trough. The lines do not have a proper distance between them, being unable to provide diversified access points for the residents, as well as the main destinies being limited to the city centre and Santa Luzia Neighbourhood. In addition, the buses timetable are considered inefficient, as the frequency and waiting time are considered unacceptable (around one to two hours).

Figure 22 - Shopping Park Neighbourhood City and Bus Lines Map
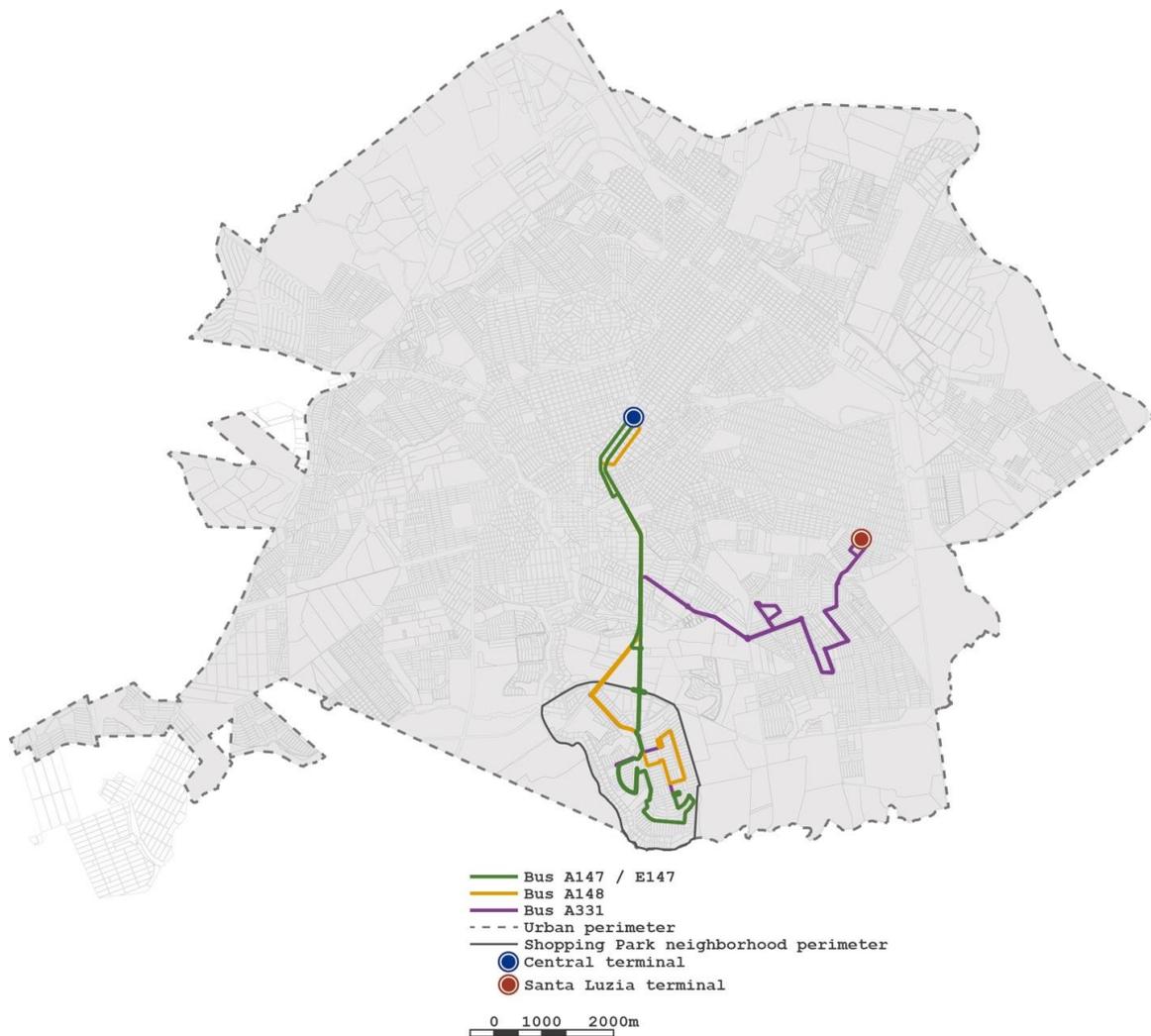
Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 23 - Shopping Park Neighbourhood Bus Lines Maps
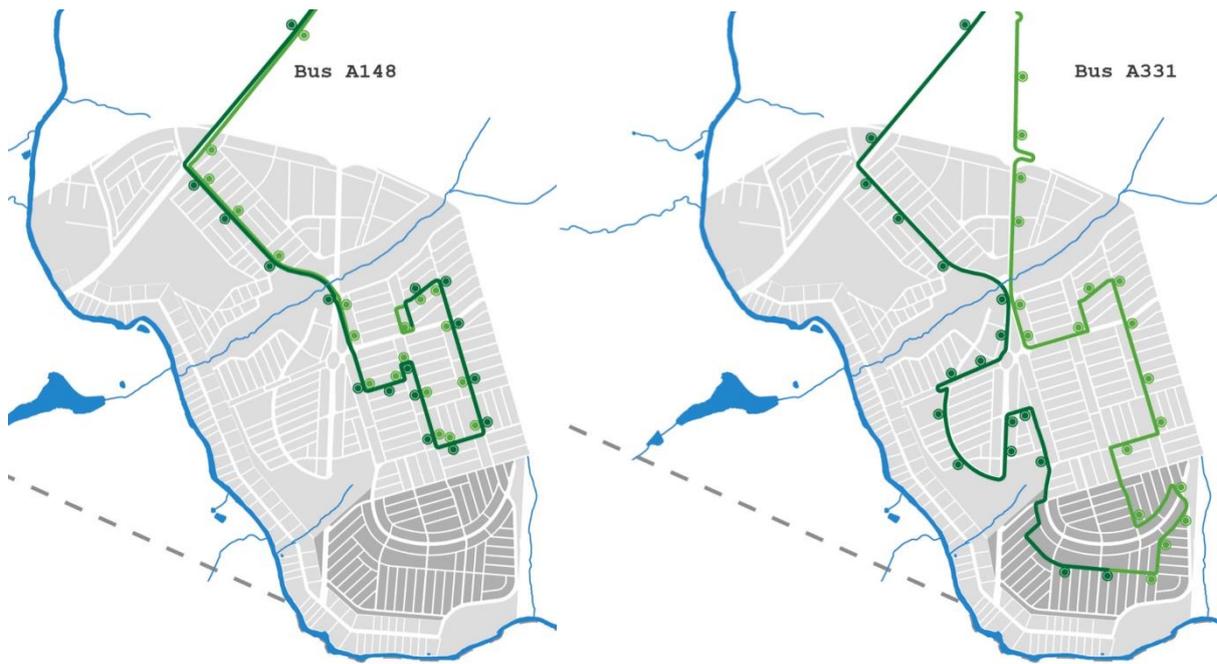
pathway - Central area to neighborhood
pathway - Neighborhood to central area
stop

500m

Bus A148

Bus A331

Bus pathway - Central area to neighborhood
Bus pathway - Neighborhood to central area
Bus stop

0   200   500m

Bus A147 / E147*
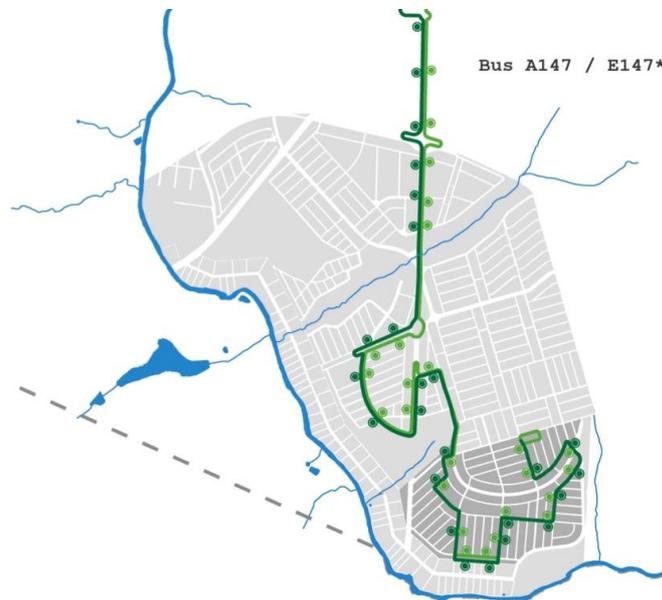
*The bus E147 has stops just inside the Shopping Park
neighborhood perimeter
Bus pathway - Central area to neighborhood
Bus pathway - Neighborhood to central area
Bus stop

0   200   500m

Source: Author, 2016.

2.4.2.2. CYCLE PATHS

The existents cycle paths do not fulfil their objectives. They are made from low-quality materials and have bad execution, as well as not presenting proper traffic signalling what makes it difficult for the residents to even identify them. Besides that, they do not present connection or continuity within the road network or any other transport system.

Figure 24 - Shopping Park Neighbourhood Cycle Paths Map

Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 25 - Photomontage: Shopping Park Neighbourhood Cycle Paths

Source: Gollino, 2015.

2.4.2.3. SIDEWALKS

The sidewalks show the negligence towards public equipment. They were initially designed as a main passage with 90 cm, with two green lanes at each side with 30 cm. With time and the residents' arrival, the sidewalks changed into only one green lane that was not even large enough to plant the trees that were

initially designed, also decreasing the permeable areas. Some sidewalks are deteriorated or even inexistent near preservation areas or institutional lands.

Figure 26 - Photomontage: Shopping Park Neighbourhood Sidewalks

Source: Arantes, 2015.

2.4.2.4. FLOWS

The neighbourhood presents different kinds of flows and interactions. In the map below it is possible to identify the different types of flows that exist within the site, and how the population tends to concentrate on the facilities surroundings. This gives an insight as well on how people move and which directions they mainly use so that future actions can consider these dynamics.

Figure 27 - Neighbourhood Flows Mapping
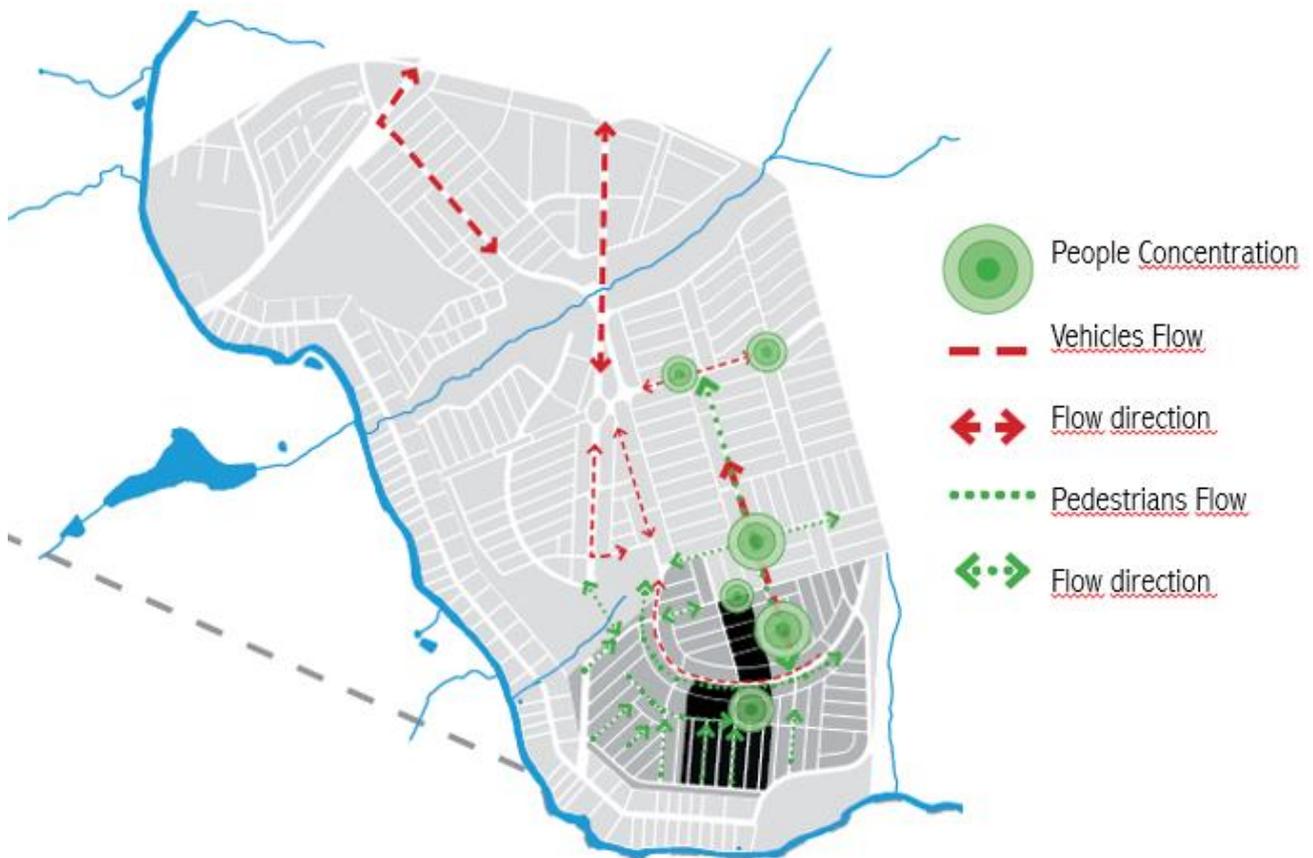
Source: Auhtor, 2015.

2.5 ENVIRONMENTAL IMPACT

There are several functional problems such as lack of enough manholes, structural problems in the houses - such as the lack of retaining walls, sewage reflux, roads without asphalt paving, fires, illegal dumping and irregular occupations, that greatly affect the environment.

2.5.1. NATURAL RESOURCES

The MCMV houses are located in an area of great environmental relevance. Before they were established, the area was considered as a Zone of Partial Preservation, which means low-density occupation. However, in 2006, it was turned into ZEIS 1 (Social Interest Special Zone). As in 2010, 3.800 houses were constructed with the MCMV Programme, the density level rose and some houses were even placed near hydric resources. The mandatory preservation areas for the river and streams margins are preserved, even so, instead of being important positive points of Shopping Park, their environmental and leisure potential is still underrated, turning it into barriers within the neighbourhood instead of free spaces of quality.

Figure 28 - Shopping Park Neighbourhood Natural Resources and Interaction spots


```
0    200    500m
```

Source: TFG_Juliana Arantes, edited by author, 2016.

The vegetation present is the Cerrado Biome, and as far as of now, the vegetation still maintains its original characteristics.

Figure 29 - Cerrado biome
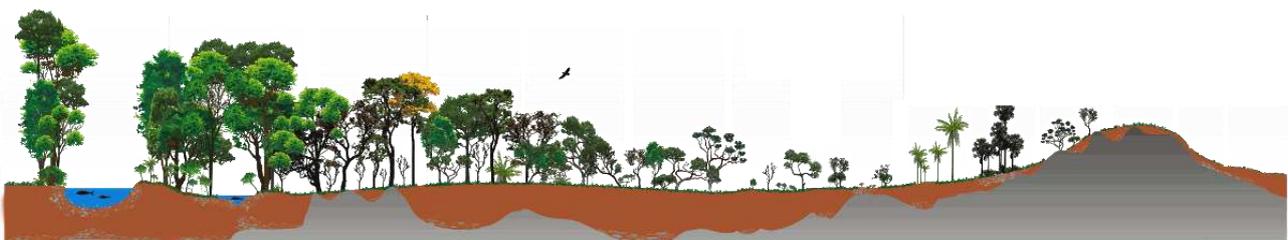
Source: WWF

Figure 30 - Shopping Park Neighbourhood Permanent Preservation Area

Source: Gollino, 2015.

They are small trees, with crooked branches and deep roots, often present in springs and permanent preservation areas. Besides the cerrado characteristic vegetation, there are intersecting points nearby paths of water resources, and significant extensions in the riparian areas of the cerrado field, which is the transition between field and other types of cerrado vegetation, with marsh areas.

In institutional areas not yet settled and areas intended to become squares, you can also see remnants of this vegetation. The following map shows the existing green areas along with the hydrography. In addition, in a darker tone, there are the green areas planned to remain in the neighbourhood with the largest presence of native vegetation.

Figure 31 - Shopping Park Neighbourhood Map

Source: TFG_Juliana Arantes, edited by author, 2016.

59
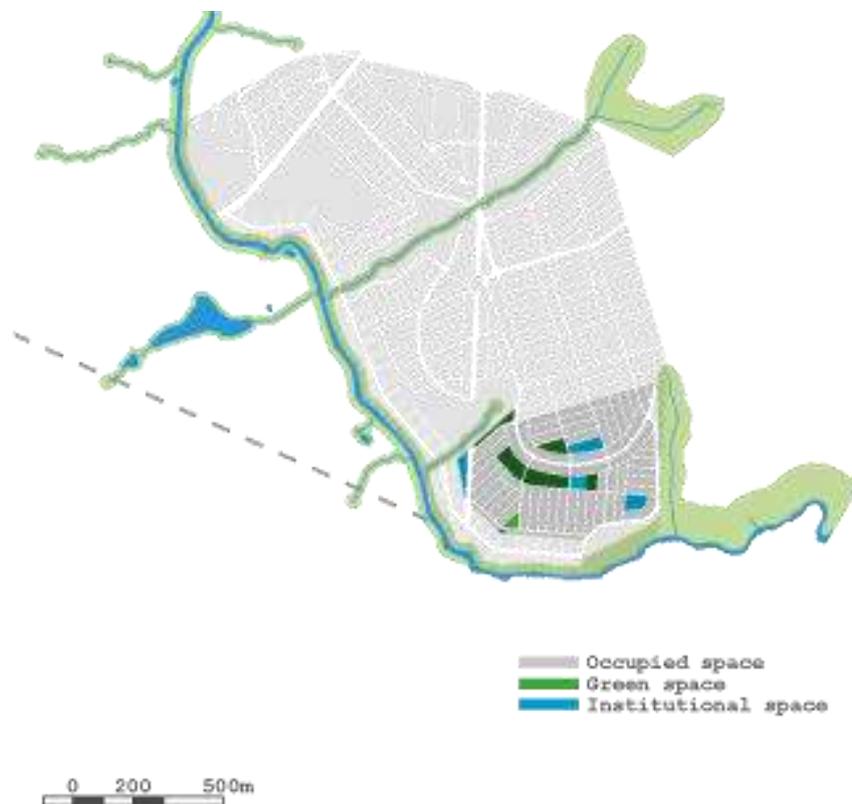
In the surrounding hydrography, there is the main river channel of the city. The water from the *Uberabinha* river is used for domestic consumption and also for the transport of urban and industrial wastewater. One of its main tributaries, the *Ribeirão Bom Jardim*, is the second responsible for the water supply of the city. Located in the west of the district, already in the countryside.

The neighbourhood is also surrounded by two other streams without official nomenclature, forming barriers between one neighbourhood and another.

According to the Soil map, the area of the neighbourhood, taking into account the *Ribeirao Bom Jardim* and the surrounding area, you can see that the present soil is the red Latosol. It is a common soil type in Brazil, easily identifiable and can deduce the existence of organic matter, iron oxide, in addition to having high weathering and good physical condition.

Figure 32 - Map of the State of Minas Gerais soils (Uberlândia Region)

Source: Belo Horizonte: State Environmental Foundation, 2010. FEDERAL UNIVERSITY OF VIÇOSA; FOUNDATION CENTER TECHNOLOGICAL GENERAL MINES; FEDERAL UNIVERSITY OF LAVRAS; FOUNDATION STATE OF THE ENVIRONMENT. Adapted by the author.

2.5.2. WATER SOURCES, FLOWS

As previously mentioned, *Uberabinha* River, part of the Araguari River basin, is of great importance for the city, constituting together with its tributaries, the source used for the population's water supply. It is born in

the north of the city of Uberaba, runs through the city of Uberlândia, and empties into the *Araguari* River, at north-west of the city, reaching a total length of 150 km.

Its main tributaries are in the countryside, which are *the Ribeirão Beija-Flor, Rio das Pedras* and *Ribeirão Bom Jardim*, another important source for the city's supply. "(BDI 2015)

According to technical director of DMAE, Fernando Guimarães, just over 80% of the water volume produced in Uberlândia is sent by *Sucupira* and *Bom Jardim* Water Treatment Station for residential use.

Figure 33 - Atlas of water supply
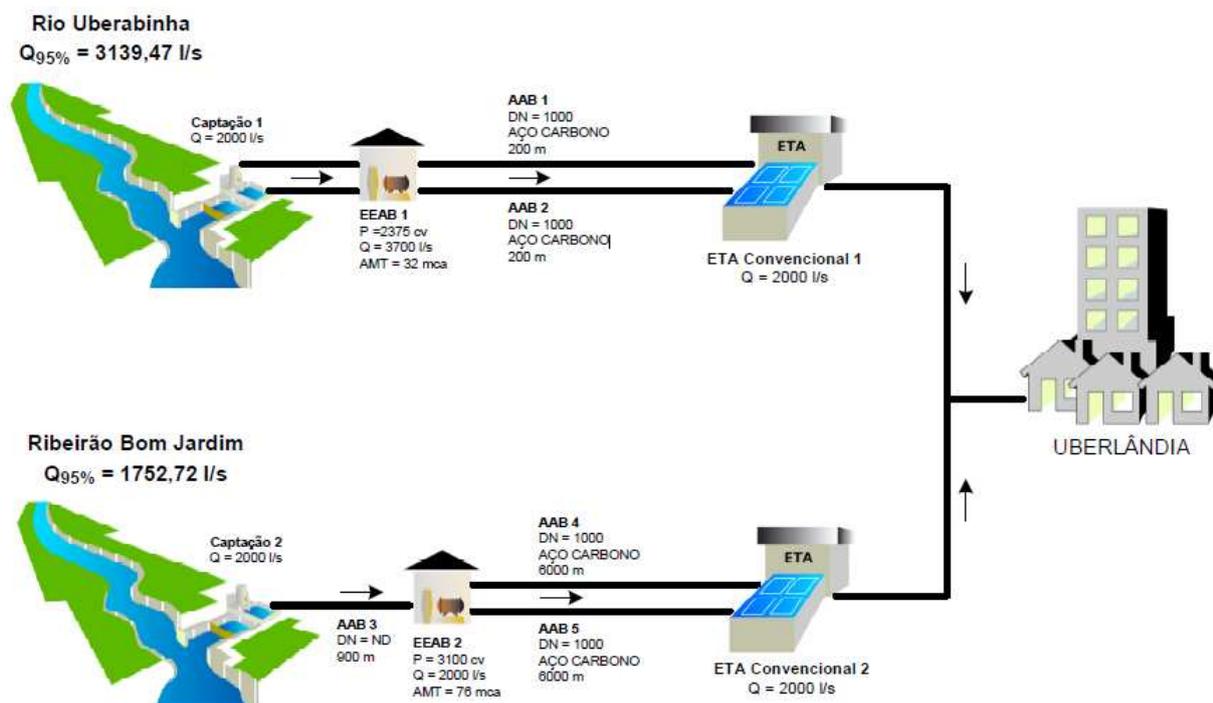
Source: ANA- National Water Agency

The *Bom Jardim* distributor system supplies by gravity to the lower area of the city and by settlement for the high area. The main places attended are:

• *Cruzeiro dos Peixotos* Street Reservation Centre; and the following Neighbourhoods: *Centro, Martins, Saraiva, Jardim Brasil, Maravilha* and others;

• *Santo Inácio* Reservation Center: Meets the neighbourhoods on the left bank of the *Uberabinha* River;

• *São Jorge* Reservoir;

• Shopping Park Neighbourhood.

2.5.3. TOPOGRAPHY

The MCMV houses are located in a land with 12% declivity. The problem lies in the houses allocation, as they are perpendicular to the level curves instead of following the same direction. This increases the water

velocity, and together with the streets without paving or any proper vegetation, causes erosion and the river Uberabinha siltation. Also, added to the lack of enough manholes, this causes sewage reflux and compromises the houses structural stability.

Figure 34 - Shopping Park Neighbourhood Topography Map
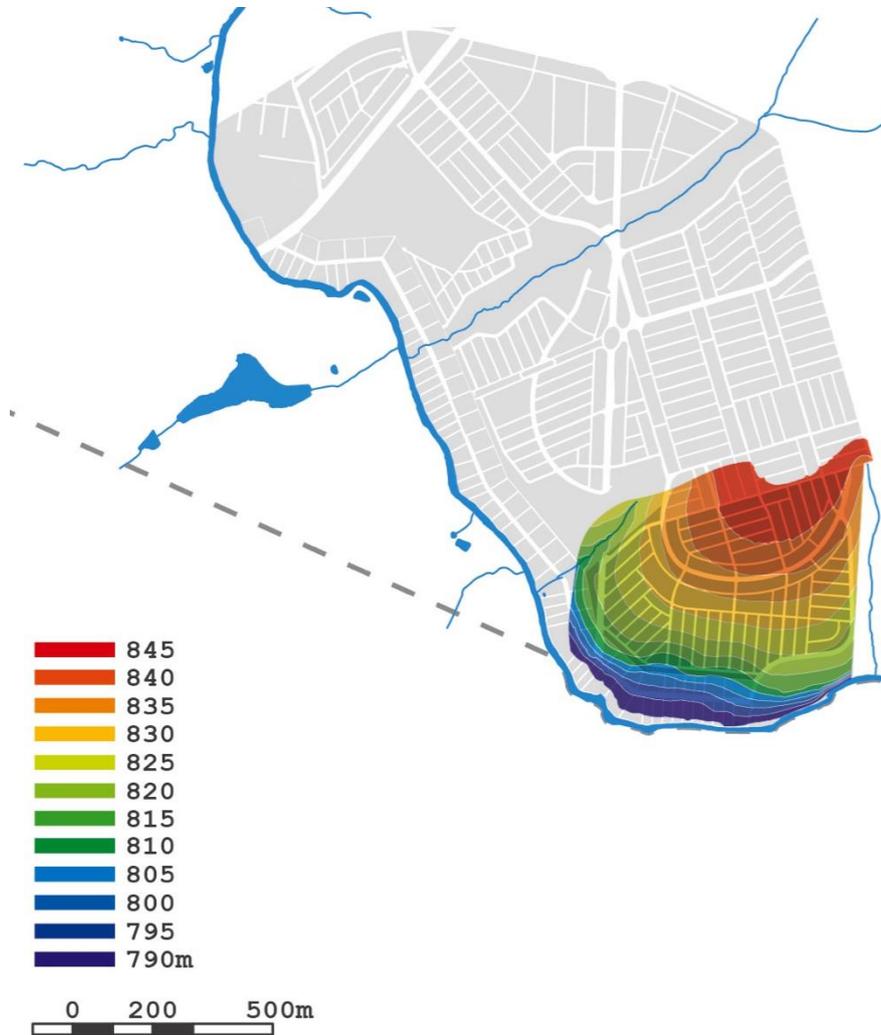
As mentioned, the way of implantation of the blocks, put some houses in a difficult situation in relation to the topography. Especially in the lower places, the design as proposed has resulted in a great gradient leading to the need of important earthmoving services. Moreover, some houses were constructed without using retaining walls, exposing several houses to landslide and structural collapse.

Figure 35 - Photomontage: Blocks Implantation and Landslide accident

Source: Tolentino, 2012 (Left); *Correio* Journal, 2013(Right).

2.5.4. LANDSCAPE

The neighbourhood does present green spaces within its area, unfortunately, they cannot be qualified as proper green open spaces as they do not present any landscape or an architectural feature that may benefit the residents, such as a shaded area for the summer heat. Also, the inhabitants mainly focus on paving their lots, without putting any thought into any landscape resource, decreasing the permeable areas.

Figure 36 - Shopping Park Neighbourhood Green Spaces Map

Figure 37 - Neighbourhood Landscape

Source: Arantes, 2015.

2.5.5. INVASIONS

There are illegal occupations around the river margins, in the preservation area, located within 50m of the watercourse. The occupations started around 2012 and to this date count with approximately 800 families that claim to be there on their own, without connection to any political or social organisation. One of the main issues, besides the illegal situation they are in, is that their sewage is thrown directly into the river, which greatly affects the hydric resources and people's health. The prefecture warned the families about their illegal situation, but no action has actually taken place until today.

These occupations reflect on the need of focus by the MCMV Programme towards the families within the income bracket 1 (0 to 3 minimum wages), instead of mainly focusing on the 3 to 10 minimum wages class, as reality is showing that they are the part that needs more attention.

Figure 38 - Shopping Park Neighbourhood Invasions Map

Invasions
ZPL - Preservation and Recreation Zone

0   200   500m
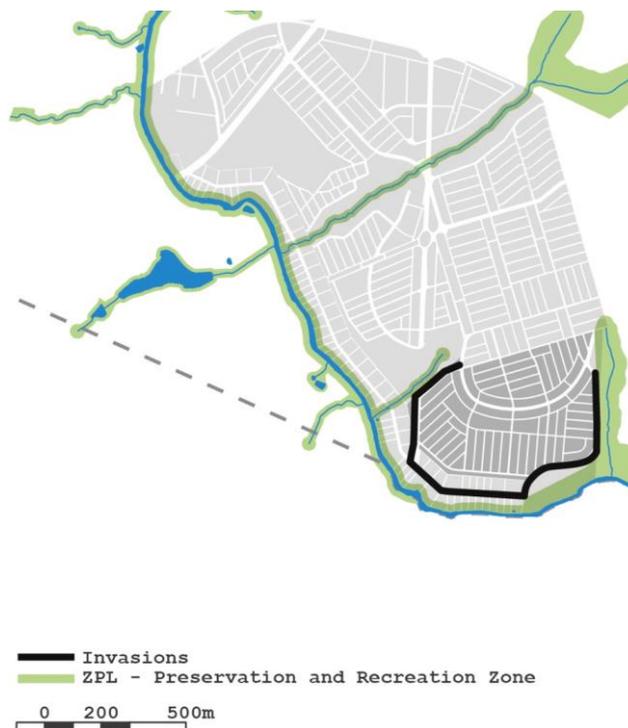
Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 39 - Illegal Property

Source: Gollino, 2015.

2.5.6. FIRES

There has been an increase in the fires around the region. Although they are a natural behaviour within the dynamics of the Cerrado biome, its increase is going beyond Cerrado's natural capacity of regeneration. They are mainly caused by the burn of domestic litter, fireplaces near watercourses, field cleaning trough fire and disposal of flammable materials. This causes a great impact on the environment and residents health.

2.5.7. WASTE

Accumulation of litter is another big (and old) problem in the area, where domestic and construction waste (reforms made mainly by the MCMV residents themselves) are the main causes. This perpetuates an act of illegal dumping, where people keep leaving the waste in the open, becoming a threat to people's health. In addition, this may cause soil contamination, affecting the hydric resources.

Figure 40 - Shopping Park Neighbourhood Illegal Dumping Map
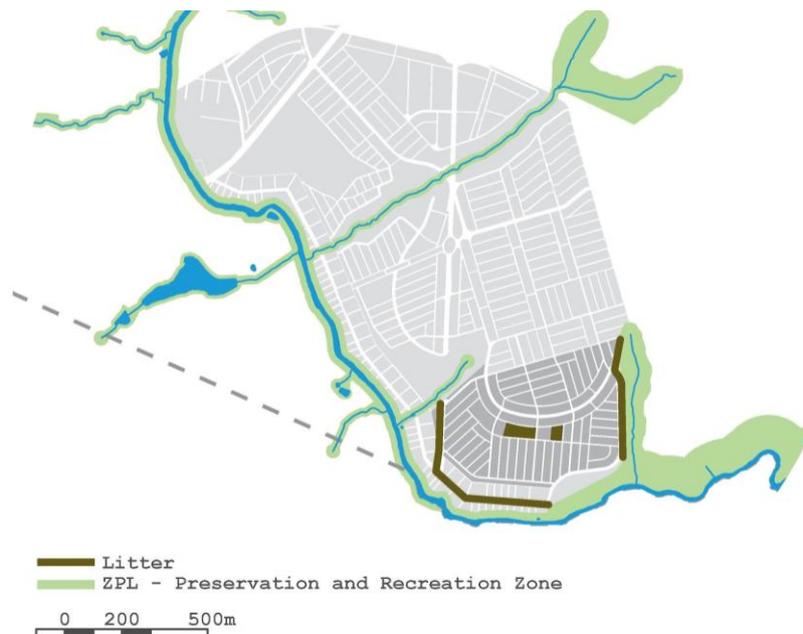
Source: TFG_Juliana Arantes, edited by author , 2016.

It is noticeable that the lowest points are the most affected with garbage, especially construction waste. Probably because of the availability of space associated with ease transportation, since the topography facilitates the descent weighing even if the work is manual. The waste present in green and institutional areas are very significant, and although there is waste collection three times a week, it is common to see household waste scattered in the street and within the limits of these areas, in addition to the plastic bags that, taken by the wind, spread themselves between the trees, giving the location and abandoned aspect.

Figure 41 - Photomontage: Illegal Dumping

Source: Gollino, 2015 (Left); Arantes, 2015 (Right).

2.5.8. SHORTAGE, WATER, ENERGY, FOOD

In 2014, Uberlândia had the second-worst drought recorded since the 80's. Rationed water distribution was needed, with a decrease in the pressure during the day in some neighbourhoods of the city in order to preserve the level of catchment of the water channel. The population was even oriented to avoid the use of rubber hoses in house cleaning activities.

According to a report from *Correio de Uberlândia* newspaper on February 7th, The Municipal Department of Water and Sewerage (DMAE) began operating the water distribution in Uberlândia alert system. *Bom Jardim* and *Sucupira* water reservoirs marked daily levels of water between 2.8m and 3m, which is considered low for this month. The rates do not exceed the maximum supported by the dams, up to 3.10 m of water at a time where, usually, the floodgates would be open because of excessive rain.

Besides the shortage in some periods, Uberlândia has a considerable rate of water loss. According to DMAE, Uberlândia loses around 29% of the water produced in the city, being water meter reading errors, leaks and illegal water supply the main reasons.

As shown in the G1 Triangulo Mineiro newspaper report on September 1rst of 2014, the *Bom Jardim* reservoir is responsible for 52% of the city's supply, and all the water that passes through the site is treated and consumed. According to the director of the Municipal Department of Water and Sewerage (DMAE), Orlando Resende, the situation was worrisome. "Apparently the water level of the reservoir is normal, but all the water that arrives on site is consumed in the city. The reservoir is relatively small, so it is necessary to talk about water saving.".

2.5.9. STRETCHED SEASONS DRIED

In the dry season period, the precipitation levels keep falling while also recording the lowest temperatures. With the reduction in rainfalls and consequently low humidity, the drier days contribute to increased air pollution and occurrence of fires, besides damage to the population's health, such as respiratory and circulatory problems.

In the next chart, you can see how the city of Uberlândia has an extensive dry period throughout the year. Visitors from other cities can usually take notice of the weather instantly. Since a portion of the residents is already accustomed to this kind of climate, they do not realise how long this season is.

Graph 7 - Dry Season Period Duration of the city of Uberlândia - MG

Source: Org. Aline F. Roldão (2012)

2.5.10. ATMOSPHERE CONDITIONS

Table 4 - Climate Data - Uberlândia

Meses	jan	fev	mar	abr	mai	jun	jul	ago	set	out	nov	dez
Temperatura máxima média (°C)	28,6	29,3	27,8	28,5	26,6	26,3	26,9	28,9	29,5	30,4	29,0	28,7
Temperatura mínima média (°C)	19,9	19,5	19,7	18,3	15,0	13,9	14,1	15,4	17,4	19,5	19,8	19,8
Umidade relativa do ar (%)	75	74	75	68	62	61	55	46	49	60	70	75
Número de dias com chuva	19	17	17	10	4	2	1	2	5	12	15	18
Precipitação mensal total (mm)	317	230	236	113	24	16	7	8	41	146	194	291
Notas:	1. A temperatura mínima chega a 9°C nos meses de maio a julho. 2. A umidade relativa do ar chega a valores críticos em torno de 20% nos meses de junho e julho. 3. Média dos últimos 10 anos.											

Source: INMET. Org. OlimpiadasRio (2016)

Through its geographical location, Uberlândia is situated in a moderate temperature range, which, along with its altitude, contributes to an annual temperature average around 23°C in 2012. The maximum and minimum temperatures recorded in the last three decades were 37.4ºC in 1997 and 1.0ºC in 1981, respectively. The precipitation regime is tropical, meaning that summer rains, starting in October /

November (wet season), becomes rarer around March / April (dry season). The dry season coincides with the winter months when air masses reach the city deprived of moisture. Historically, the maximum and minimum precipitation levels recorded were 2207.10 and 1.012,60mm respectively. (BDI 2015).

Graph 8 - Maximum and minimum temperature of the city of Uberlândia - MG
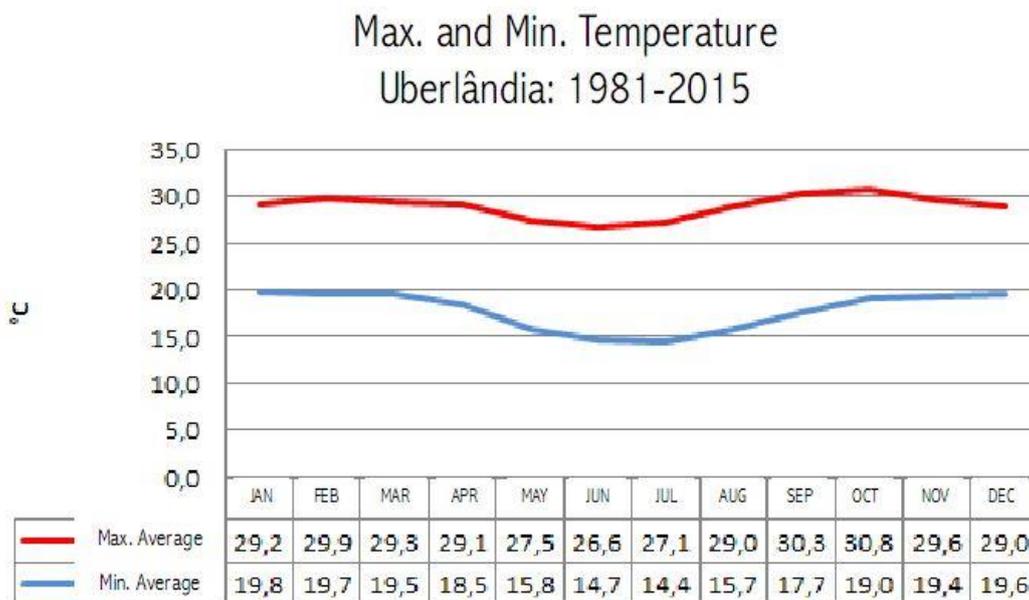
Max. and Min. Temperature
Uberlândia: 1981-2015

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Max. Average	29,2	29,9	29,3	29,1	27,5	26,6	27,1	29,0	30,3	30,8	29,6	29,0
Min. Average	19,8	19,7	19,5	18,5	15,8	14,7	14,4	15,7	17,7	19,0	19,4	19,6

Source: Ministry of Agriculture - 5th District of Meteorology / Uberlândia station - Organized by Authors.
Data from May 1996 are from the Climatology Station of the Federal University of Uberlândia.

By analysing the data along this specific period (1981-2015), it is noticeable that the precipitation level varies significantly within each year. A few years were becoming rainier, others with below-average rainfall and others within the expected average levels of rain.

Graph 9 - Precipitation levels – Uberlândia (MG) – 1981/2015
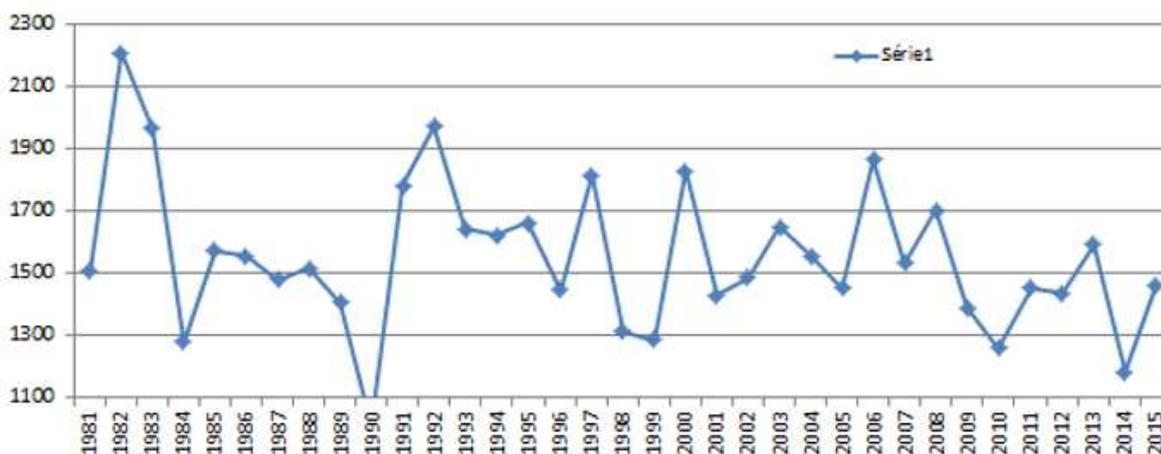
Source: Ministry of Agriculture - 5th District of Meteorology / Uberlândia station - Organized by Authors.
Data from May 1996 are from the Climatology Station of the Federal University of Uberlândia.

From the following chart, you can see the rainiest months (November to March) characteristics of the wet season, and the typical months of the dry season (April to October).

Graph 10 - Monthly precidtation – Uberlândia: 1981-2015
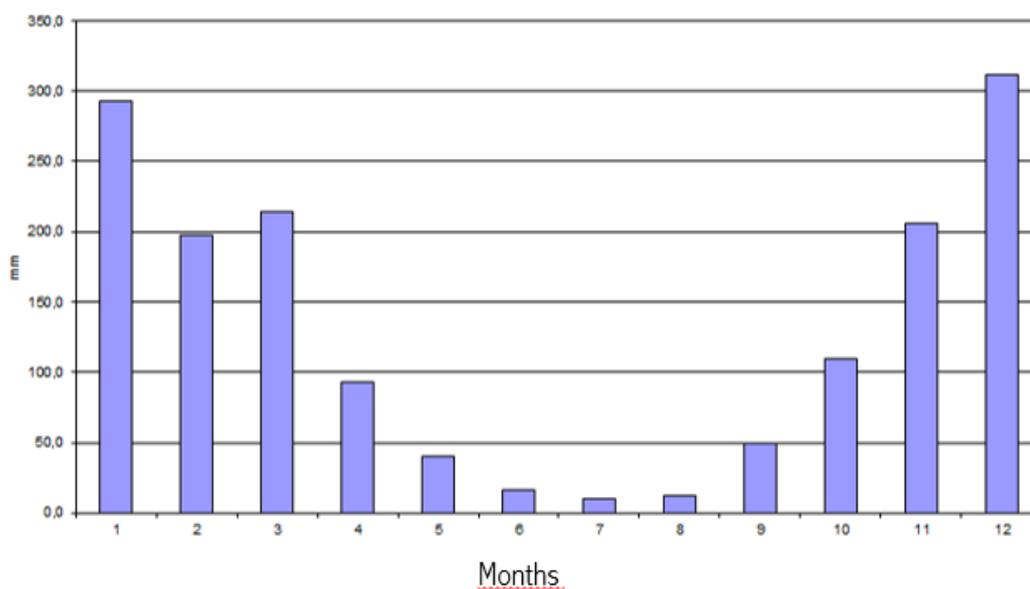
Source: Ministry of Agriculture - 5th District of Meteorology / Uberlândia station - Organized by Authors.
Data from May 1996 are from the Climatology Station of the Federal University of Uberlândia.

2.5.11. CLIMATE CHANGE

October 14th of 2014 was the hottest day in 16 years. That day, Uberlândia saw the hottest day since 1998. The automatic stations linked to the National Institute of Meteorology (Inmet) recorded, between 3 and 4pm, a maximum temperature of37,1º C. The mark was slightly below the figure of 16 years ago, according to the historical monitoring of Climatology Laboratory of the Federal University of Uberlândia (UFU). At that time, according to the notes made since the 80s by the institution, the temperature came to 37.5 º C also in October. Despite these temperatures register peak in 2014, it was not the warmest year on record as we can see in the chart below.

Graph 11 - Average temperature by year – Uberlândia: 1981-2015
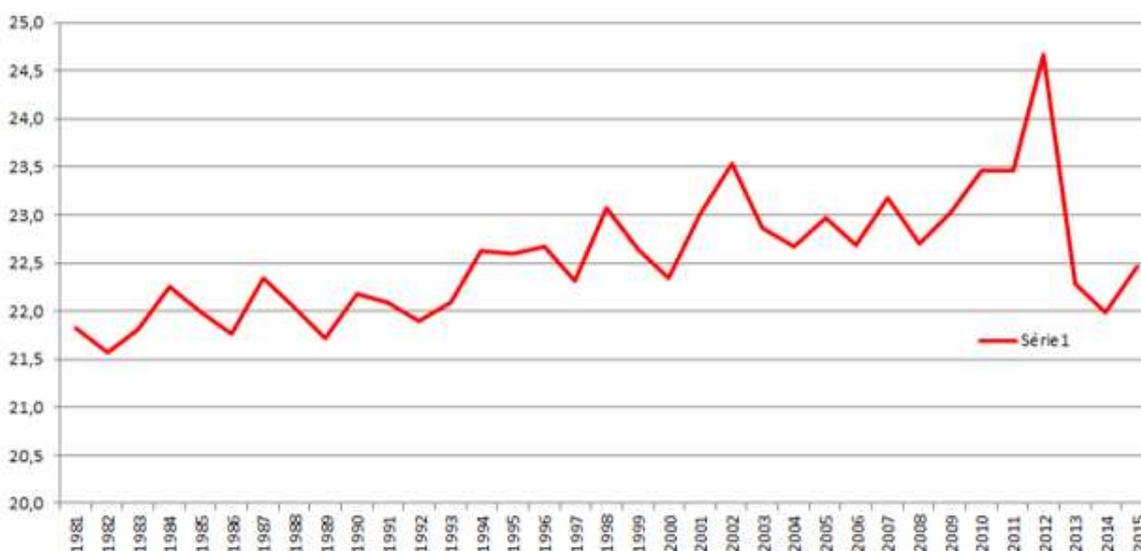
Source: Ministry of Agriculture - 5th District of Meteorology / Uberlândia station - Organized by Authors.
Data from May 1996 are from the Climatology Station of the Federal University of Uberlândia.

The average temperature has been increasing since data began to be collected, although there has been a decrease in the average temperature the last three years. There is a possibility that the years of 2013 and 2014 (the lowest in recent years) might have a difference since the months August, September and December of the first and months July of the second were not accounted for the lack of data.

2.6. ENERGY, WATER, SEWAGE SERVICES and COSTS

In Brazil, the system of production and distribution of energy is regulated by a Federal Agency after the major privatisation in the 1990s, making the private sector responsible for 67% of power generation and distribution all over the country.About 70% of the energy produced in Brazil is sourced from hydroelectric, this perceptual is now in decline, and pollutants sources are rising. The recent law allowed individuals and companies started to generate its own energy, but they can just trade it with the official energy companies. As the result, the production of solar or wind energy has increased, although it represents only 2%.

Thus, there is no power generation in Shopping Park Housing Complex, being the energy provided by the company (CEMIG), owned by both State of Minas Gerais and private investors. All of the houses have a water solar heating system which contributes significantly to decrease their energy expenditure which is about 80 kWh/month.

The water and sewage system are provided by the Municipal Water and Sewerage Company (DMAE) who is the responsible for covering the whole city. The sewer treatment is done together in the City Sewer Treatment Station also operated by DMAE. Public lighting is provided in an agreement between the energy company (CEMIG) and Municipal Prefecture and barely covers the streets and common areas, being one of the main complaints from the residents.

Table 5 - Annual energy consumption.

Consumo	325.356.726	281.707.888	275.309.374	281.348.322	285.445.663	288.788.518	293.779.000	300.224.000	318.459.000
Ano	2000	2001	2002	2003	2004	2005	2006	2007	2008

Source: Municipal Information Panel in 2011.

In 2000 and 2001 energy consumption probably decreased due to power rationing policy adopted by the government for problems in water resources, the main matrix of Brazilian energy. After this period, the consumption gradually increased again, although without reaching the same level before rationalisation. It can be explained by improvements in technology, where electronic products consume less energy along with the population awareness after the rationing policy.

As for water consumption, the population of Uberlândia is estimated to consume an average of 210,000 cubic meters of water on a daily basis, a considered high amount, as this average has been growing.

According to the technical director, it is important that the daily consumed volume decreases to properly face the dry season in the region. Although the two sources that supply the city, *Bom Jardim* and *Sucupira* are at their maximum level, they are considered of small volume, and the flow of the springs tends to reduce in the coming months.

It is known that 97.5% of the households have a connection to a water supply with a total of 2593 connections in the allotments Shopping Park III to VII only. The residential Tapajós (Shopping Park VI) is the allotment that has a greater number of supply connections.

Table 6 - Water connections in the study area.

Existent connections in the Study Area							
Connections	Neighbourhood	Residentials	%	Commercial	%	Public	%
338	SHOPPING PARK III	492	97,43	13	2,57	0	0
339	SHOPPING PARK IV	500	97,09	15	2,91	0	0
340	SHOPPING PARK V	620	96,42	21	3,27	2	0,31
342	SHOPPING PARK VI	599	98,36	9	1,48	1	0,16
343	SHOPPING PARK VII	382	98,2	7	1,8	0	0
Total: 2661 connections		**2593**		**65**		**3**	

Source: DMAE, 2016. Organized by Authors

Almost 97% of water consumption is destined to residences with 38.355m³ of daily consumption, a considerable amount compared to the rest of the city since it is equivalent to approximately 18% of the entire city consumption. Just a little more than 3% of consumption is intended for trade, and public facilities, which is an insignificant amount.

Table 7 - Residential Consumption

Residential Consumption				
Neighbourhood	Consumption	%	Monthly Average	%
SHOPPING PARK III	7733	96,64	15,717	0,524
SHOPPING PARK IV	7703	97,85	15,406	0,514
SHOPPING PARK V	8542	94,71	13,777	0,459
SHOPPING PARK VI	8322	97,68	13,893	0,463
SHOPPING PARK VII	6055	97,57	15,851	0,528
Total de consumo:				38355

Source: DMAE, 2016. Organized by Authors

Table 8 - Commercial Consumption

Commercial Consumption				
Neighbourhood	Consumption	%	Monthly Average	%
SHOPPING PARK III	269	3,36	20,692	0,69
SHOPPING PARK IV	169	2,15	11,267	0,376
SHOPPING PARK V	477	5,29	22,714	0,757
SHOPPING PARK VI	198	2,32	22	0,733
SHOPPING PARK VII	151	2,43	21,571	0,719
Total de consumo:		1264		

Source: DMAE, 2016. Organized by Authors

2.7. COMMERCE AND SERVICE EQUIPMENT

The Shopping Park Housing Complex was initially designed with a view for single use where the centre is a large avenue being planned as a commercial and institutional centre and on the blocks below or above should be a strictly residential area. After the houses construction and distribution, one can notice several houses that were under refurbishment to construct a commercial space separately, although still sharing the same lot of land, from that of the residential space. This typology has spread all over the strictly residential area, while the large planned commercial avenue has stayed almost totally void.

These tertiary activities have very particular dynamics and depend on flows to work. In this case, please note that the large planned avenue cannot provide larger flows, since it does not connect to the other parts of the territory and not even establish exit route. Thus, it is clear why, until today, there has been no interest in occupying the spaces with commercial properties.

Figure 42 - Photomonatge: Commerce and Service Activities

Source: Garrefa, 2016.

The avenue is deserted and therefore, the places with denser pedestrian flows and those destined to everyday activities are benefited by being close to the houses, leading to a natural demand for establishments accessed by those who do not wish to walk longer distances. The other aspect is related to the price of the land, unaffordable for the residents who the majority of which are from low-income families.

So due to this, many residents, for a much lower cost, have adapted their own houses to commercial activities and services, turning the houses into income generating properties while still delivering the fundamental role in supplying for the community´s convenience. However, a large majority of these adapted houses, serving commercial purposes, put the properties in a precarious situation of being against the legislation. On the other hand, public management does not inhibit such practices because they know that commerce represents for those families, their survival and a huge convenience for the neighbourhood.

Figure 43 - Commerce and Service Activities Map
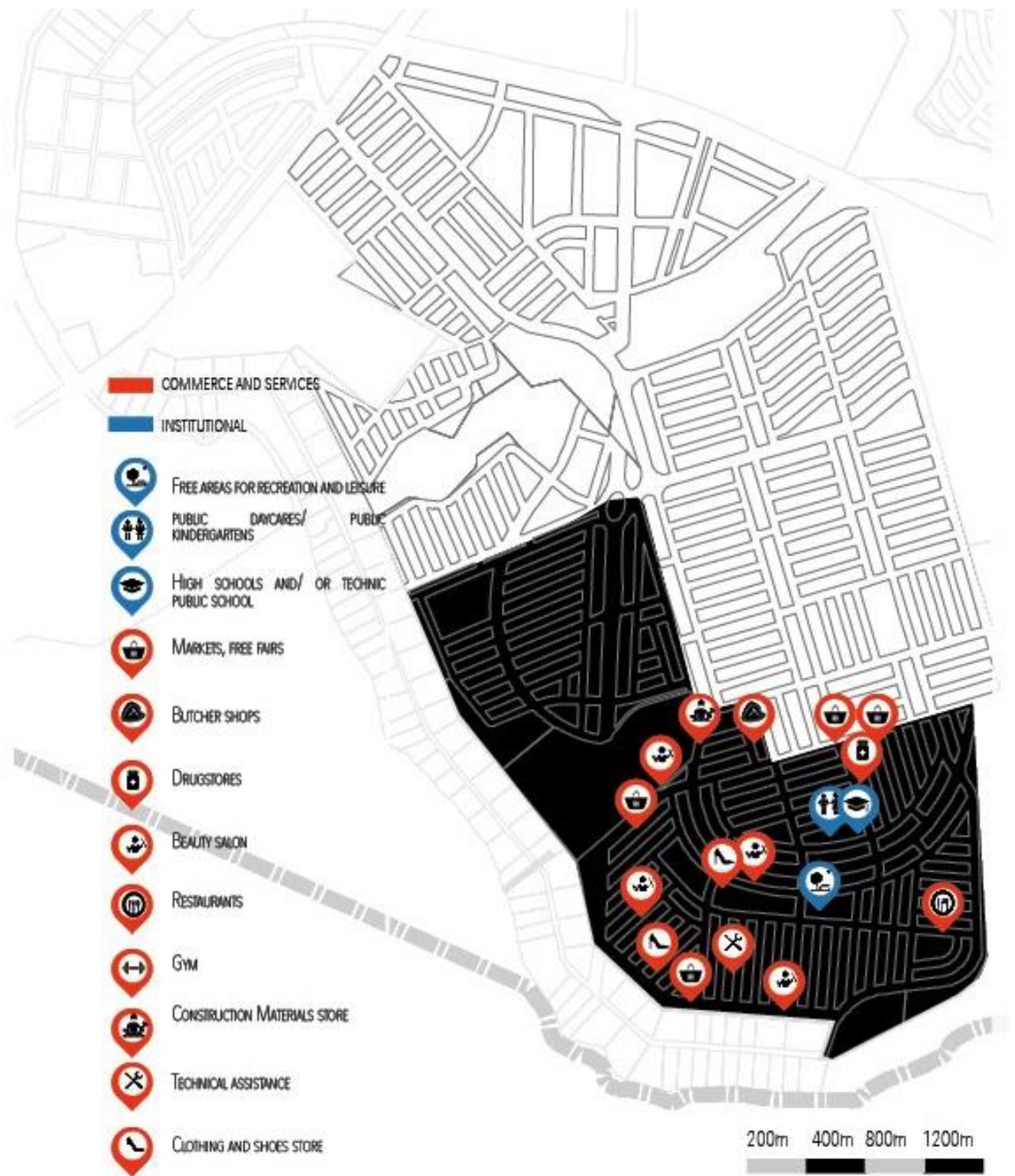
Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 44 - Photomontage: Commerce and Service Activities
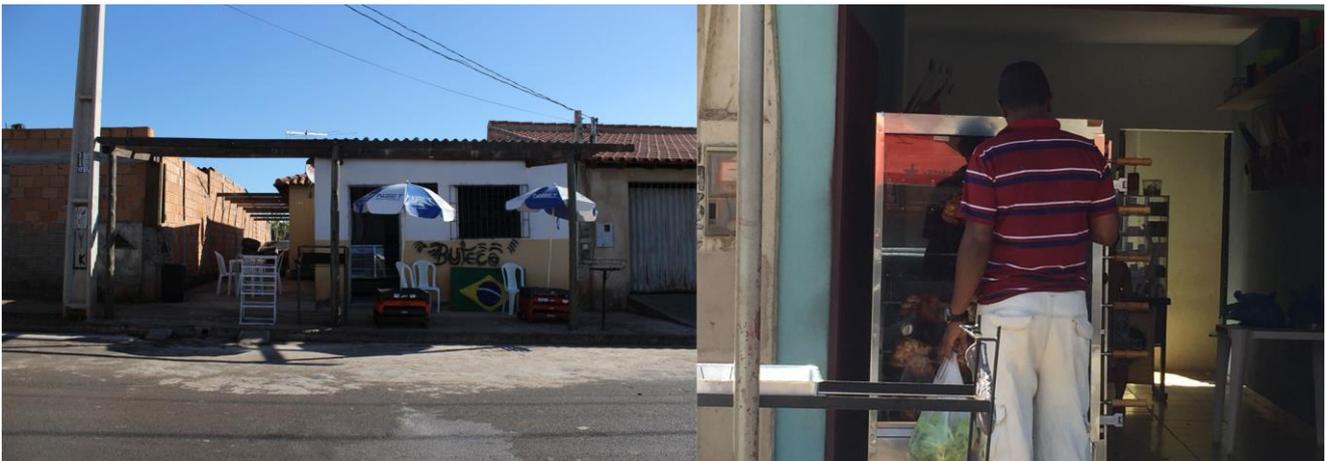
Source: Gollino, 2015 (Left); Garrefa, 2016 (Right).

2.8. HOUSING UNITS

2.8.1. THE STANDARD LAYOUT

The MCMV housing units usually follow the same layout and urban insertion. They are terraced houses placed two by two in a 200m² quarter, with 36m² constructed for each house. What eventually happens is the alteration by the residents themselves, such as the construction of walls, addition of new rooms, garage, small commerce, etc.

The programme has strict layout rules. The rooms have minimum areas defined by specific furniture measures. The house should have two bedrooms, living room, kitchen, bathroom and a sink outside as the laundry space. What is important to highlight here is that these rules restrict the design, making it harder to explore a greater and more innovative house design.

Figure 45 - Shopping Park Residential Quarter and House Unit Floor Plan
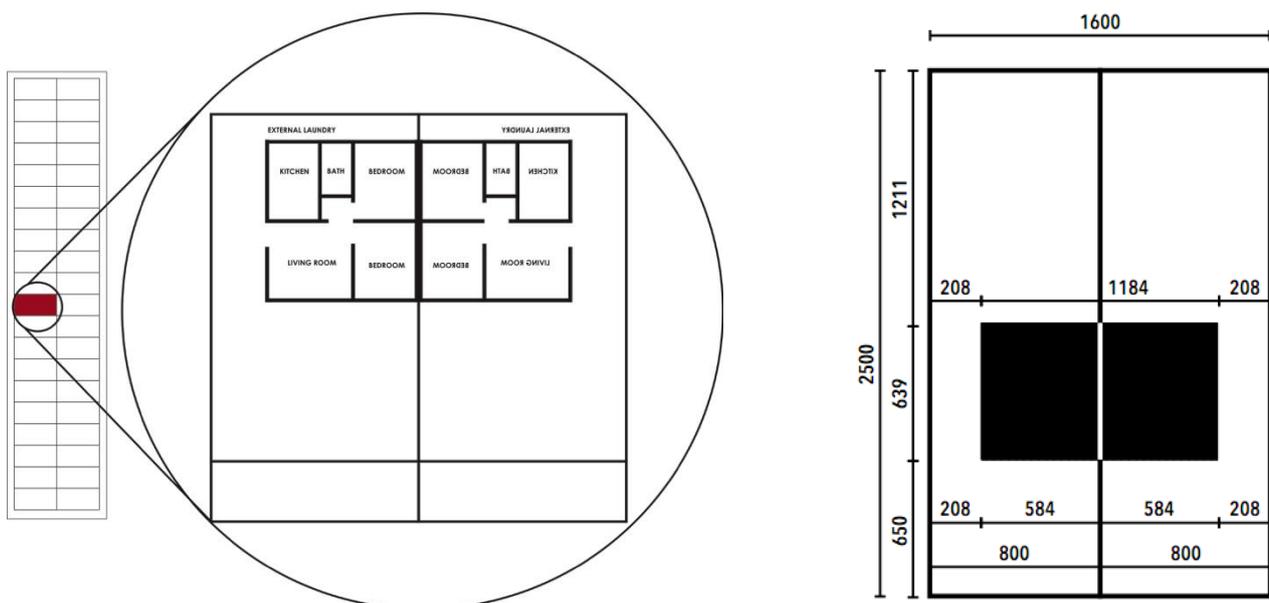
Source: TFG_Juliana Arantes, edited by author, 2016.

- Urban Infrastructure: Sewerage, rain drainage and paved roads.
- Implantation: terraced House, two by two
- Type: 2 bedrooms, kitchen, living room, bathroom, external laundry
- Constructive System: Slab Foundation, Ceramic Brick Cladding, PVC Liner, wood doors, metallic windows, ceramic tile roof.
- Coatings: Ceramic floor, walls with plaster and paint, wall coating of wet areas until 150cm high, flat glass.
- Solar heater installed in part of the houses.
- Energy Expenditure: 157,2 KWh/ month

2.8.2. HOUSE UNIT DESIGN

The rooms of the house follow a standard layout as said earlier. Below, we can see how the spaces are thought, and which furniture and size would be adequate for each room.

Figure 46 - Rooms diagram

Bedroom with double bed:
- 1 Double bed (1.4 x 1.9m)
- 1 Nightstand (0.5 x 0.5m)
- 1 Wardrobe (1.6 x 0.5m)
- Min. distance between furniture or wall – 0.5m
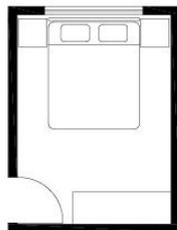
Kitchen:
- Sink (1.2 x 0.5m)
- Stove (0.55 x 0.6m)
- Refrigerator (0.7 x 0.7m)
- Canibet below the sink
- Minimum width: 1.8m
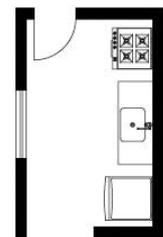
Bedroom with single bed:
- 2 Single beds (0.8 x 1.9m)
- 1 Nightstand (0.5 x 0.5m)
- 1 Wardrobe (1.5 x 0.5m)
- Min. distance between beds – 0.8m
- Mínimum circulation – 0.5m
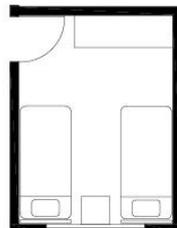
Bathroom:
- 1 shower (0.9 x 0.95m)
- 1 sink
- 1 toilet
- Minimum width: 1.5m
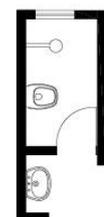
Living and dinning room:
- 1 Sofa (one seat for each resident)
- 1 Dinner table for four people
- 1 TV and wardobre support
- Minimum width: 2.4m
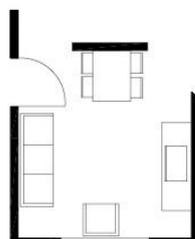
Loundry:
- 1 sink (0.52 x 0.53m)
- 1 Washing machine (0.6 x 0.65m)

Source: TFG_Juliana Arantes, edited by author, 2016.

The plans below show how is the design of the housing unit. The standard units are terraced houses with a shared wall. And the adapted units for disabled residents are located in the block corners, and they are a single unit, not sharing a wall with another resident.

Figure 47 - House unit design - standard

Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 48 - House unit design – adapted

Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 49 - House unit structure and materials
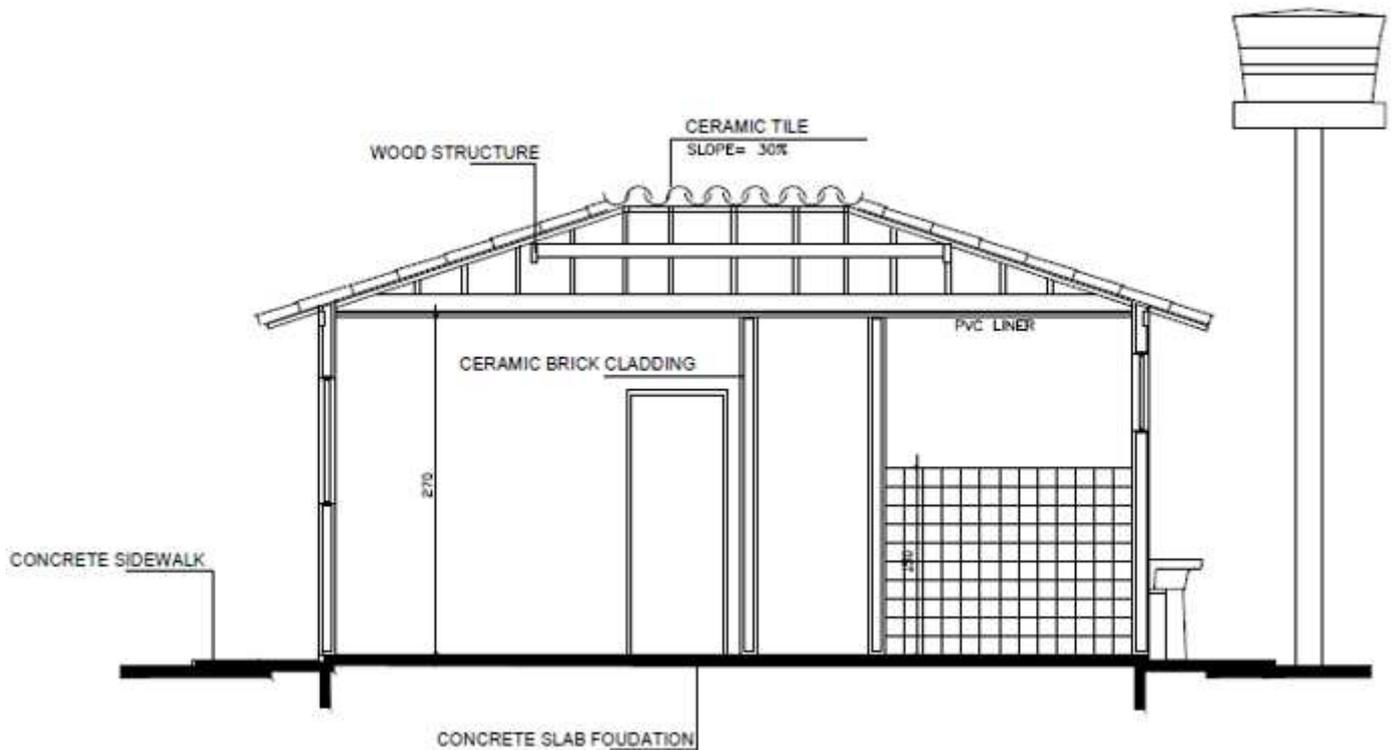
Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 50 - Shopping Park Residential Housing Unit

Source: Villa, 2015.

2.8.3. CONSEQUENCES

Nowadays, one of the main problems confronted is the house structural stability. As mentioned earlier, the undertakings for the MCMV Programme houses were profit lead, resulting in residential units with materials of low cost and poor execution. Shopping Park is a great example of that, as there have been numerous problems; from fire caused by electric installations poor executed; structural danger because of the lack of retaining walls – fact that was exposed because of the rain and lack of a proper drainage system and

vegetation; freestanding walls constructive system instead of pillars and beams system, as the reforms and additions made by the residents themselves, do not take into account the capacity of a freestanding system, causing structural problems; etc.

Figure 51 – Resident reforming her house

Source: Gollino, 2015.

In addition, a great part of the residents does not have full knowledge of the terms in the Owner Manual or the House Contract. This means that even though their house has a guarantee period, a majority of them (not knowing or being afraid) end up making the reforms themselves, leading to a poor execution resultant from the lack of professional qualification.

Figure 52 – Foundation problems

Source: *Correio* Journal, 2013.

Figure 53 – Laundry Adaption

Source: Gollino, 2015.

Figure 54 – Shopping Park Housing Units

Source: Tolentino, 2012.

After all the data presented above, it is fair to conclude that the Shopping Park Neighbourhood presents an unbalanced dynamic, with insufficient equipment, green spaces, public transport and houses of quality. Even so, it is clear to see the residents will to make it better and the potentialities the area has to offer. As we believe in the power of urban resilience, this research will seek to analyse more deeply the neighbourhood aspects in other for this area and its residents to have a better outcome.

PART 3
EVALUATION: TOOLS AND TECHNIQUES

INTRODUCTION

This study aims at utilising advanced techniques in Post-Occupancy Evaluation (POE) to develop methodological procedures for the analysis of social housing developments. The analysis will focus on the adaptive, transformative and resilience capacities of the built environment, attending to the needs of residents and the subsequent environmental impact of the ongoing transformations. For verification, the methodological procedures developed will be applied to a case study in the city of Uberlândia – Brazil. Dealing specifically with a housing complex – Shopping Park; part of the government programme *"Minha Casa Minha Vida"* located in the western region of the city.

For ample attention to the proposed objectives, the following steps will be carried out: (i) bibliographical research – theoretical founding and definition of terms and used concepts; (ii) exploratory research – collection of data and information from the subject of study and (iii) applied research – development and application of POE in the study case.

Research clippings

The analysis will be centred on three elements: (i) BUILT ENVIRONMENT (building complex, taking into consideration the scales of the district, neighbourhood and unit, and the relation of impact between the built and natural environments; (ii) AGENTS (agents that interfere with the local social dynamic); (iii) USERS (residents of the complex). The evaluation will focus on social, functional, behavioural and environmental issues of the built environment.

Operationalisation

Both research groups ("Mora" da FAUeD/UFU and "*People, Environment and Performance*" from SSoA da University de Sheffield - TUoS) will act in the development of research in a complementary way from their own abilities and interests, therefore seeking a better operationalisation and methodology as previously explained. The work will be divided into 5 parts, in which each researcher from the team will act more intensely:

vi.   GENERAL CHARACTERISTICS

Analysis items: State of the art, description of the housing programme, general characteristics of the city of Uberlândia and the study subject;

vii.   CLIMATIC NATURAL ORDER

Analysis items: vegetation, soil, water sources, flows, weather statistics, pollution, waste, topography, shortages (water, power, food), stretched dry seasons, warmer.

viii.   PHYSICAL-ARCHITECTONIC ORDER (housing and non-housing)

Analysis items: format, construction system and materials, services (electricity, water, sewage, IT/electronics, cost+suplly), internal layout, adaptation.

ix.   PHYSICAL-URBANISTIC ORDER

Analysis items: Land-use, social facilities (leisure, sport, culture, safety, security), infrastructure, transport, density, commerce/business (income generation), violence, food (agro city), income.

x.   SOCIOECONOMIC ORDER

Analysis items: demographics, social-economic data-analysis, violence, safety, policy, NGO's (3RD sector), education, health, other agents.

Frame 4 - Aspects evaluated and its tools

STAGE	FORM	DESCRIPTION	TOOLS
1.	GENERAL CHARACTERISTICS	State of the art, description of the housing programme, general characteristics of the city of Uberlândia and the study subject;	Data collection
2.	CLIMATIC NATURAL ORDER	Vegetation, soil, water sources/flows, weather statistics, pollution/waste, topography, shortages (water, power, food), stretched dry seasons, warmer	Data collection Technical analysis Questionnaire Walkthrough Performance evaluation
3.	PHYSICAL-ARCHITECTONIC ORDER	format, construction system and materials, services (electricity, water, sewage, IT/electronics, cost+suplly), internal layout, adaptation.	Data collection Technical analysis Questionnaire Walkthrough Performance evaluation CO-procuction
4.	PHYSICAL-URBANISTIC ORDER	Land-use, social facilities (leisure, sport, culture, safty, security), infrastructure, transport, density, commerce/business (income generation), violence, food (agrocity), income.	Data collection Technical analysis Questionnaire Walkthrough Behavioral mapping CO-procuction
5.	SOCIOECONOMIC ORDER	Demographics, social-economic data-analysis, violence, safety, policy, NGO's (3RD sector), education, health, other agents.	Data collection Questionnaire CO-procuction

Source: Authors, 2016.

Frame 5 - Climatic Natural Order - Perceptions and Tecnical Information

CLIMATIC NATURAL ORDER		
ASPECTS	WE WANT TO KNOW	TOOLS
Vegetation, soil, water	General information	Data collection Walkthrough
Topography	General information	Data collection
Water sources / Flows	General information	Data collection
Pollution / Waste	General information	Data collection
	How do you behave on pollution in your neighborhood?	Questionnaire
	How do you behave on waste in your neighborhood?	Questionnaire
Shortages (water, power, food)	General information	Data collection
	Some of those are missing to you? (water, power, food)	Questionnaire
Stretched dry seasons	General information	Data collection
	What bothers this time?	Questionnaire
Weather statistics	General information	Data collection
	How do you cope with extreme weather?	Questionnaire
Climate changing	General information	Data collection
	How do you perceive climate change?	Questionnaire
Expenditure (energy, water)	General information	Data collection Walkthrough

Source: Authors, 2016.

Frame 6 - Physical-Architectonic Order - Perceptions and Tecnical Information

PHYSICAL-ARCHITECTONIC ORDER		
ASPECTS	**WE WANT TO KNOW?**	**TOOLS**
Design (format, dimensions)	General information – plants, documents, measurements	Data collection
	Point the main problems in your home. (Appointed by priority)	Questionnaire
Construction system and materials	General information – plants, documents, measurements	Data collection Technical analysis
	Identifying constructive pathologies	Performance evaluation Walkthrough
	What are the main constructive pathologies of your home? Do you like the materials used in your home? (level of satisfaction) Can you find in your neighborhood the materials used in your home?	Questionnaire
	What materials do you use in the renovation of your home?	CO-procuction (housing scale)
Maintenance	Identifying aspects of maintenance	Technical analysis Walkthrough
	How do you assess the maintenance of your home? What are the problems? Level of satisfaction and open space.	Questionnaire
Services (electricity, water, sewage, IT/electronics, cost+suplly)	General information - documents, measurements How do you use the services? How do you make the decision? How do you use the equipment (microwave, light, eletric shower, washing machine, iron, computer, hair dryer, etc) time, power rating.	Data collection Performance evaluation Walkthrough
Internal layout - functionality	General information – plants, documents, measurements	Data collection
	How do you perform the activities in your home? (to sleep, to cook, to feed, work, stock, to relax, socialize, live together, sanitize, to exercise, etc). Level of satisfaction and open space.	Questionnaire CO-procuction (housing scale)
	Do you have adequate furniture and equipment for your home needs? Which furniture would you like to have in your home?	Questionnaire CO-procuction (housing scale)
Adaptation refurbshiment	How do you adapt your house to the needs of your family? What types of reforms were made? Evaluate the ease / difficulty to reform your home. Why?	Questionnaire CO-procuction (housing scale)
	How do you think your home could be? How do you improve your home for income generation?	CO-procuction (housing scale)
Adaptation for commerce	What income-generating activity is done in your home? How to adapt the space for it?	Questionnaire CO-procuction (housing scale)
Confort (noise, temperature, humidity, light)	Your home is: TEMPERATURE (winter / summer / night / day) - very hot, hot, normal, cold, very cold. Indicate the extremes rooms. NOISE (internal, external) - very noisy, loud, normal, quiet, very quiet. Indicate the extremes rooms NATURAL LIGHTING - very bright, bright, normal, dark, very dark. Indicate the extremes rooms HUMIDITY - very humid, humid, normal, dry, very dry. Indicate the extremes rooms	Performance evaluation Questionnaire
	What you greater cause discomfort in your home? Why?	Questionnaire
	What makes a comfortable home? What makes an uncomfortable home?	CO-procuction (housing scale)
Privacy	what does privacy mean to you? Do you have privacy in your home? (Level of satisfaction). How? Do you have privacy in relation to your neighbors? (Level of satisfaction). How?	Questionnaire CO-procuction (housing scale)
Previous housing	Assess your previous housing: kind, size, construction quality, comfort, location, cost, maintenance	Questionnaire

Source: Authors, 2016.

Frame 7 - Physical-UrbanistiC Order - Perceptions And Tecnical Information

PHYSICAL-URBANISTIC ORDER		
ASPECTS	**WE WANT TO KNOW?**	**TOOLS**
Land-use	General information – plants, documents, measurements with google and observation	Data collection Technical analysis Mapping
Social facilities (leisure, sport, culture, safty, security)	General information – plants, documents, measurements with google and observation. How does it work? Data at City Hall.	Data collection Technical analysis
	Evaluate your neighborhood on the following facilities: leisure, sport, culture, safety, security. Level of satisfaction. What do you miss most in your neighborhood? Indicate in order of priority.	Questionnaire
	Use of public facilities	Behavioral mapping
	What do you need? Neighborhood scale.	CO-procuction (Neighborhood scale)
Infrastructure (water, sewer, rainwater, electricity, paving, street lighting, waste, cleaning services, internet, telecommunications)	General information – plants, documents, measurements. How it works? Data at City Hall. Data collection by sampling the evaluated homes.	Data collection Mapping Technical analysis
	Lack of (water, electricity, garbage collection) in the neighborhood Do you have access to phone, internet, cable TV? Are there proper sidewalks in the neighbourhood? Are they accessible? Are the streets paved? Are the streets well signposted?	Questionnaire
Transport	General information – plants, documents, measurements Amount, route and bus schedules, fuel (impact)	Data collection Mapping Technical analysis
	Evaluate your level of satisfaction with public transport offered in your neighborhood. Quantity, route, schedule and quality of service. Indicate which means of transportation you use the most and the situation. What was the reason for choosing this means of transport?	Questionnaire
Density	General information – plants, documents, measurements Population mean estimated (questionnaire) and cross with map of land use and occupation.	Data collection Mapping Technical analysis
Commerce/business (income generation)	General information – plants, documents, measurements Map of land use and occupation.	Data collection Mapping Technical analysis
	Consumption ratio in the neighborhood. What to buy in the neighborhood? Doing the list from the land use. Identification of the types of Commerce and services in the neighborhood.	Questionnaire
Violence	General information – documents with police (depending on the level of information given by Police Bureau)	Data collection Mapping Technical analysis
	How is the security in the neighborhood? Level of satisfaction	Questionnaire
Food (agrocity)	Do you produce any kind of food in home? Do you use to eat food from the community garden? Why do you consume it? ... Health, price or other.	Questionnaire CO-procuction (Neighborhood scale)
	Location of community gardens, if any.	Data collection Mapping
Income	What is your household income? Are Your income generated by working in the neighborhood?	Questionnaire Walkthrough
Flows (people, cars)	Mapping the flows and agglomerations during the week and in the weekends. Cars, pedestrians, bicycles and buses	Data collection Walkthrough Behavioral mapping

Informal arrangement	Informal arrangements of land use and occupation. Neighbours agreement on the boundaries and limits of construction, expansion, renovations or land use patterns. Perceiving the informal agreement even in those cases running against the local legislation	CO-procuction (Neighborhood scale)

Frame 8 - Socioeconomic Order - Perceptions and Tecnical Information

SOCIOECONOMIC ORDER		
ASPECTS	**WE WANT TO KNOW?**	**TOOLS**
Demographics	Population by age band Family composition	Data collection Questionnaire
Social-economic	Family income, line of work, number of people working per household What is your family income? What is your families line work? How many people in your family are currently working	Data Collection Questionnaire CO-procuction (Neighborhood scale)
Violence	How secure do you fell yourself in the community? Level of perceiving	Data Collection CO-procuction (Neighborhood scale)
Safety	How safety do you feel yourself on? House ownership, storms, Floods, structure stability of the construction, land slide and fire risks	CO-procuction (Neighborhood scale)
Policy	Mapping the public policies for the neighbourhood, including the list of all the programmes and projects provided by the state.	Data Collection CO-procuction (Neighborhood scale)
Agents - NGO's (3RD sector) and other agents	Mapping the NGOs and other social entities actuating in the neighbourhood Identifying their ongoing actions Identifying the community leaderships	Mapping Data Collection Co-production with agents
Education	What is the level of schooling of each family member?	Data Collection (Municipality, PTTS) Questionnaire
Health	Mapping the health facilities, identifying specific health programmes assisting the community. Perceiving of Health care – what is you level of satisfaction on health care in the neighbourhood? How long does it takes to schedule a medical appointment? What is the distance from your house to the health station?	Data Collection Mapping Questionnaire Co-Production
Telecommunications	Do you have a smartphone? What do you use it for? Just speaking, connecting to the internet Dou you use the social media? (Which) ?	Questionnaire Co-Production

Stages of work

13. Research the definition of the concepts used in the work: adaptability, resilience, post-occupancy evaluation, Social Housing Developments;
14. Recognizing the basic aspects of the study area: preliminary information - general characteristics;
15. Research plan (draft);
16. Meeting with the group in Sheffield – UK (TUoS), for the definition of the methodological procedures to be used in the research;
17. Additional data on the study area;
18. Development of the methodological procedures to be used in the research, defining methods and tools;
19. Planning the application: definition of the resources, samples, and the approval of permissions, timeline and actions;
20. Application of POE tools to the case study;

21. Meeting of the Uberlândia group for the preliminary analysis and planning of the systematisation of the results;
22. Systematisation of the POE results;
23. Elaboration of the reports on activities – diagnosis of the area and recommendations for future research;
24. Forwarding of products generated through the research – scientific articles, etc.

Frame 9 - Tools and Techniques: Evaluation at Shopping Park Neighbourhood

TOOLS	Questionnaire	**DESCRITPTION:** A quantitative method that seeks to collect data from a series of questions answered by users. A very recommended method when there are a varied number of people involved in an evaluation process. Its main advantages are: being a quick method; possibility to work with a larger group of respondents and/or vast areas; impartial answer, which means anonymity allows safety and a great freedom of response; and greater uniformity in the evaluation.
		MEANS: Digital
		SAMPLE: 40 houses located in an allotment of 200 houses (20% of the whole community)
		DATE/PLACE: July 5th to 11th, 2016 - 40 residences in a block located at Shopping Park's Neighbourhood
	Walkthrough	**DESCRITPTION:** Quanti-qualitative method of analysis based on quality concerns for measuring and descriptive and qualitative identification of positive and negative aspects of the environment, also allowing to check its current situation. The analysed themes are: i) Surroundings, ii) Allotment, iii) Housing.
		MEANS: Script on paper and textual and photographic recording.
		SAMPLE: Were chosen representative lots considering some variants, such as the solar orientation and the different geographical positions of the allotment.
		DATE/PLACE: July 8th and 11th, 2016 – 4 residences in the same block located at Shopping Park's Neighbourhood
	Co-production	**DESCRITPTION:** Qualitative and participative evaluation method where the researcher keeps himself impartial, working as a facilitator on production and management of space by involved parts. According to Petcou and Petrescu (2015), it is not only about an alternative way to face unmet public demands, but also a way to provide effective access to the city.
		MEANS: Script on paper, textual and photographic recording and group dynamics.
		SAMPLE: 8 people at the 1st Co-production and 10 people at the 2nd – Invitations through brochures and WhatsApp messages, for those who have participated on Questionnaires and Walkthroughs.
		DATE/PLACE: July 9th and August 7th, 2016, at the Center of Unified Arts and Sports (CEU).

Source: Authors, 2016.

3.1 WALKTROUGHT

3.1.1. INTRODUCTION:

Through the application of the walkthrough analysis, the intent was to carry out an analysis supported by norms and rules along with the identification of positive and negative descriptive and qualitative aspects of the environment, also allowing the verification of the environment's current situation. The analysed themes are: i) Surroundings; ii) lot; iii) house unit. The Surroundings' analysis focused on the area bounded by streets *Floriza Miranda Pereira*, *Juvenilia Mota Leite*, *Wilson de Souza Júnior* and *Antônio Carlos Martins Ribeiro*. For the house and lot analysis, we adopted a sample considering the different positions of households in relation to solar orientation, the different geographical positions on the court. Within these aspects, we picked up a total of 4 houses as shown on the map below.

The visit and implementation of the walkthrough were made on the 8th and 11th of July, and the performance analysis in the 7th and 11th of december. The units were listed in a chronological application order.

Figure 55 - Evaluated Units
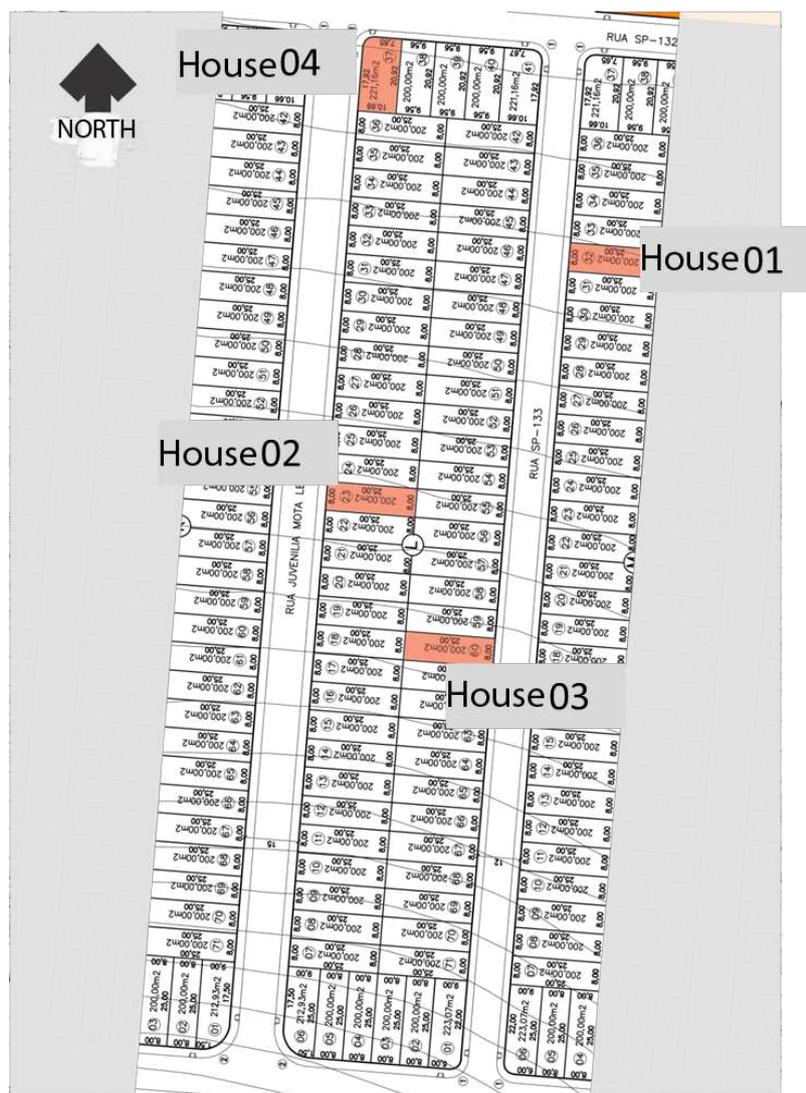
Source: Authors, 2016.

House 01 – Standard design plan, located in Floriza Miranda Pereira Street, No. 65, home to three (3) people, nuclear family with one child. Main façade facing West. There was coverage addition to the back of the house.

House 02 - Standard design plan, located in juvenilia Mota Milk Street, No. 860; home to four (4) people, single-parent family of mother and three children. Main façade facing West. There was coverage addition to the side of the house.

House 03 - Standard design plan, located in Floriza Miranda Pereira Street, No. 200; home to three (3) people, nuclear family with one child. Main facade facing East. There was expansion in the house with the addition of rooms, construction of a new housing unit in the back of the lot, paving of almost the whole lot, waterproofing the ground.

House 04 - Adapted plan for people with disabilities, located in Wilson de Souza Júnior Street, No. 625, home to six (6) people, nuclear family with four children. Main façade facing North. There was expansion in the house with a room adition.

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3.1.2. METHODOLOGY:

The methodology took into account the comparative evaluation through normative attributes (benchmark) set by various departments at the federal, state and municipal levels. As explained earlier in this report, the categories were: i) Surroundings; ii) Lot; iii) House Unit. The attributes used for analysis of the 3 categories are listed below:

Frame 10 - Evaluet aspects for the Surroundings topic

SURROUNDINGS	
EVALUATED ASPECTS	**TECHNICAL PARAMETERS**
Urban Insertion	Size and block patterns.
Relation with surroundings	Perimeter of contact with the effective urban environment.
Public Transport	Number of lines, frequency and itinerary.
Leisure and cultural facilities	Distance from the blocks' centre.
Educational facilities	Distance from the blocks' centre.
Commerce and Services	What kind of goods and services available/ from the city's or blocks' centre.
Health Facilities	Distance from the blocks' centre.
Accessibility	Adequate material, signalling and circulation condition. (conservation state, circulation axis width, presence of obstacles and levelling). Access ramps in street corners and public facilities.
Street Layout	Conservation state, signaling, elevated crosswalk and lowering of the sidewalks level for pedestrian crossing.
Paving	Adequated material, signalling and circulation condition. (conservation state, circulation axis width, presence of obstacles and levelling). Access ramps in street corners and public facilities.
Urban Furniture	Provides safety and autonomy to the user, assures the proper dimension and space within reach, the furniture itself do not act as an obstcle,

	furniture free from sharp corners and edges.
Vegetation	Number of public free spaces per inhabitant, and vegetation preservation.

Frame 11 - Evaluet aspects for the Lot topic.

LOT	
EVALUATED ASPECTS	**TECHNICAL PARAMETERS**
Dimensions	Lot and frontage minimum size.
House Situation Plan	Frontal, lateral and back clearance.
Legislation	Attends the Municipal laws, regarding its dimensions e minimum frontage, minimum clearance, utilisation coeficiente, occupancy and permeability rate.
Vegetation	Pemeability rate and vegetation's location on sidewalks.
Relation with Surroudings	Available facilities offered.
Privacy	Frontal, lateral and back clearance.
Hygiene and Cleaning Condition	Cleaning and conservation state.

Frame 12 - Evaluet aspects for the Housing Unit topic.

HOUSING UNIT	
EVALUATED ASPECTS	**TECHNICAL PARAMETERS**
Dimension –Useful Area	Project useful area. Extension useful area.
Proposed Compartmentation	Compartmentation all the needs of the individuals and the family group.
Proposed Sectorization	Proximity/detachment between individual and Family group activities.
Rooms useful area	Rooms dimension attends all the needs of the individuals and the family group.
Circulations	Circulation and utilisation space for each furniture/equipment.
Ceiling Height	Minimum ceiling height required by the municipal legislation.
Extension possibility	Edification has evolutive character.
Accessibility	Adapted house obeys the norm NBR 9050.
Natural Ventilation	Openings attend the Municipal Works Code.
Structure	Resistance - fissures and cracks. Tightness - capillary infiltration or from rain on the facades. Infiltration in wet areas (bathroom and laundry area) and wettable areas (kitchen).
Windows	Lighting areas as established in the Municipal Works Code. Tightness and operation of the windows.
Doors	Doors operation.
Roof	Tightness regarding the rain. Resistance to the winds.
Eletrical system	Division of electrical circuits.

Hydraulic and sanitary system	Tightness. Dimensioning of hot and cold water facilities. Allocation of sewage. Dimensioning of sewer installation. Disposal of rainwater. Dimensioning of gutters and conductors.
Consumption	Water and energy consumption survey
hidrossanitárias parts, metal	Proper functioning of the parts. Free of burrs, roughness or protrusions that might cause injury.
Painting	Internal and external painting.
Tabletops Vertical and Horizontal coating	Tightness - humidity on the floors and walls. Resistance - Abrasion of floors. The correct unevenness of the floors. Levelling of the ceramic pieces.
Solar heating system	Sufficient heating. Daily heating capacity. Mixers installation.
Privacy between neighbours	Clearance attends the Land Use and Occupancy Legislation. The material and thickness of the wall from the terraced houses. Louvers in the windows of the rooms.
Hygiene and cleaning conditions	Floor finishing allows sanitization. Contamination of drinking water. Tightness to gases in sewage installations.
Performance Analysis	Thermal, Luminous and Acoustic performance check

Source: Authors, 2016.

Surroudings

In order to answer the Surroundings parameters were used: the allotment and the investment projects, maps, satellite aerial photographs updated from the project's location, and information gathered during a visit to the area where the evaluated allotments are located.

The Surroundings' analysis, is made from a benchmark established in joint study between ITDP and Labcidade of FAUUSP[8]. The attributes evaluated are listed below and relate particularly to the existence and distance of various public, commercial and services facilities, as well as accessibility issues as shown below:

For this analysis walkthrough, this division was set within the following topics: leisure and culture, education, services and commerce facilities, and health facilities, following the same division of compulsory and complementary uses as the following table:

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[8] URBAN INSERTION EVALUATION TOOL for the first income bracket from the *Minha Casa, Minha Vida* Programme. Study in partnership between *LabCidade* (Public Space Lab and Faculty of Architecture and Urbanism from USP – University of São Paulo) and ITDP Brazil (Institute for Transportation and Development Policy), and the research product "Tools for the evaluation of urban insertion of these MCMV undertakings" carried out with funds from the CNPq (with funds from MCTI Call / CNPq / MCidades No. 11/2012) and the Ford Foundation.

Frame 13 - Compulsory and complementary facilities of daily, eventaul and esporadic use.

	Daily Use-15 minutes walking (1000 m)	Eventual Use - 20 minutes walking (1400 m) or 30 min. by public transport	Sporadic Use - 1 hour by public transport
Mandatory	Public Elementary and Middle School / Public High Schools and/or Technical Degree / Basic Health Units / Drugstores / Sporting and Recreational Areas / Supermarket / Lottery.	Public Elementary and Middle School / Public High Schools and/or Technical Degree / Basic Health Units / Drugstores / Sporting and Recreational Areas / Supermarket / Lottery.	Administrative Center (INSS, City Hall, "Poupatempo", and so on) / Higher Education/ Banks.
Additional	Butchers / Bakeries / Drugstores / Restaurants (pizzeria, cafes, and so on.) / Beauty Shop / Gym / Lotteries/ Technical Assistance (home appliances and electronics, vehicles, bicycles, and so on.) / Building Materials Store (Metalwork Shops, Glasses Shop, and so on).	Higher Education / Center of Reference and Social Assistance/ Public Library / Police Station / Medical Center or Specialized Clinics / Postal Service / Clothing ans Shoes Shops / Electronics Stores, Home Appliances Stores , Furnish Stores / Restaurants / Banks / Offices / Bookstores and Stationers / Assistance (home appliances and electronics, vehicles, bicycles, and so on.) / Language Schools, Information Technology Schools and and another complementary training courses.	Movies / Urban Park / Sports Gym / Stadium / Theater / Museum or Cultural Center / Supermarket / Registry Office.

Source: ITDP/ Labcidade, 2014. Edited by authors.

The reference point to measure the block's distances originated on the closest block to the Neighbourhood centre, resulted from the intersection of polygonals drawn from its ends.

Figure 56 - Study Area Centre

Source: Google Maps, 2016. Edited by authors.

In the lot scale, the reference point became the entrance gate of each lot. What stands out is that in the same block can be more privileged or more adversely affected according to its location and how the block is situated.

3.1.3. RESULTS:

3.1.3.1. Surroundings Walkthrough Analysis

Urban Insertion - Location

For the size of the blocks was used the average perimeter of the allotment of blocks, and all the blocks immediately adjacent to it. The fully permeable blocks, such as squares and parks not surrounded, were assigned the perimeter measurement of zero, since it does not constitute a barrier to the movement of pedestrians. The methodology ITDP / LABCIDADE 2014 establishes three parameters: a) block with s less than 500m perimeter - GOOD; b) block with perimeter situated between 500 and 800m - ACCEPTABLE; and c) lock with perimeter above 800 m - UNSATISFACTORY.

Figure 57 - Relation between allotments and surroundings

Source: Google Maps, 2016. Edited by authors.

It was initially calculated the perimeter of all identified blocks, totalling approximately 37,999 meters and then divided by the number of blocks. Arriving at the average perimeter of the courts.

Exemplified in the following equation:

$$37.999/62 = 612,89 \text{ meters}$$

With approximately **612.89 meters**, the average size of blocks was considered ACCEPTABLE as it was between 500 and 800 meters.

Still, the walk may have some discomfort depending on the direction of the path, because of the way that the lot is situated. Following the longitudinal direction of the topography. The longest path is also the steepest. Some blocks even have a little more than 290 meters length, being narrow and long.

Surroundings' Relation

This parameter identifies (in red) the perimeter portions that make contact with the urban fabric.

As seen in the following image, only the south side of the study area perimeter maintains contact with the urban area of the city, and even this small portion of a little over a kilometre in length is not fully consolidated.

Figure 58 - Contact with the urban surroundings - Minha Casa, Minha Vida complex Shopping Park Neighbourhood.

Source: Google Maps, 2016. Edited by authors.

Dividing the perimeter in contact with the urban environment by the total perimeter of the site, and multiplying that result by one hundred, results in the percentage of the project that is in actual contact with the urban perimeter.

$$(1083/4.207)\times100 =25{,}75\%$$

Only 25% of the analysed area is in contact with the urban fabric, value considered INSUFFICIENT according to the methodology (ITDP / LABCIDADE, 2014) to connect to the urban part. Yet, despite the neighbouring housing developments being consolidated, there are still many vacant lots. To be considered GOOD, the counted the perimeter with the consolidated urban fabric should be 100%.

Public Transport

Uberlândia public transport has three bus lines that connect Shopping Park neighbourhood to the City Centre, A147 Shopping Park - Central Bus Terminal, A148 Shopping Park - Central Bus Terminal and E147 Shopping Park - Central Bus Terminal - Semi Express. Also, it has a line leading to the *Santa Luzia* Bus Terminal, the A331 *Santa Luzia* Bus Terminal - Shopping Park - Municipal H. - Totaling 4 lines of common buses. There are no other types of public transportation such as BRT, metro, train, etc.

Figure 59 - Buses' itinerary – Shopping Park
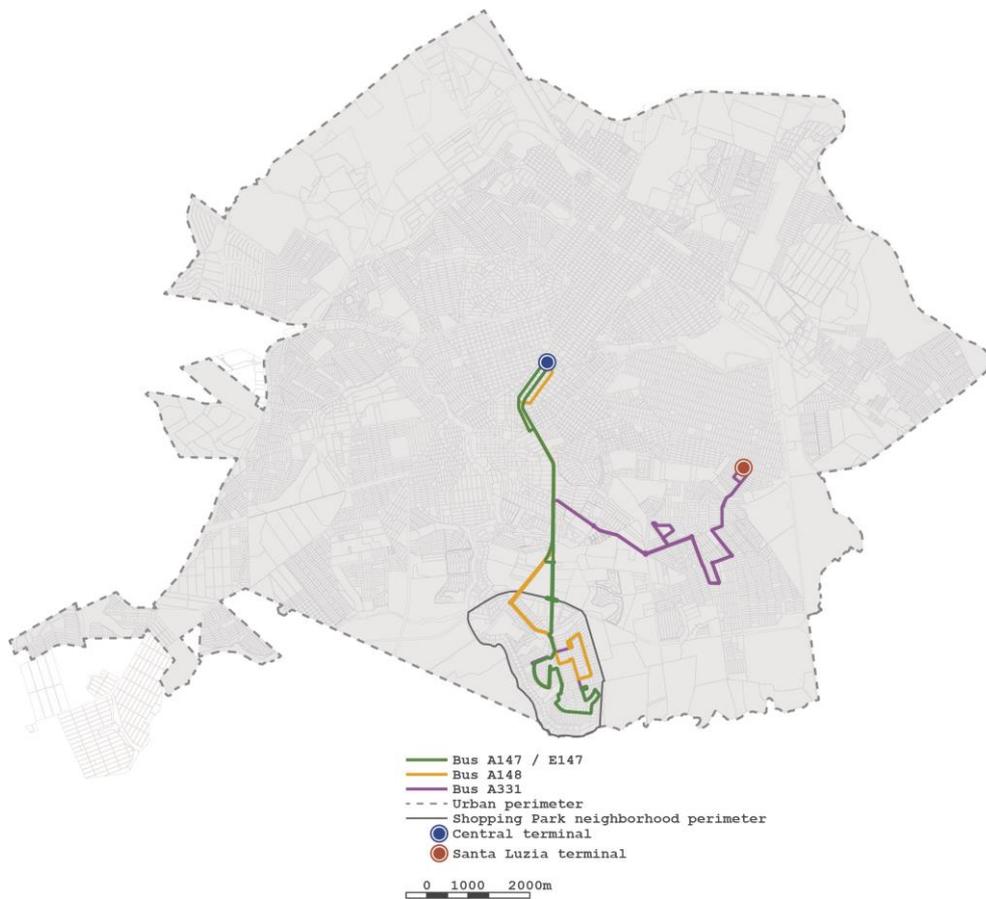
Source: TFG_Juliana Arantes, 2016.

According to ITDP / LABCIDADE methodology, 2014, when different routes are considered, public transport lines should establish a distance of at least 2 km from each other in any route part, otherwise, they are considered as a single itinerary.

As the bus lines A147, E147 have equal paths and the bus line A 148 has a maximum distance of a little over 1km away, they are considered as just one itinerary.

Thus, although Shopping Park Neighbourhood has four existing bus lines, the proximity of their paths results in only two proper routes, meaning the existence of an INSUFFICIENT amount of itineraries for the neighbourhood. The ACCEPTABLE would need to be at least three routes.

As for the frequency of public transport, the ITDP / LABCIDADE methodology, 2014 states that the classification must meet the following table aspects:

Table 9 - Classification of public transport frequency.

Between rush hours in working days	Frequency	Operation Period
GOOD	Until 10 minutes	24 h
ACCEPTABLE	11 - 20 minutes	17 h
INSUFFICIENT	Over 20 minutes	Less than 17 h

Source: ITDP/ Labcidade, 2014. Edited by authors.

The A148 line, Shopping Park – Central Bus Terminal route lasts from 25 to 30 minutes in rush hour. The A147 line, also with Shopping Park – Central Bus Terminal route lasts between 15 to 18 minutes.

The most critical lines are the line A331 T. Saint Luzia - Shopping Park – Municipal Hospital, which has 1 hour break between buses, and after 18:10 this interval goes up to 1 hour and 45 minutes. In addition, the semi-express line E 147- Shopping Park – Central Bus Terminal route do not function during rush hour or on weekends. With 30 minutes of interval, the line moves between 5:25 to 7:50 then back to traffic only at 17:06 until 18:40.

Thus, the 147 line is the only acceptable because of its relatively short range, with a running time of 19 hours.

Transport, in general, is classified as insufficient because only an acceptable line is not enough for the demand of the population. For public transport to be acceptable, it should have three routes with at least one line of each itinerary classified as acceptable.

Leisure and Culture Facilities

Uses defined by the methodology ITDP / Labcidade, 2014. The table considers only the leisure and culture:

Frame 14 - Leisure and culture facilities of daily, eventaul and esporadic use.

	Daily Use-15 minuts walking (1000 m)	Eventual Use - 20 minutes walking (1400 m) or 30 min. by public transport	Sporadic Use - 1 hour by public transport
Mandatory	Free areas for leisure and recreation	Area for sports practice	-
Complementary	Gym	Public library/ restaurants/ bookshop or stationery	Cinemas / Urban park / sports gynasium / stadium / theather / museum or cultural centre.

Source: ITDP/ Labcidade, 2014. Edited by authors.

In this manner, leisure and culture are considered acceptable by having all required uses available, along with the capacity to absorb the new demand and additional uses exist all possible uses (if there were more uses would be 7), and at least 3 uses sporadic.

Adopting the Polygonal centre shows that the required uses are at a distance of only 150 meters away.

Figure 60 - Laisure facilities within a radius of 1400 meters
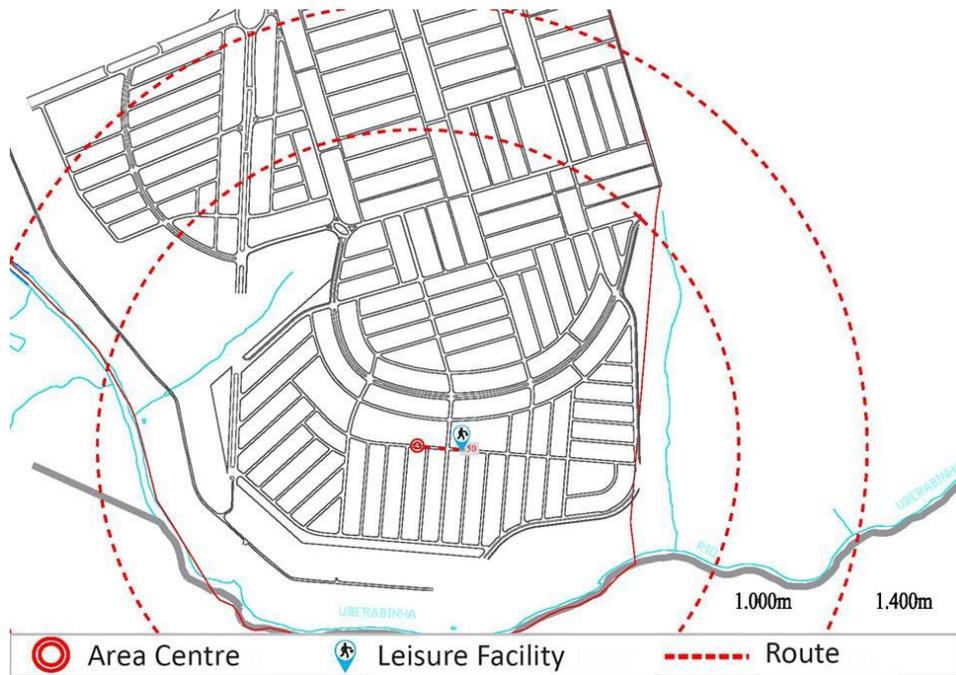
Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

The Arts and Sports Unified Centre (CEU) contain all required uses. There are free areas for leisure and recreation with landscaping in good condition and proper furniture for leisure, physical activities and an area for sports. The vegetation is still small, so the site does not have much shade, which creates discomfort at certain times for the practice of outdoor sports.

In CEU there is also unity of the Social Assistance Reference Center (CRAS).

Eventual uses and some sporadic uses exist through the public transport because of the proximity of Uberlândia Shopping, which in less than 30 minutes, allowing the population to access movies, stationery, restaurants, etc.

Sporadic uses are scarce due to the distance of the neighbourhood from the City Centre, as the last bus rides about 40 minutes to the central terminal. As long as parks, sports centre and theatre are usually far from the center located, there will be a need to ride another bus line, beside the one to the centre. Therefore, the path ends up being more than an hour of the neighbourhood.

Educational Facilities

Uses defined by the methodology ITDP / Labcidade, 2014. The table considers only the educational facilities:

Frame 15 - Educational facilities of daily, eventaul and esporadic use.

	Daily Use-15 minutes walking (1000 m)	Eventual Use - 20 minutes walking (1400 m) or 30 min. by public transport	Sporadic Use - 1 hour by public transport
Mandatory	Public Kindergartens and Early Childhood Education Public Schools	Public Elementary School and Public High School, or Technical School	Higher education institution

Complementary	-	Higher Education Institution and School of further training	-

Among them, the existing ones are:

Compulsory daily uses: Public Kindergartens and Early Childhood Education Public Schools.
Compulsory eventual Uses: Public Elementary School and Public High School
Compulsory Sporadic Uses: Higher education institution
Complementary eventual uses: Higher Education Institution and School of further training.

Educational facilities are not sufficient for the local population. Moreover, the existing children's schools do not meet the demand of children. The daily-required uses are present at a distance of a little more than half a kilometre from the centre of the polygonal figure, which is considered acceptable. However, being the only educational equipment in the vicinity does not meet the required demand of the residents of the neighbourhood.

Figure 61 - Educational facilities within a radius of 1400 Meters
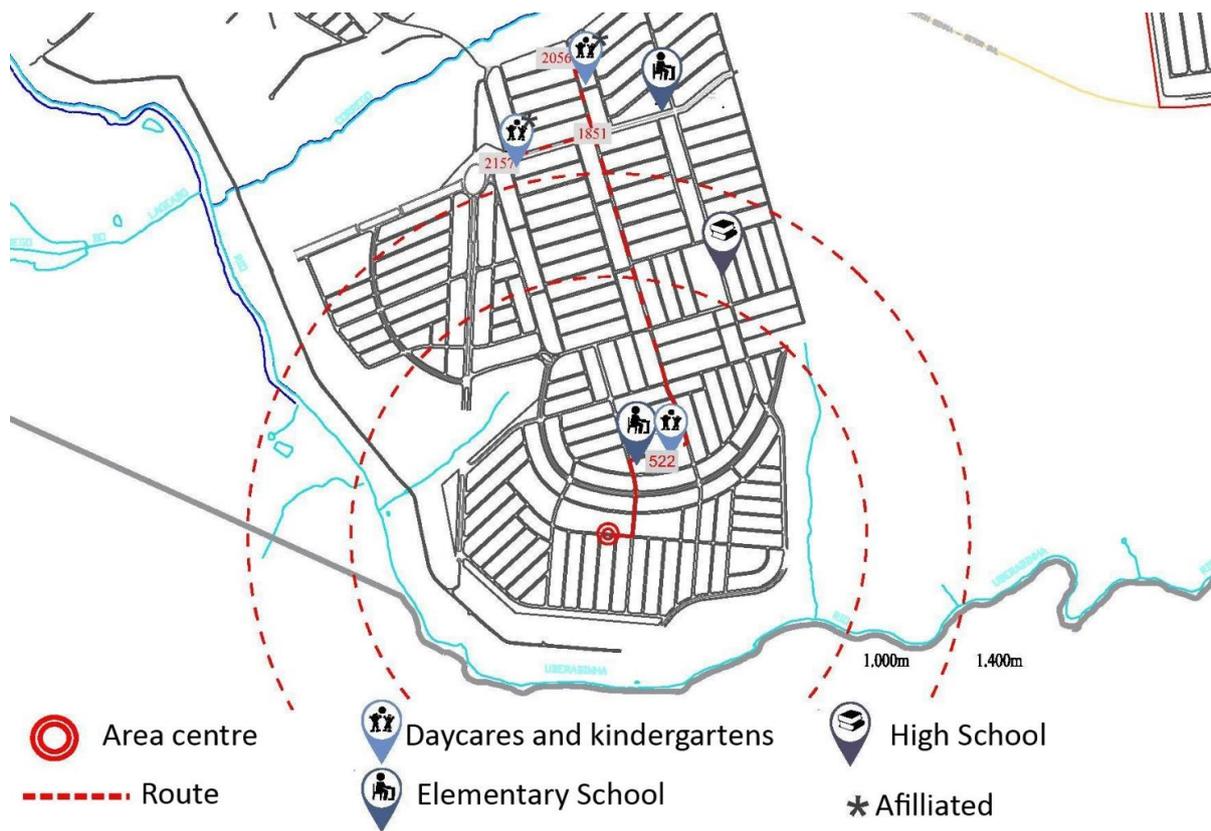
According to the distance shown in the image, there is a need for public transportation. Currently, there are buses provided by the City Hall of Uberlândia, to take students to school. In conversation with residents, we realised that many students do not study in their neighbourhood and depend on personal transport for their daily school journey, which most often is facilitated by their parents or relatives home-work route.

Services and Commerce

Uses defined by the methodology ITDP / Labcidade, 2014. The table considers only the service and commerce facilities:

Frame 16 - Commerce and services facilities of daily, eventaul and esporadic use.

	Daily Use-15 minutes walking (1000 m)	Eventual Use - 20 minutes walking (1400 m) or 30 min. by public transport	Sporadic Use - 1 hour by public transport
Mandatory	Markets, greengrocers	Pharmacies / Supermarket / ATM.	Administrative Centre (INSS, City Hall, etc.)/ Banks.
Complementary	Butcherys / Bakeries / Drugstores / Restaurants (pizzeria, cafes, and so on.) / Beauty Shop / Gym / Lotterys/ Technical Assistance (home appliances and electronics, vehicles, bicycles, and so on.) / Bulding Materials Store (Metalwork Shops, Glasses Shop, and so on).	Centre of Reference and Social Assistance/ Public Library / Police Station / Medical Centre or Specialized Clinics / Postal Service / Clothing and Shoes Shops / Electronics Stores, Home Appliances Stores , Furnish Stores / Restaurants / Banks / Offices / Bookstores and Stationers / Assistance (home appliances and electronics, vehicles, bicycles, and so on.) /	Supermarket / Registry Office

Source: ITDP/ Labcidade, 2014. Edited by authors.

Among them, the existing ones are:

Compulsory daily uses: 1- Markets, greengrocers.
Compulsory eventual Uses:1- Pharmacies; 2- ATM; 3- Supermarket.
Compulsory Sporadic Uses: 1- Government Centre (INSS, Prefecture, etc.); 2- Banks.

Compulsory daily uses:
1-Butchers;
2-Bakeries;
3-Pharmacies;
4-Restaurants (pizzeria, cafeteria, etc.);
5-Hair salon;
6-Technical assistance and repairs (electronics, appliances, vehicles, bicycles etc.);
7- Construction Material Stores.
Compulsory eventual Uses:
1-Social Assistance Reference Centre;
2- Medical Centre or specialised Clinics;
3- Clothing store, shoe store, etc.;
4- Store of electronics, appliances, furniture, etc.;
5- Restaurants;
6- Banks;
7- Offices;
8-Bookstore or stationery;

9-Technical assistance and repairs (electronics, appliances, vehicles, bicycles etc.);
Compulsory Sporadic Uses:
1- Hypermarket;
2- Office.

The neighbourhood has a variety of services and commerce considered acceptable according to ITDP / LABCIDADE methodology, 2014. There are 8 varieties of daily uses (near 15 min walk), 12 varieties of eventual uses (near a 20-minute walk or half an hour public transport), and 4 sporadic uses within a one hour range with public transport.

As we can see in the following image, there is a considerable amount of commerce and services, mostly small ones.

Figure 62 - Commerce and service facilities within a radius of 1400 meters

Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

However, despite the large amount of commerce and services the district currently has, it lacks greater diversity in the vicinity within a 15 minutes walk range, equivalent to 1000 meters. Lacking mainly a lottery or ATM near the centre of the polygonal, in order to serve the largest possible number of households.

The proximity of Uberlândia Shopping can supply some possible uses and/or needs, and it is a possible path through the public transport at a distance of a little less than half an hour ride.

Even so, it is not enough to meet all the needs of the population, since money is spent on public transport and the price of the goods are not always affordable.

Regarding the compulsory daily use, the amount of diversity is considered acceptable.

For any additional uses, the distance from the neighbourhood to *Tubal Vilela* Square and Central BusTerminal, which concentrates greater commercial diversity comes close to the recommended 30 minutes of public transport for eventual uses, but not enough to be considered acceptable.

Health Facilities

Uses defined by the methodology ITDP / Labcidade, 2014. The table considers only the health facilities:

Frame 17 - Health facilities of daily, eventaul and esporadic use.

	Daily Use-15 minutes walking (1000 m)	Eventual Use - 20 minutes walking (1400 m) or 30 min. by public transport	Sporadic Use - 1 hour by public transport
Mandatory	-	Health Units / Pharmacies	Public Hospital
Complementary	Pharmacies.	Medical centre or specialized clinics.	-

Source: ITDP/ Labcidade, 2014. Edited by authors.

The public transportation route to the Public Hospital lasts less than an hour, but the frequency range is one hour between each bus until 18:10, after this time the interval is 1 hour and 45 minutes.

Figure 63 - Health facilities within a radius of 1400 meters
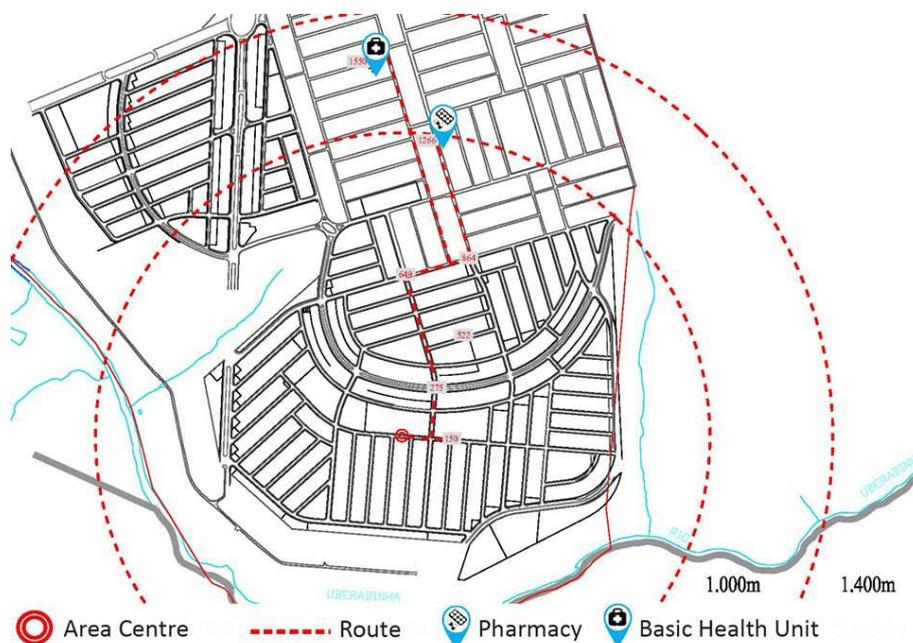
Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

The nearest pharmacy is located approximately 1266 meters away from the centre of the polygonal figure, which is considered acceptable, and despite physical exertion, there is no need to use a motor vehicle. The walking journey to reach the Family Health Unit exceeds about 150 meters from the amount considered

acceptable, requiring public or private transportation. Moreover, in conversation with the people, the biggest complaint about health was the delay in setting the appointments. They can take around four months to get an appointment with specialist doctors. Sometimes, it is even needed to move to another integrated service unit to perform an exam.

Thus, all required uses are not present, despite the difficulty of public transport access to the site. So, according to the methodology ITDP / LABCIDADE, 2014, it is considered as insufficient, because despite having all the required uses, it has no capacity to absorb the new demand.

The fact that the distance from the Basic Health Unit is within an acceptable distance only by public transport does not mean the facility is accessible to the population. The methodology ignores the value of the bus ticket, an important factor, given the high value of public transport for a family of medium or low income.

Accessibility

The site serves the accessibility standards partially.

The street signs are insufficient, with markings present only on the corners, without a crosswalk or elevated crosswalk, poor road signs and no light signalling.

All corners have access for wheelchair users, but the sidewalks present material that keeps on hindering the access and also maintenance. Those that remain with its original features contain enough access to pass and vegetation when existent, as well as trash and lamppost located in the service range, but some are very cracked and bumpy, making it a difficult path for people with disability. Many were changed, keeping space for access. Also, it is very common to come across a ramp blocking the sidewalk route, since the level of construction is higher than the street level.

The vegetation is a less frequent obstacle since there are just a few medium or large trees.

The CEU is the most accessible. The rooms contain access ramps, the free range is wide, with tactile signage for the visually impaired, and the still small vegetation does not hinder circulation.

The banks have enough space for wheelchair users next. But the concrete tables despite having varying heights, are inaccessible to anyone who has any locomotor difficulty because they are at a higher level than the sidewalk and grass area, being impossible for a wheelchair or a person with a baby cart to interact with people sitting there.

Figure 64 - Concrete banks – Arts and Sports Unified Centre (CEU)

Source: Authors, 2016.

Street Layout

The streets do not have enough signalling, with only horizontal and vertical signs without light signalling whether despite having critical junctions of full cars traffic and two different directions on the same road.

At the intersection, there is also no presence of pedestrians crosswalk or elevated crosswalk, but there is a lowering of sidewalks on every street corner.

Sidewalks Paving

The sidewalk of the Arts and Sports Unified Centre (CEU) are the most accessible, with the presence of tactile floor, all perimeter with a free route for circulation and excellent condition and cleanliness.

Figure 65 and Figure 66 - CEU sidewalks paving

Source: Authors, 2016.

But when it comes to the sidewalk of the lots, the situation changes dramatically, as shown in the following images, many are damaged with no maintenance, making it impossible to walk through them.

Figure 67 and Figure 68 - Broken sidewalks and car access ramp

Source: Authors, 2016.

Figure 69 and Figure 70 - Broken sidewalks and circulation obstacles.

Source: Authors, 2016.

Some have even been refurbished and are in excellent condition, but to solve the problem of access to the residence due to the large difference in level between the ground floor and the street, several residents have created a second ramp, which hinders the movement in the sidewalk, which should have a width of at least 1.20-meters.

Another notable problem is the presence of heavy construction waste over the path, obstructing the passage.

In the analysed cut, 54% of sidewalks have some of these problems related to mobility and maintenance.

The image below shows where and what are the most frequent problems, with 35 sidewalks having ramps problems with unwanted slope, 24 having some kind of obstruction, 38 having construction waste on the sidewalks, and 16 having some problems with the original pavement.

Figure 71 - Sidewalks quality – Chosen block, Shopping Park Neighbourhood
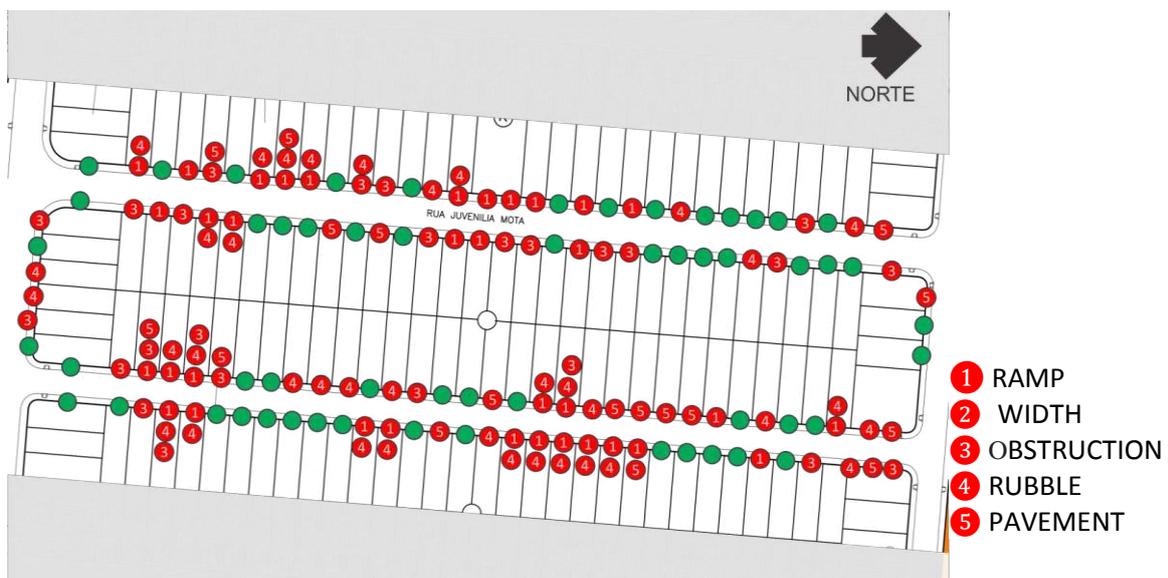
Source: Authors, 2016.

In that sense, most of the sidewalks analysed, do not meet the accessibility parameters, blocking the path of pedestrians through them. Despite corners having access ramps, it is common to see people with permanent or temporary special needs using the street instead of sidewalks.

Urban Furniture

Most of the street furniture provides the user security and autonomy, with appropriate dimensions and space for approach and reach.

In the next image, the banks have enough space beside them for wheelchair users. However, the tables, despite having varying heights, are inaccessible to anyone who has any locomotor difficulty as they are at a higher level than the sidewalk and the grass field, being impossible for a wheelchair user or even a person with a baby cart to interact with people sitting there.

Figure 72 and Figure 73 - Urban facilities, CEU

Source: Authors, 2016.

All equipment is located outside the congestion-free range. There are two bus stops in the same place, a modern and an older one. The second has no backrest since the first one has a 90 ° angle when the backrest recommended angle relative to the seat goes between 100 ° and 110 °.

Vegetation

The Brazilian Society for Urban Forestation proposed a minimum rate for public green areas for recreation value of 15 m² / inhabitant. The allotments studied meet these parameters with a little more than 21 m² per inhabitant.

The study area has approximately 141,472 m² of public green area, considering the institutional areas that have not been modified yet, and 185,000 m² of permanent preservation area (app) – in which 78.130m² are of surrounded area. That means, only approximately 248 280 m² are accessible to the population.

How to get to the value of 21.05% of green area per inhabitant:

248.280/11.794 = 21,05 m²

If the small farms located in a place that should be public did not exist, the percentage would rise to 27.7 m²/ inhabitant.

The satisfactory value even with the loss of these areas is given due to the presence of the permanent preservation area because of the proximity of the *Uberabinha* river. If we considered just the existing areas in the neighbourhood, this value would drop to 12m²/ inhabitant.

3.1.3.2. Lot Walkthrough Analysis

Dimensions

The lots have the minimum allowed Frontage of eight meters with a length of 25 meters, so the meterage is also the minimum allowed for an allotment in the Special Zone of Social Interest I with 200 m².

Lot 04, the only unit located on a corner, has larger size than the others. With frontage of 10.5 meters and lateral clearance of 21 meters, and a total of 219 m². This also meets the city's urban parameters for a lot located in a Special Zone of Social Interest I.

House Unit Location

The diverse choice of constructive interventions shows how the houses end up unfollowing the municipal parameters in various manners, and how it ends up causing some unexpected problems for the locals.

Table 10 - Urban parameters for the Special Zone of Social Interest I

	URBANISTIC PARAMETERS	House 01	House02	House 03	House 04
Frontage	**8 m**	8 m	8 m	8 m	10,5
Metreage	**200 m²**	200 m²	200 m²	200 m²	219 m²
Built Metreage	**500 m²**	54,85 m²	51,13 m²	112,30 m²	91,64 m²
Occupancy Rate	**80%**	27,25%	25,57%	56,15%	41,84%
Utilisation Coefficient:	**2,5**	0,27	0,26	0,56	0,42
Frontal Clearance:	**3,0 m**	6,5 m	6,5 m	6,5 m	-
Lateral Clearance	**1,5 m**	2,0 m	-	-	4,6 m
Back Clearance	**1,5 m**	9,2 m	12,1 m	-	3,6 m

Source: Municipal Working Code and Land Use and Occupation Law. Edited by Author, 2016.

Lot 01 was the only one to keep all urban parameters. The house suffered only cover addition in the laundry area, continuing to meet the following clearances provided in the Land Use Zoning Law. The increase was of only 17 m². Combined with the 37,85m² residence, the house has an occupancy rate of 27.25%.

The residence 02 had no room addition, keeping the front and back clearances. There was an increase in coverage in the lateral part, making the lateral clearance inexistent. In that way, it followed only part of the urban parameters, due to the lack of lateral clearance. The occupancy rate also continued within the allowed amount, occupying 51m² equivalent to only 25.5% of the maximum occupancy rate allowed in the Special Zone of Social Interest I.

Figure 74 and Figure 75 - Lots 01 and 02
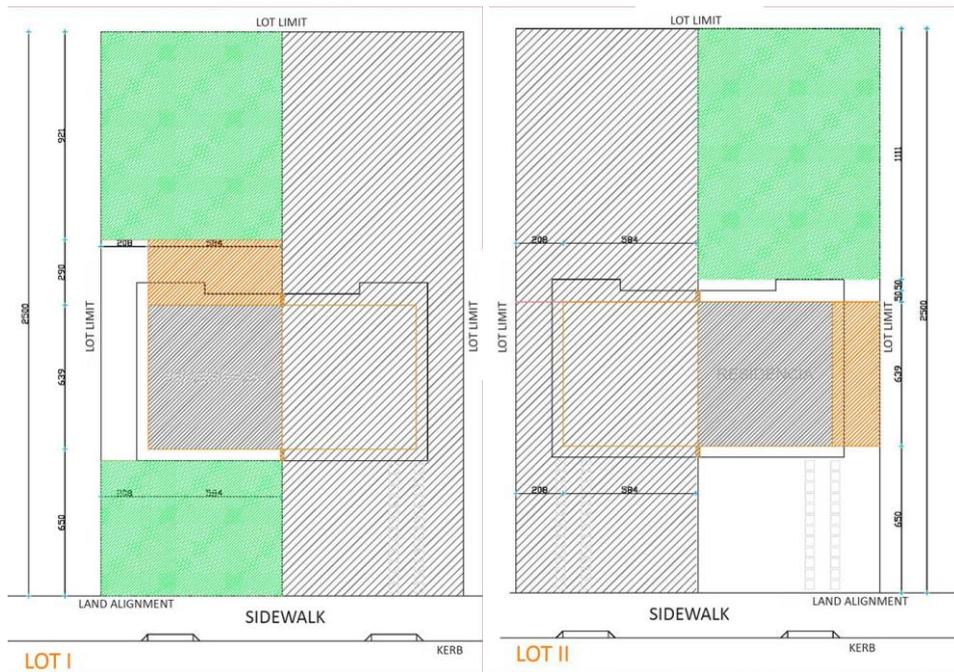
Source: Authors, 2016.

Lots 03 and 04 were the most modified. The residence 3 did not keep the lateral nor the back clearance, due to a second house with construction underway. The first house has 76.56 m² of construction and the second 35,75m², totalling a little more than 56% occupancy rate.

The house 04 has two additions, a commerce and a kitchen / service area, totalling 91.64 m² of built area, nearly 42% of occupancy rate. The lateral and back clearance were kept, however, the frontage was not respected. The commerce limits follow the division line between the lot and the street.

Figure 76 and Figure 77 - Lots 03 and 04
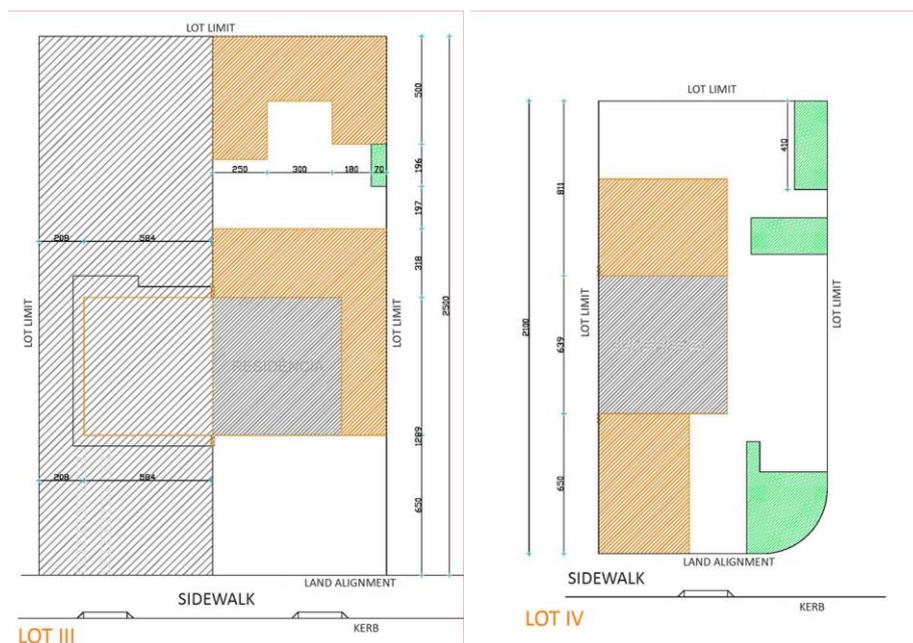
Source: Authors, 2016.

Legislation

As noted earlier, no lot has violated the minimum dimensions for a lot located in a Special Zone of Social Interest I.

The first three lots have a minimum length permitted for a Special Zone of Social Interest I of 200m², as well as frontage of at least 8 meters. Lot 04 is distinguished by its corner location. Possessing bigger frontage than the minimum allowed with 10.5 meters and 21 meters of lateral clearance, totalling 219 m².

As the houses are modified, they stop following the current legislation in Uberlândia.

The following table summarises the parameters for buildings located in the Special Zone of Social Interest I present in complementary law No. 524 of 08 April 2011 relating to Uberlândia Working Code. In complementary law No. 523 of 7 April 2011 regarding land subdivision, and complementary law No. 525 of 14 April 2011 concerning the use and occupation of land. It shows that the biggest the modification, the less permeable area was found and even fewer parameters were followed.

Table 11 - Urban parameters for the Special Zone of Social Interest I

	URBANISTIC PARAMETERS	House 01	House02	House 03	House 04
Frontage	**8 metros**	8 metros	8 metros	8 metros	10,5
Metreage	**200 m²**	200 m²	200 m²	200 m²	219 m²
Built Metreage	**500 m²**	54,85 m²	51,13 m²	112,30 m²	91,64 m²
Occupancy Rate	**80%**	27,25%	25,57%	56,15%	41,84%
Permeability Rate	**20%**	60,85%	45,53%	**0,68%**	**11,44%**
Utilisation Coefficient:	**2,5**	0,27	0,26	0,56	0,42
Frontal Clearance:	**3,0 m**	6,5 m	6,5 m	6,5 m	-
Lateral Clearance	**1,5 m**	2,0 m	-	-	4,6 m
Back Clearance	**1,5 m**	9,2 m	12,1 m	-	3,6 m

Source: Municipal Working Code and Land Use and Occupation LawEdited by Author, 2016.

Lot 01 is the only one to meet all urban parameters. The house suffered only cover addition to the service area, continuing to meet the clearances provided in the Land Use Zoning Law. The residence addition was of only 17 m², added to the 37,85m² of the residence, totalling just 54.85 m² built to accommodate a family of three. The house has an occupancy rate of 27.25%. With 121.7 m² of permeable area, it has 60.85% of permeability rate.

The house 02, although having a simple modification, with the coverage addition eliminated the lateral clearance. However, the occupancy rate remained within the allowed amount, since the occupied 51m² corresponds to only 25.5% of maximum occupancy rate, while the maximum allowed amount is 80%.

The last two lots analysed showed the greatest changes and consequently less followed parameters.

In the third lot, the occupancy rate is within the allowed with 56.15%. However, the permeability rate is only 0.68%, which does not allow the proper absorption of rainwater. The lateral and back clearances have not been respected, hurting the privacy of residents.

Lot 04 is out of the parameters permitted by law due to the frontal clearance, which is taken by the commerce establishment, along with permeable area of only 11.44%, which is below the minimum rate allowed. The occupancy rate is close to half the maximum rate allowed, and the lateral and back clearances are within the allowed value.

Vegetation

As for the lot's vegetation, Uberlândia's legislation, accessibility norms and the Energy Company of Minas Gerais - CEMIG offers guidelines in order for the existing vegetation to not affect mobility, absorption of rain water or cause infrastructure problems.

In accordance with NBR[9] 9050, planting control should ensure that the elements (branches, roots, twigs of shrubs and trees) and its protections (low walls, railings, etc.) do not interfere with accessible routes and areas of pedestrian circulation.

Adjacent areas to accessible routes and pedestrian circulation areas, the vegetation cannot have thorns or other characteristics that might cause injury; roots that damage the paving or have dangerous toxic features.

And strengthening these aspects, the CEMIG afforestation manual also has the following guidelines for the location of trees:

• At least four meters distance from poles

• One meter distance from the garage entry.

• A two-meter manhole and 60cm underground pipes.

• A two meters distance from corners.

• In plantations planning across the vacant lots, the seedlings should be placed four meters away from the limits, avoiding future problems with access to the building.

None of the lots analysed showed large vegetation that blocks the movement of free range, or vegetation near the garages, lampposts, to have problems with wiring or piping near the roots.

However, two lots did not meet the criteria for not having a permeable area within the urban parameters of the city.

With only 0.68% and 11.44% permeation rate, Lots 03 and 04, respectively, do not have sufficient area for the absorption of rainwater according to the Law of Land Use. For keeping the lot in perfect absorption condition, 20% (twenty percent) of the area should be preserved, being free from paving or any other obstruction. If the lots possessed and area with less than 200 m², the permeable rate should be 10%.

As for the other two lots, they have much higher rate than the minimum allowed, being 60.85% for Lot 01 and 45, 53% for Lot 02. Aside from these areas being permeable, both lots have vegetables and fruits planted at the back.

Surroundings Relation

The fact that the analysed allotments do not have 100% contact with the urban environment, limits the range of facilities, commerce and services supply in the vicinity. Still, there is a considerable number of currently commercial establishments close to the reference quarter.

According to ITDP / LABCIDADE methodology, 2014, the facilities, commerce and services whose use is sporadic and non-essential, but at the same time very important for ensuring the quality of urban insertion of future developments. They need to be accessible within a range of an hour travel by public transport.

Compulsory sporadic uses available to the public are:

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[9] NBR – Brazilian Norm

1- Public Hospital
2- Management Government Centre (INSS)
3- Higher Education Institution
4- Banks

And the complementary sporadic uses are:

1- Cinema
2- Sports gym, stadium, etc.
3- Museum or Cultural Centre (Arts University Museum)
4- Hypermarket
5- Office

For facilities, commerce and services with eventual uses, methodology considers that they should be available within a 1400 meters distance, which is equivalent to 20 minute walk or available to 30 minutes by public transport.

The proximity of Uberlândia Shopping can supply some eventual user' needs, which is only possible by public transport. With a distance of less than half an hour's journey, the population has access to movies, stationery, restaurant, pharmacy, hypermarket, etc.

However, it is not enough to meet all the needs of the population. Although the methodology considers the public transport, the bus ticket high cost prejudices the mobility. Also, being a mall with many high-class shops, even if they are available they are not affordable.

Compulsory eventual uses available are:

1- Public Elementary Schools
2- ATM
3- Health Units
4- Pharmacies
5- Area for sports practice
6- Supermarket
7- Public High Schools

Complementary eventual uses are:

1- Higher Education Institution
2- Social Assistance Reference Centre
3- Public Library
4- Bookstore or stationery
5- Medical Centre or specialised Clinics
6- Technical assistance and repairs (electronics, appliances, vehicles, bicycles etc.)
7- Clothing store, shoe store, etc.
8- Store of electronics, appliances, furniture, etc.
9- Restaurants
10- Banks
11- Offices

The sporadic uses are in an acceptable amount for the methodology ITDP / LABCIDADE, 2014, since the minimum needed was seven uses. Even so, the fact that there, not all the Compulsory uses are available, it can be said that the uses for all lots are insufficient.

For mandatory use, besides having all uses, it is necessary that the available ones attend the population's demand, which does not happen in the case of the health unit. In conversation with the population, the biggest complaint about health was the delay in the appointments, sometimes taking up to four months to get an appointment with a specialist doctor. So, when there is a need, they usually go to another integrated service unit to perform an exam.

In relation to daily uses, they need to be closer to the housing unit, because this implies daily trips with small children or shopping for everyday supplies. They should be available within a distance of up to 1000 meters, equivalent to a 15 minutes' walk.

The compulsory daily uses available within less than 1000 meters distance from the entrance of all the lots are:

1- Public Kindergartens
2- Public Early Childhood Education Schools
3- Free áreas for leisure and recreation
4- Markets, greengrocers.

The complementary daily uses available within less than 1000 meters distance from the entrance of almost all the lots are:

1- Butchers
2- Bakeries
3- Pharmacies
4- Restaurants (pizzeria, cafeteria, etc.)
5- Hair salon
6- Construction Material Stores.
7- Technical assistance and repairs (electronics, appliances, vehicles, bicycles etc.)

The Arts and Sports Unified Centre (CEU), classified as a mandatory daily and eventual. It has free areas for leisure and recreation with landscaping in good condition, furniture for leisure, physical activities and an area for sports. The vegetation is still small, so the site does not have much shading, generating discomfort at certain times for the practice of outdoor sports. The Arts and Sports Unified Centre also has a unit of the Social Assistance Reference Centre (CRAS).

Despite all the lots being located within distances of less than 1000 meters from all required uses, in education, there are also problems related to the demand of the population aside from the facility availability.

Likewise, the existence of Public Daycare and Nursery School kindergarten being less than 1000 meters away from each lot entrance - making a walking journey possible – being the only near, is insufficient to meet the required demand of the residents of the neighbourhood.

Thus, there are not all the uses required with enough availability to meet the population's demand.

The sporadic uses compose an acceptable amount, having more than 4 uses. Even for Lot 03, which was the one with greater distance from the centre of the neighbourhood.

Lot 01, despite being near the neighbourhood's centre, is classified as INSUFFICIENT, even with 5 complementary sporadic uses, 11 complementary eventual uses and 7 complementary daily uses. The reason is their capacity is not enough to meet the required demand of the residents of the neighbourhood.

The nearest pharmacy is approximately 997 meters away from the reference lot, distance still acceptable to not use motor vehicle As for the Family Health Unit, the distance goes 14 meters over the maximum acceptable of 1400 meters, equivalent to a20 minute walk.

Figure 78 - Facilities within a radius of 1400 meters distance from Lot 01

Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

Lot 02 also has an INSUFFICIENT relation with the surrounding according to the ITDP / LABCIDADE methodology, 2014. Both the fact that no public high or technical schools are within a 20-minute walk or 30 minutes by public transport. Due to the lack of availability of all mandatory uses, meaning they do not meet the required demand of the residents of the neighbourhood.

The lot also has 5 complementary sporadic uses, 11 complementary eventual uses and 7 complementary daily uses.

The nearest pharmacy is at approximately 1247 meters away from the reference lot, considered an INSUFFICIENT walking distance.

Figure 79 - Facilities within a radius of 1400 meters distance from Lot 02

Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

Lot 03, as seen previously, was the least inserted into the surroundings by being situated further away from the neighbourhood's Polygonal centre, and closer to the border of the neighbourhood with the non-urban area. Thus, classified as INSUFFICIENT.

The health unit within 1424 meters is no longer considered an accessible distance of a 20 minute walk.

Figure 80 - Facilities within a radius of 1400 meters distance from Lot 03

Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

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The nearest pharmacy is approximately 1007 meters away from the third reference lot, considered acceptable to walk.

For lot 04, despite being the closest to the centre of the neighbourhood, it is also classified as INSUFFICIENT. It also has 5 complementary sporadic uses, 11 complementary eventual uses and 7 complementary daily uses.

The image shows a prime location opposite to the CEU.

Figure 81 - Facilities within a radius of 1400 meters distance from Lot 04

Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

The nearest pharmacy is about 900 meters away from the reference lot, distance considered still acceptable to not use a motor vehicle. Through a walking journey, it is also possible to get to the Basic Health Unit.

Privacy

In order for residents to have privacy from their neighbours, it is necessary that the lot situation on site corresponds to all the front, side and back clearances, plus the coefficient of utilisation, as required by supplementary law No 525 of 14 April 2011 of the Land Use Zoning, which describes these urban norms.

For the Special Zone of Social Interest I, where the houses are located, the rates are:

Table 12 - Usage coefficient and clearances for the Special Zone of Social Interest I.

URBANISTIC PARAMETERS	
Utilisation Coefficient:	2,5
Frontal Clearance:	3,0
Lateral Clearance	1,5
Back Clearance	1,5

Source: Municipal Prefecture of Uberlândia, 2016. Edited by authors.

As for the utilisation coefficient – which would imply the neighbour's loss of privacy if the houses were two-story – there was no house that failed to comply with that guideline or that lost of privacy due to visual contact within neighbours.

The residences 01 and 04 are those with greater privacy between the residents and their neighbours, complying with the clearances needed in the norm. The second most advantage, as they were not terraced, which makes it the most privileged type in terms of privacy.

The house has extensions in the front and back of the original residence, failing to meet the front clearance parameter, where the frontal room's exclusive purpose is for the commerce, and it does not disturb the residents' privacy.

The house 01 has one single change, the coverage of the laundry area, also keeping its original clearances, meeting all the parameters.

The house 02 partially meets the privacy settings, as the addition of a covered area leaning against their neighbour's wall to decrease the sunlight, caused a loss of privacy as it is completely possible to hear the other side of the wall. The same is true in the bedrooms, in and attenuated form, because the bedrooms wall is the one shared by both houses.

The house 03 does not meet the parameters as the frontal clearance was the only one maintained. The lateral part is the most harmful to residents, because the frequency of use of the site, since in this collective area they can hear all the sounds through the wall. The same will happen in the second home that has all the rooms facing their neighbours' house.

Hygiene and Cleaning

Except for the residence 03, the others partially attend or do not atend the guidelines of city's norms, which says that any land, whether built or not, should be kept in a perfect state of cleanliness and conservation, preventing them from being used as a garbage dump and waste of any kind. Because they have some kinds of stored materials, especially construction materials, which they tend to keep to use later.

Lot 03 is all walled with hollow bricks, almost all cemented and in perfect condition of cleanliness and conservation, with minimal garden space, which is also very well maintained.

The front of house 01 is open to the street, where they keep some stored construction materials. Although the frontage is used as a deposit location, the place itself is in perfect maintenance state, permeable, and it does not have any other type of waste. The rest of the lot is also kept clean.

Figure 82 - Storage of construction materials in lot 01

Source: Authors, 2016.

The access gate is located between the wall of the house and the motto of side clearance. In the residence back there are various fruit trees and normal ones where the shade is a shelter for the dogs. The place is also fenced, dividing the permeable and non-permeable area.

The house 02 is all walled with hollow bricks of 8 holes, without a front gate, and the lot is partially clean at the back, place where there is a garden for family consumption, surrounded by various materials.

Figure 83 and Figure 84 - Back of lot

Source: Authors, 2016.

On the side of the, because of the coverage, there a household furniture storage. There are also construction materials both at front and back of the house.

Lot 4 is all walled with a hollow brick of 8 holes, without plaster. A good part of the land is waterproofed but has cracks in the pavement. In the back, there is a dump with leftover construction materials and various others.

Figure 85 and Figure 86 - Waste dispposed at the back of lot 04

Source: Authors, 2016.

3.1.3.3. Housing Unit Walkthrough Analysis

Dimensions – Useful Area

The *Minha Casa, Minha Vida* Programme (PMCMV) establishes a minimum area of 32 m² for a one-story house with 2 bedrooms without laundry area and a minimum area of 36 m² for adapted units for disabled users.

Here we considered only the area of the original project, not the construction additions made by the resident.

In the housing complex, both units with a standard design plan, as well as adapted design plan have an internal floor area of 33.42 m². Therefore, only the standard plan units evaluated (houses 01, 02, and 03) meet the minimum area required.

Below is the original plan of the two typologies.

Figure 87 - Original Project – Standard House Plan
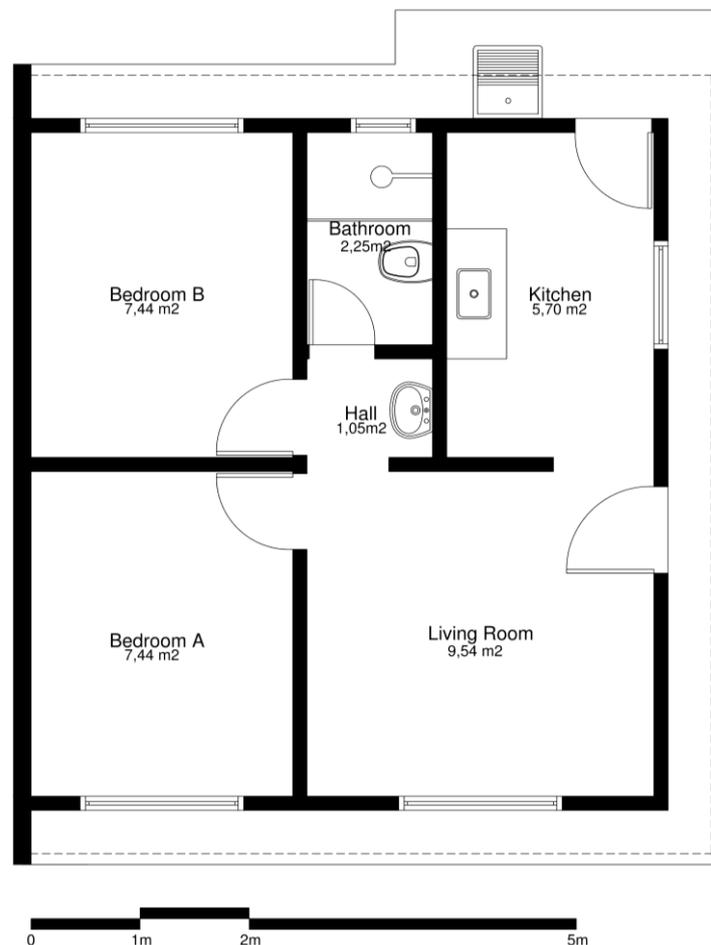
Source: Authors, 2016.

Figure 88 - Original Project – Adapted House Plan
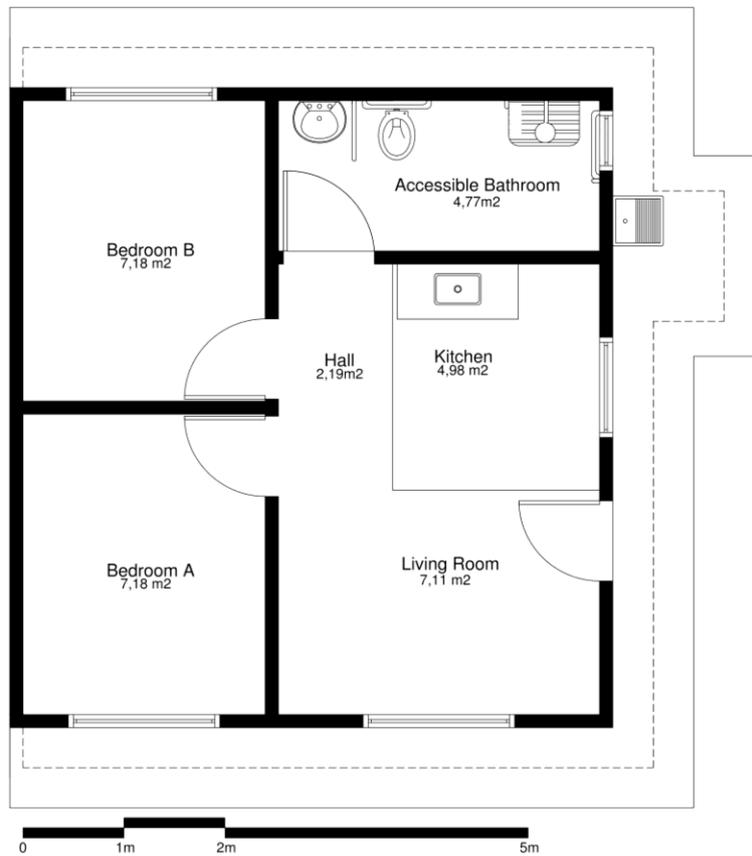
Source: Authors, 2016.

Division Proposed

According to Pereira (2015) the residence must have spaces compatible with the nine individual human needs and the family group:

1 - Enter / circulate

2 – Interact with family and visits

3 - Work / individual recreation

4 - Prepare meals

5 - Serve meals

6 - Sleep / rest / study

7 - Personal Hygiene

8 - Treat clothing

9 - Housekeeping

These nine activities were related to the following rooms in the four houses:

Frame 18 - Distribution of essential housekeeping activities

Activity	House 01	House 02	House 03	House 04
Enter / circulate	All rooms	All rooms	All rooms	All rooms
Interact with family and visits	Living room	Living room	Living room Extension	Living room Extension
Work / individual recreation	-	Living room *	-	Cozinha* Extension *
Prepare meals	Kitchen	Kitchen	Kitchen Extension	Extension
Serve meals	-	Living room	Extension	Cozinha Extension
Sleep / rest / study	Bedrooms**	Bedrooms **	Bedrooms **	Bedrooms **
Personal Hygiene	Bathroom Circulation	Bathroom Circulation	Bathroom Extension	Bathroom
Treat clothing	Extension	-	Extension	Extension
Housekeeping	Extension	-	Extension	Extension
* Activity carried out in the tables to serve meals located in these rooms. ** It does not include the study activity.				

Source: Authors, 2016.

Therefore, it is considered that the compartmentalisation of the units is unsatisfying because of the work and individual recreation activities (3), study (6), treat clothes (8) and housekeeping (9), are not contemplated in the original design.

Zoning Proposal

According to Pereira (2015), the distribution of individual human and the family group needs should consider a bigger adequacy to the need to approach / detachment and integration / separation between activities, which is described below in its Relations' Matrix:

Figure 89 - Relationships Matrix
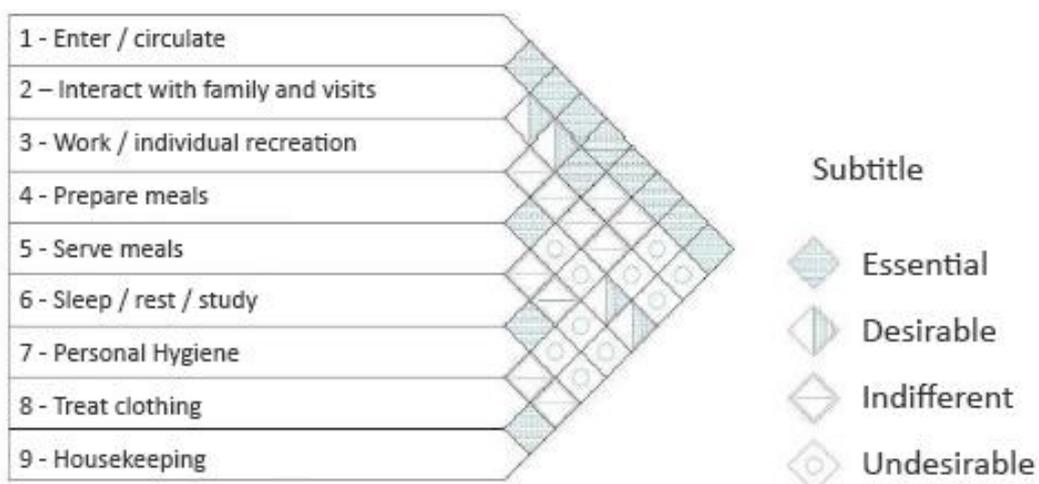
Source: PEREIRA, 2015. Edited by authors.

The applied Matrix below uses colours in cells to categorise the ideal relationship between activities on the top of the rows and columns. Green for essential relationship, blue for desirable, orange to red to indifferent

and undesirable. In the cells are inserted numbers from 01 to 04, representing the number of homes in which the activities are related.

Table 13 - Relationship matrix application

Relationship matrix	1 - Enter / circulate	2– Interact with family and visits	3 – Work / individual recreation	4 – Prepare meals	5 – Serve meals	6 – Sleep / rest / study	7 – Personal Hygiene	8 – Treat clothing	9 – Housekeeping
1 - Enter / circulate		01 02 03 04	02 03 04	01 02 03 04	02 03 04	01 02 03 04	01 02 03 04	01 02 03 04	01 02 03 04
2– Interact with family and visits			02 03 04	01 02 03 04	02 03 04	01 02 03 04	01 02 03 04	03 04	03 04
3 – Work / individual recreation				03 04	03 04	02 03 04	03	03 04	03 04
4 – Prepare meals					02 03 04	03	03	01 02 03 04	01 02 03 04
5 – Serve meals						02 03	02 03	03 04	03 04
6 – Sleep / rest / study							01 02 03 04	03	03
7 – Personal Hygiene								03 04	03 04
8 – Treat clothing									01 02 03 04
9 – Housekeeping									

Legend		Essential		Desirable
		Indifferent		Undesirable

Source: Authors, 2016.

It is observed in the matrix that most homes have relationships that are considered essential and desirable. On the other side, the relationships deemed to be undesirable occurs in homes 03 and 04 due to overlapping of activities in the expansion areas, which are used to interact with family and visits, work / personal recreation, preparing meals, serving meals, treat clothes, housekeeping.

Therefore it is considered that, as the compartmentalization proposal attendance is regular because the original design enables the desirable proximities and avoids the undesirable nearby.

Rooms Useful Area

To Pereira (2015), the architectural design of housing units should provide sufficient area to hold and use the minimum furniture for the nine essential domestic activities as in the matrix below. It is not established a minimum area for each room.

Frame 19 - Functional Matrix

Essential Activities	Furniture/ basic equipment	Reference piece	Dimensions (cm)	Space of use (cm)
1 - Enter / circulate	Access to the house, the rooms, equipment and furniture and windows in a direct and clear way.	Doors	80 cm	85 x 85
		General circulation	80 cm	80 x 80
		Restrict circulation	60 cm	60 x 60
2– Interact with family and visits	Number of seats equal number of beds + support TV and stereo. Consider the need for a possible sleeping space.	Sofa with 3 seats	190 x 80	190 x 60
		Sofa with 2 seats	140 x 80	140 x 60
		Sofa-bed 3 seats	190 x 80	190 x 100
		Sofa-bed 2 seats	140 x 80	140 x 100
		Arm chair	90 x 80	90 x 60
		TV shelf	80 x 40	80 x 60
3 – Work / individual recreation	Support for computer and storage space.	Computer desk with chair	90 x 50	90 x 60
		Three-door aereall cabinet	90 x 30	90 x 40
4 – Prepare meals	Basic Trio for storing food, prepare and cook: fridge, sink and stove. Equipment for storing food and utensils. Equipment to store table linen, can happen associated with serving meals.	Stove and oven	55 x 60	60 x 90
		refrigerator	70 x 70	60 x 90
		Three-door or two-door/ four-drawers cabinet under sink	120 x 50/ 120 x 30	120 x 90
		Two-door cabinet and aereal cabinet	80 x 50/ 80 x 30	80 x 90
		Meal support (optional)	80 x 40 (80)	80 x 130
5 – Serve meals	Table with seats equal to the number of beds.	Square table 4 places	90 x 90	90 x 60 p/lugar
		Retangular table 6 places	120 x 80	90 x 60 p/lugar
6 – Sleep / rest / study	Bed for two people (double + 2 singles). Equipment for storing objects, personal clothing and shoes. Associate preferably in "sleeping couple," equipment to store bedding and bath. In the "sleeping children"	Double bed	145 x 195	195 x 60
		Single bed	90 x 195	195 x 60
		Baby crib	70 x 135	135 x 60
		Six-door wardrobe	180 x 55	180 x 80

	associate work surface to study with storage equipment.	Four-door wardrobe	120 x 55 + 70 x 50	120 x 80
		Study desk with chair	90 x 50	90 x 60
		Nighstand	45 x 30	60 x 40
7 – Personal Hygiene	Equipment for self cleaning/ hygiene: sink and shower / box. Meet physiological needs - toilet. Consider the area to dry up or bathing a child, outside the box.	Washing basin with cabinet	55 x 35	80 x 60
		toilet	40 x 65	80x 60
		Retangular box	80 x 100	80 x 60
8 – Treat clothing	Equipment to perform the complete cycle of treatment of the clothes: tank, washing machine and clothesline suspended. Equipment for storage of cleaning products.	Tank	60 x 60	90 x 60
		Washing machine	60 x 60	80 x 60
		Clothes line	80 x 50	80 x 40
9 – Housekeeping	Equipment for storage products / home maintenance equipment and light tools.	Two-door cabinet and aereal cabinet	80 x 50 / 80 x 30	80 x 90

Source: PEREIRA, 2015. Edited by authors.

In the original design the rooms have the following areas:

Table 14 - Rooms useful area

Room	Useful area (m²)	
	Standard house plan (Houses 01, 02 and 03)	Adapted house plan (House 04)
Living room	9,54	7,11
Kitchen	5,70	4,98
Bedroom A	7,44	7,18
Quarto B	7,44	7,18
Bathroom	2,25	4,77
Circulation	1,05	2,19
Laundry area	0	0

Source: Authors, 2016.

In the application of the tool, it was made the dimensions collection of all existing furniture in every residence, both in the original part of the house and in the extensions, and, later, the Layout plan of each house was generated.

Analysing the layout plan with the household furniture and marking of needed area for each furniture / equipment was observed in every room:

Living Room

House 01 – 3 residents

The house has a guests area to hang out with family and receive visits, since there are five seats on the couch, however the sofa area of use is slightly reduced;

It does not include area for meals.

It does not include space for work or individual recreation.

Figure 90 - Living room Layout - House 01
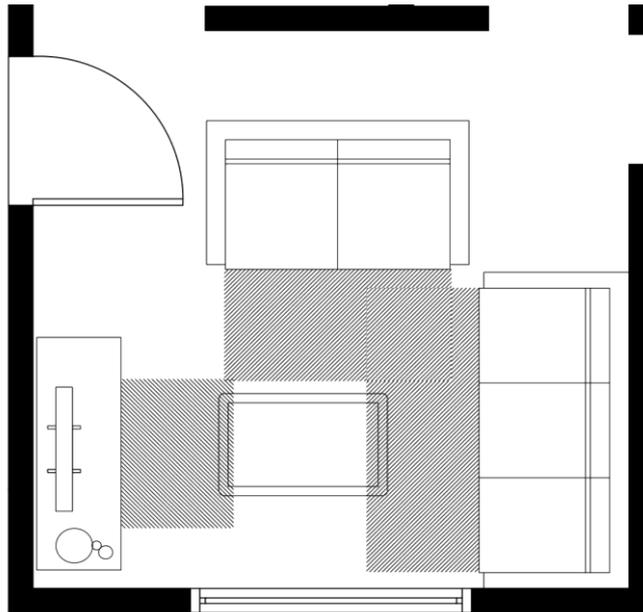
Source: BORTOLI, 2016.

Figure 91 - Living room - House 01
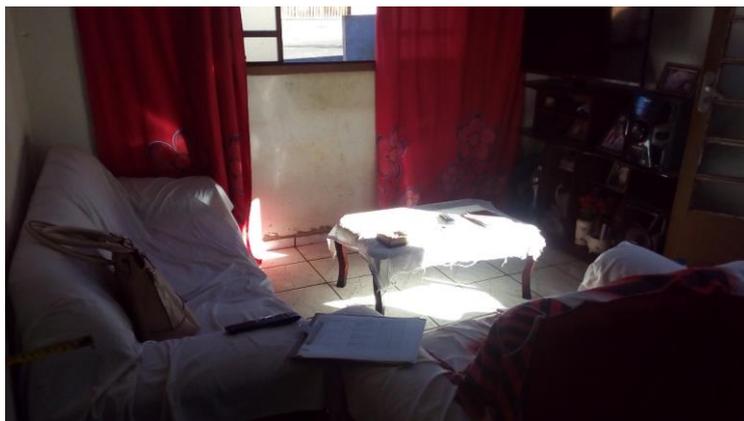
Source: BORTOLI, 2016.

House 02 – 4 residents

The house has a guests area to hang out in the family, but does not allow the reception of visitors, as one of the sofa seats cannot be used due to overlapping between the uses of the space, the Tv table also has reduced space utilisation.

It partially contemplates the activity of serving meals as there are only three places available the table and their space usage conflicts with circulation.

It does not include space for work or individual recreation.

Figure 92 - Living room Layout - House 02
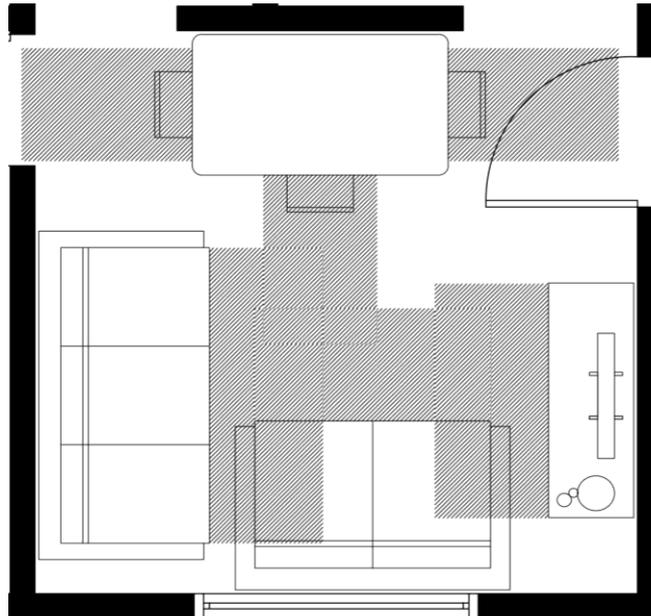
Source: BORTOLI, 2016.

Figure 93 - Living room - House 02

Source: BORTOLI, 2016.

House 03 – 3 Residents

Guests area to hang out with family, adequate working space, but does not allow visits because there are only three seats on the couch.

It does not include an area for meals.

It does not include space for work or individual recreation.

Figure 94 - Living room Layout - House 03
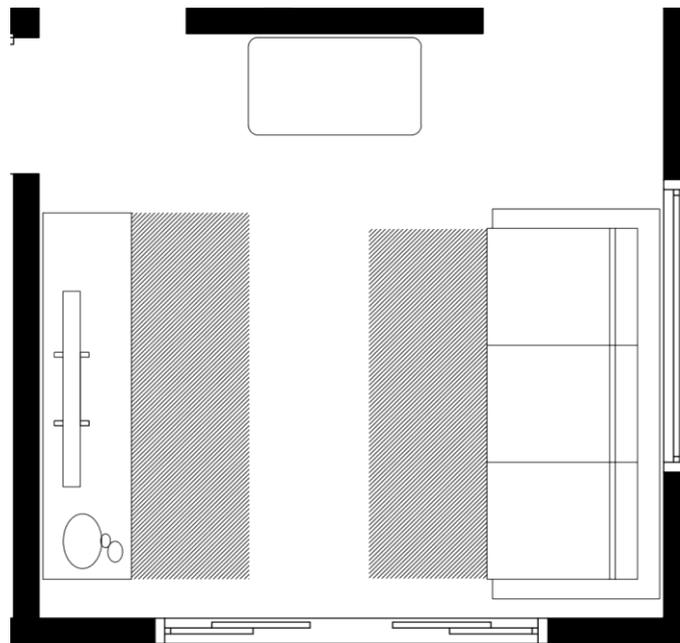
Source: BORTOLI, 2016.

Figure 95 - Living room - House 03
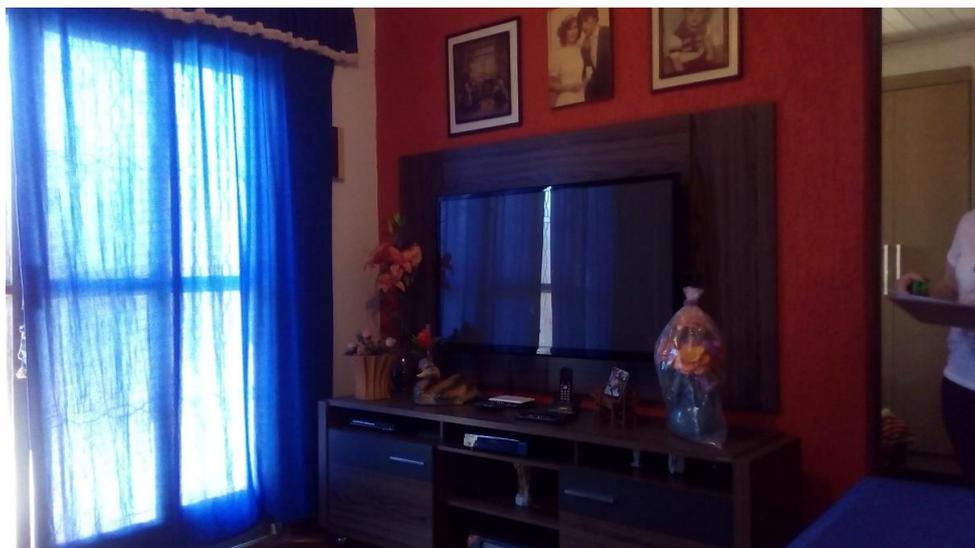
Source: BORTOLI, 2016.

House 04 – 6 residents

It does not include an area to hang out as a family and does not allow the reception of visitors, as the number of sofa seats is insufficient for the number of residents, plus a seat becomes unusable due to overlapping of the uses of the space. The TV shelf also has reduced space utilization.

It does not contemplate the activity of serving meals.

It does not include space for work or individual recreation.

Figure 96 - Living room Layout - House 04
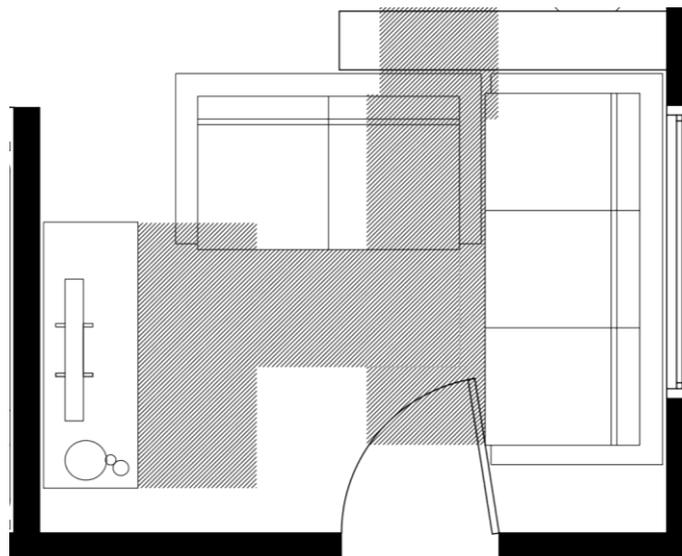
Source: BORTOLI, 2016.

Figure 97 - Living room - House 04

Source: BORTOLI, 2016.

Kitchen

House 01 – 3 residents

Includes an area for meal preparation with adequate working area, but the circulation is compromised.

Figure 98 - Kitchen Layout - House 01
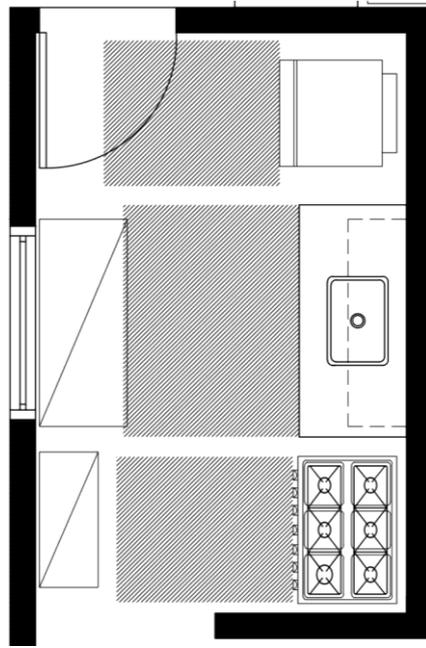
Source: BORTOLI, 2016.

Figure 99 - Kitchen - House 01
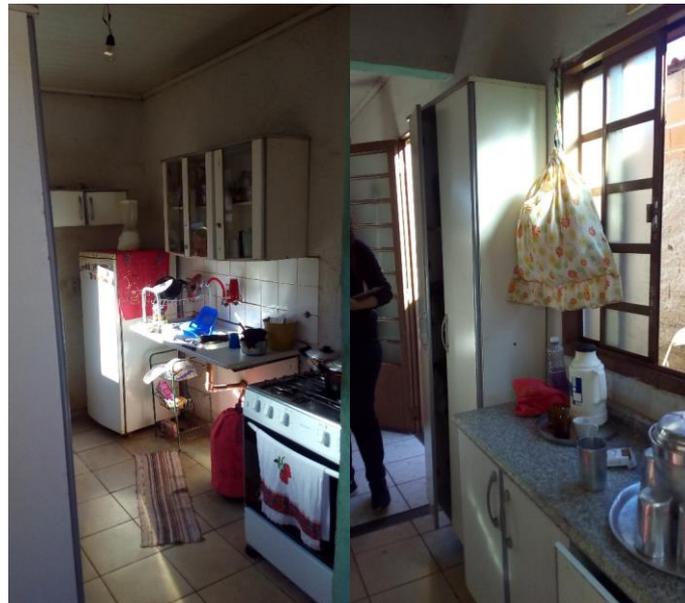
Source: BORTOLI, 2016.

House 02 – 4 residents

Partially contemplates area for meal preparation, because the stove did not fit properly, compromising its use area. The sink and the refrigerator use area are also reduced, because of conflict with storage furniture, circulation is also compromised.

Figure 100 - Kitchen Layout - House 02
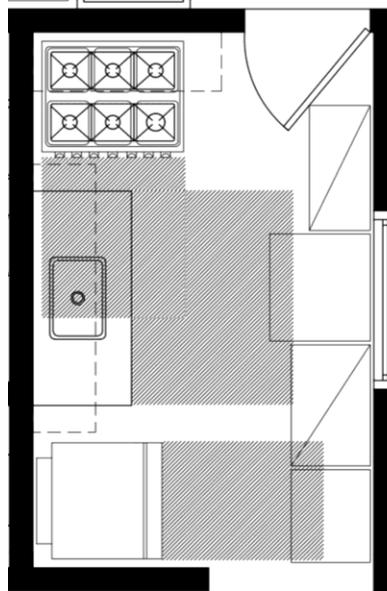
Source: BORTOLI, 2016.

Figure 101 - Kitchen - House 02

Source: BORTOLI, 2016.

House 03 – 3 residents

The space do not contemplate an area for preparation of meals as the residents use the kitchen only for storage in cupboards and in the refrigerator, thus, its area of use conflicts with the circulation.

Figure 102 - Kitchen Layout - House 03
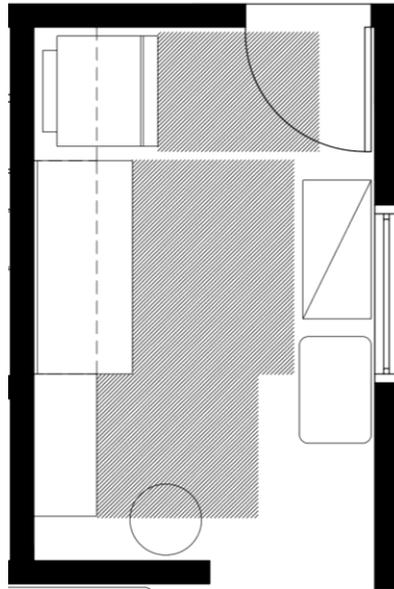
Source: BORTOLI, 2016.

Figure 103 - Kitchen - House 03

Source: BORTOLI, 2016.

House 04 – 6 residents

The space does not contemplate area for preparation of meals because residents use the kitchen only for storage cabinets and to serve meals. Also, the seats at the table are insufficient for the number of residents, making the area of use is reduced.

Figure 104 - Kitchen Layout - House 04
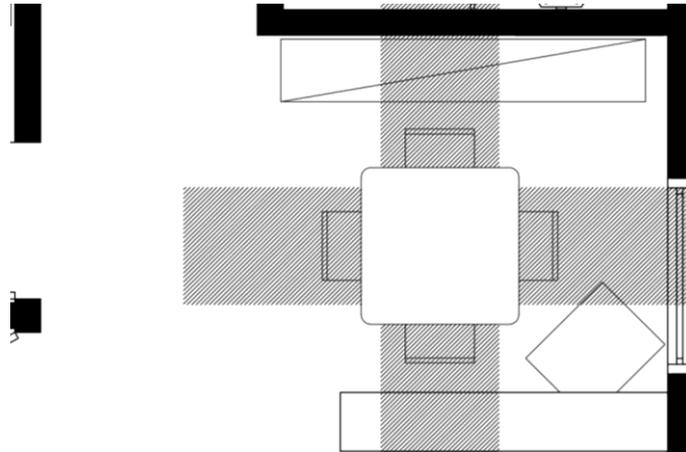
Source: BORTOLI, 2016.

Figure 105 - Kitchen - House 04

Source: BORTOLI, 2016.

Bedroom A

House 01 – 3 residents

The master bedroom includes the activity sleep / rest with a double bed, a wardrobe with six doors and an extra support furniture. The bed area of use is just enough on one side, as in non-existent furniture side and the other is insufficient because of conflicts with the wardrobe.

Figure 106 - Bedroom A Layout - House 01
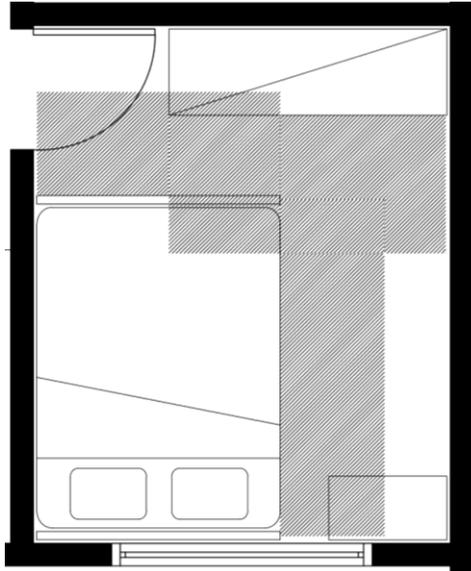
Source: BORTOLI, 2016.

Figure 107 - Bedroom A - House 01

Source: BORTOLI, 2016.

House 02 – 4 residents

The three children bedroom partially covers the activity sleep / rest, because it has a bunk bed and a mattress on the floor, two wardrobes of six doors, a two-door one and a support furniture, there is no area of use for any of the furniture, or circulation. There is no room for a study desk.

Figure 108 - Bedroom A Layout - House 02
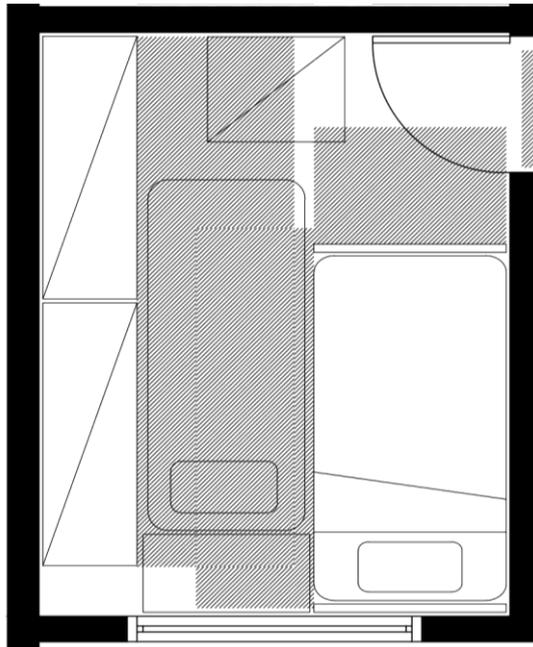
Source: BORTOLI, 2016.

Figure 109 - Bedroom A - House 02

Source: BORTOLI, 2016.

House 03 – 4 residents

The master bedroom includes the activity sleep / rest with a double bed, a wardrobe of six doors and a support furniture. The bed area of use is non-existent on one side and the other is insufficient because it conflicts with the wardrobe and the support furniture.

Figure 110 - Bedroom A Layout - House 03
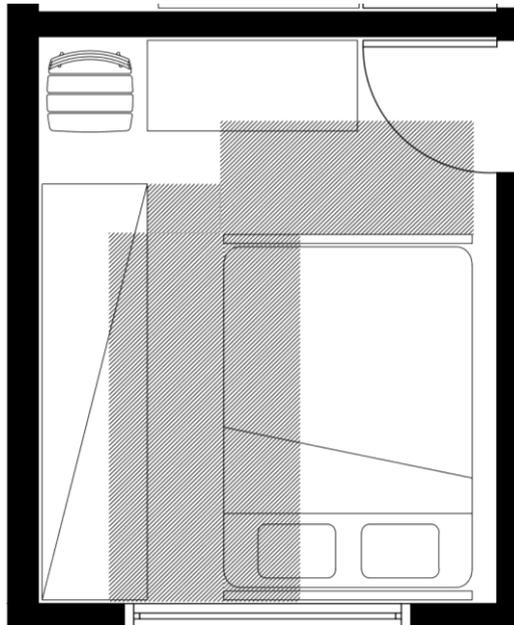
Source: BORTOLI, 2016.

Figure 111 - Bedroom A - House 02

Source: BORTOLI, 2016.

House 04 – 6 residents

Bedroom of four children room, attending the activity of sleep / rest, with two bunk beds and a six-door wardrobe. The area of use is insufficient for both bunk beds and for the wardrobe. There is no room for a study desk.

Figure 112 - Bedroom A Layout - House 04
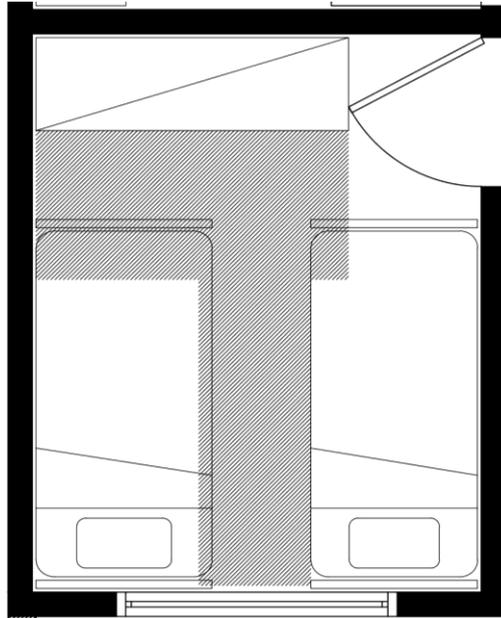
Source: BORTOLI, 2016.

Figure 113 - Bedroom A - House 04

Source: BORTOLI, 2016.

Bedroom B

House 01 – 3 residents

It is the child's room, having the activity sleep / rest with a single bed and a six-door wardrobe. The use of bed area is sufficient. There is enough space for a study desk insertion.

Figure 114 - Bedroom B Layout - House 01
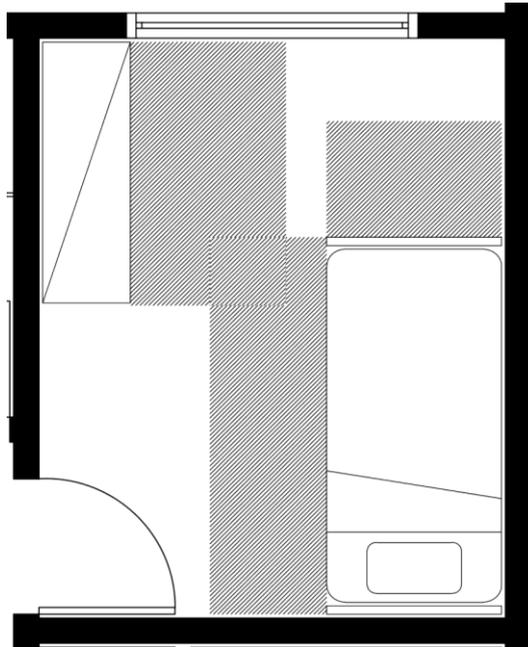
Source: BORTOLI, 2016.

Figure 115 - Bedroom B - House 01
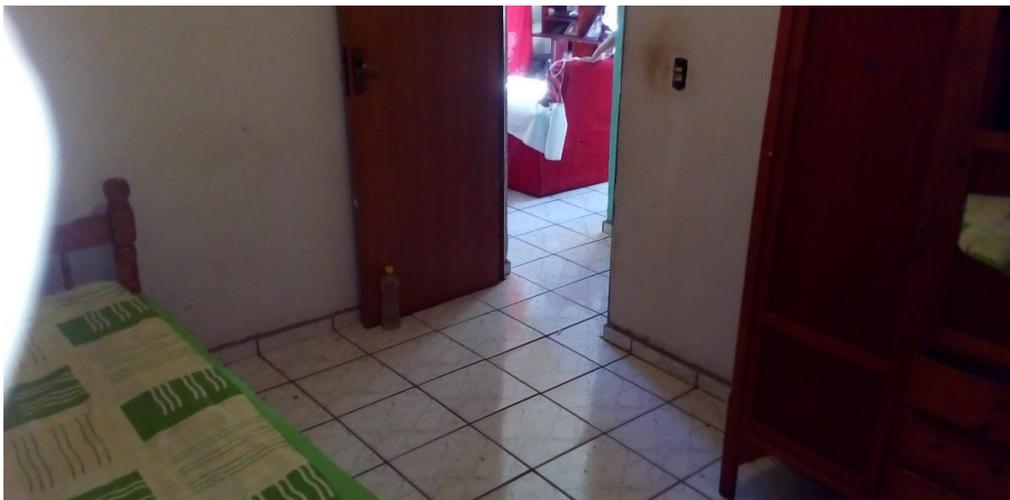
Source: BORTOLI, 2016.

House 02 – 4 residents

The mother's room has the activity sleep / rest with a double bed and three supporting furniture. The use of bed area is insufficient on three sides, as it conflicts with the support furniture.

Figure 116 - Bedroom B Layout - House 02
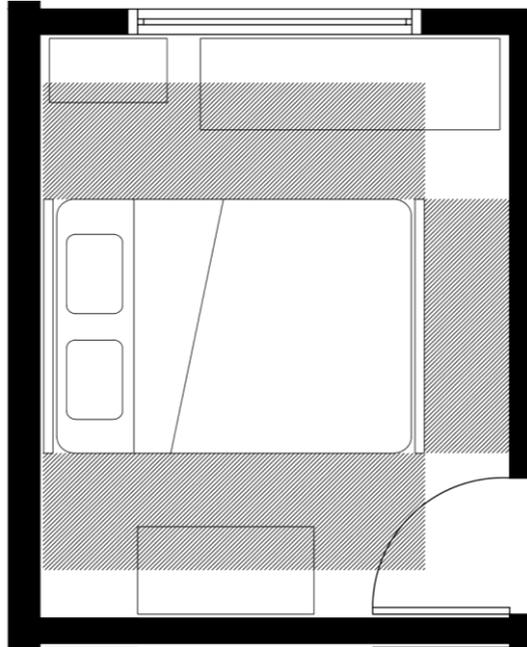
Source: BORTOLI, 2016.

Figure 117 - Bedroom B - House 02

Source: BORTOLI, 2016.

House 03 – 3 residents

The child's room has the activity sleep / rest with a single bed, a six-door wardrobe and two supporting furniture. The use of bed area is sufficient. There is not enough space for a study desk insertion.

Figure 118 - Bedroom B Layout - House 03
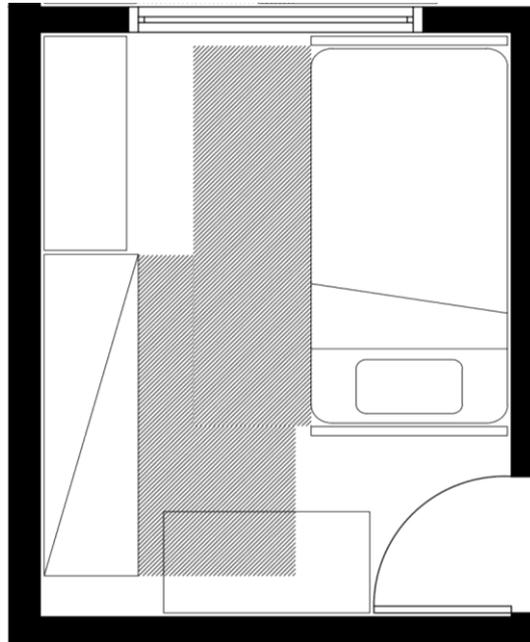
Source: BORTOLI, 2016.

Figure 119 - Bedroom B - House 03

Source: BORTOLI, 2016.

House 04 – 6 residents

The master bedroom includes the activity sleep / rest with a double bed, a six-door wardrobe and a support furniture. The bed area of use is enough on one side, another side is non-existent and the other is insufficient because it conflicts with the wardrobe.

Figure 120 - Bedroom B Layout - House 04
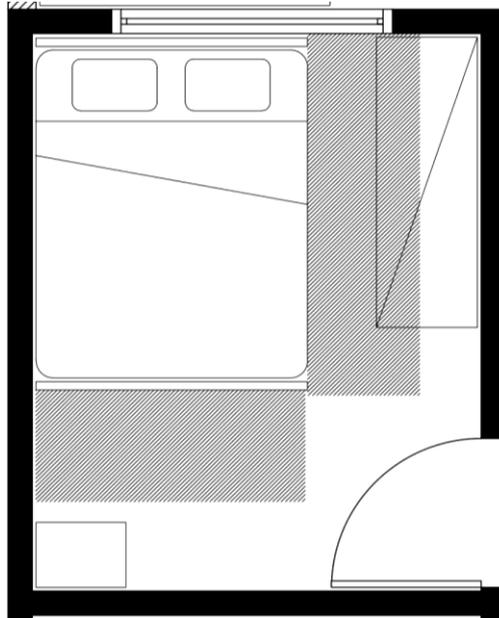
Source: BORTOLI, 2016.

Figure 121 - Bedroom B - House 04

Source: BORTOLI, 2016.

Bathroom

House 01, 02 e 03.

It partially covers the activity of making personal hygiene, contemplates a proper space for the basin, which is located in the circulation hall of the house 01 and 02 and the house 03 is non-existent because it was taken off from its original place by the dwellers.

Figure 122 - Bathroom Layout– House 01, 02 and 03
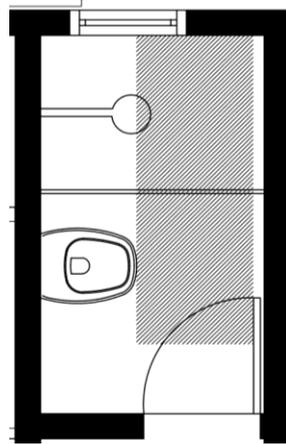
Source: BORTOLI, 2016.

Figure 123 - Bathroom - House 02

Source: BORTOLI, 2016.

House 04

It partially covers the activity of making personal hygiene, because the toilet is located inside the shower stall and its uses' space overlap.

Figure 124 - Bathroom Layout– House 04
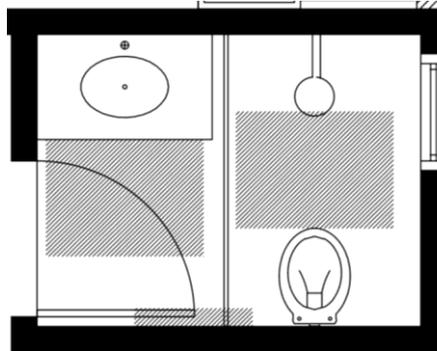
Source: BORTOLI, 2016.

Figure 125 - Bathroom - House 04

Source: BORTOLI, 2016.

Circulation

House 01 and 02

Conflicting circulation space with space to personal hygiene, as the wash basin is located in the same place.

Figure 126 - Circulation Layout– House 01 e 02
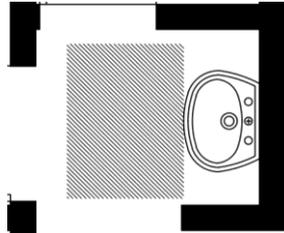
Source: BORTOLI, 2016.

Figure 127 - Circulation - House 02

Source: BORTOLI, 2016.

House 03

The sink was taken from its original place by the residents. On site there are some cardboard boxes, which partially obstruct the passage.

Figure 128 - Circulation Layout– House 03
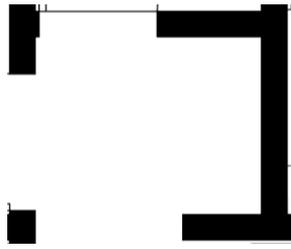
Source: BORTOLI, 2016.

Figure 129 - Circulation - House 03

Source: BORTOLI, 2016.

House 04

Figure 130 – Enough circulation space, obstacle-free.
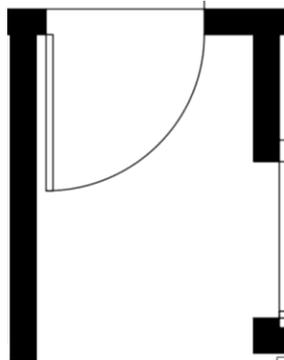
Fonte: Organizado pelos autores, 2016.

Laundry Area

The initial Project does not contemplate the laundry area.

House 01

The owners have created a service area in the back of the house, with two tanks and a washing machine, with sufficient space utilisation.

Figure 131 - Laundry Area Layout – House 01
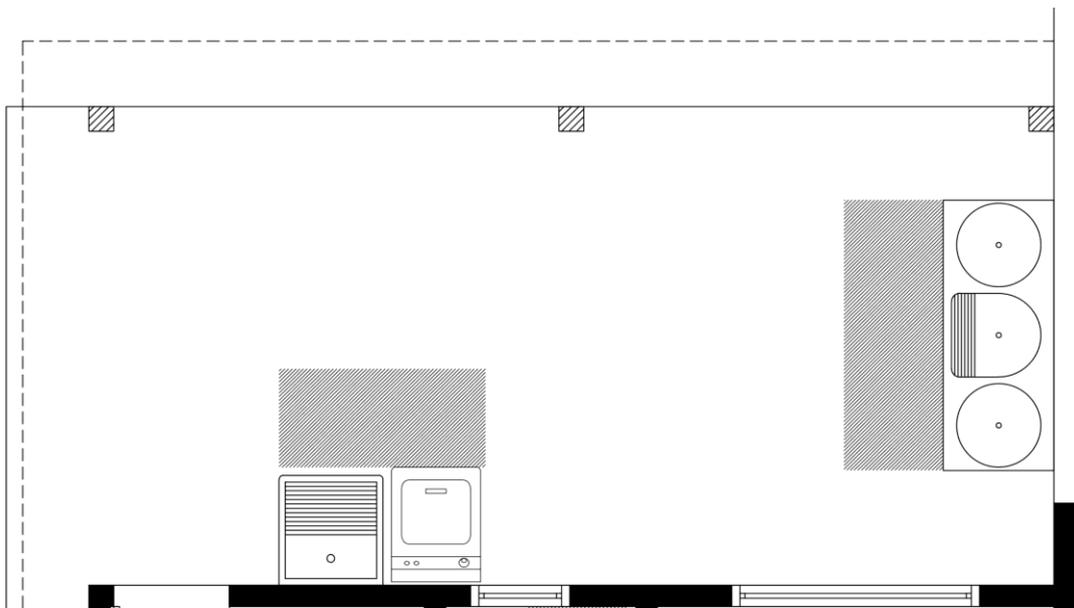
Source: BORTOLI, 2016.

Figure 132 - Laundry Area – House 01

Source: BORTOLI, 2016.

House 02

It does not have any covered laundry area. There are a tank and a washing machine used for washing clothes and a refrigerator and a broken washing machine, used for storage. All, located at the back of the house.

Figure 133 - Laundry Area Layout – House 02
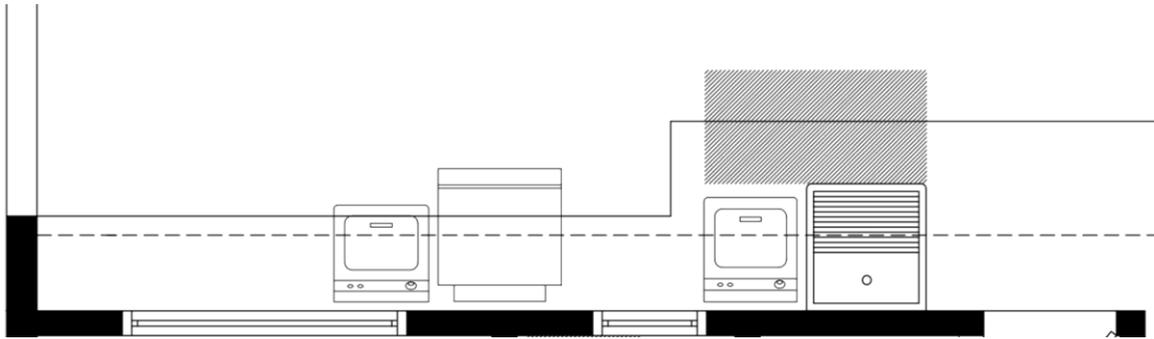
Source: BORTOLI, 2016.

Figure 134 - Laundry Area – House 02

Source: BORTOLI, 2016.

House 03

The owners have created a laundry area in the back of the house, where are located the tank and washing machine. The environment are also located the stove, the table to serve meals, a bank and a support furniture. Therefore, the space is also used as kitchen. The tank space utilisation conflicts with the support furniture.

Figure 135 - Laundry Area Layout – House 03
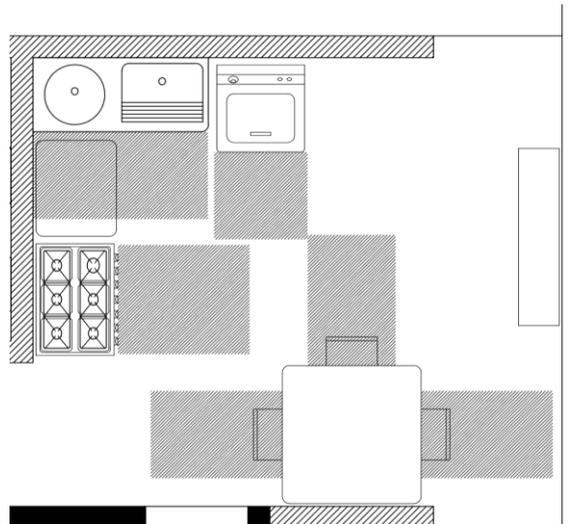
Figure 136 - Laundry Area – House 03

House 04

The owners have created a service area in the back of the house, where are located the tank and a washing machine. In this space are also located the stove, refrigerator, another table to serve meals, four support furniture, plus another washing machine and a stove that are not used. Therefore, the space is also used as a

kitchen. The space utilisation table conflicts with the spaces to use the sink and stove, which also conflicts with the refrigerator.

Figure 137 - Laundry Area Layout – House 04
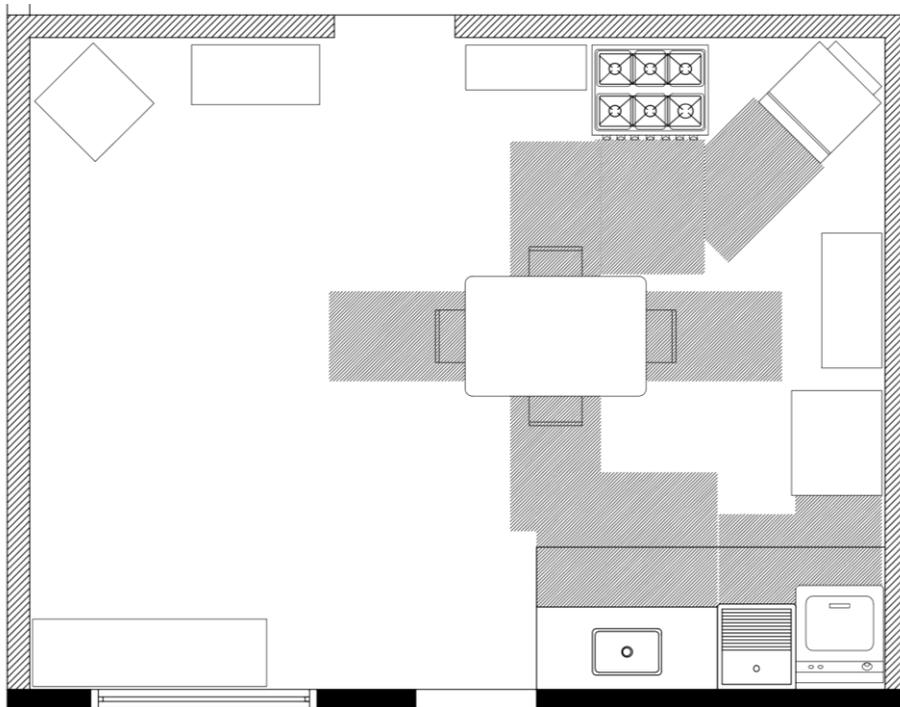
Source: BORTOLI, 2016.

Figure 138 - Laundry Area – House 04

Source: BORTOLI, 2016.

Figure 139 - Laundry Area – House 04

Source: BORTOLI, 2016.

Below is the summary table evaluating the area of the existing rooms of the four evaluated houses, where we can see that in the initial design, all rooms have insufficient areas, although the total built area meets wat is required by PMCMV. The only room with enough considered area is the laundry/service area built by the residents, if they did not realise activities that were supposed to happen in the other rooms according to the original project.

Frame 20 - Rooms useful area evaluation

Room	Area Evaluation	Observations
Living room	Insufficient	**Activities not covered:** Work/ individual recreation **Compromised activities:** Circulate Interact with Family and visits Serve meals
Kitchen	Insufficient	**Compromised activities:** Circulate Prepare meals
Couple bedroom	Regular	**Compromised activities:** Circulate
Children bedroom	Insufficient	**Activities not covered:** Study **Compromised activities:** Circulate Sleep/rest
Bathroom	Insufficient	**Compromised activities:** Personal hygiene
Circulation	Insufficient	**Compromised activities:** Circulate
Laundry area	Sufficient	Room built by the residents

Source: Authors, 2016.

Circulation

According to Pereira (2015), access to the house and the rooms (doors and openings) must have a minimum width of 80 cm. Moreover, access to furniture and windows must have at least 60 cm.

It is observed that the houses 01, 02 and 03 access doors are between 78 cm and 80 cm wide, thus partially meet the norm. The access doors to the rooms have 75 cm in circulation, 65 cm in bedrooms and 55 cm wide in the bathroom, so they all do not meet what is expected.

In the house 04, by being accessible all ports are 80 cm wide.

Circulation access to furniture and windows is quite low in all rooms except for the bathrooms of houses 01,02 and 03, which are rooms that have only a single bed (houses 01 and 03), and in the kitchen of the houses 01 and 03 and room in the house 03.

Ceiling Height

According to the Municipal Working Code - Complementary Law No. 524 of 08 April 2011, the minimum right foot must have 2.60m in loitering rooms (bedrooms, living room and kitchen) and 2.40 m in the other rooms.

In all houses, all rooms have a ceiling height of 2.70 m, thus meeting what is expected.

Extension Possibility

The NBR 15575 determines that, in the design and implementation of the evolutionary character of buildings – meaning those already marketed with extension prediction – the developer or builder must attach the specifications and construction details to the property manual. This is necessary to expand the building as a whole, floor, roof and building installations, considering the dimensional coordination and the physical and chemical compatibility with the materials available regionally, wherever possible.

As this housing complex do not have an evolutionary character, the technical information required to carry out extensions were not provided. Nevertheless, the vast majority of residents held expansions in the houses, especially when considering that they do not have a covered laundry area.

House 01

Expansion in the back of the house to create the service area of 17 m². It does not have closure by walls, only the floor and roof were made. The coverage of this area obstructs ventilation and natural lighting in the bedroom B (child) and bathroom.

Figure 140 - Extension – House 01
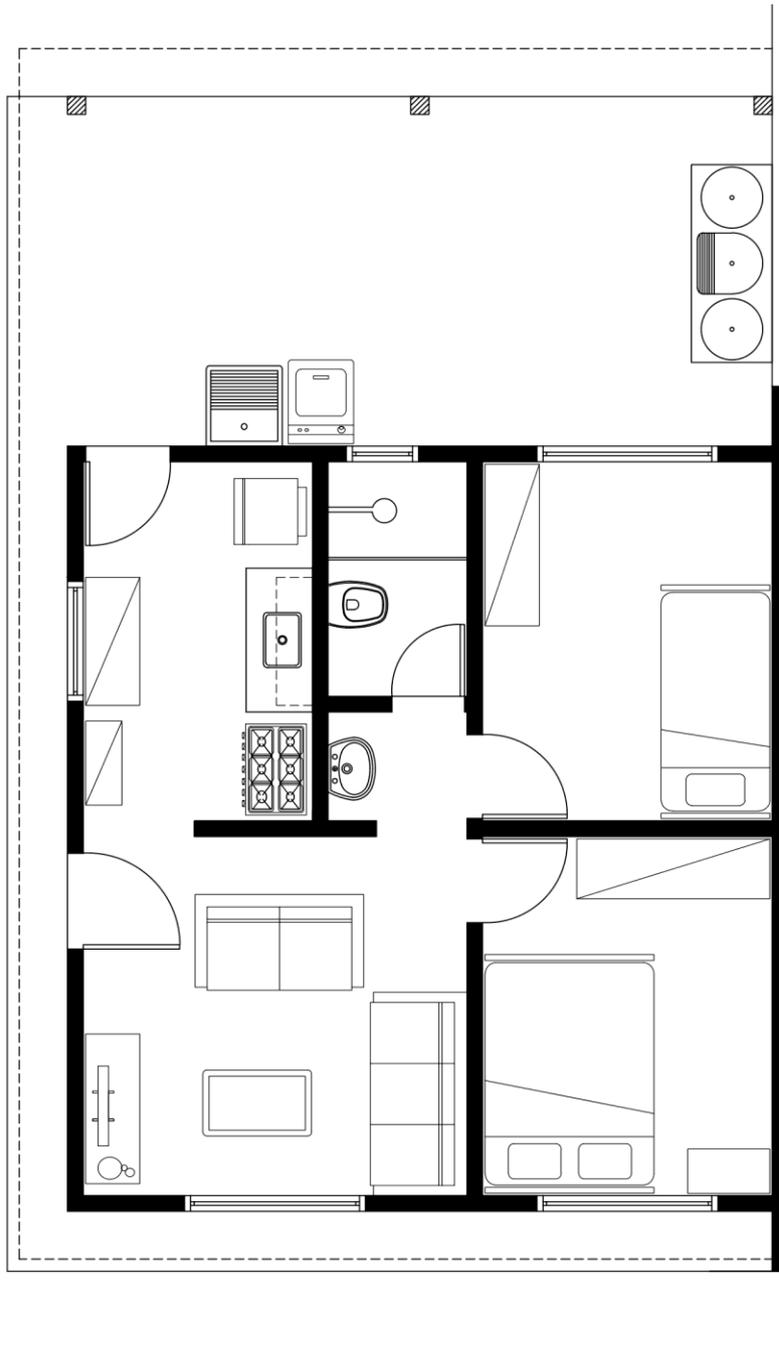
Source: Authors, 2016.

House 02

A floor and cover were made on the right side of the house, between the house and the wall, creating an indoor circulation with an area of 12.8 m². It does not have closure walls between the housing unit and the lot walls. The coverage of this area obstructs ventilation, natural lighting in the kitchen and the living room.

Figure 141 - Extension – House 02
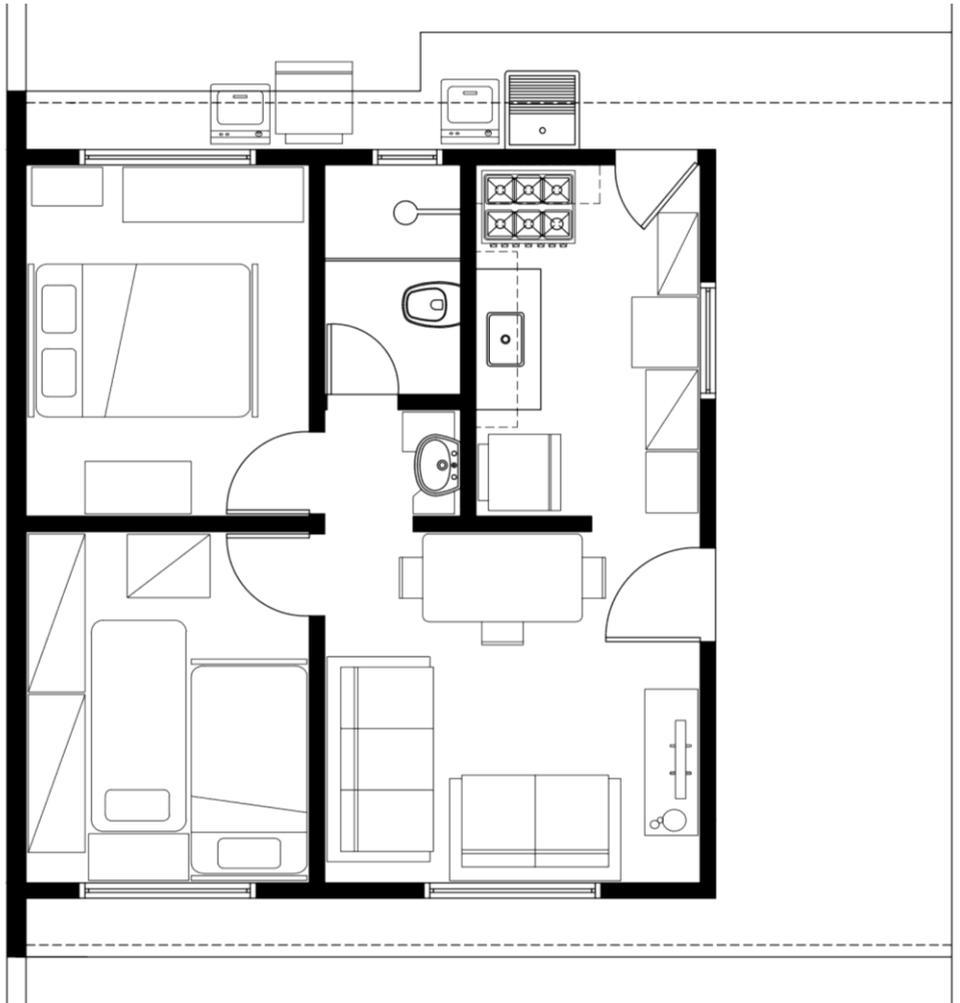
Source: Authors, 2016.

House 03

An extension was made in back of the house to create a bedroom, a bathroom and a space that houses the service area and kitchen, with a total of 26 m². There was the construction of floor and coverage at the side of the house, between the house and the lot limits, creating an indoor circulation with an area of 12.8 m². These extensions obstruct ventilation and natural lighting in the living room, kitchen, bathroom and bedroom B (child).

In addition to the expansions, residents also changed location and type of the window frames. They are also building a second house at the back.

Figure 142 - Extension – House 03
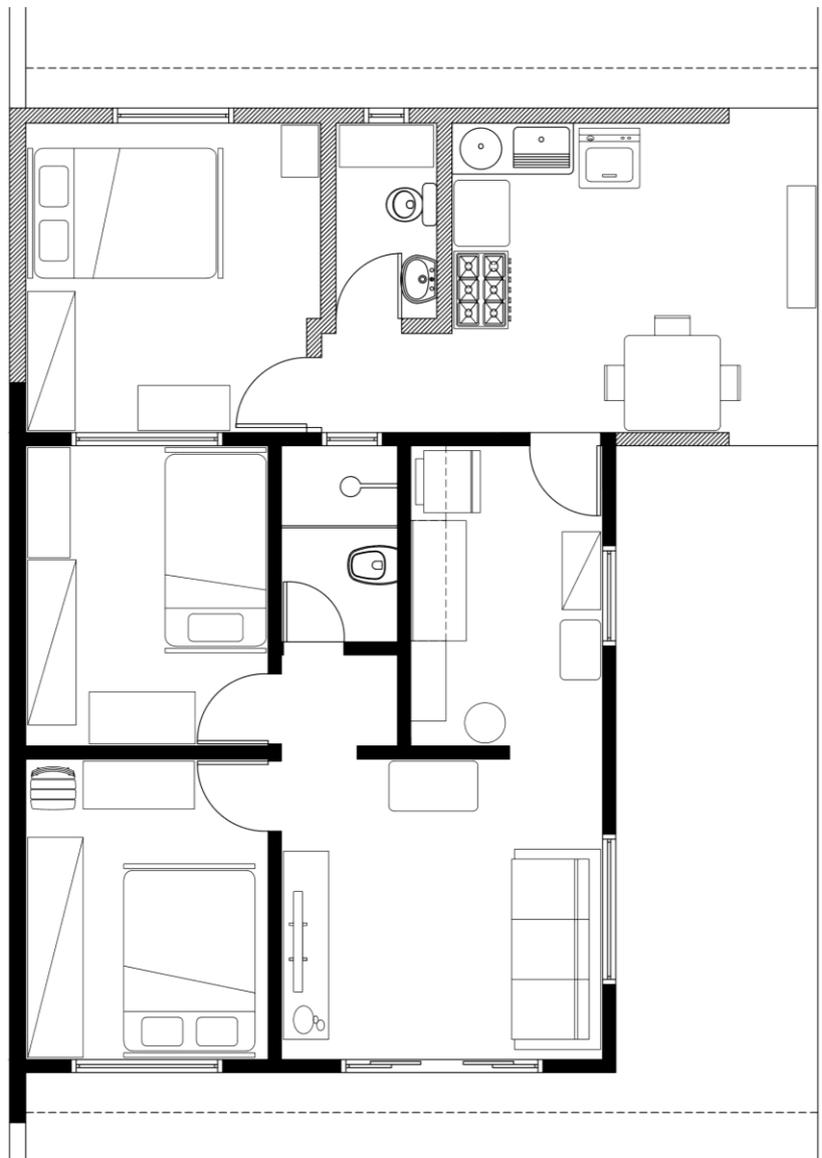
Source: Authors, 2016.

House 04

An expansion was made at the back of the house to create an enclosed space that houses the service area and kitchen, with total area of 24.65 m². This expansion obstructs ventilation and natural lighting in the bedroom B (double). It was also built a commercial property in front of the lot, which also obstructs ventilation and natural lighting in the bedroom A (children). Internally, the size of the bathroom was reduced in order to create access to the service area. It also created a low wall between the kitchen and the living room, and change of the rooms' windows.

Figure 143 - Extension – House 04
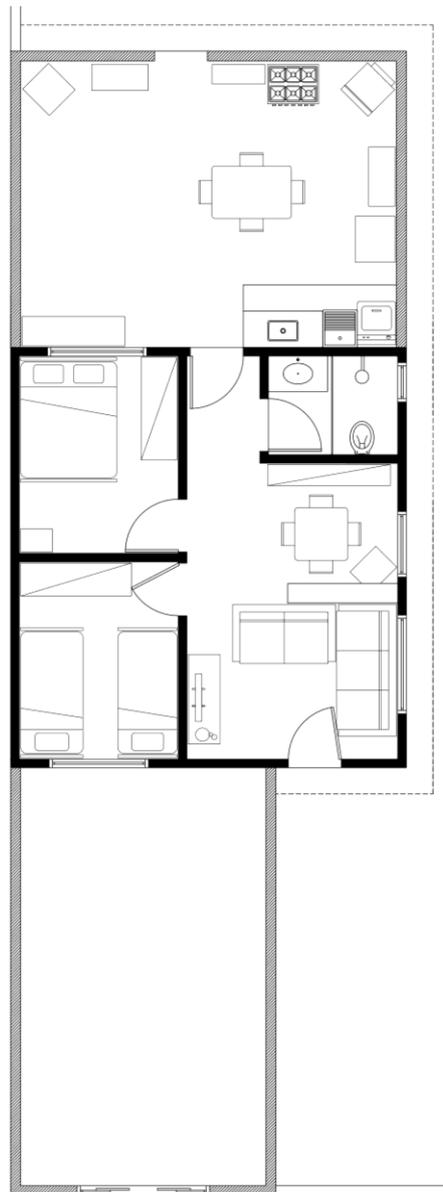
Source: Authors, 2016.

Accessibility

NBR 9050, which regulates the accessibility in buildings, furniture, urban spaces and facilities at a national level, determines technical parameters to be observed regarding the accessibility conditions in the building, and these parameters are listed below:

• Doors and spans with minimum clear width of 80 cm.

• Doors and spans with a minimum height of 210 cm.

• Lever type door handle.

• Door handle at a height between 0.90 m and 1.10 m from the finished floor.

• Adapeted toilets and rooms' doors must have a horizontal handle.

• Handle is at a height of 0.90 m of the shaft floor.

• Handle with length equal to half the width of the door.

• Sanitary Bowls with lateral transfer area, diagonal and perpendicular compatible with the Reference Module that has dimensions of 80 cm x 120 cm.

• Sanitary Basin accessible has 46 cm of the top edge of the finished floor.

• Toilets have horizontal support rails with a length of 80 cm and a height of 75 cm.

• Toilet paper spot built at a height of 50 cm to 60 cm above the finished floor, and 15 cm away from the front edge of the sanitary bowl.

• Sink with frontal approach area for users in wheelchairs.

• Sink has a single-command type, lever or electronic sensor tap commands.

• Sink installed between 78 cm and 80 cm from the floor, relative to its upper face.

• Sink allows headroom of 0.73 m without columns or cabinets, with protection for the syphon and piping.

• Sink has horizontal support bar at a height of 80 cm horizontal.

• Bath mirror has the lower edge at the height of maximum 90 cm from the finished floor.

• Shower box has an external transference area, allowing parallel approach by a person in a wheelchair.

• Contains horizontal support bar with a length of 60 cm and a height of 75 cm and vertical support bar with a length of 70 cm and a height of 75 cm, or an "L" bar of the same minimum dimensions.

• Shower box support bank has minimum dimensions of 70 cm x 45 cm, rounded corners and slip-resistant and waterproof surface.

• The shower has single-command type faucets by a lever.

• The shower taps have a maximum height of 1 m.

• Manual shower located 1 m above the floor.

• Soap and towel racks located between 0.80 m and 1.20 m from the finished floor.

• Maximum floor level difference between the shower box and the rest of the bathroom of 1.5 cm, with slope of 1: 2 (50%).

• Kitchen with minimum clear width of approach of 80 cm.

• Kitchen sink has maximum height of 85 cm from the finished floor.

• Kitchen sink with lower headroom of at least 73 cm.

• The gaps between 0.5 cm and 1.5 cm have bevelled finishing at a ratio of 1: 2.

• Switches and plugs to a maximum height of 1 m from the finished floor.

• Minimum circulation of 90 cm wide

• Dislocation module 90 ° with minimum dimensions of 1.2m x 1.2m.

• Dislocation Module 180 ° with minimum dimensions of 1.2 m x 1.5 m.

• Dislocation Module 360 with minimum dimensions of 1.5 m x 1.5 m

Between the evaluated houses, only house 04 has the adapted house plan for disabled people. However, it was modified by the residents for not having any wheelchair in the family, so the house was analysed according to the current situation.

Within the parameters, the only ones attended are:

• Doors and spans with minimum clear width of 80 cm.

• Doors and spans with a minimum height of 210 cm.

• Lever type door handle.

• Door handle at a height between 0.90 m and 1.10 m from the finished floor.

• Switches and plugs to a maximum height of 1 m from the finished floor.

Natural Ventilation

The Municipal Working Code - Complementary Law No. 524 of 08 April 2011 states:

The internal compartments are not considered sufficiently insulated, illuminated and ventilated when its farthest point of the opening is at a distance equal to or greater than twice the ceiling height.

The ventilation area of the compartments must be of at least 50% (fifty percent) of the illumination area required. So, in rooms for long stay (bedroom, living room and kitchen) the ventilation area should be of at least 1/12 of the floor area, and rooms for short stay (toilet) 1/16 of the floor area.

For insulation, lighting and ventilation, all long stay rooms (bedrooms, living room and kitchen) or short stay ones (toilet) should have direct relation with an open space, free and clear of any type of construction.

Regarding the relationship between the ceiling height and the distance between the opening of ventilation and lighting and the farthest point of the room, in all homes, the norm is attended.

The relationship between the room floor area and the windows area, we see in the table below that the houses with a standard design plan, the kitchen and living room windows' openings for ventilation are insufficient. However, in the adapted house only the bathroom ventilation is insufficient.

Table 15 - Natural ventilation openings

Room	Area (m²)	Natural ventilation	
		Required ventilation area (m²)	Existent ventilation area (m²)
Standard house plan – Houses 01, 02 and 03			
Living room	9,54	0,80	0,67
Kitchen	5,7	0,48	0,43
Bedrooms	7,44	0,62	0,67
Bathroom	2,25	0,14	0,14
Circulation	1,05	-	-
Adapted house plan – House 04			
Living room	7,11	0,59	0,67
Kitchen	4,98	0,42	0,43
Bedrooms	7,18	0,60	0,67
Bathroom	4,77	0,30	0,14
Circulation	2,19	-	-

Source: Authors, 2016.

The lack of openings communicating directly with spaces without cover and clear of any construction is the main ventilation issue because all homes evaluated have been reformed by the residents, creating ventilation obstruction in many rooms, especially in the bathroom and bedroom B, with the creation of a covered laundry area in the house.

Another recurring problem in the houses is the partial obstruction of the ventilation by furniture.

Structure and Sealing

The NBR 15757 determines that the structure should not cause displacement or excessive cracks to construction elements linked to the structural system, taking into account the permanent actions and use actions, nor block the free functioning of elements and components of the building, such as doors, windows, nor affect the building installations.

As for seals, this should limit travel and cracks to acceptable values in order to ensure the free operation of elements and components of the residence. The facades are to be watertight due to incidents from rain or other sources. The inner walls should not allow water infiltration through their faces when in contact with wet areas.

All homes have a constructive system of self-supporting masonry, having both functions as sealing and as structure.

Concerning the cracking, there is little occurrence and in small proportions, not interfering with the operation of any other component of the building. In the house 01 there is only a crack on the outside of the house in the kitchen background. In the house 02, there is a small crack near the ceiling, and a detachment

in the room door around the bedroom B. In house 04, there is a crack in the bedroom B and a crack above the kitchen door.

Regarding infiltration on the facades, there is occurrence only in house 01 of a capillary infiltration.

Referring to infiltration in inner walls, there is no occurrence in any house.

Figure 144 and Figure 145 - Cracks and leaking – House 01

Source: Authors, 2016.

Figure 146 and Figure 147 - Cracks and leaking – House 02

Source: Authors, 2016.

Figure 148 and Figure 149 - Cracks and leaking – House 03

Source: Authors, 2016.

External Window Frames

The NBR 15575 states that the natural lighting of living rooms and bedrooms is provided through doorways or windows. In the case of windows, it is recommended that the height of the sill be positioned at a maximum of 100 cm from the inner tread and the dimension of the headband at a 220 cm maximum span from the inner tread.

According to the Municipal Working Code - Complementary Law No. 524 of April 8, 2011, the area of the openings destined to insulation and lighting of the compartments should be at least 1/6 of the area of long stay rooms and 1/8 area of short stay rooms, and the ventilation openings must be of at least half the area for lighting.

The NBR 10821 specifies the performance requirements for the use of window frames, that they must have: air permeability, water tightness, wind resistance, handling resistance, safety in handling and shading operations of the frames of the bedrooms.

All houses have evaluated have a sill of 120 cm and 220 cm of headroom, therefore not meeting the particular NBR 15575.

Concerning the dimension of the ventilation and lighting openings, we realised tha in the original house plan, the opening area for lighting and ventilation in the kitchen and the bedrooms is insufficient, and as already stated in the natural ventilation item, the opening for ventilation of the bedroom and the kitchen window frames are insufficient.

In the original design of the Adapted house plan, we realized that the area for natural lighting is insufficient in the bedrooms and in the bathroom. However, the residents painted all glassed part of all frames of the house except the bathroom, which further restricts the lighting area. So, according to the current condition, all rooms have sufficient natural lighting. The area for natural ventilation is insufficient only in the bathroom.

Table 16 - Natural ventilation and lighting openings
Source: Authors, 2016.

Room	Área (m²)	Natural lighting		Natural ventilation	
		Existent lighting area (m²)	Existent lighting area (m²)	Existent ventilation area (m²)	Existent ventilation area (m²)
Standard house plan – Houses 01, 02 and 03					
Living room	9,54	1,59	2,37	0,80	**0,67**
Kitchen	5,7	0,95	**0,90**	0,48	**0,43**
Bedrooms	7,44	1,24	**0,67**	0,62	0,67
Bathroom	2,25	0,28	0,30	0,14	0,14
Circulation	1,05	-	-	-	-
Adapted house plan – House 04					
Living room	7,11	1,19	2,37	0,59	0,67
Kitchen	4,98	0,83	0,90	0,42	0,43
Bedrooms	7,18	1,20	**0,67**	0,60	0,67
Bathroom	4,77	0,60	**0,30**	0,30	**0,14**
Circulation	2,19	-	-	-	-

As for the performance described in the NBR 10821 – the air permeability topic, it has not been analysed, since, according to geographical location and climatic conditions, there are no major concerns about the air exchange between the interior and exterior of the house.

Regarding water leaking, no house presented leaks in case of rain. In addition, regarding the resistance to wind loads, no house showed deformation in the window frames. Regarding resistance to handling, only the house 01 had a problem with a broken lock of the living room door. As for security in handling operations also no cases of fall of part of the frame. As for the shading of the frames of the rooms, all houses have Venetian window in the rooms, which allows the shading.

Figure 150 - Lock – House 01

Source: GARREFA, 2016.

Wood Doors

The NBR 15575 specifies that the elements and components of the housing (latches, handles, cremones, guillotines, etc.) must be designed, constructed and assembled so as not to cause injury to users. At the evaluated houses, this parameter is satisfactorily attended.

It was also verified that all rooms have doors properly functioning, and they also have locks, which are in good condition.

Coverage

The NBR 15575 determines that the covers of the buildings must be resistant to wind action, preventing rupture, instability, chunking or damage to any coverage component subject to suction and pressure impacts. It also states that should be sealed against rainwater, preventing the formation of moisture and thus, preventing the proliferation of insects and microorganisms.

No house presented wind resistance problems, but in relation to leaks, all homes have leaks on the roof causing seepage in the walls. The main reason reported by them is the lack or improper sealing of the pierced tiles for the installation of the solar heating system.

Figure 151 - Solar heating system and boiler on the roof – House 01

Source: GARREFA, 2016.

Electrical Installations

The NBR 15575 says that the electrical installations of residential buildings must be designed according to the NBR 5410 and other International Standards applicable, and that special attention should be given to prevent the risk of ignition of materials in short circuit function and overvoltage. It also says that the electrical installations favour the adoption of solutions, case by case, and to minimise energy consumption, including the use of natural lighting and ventilation and alternative energy-based heating systems.

The evaluated houses' electrical system could not be accessed in order to measure the size of the wires and other components according to the demand of each house.

Regarding the use of solutions that minimize power consumption, all housing houses have a solar heating system for heating the shower water, which leads to reduced consumption.

Hydraulic Installations

The NBR 15575 - determines the following requirements to be followed in a hydraulic system:

As for Tightness: present tightness when subjected to pressure expected on the project.

As for the design of cold and hot water installations: the building system of hot and cold water has to provide water pressure, flow and volume compatible with the use associated with each point of use, considering the possibility of simultaneous use.

As for the design of the sewage system: the building of sewage system must collect and remove the flow rates that are usually discharged by the devices without overflow, accumulation in the installation, soil contamination or return of unused devices.

Regarding the use and reuse of water: wastewater from the hydro-sanitary systems should be directed to public collection networks and if there is the availability of these, systems should be used to prevent contamination of the local environment.

For leaks of gases in sewage systems: the sanitary sewer system should be designed so as to not allow a break of the water seal.

The sizing of gutters and conductors: the gutters and drivers must support the expected flow, calculated from the rain intensity adopted for the town and for a certain return period.

From the evaluated houses, the house 04 has a sealing problem in the hot water system, solar heating, with leakage and dripping occurring on the ceiling.

The houses do not have problems with the design of cold water, hot water and sewage systems. There is no rain water system. The water from all houses is directed to the municipal sanitary sewer.

The main problem presented is in regards to the gases leaking and sewage system. The 02,03 and 04 houses have a return of gases in manholes or bathroom.

Consumption

It was verified the average monthly water consumption of the units through its history consumption (6 months) present in the bills from DMAE - Municipal Department of Water and Wastewater, it was also made the consumption/inhabitant in each residence, as shown below.

Graph 12 - Water consumption graphic

Average Water Consumption
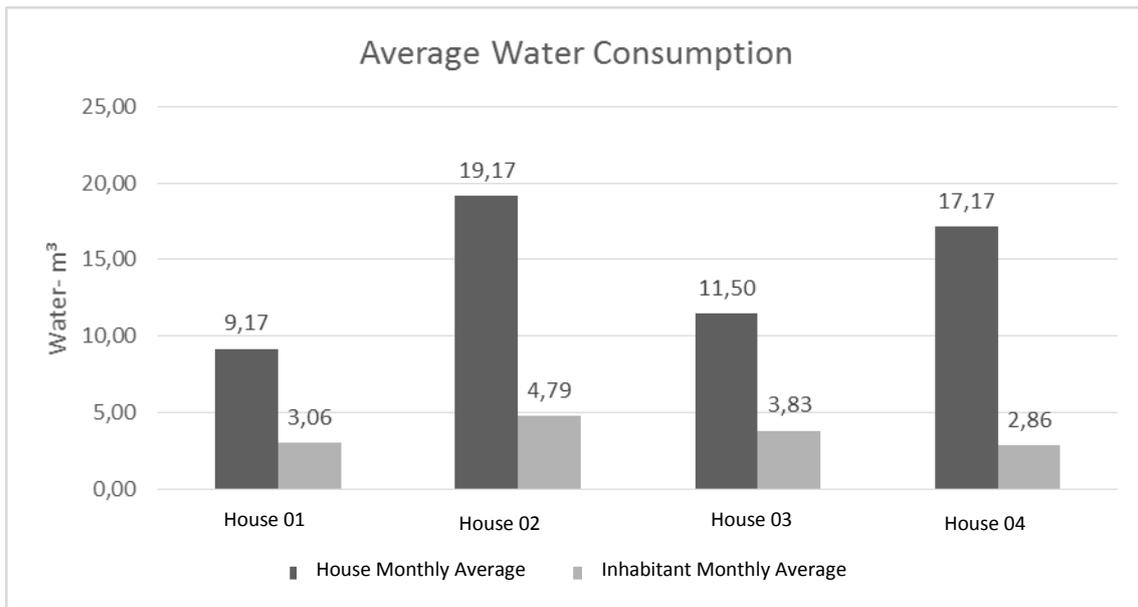
Source: DMAE, 2016.

We listed all electrical and electronic equipment existing in each unit, with its power (W) and monthly usage time. Thus, it was made a monthly consumption forecast in kW/h. We identified the average monthly electricity consumption of each unit through its history consumption (12 months) present in bills from CEMIG – Energy Company from Minas Gerais, along with average consumption/inhabitant.

Graph 13 - Eletricity consumption graphic

Average Electricity Consumption
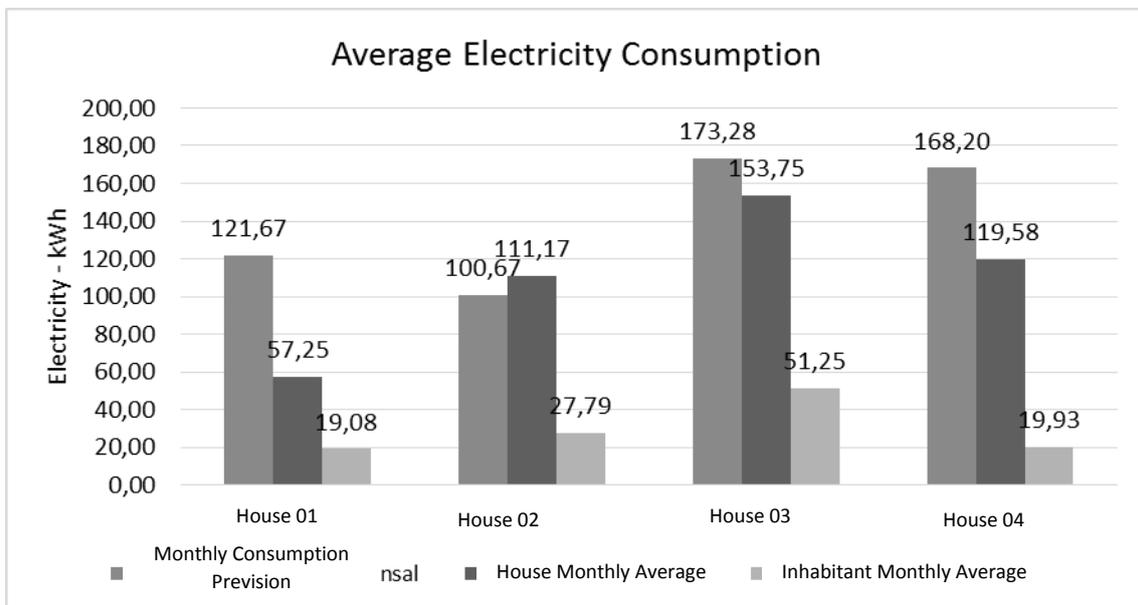
Source: CEMIG, 2016.

Tabletops, hydraulic parts, metal

The NBR 15575 determines that utilised parts, including manoeuvring records, must have steering wheels or devices with shape and dimensions that can provide torque or operating force in accordance with the rules of each product specifications, and are free of burrs, roughness or protrusions that might cause injury.

Evaluated houses have no malfunction or ergonomic problems in the crockery, metal and hydraulic parts.

Painting

All houses in the complex were properly delivered with internal and external painting.

Vertical and horizontal coatings

The NBR 15575 determines the parameters that the floors and walls must meet:

For leaks: flooring systems must be tight against rising moisture, considering the maximum height of the water table expected to exist on the construction site. The wet areas of flooring systems should prevent the passage of moisture to the other constructive components of the house.

Resistance to moisture: withstand exposure to moisture, in normal use conditions, without deterioration in its properties that can compromise their use.

Chemical resistance: withstand exposure to chemical agents commonly used in the unit or present in household cleaning products.

Mechanical resistance: withstand the mechanical stresses associated with the normal use conditions for each specific environment.

All houses were delivered with ceramic coating only in the bathroom and kitchen, the bedrooms and living room only had mortar subfloor, and some residents bought and set ceramic tile floors in these rooms on their own. Later, *Caixa Econômica Federal* (CEF) – Federal Bank, provided the ceramic floor for the residents who had not yet purchased them. There were also levelling floor problems in some homes, being some repaired by the residents themselves and others by the CEF.

The current condition of the floors and coatings was evaluated.

The evaluated houses do not show any evidence of sealing problems on floors and walls.

There is a problem with the floor resistance in the bathroom and the kitchen of house 01, due to its porous character and presence of many visual spots.

It is also observed floor levelling problem in the bathroom of the house 04, and floor and coating detachment the houses 01 and 04, problems caused by poor constructive execution.

Figure 152 and Figure 153 - Kitchen floor and Bath floor – House 01

Source: GARREFA, 2016.

Figure 154 – and Figure 155 - Coating Detachment – House 01 e Floor Detachment – House 04
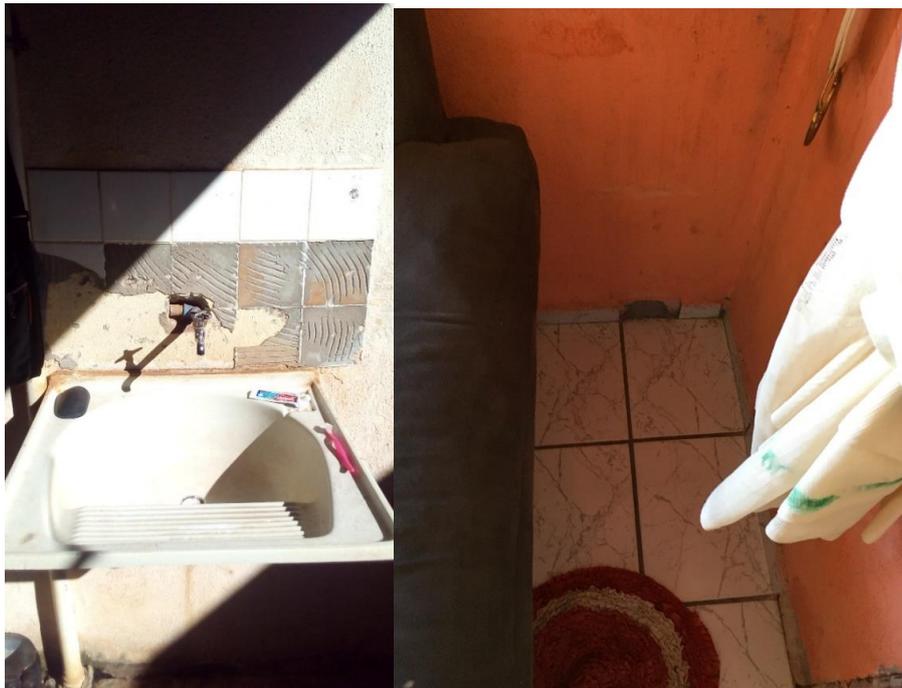
Source: GARREFA, 2016.

Solar Heating System

In the solar heating system evaluation, the houses were analysed through the following items:

Heating enough water for the use of all residents throughout the day.

Heating water to an adequate temperature for the bath.

Hot water tap mixer is located on the left side of the shower box.

In all evaluated houses, the system was considered satisfactory for all items assessed.

Privacy between neighbours

The Municipal Working Code - Complementary Law No. 524 of April 8, 2011, states that the terraced houses should have for each housing unit, a minimum free private area of 11,50m², with a minimum size of 1,50m.

NBR 15575 determines that in the soundproofing performance, the average standardised difference level, DnT,w, between terraced housing units, where at least one of the shared wall's room is a bedroom, must be ≥45 dB.

All evaluated homes meet the minimum private area, being the smallest area of 87,7 m².

Residents of all evaluated homes reported a lack of sound privacy from their neighbours, due to the terraced houses. The acoustic evaluation of the units will be held later, where it will be possible to verify the acoustic performance of the shared walls.

Hygiene and cleaning conditions

The NBR 15575 specifies the hygiene parameters that must be met in the building:

The biological contamination of the water in the system of drinkable water: all apparent installation components should be made of a washable and waterproof material to prevent permeation of dirt or bacteria growth, or even biological activity.

The contamination of drinking water from the building system: the buried facilities system components must be protected against the entry of animals or foreign bodies and liquids that can contaminate drinking water.

For gases leaks in the sewage system: the sanitary sewer system should be designed in order to not allow a break of the water seal.

At the evaluated houses, there were no reports of water contamination. However, as already stated under "Hydraulic systems", there is gas return from the sewage system gases in houses 02,03 and 04.

This requirement also considered the floor's state, which as explained in "vertical and horizontal Coatings" presents porosity and stains in the kitchen and in the bathroom of house 01, and incorrect floor levelling in the bathroom of house 04, which causes water puddling. These factors compromise the hygiene and cleaning of the property.

3.1.3.4. Performance Analysis

Thermal Performance

The thermal performance of the houses was evaluated according to the criteria of NBR 15575-1, which established the levels of performance for temperature measurement in typical summer days and typical winter days in some cities according to 8 Bioclimatic Zones in NBR 15220-3.

According to the standard, when evaluating the performance of buildings, the analysis should be performed on a typical summer day or typical of winter. This typical day is characterized by the external temperature of the cities listed at the tables A.2 and A.3 of annex A of NBR 15575-1. The norm indicates that for cities that are not included in the tables, it should be taken as the typical day of the nearest city that is in the same bioclimatic zone, and that has altitude with the same order of magnitude. According to NBR 15220-3, Uberlândia-MG belongs to the Bioclimatic Zone 4 and since the city is not included in the tables in annex A of

the Norm, the typical day of the city of Brasília - DF was used, according to table A.2 of the Norm, presenting maximum daily temperature of 31,2 ºC in the typical day of summer. Therefore, to make the measurements of the internal temperatures of the houses, December 07th was selected, because it had a temperature close to 31.9 ºC.

The external temperatures recorded by the climatological station of Uberlândia were collected on the website of the National Institute of Meteorology (INMET). The internal temperatures were collected instantaneously, during the day that presented the highest external temperatures, between 4 and 6 pm. The measurements were made in the centre of the rooms of the houses, at an height of 120 cm. The values were recorded in a form and later the difference between internal and external temperature was calculated, as we see below in Frame 21.

Frame 21 – Thermal performance evaluation

Thermal Performance Evaluation					
Evaluated Units		**Internal Data**		**External Data**	
House 01 - n°65		Time:	17:57	Time:	18:00
Room:	Living room	Ti, max	34,8 ºC	Te, Max:	31,9 ºC
Opening direction:	W	RH%:	58,60%	RH%:	38%
External walls direction:	W / N	Vel. Vento:	0,9 m/s	Vel. Vento:	1.7 m/s
		Ti, max - Te, max		**2,9 ºC**	
House 02 - n°860		Time:	16:45	Time:	17:00
Room:	Living room	Ti, max	32,9 ºC	Te, Max:	31,7 ºC
Opening direction:	S	RH%:	53,20%	RH%:	39%
External walls direction:	W / S	Wind speed:	0,11 m/s	Wind speed:	2,5 m/s
		Ti, max - Te, max		**1,2 ºC**	
House 03 - n°		Time:	17:15	Time:	17:00
Room:	Living room	Ti, max	32,4 ºC	Te, Max:	31,7 ºC
Opening direction:	N	RH%:	57,50%	RH %:	39%
External walls direction:	E / N	Wind speed:	0,1 m/s	Wind speed:	2,5 m/s
		Ti, max - Te, max		**0,7 ºC**	
House 04 - n°625		Time:	16:18	Time:	16:00
Room:	Living room	Ti, max	33 ºC	Te, Max:	30,7 ºC
Opening direction:	W	RH %:	54,60%	UR RH	41%
External walls direction:	W / N	Wind speed:	0,13 m/s	Wind speed:	2,9 m/s
		Ti, max - Te, max		2,3 ºC	

Source: Authors, 2016.

The NBR 15575-1 establishes performance levels regarding the internal and external temperature difference in each bioclimatic zone, according to Frame 22.

Frame 22 – Thermal performance levels

Performance Level	Criterion	
	Zones 1 to 7	Zone 8
M	Ti,max ≤ Te,max	Ti,max ≤ Te,max
I	Ti,max ≤ (Te,max – 2° C)	Ti,max ≤ (Te,max – 1o C)
S	Ti,max ≤ (Te,max – 4°C)	Ti,max ≤ (Te,max – 2o C) and Ti,min ≤ (Te,min + 1o C)

Source: NBR 15575-1, 2013. Edited by authors, 2016.

What we observe is that none of the houses evaluated meet the minimum performance, which predicts internal temperature less or equal to external temperature. On the contrary, all houses had internal temperature greater than external, and the houses with lower performance are those that the room has the the window wall facing west and another wall facing north.

Light Performance

The analysis of the natural light performance was performed in all rooms of the four houses, using two luximeters. The illuminance (lux) was measured inside each room, placing the luxmeter in the center of the room at a height of 75 cm, with doors and windows open and unhindered by curtains. Simultaneously with each measurement inside the rooms, the illuminance was measured at the exterior of the house in a shaded location near the environment in question.

The measured values were recorded in a form and with these values, the Daylight Factor of each environment was calculated, which is the percentage of diffuse light from the exterior that reaches the interior of the environment. The index is expressed by the equation FLD = (Ei / Ee) x100, where Ei is the internal illuminance and Ee is the external illuminance. In Frame 23 the illuminance of each room is expressed as well as its FLD.

Frame 23 – Light performance

Light Performance								
	House 01		House 02		House 03		House 04	
Rooms Original House	illuminance - Lux	FLD %	illuminance - Lux	FLD %	illuminance - Lux	FLD %	illuminance - Lux	FLD %
Living Room	4600	65,34	847	10,87	150	2,58	860	3,61
Bedroom 01	836	11,24	704	9,78	258	6,00	24	0,11
Bedroom 02	18,7	0,48	2,0	0,03	5,7	0,09	43,0	0,33
Kitchen	455	12,33	155	2,58	27	0,44	-	-
Bathroom	48	1,18	42	0,64	7	0,10	50	0,30
Rooms Extension	illuminance - Lux	FLD %	illuminance - Lux	FLD %	illuminance - Lux	FLD %	illuminance - Lux	FLD %
Bedroom 03	-	-	-	-	78,5	1,64	-	-
Kitchen 02	-	-	-	-	428	6,83	182	1,38
Bathroom 02	-	-	-	-	607	9,03	-	-

Source: Authors, 2016.

The NBR 15575-1 establishes the levels of light performance both in relation to the illuminance within each environment and the FLD of the same, as presented in Frame 24.

Frame 24 – Light performance levels

Room	Performance level – Illuminance and FLD					
	M		I		S	
	Lux	FLD %	Lux	FLD	Lux	FLD
Living Room; Bedroom; Dinning room / kitchen; Service area.	≥ 60	≥ 0,50	≥ 90	≥ 0,65	≥ 120	≥ 0,75
Bathroom; Inner corridor or stairway to unit; Common use corridor (buildings); Common staircase (buildings); Garages/Parking lots	Not required	Not required	≥ 30	≥ 0,25	≥ 45	≥ 0,35
M - Minimum I - Intermediary S – Superior						

Source: NBR 15575-1, 2013. Edited by authors, 2016.

Based on these data we realize that the environments that do not meet the minimum level of performance are, room 02 of all houses, kitchen of house 03 and room 01 of house 04. All these environments are adjacent to extensions built or under construction, carried out by the residents themselves.

Acoustic Performance

The houses selected to perform the acoustic measurements do not coincide with the houses where the other evaluations of this tool were applied, because it is necessary to measure two neighbouring houses, since it is the acoustical comfort between terraced houses. In only one of the houses used in the walkthrough the neighbouring house was available for the measurement. Therefore, we searched for two other houses available for the pair measurement. One of the pairs selected was of special importance for comparison purposes, since the wall between the two houses had already been elevated, completely separating the roof, unlike in the original houses where the roof is shared, and where the technical team assumed that the noises were spreading from.

Figure 156 – Map of houses evaluated

Legend : ▮ Noise-emitting house   ▮ Noise Receiving House
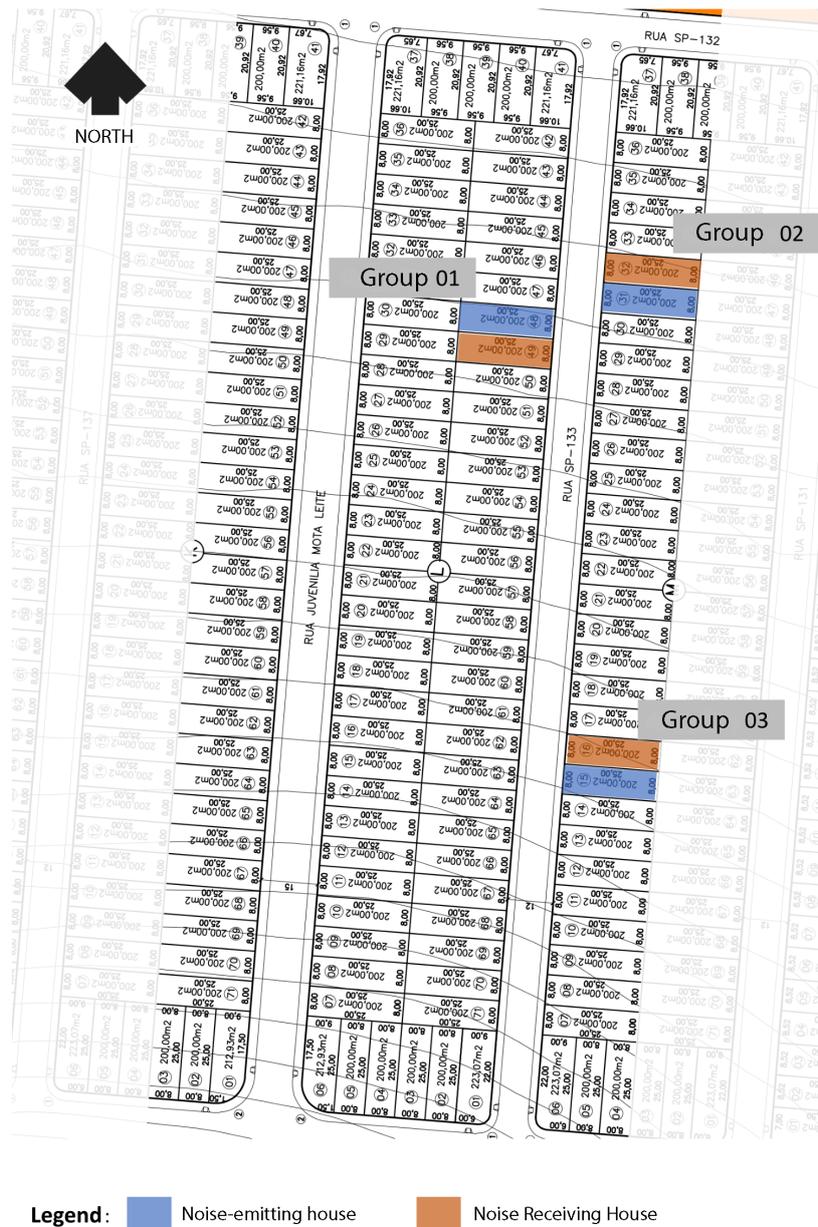
Source: Authors, 2016.

To verify the noise level that is transmitted between the semi-detached houses these have been classified as noise-producing house and noise-receiving house. In the emitting house, two rooms were selected to make noise: one of the rooms, because they have the common wall with the neighbouring house, and the kitchen, whose location is the furthest from the neighbouring house. In the emitting houses a sound box was placed in the center of the selected room, positioned at an average height of 50 cm, facing towards the neighbouring house. Two types of verification were made: qualitative and quantitative. For qualitative verification of the perception of the sound was emitted audio of a speech to simulate the human speech aloud. Measurements were made with the decibel meter, always at a minimum distance of 50 cm from the walls and at a height of 120 cm, to check the noise level inside the room with doors and windows closed. The volume of the sound box was the same for all Emissions, where the emitted internal noise level ranged from 74 to 95 decibels.

For quantitative measurement the sound box was kept in the same location and with the same volume, emitting the sound of a concrete mixer in operation, being a sound more constant than the speech, because it does not have large peaks of noise or pauses. Measurements were also made with the decibelimeter to verify the average internal noise level, and this noise also ranged from 74 to 95 decibels.

In the receiving houses, for the qualitative evaluation, the perception of one of the evaluators regarding the level of intelligibility of the speech that was emitted in the neighbouring house was verified, and classified as not audible, audible/do not understand, audible/understands with difficulty and clearly audible . In the quantitative evaluation, two measurements of the noise level were made in the center of all rooms, with one decibel meter at a height of 120 cm, with windows and doors closed. First, a measurement with the environment in silence, without noise emission from the neighbouring house, and subsequently a measurement during the emission of noise in the neighbouring house to verify how much noise the house was transmitting to them.

Therefore, in each room of the receiving house, 2 qualitative evaluations (emission of one-room and kitchen noise) and 2 quantitative measurements (noise emission of a room and of the kitchen) were made, along with 1 measurement without emission of noise, totaling 25 measurements/evaluations in each receiving house. The data was manually recorded on a form and tabulated later.

The results obtained in the qualitative evaluation are presented in Frame 25, where we observed a higher performance of house 03.

Frame 25 – Qualitative acoustic performance

Qualitative Evaluation – Speech Perception						
Receiving room	House 01		House 02		House 03	
	Emission Bedroom 01	Emission Kitchen	Emission Bedroom 02	Emission Kitchen	Emission Bedroom 01	Emission Kitchen
Living Room	Audible/ Understands with difficulty	Audible/ Understands with difficulty	Audible/ Understands with difficulty	Audible/ Do not understand	Audible/ Do not understand	Not audible
Bedroom 01	**Clearly audible**	Clearly audible	Clearly audible	Audible/ Understands with difficulty	**Audible/ Understands with difficulty**	Not audible
Bedroom 02	Clearly audible	Clearly audible	**Clearly audible**	Audible/ Do not understand	Audible/ Understands with difficulty	Not audible
Bathroom	Audible/ Understands with difficulty	Audible/ Understands with difficulty	Audible/ Understands with difficulty	Audible/ Do not understand	Not audible	Not audible
Kitchen	Audible/ Understands with difficulty	Audible/ Understands with difficulty	Audible/ Understands with difficulty	Audible/ Do not understand	Audible/ Do not understand	Not audible

Source: Authors, 2016.

NBR 15575-4, relates the degree of high speech intelligibility among adjacente environments to the degree of isolation between them, as shown in Frame 26.

Frame 26 – Degree of isolation between adjacent environments according to qualitative acoustic performance

High speech intelligibility in the adjacent enclosure	Sound Insulation, DnT,w [dB]
Clearly audible: listen and understands	35
Audible: listen, understands with difficulty	40
Audible: does not understand	45
Not audible	≥50

Source: NBR 15575-1, 2013. Edited by authors, 2016.

Therefore, considering the intelligibility between adjacent environments in the three houses evaluated we have: house 01 (where the adjacent environments are bedroom 01 and bedroom 02), and house 02 (where adjacent rooms are bedroom 02 and bedroom 02). In both, speech is considered as clearly audible, therefore an estimated value of isolation between the environments of 35 dB. In the case of house 03 where the adjacent environments are bedroom 01 and bedroom 01, the speech is considered as audible/understands with difficulty, therefore the degree of isolation Is 40 dB.

In the quantitative evaluations, Frame 27, we observed that when sound is emitted from a quarter, house 03 performs better than other houses, and house 02 performs much lower. On the other hand, in the emission from the kitchen the house 01 presents better result.

Frame 27 – Quantitative acoustic performance

Quantitative Evaluation - Sound Level Difference Between Environments in dBA						
Receiving room	House 01		House 02		House 03	
	Emission Bedroom 01	Emission Kitchen	Emission Qu Bedroom 02	Emission Kitchen	Emission Bedroom 01	Emission Kitchen
Living room	42,50	52,05	25,55	45,90	43,10	45,55
Bedroom 01	39,70	48,70	27,65	46,05	46,95	47,60
Bedroom 02	37,25	51,15	30,15	46,20	46,95	47,25
Bathroom	39,95	50,35	31,10	45,20	48,40	48,95
Kitchen	43,70	52,80	32,00	45,30	45,05	45,90

Source: Authors, 2016.

The NBR 15575-4 presents a table with the limits of the level difference weighted among environments, DnT, w, for dividing elements of specific environments. Frame 28 shows the values for shared walls between bedrooms, which is the case for houses evaluated.

Frame 28 – Levels of acoustic performance

Element	DnT,w [dB]	Performance Level
Wall between autonomous housing units (twinning wall), in the case where at least one of the environments is a dormitory	45 a 49	M
	50 a 55	I
	≥ 55	S
M – Minimum I- Intermediary S- Superior		

Source: NBR 15575-1, 2013. Edited by authors, 2016.

Based on the results obtained between adjacent rooms evaluated in the three houses, we have a sound level difference of 39.7 dBA in house 01, 30.15 dBA in house 02 and 46.95 dBA in house 03. House 03 is the only

one that meets the minimum performance level, which confirms the superior performance of house 03 compared to the other two.

3.1.4. CONCLUSION:

Only 25.75% of the study area is in contact with the urban perimeter, which is considered insufficient for the neighborhood to be classified as 'inserted in the city'. Along with this condition of insertion in the city, public transportation is also classified as insufficient, for the neighborhood is served by 4 bus lines. Besides, the number of itineraries, as well as the interval between journeys, that reach up to 105 minutes, do not agree with the recommendations. In this context, the waiting time at the bus stop is long, and only a few points are sheltered from the weather conditions. Therefore, there is a need for quality in public transportation and a need to install shelter at bus stops.

Regarding the equipment of the neighborhood, the quantity and location of service and commercial establishments is considered acceptable. The amount of educational and health equipment is sufficient and they have acceptable distance, based on the center of the study area as a reference, but this maximum distance is not attended when the houses that are farther south of the neighborhood are taken as a base. The leisure and cultural equipment are considered as satisfactory since they are all installed in the Center of Arts and Unified Sports (CEU), which is in a place of easy access. However, there is a scarcity of shaded areas and furniture, which results in a low use of this area. The implantation of furniture could increase the usage potentioal of CEU. The amount of public green areas, 21.05 m² / inhab, is considered sufficient, but the vast majority of leisure spaces are not yet consolidated, becoming critical points of accumulation of garbage and rubble, and of increasing insecurity in the neighborhood.

Regarding the streets and sidewalks, it was possible to notice the need to install light signaling and pedestrian strip in a cross of intense flow. Of the evaluated sidewalks, 54% have at least some type of obstruction, either by vegetation, trash, rubble or ramps, as well as poor quality or lack of pavement and insufficient width, therefore, free pedestrian circulation is not possible. The sidewalks are also not accessible to wheelers or persons with reduced mobility.

Regarding the lot, the permeable areas of 50% of the houses evaluated do not agree with the requirements of municipal legislation, which is at least 20% of the total area of the lot. The other 50% have larger permeable area than required and they use this area to produce fruits and vegetables. The low permeability rate can be associated with the ease of cleaning. The residents should be aware of the importance of maintaining the green areas of the lot. They should also be able to transform these spaces into orchards and gardens. Regarding hygiene and cleanliness, 75% of the lots present accumulation of some residue or construction material.

As for the dimensioning of the unit, the project of the house model agrees with the minimum area required by the PMCMV which is 32 m², however the accessible house does not meet the minimum of 36 m². Both have 33.4 m². In 100% of the homes, the useful area of the rooms at the original project is insufficient to provide basic furniture that covers all essential domestic activities. There is no space for the use of existing furniture and for circulation. The insufficiency of space is reaffirmed because 100% of the houses have expansion carried out by the residents. In all houses only fixed furniture are used, which do not present dimensional and usage flexibility. It is possible to predict furniture design that allows this flexibility, and that can be made by the residents to better adapt and reduce space.

Regarding the natural lighting of the rooms, in rooms 02, the lighting is below the minimum performance in 100% of the houses. 25% of the rooms 01 and 25% of the kitchens also do not meet the minimum required. This is one of the problems caused by the enlargements, which are done by the residents, without the advice of a professional, which also cause obstruction of natural ventilation and possible structural problems. Regarding thermal performance, 100% houses had internal temperature higher

than the external temperature in a day with typical summer characteristics, while the minimum performance is that the internal temperature is less or equal to the external. Three sets of houses were evaluated for the acoustic performance of the shared wall, and only one had the minimum level of performance. However, in this set of houses, the residents erected the conjugated wall up to the ridge. So, this can be one of the alternatives to at least ease the lack of acoustic privacy between neighbors.

Regarding the installations, the main problem was the return of gases in the sewage system in 75% of the houses. As for the coverage, 100% of the houses present leak in the roof, next to the system of solar heating, that causes infiltrations in internal walls.

3.2 QUESTIONNARIE

3.2.1 GENERAL INFORMATION

DATE OF APPLICATIONS: 5th to 11th of July 2016
RESEARCHERS: Professor - Dr Simone Barbosa Villa, Professor - Dr Fernando Garrefa, Master's Student - Juliana Silva Arantes, Master's Student - Karen C. Ruman de Bortoli, Undergraduate Student - Aline Rodrigues, Undergraduate Student - Paula Vasconcellos, Undergraduate Student - Vanessa Campelo
LOCATION: The questionnaires were applied in 40 residences in one block located at Shopping Park's Neighbourhood, Uberlândia city, Minas Gerais state in Brazil. In order to facilitate the questionnaires' application, the four streets were considered in two groups, group A (Juvenilia Mota Leite St. and Wilson José de Souza St.) and B (Floriza Miranda Pereira St. and Antônio Carlos Martins Ribeiro St.), as it is shown below.

Figure 157 - Location of the Study Area.
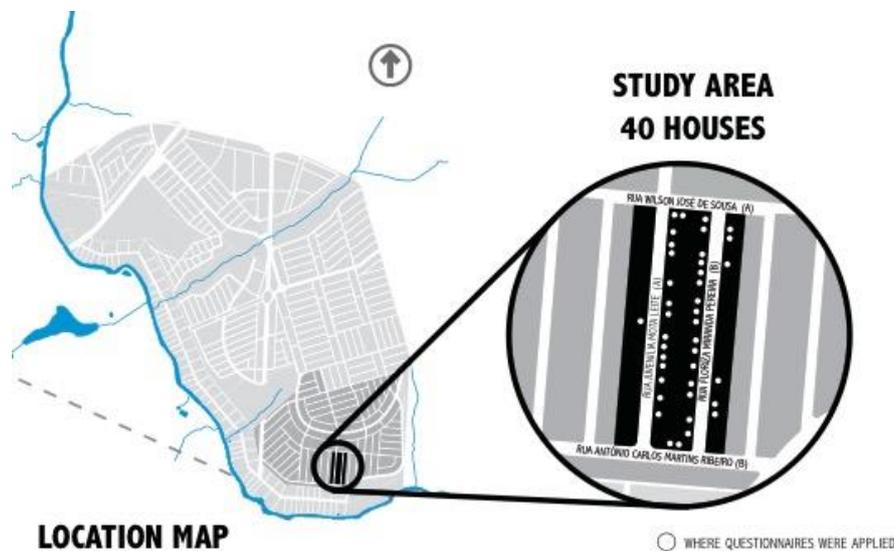
Source: Authors, 2016.

Figure 158 - Houses where the questionnaire was applied.
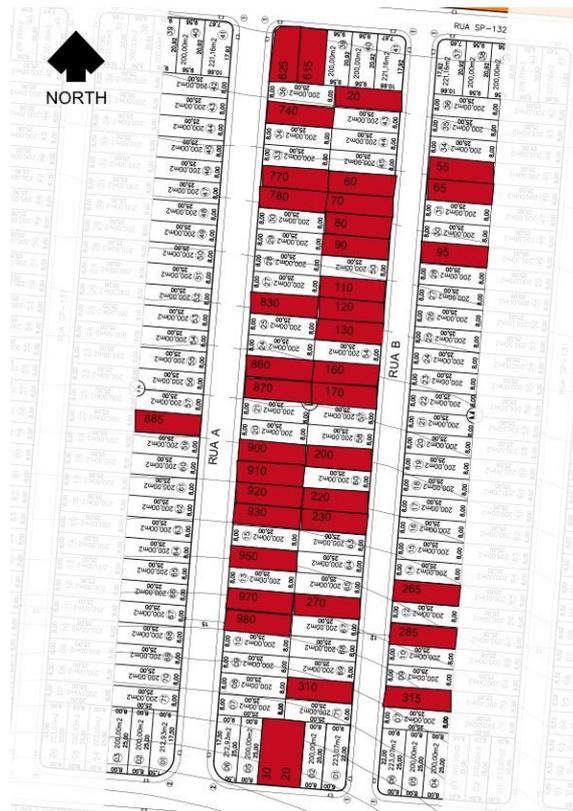
Source: Authors, 2016.

3.2.2. DEFINITION & PURPOSE

The questionnaire (survey) is a quantitative method that seeks to collect data from a series of questions answered by users. Kowaltowski et al. (2013) agrees it is a very recommended method when there are a varied number of people involved in an evaluation process, such as this case study. It is also considered a relatively inexpensive method, which has to combine statistical analysis with the data analysis - tabulation of results. According to Rheingantz et al. (2009), the main advantages of the use of questionnaires are: quick method; possibility to work with a larger group of respondents and/or vast areas; impartial answer, which means anonymity allowing safety and a great freedom of response; and greater uniformity in the evaluation. However, it also has some disadvantages, such as the generalisation of responses, which can skip an exception case that might be interesting. It is important to highlight that the questionnaire in this study is part of the post-occupancy evaluation, which is the process of evaluating buildings in a systematic and rigorous manner after the dwellings have been built and occupied for some time. Therefore, the main purpose of the questionnaire of this case study is identifying information of the population's characteristics and the satisfactory level of residents regarding their home and the neighbourhood.

Frame 29 - Aspects to be assessed in the questionnaire

QUESTIONNAIRE	
ASPECTS	QUESTION
Pollution / Waste	How do you behave on waste in your neighbourhood?
Construction system and materials	What are the main constructive pathologies of your home?
	Do you like the materials used in your home?
	Can you find in your neighbourhood the materials used in your home?
Maintenance	How do you assess the maintenance of your home?
	What are the problems?
Internal layout -	How do you perform the activities in your home?

functionality	(to sleep, to cook, to feed, work, stock, to relax, socialise, live together, sanitise, to exercise, etc).
	Do you have adequate furniture and equipment for your home needs?
	Which furniture would you like to have in your home?
Adaptation refurbshiment	How do you adapt your house to the needs of your family?
	What types of reforms were made?
	Evaluate the ease / difficulty to reform your home. Why?
	How do you think your home could be?
	How do you improve your home for income generation?
Adaptation for commerce	What income-generating activity is done in your home? How to adapt the space for it?
Confort	Your home is: TEMPERATURE (winter / summer / night / day). Indicate the extremes rooms.
	HUMIDITY. Indicate the extremes rooms
	NATURAL LIGHTING. Indicate the extremes rooms
	NOISE (internal, external). Indicate the extremes rooms
	What you greater cause discomfort in your home? Why?
Privacy	What does privacy mean to you? Do you have privacy in your home? How?
	Do you have privacy in relation to your neighbours? How?
Previous housing	Assess your previous housing: kind, size, construction quality, comfort, location, cost, maintenance
Social facilities	Evaluate your neighbourhood on the following facilities: leisure, sport, culture, safety, security.
	What do you miss most in your neighbourhood?
Infrastructure	Lack of (water, electricity, garbage collection) in the neighbourhood.
	Do you have access to phone, internet, cable TV?
	Are there proper sidewalks in the neighbourhood? Are they accessible? Are the streets paved?
	Are the streets well signposted?
Transport	Evaluate your level of satisfaction with public transport offered in your neighbourhood. Quantity, route, schedule and quality of service. Indicate which means of transportation you use the most and the situation. What was the reason for choosing this means of transport?
Violence	How is the security in the neighbourhood?
Food (agrocity)	Do you produce any kind of food at home?
	Do you use to eat food from the community garden? Why do you consume it? ... Health, price or other.
Income	What is your household income?
Demographics	Population by age band Family composition
Social-economic	Family income, line of work, number of people working per household
	What is your family income?
	What is your families line work?
	How many people in your family are currently working
Education	What is the level of schooling of each family member?
Health	Perceiving of Healthcare – what is your level of satisfaction with healthcare in the neighbourhood?
	How long does it take to schedule a medical appointment?
	What is the distance from your house to the health station?
Telecommunications	Do you have a smartphone?
	What do you use it for? Just speaking, connecting to the internet
	Dou you use the social media? (Which)?

Source: Authors, 2016.

3.2.3. APPLICATION

The questionnaire was applied from 5th to 11th of July 2016. The researchers were divided into pairs and each group approached the dwellers in their own places, which was an interesting fact because they could observe the houses during the application. Even though each application took about 30 to 50 minutes, most of the residents were very receptive and collaborated well with the research, including extra comments. In total, the researchers applied the questionnaires in 40 houses located in an allotment of 200 houses, which means only 20% of the whole community. In order to facilitate the application and also the processing of data's results, it was decided to use the e-tablet as the main tool. Moreover, its use avoided some problems such as impossibility to apply it with children and illiterate; low rates of return of the questionnaires and/or high rates unanswered questions; failure to clarify doubts and misunderstandings of the respondents; risk prior reading of questions and then influence the answers; and the possibility of another person (which is not the dweller) fill it; which are all common in the application of questionnaires on paper. However, it is important to remember that the way that the questions were read to the users may have influenced their answers.

The questionnaire was organised in five main aspects: family's characteristics, surrounding' characteristics (neighbourhood), allotments' characteristics, housing' characteristics and finally, energy efficiency and sustainability.

Figure 159 - Scales Approach.
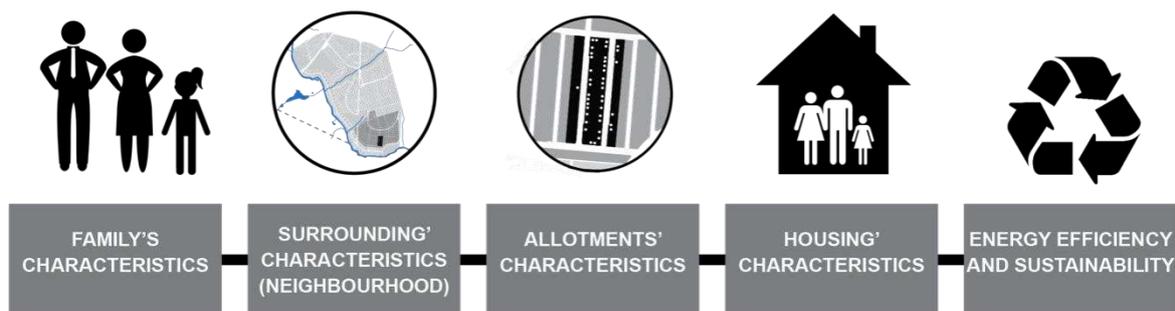
Source - Authors, 2016.

It is important to clarify that the questionnaire was developed with closed questions. In the majority of them, it was used the Likert scale of satisfaction, which means five answers options from very satisfied to very unsatisfied, including average as 'partially satisfied'.

Figure 160 - Example of Scale of Satisfaction.

Source: Authors, 2016.

3.2.4. RESULTS

3.2.4.1. FAMILY'S CHARACTERISTICS

Note: In this part, the results will be illustrated through charts as the example below.

Figure 161 - Example of Results.

TITLE - TOPIC

| (40) | 7.5 | 17.5 | 42.5 | 25.0 | 2.52.52.5 |

total respondents

number of respondents in percentage

■ subtitle ■ subtitle ■ subtitle ■ subtitle ■ subtitle ■ subtitle ■ subtitle
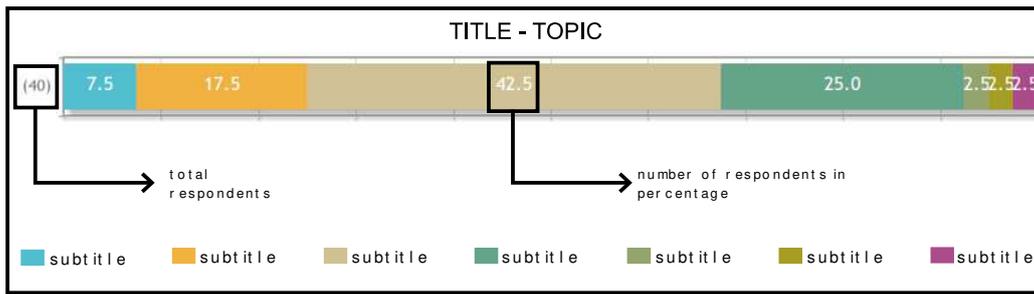
Source: Authors, 2016.

Regarding respondent characteristics, the majority of respondents are women (77%), with a predominant age group of 31 to 40 years (42.5%), with excellent or good health conditions (75%). Also, a large number of them considered themselves as the householders, as we can see bellow. (Graphs 14 & 15)

Graph 14 - Age groups of respondents

AGE

| (40) | 7.5 | 17.5 | 42.5 | 25.0 | 2.52.52.5 |

■ 10 to 20   ■ 20 to 30   ■ 31 to 40   ■ 41 to 50   ■ 51 to 60   ■ 61 to 70   ■ 71 or +

Source: Authors, 2016.

Graph 15 - Family's status

FAMILY STATUS

| (40) | 42.5 | 15.0 | 10.0 | 0. | 27.5 | 0. | 5.0 |

■ householder   ■ life partner   ■ children   ■ son in law or daughter in law   ■ grand daughter or grandson   ■ mother or father   ■ another relative
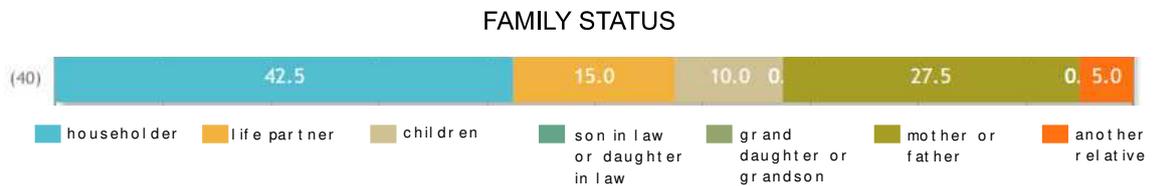
Source: Authors, 2016.

Regarding family profiles (Graph 16), it was identified eight kinds of family. Comparing the family's profile before and after where they are currently living, nuclear family and single parent family still the main type indeed.

Graph 16 - Previous versus current family profile

PREVIOUS FAMILY PROFILE (BEFORE MOVING TO THIS HOUSE)

| (40) | 55.0 | 25.0 | 2.52.5 5.0 | 7.5 02.5 |

CURRENT FAMILY PROFILE

| (40) | 45.0 | 22.5 | 10.0 | 2.5 | 10.0 | 7.5 02.5 |

■ nuclear family   ■ single parent family   ■ one person   ■ dinc (couple with no children)   ■ extended nuclear family (parents + children + relatives)   ■ extended single parent family (one of the parents + children + relatives)   ■ elderly couple   ■ cohabitation
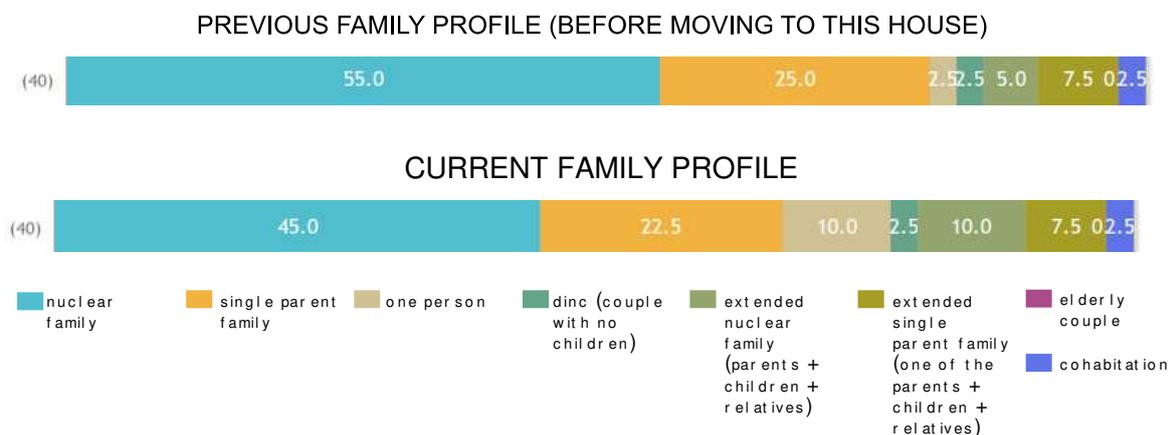
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Yet comparing the conditions before and after they move, more than a half of the respondents (65%) (Graph 17) consider they are more satisfied or partially satisfied with the previous house. The reasons for it is mainly because of the location (neighbourhood), as we can see below 65% (Graph 18) agree that the previous location was much better or better, and none of them consider the previous location as terrible. The other reason is because when it was compared the previous and current house conditions related with house size (Graph 18) and finishing (Graph 18), it is clear to see how the population was divided, which means half of them considered the previous better and also the other half do not agree.

Graph 17 - Satisfaction level of the previous house

SATISFACTION (PREVIOUS HOUSE)

(40)	15.0	32.5	17.5	27.5	7.5

■ very satisfied ■ satisfied ■ partially satisfied ■ unsatisfied ■ very unsatisfied
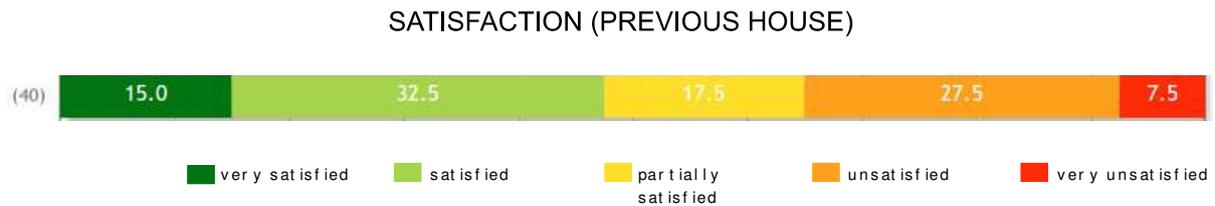
Graph 18 - Location, size and house finishing of the previous house

LOCATION (PREVIOUS HOUSE)

(40)	17.5	47.5	15.0	20.0

SIZE (PREVIOUS HOUSE)

(40)	5.0	37.5	25.0	30.0	2.5

HOUSE FINISHING (PREVIOUS HOUSE)

(40)	7.5	37.5	12.5	37.5	5.0

■ much better ■ better ■ neutral ■ poor ■ very poor

One interesting fact is that apparently, dwellers seem more satisfied with their previous house, however, the next chart demonstrates that they also consider it as more expensive in housing expenses than the current one (Graph 19). The reason for they considered the old location better is because there they had more facilities than the newest one. According to the dwellers, they had better access to public health, school, supermarket, and so on. Also, the expenses can be explained by the current financial housing, which is cheaper than the renting, because 55% of them used to rent their previous place (Graph 20).

Graph 19 - Monthly housing expenses of the previous house

MONTHLY HOUSING EXPENSES (PREVIOUS HOUSE)

(40)	2.6	69.2	7.7	15.4	5.1

■ much higher ■ higher ■ equal ■ lower ■ much lower

Graph 20 - Acquisition state of the previous house

ACQUISITION STATE (PREVIOUS HOUSE)
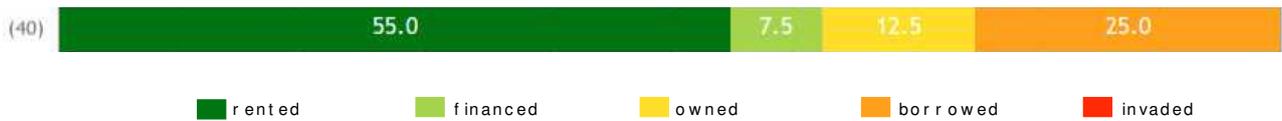
Source: Authors, 2016.

Thus, comparing the Graphs 21 and 22, it can be also concluded that there is a decrease of rented houses as well as borrowed houses. On the other hand, the percentage of homes financed increase 67.5%, as we can see below.

Graph 21 - Currently acquisition state

ACQUISITION STATE (CURRENT HOUSE)

Source: Authors, 2016.

Graph 22 - type of previous house

KIND OF HOUSING (PREVIOUS HOUSE)
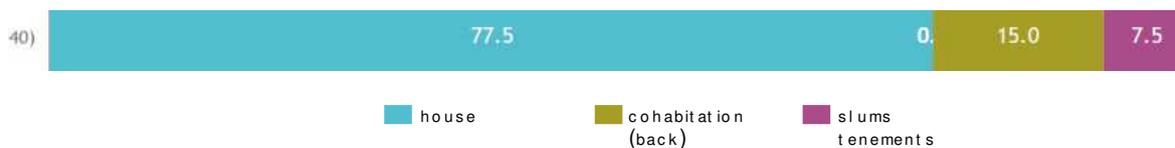
Source: Authors, 2016.

One of the principles of the Human Development Index - HDI (IDHM Brazilian, 2013) is the level of education. In this case study, it was noticed a low education rate, since the majority of respondents did not have the opportunity to get a higher education degree (Graph 23).

Graph 23 - Education level

EDUCATION LEVEL

Source: Authors, 2016.

It is important to highlight that in Brazil when people have no superior degree, they probably will not be able to have a satisfactory job, and consequently they will have a low salary. It was also confirmed by the respondents' monthly income, which is another principle of the Human Development Index – HDI (IDHM Brazilian, 2013). Most of the responders (72%) declared that they usually earn about R$1.000 to 2.000 (238 - 400 GBP), while only 28% earn about R$2.001 to R$10.000 (465 - 2.320 GBP).

Another important point to consider is the numbers of workers in each family. According to the next chart (Graph 24), most of the houses have only one worker (53.8%), which means this person is responsible for support the whole family with a salary around R$1000 to 2000 (238 - 400 GBP) as it was mentioned. Additionally, although the percentage of families with no workers is lower than families with one or two workers, it stills an impressive percentage (12.8%).

Graph 24 - Workers per family

WORKERS PER FAMILY
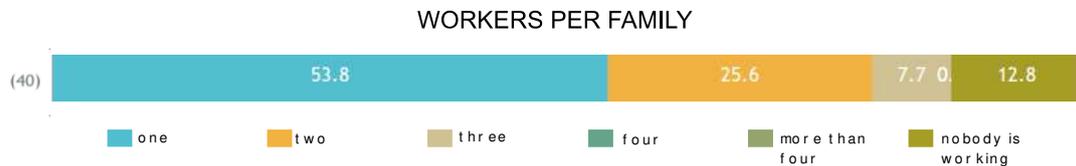
Source: Authors, 2016.

In order to understand even more the families income, in the questionnaire was also asked if the dwellers have a housekeeper or any kind of employee, 95% answered negatively. However, considering this 5%, it was questioned the payment method. The majority answered they pay monthly (66.7%), while only 33.3% said pay monthly and/or daily. It is important to clarify that none of these employees is an overnight stay.

Access to information and communication is one of the "foundations of well-being," Social Progress Index (Stern et al., 2015). In the questionnaire, they were addressed in three points: cable TV, computer or e-tablet and cell phone. It was concluded that almost half of them (42.5%) (Graph 25) have cable TV and a bit more than a half (52.5%) (Graph 26) have computer or e-tablet, which as we see below.

Graph 25 - Cable TV

CABLE TV
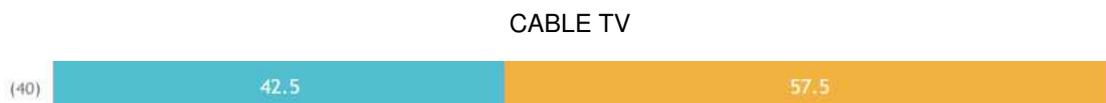
Source: Authors, 2016.

Note: for those which answered yes, 72.7% have only one e-tablet or computer, the others have more than one.

Graph 26 - Computer or e-tablet

COMPUTER OR TABLET

Source: Authors, 2016.

Also, 97.5% of the respondents have a cell phone, which 70% of them affirm they have one or two cell phones, while 30% have more than three. Moreover, most the dwellers (92.5%) (Graph 27) use the phone to speak, followed by the use of the Internet (75%) and, finally, (65%) for text messages.

Graph 27 - smartphone's use

SMARTPHONE'S USE

Source: Authors, 2016.

Another important fact is the respondents use Internet mostly for Facebook and WhatsApp as it is shown below (Graph 28).

Graph 28 - Internet use

INTERNET USE (ON SMARTPHONES)
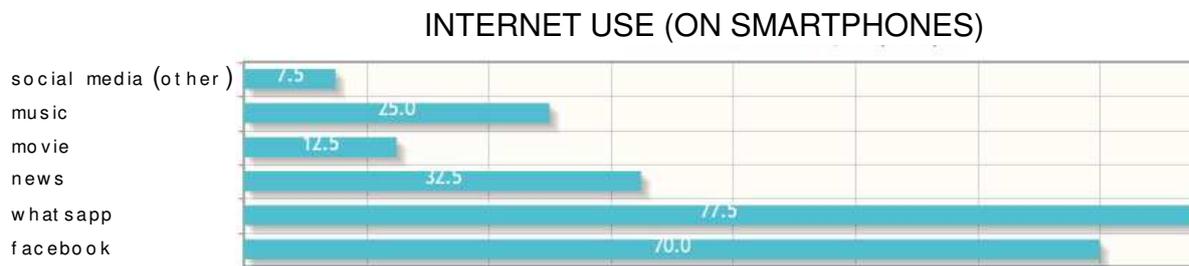
Source: Authors, 2016.

3.2.4.2. SURROUNDING' CHARACTERISTICS (NEIGHBOURHOOD)

In this part, it will be reported the satisfaction level of the dwellers regarding their current neighbourhood. It was asked for the dwellers how they felt regarding their current neighbourhood. More than a half of them (60%) (Graph 29) said they are happy where they are living. In addition, most of them reported they never had a lack of water (97.5%), or light shortcut (87.5%).

Graph 29 - How they feel about their neighbourhood

HOW DO YOU FEEL IN RELATION TO YOUR NEIGHBOURHOOD?

Source: Authors, 2016.

However, as it was previously mentioned, more than a half of the respondents (65%) (Graph 17) consider them more satisfied or partially satisfied with the previous house. Mainly because of the location, which means the old neighbourhood had a higher quality of facilities. The next Graph (30) emphasises it. In all the aspects (leisure, culture, public health, public education, public transport), more than half of the population report they are not very satisfied.

Graph 30 - Quality of the facilities

QUALITY OF THE FACILITIES (CURRENT NEIGHBOURHOOD)
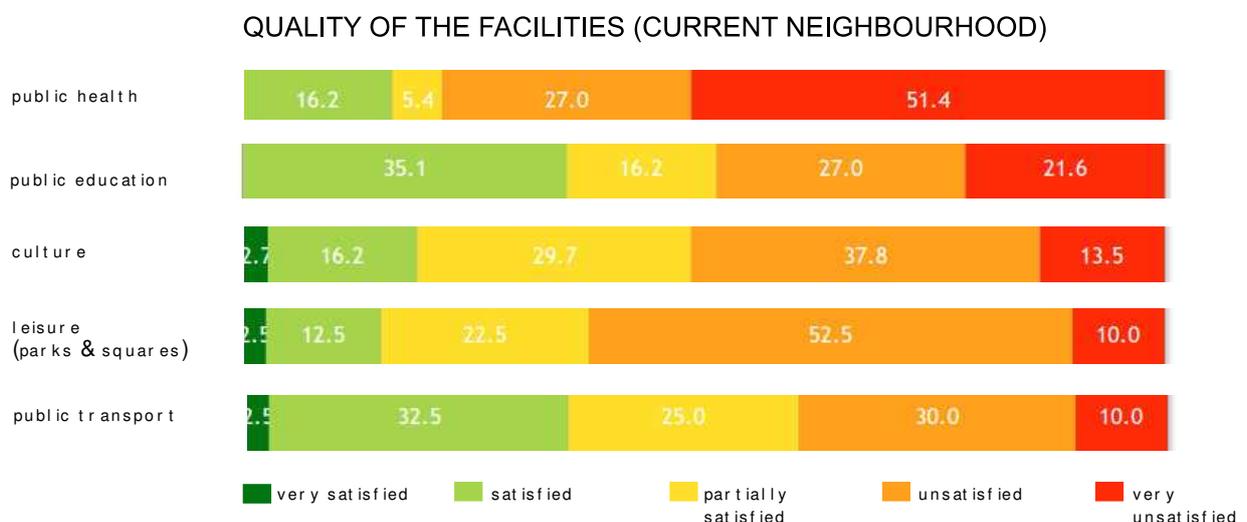
One of the highest compalints is about the public health, once Shopping Park's neighbourhood has only health centres, while they have a need for a hospital to correspond to the population of more than 11,000 of people. Although dwellers consider the health centres close to them, taking not long than 30 minutes to arrive (Figure 24), they feel very unsatisfied with the health treatment (Graph 31). Some of them reported they have to wait a long period for the appointments and in emergency cases, they must go to another hospital, which takes more than an hour to arrive there. Also, they reported a lack of medications in some cases.

Graph 31 - Health treatment satisfaction

HEALTH TREATMENT SATISFACTION

(40)	2.6	12.8	23.1	12.8	48.7

■ very good ■ good ■ regular ■ bad ■ very bad
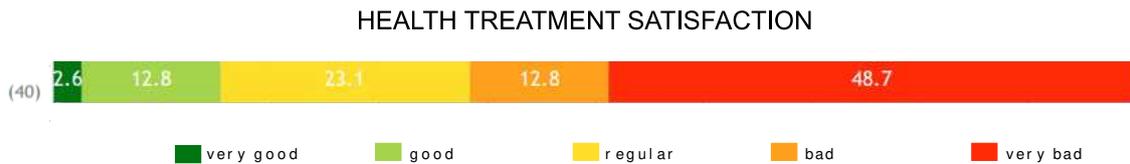
Graph 32 - How long they take to arrive at the health centre

TIME THEY USUALLY SPEND TO ARRIVE AT THE HEALTH CENTER

(40)	28.9	47.4	7.9	7.9	7.9

■ 5-15min ■ 16-30min ■ 31-45min ■ 46-60min ■ +than 1h
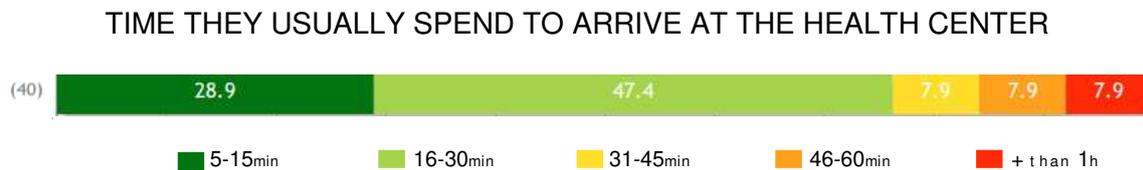
Regarding other aspects of the neighbourhood, the majority of respondents (62.5%) agree Shopping Park is a very pleasant or pleasant neighbourhood (Graph 33). Conversely, in relation to appearance, they seem to be divided, half believes it is a beautiful neighbourhood, but the other half does not agree (Graph 34).

Graph 33 - Comfort and pleasantness

COMFORT AND PLEASANTNESS

(40)	2.5	60.0	25.0	12.5

■ very pleasant ■ pleasant ■ regular ■ unpleasant ■ very unpleasant

Graph 34 - Appearance

APPEARANCE

(40)	30.0	42.5	22.5	5.0

■ very beautiful ■ beautiful ■ regular ■ ugly ■ very ugly
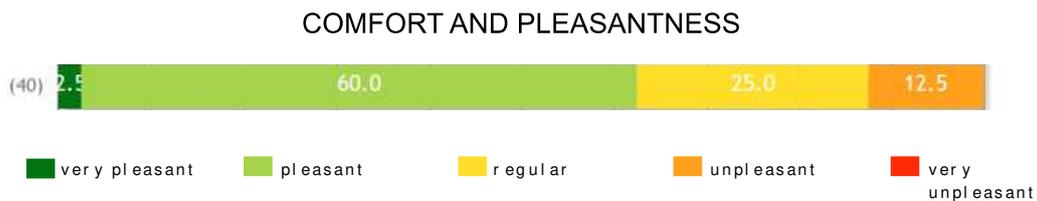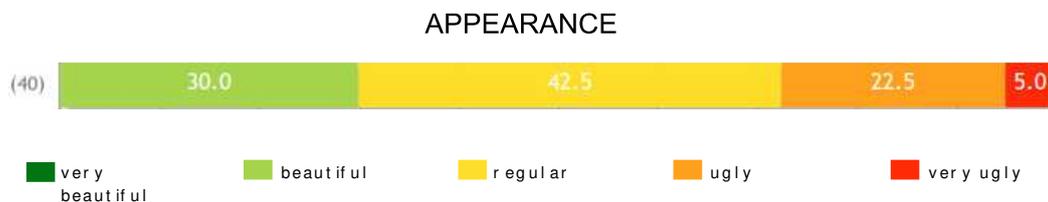
From the standpoint of maintenance, cleaning, city integration and safety, the population seem not be satisfied. 65% of them believe the area is abandoned or fully abandoned (Graph 35). This can be justified by the high amount of waste, which is thrown on vacant land.

Graph 35 - Maintenance and Cleaning

MAINTENANCE AND CLEANING

| (40) | 5.0 | 20.0 | 10.0 | 52.5 | 12.5 |

fully care · partially care · regular · abandoned · fully abandoned
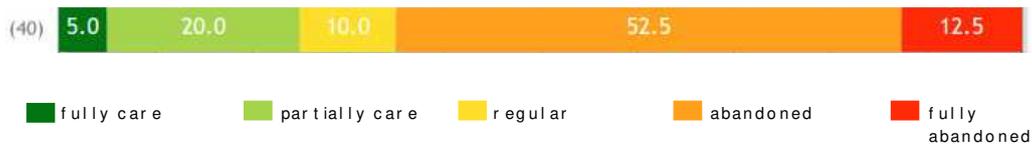
Source: Authors, 2016.

There is an interesting fact about the city integration because more than a half of the dwellers (51.3%) agree that the neighbourhood is excluded from the city, which means it is very far from the facilities at the city centre (Graph 36). However, there is one part of the population (17.9%), which believes that the area is fully integrated. The reason is because there is a main avenue that connects the suburb to the city centre. Thus, both public transport's users or car's users do not take a long time to go to the city centre, which means these percentage makes Shopping Park seem fully integrated into the city.

Graph 36 - City Integration

CITY INTEGRATION

| (40) | 17.9 | 15.4 | 15.4 | 46.2 | 5.1 |

fully integrated · partially integrated · regular · excluded · fully excluded
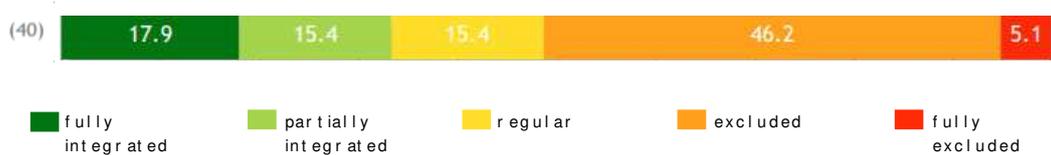
Source: Authors, 2016.

The last aspect is safety, 70% complained about it and report they feel completely unsafe or unsafe in their neighbourhood (Graph 37). From those who feel unsafe, they mentioned that the fear is related to the drug trafficking. In addition, according to them, there is neither policing nor a police office at the neighbourhood.

Graph 37 - Safety

SAFETY

| (40) | 2.5 | 20.0 | 7.5 | 35.0 | 35.0 |

completely safe · partially safe · regular · unsafe · completely unsafe

Source: Authors, 2016.

3.2.4.3. ALLOTMENTS' CHARACTERISTICS

Regarding the block, which was applied the questionnaire, it was identified the dwellers' opinion about the conditions of some facilities, as well as the level of interaction between the neighbours. Starting with the positive aspects, there was a large percentage agreeing they have a great or good interaction with their neighbours (66.6% - Graph 38). In addition, most of them consider they have a good or regular privacy in relation to the street (63.9%) as well as the quality of the streets (76.9%) and the streets' signalling (61.6%). However, there was a small percentage (38.5%) which report they are not satisfied with the streets' signalling because the automobiles drive very fast. This complaining was mostly noticed at the Juvelina Street, where there is also a bus line coursing there. The last aspect, which was considered in a positive way, it was general appearance, 69.3% agree their allotment has a good or regular appearance.

Graph 38 - Conditions and facilities evaluation

	great	good	regular	bad	very bad

neighbour interaction	5.1	61.5	10.3	15.4	7.7
quality of the strees	7.7	53.8	15.4	17.9	5.1
privacy in relation to the street	2.8	47.2	13.9	25.0	11.1
streets signaling	2.6	46.2	12.8	23.1	15.4
general appearance		46.2	23.1	25.6	5.1
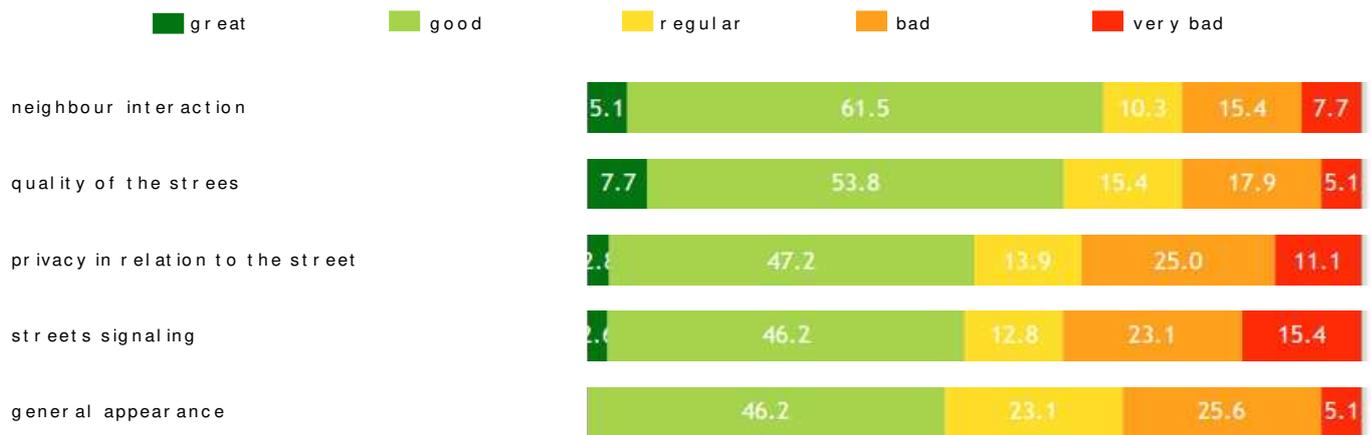
Source: Authors, 2016.

Figure 162 - Photo of a neighbour interaction

Source: Tolentino, 2012.

On the other hand, the following aspects are generally considered with poor quality conditions. To start with cost-benefit, 61.3% mentioned they believe it is unsatisfactory or regular. According to the dwellers, the bills are expensive considering the amount of usage.

Graph 39 - Cost-Benefit

	good	regular	bad	very bad
cost-benefit relation - water/energy/transport	38.5	12.8	38.5	10.3

	great	good	regular	bad	very bad

Source: Authors, 2016.

Regarding street's safety, 33.3% of the respondents considered the street is safe, but 41% do not agree, which means this point divides the population.

Graph 40 - Street's safety

Source: Authors, 2016.

71.8% of the dwellers agree that the buildings of the block have a regular or bad, or very bad quality.

Graph 41 - Quality of the constructions

Source: Authors, 2016.

In relation to the next points, as we can see, they are not considered in good conditions. Firstly, there are no sufficient common areas for the population demand. There is only one community centre for the whole area, with has more than 11,000 of people. Also, the public spaces and the green areas are not clean, and there is not a satisfactory maintenance. Furthermore, there is waste in the green areas and in empty lots, next to the common areas, such as the community centre.

Graph 42 - Public space, facilities and green areas
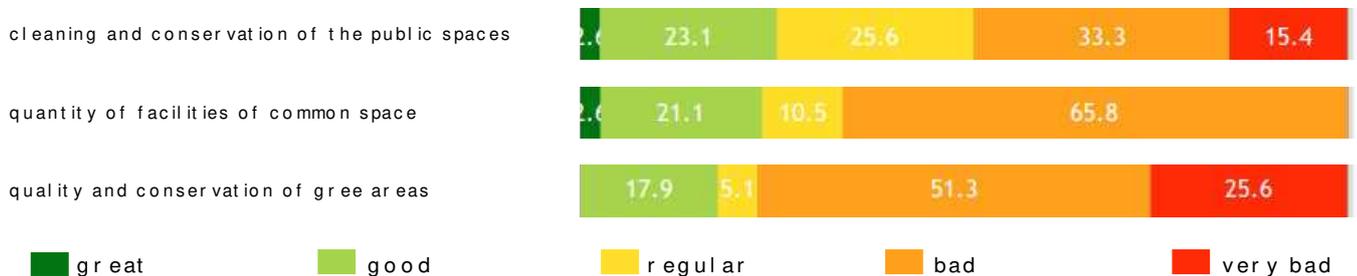
Source: Authors, 2016.

Figure 163 - Public space, facilities and green areas in bad conditions

Source: Gollino, 2015.

Another aspect with large complaints is the sidewalk (Graph 43 and Figure 162). The main reason is because it is not appropriate and consequently it is not accessible for people with disability. In this part of the questionnaire, most of the dwellers assume that they prefer to walk on the street than at the sidewalk, even those who have no disability. Another interesting fact is, in Brazil the sidewalk is dweller's responsibility, which means they cannot afford it.

Graph 43 - Sidewalks quality

| acessibility for people with physical restrictions | 15.4 | 12.8 | 51.3 | 20.5 |
| quality of the sidewalks | 12.8 | 15.4 | 53.8 | 17.9 |

great   good   regular   bad   very bad
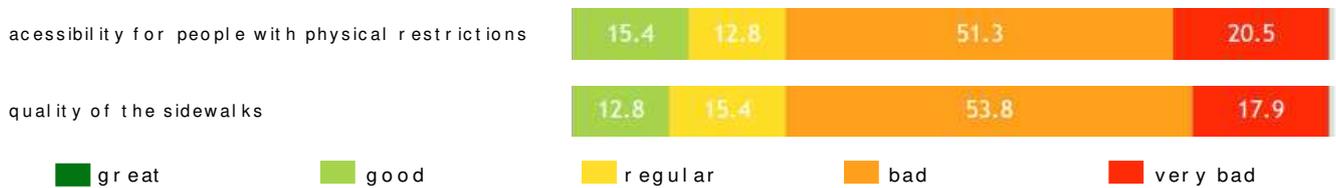
Source: Authors, 2016.

Figure 164 - Sidewalk bad conditions

Source: Group study, 2016.

3.2.4.4. HOUSING' CHARACTERISTICS

In this part of the questionnaire was investigated several points in relation to the housing conditions, such as the level of satisfaction in relation their home as well as the kind of activities their do in each room and so on. The first point was about how they feel regarding their homes. 62.5% agree it is a place they identify. (Graph 44)

Graph 44 - Residence meaning

WHAT THIS RESIDENCE REPRESENTS FOR YOU?

a place i identify myself with	62.5
a place where the people i like are	57.5
a material investment	55.0
a place where my belongings are	52.5
place where i spend most of my time	50.0
safe place	45.0
a place where i can realize my activities	37.5
a place where i solely sleep	7.5
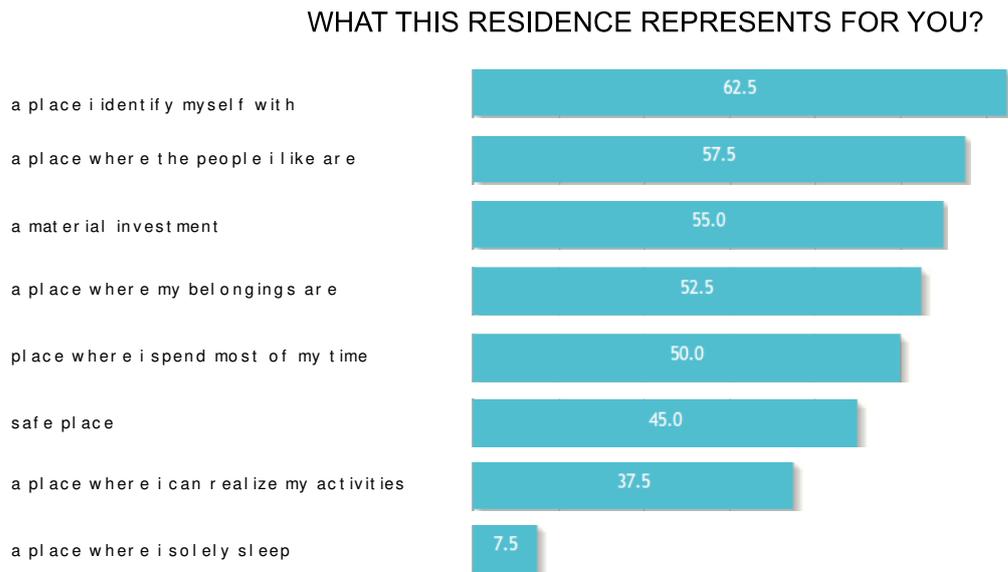
Source: Authors, 2016.

The other point of the questionnaire was related to the negative aspects of living at their current place (Graph 45). Most of the dwellers (82.5%) agree the main issue is the terraced houses. This is because the neighbours share the same wall, and, as they reported, they feel a lack of privacy. Another problem is the lack of safety. Some of them (47.5%) reported they feel unsafe because of the neighbourhood, which is considered unsafe, and others declared they feel unsafe because they have not constructed walls to limit their lots. One positive point is only a few of them complained about the difficulty (25%) or lack (12.5%) of interaction with neighbours. It means that even though they have an issue related to the shared wall, they still have a good interaction with their neighbours.

Graph 45 - Negative aspects

terraced houses | 82.5
lack of safety | 47.5
reduced house space | 25.0
difficulty on interation with neighbours | 25.0
long distances from the public facilities | 22.5
lack of interation with neighbours | 12.5
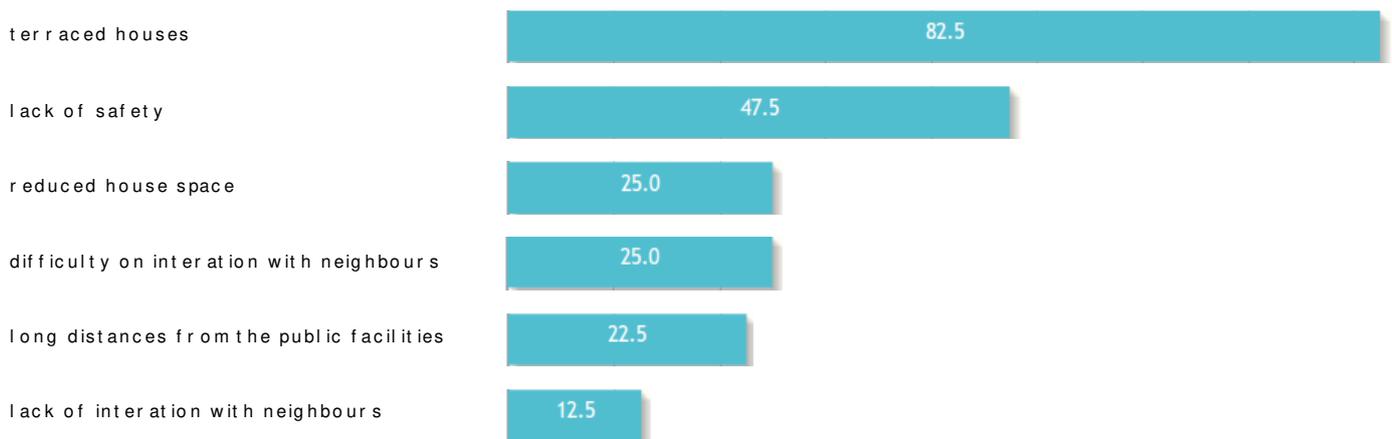
Source: Authors, 2016.

Figure 165 - Share wall

share wall

Source: Authors, 2016.

Regarding the types of activities they usually do in their residence, it was built a map based on the dweller's answers, which was located their most common daily actions in each room, as we can see below.

Figure 166 - Activities in each room
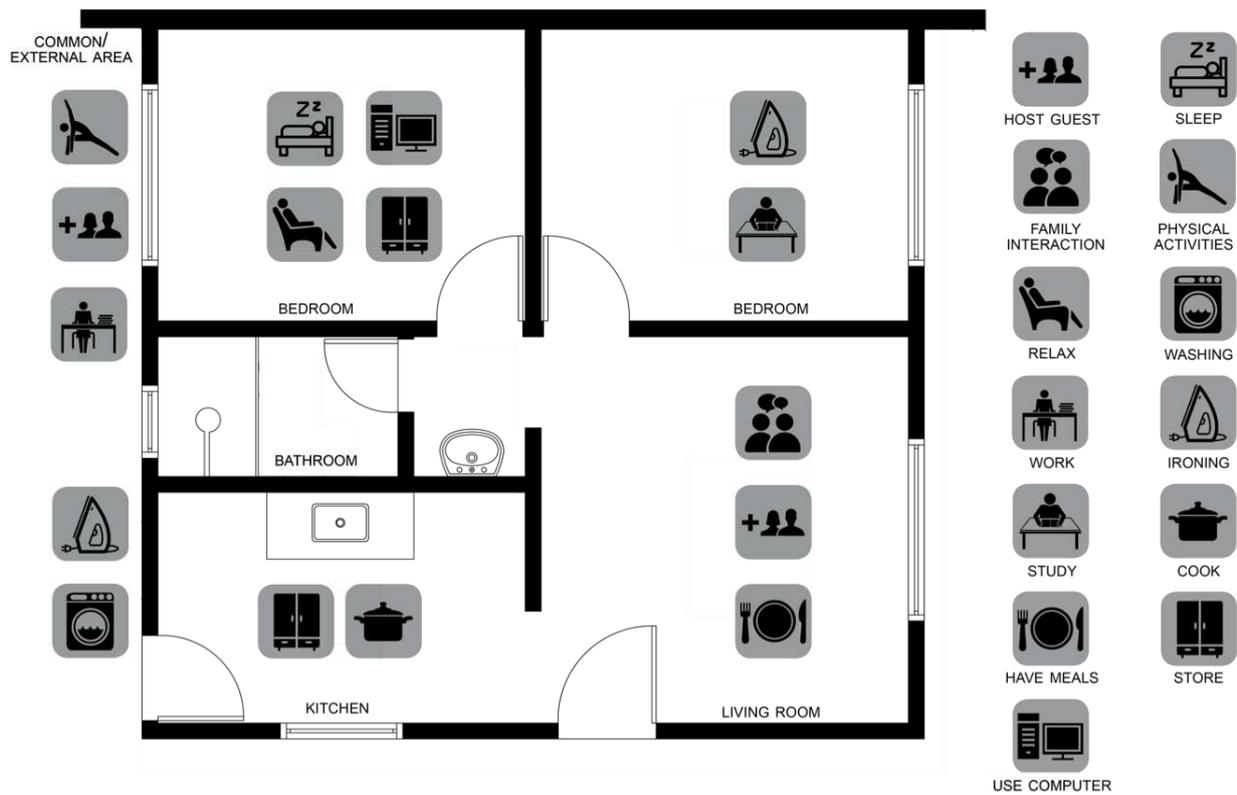
Source: Authors, 2016.

In order to understand better the map above, each activity will be addressed separated and analysed by location, frequency and how well the dwellers usually do it. To start with family interaction, most of them (72.5 %) usually stay with their family at the living room and they considered they do it well. In other words, they feel they have enough space for it.

Graph 46 - Family interaction

WHERE DO YOU DO?

- LIVING ROOM — 72.5
- COMMON/EXTERNAL AREA — 22.5
- KITCHEN — 7.5

HOW OFTEN?

- EVERYDAY — 67.5
- ALMOST EVERYDAY — 10.0
- SOMEDAYS — 7.5
- NEVER — 2.5
- RARELY — 2.5

HOW WELL?

- WELL — 62.5
- REGULAR — 12.5
- VERY WELL — 7.5
- BAD — 5.0
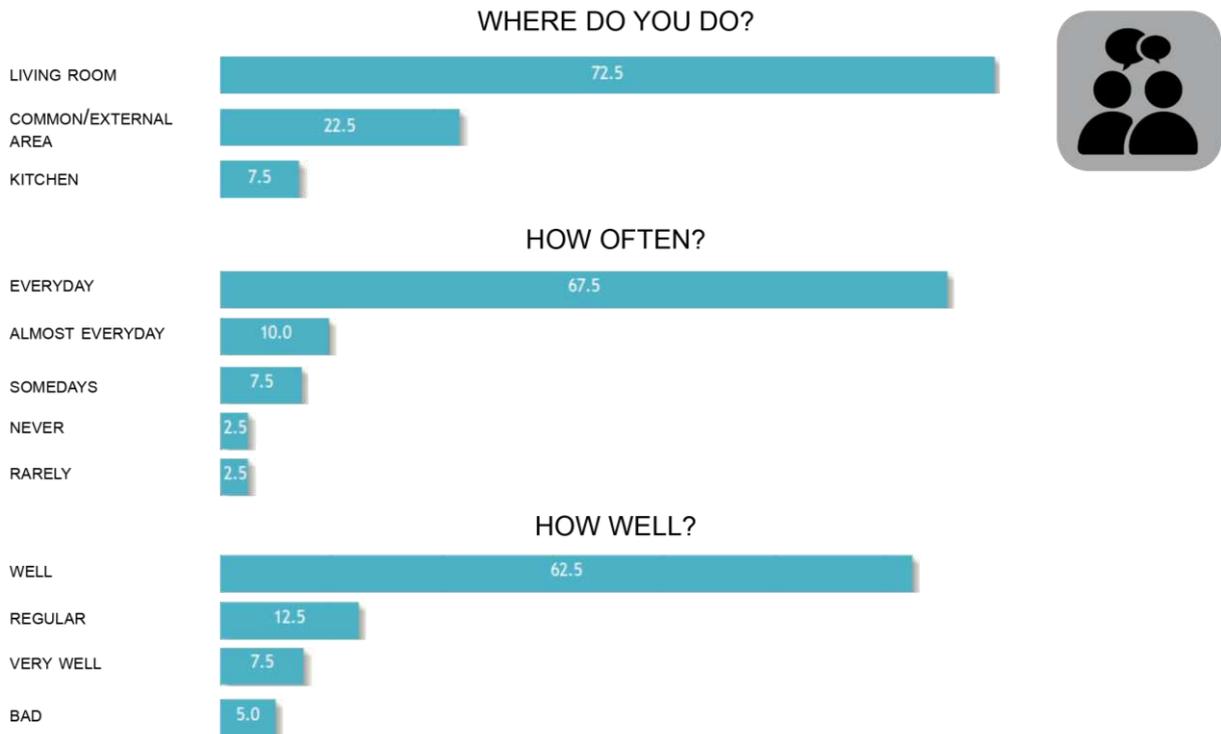
Source: Authors, 2016.

Regarding cooking time, as we see below, most of them (87.5%) usually cook in the kitchen. Only 7.5% use the common (external) area for cooking. Also, the majority affirm they do it well in their space.

Graph 47 - Prepare meals

WHERE DO YOU DO?

- KITCHEN — 87.5
- COMMON/EXTERNAL AREA — 7.5
- BEDROOM — 2.5
- LAUNDRY — 2.5

HOW OFTEN?

- EVERYDAY — 87.5
- ALMOST EVERYDAY — 10.0
- NEVER — 2.5

HOW WELL?

- WELL — 62.5
- REGULAR — 15.0
- BAD — 10.0
- VERY BAD — 5.0
- VERY WELL — 5.0
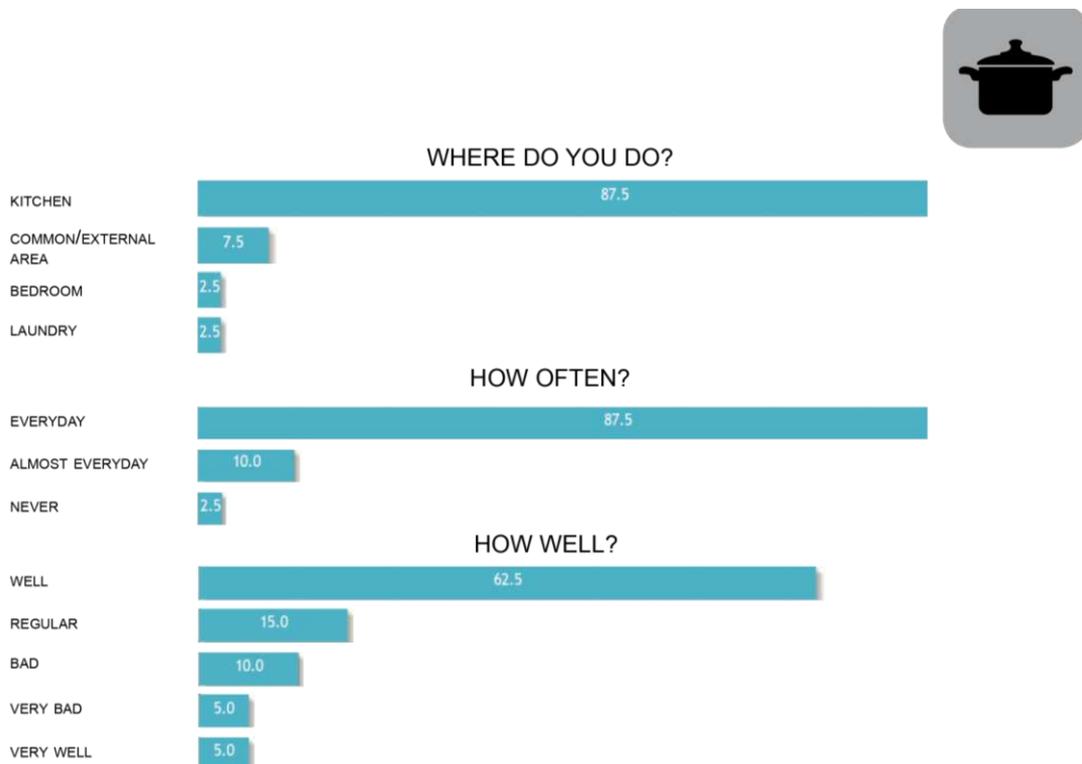
Source: Authors, 2016.

Likewise, sleep activity is most common in the bedroom (97.5%), while some of them report they also sleep in the living room (10%). Also the majority affirm they do it well in their space.

Graph 48 - Sleep

WHERE DO YOU DO?

BEDROOM	97.5
LIVING ROOM	10.0

HOW OFTEN?

EVERYDAY	90.0
ALMOST EVERYDDAY	5.0
SOMEDAYS	2.5

HOW WELL?

WELL	72.5
REGULAR	12.5
BAD	7.5
VERY WELL	5.0
VERY BAD	2.5
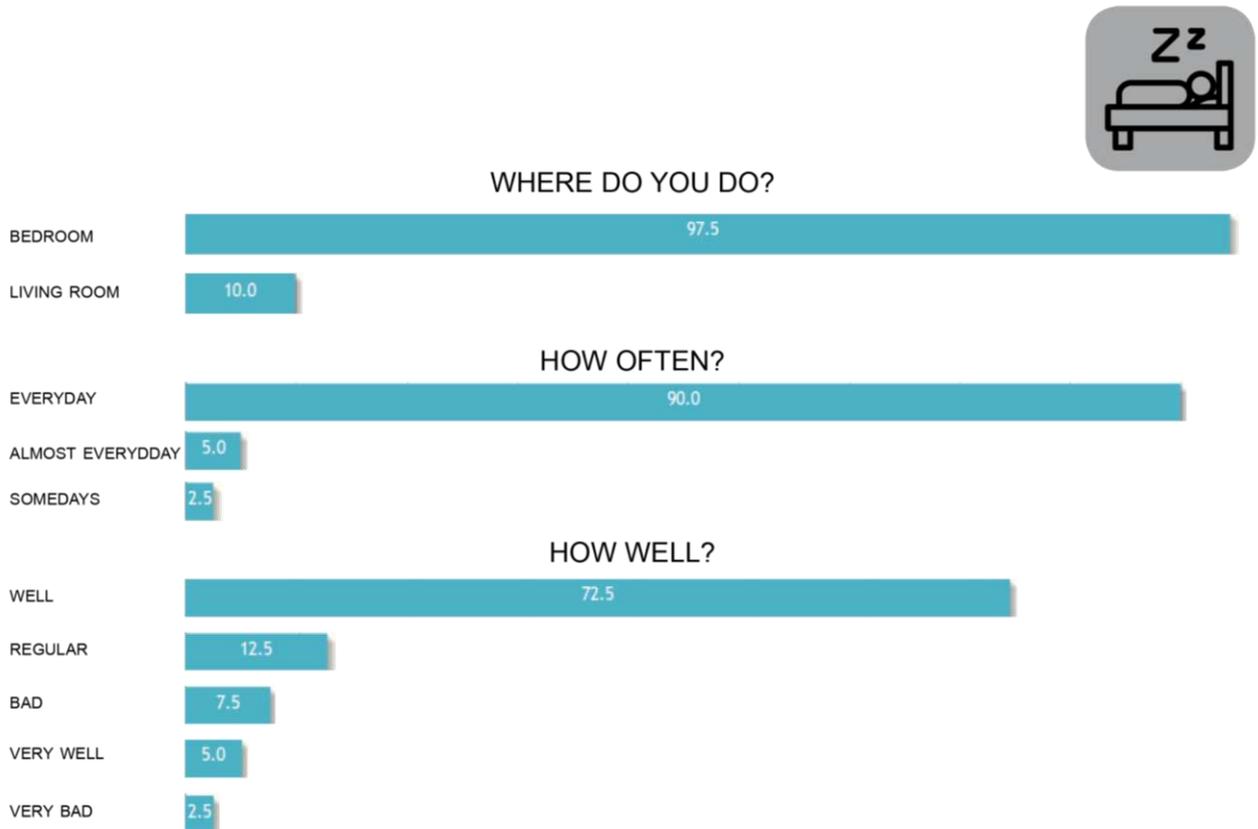
Source: Authors, 2016.

Regarding the storage, the three most common spaces for it is bedroom, kitchen and living room.

Graph 49 - Storage

WHERE DO YOU DO?

BEDROOM	90.0
KITCHEN	87.5
LIVING ROOM	40.0
BATHROOM	10.0
LAUNDRY	10.0
COMMON/EXTERNAL AREA	7.5

HOW OFTEN?

EVERYDAY	72.5
SOMEDAYS	7.5
NEVER	2.5
ALMOST EVERYDAY	2.5

HOW WELL?

VERY BAD	7.5
BAD	10.0
REGULAR	27.5
WELL	37.5
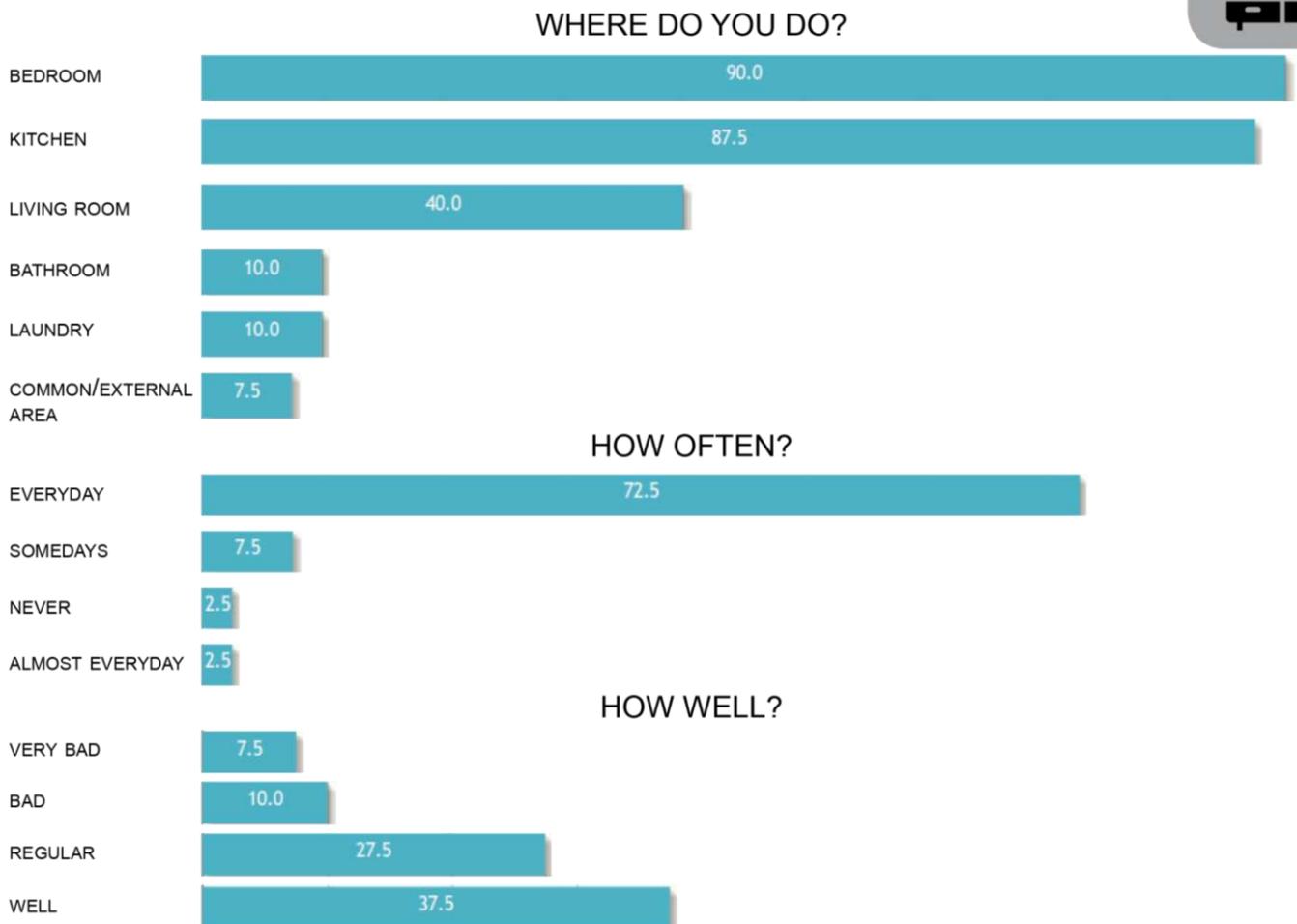
Source: Authors, 2016.

One interesting fact about the study activity is reported they do not study often, 60% of them affirm they never study or study only some days. When they do study, they usually study in the common area, or bedroom, or in the living room. 45% believe they do it well in the place they have.

Graph 50 - Study time

WHERE DO YOU DO?

COMMON/ EXTERNAL AREA — 17.5
BEDROOM — 35.0
LIVING ROOM — 20.0

HOW OFTEN?

NEVER — 30.0
SOMEDAYS — 30.0
EVERYDAY — 20.0
ALMOST EVERYDAY — 5.0

HOW WELL?

WELL — 45.0
BAD — 7.5
REGULAR — 7.5
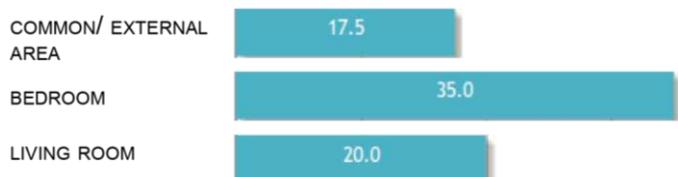
Source: Authors, 2016.

Another activity they reported that they do not practice often is exercising. 67.5% of them never practice any physical activity at their place. The small percentage, which does, usually uses the external area for it, and they agree they can do it well.

Graph 51 - Physical activities

WHERE DO YOU DO?

COMMON/ EXTERNAL AREA	7.5
BEDROOM	2.5
LIVING ROOM	2.5

HOW OFTEN?

NEVER	67.5
ALMOST EVERYDAY	5.0
EVERYDAY	2.5
SOMEDAYS	2.5
RARELY	2.5

HOW WELL?

WELL	7.5
REGULAR	5.0
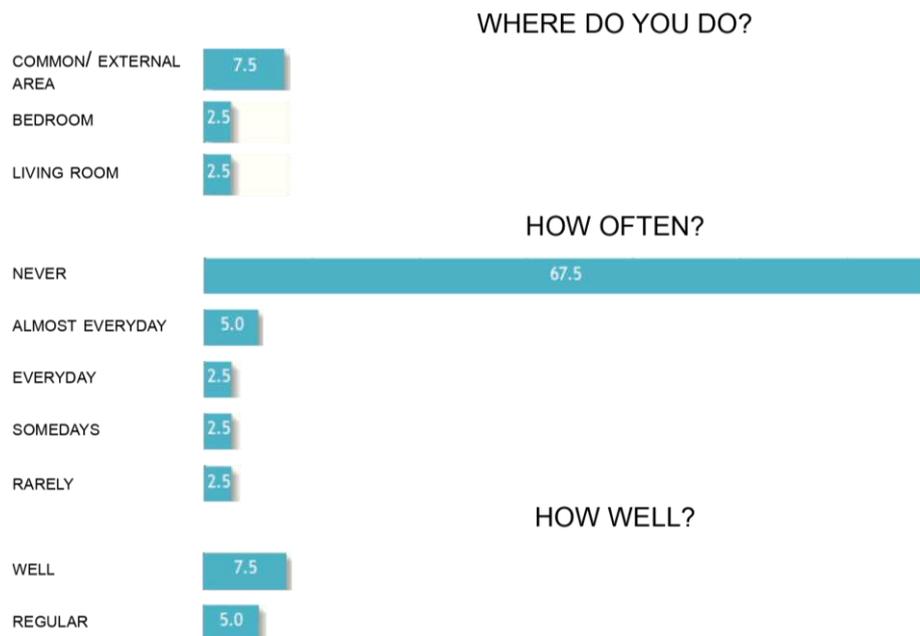
Source: Authors, 2016.

For ironing and washing, there were a variety of places where they do this activity. The most common answers were laundry, bedroom, common area, living room and kitchen. Considering the comments of the dwellers, it was noticed that kitchen, laundry and common area were mostly used for washing, while bedroom and living room for ironing. Also, it is important to notice that they only wash or iron some days. Most of them reported they only iron clothes when it is extremely necessary. Finally, most of them (75%) agree they do it well.

Graph 52 - Washing and ironing

WHERE DO YOU DO?

LAUDRY	65.0
BEDROOM	25.0
COMMON/ EXTERNAL AREA	22.5
LIVING ROOM	20.0
KITCHEN	10.0

HOW OFTEN?

SOMEDAYS	75.0
RARELY	12.5
ALMOST EVERYDAY	5.0
NEVER	2.5
EVERYDAY	2.5

HOW WELL?

WELL	75.0
REGULAR	15.0
BAD	7.5
VERY WELL	2.5
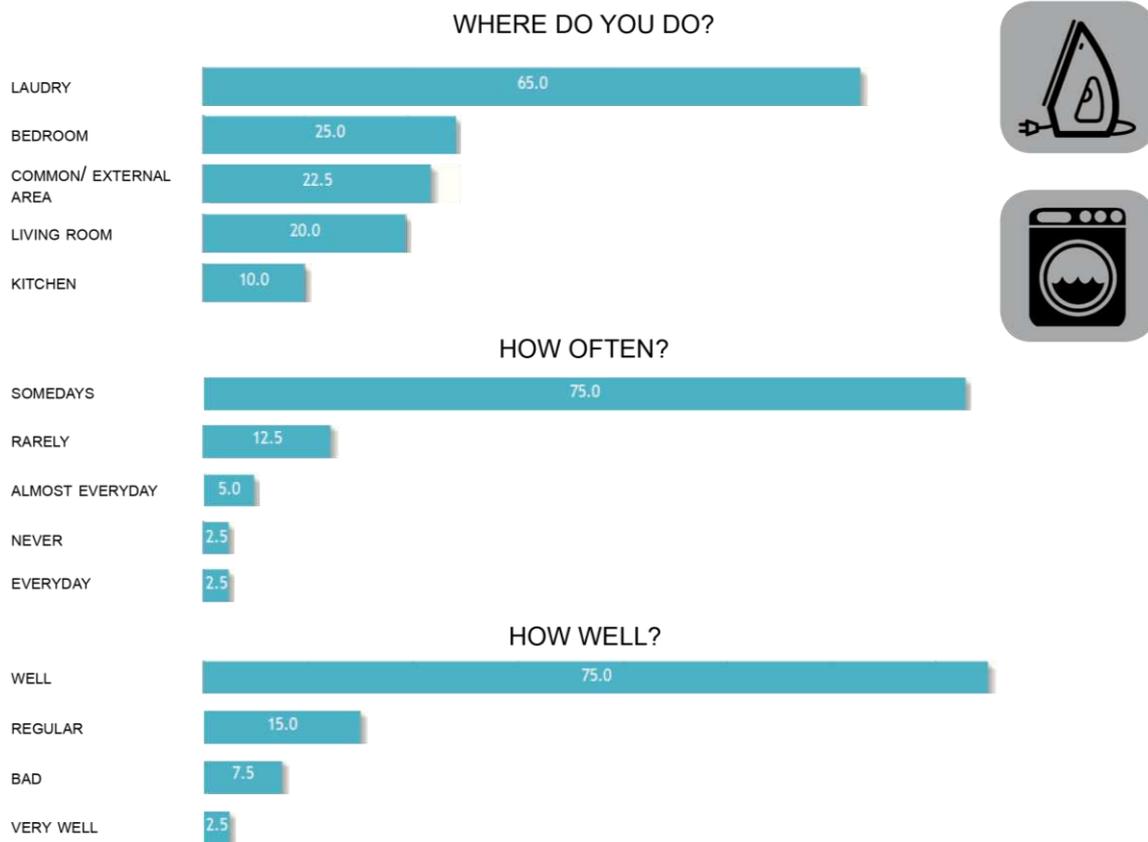
Source: Authors, 2016.

Most of them reported they usually have meals in the living room. Also, there is a small percentage (47.5%), which said they have meals in the common area and/or kitchen. 62.5% believe they do it well.

Gaph 53 - Having meals

WHERE DO YOU DO?

- LIVING ROOM: 72.5
- COMMON/ EXTERNAL AREA: 27.5
- KITCHEN: 20.0

HOW OFTEN?

- EVERYDAY: 92.5
- ALMOST EVERYDAY: 5.0
- RARELY: 2.5

HOW WELL?

- WELL: 62.5
- REGULAR: 17.5
- BAD: 12.5
- VERY WELL: 7.5
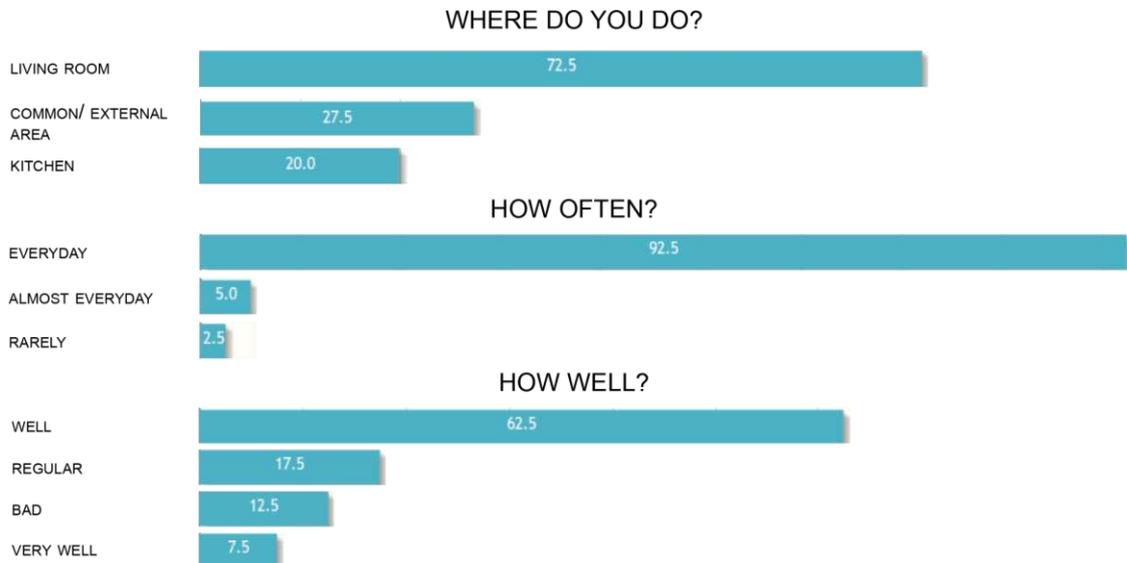
Source: Authors, 2016.

Regarding when they receive guests, there are two places that they mostly use, common area and the living room. Also, 52.5% report they rarely receive visitors, but when they do they think they can host them well.

Graph 54 - Host guest

WHERE DO YOU DO?

- COMMON/ EXTERNAL AREA: 60.0
- LIVING ROOM: 55.0
- KITCHEN: 20.0
- LAUNDRY: 12.5
- BEDROOM: 5.0

HOW OFTEN?

- RARELY: 52.5
- SOMEDAYS: 32.5
- ALMOST EVERYDAY: 10.0
- EVERYDAY: 5.0

HOW WELL?

- WELL: 70.0
- REGULAR: 20.0
- BAD: 7.5
- VERY WELL: 5.0
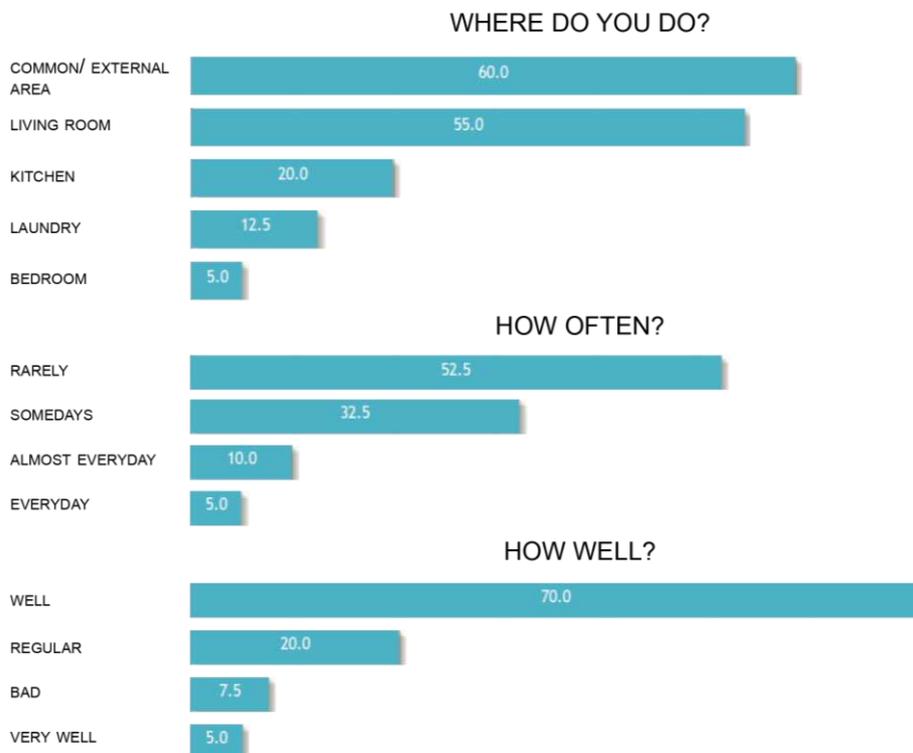
Source: Authors, 2016.

91.4% of the dwellers reported they use their home for leisure activities. In this part, it what asked where and how well they usually relax. The there most common answers were in the bedroom (60%) or living room (35%). 65% report they do it well and often (67.5%).

Graph 55 - Relaxing time

WHERE DO YOU DO?

BEDROOM	60.0
LIVING ROOM	35.0
COMMON/ EXTERNAL AREA	10.0

HOW OFTEN?

EVERYDAY	67.5
SOMEDAYS	15.0
RARELY	7.5
ALMOST EVERYDAY	7.5
NEVER	2.5

HOW WELL?

WELL	65.0
REGULAR	17.5
VERY WELL	10.0
BAD	5.0
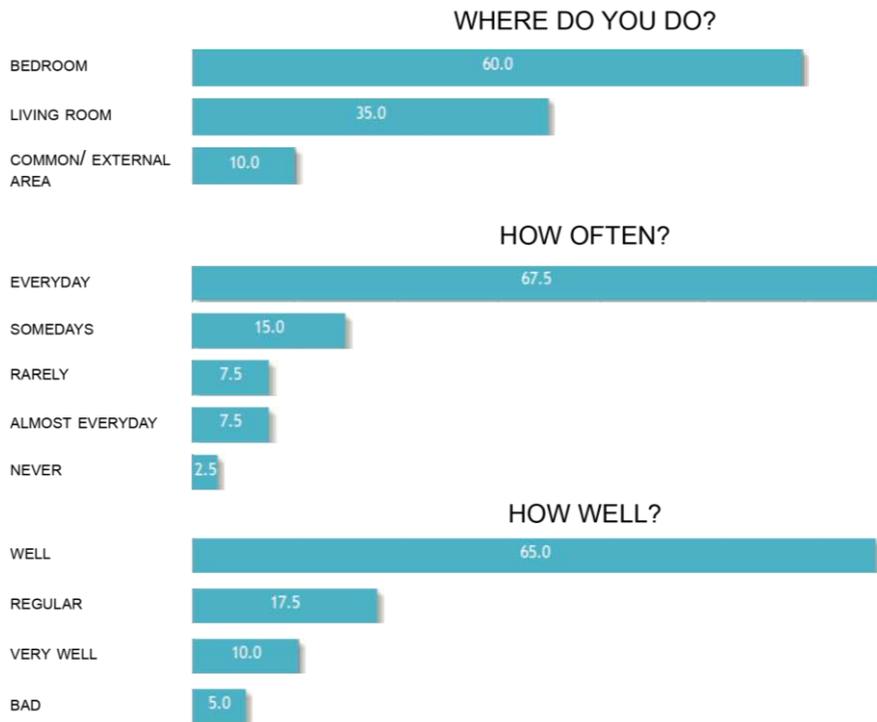
Source: Authors, 2016.

For those who work at their place, they believe they can do it well and usually use the external area for it.

Graph 56 - Work

WHERE DO YOU DO?

COMMON/ EXTERNAL AREA	22.5
LIVING AREA	15.0
LAUNDRY	2.5
KITCHEN	2.5
BEDROOM	2.5

HOW OFTEN?

NEVER	40.0
EVERYDAY	20.0
SOMEDAYS	10.0
ALMOST EVERYDAY	5.0

HOW WELL?

WELL	20.0
REGULAR	12.5
BAD	2.5
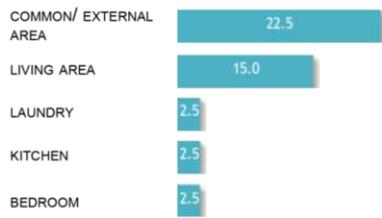
Source: Authors, 2016.

Lastly, the bedroom and living room was cited as the most common place for computer use. For those who use it, they feel comfortable where they do, as we see below.

Graph 57 - Use computer

WHERE DO YOU DO?

LIVING ROOM — 27.5
BEDROOM — 27.5
KITCHEN — 5.0
COMMON/ EXTERNAL AREA — 2.5

HOW OFTEN?

NEVER — 37.5
EVERYDAY — 17.5
SOMEDAYS — 15.0
ALMOST EVERYDAY — 7.5
RARELY — 7.5

HOW WELL?

WELL — 35.0
REGULAR — 10.0
VERY WELL — 2.5
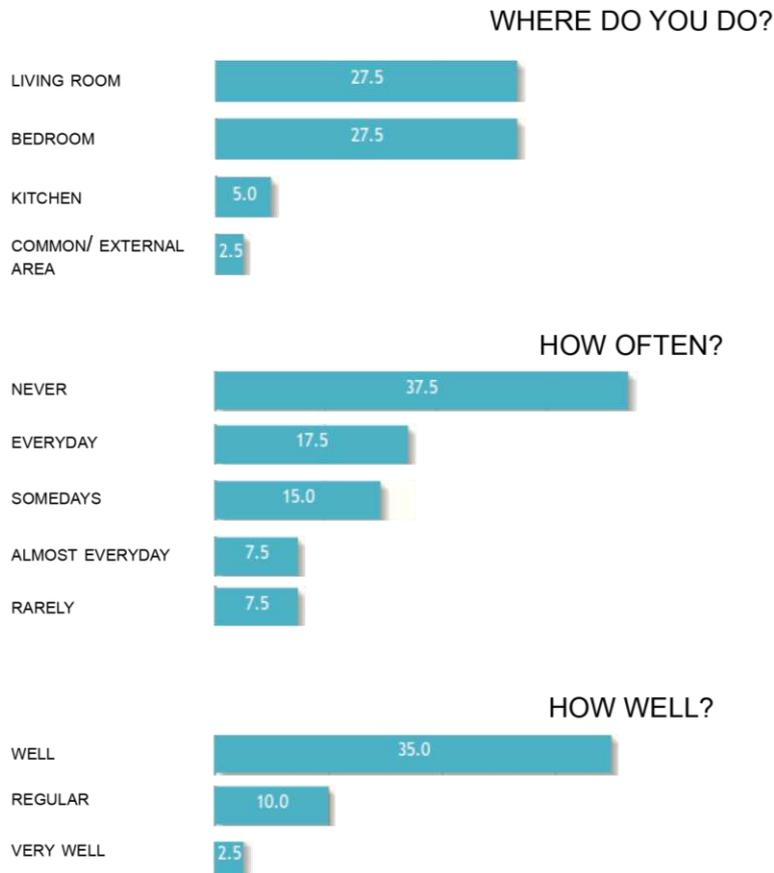
Source: Authors, 2016.

To summarize, some activities are held in rooms, which are not appropriate. For example, washing clothes in the kitchen; Sleep in the living room; Ironing clothes in a variety of places such as, laundry, bedroom, common area, living room and kitchen. Thus they have to adapt to carry it out. Consequently, although they all seem to do their activities well, it shows this house does not have enough space for their needed daily activities. There are overlaps of very different functions, such as ironing and studying in the bedroom; Work and receive visits in the external area.

Yet about each room, it was identified how satisfied they were regarding the temperature, size, lighting and so on. Below each of these points is going to be addressed. Starting with the size of the house, 62.5% believe the house is small. Also, they considered the follow rooms as the main problem: kitchen; bedroom and bathroom. Even though the laundry has a large percentage of satisfactory answers, it is also one of the rooms that the people most complained. The reason was because when they moved to this place the laundry was only a simple laundry sink, meaning that there was not a specific place for it. The living room was the place they less complained about, however, it still has a large percentage of dissatisfaction because of its size.

Figure 167 - Room size satisfaction

| kitchen | 27.5 | 2.5 | 35.0 | 35.0 |

| laundry | 5.0 | 42.5 | 5.0 | 25.0 | 22.5 |

| bedroom | 2.5 | 22.5 | 12.5 | 42.5 | 20.0 |

| bathroom | 5.0 | 25.0 | 10.0 | 42.5 | 17.5 |

| living room | 40.0 | 15.0 | 32.5 | 12.5 |

great · **good** · **medium** · **bad** · **terrible**

very big · **big** · **medium** · **small** · **very small**

| residence size | 25.0 | 12.5 | 57.5 | 5.0 |
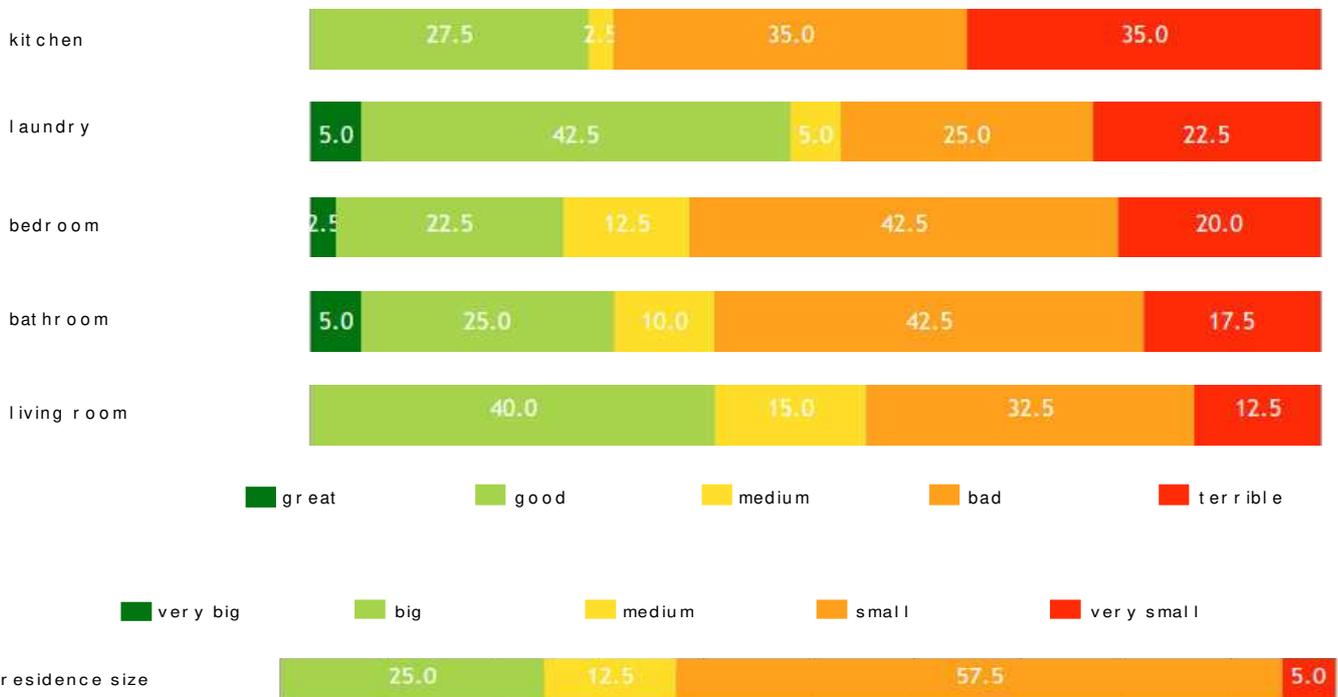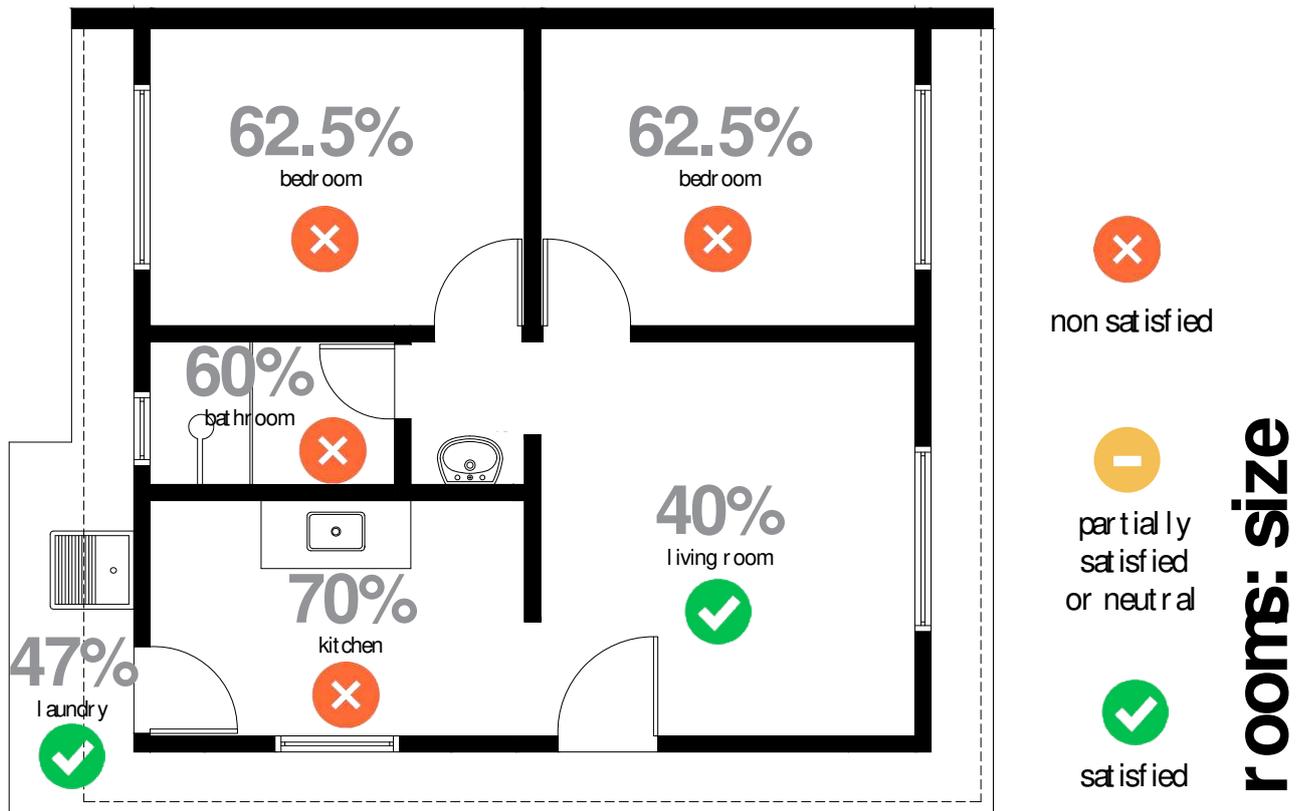
Source: Authors, 2016.

In relation to the furniture, 56.4% (Figure 166) of the responders believe they generally have enough furniture and also, 53% reported that all their previous furniture did fit all when they moved (Graph 58). The

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main reason it is because most of them affirmed they did not have furniture before. In the map bellow, it is shown they are not satisfied regarding the easiness of furnishing the space.

Figure 168 - Rooms furniture satisfaction

kitchen	30.8	2.6	38.5	28.2
laundry	46.2	7.7	23.1	23.1
bedroom	2.6	25.6 / 10.3	46.2	15.4
bathroom	25.6	12.8	46.2	15.4
living room	5.1	46.2	2.6 / 30.8	15.4

■ great ■ good ■ medium ■ bad ■ terrible
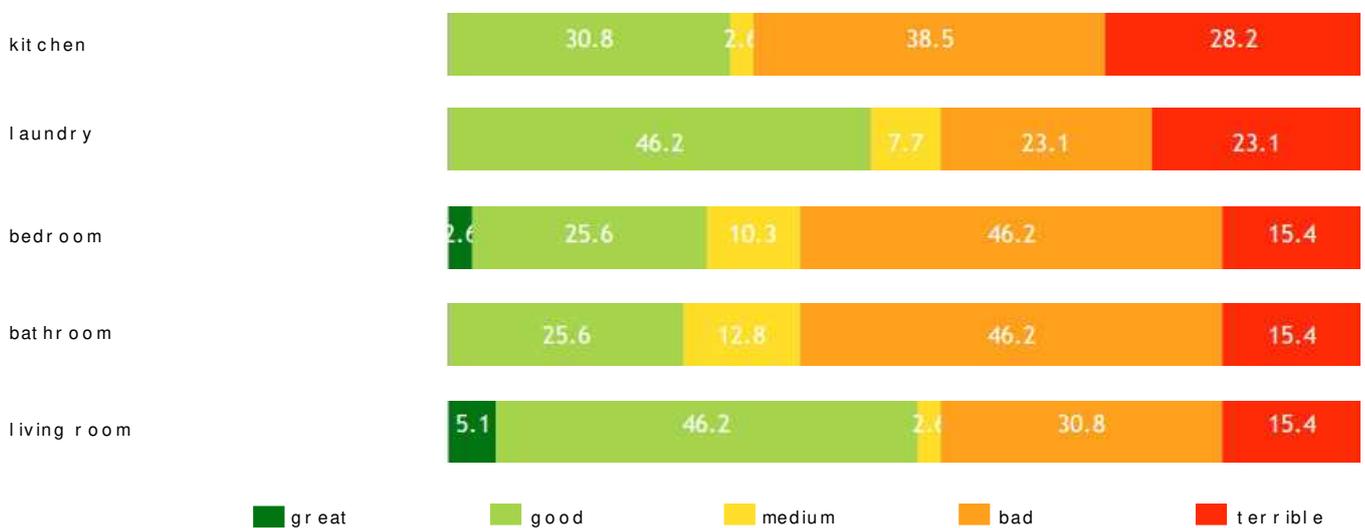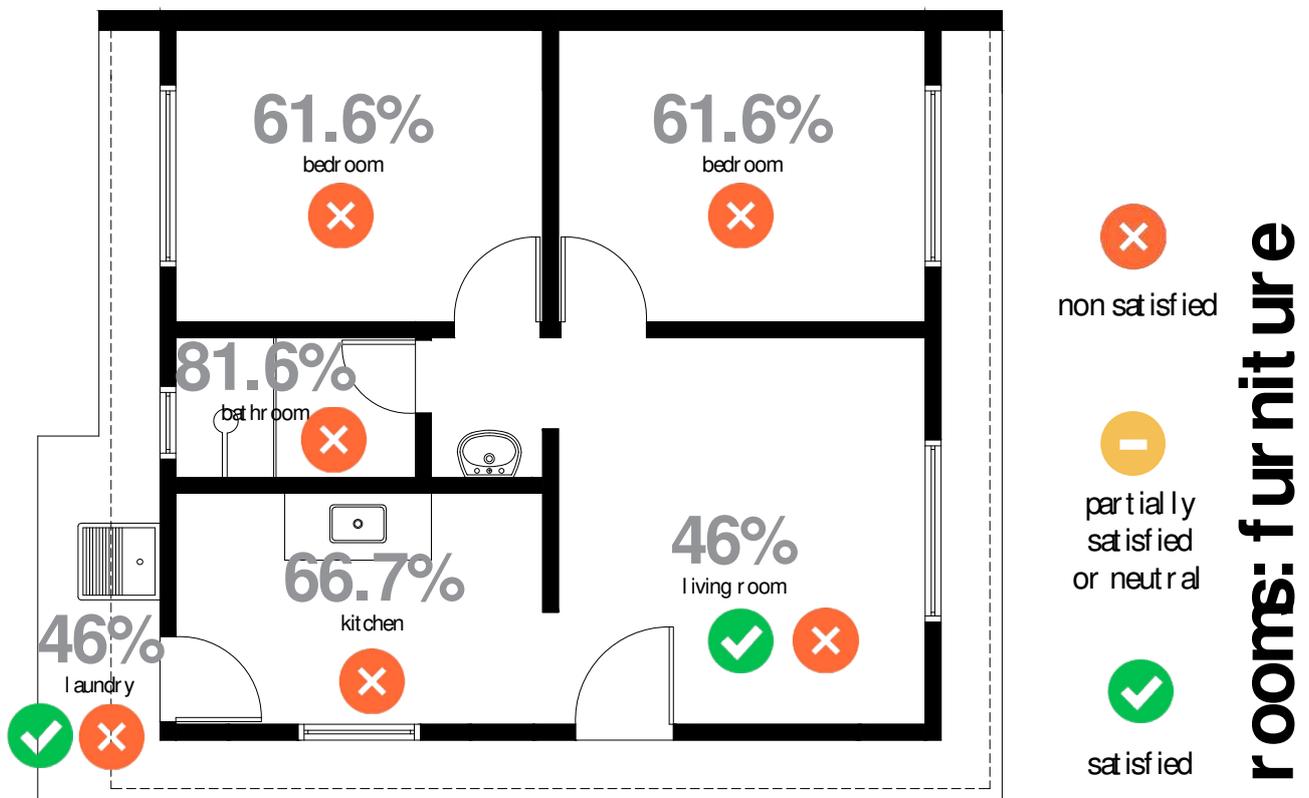
Source: Authors, 2016.

Graph 58 - Previous furniture

■ fitted completely ■ fitted partially ■ half fitted ■ few fitted ■ none fitted

previous furniture fit in the new residence	35.9	17.9	5.1 / 17.9	23.1

Source: Authors, 2016.

Graph 59 - Quantity of furniture

completely sufficient	sufficient	medium	insufficient	completely insufficient

current quantity of furniture	15.4	41.0	12.8	30.8

Source: Authors, 2016.

Regarding to the temperature, most of the respondents feel partially satisfied or neutral, which means they did not consider it as an issue.

Figure 169 - Rooms temperature

rooms: temperature

52.5% bedroom

52.5% bedroom

66.7% bathroom

55% living room

57.5% kitchen

50% laundry

non satisfied

partially satisfied or neutral

satisfied

	great	good	medium	bad	terrible
bathroom	10.3	12.8	66.7	7.7	2.
kitchen	10.0	15.0	57.5	12.5	5.0
living room	12.5	17.5	55.0	12.5	2.
bedroom	12.5	17.5	52.5	15.0	2.
laundry	12.5	15.0	50.0	12.5	10.0
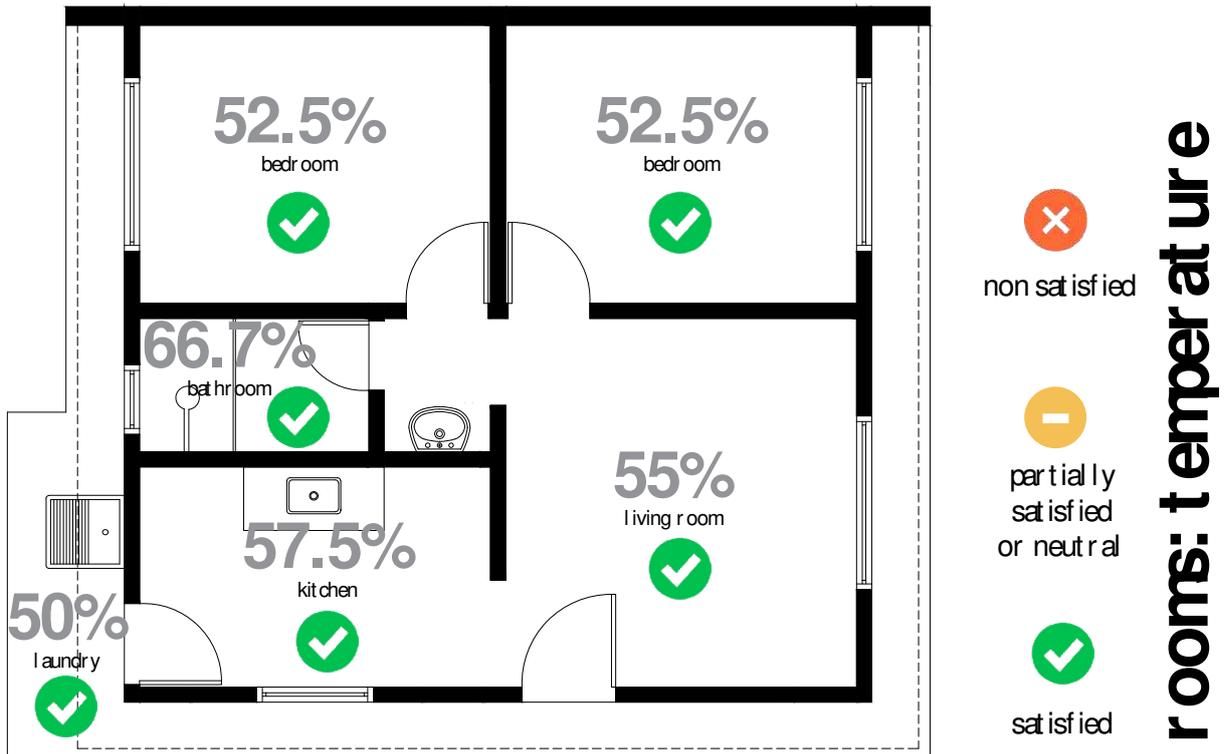
Source: Authors, 2016.

Likewise, most of the dwellers agree that the natural lighting is satisfying. The only interesting fact is the bedroom on the left and also the bathroom that sometimes do not have natural lighting, this is because the dwellers tend to add a covering in that part of the house.

Figure 170 - Rooms lighting
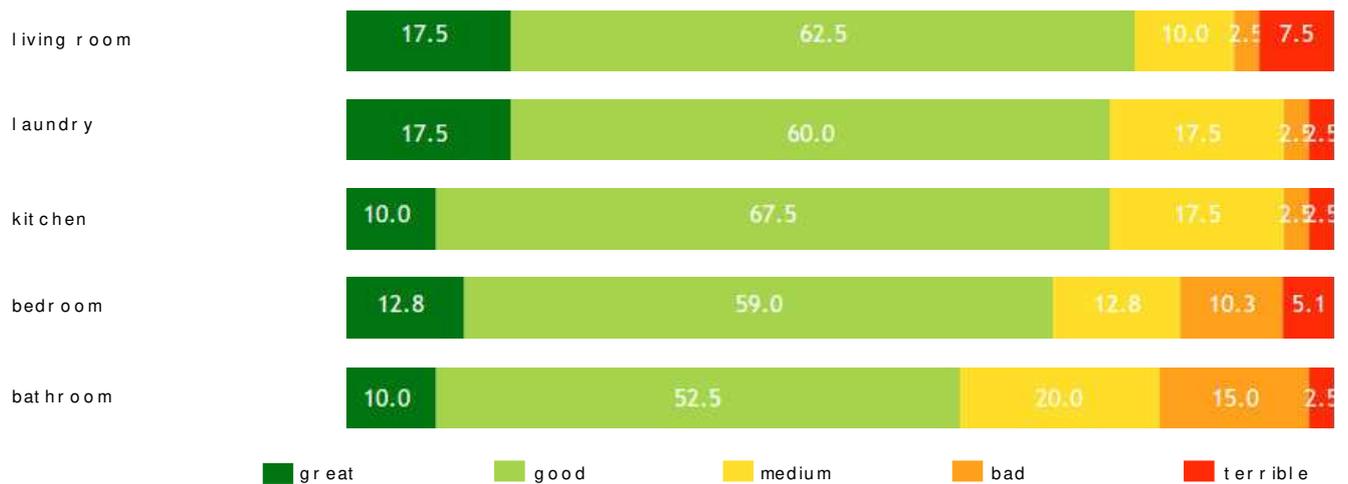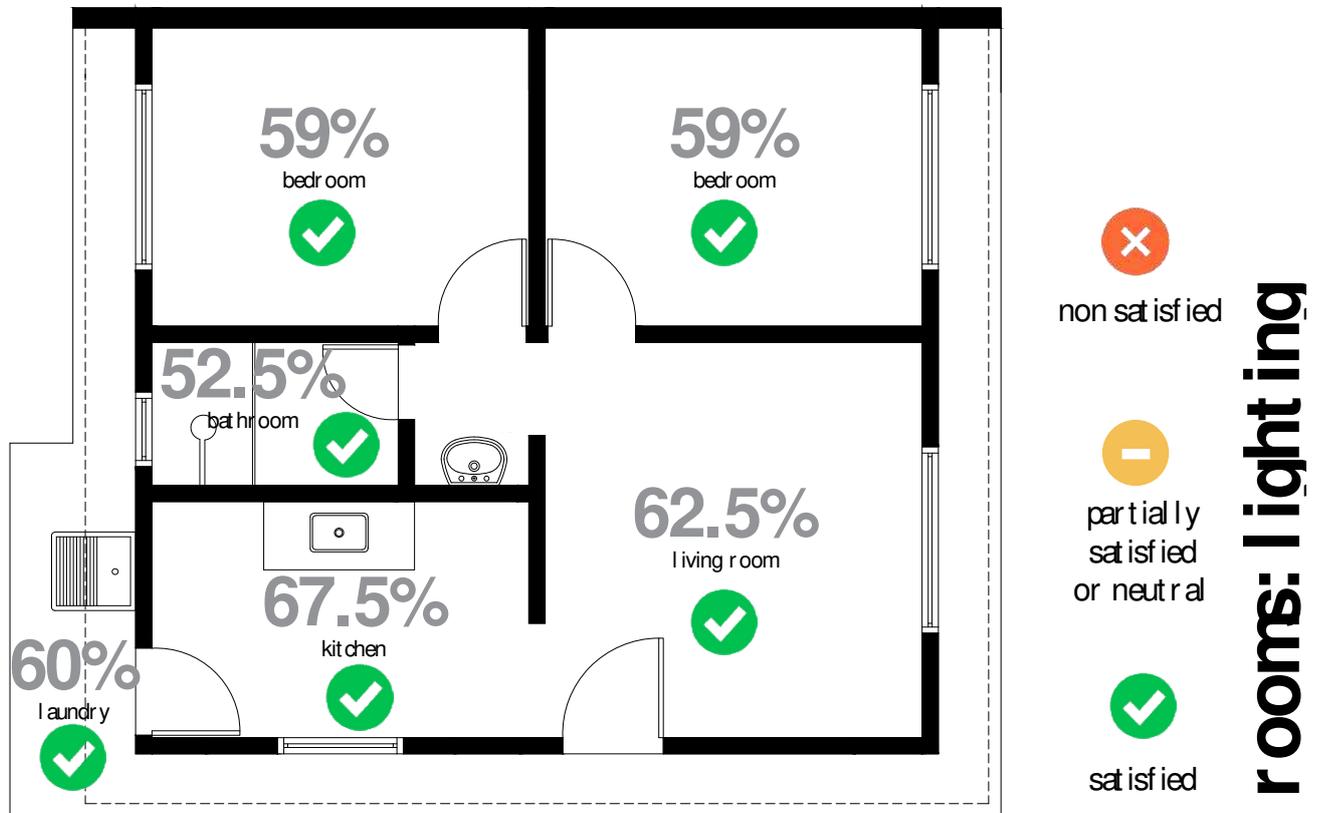
Source: Authors, 2016.

In relation to the ventilation, some of the responders agree it is not an issue. According to them, the rooms have good ventilation.

Figure 171 - Rooms ventilation
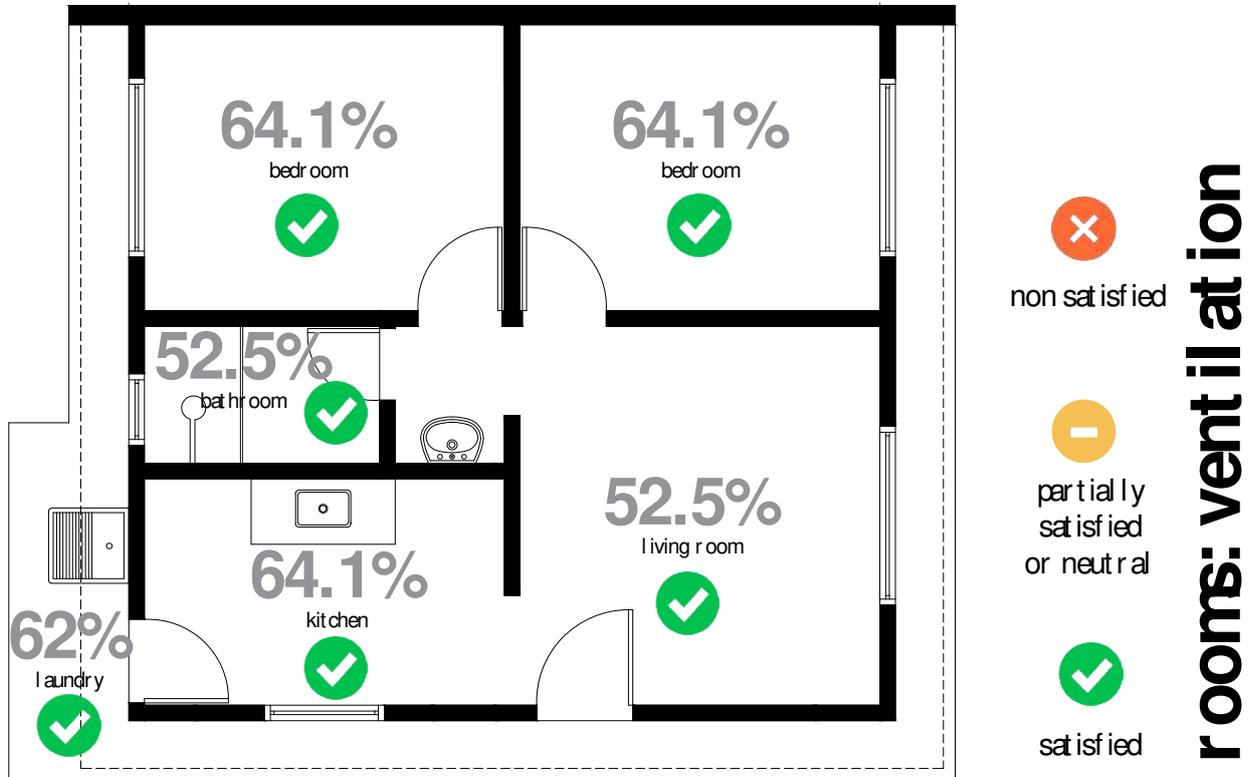
Source: Authors, 2016.

One of the main issues of the acoustics is the shared wall, which divides the two terraced houses. The wall is located at the bedrooms, and most of the dwellers reported they feel lack of privacy.

Figure 172 - Rooms acoustic
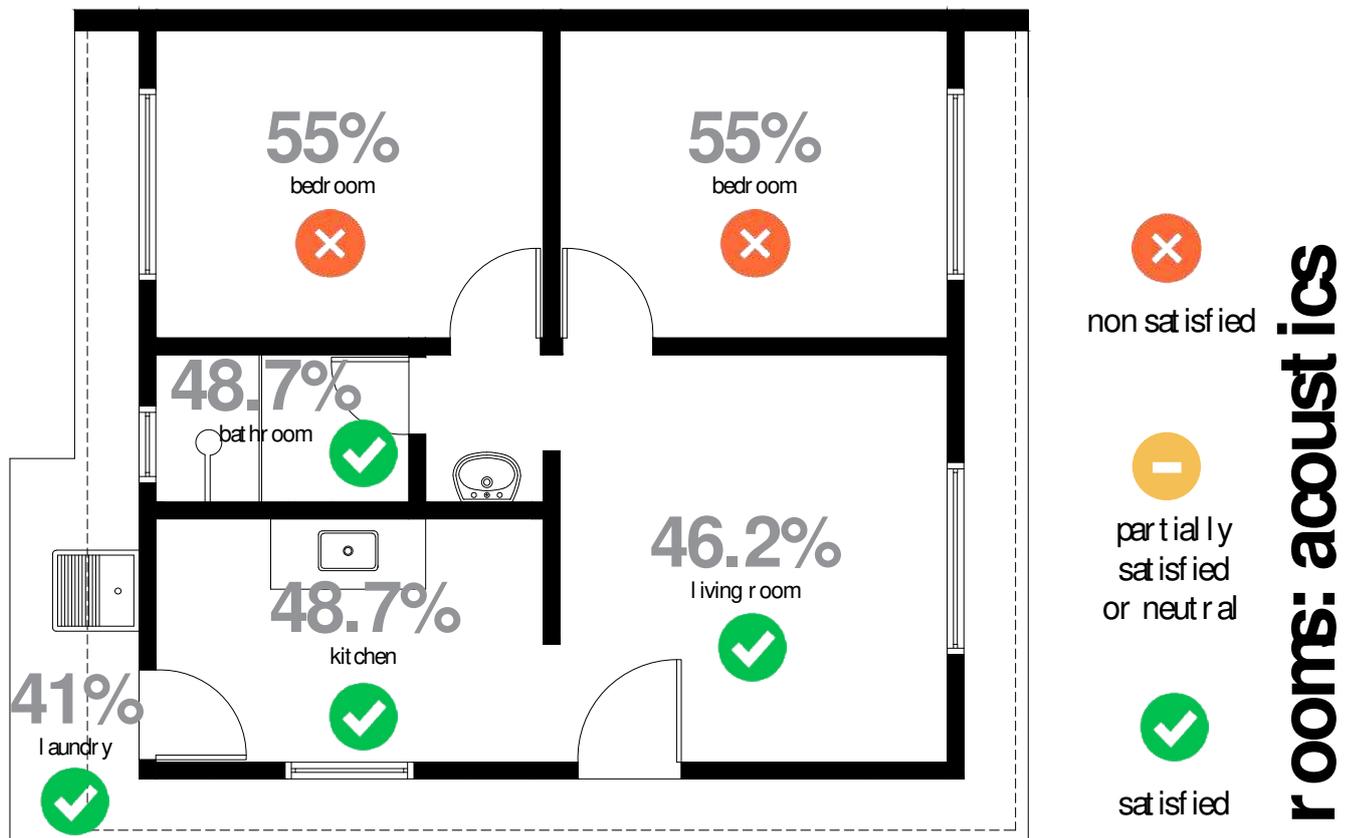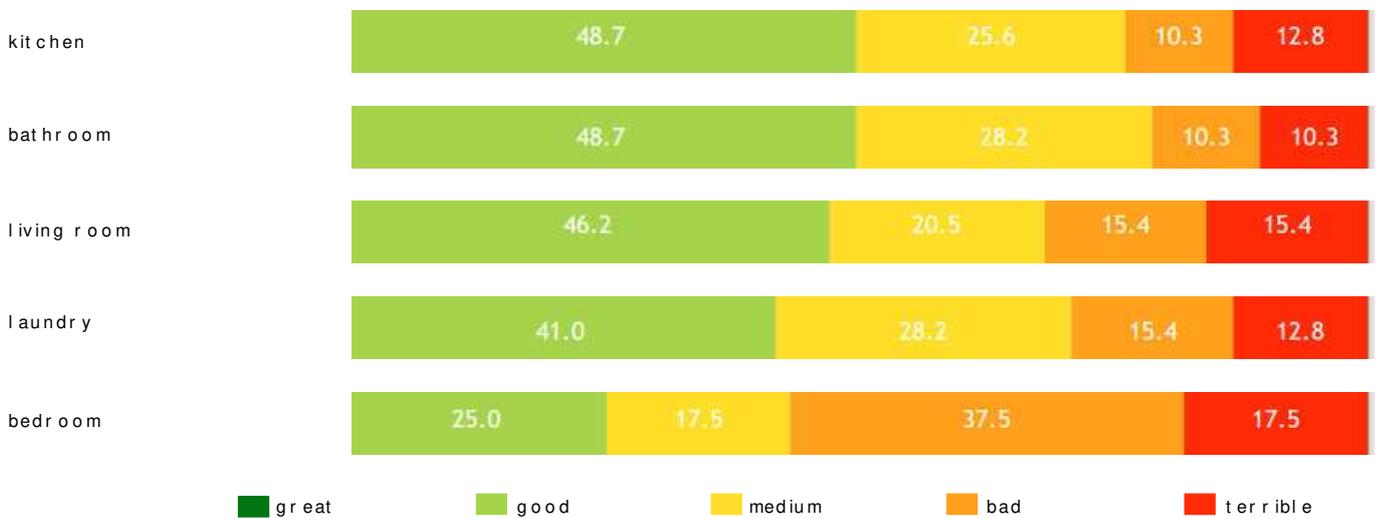
Source: Authors, 2016.

Although they believe it is difficult to furnish the space, the dwellers also think they can store well. Thus, most of them feel satisfied storing their belongings.

Figure 173 - Rooms storage
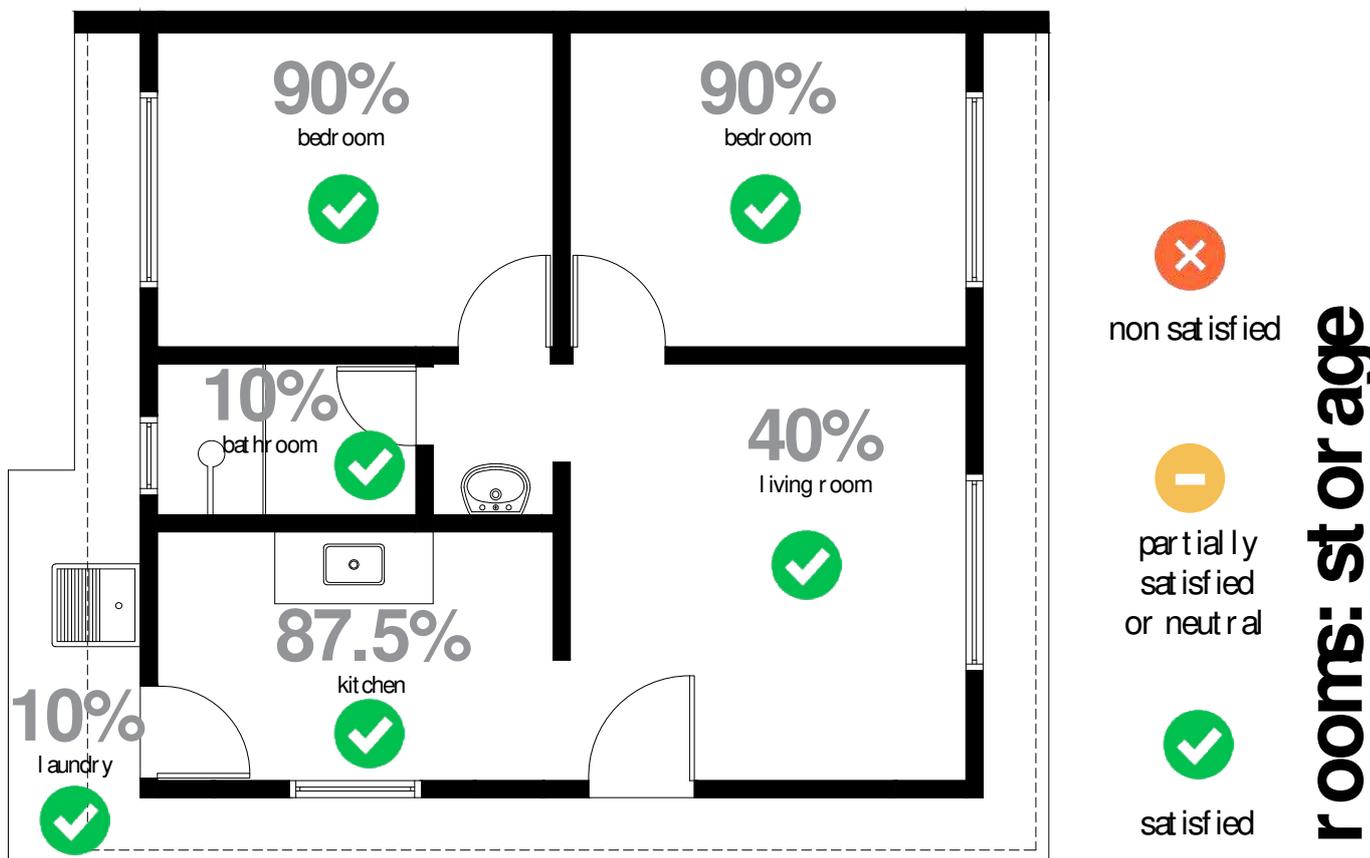
Source: Authors, 2016.

Regarding the level of satisfaction about the location of the houses. In the Graph (60) below, we can see that most of the dwellers feel satisfied with the proximity of their house to facilities. However, they are not satisfied with the proximity to their workplace, as well as to the city centre.

Graph 60 - Proximities
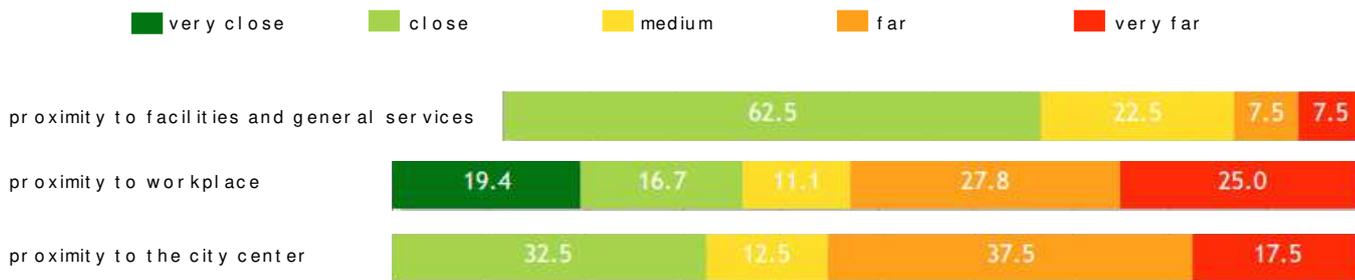
Another point, as it was previously mentioned, the safety issue. In this case of scale (housing characteristics), they mostly feel unsafe against robbery and strangers entrance.

Graph 61 - House safety

| very safe | safe | medium | unsafe | very unsafe |

| safety against robbery and strangers entrance | 37.5 | 7.5 | 42.5 | 12.5 |

Source: Authors, 2016.

In relation to the external house appearance, most of them (76.3%) considered it as beautiful and medium. It is important to clarify that they have changed the external house. Thus, they considered its currently beauty aspect.

Graph 62 - House appearance

| very beautiful | beautiful | medium | ugly | very ugly |

| external appearance of the residence | 39.5 | 36.8 | 21.1 | 2.6 |

Source: Authors, 2016.

Although they believe the appearance is beautiful, they considered the quality of the construction and finishing materials from the original design were bad or very bad (52.5%).

Graph 63 - House quality construction and finishing

| great | good | medium | bad | terrible |

| quality of the construction and finishing materials used | 5.0 | 20.0 | 22.5 | 27.5 | 25.0 |

Source: Authors, 2016.

The majority of the responders (65%) believe it is easy to maintain and keep the house clean.

Graph 64 - House maintenance and cleaning

| great | good | medium | bad | terrible |

| cleaning and maintenance easiness | 2.5 | 62.5 | 7.5 | 17.5 | 10.0 |

Source: Authors, 2016.

In relation to the rooms' division, according to the results, the dwellers demonstrate they are very divided. 40% agree it is well divided, while 42.5% believe it is very badly or badly divided.

Graph 65 - Rooms division

very well divided	well divided	medium	badly divided	very badly divided

rooms' division	40.0	17.5	32.5	10.0

Source: Authors, 2016.

Although this result demonstrates the dwellers are divided (50% considered they do not have privacy, while 42.5% think they have), it was mentioned before that most the dwellers complained about privacy, mainly because of the shared wall.

Graph 66 - Privacy in relation the neighbours

completely privacy	reasonable privacy	medium	few privacy	no privacy

privacy in relation to the neighbours	20.0	22.5	7.5	25.0	25.0

Source: Authors, 2016.

Considering the privacy between their family members, most of them (57.9%) agree it is not a problem between them.

Graph 67 - Privacy between the house residents

completely privacy	reasonable privacy	medium	few privacy	no privacy

privacy between the house residents	15.8	42.1	10.5	21.1	10.5

Source: Authors, 2016.

Although they considered they have several issues where they live, most of the dwellers (67.5%) believe that they identify themselves with their residence.

Graph 68 - Identify yourself with your residence

very much	reasonably	medium	a little	none

identify yourself with your residence	47.5	20.0	20.0	10.0	2.5
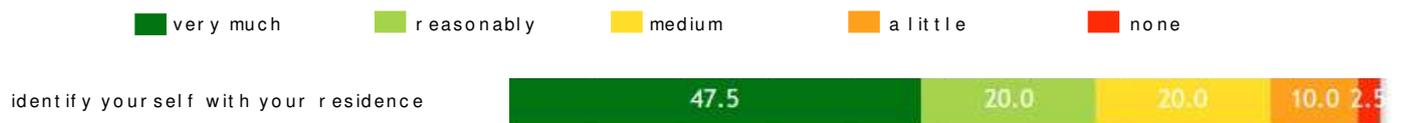
Source: Authors, 2016.

Also, the majority (77.5 %) adapted very much or reasonably their residence.

Graph 69 - Adapted to their residence

very much	reasonably	medium	a little	none

how much they have adapted to their residence	52.5	25.0	7.5	10.0	5.0

Source: Authors, 2016.

In order to understand how the dwellers have adapted their residence, it was identified the number of people which have changed their place. 92.3% reported that they have changed something from the original design of the house. Also, it was asked which rooms that they mostly changed (Figure 172). As it shown

below, all the rooms have been changed. However, comparing all the rooms, there is a large percentage that modified mainly the external area including the laundry.

Figure 174 - Rooms alterations
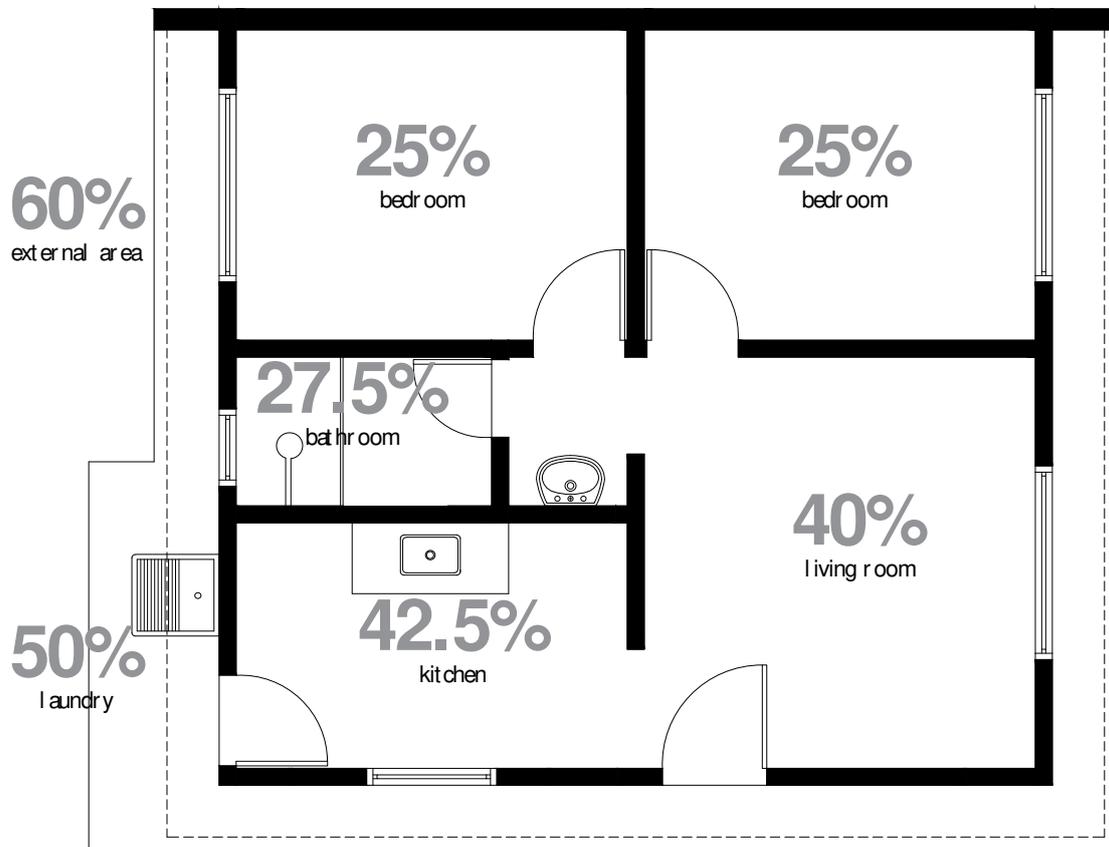
Source: Authors, 2016.

Moreover, it was identified the reasons for the changes and reforms in the house. The first reason was enlarged the rooms, with 80% of the responders agreeing with it. Moreover, there was a significant percentage relating the reasons with solve technical problems and privacy and comfort improvements (Graph 70).

Graph 70 - Reasons for reform

Reason	Value
enlarge the room	80.0
solve technical rpoblems	47.5
improve privacy	45.0
improve the comfort	40.0
change the rooms' function	20.0
build a commercial area	15.0
improve the stocking	10.0
improve the aesthetical apperance	10.0
eliminate the room	5.0
do not apply	5.0
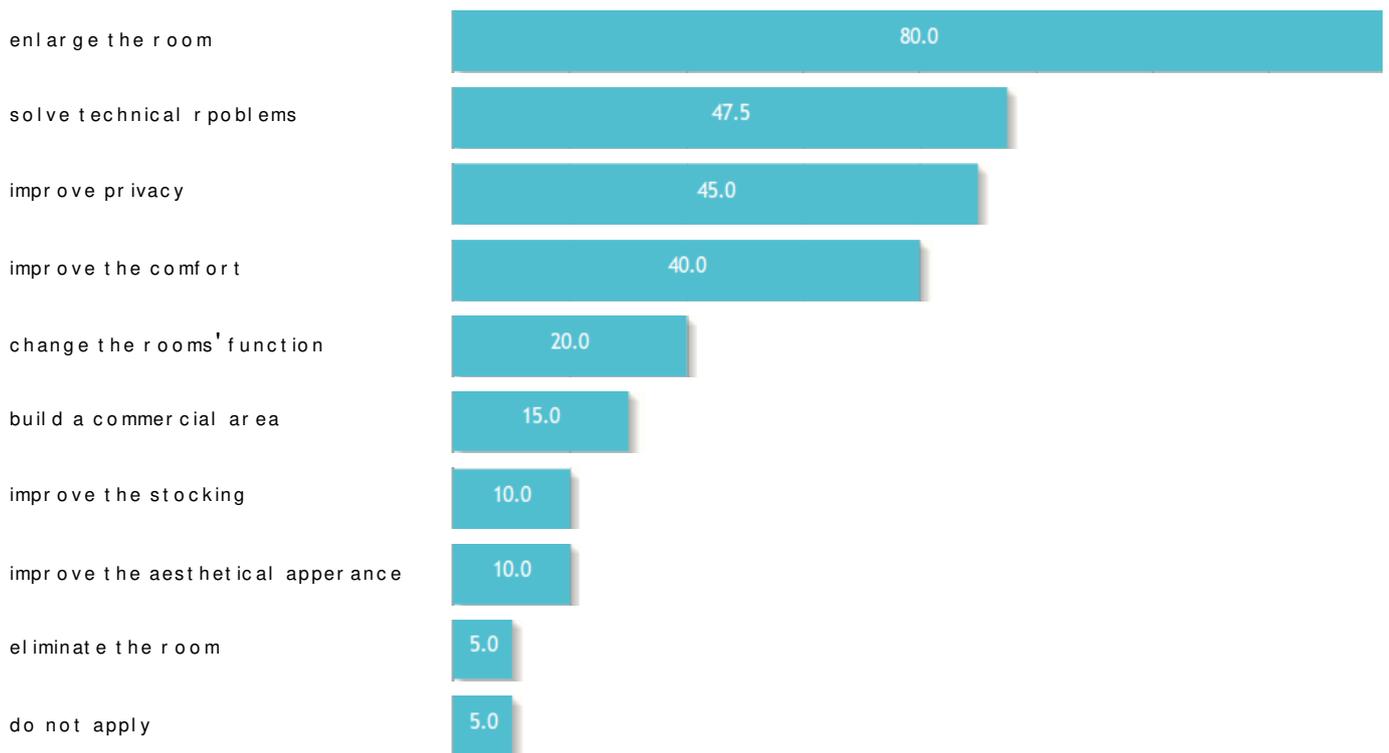
Source: Authors, 2016.

Finally, it was investigated what it was mostly done in the reforms. The mainly and also the first modification that dwellers did it was the construction of walls. Once they moved to where they live, they built a wall to limit or close their lot. The others modifications, which were also greatly cited were: enlarge or exchange of coverage, addition or removal of walls, paving of the external area, and finally, painting (Figure 76).

Although the housing program do not allow the construction of commercial areas in the lots, 15% of the responders reported that they built some type of commercial area in their house. It can relate with the percentage of dwellers that said they use their house to earn an extra income, which is 30%.

Graph 71 - What it was done in the reform

Category	Value
walls construction	77.5
enlarge or exchange coverag	67.5
adding or removing wall	57.5
paving the external area	52.5
painting	40.0
leisure area creation	32.5
hydraulic and sanitary facilities installation	32.5
eletric facilities installation	32.5
change of doors or windows	30.0
change of finishing	30.0
creation of rooms for commercial areas	15.0
adding cabinets	10.0
do not apply	5.0
plaster placement	2.5

Source: Authors, 2016.

3.2.4.5. ENERGY, EFFICIENCY AND SUSTEINABILITY

In this part of the questionnaire, it was investigated the environmental awareness of residents. Firstly, it was questioned if they save electricity and/or water. Most of them reported that they do save and the most common reason is to reduce the bills. There was a small percentage that reports that they save because of the environment and also the fear of rationing in dry time.

Graph 72 - Reasons fro save electricity and water

WHY DO YOU SAVE ELETRICITY AND/OR WATER?

TO REDUCE THE BILLS	87.5
TO CAUSE LESS DAMAGE TO THE ENVIRONMENT	30.0
FEAR FROM RATIONING IN DRY PERIODS	30.0
DO NOT SAVE WATER	10.0
DO NOT SAVE ELETRICITY	7.5

Source: Authors, 2016.

Moreover, it was identified the main ways to save water and electricity for them. As it is shown below, most of them usually turn off the lights after they leave a room. Also, they reported that they use economic lamps and turn off the house appliances when they are not using it.

Graph 73 - Ways to save electricity

WHAT DO YOU DO TO SAVE ELECTRICITY?

TURN OFF THE LIGHTS AFTER YOU LEAVE THE ROOM	77.5
USES ECONOMIC LAMPS (LIKE FLUORESCENT AND LED)	37.5
TURN OFF THE APPLIANCES WHEN THEY ARE NOT IN USE	35.0
BUY HOUSE APPLIANCES WHICH SAVE ENERGY	15.0
DO NOT SAVE ELECTRICITY	10.0

Source: Authors, 2016.

In relation to the water saving, the most common way for them is brush the teeth with the tap closed, and also reuses water from the washing machine to wash the residence. It is important to clarify that in Brazil people usually wash their house, mainly the pathway. When they choose to reuse the water from the washing machine it demonstrates a very clever way to save water and a friendly environmental mentality.

Graph 74 - Ways to save water

WHAT DO YOU DO TO SAVE WATER?

BRUSH TEETH WITH THE TAP CLOSED	50.0
REUSES WATER FROM THE WASHING MACHINE TO WASH THE RESIDENCE	47.5
SOAP THE DISHES WITH THE FAUCET CLOSED	37.5
TAKE QUICK BATHS (5 TO 10 MINUTES)	35.0
USE THE WASHING MACHINE WITH MAXIMUM CAPACITY	27.5
DO NOT SAVE WATER	22.5
OWN APPLIANCES THAT SAVE WATER	10.0
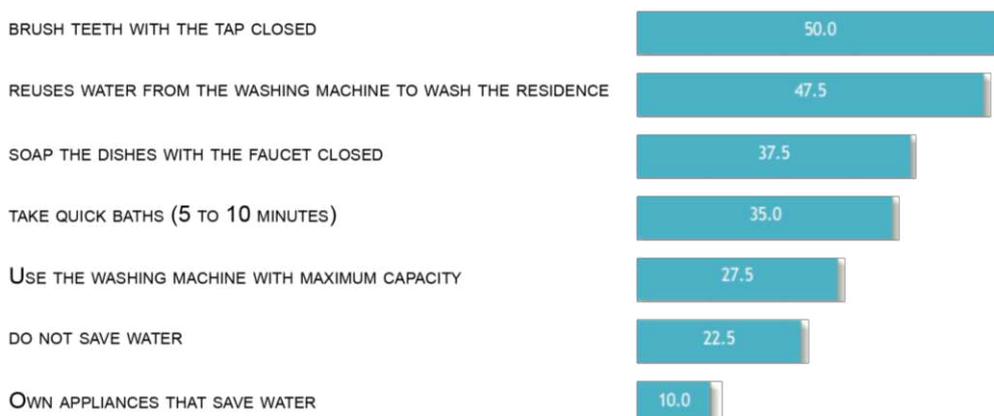
Also, it was questioned the waste separation. It was interesting to note the fact that the majority of respondents (57.5%) carry out the separation of recyclable waste, (such as plastic bottles, milk cartons and aluminium cans) from the organic waste. However, only 10% know the destination of the recyclable waste.

Graph 75 - Waste separation

do you separate waste between recyclabe and common?

Graph 76 - City's recycled destination

do you know where the city's recycled waste go?
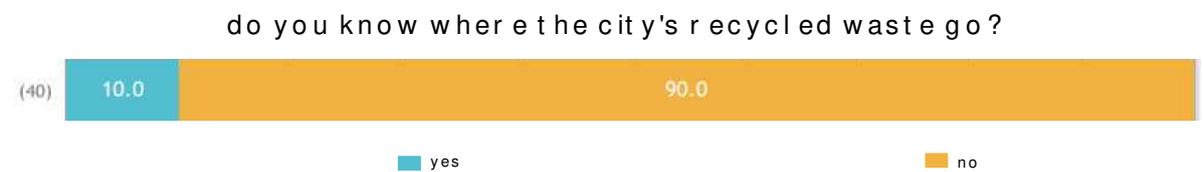
Moreover, a significant 76.3% carry out the separation of oil for reuse. This information shows that the existence of a consolidated environmental awareness in the neighbourhood.

Graph 77 - Oil waste

do you separate oil waste from the othe kinds of waste?

Yet about the garbage, 65% of respondents reported that they have seen their neighbours throwing garbage on the streets and in empty lots. However, only 5% of respondents assume that they have done it.

Graph 78 - Neighbour throwing litter on street

do you usually see your neighbour throwing litter on street?

Graph 79 - Waste discard on street

do you usually discard your waste on street?
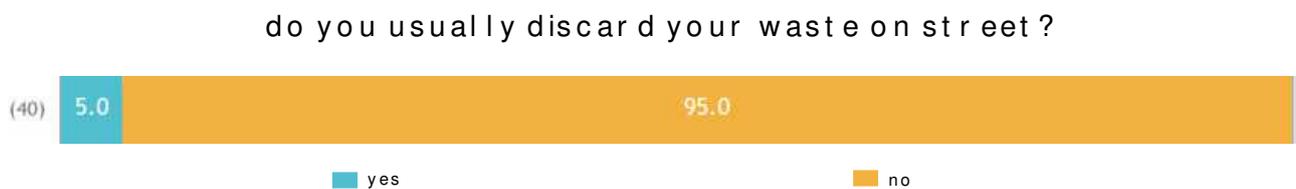
Graph 80 - Waste discard in vacant lots

do you usually discard your waste in vacant lots?

(40)	25.0	75.0

■ yes   ■ no

Source: Authors, 2016.

There are two reasons for this interesting fact. The first assumption is the study area is located at a land sloping towards the Uberabinha's river. It means that when there is a strong wind or rain the garbage flows according to the topography, and pollutes even more. Another point is the public dumps have leaked format, which leads to poorly packaged junk "escape" from their crevices. In addition, most of the houses are in constant reforms, which mean there is a lot of construction waste on the street. Thus, those features contribute to visual pollution of the streets, which remains even after sweeping dirty, and keeps increasing in the lowest part of the neighbourhood, where they accumulate waste. The second assumption is that most of the dwellers did not assume they usually discard waste in empty lots. Thus, it may mean that there is awareness of what the right practice is; however, there is no proper place to discard a large amount of waste.

Regarding the vegetation, 76.9% of respondents have some kind of plan in their place, but 67.5% of them miss more gardens and green areas. It is an interesting fact because, when the dwellers moved into their new place, they had enough space to create gardens and green areas. However, most of them prefer to pave and some of the reasons were the difficulty of maintenance and/or lack of knowledge for plantation and/or financial resources, and so on.

Graph 81 - Plants

do you have plants?

(40)	76.9	23.1

■ yes   ■ no

Source: Authors, 2016.

Graph 82 - Green area

do you miss garden or green areas in your residence?

(40)	67.5	32.5

■ yes   ■ no

Source: Authors, 2016.

Another interesting result is related to organic food production and consumption. More than half of respondents reported producing some kind of food at home, referring to the feet of fruits, vegetables and medicinal herbs. However, only 15.2% affirmed that they are consumers of organic food. Thus, it can be concluded that majority of this study case do not know the meaning of organic food.

do you consume organic food?

15.2	69.7	15.2

(40)

■ yes　　　　　■ no　　　　　■ sometimes

Source: Authors, 2016.

Graph 84 - Producing food

do you produce any food at your home?

52.5	47.5

(40)

■ yes　　　　　■ no

Source: Authors, 2016.

Regarding the displacement, 78.8% of respondents take up to an hour to get to the workplace, usually located in the city centre. The main means of transport are the bus (60% of respondents), the car (17.5%) and motorcycle (12.5%). This fact emphasises the Graph 60 (previously mentioned), which shows they considered their house far or very far to the workplace and also to the city centre.

Graph 85 - Time to arrive at workplace

how long do you take to go to your work place?

48.5	18.2	12.1	12.1	9.1

(40)

■ up to 30 min　　■ 30 - 45 min　　■ 45min - 1h　　■ 1h - 1:30h　　■ 1:30h - 2h　　■ more than 2h

Source: Authors, 2016.

Graph 86 - Type of transport

what the main kind of transport do you use?

60.0	0.	12.5	17.5	2.	7.5

(40)

■ bus　　　■ motorcycle　　　■ car　　　■ bicycle　　　■ foot
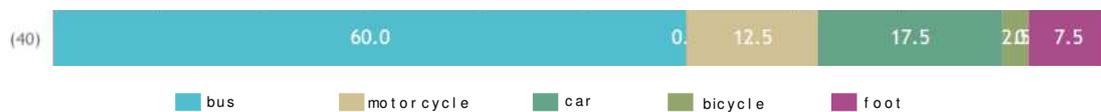
Source: Authors, 2016.

3.2.5. CONCLUSION:

Despite all weaknesses detected in this tool, it is noted that all these points are factors and / or potential for intervention.

On the scale of the neighbourhood and block, for example, the quality in relation to public facilities was one of the aspects of greater dissatisfaction. This is mainly due to two factors: the absence of facilities that exceeds local demand and also the bad maintenance and cleaning regarding to the existing facilities. This dissatisfaction becomes even more evident when we note that residents reported that they were more satisfied in their old home because of the location relative to public facilities. In this sense, we note the potential for co-production in the maintenance, cleaning and qualification of existing public and green

facilities and spaces. It is necessary to bring to the residents the feeling of belonging and reinforcement of identity regarding public spaces.

On the scale of the housing unit and block, the quality of the buildings is one of the aspects of greater dissatisfaction. As was previously mentioned, the residents believe that the terraced houses are one of biggest problem. This become more evident when we notice the issues of acoustics and dissatisfaction with privacy. In addition, one of the most reasons cited for reforms was solving technical problems and improving privacy. Thus, it is essential to plan co-production themes that seek solutions to improve these dwellings in these aspects.

Regarding sustainability, one of the biggest weaknesses of the site is the waste issue. Although the residents already separate the garbage, they still do not know the destination of this recycled garbage. There is no recycling in the residence with organic waste, for example. In addition, waste deposited in public places and land still intensifies the problem in relation to cleaning and maintenance of the neighbourhood.

Finally, there is a great potential of the region in relation to the lots. Many residents, despite complaining about the absence of garden spaces in their homes, most of them have reported that they already have plants in their places. In addition, the size of lot is very big. Thus, there is a potential for co-production interventions in the sense of creating greater environmental awareness, producing food at home, fertilizing from the domestic organic waste itself.

3.3 CO-PRODUCTION

INTRODUCTION

Co-production, or participative evaluation, has as a premise the researcher impartiality, who works as a facilitator on production and management of space by all involved parties, including the community directly benefited. The tool has emerged in response to a social, political and economic context in which companies and government cannot respond to contemporary urban challenges in time.

According to Petcou and Petrescu (2015), it is not only about an alternative way to face unmet public demands, but also a way to provide effective access to the city. The citizens' right to the city means the right to the urban land, and moreover, the right to participate in its development, use and management. Thus, the partnership between academics and non-academics, through co-productive work methodologies, can reach significant public benefits. The generation and dissemination of knowledgement matters while it enables new possibilities of interaction with contemporary issues.

The boundaries between knowledgement production and effective action must be blurred, promoting a reconciliation of academic and non-academic communities. According to Vanderhoven and Campbell (2016), research must be a collaborative, interactive process of shared learning. There is no hierarchy of knowledge forms, prevail a great interdisciplinarity, and, overall, the main goal is the effective action. Traditional research approaches are overcome, while non-academic communities are no more a passive role at the play.

From this, were realised two experiences of Co-production at Shopping Park neighbourhood. One shaped as a Collective Coffee, and the another as the Second Meeting of 'Renew Shopping Park' group, as detailed below. Both meetings were previously divulged between residents through brochures (Annexes 3, 4 and 5).

LOCATION

The Center of Unified Arts and Sports (CEU) is located at 700 Juvenília Mota Leite Street, at Shopping Park neighbourhood. Was conceded by the administration of CEU, to the meetings, a space with about 100

square meters, shared between a classroom and a workshop room. The classroom was equipped with 20 chairs, a large desk and a multimedia projector. The workshop room was equipped with 3 large desks, 2 small desks, 4 chairs, a fridge and 2 tall cabinets (that divided the space).

3.3.1 CO-PRODUCTION Nº 1

NAME: Café Coletivo "Do que você precisa?", DATE: 07/09/2016

ADRESS: Center of Unified Arts and Sports (CEU), 700 Juvenília Mota Leite Street, Shopping Park, Uberlândia.

RESEARCHERS: Arch. Drª. Simone Barbosa Villa, Arch. Dr. Fernando Garrefa, Arch. Juliana Silva Arantes, Arch. Karen C. Ruman de Bortoli, Aline Rodrigues, Paula Vasconcellos, Vanessa Campelo

PURPOSE: The first experience of Co-production had as the main purpose to present the research in course to the community of Shopping Park neighbourhood and its main goals and adopted methodology. The building of resilient cities depends on the commitment of various actors, and especially the citizens directly involved, at this case, the Shopping Park dwellers.

Through questions as "What do you need?", "What is missing here?", "What would you like to have here?", the residents were encouraged to reflect on the neighbourhood, the housing unit and the relationships between them. Next, residents were invited to suggest locations in the neighbourhood for the urban elements proposed by them, locating it with a flag in map previously prepared by the researchers.

Were secondary goals of this Co-production:

- To identify the main complaints of the residents in respect to their neighbourhood;
- To collect suggestions of improvements and its respective locations on the space;
- To elect a name to identify the project between the residents.

NARRATION: The breakfast served at the Collective Coffee was prepared by researchers and disposed on a side desk in the workshop room. A map of the Shopping Park neighbourhood scaled in 1 to 300 m was posted on a styrofoam base, in order to receive flags with the proposals of urban elements to the neighbourhood. The map was disposed at a large desk in the centre of the room, allowing the placement of participants around.

A few minutes after the start time, the researchers went to the street to attract the attention of passersby to the event. As residents arrived and served themselves with food, they were asked to mark their homes on the map with a flag, identified by their names. Next, the participants were encouraged to comment individually on their neighbourhood, through questions like "What do you need?", "What is missing here?" "What would you like to have here?", and finally, "Where would be a good place for it?". Then, the researchers marked the urban elements cited with a flag on the map.

In a second stage, with participants around the map (Figure 174), researchers have launched issues for collective discussions, such as: open spaces, recreational facilities, health facilities, educational equipment, disposal of waste and neighbourhood relationship. Part of the team was responsible for the photographic records and notes on key issues cited and demands, listed below in the order they have appeared:

- Installation of a Multisport Centre covering the "top of the neighbourhood", which be closed and specific to the practice of sports;
- Creation of an Ecological Park to the neighbourhood, which offers sportive activities;
- Installation of a supermarket in the southern portion of the neighbourhood;
- Building of a School, that include the high school degree;

- Construction of 3 to 4 Kindergartens around the neighbourhood, that operate at full-time;
- Hypermarket that has a Lottery to provide financial services;
- Designing of a Linear Park along the river;
- Neighbourhood relationship harmed by the fact houses are detached, mainly due to the shared noise;
- The need of an acoustic solution to the shared wall;
- A resident reported that she had problem with her neighbour's accumulation of trash and rat infestation;
- Frequent deposition of paper and clothes on vacant allotments attract rodents;
- Need of large displacement to access health care equipment;
- Pedestrians using the street to transit due to irregularity on sidewalks;
- Lack of trees at the streets;
- Instalation of kiosks and running tracks near the school;
- Qualification of the river area, where currently occurs deposition of waste and consumption of illicit drugs, making it difficult to coexist;
- Sorting of recyclable waste, such as steel cans and PET bottles, to local waste pickers;
- The litter collection is efficient, but streets remain dirty due to dwellers' lack of commitment;
- Discussion: "What can each resident do?"
  - To look after the shared spaces, such as walls and allotments' backs;
  - Shared rental of garbage buckets to adequate collection of rubber;
  - Proper packaging of their own waste.

Figure 175 - Collective Discussion.

Source: BORTOLI, 2016.

Figure 176 - Activity with children.

Source: RIBEIRO, 2016.

Figure 177 - Activity with children.

Author: RIBEIRO, 2016

Simultaneously to the Collective Discussion, children present were encouraged to draw under the theme "My neighbourhood is ...". Some children drew their own residence and other, free spaces of the neighbourhood (Figures 175 and 176). During this activity, the children's point view of the neighbourhood was also observed, when the main topics mentioned were:

- The lack of security caused by the existence of vacant allotments near school and daycares;
- The desire on creating of a square next to the school;
- The creation of an Elementary School next to the existing daycare;
- The fact that CEU is not a safe place to have fun at night;
- The courses offered by the CEU are tiring;
- CEU could offer more sportive activities;
- The fact that they play more at their streets than at CEU;
- Accidents occur frequently in the streets that surround CEU, there is not a semaphore;
- It is necessary to create bus shelters at the bus points;

- The desire to have an ice-cream parlor ans a market at the "new neighbourhood";
- The creation of a club with pools;
- The existence of neighboring parking trucks on the street, blocking the entrance to the garages.
- The belief that a joint effort of cleaning would not work, since the coexistence between neighbours is negative.

Figure 178 - Presentation - Slides 1 - 4.

Source: ARANTES, 2016.

Figure 179 - Presentation - Slides 5 - 8.

Source: ARANTES, 2016.

Figure 180 - Presentantion of the project.

Source: VASCONCELLOS, 2016.

Once reached the peak of participants, a total of 8 adults and 5 children, all were invited to occupy the classroom chairs, where attended to the presentation of the project and the team. The presentation

included the topics: "Ideas and Actions", "About us", "Goals", "How?", "Where?" and "How can I help?" (Figure 178).

During the presentation, it emerged the subject "creation of orchards and vertical gardens" when a resident suggested the installation of PVC pipes in the walls of houses to accommodate this.

Names suggestions were asked to identify the project among the community. "Integrated City", "Integration City," "Reinvent Shopping Park" and "Renew Shopping Park" were some of the suggested titles. It was agreed by most that the title will be "Renew Shopping Park - Integrated Solutions for the Neighbourhood." The figure 179 illustrate some moments of the presentation.

Finally, Registration Data were collected from participants at the first experience of Co-production at Shopping Park neighbourhood (Annex 6).

RESULTS:

Figure 180 places at the Shopping Park neighbourhood the urban elements proposed by the residents of the first co-production. Such suggestions refer mainly to the installation of new commerces, health and education facilities, and leisure and rest facilities in the neighbourhood.

It is considered that the first experience of co-production between researchers and residents at Shopping Park neighbourhood was positive to establish the link between academic and non-academic community.

Figure 181 - Situation of urban elements proposed by residents.

Source: BORTOLI, 2016.

3.3.2 CO-PRODUCTION Nº 2

NAME: II Meeting Renew Shopping Park: "What is your favourite place at the neighbourhood?"

DATE: 08/07/2016

ADRESS: Center of Unified Arts and Sports (CEU), 700 Juvenília Mota Leite Street, Shopping Park, Uberlândia.

RESEARCHERS: Arch. Drª. Simone Barbosa Villa, Arch. Dr. Fernando Garrefa, Arch. Drª. Fionn Stevenson, Arch. Juliana Silva Arantes, Arch. Karen C. Ruman de Bortoli, Aline Rodrigues, Paula Vasconcellos, Vanessa Campelo

PURPOSE: In the second Co-production, the aim was to continue the process of understanding the needs and potentials of the Shopping Park community, based on the previous question "What do you need?", evolving to the new question "What is your favourite place in the neighbourhood?". Observing the prevalence of a negative feeling about the neighbourhood in the 1st Co-production was tried a positive approach to this second experience, trying to identify possible anchor spaces for changing and improvements on the Shopping Park neighbourhood. Were goals of the second Co-production experience:

- To identify and characterise residents' favourite places at the neighbourhood;
- To present projects developed and in progress in Brazil and in the world that aim to qualify the communities in which they operate through participatory planning processes.

NARRATION: The second experience of Co-production developed at Shopping Park was entitled "II Meeting Renew Shopping Park", that was disclosed a few days before it among the dwellers, personally and WhatsApp, using brochures (Annex 4). Phone numbers were collected during the personal disclosure. Through the central question "What is your favourite place in the neighbourhood?", residents were encouraged to reflect on the neighbourhood and about themselves, and qualify sites chosen in its positive and negative aspects. The recording of those informations occurred by placing green flags for positives, and red for negative aspects, on the same map used in the 1st Co-production.

A breakfast acquired in a bakery near by CEU was arranged at the workshop room and the map, again arranged in a central table visible to all participants. A few minutes after the start time, the researchers went to the street to attract the attention of passersby to the event. As residents arrived and served themselves with food, they were asked about their favorite places at the neighbourhood.

Figure 182 - Presentation of the project.

Source: BORTOLI, 2016.

Once the participating public of the 2nd Co-production differed of the public participating in the 1st, the researchers presented synthetically the project and its goals for these residents in order to contextualise them in the discussion (Figure 183). Most participants were unprepared to start to reflect on favourite locations in the neighbourhood before placing their opinion in relation to their needs and lacks. Thus, the needs identified in the 1st Co-production were strengthened by these residents, who commented on the need of a lottery and supermarkets in the neighbourhood, as well as recycling points (Ecopoints) and more shopping facilities. Other problems reported by residents of the neighbourhood were:

- The existence of a separation between the old part of the neighbourhood and the new housing allotments, named Shopping Park 1 and 2, what causes hostility among residents;
- Their difficulty of adapting when they move to the neighbourhood;
- The fact that the house is detached is a problem due to noise, causing depression in some residents;
- The financial difficulty impedes them improving their houses;
- The significant spent on the construction of prop walls;
- The lack of government attention in relation to housing at Shopping Park;
- The lack of technical assistance when reforming and changing housing units, resulting in cracks and inconvenience to the residents and their neighbour;
- The loss of the guarantee of the house when it is modified; and
- The shortage of funds on making improvements in homes, and the lack of technical assistance. Often the houses that have been renovated has a bricklayer as a resident, what is not the reality of all (high expenses with labour).

After that, it was remade the question "What is your favourite place in the neighbourhood?", And cited sites were: My Street, CEU, the River and the School. Overall, the negative aspects prevailed over the positive and were even made some suggestions of facilities for each one of these cited places.

Figure 183 - Discussion about favourite places.

Source: BORTOLI, 2016.

With regard to "My Street", the positive aspects mentioned were the good relations with neighbours and the possibility of flying kites. The negatives were: drug trafficking, irregular sidewalks, lack of privacy, noise

caused by parties, drug use, lack of trees, the fact that lot and street be given uneven, requiring the construction of ramps, the accumulation of waste and the proximity to vacant allotments, with high grass. Some residents suggested conducting Sports Competitions and Conversation Circles to qualify the neighbourly relations and the installation of Supermarkets and Recycling Points (Ecopoints) nearby their homes.

The positive aspects of the CEU are: the possibility to fly a kite there, the fact of being enjoyable during the day as a meeting place, and the offer of Capoeira courses. Deposition of waste, lack of activities offered by CEU and the lack of security were the negative aspects mentioned. The construction of a square at the lot next to CEU was suggested, as the installation of an Arcade Shop.

At the River, some people reported being possible to fish and to swim near the waterfall, as positive aspects. However, the occurrence of invasions and drug use there creates a hostile situation. Was suggested the installation of facilities capable of diversifying the use in the region and bring urban dynamics, may reduce the feeling of insecurity.

With regard to the School, although it was cited as a favourite place for some residents in the, only negative aspects were pointed, referring to the deposition of garbage on its surroundings.

Figure 184 - Discussion about favourite places.

Author: BORTOLI, 2016.

After the characterization of the favourite places in the neighbourhood, new complaints have arisen concerning the construction and operation of the CEU in the neighbourhood. Some residents believe that its construction was a waste of public money, and that would be a higher advantage the construction of schools and kindergartens for the neighbourhood. The reasons cited for this belief were:

- The short supply of activities and the lack of regularity of existing activities;
- The lack of instructors and the poor use of the physical space;
- The lack of activities focused on women;
- The lack of a police station or municipal guards who regularly could pass in the region;
- The existence of a theatre that does not offer a theatre course;

- The drug trafficking on site and threats from traffickers to the population;
- The lack of trades and other activities around CEU, capable of bringing urban dynamics and, therefore, more security to the site.

Despite all these problems, it was agreed that the CEU is currently the most important reference point of meeting to the residents in that region, pointing to the need of its renewal. Some residents showed discontent regarding the low participation and membership of neighbours in activities to benefit improvements for all.

Figure 185 - Discussão sobre locais favoritos.

Source: BORTOLI, 2016.

Once exhausted the discussion, residents were invited to occupy the classroom where attended to the presentation of the results obtained in the 1st Co-production and projects developed and in progress in Brazil and abroad, that aim to qualify the communities in which they operate through participatory planning processes. The purpose of this presentation was to contextualise the Renew Shopping Park group in a national and global scene, showing them that such activities really exists and generate tangible results, benefiting the communities involved. It is believed that the motivation comes from the knowledge of actual case studies, so Calafate and R-Urban projects have been shown in a synthetic way for the group, as shown in slides at Figures 186, 187 and 188.

Figure 186 - Presentation - Slides 1 - 4.

Source: BORTOLI, 2016.

Figure 187 - Presentation - Slides 5 - 8.

Source: BORTOLI, 2016.

Figure 188- Apresentação - Slides 9 - 10.
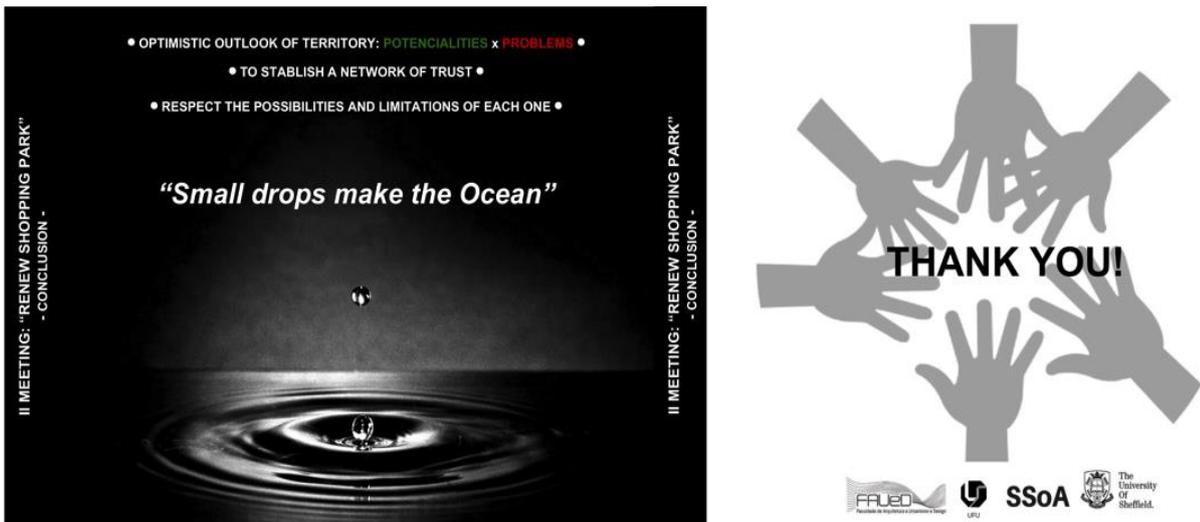
Source: BORTOLI, 2016.

Figure 189 - Presentation of projects to the residents.

Source: VILLA, 2016.

RESULTS: Figure 16 situates at the Shopping Park neighbourhood the favourite places of the residents, as well as its positive and negative aspects, and suggestions for facilities to these locations. It is noticed that the comments predominated on the "My Street" element, and there, the perception of negative aspects, highlighting the dissatisfaction of the residents regarding their current housing situation. Again, was noticed the difficulty to glimpse positive aspects when so many problems call more attention, pointing to the need for a change of approach on the next meetings.

Figure 190 - Positive and Negative Aspects and Suggestions to the Favourite Places at Neighbourhood.

FAVOURITE PLACES AT THE NEIGHBOURHOOD:

Positive Aspects   Negative Aspects   Suggestions to the Neighbourhood

MY STREET

1 Good Neighbourhood
2 To Fly a Kite

1 Drug Sales
2 Irregular Sidewalks
3 Parties and Noise
4 Drug Use
5 Lack of Trees
6 Lack of Privacy of Houses
7 Allotment and Street not Level
8 Litter
9 Does not like Vegetation

1 Supermarket
2 Ecopoint
3 Sports Competitions
4 Conversation Circles

CEU (POLI)

2 To Fly a Kite
3 Enjoyable During the Day
4 Capoeira

8 Litter
10 Lack of Activities at CEU
11 Lack of Security

5 Square
6 Arcade Game

UBERABINHA RIVER

5 Waterfall
6 Fishing

11 Lack of Security
12 Invasions

7 Instalation of Facilities

SCHOOL

8 Litter

Source: BORTOLI, 2016.

3.3.3. RECOMENDATIONS FOR THE TOOL

During the visit of a collaborator researcher, from the University of Sheffield, Architect and Professor Fionn Stevenson, between 06 and 08/12/2016, were presented and discussed the results of the 1st and 2nd Co-productions at Shopping Park neighbourhood. Since the 2nd Co-production was the first activity that involved personally the visitor, on 07/08, from the intersection between the two experiences derived important interpretations and conclusions.

In both experiences, much has been said about the needs of residents and less about positive aspects and improvement potentials for the neighbourhood, although the main objective of the 2nd Co-production has been to identify the favourite places of the participants in the neighbourhood (positive approach). This result indicates the great concern and dissatisfaction participants residents regarding their current housing situation. Realising the negative sentiment of the residents in relation to the neighbourhood, the first hint of Professor Fionn is that the 3rd Co-production must focus on the choice of effective qualification actions for the neighbourhood.

Evaluating the results of the two Co-productions, the questionnaires and walkthroughs, were 5 the possibilities of actions suggested by Professor Fionn, considering the effective capacity of staff in the neighbourhood, through interventions on a small scale. Were they:

1. **House**: resolution of acoustic discomfort through the use of alternative and cheap insulating materials such as recycled paper and jeans; Resolution of the climate discomfort through the installation of air circulation and light penetration, through PVC pipes and PET bottles.

2. **Green Walls**: using the walls as vertical gardens, able to qualify the free spaces and bring a climate comfort condition for housing.

3. **Ecopark**: creation of places to the wildlife in shared funds of allotments in order to amplify the good relationship observed between some residents and to promote the establishment of new links between people and between them and nature.

4. **Recycling**: installation of points to collecting construction waste and other recyclable materials, capable of being transformed and reused in new constructions.

5. **Bus Shelter**: design and installation of new shelters for bus.

In a subsequent decision, the researchers concluded that in a possible voting among dwellers, preferences would tend to choose interventions for homes, since there are the problems more experienced by residents. Thus, the proposals 1 and 2 will be addressed in another Co-production, specifically directed to the housing unit. Thus, the alternative 3, 4 and 5, plus qualifying proposals to the square of the CEU (Poli), will be brought to discussion for residents in the 3rd Co-production, with the objective of choosing one of them to start the qualifying process at the neighbourhood.

Professor Fionn also commented on the importance of strengthening the brand of the group "Renew Shopping Park" in disclosure and during the next Co-productions, and the importance of maintaining an always-on and positive communication with the locals, through the group on WhatsApp and personally. She has also suggested that the next meeting takes place in a more visible and less cloistered place, different from the room ceded by CEU, which may have embarrassed some residents to participate.

After all, a recurring observation o Professor Fionn was the importance of considering by a more attentive way the views of minorities in the development of participatory work. Often, what clashes is a strong indication of what needs to be done first to the benefit of all.

3.3.4. CO-PRODUCTION Nº 3

NAME: III Meeting Renew Shopping Park : "Voting for Actions to the Neighbourhood"

DATE: 10/12/2016

RESEARCHERS: Arch. Simone Barbosa Villa

Arch. Fernando Garrefa

Arch. Elza Santos

Arch. Juliana Silva Arantes

Arch. Karen C. Ruman de Bortoli

Arch. Débora Cristina Araújo

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Geo. Ivone Tavares Batista

Arch. Talita Rodrigues Pereira

Aline Rodrigues

Paula Vasconcellos

Vanessa Campelo

3.3.4.1. PURPOSE:

The third Co-production had as objective to take to vote in the community some intervention alternatives of qualification to the Shopping Park neighbourhood, identified in the previous Co-production, being: Ecopark, Ecopoint, Qualification of Poli's Square and Bus Shelter. The intention was to choose the order of priority for the execution of these interventions in the neighbourhood.

3.3.4.2. NARRATION:

The third experience of Co-production developed at Shopping Park was shaped in an event entitled "III Meeting Renew Shopping Park", and disclosed at the previous week among the residents via WhatsApp, through brochures. Three means of communication and expression were used to collect the preferences of the residents, being: Banners, with illustrative images for each intervention alternative (Figure 191); Drawing sheets for children, with boxes to choose one of the intervention alternatives (Figure 192); And Paper Roll, for adolescents and adults to express themselves freely (Figure 193).

The event took place on the same day as the Children's Day was celebrated, reason why it was possible to reach an audience that was significantly larger than in the previous Co-productions *(around 260 people[10])*, and, therefore, a greater degree of assertiveness regarding the voting results.

Annex 6 brings the registration form of the participating residents. As the residents approached, the researchers did their registration, explained the proposals illustrated in the Banners and offered an atomic brush so that they could vote in their favourite proposal of intervention. Then, adolescents and adults were asked to contribute with a drawing or phrase on the Roll of Paper and for the children to draw something in the Drawing Sheet, both about the theme "Actions for My Neighborhood". As a form of recognition for participation, everyone received an ice cream in celebration of Children's Day. On that day, approximately 400 ice creams were distributed during and after the dynamics performed.

Figure 191 - Banners with illustrative images for each intervention alternative.

Source: BORTOLI, 2016.

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[10] Amount estimated based on the number of direct votes through the Banners (141) plus the number of indirect votes through the Children's Drawing Sheets (146), considering that some adults voted in more than one possibility of intervention and some children did more than a drawing.

Figure 192 - Drawing sheets for children

Figure 193 - Paper Roll, for adolescents and adults.

Source: BORTOLI, 2016.

3.3.5.3. RESULTS:

By counting the results of direct voting (through the Banner and Children's Sheets) and indirect voting (through the Paper Roll), it is clear that the intervention that was most accepted by the residents was the Ecopark. Sequentially, in order of preference: Qualification of Poli, Ecopoint and Bus Shelter. Picture 6 below illustrates the results obtained.

Graph 87 - Votes through different means.
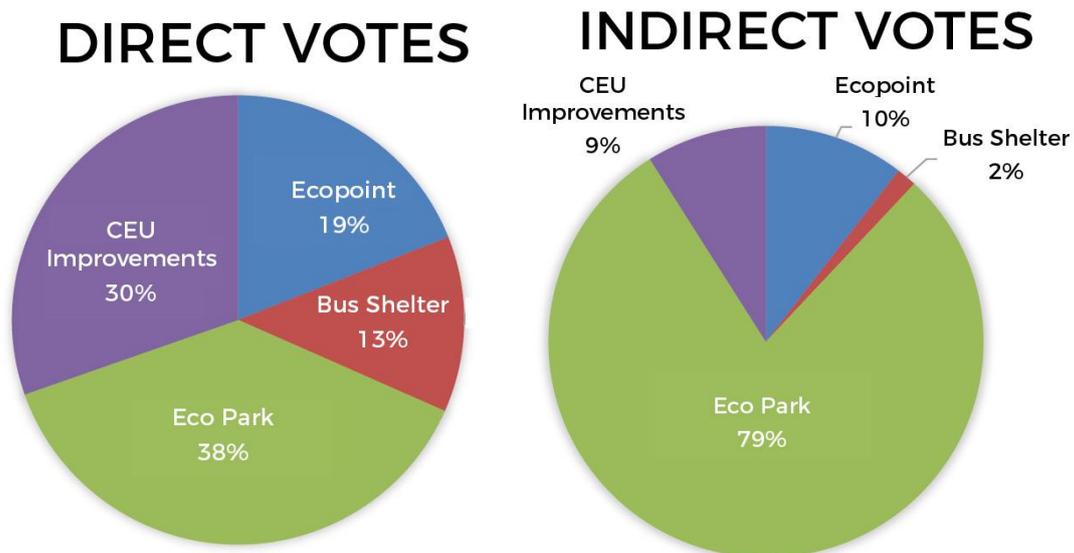
Source: BORTOLI, 2016.

In the Paper Roll some loose sentences and suggestions were left, as follows:

• The world has to be like this (Phrase followed by a drawing of sun with clouds and a bin);

• Respect, freedom;

• Every child should play;

• Child is behind;

• Together we are more friends, more health!

• The world must preserve and leave the world clean;

• Love;

• Hope;

• Nature!

• Happy Children's Day;

Sofia is beautiful.

• Only trash can not solve!

• You need to improve the trash!

• Lack of equipment in POLI!

• Vague land near the POLI can be used for a square with ecoponto and recycled toys;

• Volleyball court without infected and covered sand;

• A community garden;

• The garbage issue is a problem for everyone - Awareness!

• Planting more trees and trying to reduce deforestation.

Figure 194 - Commitment of dwellers
Figure 195 - Ice cream distribution.

Source: BORTOLI, 2016.

It is considered that the third experience of Co-production at Shopping Park neighbourhood reached its goal when counting on great participation and involvement of the public, mainly for having taken place in the Day of the Children, aiming to observe similar opportunities in future events.

After all, it is interesting to note that among the intervention options given, the simplest resolution ones, such as the bus shelter and the ecopoint, were the least popular among residents. Most of the participants (between 68% and 88%, respectively, through direct and indirect votes) choose interventions with the greatest impact, such as the creation of an Ecopark for the neighbourhood and the re-qualification of Poli facilities. This result shows the extent of residents' dissatisfaction with the supply of recreational equipment in their neighbourhood.

It is interesting to note that the significant participation observed in this experience occurred mainly due to the Children's Day events in the Poli Square, which received people from various places in the neighbourhood and in the city. There was no participation of members of past Co-productions, pointing to the need to validate the results obtained from the community of the original study area in new Co-productions.

3.3.5. PARTIAL CONSIDERATIONS

The first co-production had as objective to provide an initial approximation between researchers and community, in order to understand their difficulties and to identify possible locations at the neighbourhood for the accomplishment of qualifying interventions. The lack of health and education facilities, as well as day-to-day services (such as pharmacies, lottery, gas stations, etc.) and recreational environments were the main deficiencies quoted.

The second co-production aimed to refine the results of the first, identifying key locations for qualifying intervention, prioritizing a positive approach through questions such as "what's your favourite place in the neighbourhood?" Or "what do you like most about it?" A completely different audience participated in this event, which is why the results of the first Co-production were repeated regarding the needs of the neighbourhood. After this, key places for intervention were finally mentioned: the street, the Poli, the Uberabinha River and the School. About them, complaints predominated, demonstrating the difficulty in seeing positive aspects when problems call more attention.

The third Co-production had as objective to take to voting different actions of intervention in the neighbourhood, based on the complaints of the residents observed in the previous events. The research group concluded that moving to the qualification action would be the best way to promote community engagement in resolving the neighbourhood probles. The holding of the event on Children's Day ensured the participation of a significant number of people from various locations in the neighbourhood and the city. Among the actions for qualification put on voting, the following were chosen in order of priority: the creation of an Ecopark, the qualification of Poli, the creation of an Ecopoint and the construction of bus shelters. However, once again, the absence of participants from the first Co-productions was noticed, which weakens the results obtained and points to the need for their validation with the original community in subsequent events.

PART 4

ANALYSIS

4.1. SOCIOECONOMIC ORDER ANALYSIS

4.1.1. SOCIOECONOMIC AND DEMOGRAFIC ASPECTS

For a better comprehension of the neighbourhood's dynamics, and its resilience process, it is necessary to understand the context in which the residents build it. When analysing the data collected in the PTTS (see chapter 2.2.3, page 42) and the data obtained through the questionnaire, it was possible to establish a profile of the residents of Shopping Park, their family composition and other socioeconomic and demographic aspects that directly influence the resilience and adaptability process.

During the application of the questionnaire, the respondents' predominant age varied between 31 and 40 years old (42.5%), in which women were the majority, corresponding to 77% of the total of interviewees. This is an important fact to be highlighted, as through the stories and information obtained from the questionnaires, we were able to notice that the Neighbourhood is also popularly known as the place of the elderly women and single mothers. This fact is reinforced by the female majority participation in co-productions. In addition, a relevant percentage of respondents (42%) consider themselves the head of the household, which can make us conclude that the majority occupying this position are women.

Graph 88 - Age of the respondents

Source: Author, 2016.

Graph 89 - Genre of the repondents

Source: Author, 2016

Graph 90 - Position in the family

Source: Author, 2016

Figure 196 - Women participating in the co-production

Source: BORTOLI, 2016

In the residents' family profile, the single-parent family (22.5%) and nuclear family (45%) stand out, representing a majority among the eight types of family groups identified during the POE. As expected, the neighbourhood is composed of low-income families, as required by the guidelines for this income bracket of the "*Minha casa, Minha vida*" Programme (PMCMV). During the questionnaire, 72% of respondents reported having a family income of about R$ 1,000 -2,000 (1 until 2 minimum wages), while only 28% earned about R$2,001-10,000. However, it is important to notice that, according to the Department of Statistics and Socioeconomic Studies (DIEESE), in December 2013, the minimum wage able to satisfy the families' basic needs (according to the price of a standard food parcel) was R$2.765,44, which indicates that the family income of the majority of the residents is not sufficient to provide a good lifestyle.

Graph 91 - Family profile
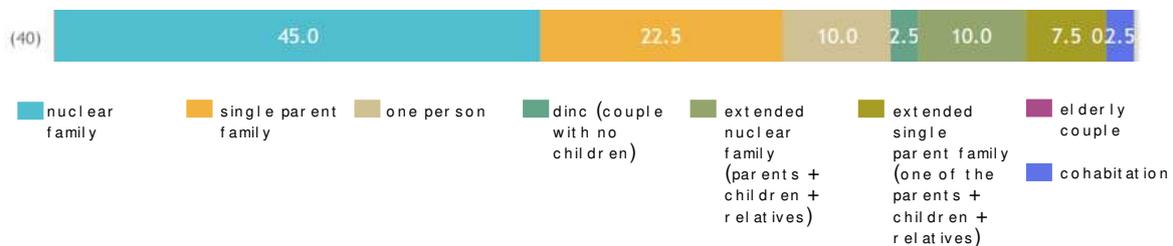
Source: Author, 2016

Graph 92 - Monthly income

Source: Author, 2016

Graph 93 - Workers by family

Source - Author, 2016

Another factor that exposes the insufficient monthly income is directly related to the number of workers in each family, since, according to the questionnaire, about 53.8% of households have only one person in the family working. This brings us to a context in which most of these families, being single-parent or nuclear, have an average of 3 to 4 members (at least) being supported by only one person.

Figure 197 - Population's characteristics
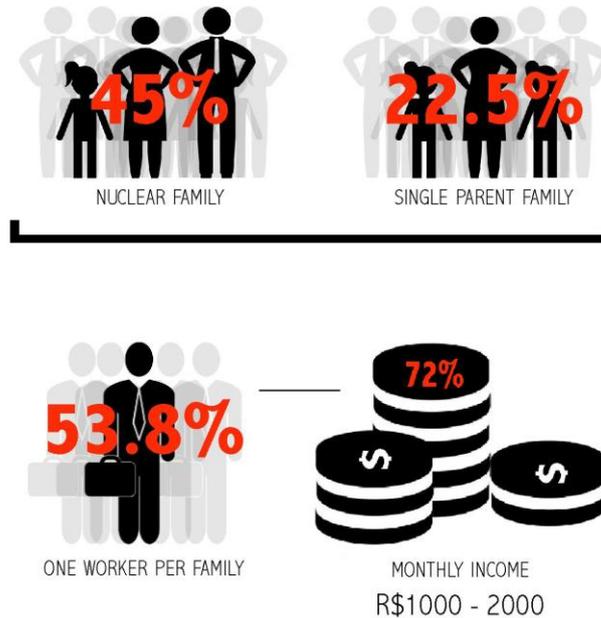
Source: Author, 2016.

The low income and low number of people per residence working are also directly linked to the low schooling level of the residents. During the data collection, Arco Verde[11] already indicated within the PTTS (see chapter 2.2.3, page 42) that in the PMCMV lots, generally, most of the residents had only completed High School, which justified the fact that most of the residents' jobs fit in general services (cleaning, briklayers, etc.). This information was verified during the application of the questionnaire, as shown in the chart below.

Graph 94 - Schooling level

Source: Author, 2016.

In addition to this, the insufficiency of local educational facilities contributes to the perpetuation of this low schooling. During the co-productions and conversations during the questionnaire's application, it was possible to perceive residents' dissatisfaction with existing educational facilities, indicating that despite the low level of education of the majority, they are concerned about their families' education and are aware of its importance.

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[11] Environmental Advisory and Consulting Company responsible for the reports of the Social Technical Work (TTS), carried out together with the ASP and Diefra companies, the Municipal Prefecture of Uberlândia and the *Caixa Econômica Federal* (Federal Bank).

Figure 198 - Discussion during the co-production

Source: BORTOLI, 2016.

Graph 95 - Satisfaction in relation to education
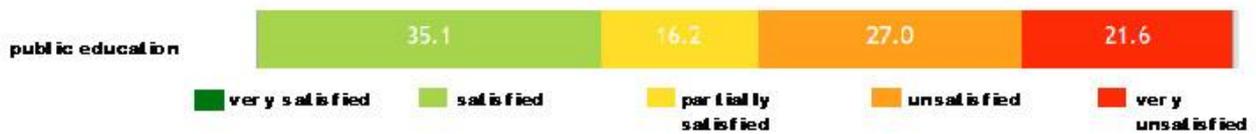
Source: Author, 2016.

According to the analysis performed during the Walkthrough (see chapter 3.1.3., Page 97) - having as a parameter the ITDP / LABCIDADE methodology (2014), the educational facilities are not capable of meeting the population demand, making clear the residents' difficulties in the quest for proper education for their families.

Figure 199 - Educational Facilities within a 1400m radius
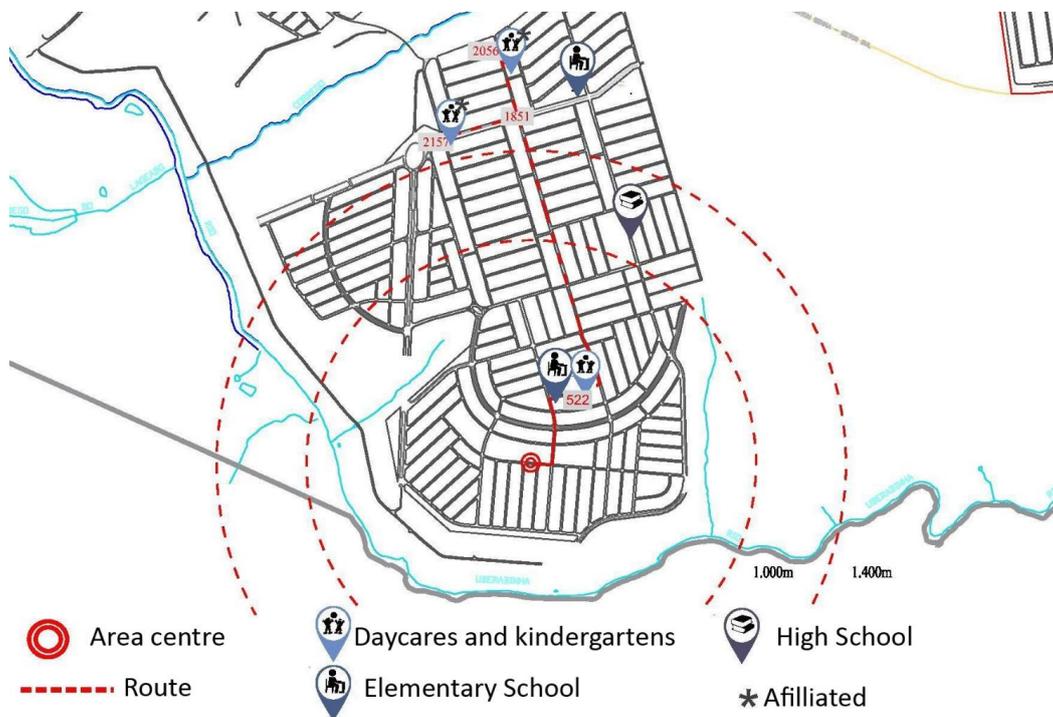
Source - Municipal Prefecture of Uberlândia, 2016. (Edited by author)

Therefore, it is understood that the general family profile of the residents is composed of nuclear or single-parent families, with low income and a low schooling level. However, it is important to realise how, even with few resources, these families can adapt themselves, think of new ways to generate income, ways to refurbish and expand their homes, among other actions. This indicates the strong resilience and adaptability character inert within these users, who are always looking for new ways to improve the quality of their lifestyle, despite all the variables of negative influence that interfere in this process.

4.1.2. VIOLENCE AND SAFETY

Violence and safety are one of the most raised discussion topics during the co-productions and application of the questionnaires, and the absence of any type of police station in the neighbourhood is the main reason. Shopping Park, like many other deprived neighbourhoods, suffers from social exclusion, which makes drug use and trafficking the main dangerous components, since activities such as drug trafficking are seen as a form of social ascension and empowerment. In addition, several people indicated during the co-productions (mainly during the first and second) the need for some type of action within the neighbourhood and the CEU to fight against drug trafficking.

Figure 200 - Situation of the urban elements proposed by the participants (focus on police station)
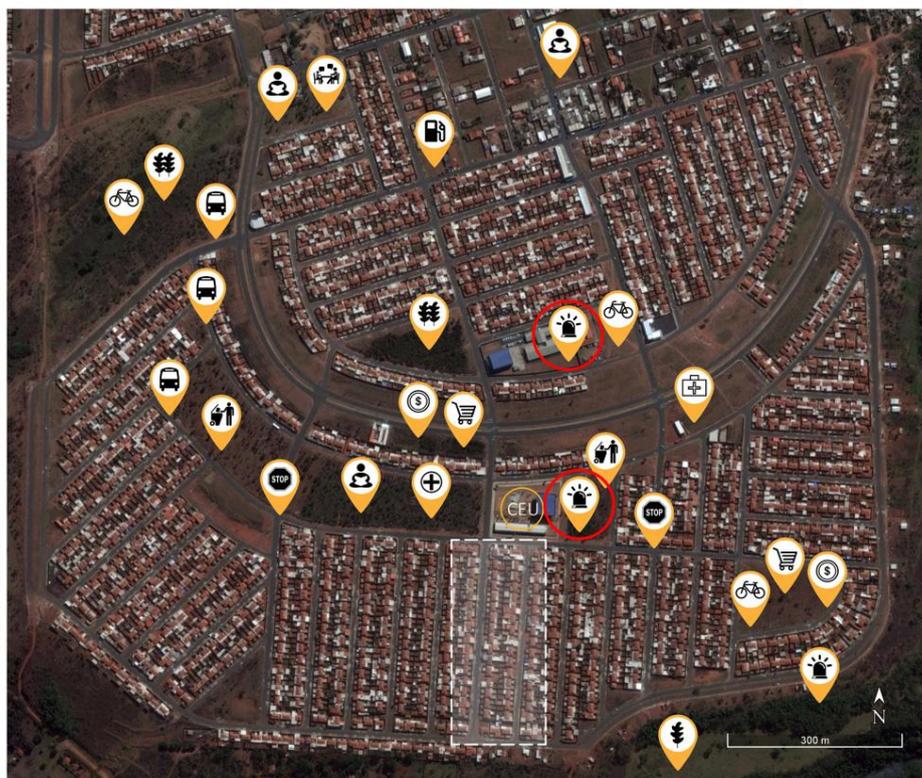
LEGEND:

Basic Health Unit	Recreation Center	Lottery
Public Hospital	Linear Park	Gas Station
Traffic Signaling	Echologic Park	Police Station
Public Daycare	Ecopoint	Bus Shelter
Public High School	Supermarket	

Source: Author, 2016.

As identified in the map above (generated from a co-production), the first suggestion is precisely the installation of a police station in the CEU. This fact is reinforced by the questionnaire, as 70% of the respondents complained about the insecurity they feel in their neighbourhood.

Graph 96 - Insecurity in relation to the neighborhood

Source: Author, 2016.

Figure 201 - News about violence in the Shopping Park Neighbourhood

*Title Translation: "Violence in the Uberlândia's Neighbourhood decreases, however residentes still worry"

Source: http://g1.globo.com/minas-gerais/triangulo-mineiro/noticia/2016/09/violencia-em-bairro-de-uberlandia-cai-mas-moradores-ainda-se-preocupam.html

Figure 202 - News about drug traffic in the Shopping Park Neighbourhood
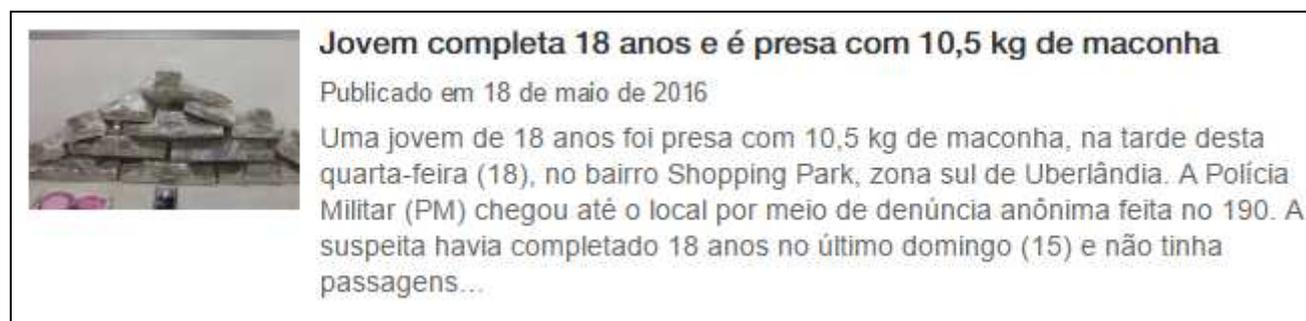
*Title Translation: "Young girl turns 18 and is arrest with 10,5 kg of marijuana"

Source: http://www.correiodeuberlandia.com.br/tag/bairro-shopping-park/

Military Police data, collected between 2014 and July 2016, confirm the existence of violence in the area, however, the charts do not yet establish a relevant pattern of growth or decrease of any of the actions identified. Still, it justifies the fact that, according to the questionnaire, 55% feel insecure at home, residence robbery has the highest rates among the types of violent actions listed below.

Graph 97 - Violent actions in the Shopping Park Neighbourhood

Source - 9th Military Police Battalion

Besides robbery, verbal threats are also a relevant topic, as it raises another problem: the interaction between neighbours. In the questionnaire, it was noticed that only some of the respondents complained about the difficulty (25%) or the lack (12.5%) of interaction within neighbours. Nevertheless, bad coexistence generates verbal and even physical conflicts and, consequently, insecurity in the neighbourhood. Still, it does not prove to be a cause as disturbing as robbery and drug trafficking.

Graph 98 - Level of interaction between neighbors

Source: Author, 2016.

What is important to identify, is that, in general, this state of insecurity indicates the social vulnerability in which these families, these residents meet, since the lack of safety interferes directly in the way in which

they refurbish / alter their houses and also how they use the public space. In addition, several residents reported during the co-productions and application of the questionnaires, that they avoid using spaces such as the CEU fearing that their children will be involved in drug trafficking and related activities.

Figure 203 - Favorite places – positive and negative points, and sugestions

FAVOURITE PLACES AT THE NEIGHBOURHOOD:

Positive Aspects   Negative Aspects   Suggestions to the Neighbourhood

MY STREET

1 Good Neighbourhood   1 Drug Sales   1 Supermarket
2 To Fly a Kite   2 Irregular Sidewalks   2 Ecopoint
                    3 Parties and Noise   3 Sports Competitions
                    4 Drug Use   4 Conversation Circles
                    5 Lack of Trees
                    6 Lack of Privacy of Houses
                    7 Allotment and Street not Level
                    8 Litter
                    9 Does not like Vegetation

CEU (POLI)

2 To Fly a Kite   8 Litter   5 Square
3 Enjoyable During the Day   10 Lack of Activities at CEU   6 Arcade Game
4 Capoeira   11 Lack of Security

UBERABINHA RIVER

5 Waterfall   11 Lack of Security   7 Instalation of Facilities
6 Fishing   12 Invasions

SCHOOL

8 Litter

Source: Autor, 2016.

Figure 204 - Discussion about favourite places.

Source: BORTOLI, 2016.

4.1.3. PUBLIC POLICIES, NGOs AND OTHER AGENTS

The neighbourhood presents important social entities that work to combat the social vulnerability in which these families live. As identified in the data collection, these entities are responsible for inclusion, social assistance and education programmes, whose leadership had and still has great participation and influence in the Shopping Park Neighbourhood. Among them, it is worth mentioning the NGO *Estação Vida* and the church *Missão Sal da Terra*. As for the existing public policies, were identified the activities of the CRAS (Center of Reference and Social Assistance), as well as sports, educative and cultural activities concentrated in the CEU (Center of Arts and Unified Sport).

Figure 205 - Mapping of Social Entities and Leaderships in the Shopping Park Neighbourhood

Source: Author, 2016.

The activities carried out by these entities conform a broad spectrum, from sports activities to social assistance and family visits (see chapter 2.3.7, page 47). However, it is important to note that in the co-productions and reports during the questionnaire, although residents are aware of the activities that are carried out in the CEU and the NGO, as well as the services offered by the CRAS, their level of participation in them is still low. Even during the co-productions, it was possible to notice that there is not a strong interaction of the residents of the residential with the leaders of the Association of Residents of the Shopping Park Neighborhood, fact that is accentuated by the distance of the allotment from the headquarters of the Association.

Figure 206 - Activities in the NGO *Estação Vida*

Source: http://www.projetoestacaovida.com.br/

Throughout the co-productions, it was also clear that residents believe that the activities offered in the CEU are insufficient. The residents believe that more activities could exist, even demonstrating the desire to have a bigger sports facility with better infrastructure. In addition, residents who work as artisans at home, and live off the income from their products, have proposed the creation of activities that support the local craft.

Figure 207 - Map "What do you need" – Co-production

Source: BORTOLI, 2016.

It can be understood that there is a lack of a stronger link between the local residents and the governmental and nongovernmental entities so that a social network can exist with more strength and connection. An important factor is that, although residents are aware of these policies and programmes, there's not a relevant number of people participating in order for these activities to positively affect the neighbourhood.

4.1.4. HEALTH

Despite the existence of health facilities - pharmacy, Basic Health Unit, and a public hospital less than an hour's drive away - they are a major point of the population's complaint. Through the walkthrough, it was possible to prove the insufficiency of existing facilities (see chapter 3.1.3., Page 100), since, according to the ITDP / LABCIDADE methodology (2014), although the site has all the mandatory uses, it has no capacity to meet the demand.

Graph 99 - Satisfaction in relation to health

Source: Author, 2016.

Figure 208 - Health Facilities within a 1400m radius
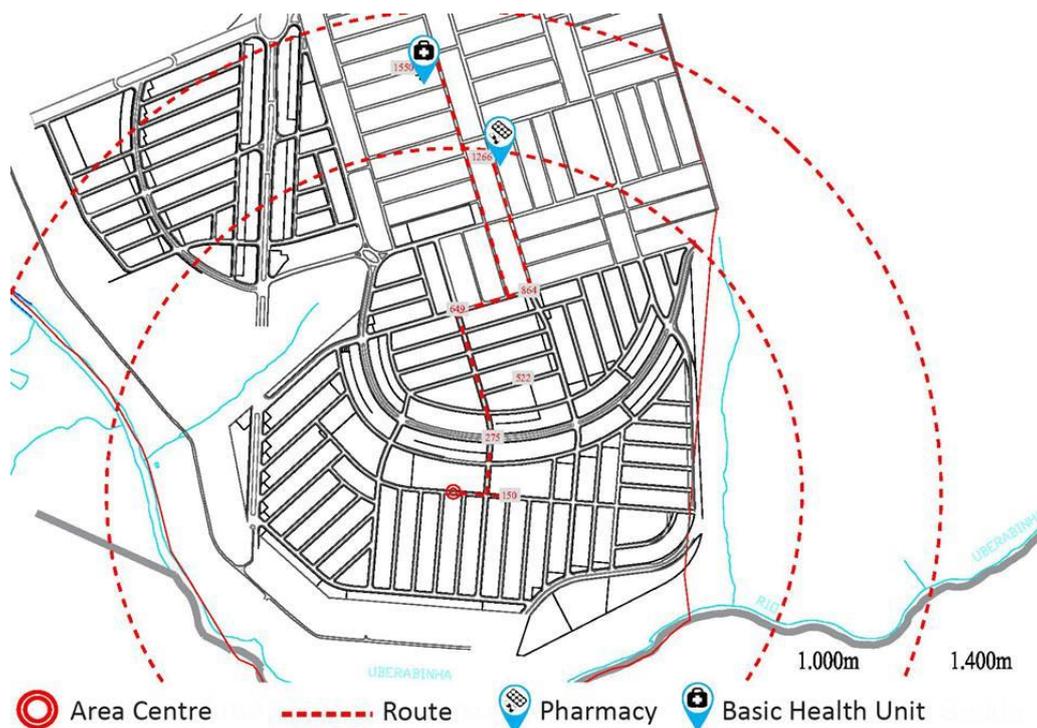
Source: Municipal Prefecture of Uberlândia, 2016. (Edited by author).

The dissatisfaction with the health service was strongly present in the questionnaire, with 78.4% dissatisfied with the system. Dissatisfaction that was also present in the residents' speeches during the first co-production, being the construction of a *UAI* (Unity of Integrated Care) in the neighbourhood the most adhered solution by those that were present, since the existing *UBSF* (Basic Health Unit) cannot meet the population demand of more than 11.000 inhabitants. In addition, it was analyzed during the walkthrough (see chapter 3.1.3., Page 100) that to reach the public hospital, although it is less than an hour's journey (in accordance with the norm), public transportation offers a frequency range between bus lines of one hour or

up to 1 hour and 45 minutes (depending on the time), which is a very worrying factor in cases of greater emergency.

Figure 209 - UBSF(Basic Health Unit) Shopping Park

Source: Google Maps

The *UBSF* is not capable of meeting the demand, being the service offered and the scheduling of appointments the biggest points of complaint. Appointments can take about four months to be scheduled with medical specialists. In addition, not all procedures can be performed there, creating the need to move to a Unit of Integrated Care (*UAI*) for a basic examination.

Considering the family profile of the residents - with a large proportion of single mothers and elderly women - it is clear the need for a better health care system and a closer health facility with an infrastructure correspondent to a *UAI*. Because the residents' health directly influences their quality of life and consequently how they respond to the environment around them.

4.1.5. TELECOMMUNICATIONS

As stated in the questionnaire report (see Chapter 3.2.4.1, page 179), access to information and communication is one of the "welfare basics," Social Progress Index (Stern et al., 2015). Therefore, cable TV, computer / e-tablet and cellphone were used as a way of investigating the telecommunication level (see chapter 3.2.4.1, page 179). As a result, it was identified that 42.5% have cable television and slightly more than half, 52.5% have a computer or e-tablet. The cellphone was identified as the most used form of communication since 97.5% of the interviewees have a cell phone. Even os, 70% claim that they have one or two cell phones, while 30% have more than three. In addition, most of the residents (92.5%) use their cell phones to talk, followed by Internet use (75%) and, finally, (65%) text messages.

Figure 210 - Data about smartphone and internet use
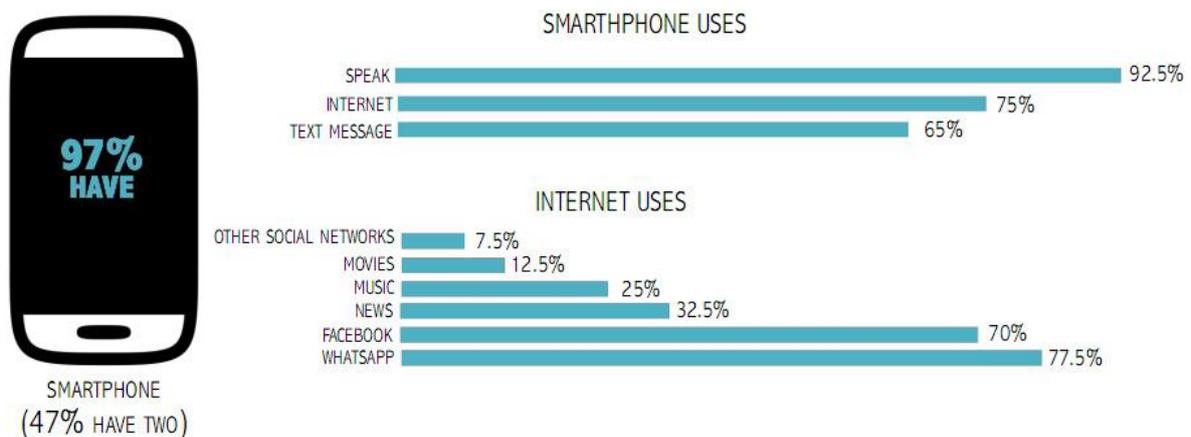
Source: Author, 2016.

This information was crucial to better understand how residents keep up with news and updates, as well as to identify the best channel of communication between the residents and the research group, because if the objective is to investigate and improve their resilience and adaptability, constant communication - in addition to the meetings in the co-productions - is an essential factor. That has been proven itself truth, as, until the present moment, the main communication link with the residents is a group created with the Whatsapp application.

4.1.6. PARTIAL CONSIDERATIONS

It is evident how the residents of the analyzed area end up living in a state of social vulnerability, in which the families' low income, together with the precarious public infrastructure offered, the constant level of insecurity and lack of a social network that has the strength to connect the residents can be listed as the main factors. At the same time, the resilient and adaptive character inert to residents - who, on their own, are always seeking a better way of living - together with their desire to live in a better neighbourhood, and the presence of Organizations and public policies that can be strengthened if there is a bigger adhesion by the residents, make up a framework of potentialities that can break this stigma and transform the neighbourhood. In this way, it is understood that, although the socioeconomic context within the area is not so positive, the human factor - the user - acts as a key part in the articulation of approaches and solutions to be taken, in search of a better Shopping Park.

Frame 30 – Conditioning Factors of Resilience: Socioeconomic Order

| Conditioning Factors of Relisience: Socioeconimic Order		
Aspects	Fragilities	Potentialities
Demographic aspects	- Among the respondents, 80.6% have a monthly income between R $ 1000 and 2000, below the standard capable of meeting the basic needs of the citizen, which is an amount of R$ 2765.44, according to DIEESE. - In addition, the high cost of reforms overburden the income of these families socially and economically vulnerable.	- Feeling of belonging deriving from the realization of the "Owning your own home dream" justifies the resilient and adaptive character of the residents, due to their initiatives in adapting their own residence. In addition, 67.5% are generally satisfied with their residence and 77.5% have adapted well to it. - The fact that they can make these adaptations, despite difficulties such as technical knowledge and low family income, demonstrates their willingness to improve the place in which they live.
Education	- The employment of the majority of the residents is linked to general services (cleaning, bricklayers, etc.), with low income due to the poor level of schooling, with only 5% of the residents having Incomplete Higher Education, and a lower rate with only 2, 5% having completed Higher Education.	- During the co-productions, the residents showed dissatisfaction towards the existing educational facilities, indicating that despite the low level of education of the majority, they are concerned about their families' education and are aware of its importance.
Violence and Safety	- Insecurity is a big problem, with 70% of residents feeling insecure in the neighbourhood. In fact, residents no longer attend public spaces such as the CEU because of practices such as drug trafficking on the spot.	
Public policies, NGOs and other agents	- There is a lack of a stronger social network and greater collective awareness, mainly due to the low	- The neighbourhood has important social entities that work to combat the social vulnerability in which these families live -

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	adherence of residents to the activities in existing social entities and public facilities - such as the *Estação Vida* NGO and CEU. - The lack of adequate public infrastructure also aggravates this issue. The residents consider that the activities offered in the CEU are still insufficient, due to faults in their operation system and overall infrastructure.	NGOs *Estação Vida* and *Missão Sal da Terra*, CEU, CRAS. Despite the current low membership, they have potential to act as a stage for collective action in the near future. - Due to its location and activities offered, CEU presents potential that can unite the community in order to develop a better neighbourhood, acting as the main reference of leisure equipment.
Health	- In addition, 78.4% are dissatisfied with the health equipment, because although the place has all the mandatory uses, it does not have the capacity to meet the existing demand.	
Telecommunications		- Residents are connected, so it was possible to establish a channel of communication with the community through applications that use the internet as the main platform.

Source: Authors, 2017.

4.2 CLIMATIC NATURAL ORDER ANALYSIS

4.2.1. NATURAL RESOURCES (VEGETATION, SOIL, WATER AND FLOW)

The Shopping Park Neighbourhood is located in an area of great environmental relevance, mainly due to the presence of the *Uberabinha* River[12]. It is noticeable that, along with its course within the Neighbourhood, its marsh and riparian areas' vegetation is still well preserved, in comparison to the urban areas outside the Neighbourhood that the river flows into. The river is an important recreational reference for the residents of Shopping Park as reported in the 1st and 2nd co-productions, where it became known that the river was home for a range of activities performed by the users, such as fishing, bathing and other leisure activities alongside the river bank. However, according to residents' reports, leisure activities that could be done at ease during the beginning of the Neighbourhood, began to compete with other actions such as drug use, litter disposal and also the deforestation for the construction of irregular houses (as a result of the invasions).

It is important to note that the residents are aware of the great landscape and environmental value that the *Uberabinha* River represents for the Neighbourhood. Nevertheless, they justify their lack of interaction with the area due to the difficulties and risks presented. During a co-production, in one important speech, one of the residents contemplated about some personal thoughts, saying that this condition lies in a vicious cycle - the more residents stopped using the area, the bigger the growth of degrading activities, such as litter, drugs, violence and deforestation.

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[12] Uberabinha River, part of the Araguari River basin, is of great importance for the city, constituting together with its tributaries, the source used for the population's water supply. It is born in the north of the city of Uberaba, runs through the city of Uberlândia, and empties into the Araguari River, at north-west of the city, reaching a total length of 150 km. Its main tributaries are in the countryside, which are the Ribeirão Beija-Flor, Rio das Pedras and Ribeirão Bom Jardim, another important source for the city's supply (BDI 2015). The last distributor system is responsible for supplying drinking water to the residences of the Shopping Park Neighbourhood, supplying by gravity the lower part of the city and by repressing the high. (Page 60)

Related to these difficulties presented in the *Uberabinha* River area, it was suggested by the residents and potential users, during the 1st co-production, the installation of facilities capable of diversifying the uses in the region, bringing more dynamic to the place as well as reducing the sense of insecurity.

The residents' interest in the area, as well as their wish for more safety, shows their desire for a greater interaction with the natural environment. The population recognises the importance that the river banks plays, along with the potential that the Neighbourhood offers due to its proximity to the river as well as available land for possible ecological projects. Furthermore, they all yearn for changes for the better.

The readiness these residents show in contributing to these improvements strengthens the network between them and also increase the resilience. The knowledge they acquire through the collaborative activities can be passed on to others and, therefore, form a more empowered population.

The co-production sessions have made it obvious to the research team that the river is one of the keys to develop a greater sense of belonging towards the area. It gives the Neighbourhood a synergy with nature, rarely reached in other neighbourhoods of Uberlândia. It is understood that this sense must be developed and maintained through activities that can maintain a great frequency of people as well as improve the level of sociability. It is the feeling of belonging that makes them take better care of the area, together with encouraging new residents to contribute to the common good.

Furthermore, it is on the banks of the *Uberabinha* River that most part of the Neighbourhood's vegetation is located. Through the permanent preservation area (represented in the following figure) the study area was able to reach a public green area for recreation ratio greater than 15 m²/inhabitant, which is the recommended by the Brazilian Society of Urban Afforestation.

Disregarding the permanent preservation areas, the previously mentioned value would fall off to 12 m²/inhabitant since the Neighbourhood has almost no vegetation of medium and large size. It is only in the institutional areas not yet established (indicated in a darker tone), and in the green areas planned to keep a greater amount of native vegetation, that larger trees are located. According to the questionnaire, 51.3% of respondents rated the conditions of green areas as bad, and 25.6% as very bad. Moreover, these areas are not properly maintained, with a presence of domestic and construction waste.

The afforestation of the Neighbourhood's streets is practically non-existent. Although typical trees species from Cerrado were planted in front of each house, they were gradually removed either by changes made by the residents or because they were not properly looked after. Two large areas still maintain the natural vegetation of the Cerrado. They are waiting for the construction of urban facilities or squares and, most likely, will have the vegetation suppressed at the moment of these facilities' construction. This phenomenon has already happened in the Centre of Arts and Unified Sports (CEU), where the original vegetation gave place to the construction and exotic species of vegetation.

Figure 211 - Shopping Park Neighbourhood Green Areas Map
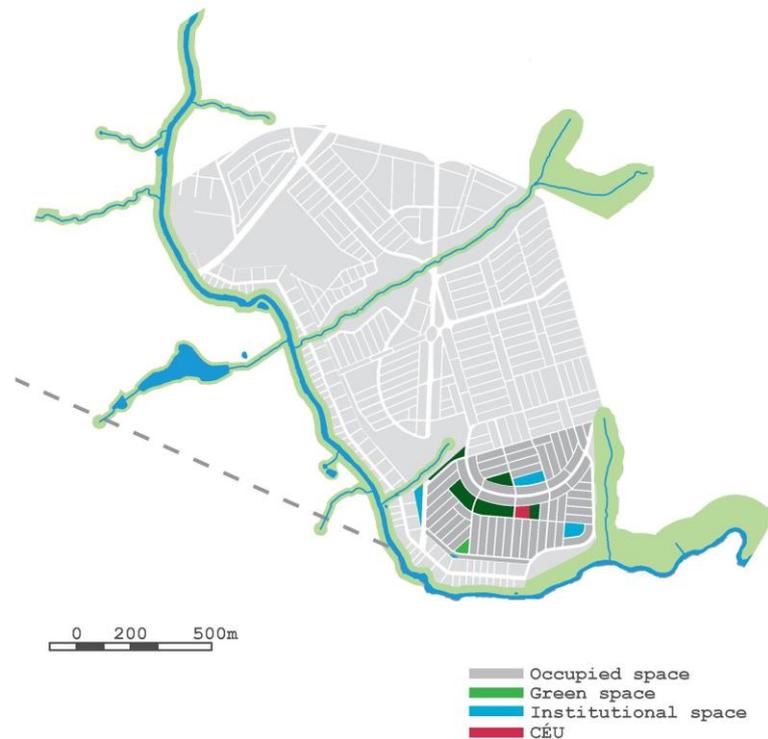
Source: TFG_Juliana Arantes, edited by author , 2016.

It is known that areas devoid of vegetation tend to provide environmental discomfort to the pedestrian due to direct solar radiation on the sidewalks, as well as visual discomfort, among other reasons, therefore, presenting low environmental quality. "The vegetation works in urban microclimates contributing to the improvement of the urban environment in several aspects: it mitigates the solar radiation in the hot season and modifies the local temperature and relative air humidity through shading, reducing the thermal load received by the buildings, vehicles and pedestrians. It also modifies the winds' speed and direction, acts as an acoustic barrier, and when in great quantity, interferes in the frequency of rains. Through photosynthesis and respiration, it reduces air pollution. "(Mascaró, 2002. p.32). In addition, trees are elements of visual and ornamental value. They display relaxing colours and provide comfort, as well as providing food through fruits.

Residents stated that the City Hall planted trees when the houses were delivered, however, as many residents had not yet moved, there was no sufficient irrigation needed for a seedling to grow and withstand the wait until the arrival of the rainy period. Those that were watered and cared for, were eventually cut down by the residents themselves fearing that it could damage the sidewalks and bring excessive dirt from the fallen leaves, or to avoid unwanted meetings at their doors, as reported in the second co-production and in conversations with residents in the questionnaire's application. On the other hand, also during the co-productions, they recognised that the blocks need vegetation and that the absence of it makes the Neighbourhood more ugly.

Shading is the most wanted effect provided by vegetation. This indicates that many are still unaware of the importance and functions of vegetation. Certainly, their presence in the urban environment is not free of conflicts, however, with the right planning and species, it is possible to enjoy the many benefits offered by afforestation with the least friction with the urban infrastructure.

When it comes to the vegetation inside the lot, the situation repeats itself, although 67.5% of the residents reported missing more gardens. When the residents move to their new location, most of the lot has still enough space to create gardens and green areas. However, once the residents acquire the power to do some renovation, one of the first steps to be undertaken is to pave the area destined for a yard.

The majority prefer not to invest in green areas because of difficulty in maintenance, and/or lack of knowledge and/or financial resources, among other reasons. The health and economic benefits that homemade plant food can bring are unknown and/or disregarded by the residents.

The questionnaire shows an interesting result regarding the production and consumption of organic food. More than half of the respondents reported producing some type of food at home, referring to fruits, vegetables and herbs. However, only 15.2% stated that they are consumers of organic foods. Thus, we can conclude that the majority of the population in this study are not aware of the meaning of organic food. This shows how much the inhabitants need ecological literacy in order to take advantage of the main benefits offered.

Concerning the presence of vegetation in the units, it is observed through the results of the walkthrough that the ones with fewer interventions perform better than the others. The greater the intervention the smaller the permeable area, as shown in the following images:

Figure 212 - Lot 01; Lot 02; Lot 03; Lot 04.
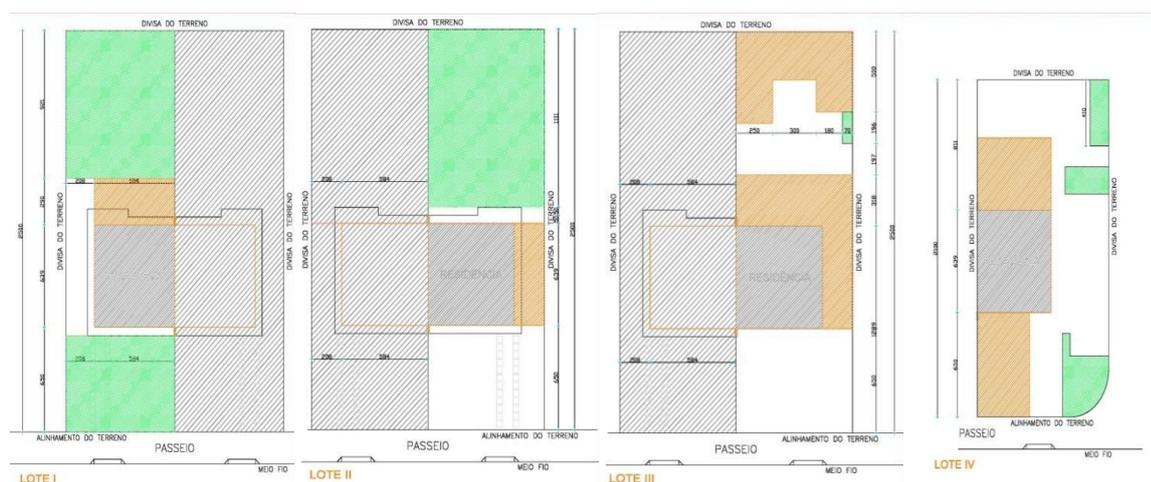
Source: Author , 2016.

This situation can be justified when analysing the largest area available for growing plants in the units. The houses with a greater permeable area the ones that have vegetables and fruits planted at the back, taking advantage of the shade to provide comfort for the residents and their pets.

It should be noted, therefore, that a percentage of the residents show their resilience as they take advantage of the existent space they have to produce their own food, providing environmental comfort, saving money and, unintentionally, also benefitting their health.

These examples can spread encouragement among other residents, showing the benefits that a permeable lot with vegetation can offer, and so, break with the cultural paradigm that paving the permeable areas of the lot is the best way to do it. Since, in addition to being more economical, a properly maintained does not grow weeds, and, as one possible solution, can plant trees with larger foliage in order to make cleaning and maintenance easier.

4.2.2. TOPOGRAPHY

The houses in the Shopping Park Neighbourhood are located on a land of up to 12% slope. The residences located near the *Uberabinha* River have the steepest slope. Some lots even have more than two meters of unevenness, especially in places near the river, where the proposed project resulted in a large gradient, leading to the need for important earthmoving services.

Figure 213 - Shopping Park Neighbourhood Topography Map
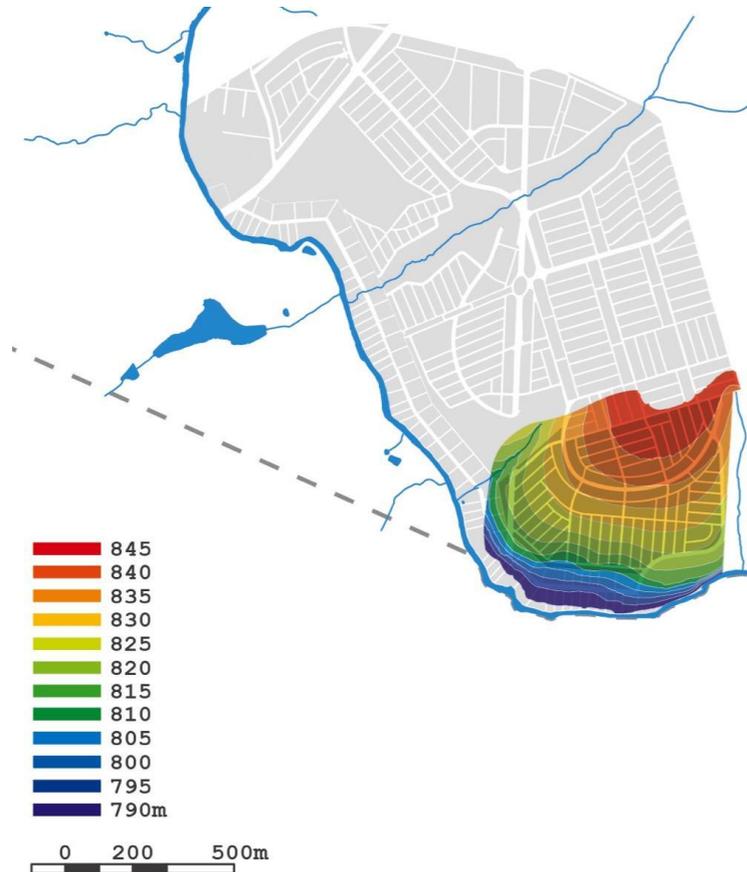
Source: TFG_Juliana Arantes, edited by author , 2016.

Furthermore, most homes were built without the use of retaining walls, which resulted in landslides and concern among residents. The absence of structural retaining elements has caused several housing units to be on the verge of a landslide and structural collapse. During the second co-production session, residents reported concerns about the high cost they had to bear to construct retaining walls together with the lack of assistance from both the *Caixa Econômica*(Federal Bank) and Uberlândia City Hall. They also reported feelings of insecurity about letting their children play in backyards, fearing they would hurt themselves due to the land unevenness between one lot and another, as pictured in the following images.

Figure 214 - Houses location and landslide accident

Source: Tolentino, 2012 (Left); Correio de Uberlândia, 2013(Right).

The blocks present an acceptable dimension according to the ITDP / LABCIDADE methodology, 2014. Even so, the allotment presents troubling situations in relation to the topography, mostly due to the manner the courts were allocated, as they are perpendicular to the level curves. This increases the water velocity, exposing the back of the lots and/or unpaved streets without any type of adequate vegetation, causing erosion and the *Uberabinha* River siltation. Moreover, strong winds and downpours lead the accumulated litter into the lower areas.

Another existent problem, also reported in the 2nd co-production, was the difficulty physically handicapped people had to walk with ease around the area. The blocks allocation causes discomfort depending on the route direction since the longest path is also the steepest. Some blocks even reach a little more than 290 meters in length, composing a narrow and long walking route.

Such problems have interfered negatively in the quality of life of the residents, especially towards those who have a temporary or permanent physical handicap. The sidewalks were highlighted as the major problem for the residents' mobility since the lots delivered were not even with the street level, which demanded a quick and cheap solution from the residents. Since they have little space and resources, the users solved the problem with a second ramp to give access to the lot, creating obstacles in the sidewalks, obstructing the pedestrians' path and compelling them to walk along the street.

These types of problems, originated in the Neighbourhood, contribute to a lower resilience of the residents. Since the possible solutions for their daily problems become quite restricted. Residents have the need to adapt to the environment they live in, and the process of adaptability usually happens spontaneously, however, limited resources impairs the search for a better quality of life.

4.2.3. POLLUTION AND WASTE

The disposal of solid waste is a major problem in the Neighbourhood, mainly due to the habit of illegal dumping in the open, mostly in green or institutional areas not yet occupied, in addition to the presence of household litter spread on the streets.

The construction activities are intense in the Neighbourhood, either by the construction of commercial establishments; by the need to construct retaining walls between lots to solve topographic problems; to construct walls around the lot borders, viewed by the population as a mean to obtain privacy and safety; but mainly due to the constant renovations and extensions the residents perform in their houses. The latter being due to dimensional issues and the arrangement of spaces, as well as an exchange of finishing materials due to the quality and/or aesthetics of the original ones. Therefore, there is a huge amount of construction waste produced, yet, there is no proper place for this type of waste disposal in the Neighbourhood. In

Uberlândia, there are 12 *Ecopontos* (Proper place for disposal of construction and recyclable waste) of the City Hall, the nearest one being located in the São Jorge Neighbourhood, being 9.5 km away.

Figure 215 - Closest *Ecoponto* to the Neighbourhood

Source: Author , 2016.

Household garbage from the Neighbourhood is collected by the city's municipal cleaning service three times a week, which can be considered a good frequency. Only, what causes the accumulation of garbage in the streets is, in fact, the residents' habit of putting their garbage directly on the sidewalk or the street for collection (some because they do not have an individual trash can on the sidewalk), where dogs are able to rip the bags and scatter them down the street. Another fact is that some residents do not put the trash in bags any other type of container to be put in the trashcan for collection, placing the trash in a loose way, causing leaks that end up falling on the sidewalk. In any case, the urban cleaning service does not collect garbage that is not conditioned in some container and the Shopping Park Neighbourhood is not served by street sweeping cleaning service, which is performed in some Neighbourhoods of the city.

The green areas located in the lower regions of the Neighbourhood, close to the river, are the most affected by the irregular disposal of waste, from construction, tree pruning and lot cleaning, as well as domestic waste. This is due to the topographic composition that facilitates the transportation of these materials, which is usually done manually by the residents. The slope also facilitates the descent of garbage scattered throughout the streets, through rain and wind. However, because of the presence of several bags full of domestic garbage, it can also be noticed that some residents actually discard them directly in these places. Other vacant lots in the Neighbourhood (mainly institutional land or for green area) are also used for garbage disposal, a fact that was mentioned by the Co-production participants.

The urban cleaning service does the cleaning of these vacant lots, collecting all the garbage and waste, conducting them to the municipal landfill. It is not known how often this cleaning is carried out, even so, this

does not solve the problems of visual and environmental pollution, the proliferation of insects, rodents and venomous animals, and the consequent health problems these can cause.

In the questionnaire, two important results demonstrate that the residents are aware that the irregular waste disposal is inappropriate. Although 65% of respondents say they have seen their neighbours throwing garbage on the streets or in vacant lots, only 5% said they already did the same. This data also appeared in the 2nd co-production, where participants cited the accumulation of garbage on their street and also in the vicinity of CEU and schools as a negative aspect of these places.

There is also the accumulation of waste in some lots of the residences. In the Walkthrough, out of the four houses evaluated, two have an accumulation of construction waste, such as bricks, tiles and wood. In the second co-production and during the application of the Questionnaire, some residents reported that there are neighbours who accumulate both construction and household waste within the lot, which favours the proliferation of rodents throughout the neighbourhood.

This is an issue that demands public investment, mainly due to the lack of an *Ecoponto* for the waste disposal on the neighbourhood - which was a recurrent complaint in the 1st Co-production. However, it is also an issue of the population's awareness that irregular disposal goes beyond an aesthetic matter, being, in fact, a serious environmental, health and sanitation problem.

There were also reports of the use of construction waste for filling to reach the ground level desired because due to the topography of the neighbourhood together with the blocks allocation manner, the creation of retaining walls and proper cut and filling of the lot was necessary for the majority of the area. In a way, this is a resilient practice, since the execution of these services is important, even essential in some cases, to guarantee the safety of the residents, but it is a very costly service that the user has to bear. Yet, depending on the time required to fill the land, the exposed gargabe serves as housing for rodents and other animal vectors of diseases.

The municipality of Uberlândia counts with the service of selective garbage collection, where the recyclable garbage is collected in the houses and sent to sorting centres of the different types of materials. However, the service does not serve all of the city's neighbourhoods and, out of 74, 48 neighbourhoods are not served, and Shopping Park is one of them. But, what can be observed through the Questionnaire is that the population already has the habit of recycling, because 57.5% carry out the separation of recyclable waste from organic waste, which residents report mainly being aluminium cans, PET bottles and cardboard. In fact, there are residents in the neighbourhood who collect some of these materials and sell them to cooperatives, using this practice as a complement to their income or, in some cases, as their main source of income. In the questionnaire, we also noticed that 76.3% of the population separates the used edible oil from other residues, which is an expressive amount, and the main destination of this oil is the homemade soap used for general cleaning.

Figure 216 - Main points of inadeqaute litter disposal

Source: TFG_Juliana Arantes, edited by author , 2016.

4.2.4. SHORTAGE (WATER, ENERGY AND FOOD)

In 2014, after approximately two years of the delivery of the keys to popular houses, Uberlândia had the second worst drought registered since the 80's. In which it was necessary the rationed distribution of water, with the reduction in pressure during the day in some districts of the city to preserve the level of the water channel. There was a widespread campaign by the city to make citizens aware of not to waste water by washing sidewalks, backyards and cars, along with other saving measures.

However, in the questionnaire applied, most of the residents reported that they never had a lack of water (97.5%) or even electricity (87.5%). It was also asked if they did something to save water and electricity, and what reasons led them to choose to save both.

Graph 100 - Reasons to save energy and water.

Source: Author, 2016.

Most said they save both, stimulated mainly by the financial economy. Only a lower percentage (30%) reported that the economy was motivated by concern towards the environment and/or fear of rationing in dry weather.

In this way, the results show how much the residents are already attentive about facts related to the waste of water and energy. However, fundamentally, such economy is not for environmental conscience, but rather for economic reasons.

In the chart below you can see some ways residents use to save water. In which, closing the faucet while brushing the teeth is the most mentioned with 50%, and reusing the water from the washing machine to clean the residence or backyards was right after with 47.5%.

Graph 101 - Means of saving water

WHAT DO YOU DO TO SAVE WATER?

BRUSH TEETH WITH THE TAP CLOSED	50.0
REUSES WATER FROM THE WASHING MACHINE TO WASH THE RESIDENCE	47.5
SOAP THE DISHES WITH THE FAUCET CLOSED	37.5
TAKE QUICK BATHS (5 TO 10 MINUTES)	35.0
USE THE WASHING MACHINE WITH MAXIMUM CAPACITY	27.5
DO NOT SAVE WATER	22.5
OWN APPLIANCES THAT SAVE WATER	10.0
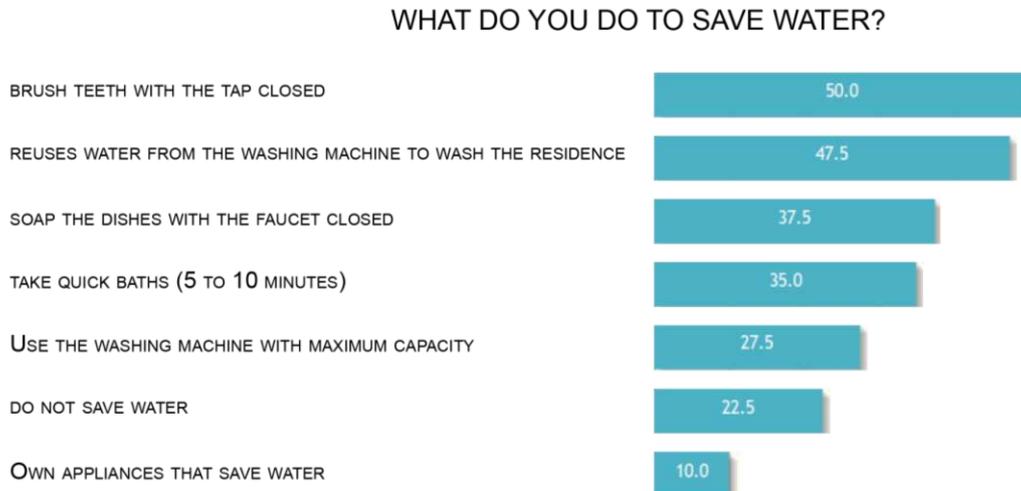
Source: Author, 2016.

Regarding the saving of electric energy, it is possible to observe the ways residents use to save energy in the chart below:

Graph 102 - Means of saving energy

WHAT DO YOU DO TO SAVE ELECTRICITY?

TURN OFF THE LIGHTS AFTER YOU LEAVE THE ROOM	77.5
USES ECONOMIC LAMPS (LIKE FLUORESCENT AND LED)	37.5
TURN OFF THE APPLIANCES WHEN THEY ARE NOT IN USE	35.0
BUY HOUSE APPLIANCES WHICH SAVE ENERGY	15.0
DO NOT SAVE ELECTRICITY	10.0
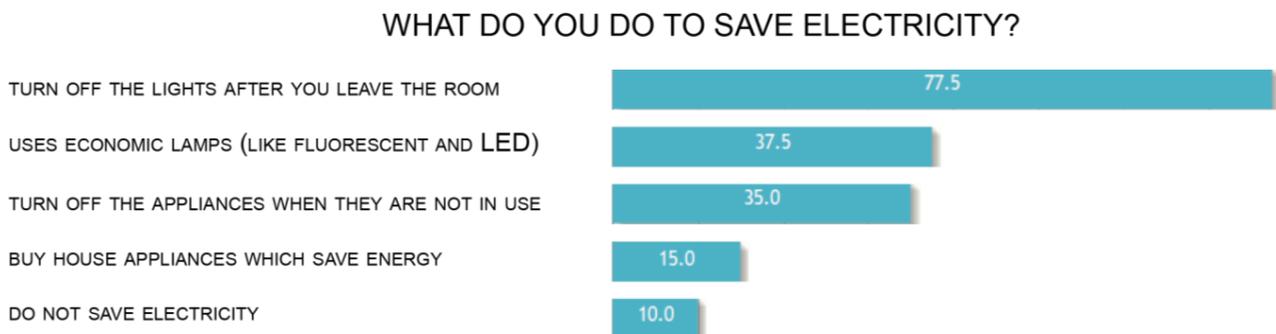
Source: Author, 2016.

The rational use of electricity happens more frequently. This is probably due to the cost of electricity being much higher than the water cost since 87.5% of residents confirmed that the main concern is with the financial cost. Also, the number of people who do not save water is more than twice the number of people who do not save electricity. The most frequent form of energy saving is the practice of turning off the lights when leaving the room. In addition, they reported that they usually use economical light bulbs and also turn off the appliances when they are not in use. It should be noted that the presence of solar water heater in all houses was reported by residents as easy to use, having a relevant role in energy saving.

The washing machine used in its maximum capacity is the second least used means of economy, and 20% more of the interviewees use the water to clean the residence. Service that promotes more work and delay in domestic tasks. A mere accumulation of clothes results in an increase in the economy of both water and energy. However, some residents are not completely aware of it. In this manner, we see the need for the

residents' greater enlightenment about water waste, so they can be aware of the damages that its irrational use can cause.

Although residents do not suffer from the lack of water nowadays, it is important to raise awareness about the fact that this reality may change, as they may face serious problems in the future due to lack of water, and it will depend mostly on them for the impacts to be attenuated. The awareness of at least one resident of the residence has an impact on all the residents, through the dialogue and awareness of the neighbour.

4.2.5. STRETCHED DRY SEASONS

Uberlândia is located in a bioclimatic zone characterised by a long period of drought and consequently dry weather. Chart 4, below, shows that the months from May to October are affected by the low relative humidity of the air, and in July, August and September it reaches below 60%, which is recommended by the World Health Organization (WHO) as the ideal level for the human organism. The month of August has the lowest rainfall index and relative humidity of the air. It can be observed that although the average humidity is usually within the standards considered good, it is still only the average, emphasising that there are several days with humidity typical of desert regions. In this year, the minimum humidity level was recorded in the month of July, when it reached 11%.

Graph 103 - Relative Air Humidity and Precipitation from 1996 to 2015

The low humidity of the air is a threat to human health, favouring primarily diseases of the respiratory system. Another major problem with the dry climate is the increase in the rate of burning in the vegetation. Architectural strategies can be adopted to soften the effects of low humidity, such as the use of vegetation and water near the openings of buildings. This is also effective at street level, as the improvement of

humidity rates is one of the benefits of urban forestation. What is observed in the neighbourhood is precisely the lack of vegetation, both in the lots, in the streets and public areas. It is necessary to emphasise the importance of the preservation of the riverbed that passes through the neighbourhood, conserving its vegetation, and consequently, the mild microclimate generated there.

4.2.6. ATMOSPHERE CONDITIONS

Uberlândia has two well-defined seasons: a wet season with higher temperatures from October to April, and a dry season with mild temperatures from May to September, as seen in the following graph.

Graph 104 - Temperature and Precipitation from 1996 to 2015
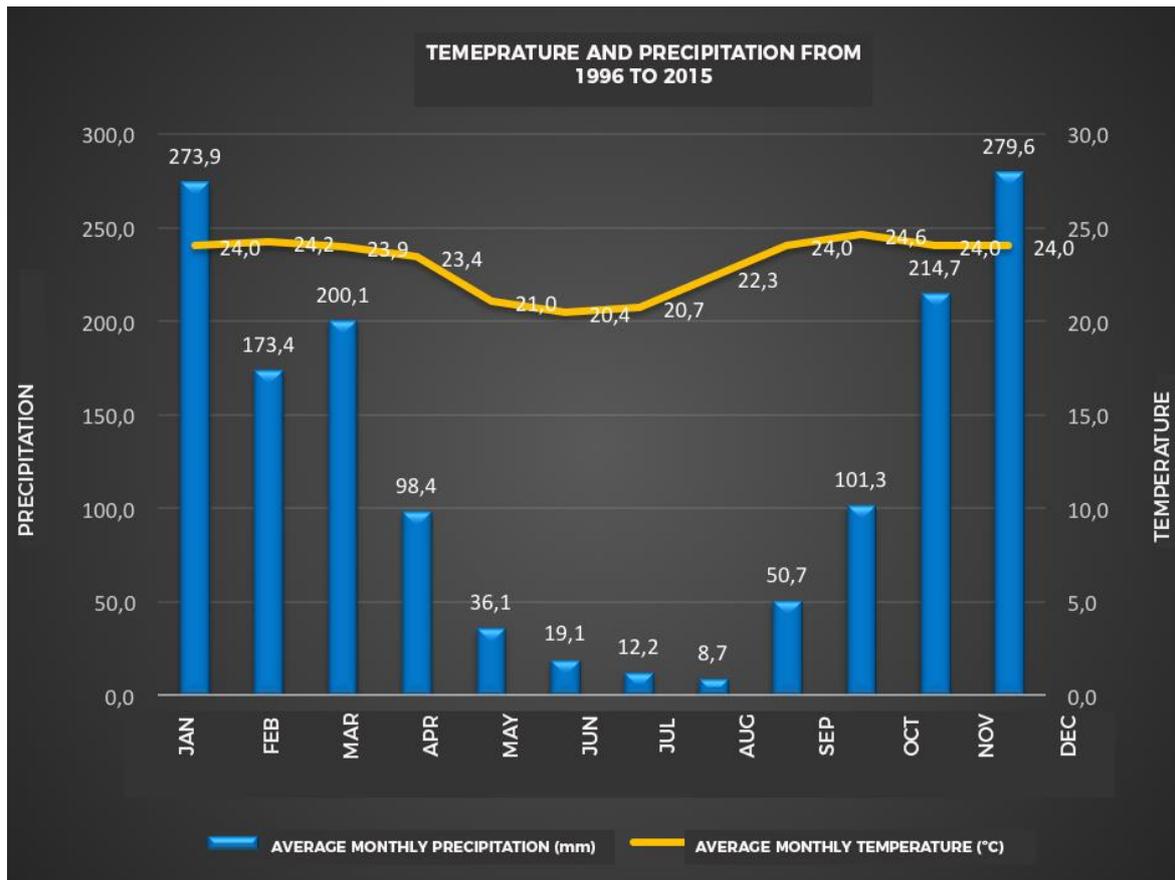
Source: Laboratory of Environmental Comfort and Energy Conservation - Faculty of Architecture, Urbanism and Design - UFU, 2016.

The Norm NBR 15.220-3 does a bioclimatic zoning of the country, dividing it into 8 zones, according to the climatic characteristics of each one, in order to establish constructive guidelines to optimise the thermal performance of buildings. Uberlândia is inserted in the Bioclimatic Zone 4 and, for this bioclimatic zone, the recommended constructive strategies are openings for ventilation of medium and shaded sizes, heavy external walls and a light and insulated cover. The strategies of passive thermal conditioning are composed of evaporative cooling and thermal mass for cooling; selective ventilation in the summer; solar heating of the building; and heavy internal walls in winter (NBR 15.220 / 2005).

In the houses of the neighbourhood, we observed that such strategies to temper the temperature are not adopted. In the walkthrough analysis, it is verified that the internal temperature of the house in the summer is superior to the one recommended by the NBR 15.575-1. Even so, in the questionnaire the residents evaluate the temperature of the rooms as satisfactory or neutral, while at the city scale a general level of

dissatisfaction is noticed, especially with the high temperatures. A factor that may have influenced this result is the fact that the neighbourhood quarter analysed is located close to the river.

During the period of high rainfall level, residences are more prone to rainfall-like pathologies, such as shedding and infiltration. In the urban scale, mainly due to the low soil permeability rate and steep topography, problems such as overload in the water distribution network and erosions, affecting mainly the lower regions of the neighbourhood.

Even in periods where rainfall is scarce, the major problem is the low volume of water in the dams for electricity generation and water supply, in addition to the decrease in food production, which consequently leads to a rise in the price of electricity and water bills, as well as the price of food. Resilient practices that could be encouraged are the storage of rainwater for reuse, along with food production done by the residents themselves in their homes, or collectively in the neighbourhood.

4.2.7. CLIMATE CHANGE

The average temperature by year graph indicates how much the average temperature has been increasing since the data began to be registered. The last three years show decrease in the average temperature, however there is possibility that the year 2013 and 2014 (the lowest levels in the last years) present some difference, as the months of August, September and December of 2013 and the month of July of 2014 were not accounted due to lack of data. This graph attests the occurrence of global warming.

Graph 105 - Average temperature by year – Uberlândia: 1981-2015

Source: Ministry of Agriculture - 5th District of Meteorology / Uberlândia station - Organized by Authors.
Data from May 1996 are from the Climatology Station of the Federal University of Uberlândia.

Some residents are resilient through the recycling of garbage in an involuntary way, since their real intention is only to obtain some income through the sale of the materials. Even so, this helps to minimise the emission of polluting gases generated in landfills and dumps. The initiative, although punctual, with the appropriate encouragement and awareness of the population, could potentiate other contributions to ease climate change and thus make the population more resilient and ecologically literate.

4.2.8. EXPENDITURE (ENERGY AND WATER)

4.2.8.1. ENERGY

In the state of Minas Gerais, based on data from 2010, the main source of energy used in the residential sector is electricity (34.9%), a renewable source of energy. Followed by liquefied petroleum gas (31.8%) and firewood (31.2%). Hydroelectric generate the majority of this electricity, and the supply's responsibility lies with CEMIG.

At the national level, having 2015 as the base year, electricity corresponds to 45.2% of residential energy consumption. The graph of the Brazilian electrical matrix shows that hydropower is still the main source of electric energy in the country, with residences accounting for only 9.6% of Brazilian energy consumption in 2015.

Graph 106 - Brazilian Electrical Matrix – 2015
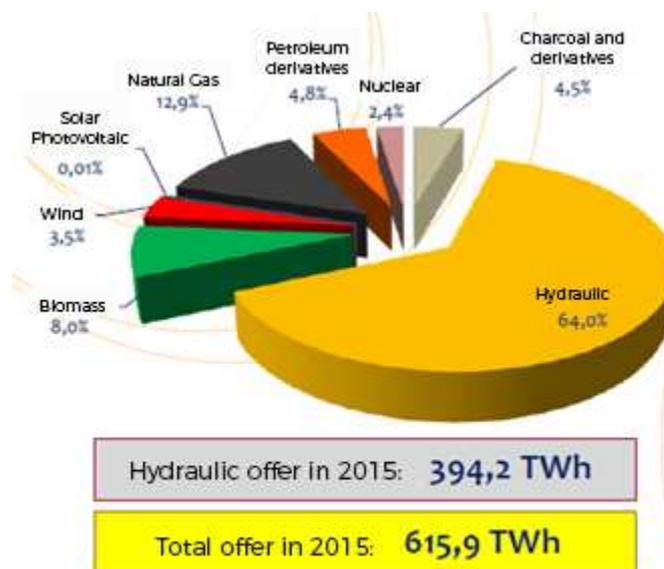
Source: *BEN* (National Energy Balance), 2016 | Base year - 2015. Energy Research Company (*EPE*).

The alternative sources of renewable energy that are derived from the natural environment are still little explored in the country, however solar and wind energy production has been growing in recent years, mainly due to normative resolution No. 482, OF APRIL 17, 2012 of the National Energy Agency (ANEEL). ANEEL encourages the generation of solar energy through photovoltaic panels, with the "compensation" of credits (when the energy generated in a month is higher than the energy consumed, the consumer gets credits that can be offset in their Energy bills.

Although wind power is still not very representative in the country, the production of energy from the winds has been in the spotlight with an increase of 75% in the last year. Supply rose from 2% in 2014 to 3.5% in 2015. The total amount is of wind generation is approximately of 21,625 GWh, exceeding nuclear generation as shown in the following chart.

Graph 107 - Evolution of Wind Generation

2007	2008	2009	2010	2011	2012	2013	2014	2015	Δ 15/14
663	1.183	1.238	2.177	2.705	5.050	6.578	12.210	21.625	77,11%
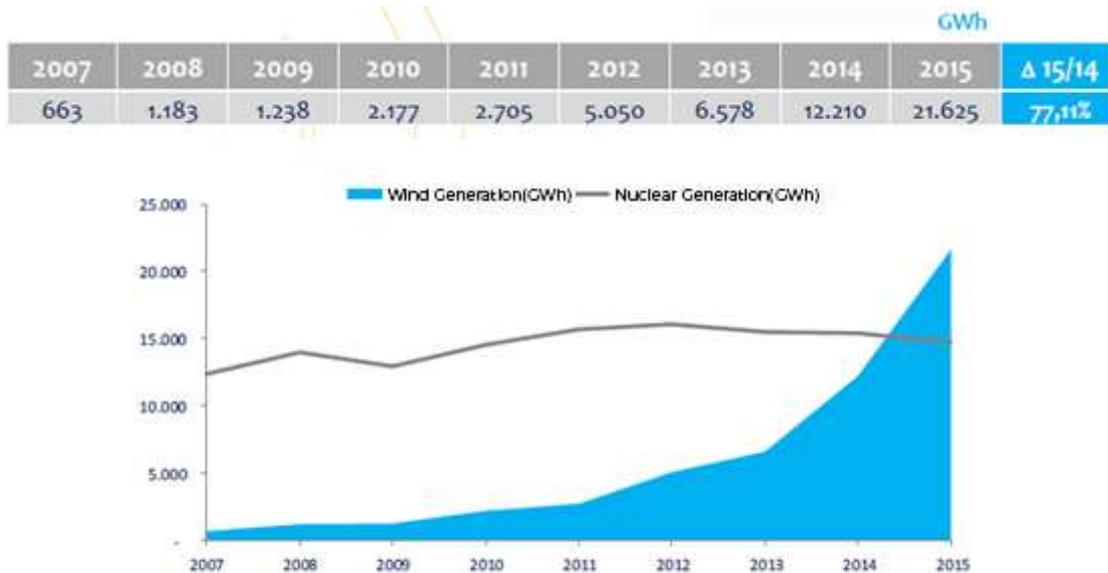
Source: *BEN* (National Energy Balance), 2016 | Base year - 2015. Energy Research Company (*EPE*).

Solar energy now accounts for 0.01% of the renewable matrix in 2015. From 16 GWh in 2014 to 59 GWh of electricity generation. Although the percentage is still very small when compared to other forms of electric power generation, the value is considerable when observed the economy through the solar exploitation.

Only in Minas Gerais, according to data from the 30th energy balance, it was accounted 4,8% of energy avoided in relation to the total consumption of electric energy. This amount becomes even more significant when compared to the total consumption of electricity in the commercial, public and residential, the ones which were most affected by the insertion of solar heating technology. In this case, the percentage of savings in relation to these three sectors was 13.7% in 2014 (BEEMG).

In Uberlândia, this practice already exists, but the initial investment is still quite expensive, and, for now, it is still not feasible for housing of social interest. Mainly generated by the hydroelectric system, energy in Brazil is mostly dependent on water resources, becoming vulnerable to climatic and environmental conditions. As in some regions of Brazil, there are long periods of drought, the production of electric energy is compromised when the level of the reservoirs falls. In these cases, the hydroelectric is shut down and thermoelectric, fuelled by natural gas coming from Bolivia are used. When this practice occurs, there is an increase in the energy tariff because natural gas generation is more expensive than using water sources.

In graph 108, referring to the consumption of electricity per capita raised in the Walkthrough, we noticed that the actual consumption per inhabitant is below the expected according to the equipment present in each house, probably due to inaccuracy of the resident when indicating the time of daily use of each of the equipment.

Graph 108 - Eletricity Monthly Consumption Per Capita in 2015/2016

Eletricity Monthly Consumption Per Capita in 2015/2016

Walkthrough Evaluated Houses
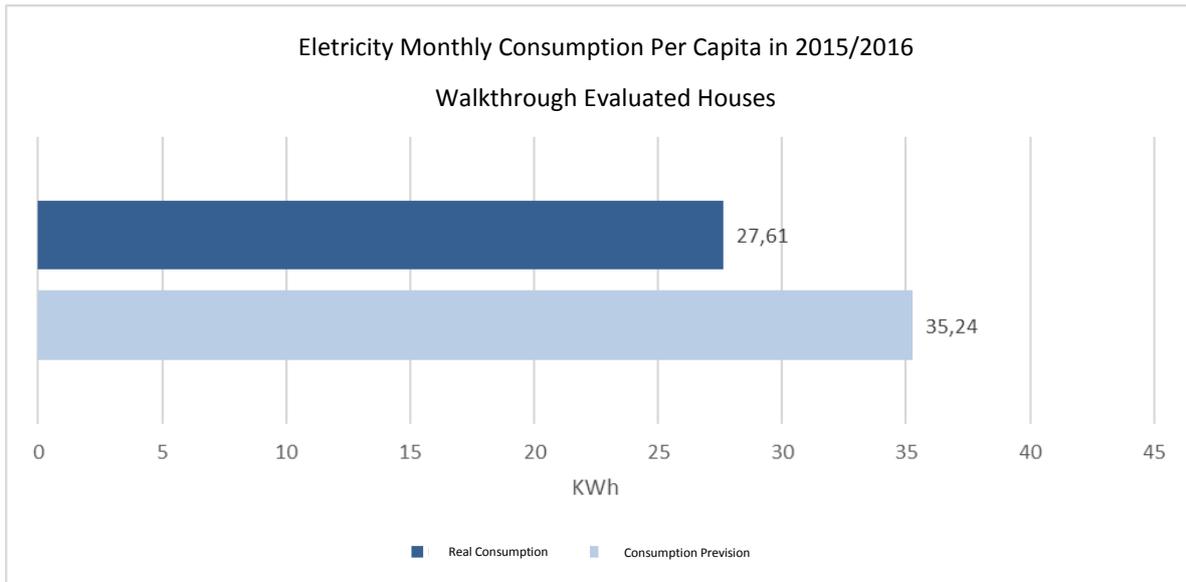
Source: Electric Energy bills - CEMIG, 2016. Residential Consumption Simulator - CEMIG, 2016. Organized by the authors.

Comparing the electric energy consumption of the houses evaluated by the Walkthrough and the general consumption data (graph 109), we can see that the consumption of the dwellers of the houses is much smaller than the per capita consumption of both the municipality and the state and country. Therefore, it can be inferred that the use of the solar heater destined to heat the water of the bath, instead of the electric shower, generates a great economy. Another factor we can consider is the gradual awareness of the population regarding the reduction of energy and water expenses, due to the water crises that the country has been facing over the years.

Graph 109 - Monthly Residential Consumption of Electricity Per Capita in 2008

Monthly Residential Consumption of Eletricity Per Capita in 2008
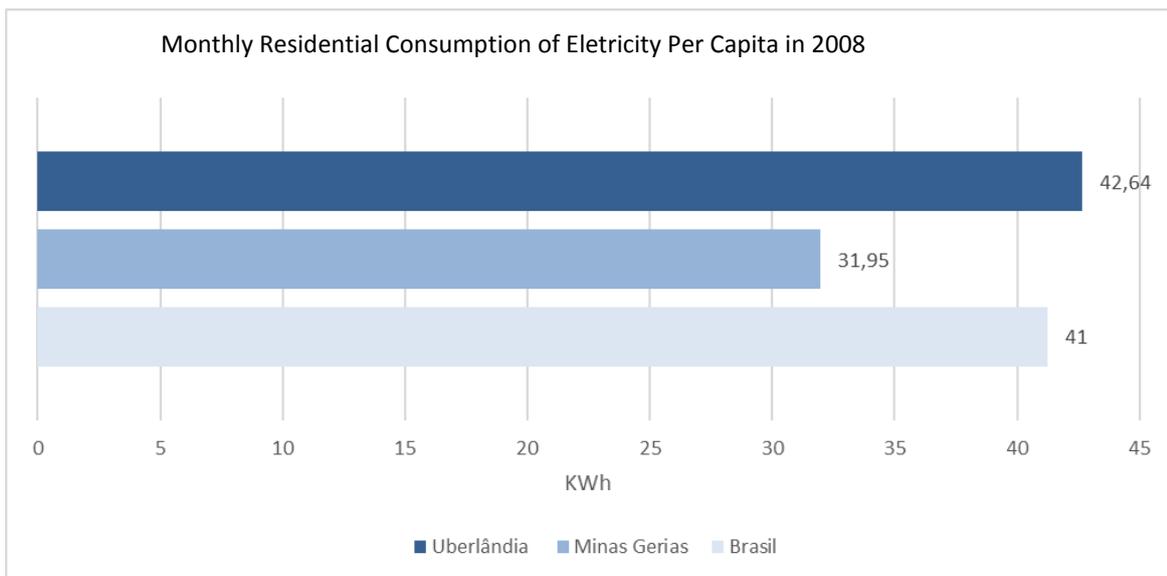
Sources: Municipal Information Panel - Uberlândia, 2011. Energy Balance of the State of Minas Gerais, 2011. Monthly consumption of electricity by class (regions and subsystems) 2004 to 2015, 2015. Brazilian Institute of Geography and Statistics - IBGE, 2016. Organized by the Authors.

4.2.8.2. WATER

The Municipal Department of Water and Sewage (DEMAE) carry out the water supply, in Uberlândia. The water comes from two reservoirs, *Uberabinha* River - Treatment Station Sucupira, and *Ribeirão Bom Jardim - Bom Jardim* Treatment Station. As the two dams are considered small, mainly if taking into account that we are in a region of long periods of drought, as well as considering the growth projection of the population, a third Station point is in the initial construction phase.

In the Shopping Park Neighbourhood, most of the water consumption is destined to the residential sector, representing 97.45% of the total, with the remaining 2.55% destined to the commercial and public sector. Also, the consumption of the neighbourhood corresponds to 18% of the Total consumption of the city.

According to data from the National Secretariat of Environmental Sanitation in 2014, the average daily water consumption per inhabitant in Brazil was 162 liters, in the Southeast Region was 187.9 litres, in the state of Minas Gerais was 154.1 litres, and in Uberlândia was 224.8 litres. In the Walkthrough evaluation, based on the consumption data of each household, we observed that the average daily consumption is 118.8 litres per inhabitant. This level of consumption is way below the municipality average, but still higher than the recommended by the World Health Organization, which is of 110 litres per day per person, which reveals, once again, the population's awareness towards the reduction in consumption.

Although the consumption of both electricity and water in the houses evaluated in the Walkthrough was lower than the other data analysed, in the Questionnaire 61.3% of the interviewees classified as unsatisfactory or regular the cost-benefit ratio of these items, as they consider that they pay a high cost compared to the amount consumed.

Graph 110 - Daily Water Comsumption Per Capita in 2014
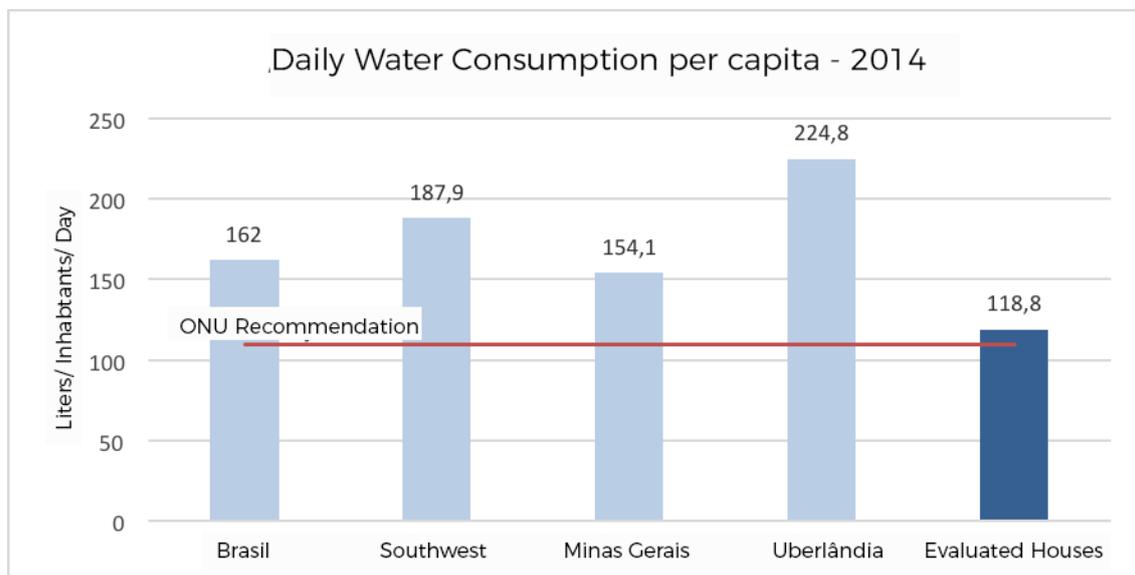
Source: Diagnosis of Water and Sewage Services of 2014 - Ministry of Cities, 2014. Historical Series - National Information System on Sanitation - Ministry of Cities, 2016. World Health Organization - UN, 2016. Water and Sewage Accounts - DMAE , 2016. Organized by the authors.

4.2.9 PARTIAL CONSIDERATIONS

The following frame summarizes the main conditioning factors of the resilience concerning the climatic and natural order, in terms of weaknesses and potentialities observed in the study area of the Shopping Park neighborhood.

Frame 31 – Conditioning Factors of Resilience: climatic natural order

Conditioning Factors of Relisience: Climatic and Natural Order		
Aspects	Fragilities	Potentialities
Natural Resources (Vegetation, Soil and Water)	- There are illegal occupations in the Permanent Preservation Areas, located 50 meters from the Uberabinha river course, pouring sewage directly into the river and contaminating both soil and water resources. - Large institutional areas, destined to the implantation of green areas and recreation areas, have not been established yet. - Lack of large and medium trees. - Some residents have reported that their houses were delivered with saplings planted on the sidewalk, but they removed the trees to prevent them from damaging the sidewalk. They also did it to prevent unwanted people to enjoy the shade of the trees or even to avoid filth in front of the houses. This fact indicates lack of environmental awareness in the community. - Although they are in agreement with the standard, the sidewalks do not include large trees. - Excessive waterproofing of the land: 52,5% of the interviewed say that they have paved the external area of the house. 50% of the houses evaluated in the walkthrough have paved their lots beyond what is allowed by municipal legislation.	- Most of the vegetation in the neighborhood is located on the banks of Uberabinha river. - Residents recognize the landscape and environmental value of the river to the neighborhood - Some residentes recognize the need for trees on the sidewalks, and they say that if there were more trees the neighborhood would be prettier and more pleasant. - 72,9% of the interviewed have plants inside their houses. - 67,5% of the interviewed miss more green areas at home.
Topography	- The neighborhood has locations with up to 12% of declivity. - The blocks were implanted perpendicular to the contour lines, this increases the speed of the rainwater, and exposes the background of the allotments and streets without paving to the erosion, besides contributing to the Uberabinha river siltation. - When it rains, garbage flows according to the topography, accumulating in the lower areas of the neighborhood. - The very steep and long streets make walking more difficult. - A project delivered in a steep region does not include retaining wall, putting at risk the stability of the building and the safety of the population.	- Despite the high cost, many residents have built the retaining wall of their homes.
Pollution / Waste	- Lack of selective collection in the neighborhood. - The closest recycling bin to the	- 57,5% of the interviewed perform separation of recyclable garbage even if there is no selective collection.

	neighborhood is 9,5Km away. - 65% of the interviewed consider that there is negligence with maintenance and cleanliness of the neighborhood. - Large accumulation of rubble and garbage in the neighborhood's vacant lots, including institutional allotments that have not yet been occupied. - 74,3% of respondents consider the cleaning and conservation of public facilities in the neighborhood, from regular to lousy. - Accumulation of construction rubble obstructs sidewalks. - Accumulation of garbage on streets and sidewalks. - 65% claim that they see their neighbors throwing garbage on the street, but only 5% assume they do it. - Dumpsters are not suitable; their openings contribute to the scattering of domestic waste. - Accumulation of construction rubble inside the lots damages the hygiene and the aesthetics of the houses, and the health of the residents and neighbors, which leads to problems of coexistence in the neighborhood.	- 76,3% separate oil from other organic waste - Reutilization of materials to make renovations and remodeling of houses.
Scarcity (Water and Energy)	- 87,5 of the interviewed said that they save water and electric energy for the financial factor and not for environmental concern or fear of scarcity. - 7,5% do not save electric energy. - 10% do not save water.	- Eve though they are motivated by financial matters, there is a large amount of residents who save electric energy or water.
Extended Dry Seasons	- In July, August and September, Uberlândia presents Relative Air Humidity below 60%, which is minimum for the health of the human body according to WHO. - Increased probability of diseases in the respiratory system of the population. - Increased probability of burned green areas. - The neighborhood is lacking vegetation, which boosts the low humidity.	- The proximity that the neighborhood has with the Uberabinha River helps create a humid microclimate in the southern region of the neighborhood.
Atmospheric Conditions	- Uberlândia has two well-defined seasons: a wet season with high temperatures from October to April and a dry season with mild temperatures from May to September. - The internal temperature of the walkthrough houses is up to 2.9 ° C, higher than the outside temperature in the summer.	- In renovations and extensions, there is eventual concern for environmental comfort. In some houses, there are openings for ventilation and natural lighting.

	- In the housing project, constructive strategies are not used to optimize thermic performance, according to the bioclimatic zone in which the city is located. - In the period of low rainfall, there is an increase in taxes for water and electricity, and for some food.	
Climate Change	- The average annual temperature of Uberlândia has been increasing since the data began to be registered. - The average annual rainfall volume of the city is decreasing.	- Residents show resilience through the recycling of waste, which reduces the emission of polluting gases generated in landfills and dumps, which is a contribution to mitigating climate change. - Most residents save water and electric energy.
Expenses (Water and Energy)	- High taxes of water and electricity.	- The consumption of both water and electricity from the residents of the homes evaluated by the walkthrough is much smaller than the per capita consumption of the municipality, the state and the country. - Uberlândia has great potential in the production of solar energy. - All houses in the housing complex have a solar heater.

Source: Authors, 2017.

4.3. PHYSICAL-URBANISTIC ORDER ANALYSIS

4.3.1. LAND-USE

The study area is predominantly residential. Although commercial, institutional and service activities are in constant growth, they are still poorly consolidated. The area has six allotments, which corresponds to approximately 2,634 houses. There are also 122 commercial areas, 107 services, 23 institutional and only one of leisure.

Figure 217 - Land-use

CURRENT USE

RESIDENCES
INSTITUTIONS
COMMERCE
SERVICES
LEISURE

INTENDED USE

COMMERCIAL AREA
NOT CONSOLIDATED

INSTITUTIONAL AREA
NOT CONSOLIDATED

RECREATIONAL AREA
NOT CONSOLIDATED
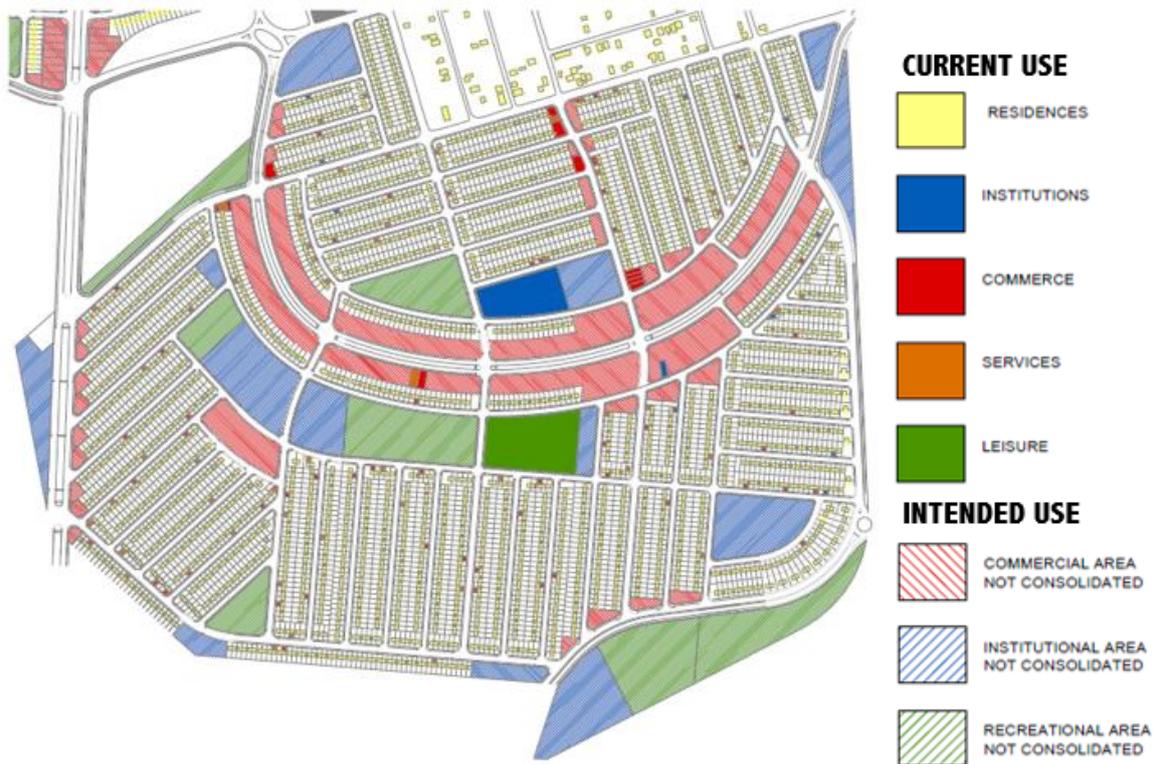
Source: Authors, 2016.

The graph below shows the percentage of use and occupation of the set of six lots.

Graph 111 - Percentage of use and occupation in the study area

4% 4% 1%

RESIDENTIAL
COMERCIAL
SERVICES
INSTITUTIONAL

91%
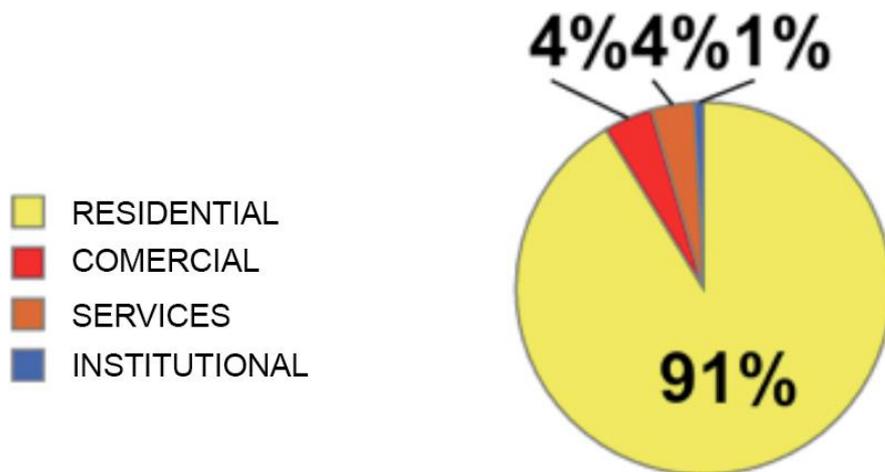
Source: Authors, 2016.

According to the SUPPLEMENTARY LAW No. 523 - on the division of land in the Municipality of Uberlândia and its districts - the allotments in Shopping Park neighbourhood should meet the following percentages:

I - 20% (twenty percent) of area for the road system;

II - 5% (five percent) of area for institutional use;

III - 5% (five percent) of area for public recreation;

IV - 7% (seven percent) of area for domains;

The following map shows the number of allotments with the division of land and areas for each use. In green areas for recreation and in blue the institutional ones.

Figure 218 - Land parcelling of the study area

Source: Authors, 2016.

Despite these allotments meet municipal legislation on the division of land, the areas facing these uses are still poorly consolidated, and only demarcations on the ground without qualification, projects or adjustments to the use of the population. Most commercial, institutional, and service locations currently focus on the main avenues, far from the housing units, as shown in the map below. The rest is characterised by being part of the residence, an annexed space, on a smaller scale, distributed among the six allotments, according to the map of use and occupation below. The areas in red and orange next to the yellow ones (residences) are these annexes.

Figure 219 - Land-use
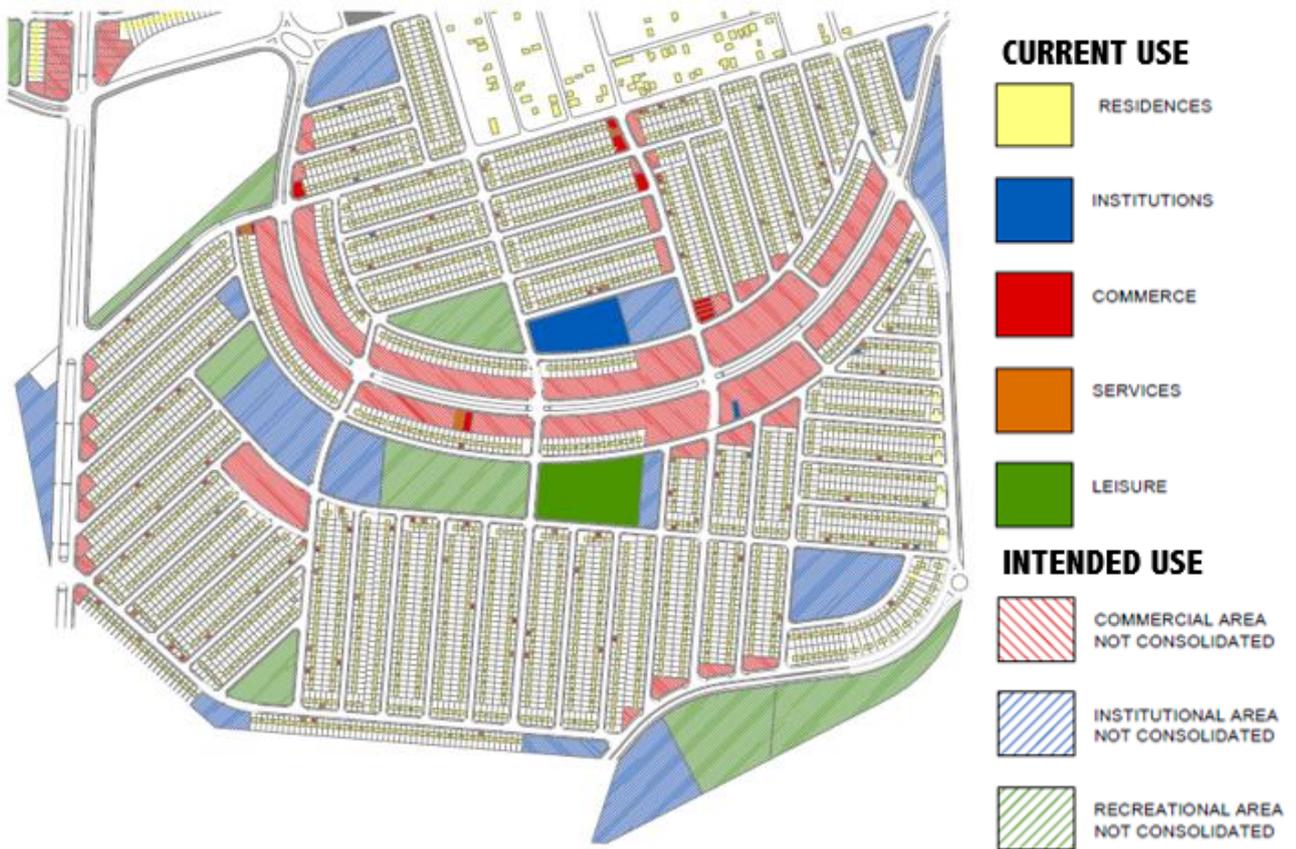
Source: Authors, 2016.

Figure 220 - Example of institutional lot without qualification and constructions

Source: Authors, 2016.

Figure 221 - Minister Homero Santos Avenue: lots intended for trade to its full extent, but there are still a few buildings

Source: Authors, 2016.

The fact is important to highlight because it shows how much the locals follow adapting their homes to condition more opportunities and varieties of services and trade to the neighbourhood. There are several examples of houses that have annexes such as bakeries, small markets, nurseries, and hairdressers, among others. Thus, it shows the local resilience bringing a better quality of life to them.

Figure 222 - Example of an annex in the houses

Source: GOLINO, 2015.

Figure 223: Example of household attachment - beverage distributor Source: Research group

Source: Authors, 2016.

Figure 224 - Example of an annex in the houses - party hall and restaurant

Source: Authors, 2016.

The adaptation factor of dwellings with attached services and trades is even more evident in the urban insertion site. From the Walkthrough, where ITDP / LABCIDADE (2014) methodology was used, we identified

that only 25% of the area is in contact with the urban network. In addition, this percentage of neighbours allotments are few consolidated, there are still many vacant lots and little availability of facilities. In the following image, only the north side of the perimeter of the area maintains contact with the urban area of the city, the other regions are lots destined to permanent preservation area, institutional and recreation areas not consolidated.

Figure 225 - Contact with the actual urban environment

Source: Google maps, 2016. Edited by Authors.

4.3.2. SOCIAL FACILITIES

As previously mentioned the Shopping Park neighbourhood is predominantly residential. Despite the municipal law of the land division to define and plan areas intended for leisure, sport and culture, these uses are still partially consolidated in the area. The demarcated areas are characterised mainly as unskilled spaces without landscaping and architectural conditions suitable residence and conviviality of the residents. In the area, for example, there is only one community centre that tries to provide the needs of approximately 2,634 families. Although this facility includes a variety of uses, recreation and sports, it is clear that it is insufficient to meet local demand. In addition, in a conversation with residents, through the questionnaire and co-production, some of them said that they do not use the place often because they do not feel safe. In fact, it is quite common to hear complaints about security in the neighbourhood. It means that although the neighbourhood has only one space for leisure and sports, it is considered marginalised by some people. Thus, the place is used more often only in events, when there are more people around.

Regarding institutional facilities such as schools and hospitals, they also prove to be insufficient for the population demand. It is noted that there are only three schools, three kindergartens and three health centres to serve the whole neighbourhood - not just for the region studied.

Figure 226 - Neighbourhood social facilities
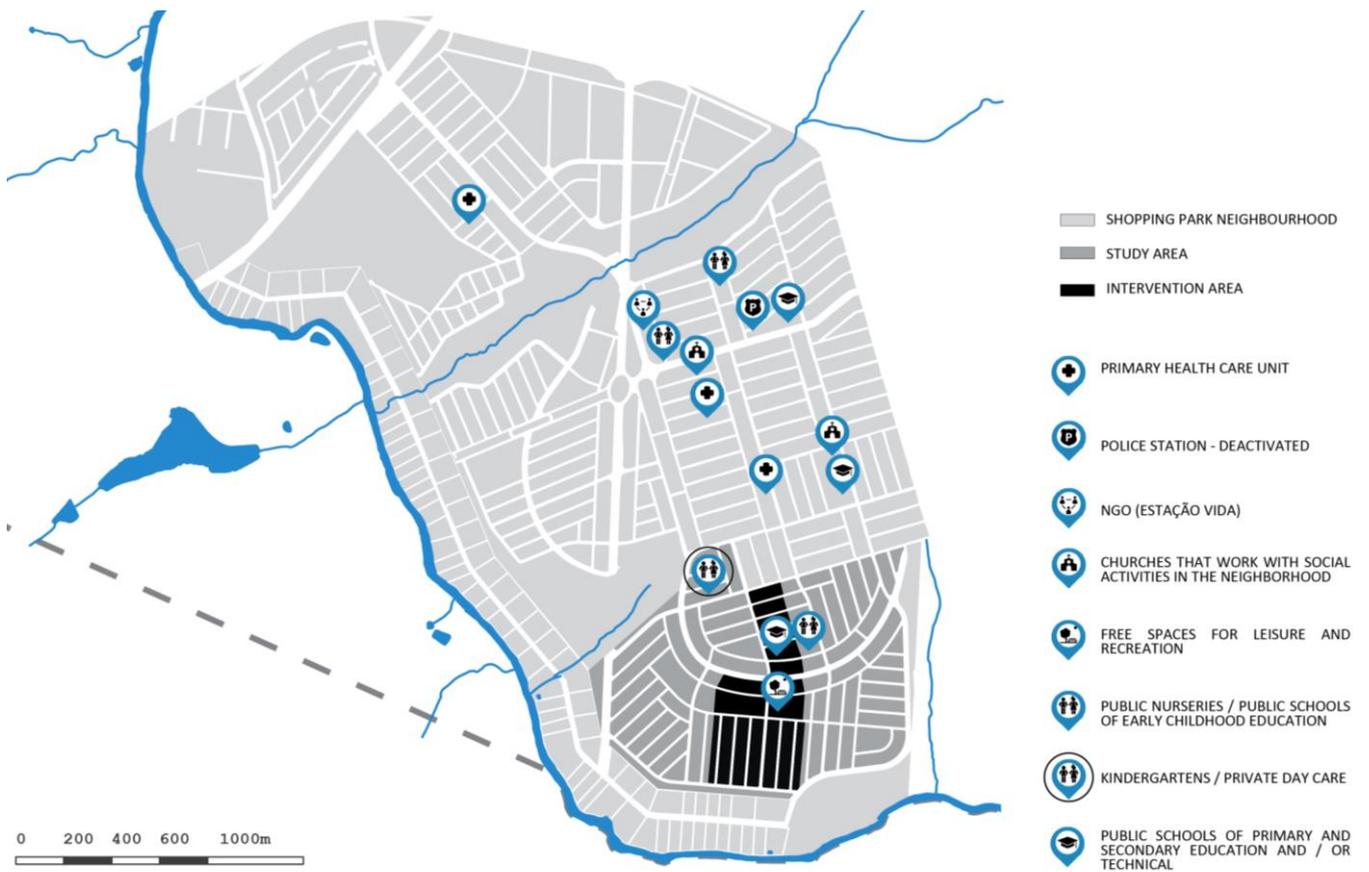
Source: Authors, 2016.

After contact with the residents in the sections of co-production, the question of dissatisfaction became even more eminent. The map below shows the summary of lack of the social facilities, which they miss the most:

Figure 227 - Equipment that most residents miss the most

LEGEND:

Basic Health Unit	Recreation Center	Lottery
Public Hospital	Linear Park	Gas Station
Traffic Signaling	Echologic Park	Police Station
Public Daycare	Ecopoint	Bus Shelter
Public High School	Supermarket	

Source: Authors, 2016.

In addition, more than half of the respondents (65%) said that the old location, where they used to live, was better or extremely better than the current one. According to residents, the main reason is due to facilitated access in relation to public health, school, and supermarket, among others.

Graph 112 - Location of the old house

LOCATION (PREVIOUS HOUSE)

| (40) | 17.5 | 47.5 | 15.0 | 20.0 |

very satisfied   satisfied   partially satisfied   unsatisfied   very unsatisfied
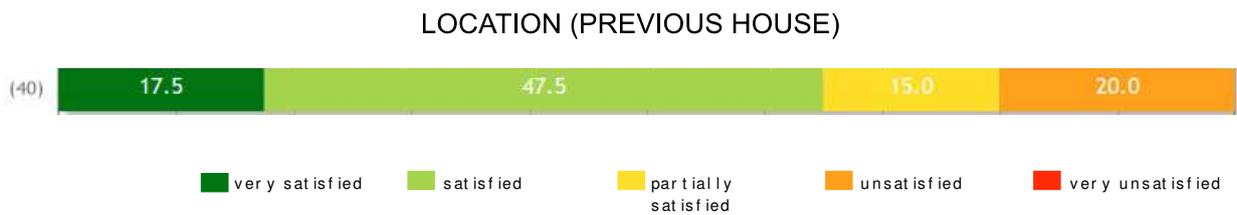
Source: Authors, 2016.

Besides the shortage of social facilities, residents also have complained that the quality of service is not satisfactory. In the chart below, it is noted that most of the residents are dissatisfied with some of them.

Graph 113 - Equipment quality

QUALITY OF THE FACILITIES (CURRENT NEIGHBOURHOOD)

	very satisfied	satisfied	partially satisfied	unsatisfied	very unsatisfied
public health		16.2	5.4	27.0	51.4
public education		35.1	16.2	27.0	21.6
culture	2.7	16.2	29.7	37.8	13.5
leisure (parks & squares)	2.5	12.5	22.5	52.5	10.0
public transport	2.5	32.5	25.0	30.0	10.0
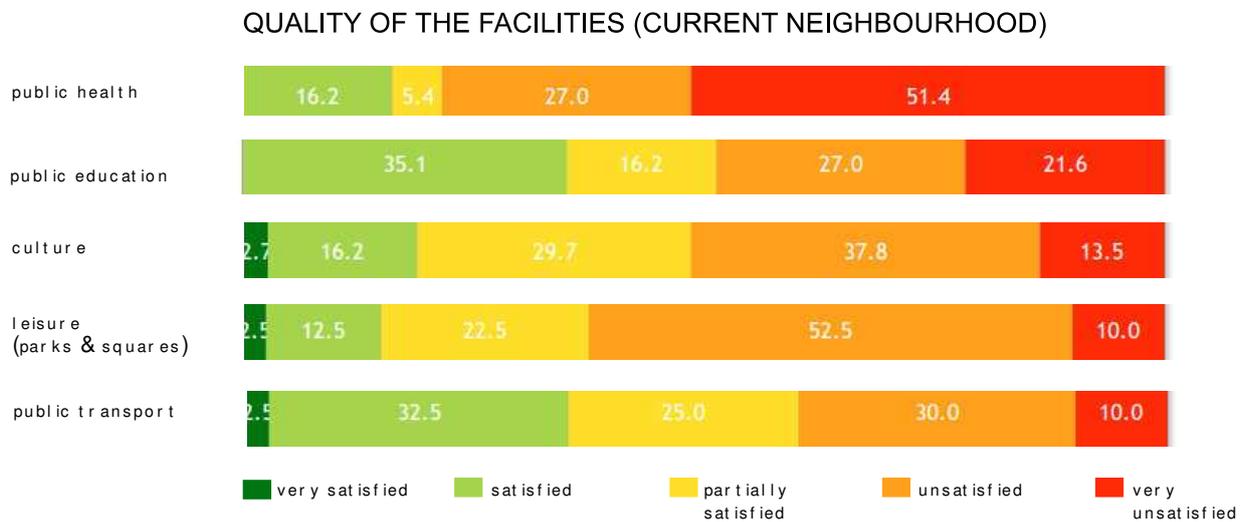
Source: Authors, 2016.

As can be seen in the graph below, one of the biggest claims of residents is relative to the quantity and quality of public health services. Again, there is the lack of places that supply the required population demand, which in the case there is the requirement of a hospital. Many residents complain that in a case of emergency they have to go to other more distant hospitals. There are also complaints about the quality of health care; some of them reported that usually they have to wait a long period to mark the consultations. Finally, they also have cited the lack of free medicines, which is somewhat common in health centres in the region.

Graph 114 - Satisfaction in relation to health care

HEALTH TREATMENT SATISFACTION

| (40) | 2.6 | 12.8 | 23.1 | 12.8 | 48.7 |

very good   good   regular   bad   very bad
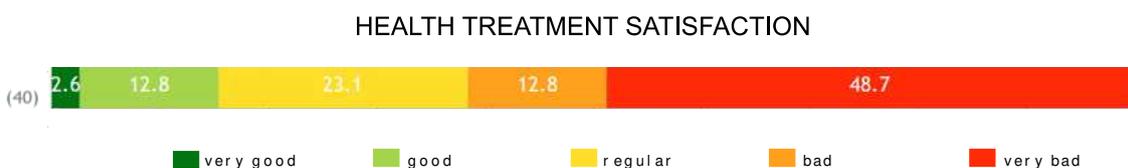
Source: Authors, 2016.

Another issue is the maintenance and cleaning of social facilities. Again, the population shows dissatisfaction. More than half of the respondents (65%) believe that the area is abandoned or totally abandoned. Often a large amount of household and building waste is noted in green areas and in vacant lots close to common areas such as the community centre.

Graph 115 - Maintenance and cleaning

MAINTENANCE AND CLEANING

| (40) | 5.0 | 20.0 | 10.0 | 52.5 | 12.5 |

fully care   partially care   regular   abandoned   fully abandoned

Source: Authors, 2016.

Graph 116 - Maintenance and cleaning of the social

cleaning and conservation of the public spaces   2.6   23.1   25.6   33.3   15.4

quantity of facilities of common space   2.6   21.1   10.5   65.8

quality and conservation of gree areas   17.9   5.1   51.3   25.6
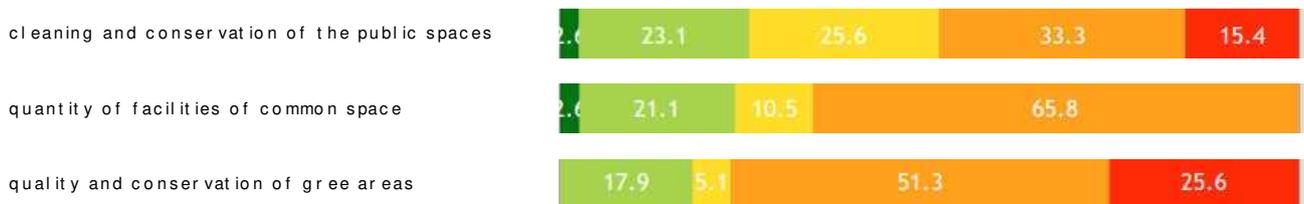
Source: Authors, 2016.

Figure 228 - Accumulation of waste in empty lots

Source: ARANTES, 2015.

It is important to note that despite all these difficulties with social facilities, we noticed a strong local resilience. The population shows great flexibility and adaptability to the opposite situations. Thus, several transformations in the space can be seen improving the quality of life, as the figure below illustrates.

Figure 229 - Soccer court drawn on the street

Source: ARANTES, 2015.

4.3.3. INFRASTRUCTURE

In relation to infrastructure and public services, such as water, sewage treatment, electricity, street lighting, Internet, telephone line and waste collection, all are provided in a satisfactory manner. However, at the beginning of the occupation of the neighbourhood, there was no consolidated or pre-established infrastructure. Lacked basic services such as street lighting, asphalt on the streets, sidewalks and social facilities. Gradually basic needs were being met, but to this day some equipment is still missing.

4.3.3.1. STREETS AND SIDEWALKS

The paving of the streets and sidewalks today is somewhat consolidated. However, many residents question the quality of them. According to the walkthrough analysis, the site only partially meets accessibility standards. Although the streets are all paved their signage is insufficient. There is only horizontal signage present only at the corners, no pedestrian range or high range, little vertical signalling and no light signalling.

Regarding the sidewalks, they were delivered paved to the residents, with a main strip of 90cm, and two green stripes on each side with 30cm. Over time, the arrival of the residents, the sidewalks were being transformed. Currently, some are deteriorated or are even non-existent, which is the case of preservation areas or institutional lands not yet qualified for use. According to the Walkthrough analysis, all the corners of the sidewalks have access for wheelchair users, but there are points to be desired regarding material hindering access and maintenance status. Those that remain original contain sufficient access range and vegetation when it exists, as well as trash and light pole are in the service range, but some are very cracked making it difficult for people with special needs. Many have been altered keeping room for access. It is very common to encounter a residential access ramp disrupting the walk since the level of construction is higher than the street level being another obstacle to the access lane. The vegetation is the less frequent obstacle since there are few trees of medium or large size. In addition, in an interview with residents, most stated that they prefer to walk on the street than on the sidewalk, even those who do not have a physical disability. This reinforces the lack of maintenance and quality of the sidewalks.

Graph 117 - Quality of sidewalks

	great	good	regular	bad	very bad
acessibility for people with physical restrictions		15.4	12.8	51.3	20.5
quality of the sidewalks		12.8	15.4	53.8	17.9
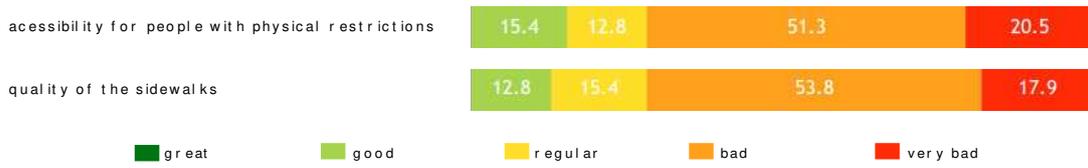
Source: Authors, 2016.

Figure 230 - Quality of sidewalks

Source: Authors, 2016.

According to the Walkthrough, only 54% of the sidewalks present some problem regarding mobility and maintenance in the area analysed. The following image shows where and what are the most frequent difficulties, with 35 sidewalks having inadequate ramps with insufficient slope, 24 having some obstruction, 38 having debris and 16 sidewalks have some problem with the pavement delivered.

Figure 231 - Quality of Driveways - study area
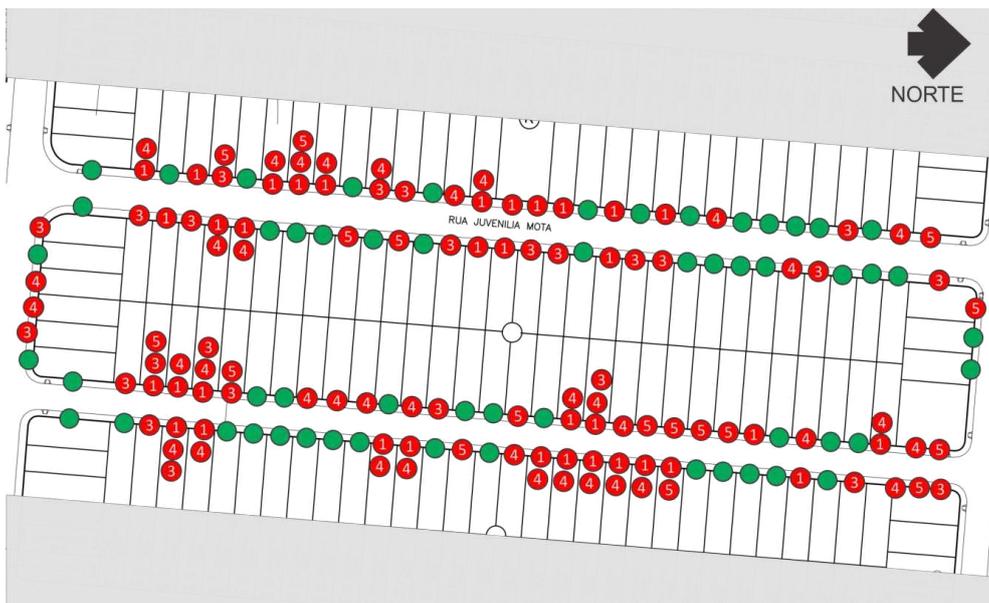
Source: Authors, 2016.

Thus, most of the sidewalks analysed does not meet the accessibility parameters, preventing the path of pedestrians through them. Although the corners have access ramps, it is common to see people with special needs to be permanent or temporary using the street instead of the sidewalks.

4.3.3.2. ENERGY

In relation to energy, a Federal Agency regulates its production and distribution. About 70% of the energy produced in Brazil comes from hydropower, perceptual that is now in decline, while the use of other polluting sources is rising. A recent law has allowed individuals and businesses to start generating their own energy, but they can only trade it with the official energy companies. As a result, the production of solar or wind energy has increased, although it represents only 2%. Likewise, there is no generation of energy in the housing complex of Shopping Park, being the energy supplied by the company (CEMIG), owned by both the State of Minas Gerais and private investors. All homes have a solar water heating system that contributes significantly to decrease energy expenditure, which is around 80 KWh / month.

4.3.3.3. WATER AND SEWER

In relation to the water and sewage system are provided by the Municipal Department of Water and Sewage (DMAE), which is responsible for covering the entire city. The sewage treatment is done jointly at the Sewage Treatment Station of the city also operated by the DMAE.

4.3.3.4. PUBLIC LIGHTING

Public lighting is provided in an agreement between the energy's company (CEMIG) and City Hall. However, among the requirements of the residents stands out the improvement of public lighting in the streets and common areas.

4.3.3.5. GARBAGE COLLECTION

The garbage collection service is provided by the city hall, but there is no selective collection. Despite this, there is a very large problem related to household and construction waste. The latter comes from the reforms and extensions promoted by the residents in their housing units. All this garbage is deposited in the open, which causes bad smell and attraction and proliferation of animals harmful to public health. For residents, the issue reinforces the need for awareness of all, because even with weekly collection and cleaning of lots that the city regularly does, the waste continues to be deposited in irregular places, degrading some lots. In addition, the local community still requires places destined to Eco Ponto, that is, places that collect and / or recycle garbage.

4.3.3.6. RAINWATER

Another problem that aggravates the issue of garbage is the capture of rainwater. Allotments in the Shopping Park neighbourhood were planted on fairly steep terrain. Due to the topography of the area, allotments present complications related to erosion and rainwater harvesting, as rainwater takes a high speed from the highest to the lowest, compromising the safety and stability of housing units and accumulating more Residues in the lower reaches of the site. In this sense, the residents question the improvement of the drainage and drainage, and the addition of more manholes to the capture of the pluvial water.

Figure 232 - Topography
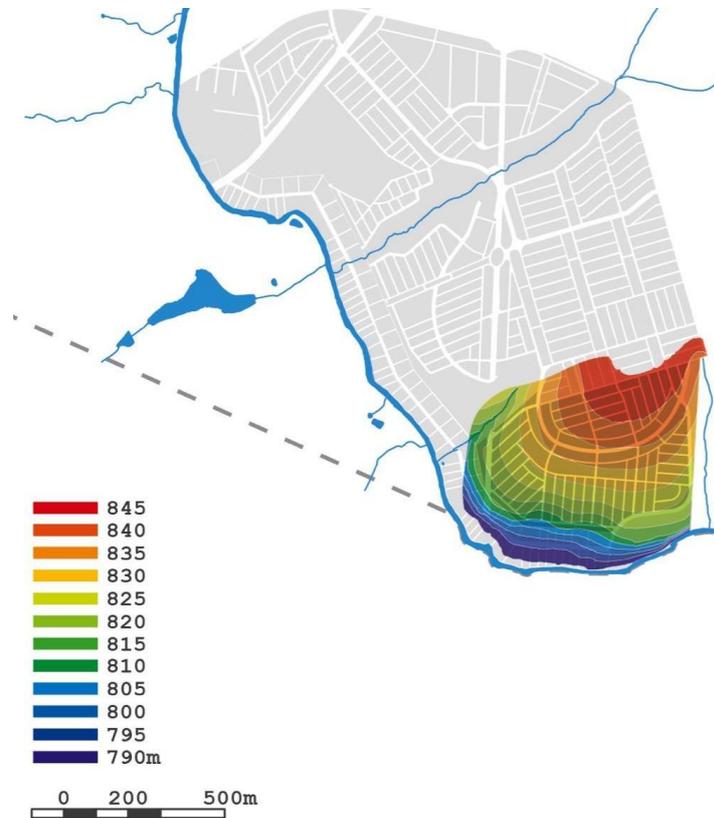
Source: TFG_Juliana Arantes, edited by author, 2016.

According to the questionnaires, the main ways of transportation that the residents reported were: bus (60%), car (17.5%) and motorcycle (12.5%). In Shopping Park there are four bus lines that circulate in the region. However, according to the Walkthrough and analysis of the routes published by the Transport Company, the number of routes is insufficient because the proximity of their paths leads to consider only two routes. To meet local demand the acceptable should be at least three lines.

In addition to the number of buses and variety of destinations being insufficient, still according to the Walkthrough, frequency also does not satisfy the community. This is due to the fact that only one bus line has the acceptable frequency, which is a range of up to 19 minutes and operation time of 19 hours, the rest have longer ranges and shorter operating times.

Figure 233 - Map of the bus lines that serve Neighbourhood Shopping Park

Bus A147 / E147
Bus A148
Bus A331
Urban perimeter
Shopping Park neighborhood perimeter
Central terminal
Santa Luzia terminal

0   1000   2000m
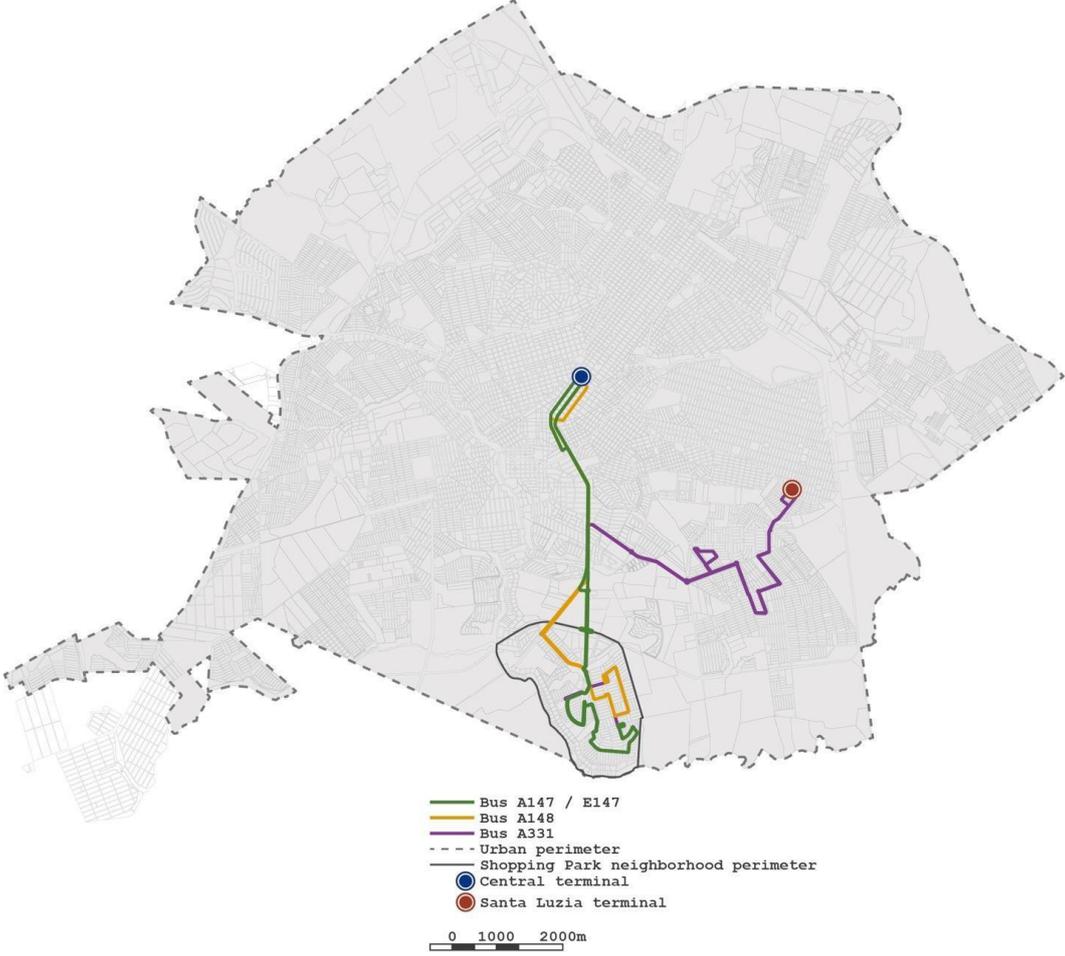
Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 234 - Map of the bus lines that serve Neighbourhood Shopping Park
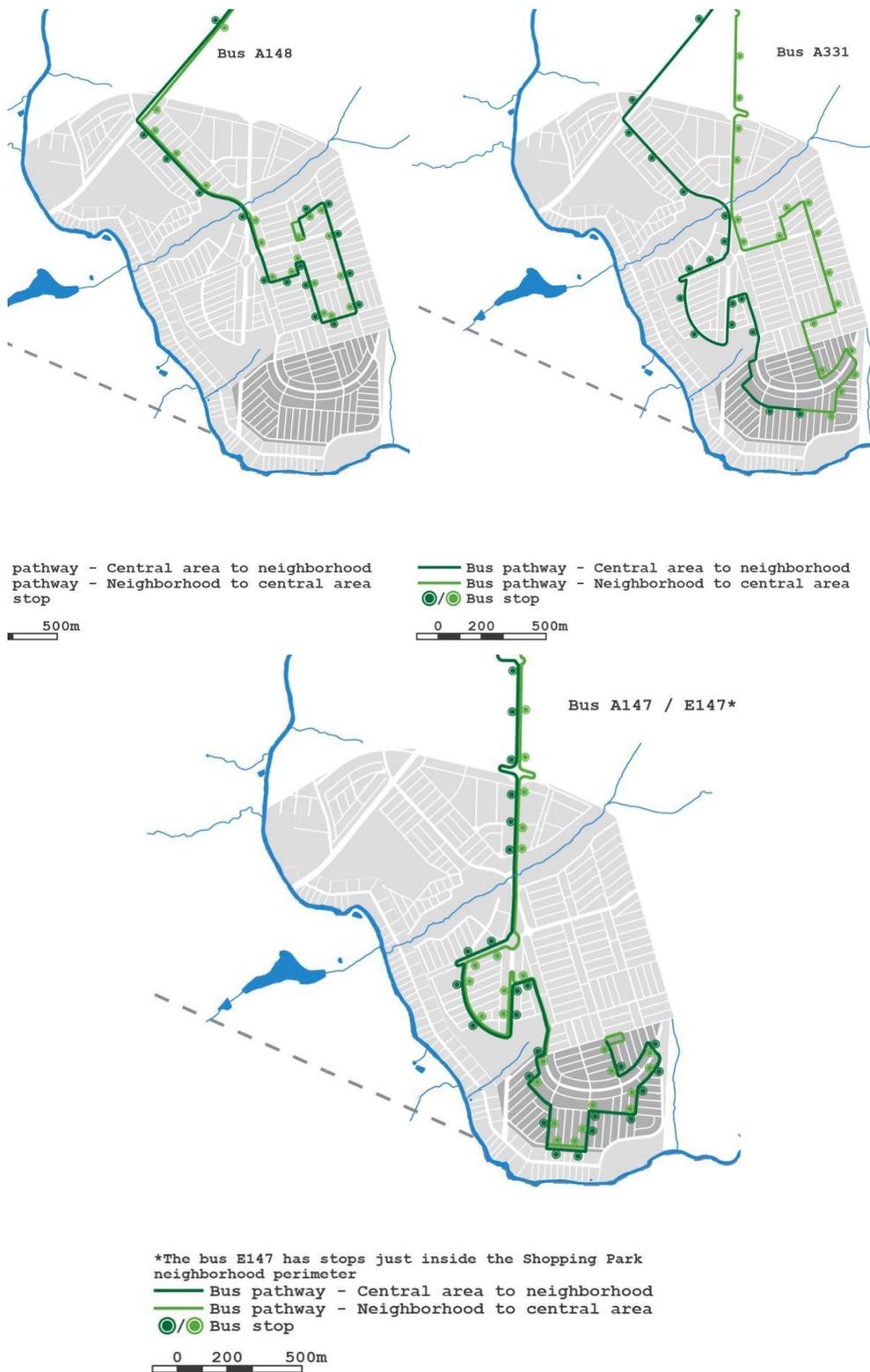
In the result of the questionnaire, this question of frequency and insufficiency of itineraries was further reinforced. A bit more than half of the residents (51.3%) agree that the neighbourhood is excluded from the city. However, there is an interesting fact about Shopping Park. Its location is considered privileged because of its proximity to the central part of the city due to an avenue that connects the neighbourhood directly to the centre of Uberlândia. In this way, there is a part of the population (17.9%), which believes that the area

is fully integrated. Thus, users of both public transport or car users do not take a long time to go to the city centre, which means that these residents agree that Shopping Park seems fully integrated into the city.

Finally, according to the PTTS Activity Report (PMU, 2014), among the population's main public transport requirements, there are also those: increase bus lines and improve their redistributions; More flexible schedules; Improvement in bus stops and also an improvement in school public transportation.

4.3.4. DENSITY

The question of density is a complex discussion that depends on several factors such as morphology, flow, and location, among others. Currently, there is no consensus and definition of what is high and low density. Some researchers believe that more compact cities with higher overall densities can keep public transportation cheaper and better, promoting energy efficiency on land, social equity, and other benefits. On the other hand, there are authors who argue that low density is a positive thing. According to Professor Fionn Stevenson, in her lecture on "Sustainable Housing, Resilience and Social Learning" (2016), for example, a low-density situation is seen in a positive way for residents to achieve greater adaptability, flexibility in their houses and consequently greater resilience. However, according to the author, high-density situations with many people living in high buildings, with standardised typologies, for example, it is possible to notice a lower resilience, for the place is limited in relation to reforms and adaptations.

The study area consists of 8 housing developments and presents a level of gross density 100Hab / Ha. To find this data took into account the existing houses and also the extensions at the back of the lot, considering an average of 5 people for each dwelling and 3 people for additional housing units. In addition, current land use was identified along with the intended use for areas not yet built or consolidated. Thus, in this case, the region is considered low density. However, these data are viewed positively as greater community resilience is observed.

Figure 235 - Study Area Density

HOUSING UNITS
(TOTAL – 3632)

EXTENSIONS
(TOTAL – 449)

IT WAS TAKEN INTO ACCOUNT 3 PEOPLE FOR EACH HOUSING UNIT, AND 5 PEOPLE FOR EXTENDED HOUSING UNITS.

11.794 Inhabitants
0,01 people/m²
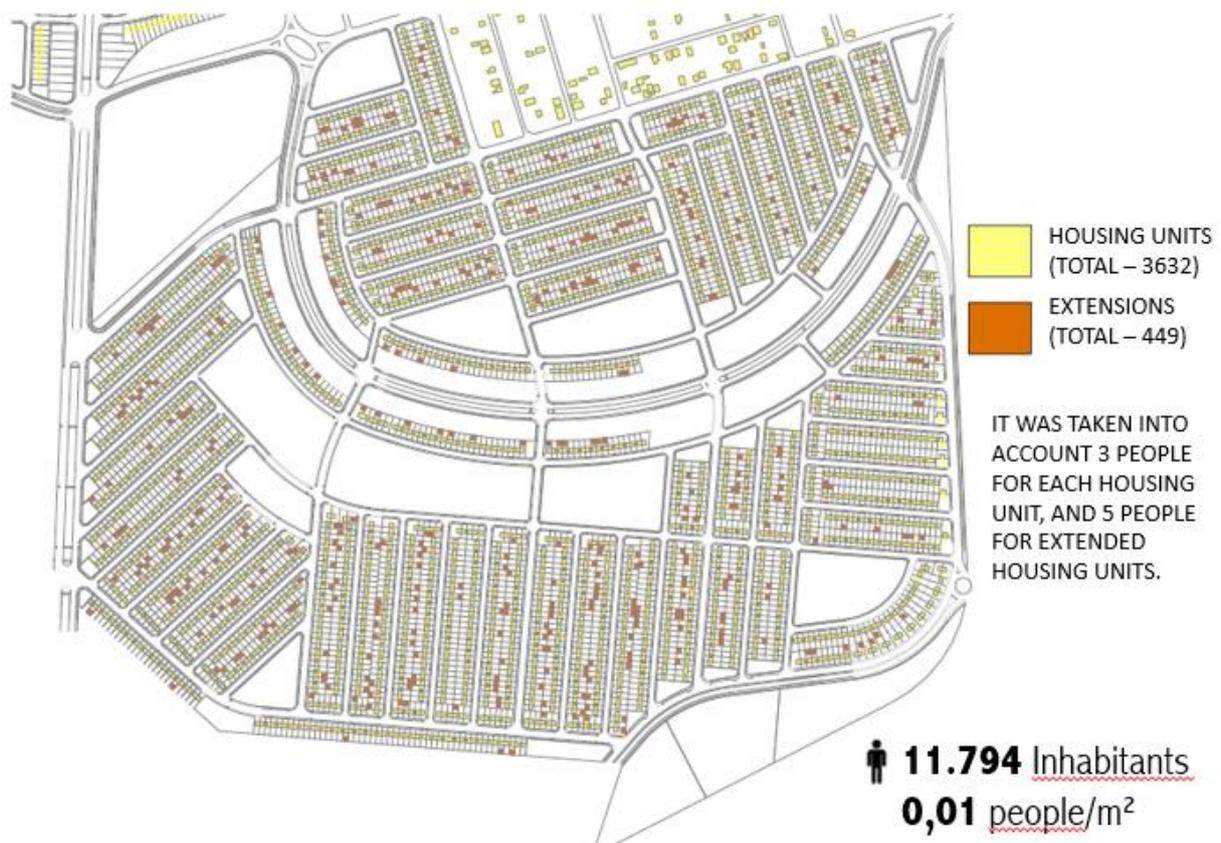
4.3.5. COMMERCE/BUSINESS

As previously mentioned, the residential blocks (from Shopping Park neighbourhood) are considered by law as strictly residential. Thus, although in disagreement with the law, there are in those courts, some commercial establishments, especially of goods and services of convenience. Initially, according to the original design, an avenue specially designed for commerce was set up.

Figure 236 - Commercial areas

Source: Authors, 2016.

However, note that after five years lots intended for trade are still unused while commercial establishments expand amid residential blocks.

These tertiary activities have a very particular dynamics and rely on flows to function. In this case, it was observed that the great planned avenue still can not provide larger flows, since it does not connect to other parts of the territory and does not even establish an exit route, as shown in the figure below. Thus the lack of interest in occupying these spaces with commercial properties is evident.

Figure 237 - Map of the road system in the Shopping Park neighbourhood

Source: Authors, 2016.

On the other hand, after the construction and distribution of houses, several reforms (Figure 21) were noted for the construction of an attached commercial space, although the residence in the same lot was still shared. This typology has spread throughout the residential area, while some planned commercial avenues are still partially empty. According to the questionnaire, 15% of respondents reported that they built some kind of commercial attachment in their home. This can relate to the percentage of residents (30%) who said they use their home to earn extra income. Although the house plan is not flexible and does not provide such spaces, the population can still adapt and try to improve the local quality of life. Moreover, even though the percentage of home-based businesses is not as significant, it clearly demonstrates local resilience, trying to overcome the limitations of the absence of commerce and services.

Figure 238 - : Sketch of adapted adaptations of on-site houses with addition of commercial annexes

ÁREA COMERCIAL

ÁREA RESIDENCIAL
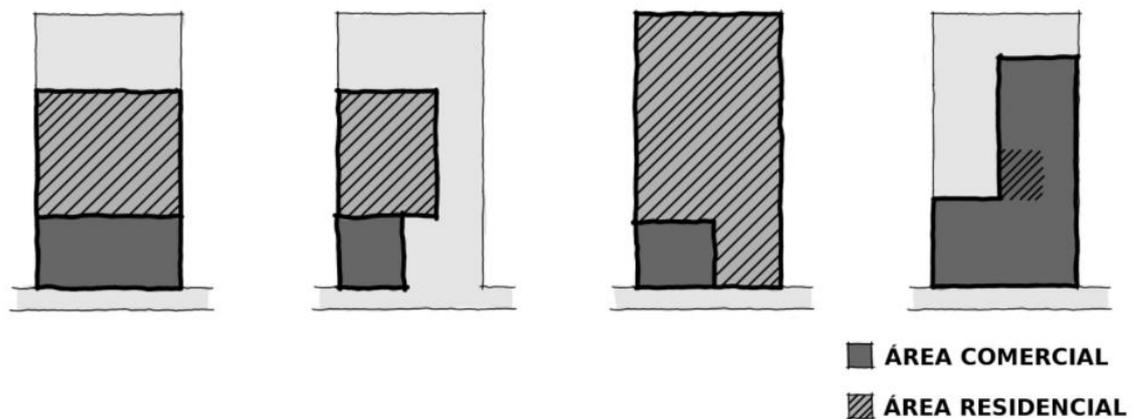
Source: Authors, 2016.

The impact of these commercial areas is often seen positively, as it was mentioned above. However, in the co-production sections, some residents complained of living very close to these small businesses, mentioning the noise as a nuisance. Despite the inconvenience, the residents still reported that there is a certain ease in relation to the proximity of the stores to their homes. However, a specific space is lacking for large-scale commercial equipment. Some examples were cited in the co-production as: gas station; Telephone service; Lottery and hypermarkets.

Figure 239 - Household and trades
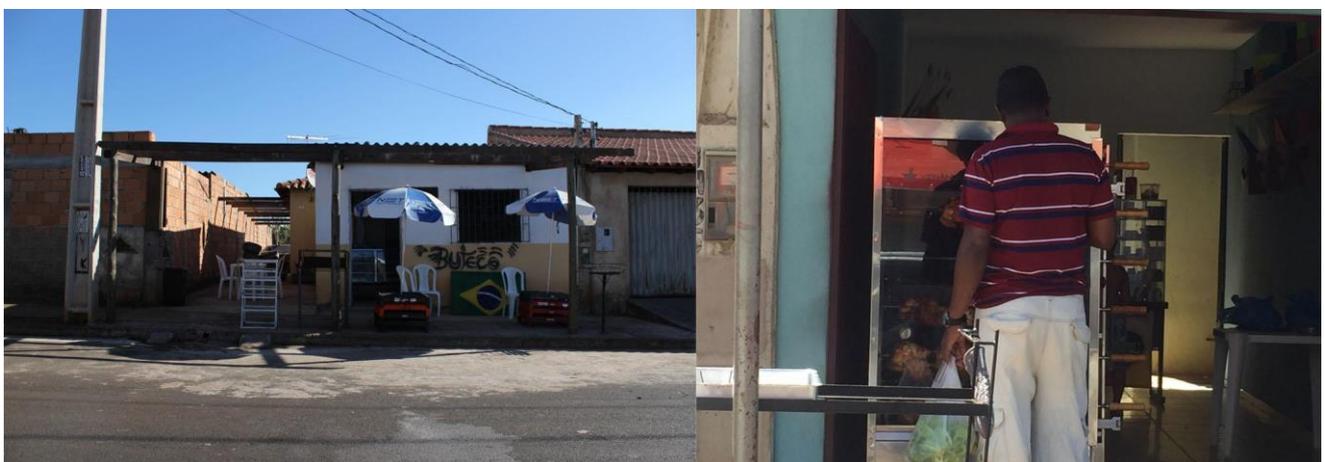
Source: Authors, 2016.

4.3.6. VIOLENCE / SECURITY

One of the main issues encountered during the collection of data about the neighbourhood was the lack of any type of police station in there. In addition, reports of drug trafficking are quite common, especially at the community centre, which creates a sense of insecurity for the population.

In contact with the main police station of Uberlândia, the indices of drug trafficking, homicides, and assault among others are relatively stable. There were no major changes compared to previous years, 2014 and 2015. Currently, the types of violent acts most present are theft in general, and verbal threats.

The chart below taken from the questionnaire result shows that 70% of respondents complained about safety and reported that they feel completely unsafe or insecure in their neighbourhood.

Graph 118 - Neighbourhood security

SAFETY

| (40) | 2.5 | 20.0 | 7.5 | 35.0 | 35.0 |

■ completely safe   ■ partially safe   ■ regular   ■ unsafe   ■ completely unsafe

Source: Authors, 2016.

On the other hand, with regard to the street security of the interviewees, 33.3% of the residents consider the street safe, but 41% do not agree. This fact divides opinions, but the result shows that the community interviewed feels safer on their own street than in the neighbourhood as a whole.

Graph 119 - Street safety

| street's safety | 33.3 | 25.6 | 23.1 | 17.9 |

■ great   ■ good   ■ regular   ■ bad   ■ very bad

Source: Authors, 2016.

In the co-production meetings, dissatisfaction with safety has been further reinforced. In addition to complaints regarding lack of policing and drug trafficking, they also cite that the fact that lots that do not yet have buildings and / or qualification for residents' use are also marginalised. This is because the place has no use, flow of people and lighting, which ends up generating, even more, insecurity in the community. In the same way, more activities were suggested at the community centre, so they can use more often and feel less insecure.

According to the PTTS Activity Report (PMU, 2014) and co-production meetings held, residents are constantly requesting reopening of the Police Station; The provision of mobile security for the neighbourhood; want the improvement in ostensive policing and specific work to combat violence and drug trafficking.

4.3.7. FOOD

In the Shopping Park, the only community vegetable garden in the region is the Estação Vida NGO, located in the old section of the neighbourhood. There is currently no other place to produce foods like fruits and vegetables. However, in visits to the houses during the application of the questionnaires, it was noticed that a large part of the inhabitants cultivates a certain type of plant. According to the interviewees, 52.5% produce some type of food at home.

In one of the dynamics of co-production, the residents suggested the construction of vertical gardens, capable of qualifying the free spaces and bring a condition of climatic comfort for the dwelling. That is, although there are no more food production sites, there is great community potential in planting and growing food in their own homes and even in free areas that have not yet been qualified for use.

Graph 120 - Food production

do you produce any food at your home?

(40)	52.5	47.5

■ yes   ■ no

Source: Authors, 2016.

An interesting fact related to the production and consumption of organic foods. Although more than half of the respondents reported producing some type of food at home, referring to fruits, vegetables and herbs, only 15.2% said they are consumers of organic foods. Thus, it can be concluded that the majority of the population of this study do not know the meaning of organic foods.

Graph 121 - Organic food consumption

do you consume organic food?

(40)	15.2	69.7	15.2

■ yes   ■ no   ■ sometimes
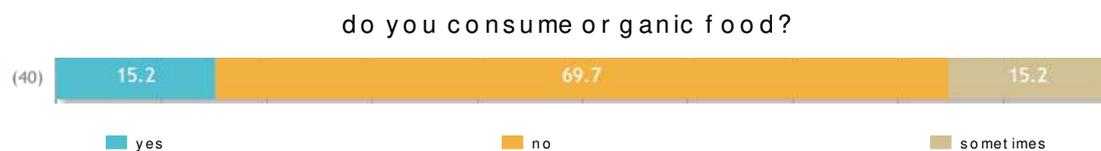
Source: Authors, 2016.

4.3.8. INCOME

The neighbourhood Shopping Park presents a profile of nuclear families of low schooling and income. According to the Inter-union Department of Statistics and Socioeconomic Studies (DIEESE) in December 2013, the minimum wage able to satisfy basic needs (according to the price of the basic basket) was R $ 2,765.44. Currently, according to the questionnaire, 72% of residents have their monthly income of around R $ 1,000-2,000 (238-400 pounds), while only 28% earn about R $ 2,001-10,000 (465-2,320 pounds) . That is, this shows that the monthly income of the majority of the population is still below the minimum wage according to DIEESE (2013).

Another factor to consider is the number of workers in each family. According to the questionnaire, most households have only one worker (53.8%), which means that this person is financially responsible for the whole family with a salary of around R $ 1,000 to 2,000 (238- 400 GBP) as mentioned. In addition, although the percentage of families without workers is lower than families with one or two workers, a significant percentage (12.8%) is still considered.

Graph 122 - Number of workers per family

WORKERS PER FAMILY

| (40) | 53.8 | 25.6 | 7.7 | 0. | 12.8 |

one two three four more than four nobody is working
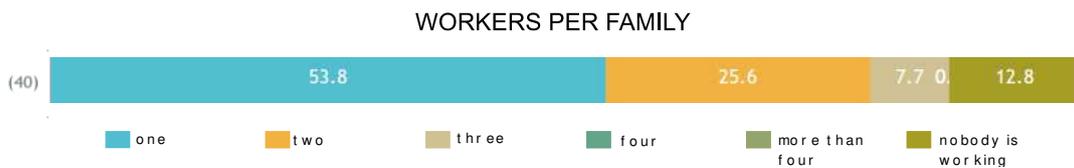
Source: Authors, 2016.

In order to further understand household incomes, the questionnaire was asked whether residents have any type of employee. 95% responded negatively. However, considering this 5% who assumed to hire any kind of helper, was asked to them the method of payment. Most responded that they paid monthly (66.7%), while only 33.3% said they paid monthly and / or daily. It is important to clarify that none of these employees stay overnight.

Access to information and communication is one of the "foundations of well-being," Social Progress Index (Stern et al., 2015). In the questionnaire were addressed in three points: cable TV, computer or e-tablet and cell phone. It was concluded that almost half of them (42.5%) (Graph 123) have cable television and a little more than half (52.5%) (Graph 124) have a computer or e-tablet.

Graph 123 - Cable television

CABLE TV

| (40) | 42.5 | 57.5 |
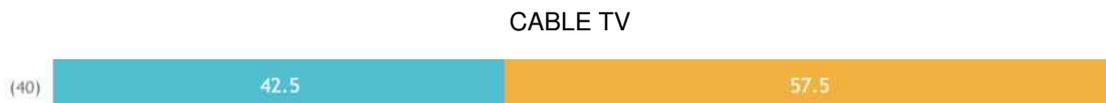
Source: Authors, 2016.

Graph 124 - Computer or e-tablet

COMPUTER OR TABLET

| (40) | 52.5 | 47.5 |

yes no
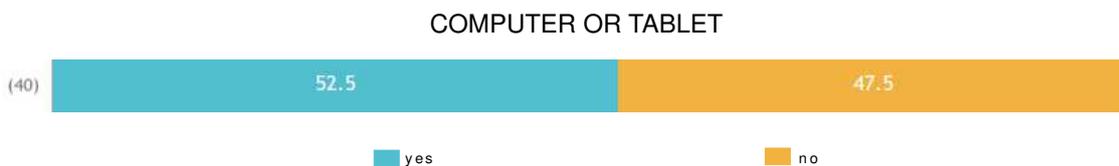
Source: Authors, 2016.

(Note: for those who answered yes, 72.7% have only one e-tablet or computer, the others have more than one.)

In addition, 97.5% of those interviewed have a cell phone. 70% of them claim that they have one or two cell phones, while 30% have more than three. Another relevant information is that most of the residents (92.5%) (Graph 125) use the cell to talk, followed by the use of the Internet (75%) and, finally, (65%) text messages.

Graph 125 - Types of uses of smartphones

SMARTPHONE'S USE

internet	75.0
texting	65.0
talk	92.5

Source: Authors, 2016.

Regarding Internet use, most of the time is used to mainly access Facebook and WhatsApp, as shown below.

Graph 126 - Internet use

INTERNET USE (ON SMARTPHONES)

social media (other)	7.5
music	25.0
movie	12.5
news	32.5
whatsapp	77.5
facebook	70.0
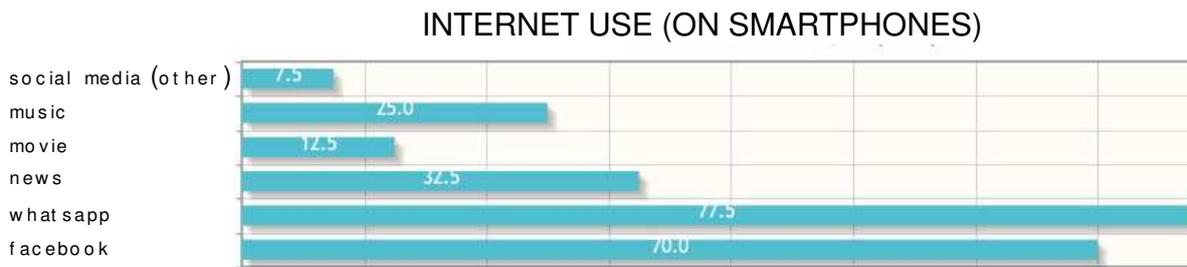
Source: Authors, 2016.

4.3.9. FLOWS

The neighbourhood presents different types of flows and interactions. In the map below, it is possible to identify the different types of flows that exist within the locality, and how the population tends to concentrate in the vicinity of public facilities such as schools, the community centre and the street that has the most consolidated commerce (as shown The figures below). This gives insight into how people move and the directions they use so that future actions research actions can take these dynamics into account.

Figure 240 - Neighbourhood Flow Mapping
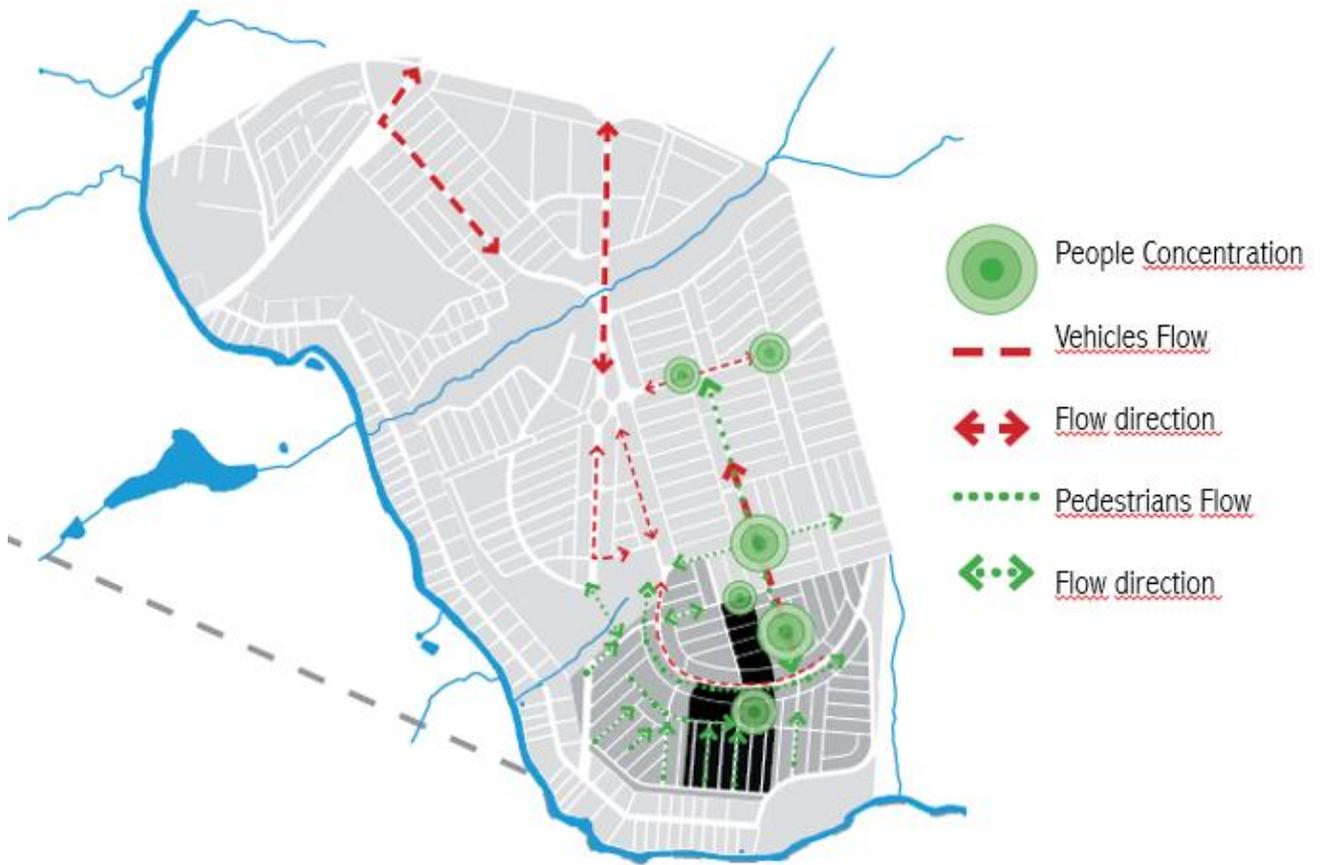
Source: Authors, 2016.

Figure 241 - Neighbourhood facilities

SHOPPING PARK NEIGHBOURHOOD

STUDY AREA

INTERVENTION AREA

PRIMARY HEALTH CARE UNIT

POLICE STATION - DEACTIVATED

NGO (ESTAÇÃO VIDA)

CHURCHES THAT WORK WITH SOCIAL ACTIVITIES IN THE NEIGHBORHOOD

FREE SPACES FOR LEISURE AND RECREATION

PUBLIC NURSERIES / PUBLIC SCHOOLS OF EARLY CHILDHOOD EDUCATION

KINDERGARTENS / PRIVATE DAY CARE

PUBLIC SCHOOLS OF PRIMARY AND SECONDARY EDUCATION AND / OR TECHNICAL

Source: Authors, 2016.

4.3.10. INFORMAL ARRANGEMENT

There are illegal occupations around the banks of the river, in the preservation area, located 50m from the watercourse. The occupations began around 2012 and by 2015 it covered about 200 families claiming to be there on their own, unconnected with any political or social organisation. One of the major issues, aside from the illegal situation they are in, is that their sewage is thrown directly into the river, which severely affects people's water and health resources.

Currently, the number of irregular occupations is lower. The remnants are in better condition, they no longer resemble the shacks at the beginning of the invasion. Today they come to be confused with the other houses on the lots.

These occupations reflect on the need for the MCMV Program to focus on families within the income range 1 (0 to 3 minimum wages), instead of focusing mainly on the class of 3 to 10 minimum wages, since reality is showing that they are the part that needs more attention.

Figure 242 - Invasions Map of Neighbourhood Shopping Park
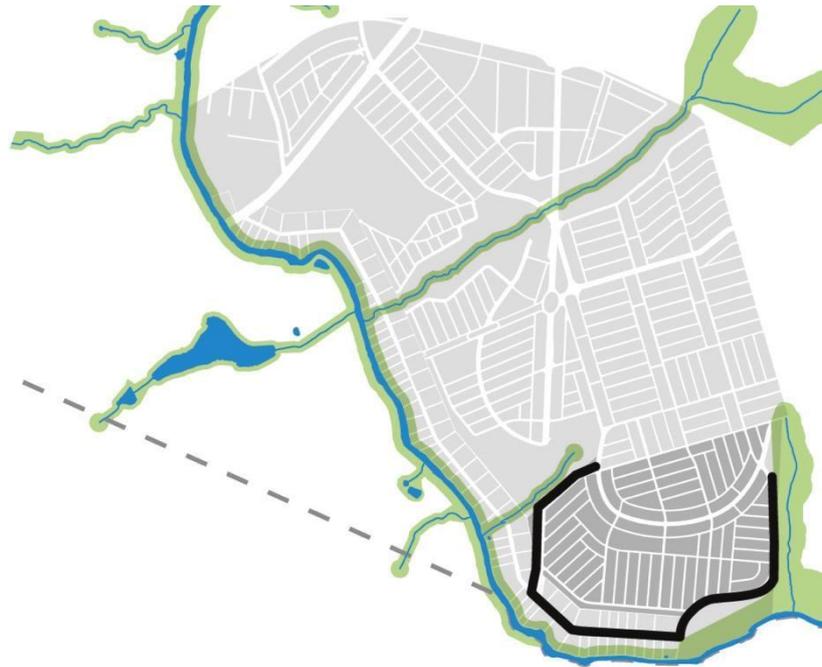
Invasions
ZPL - Preservation and Recreation Zone

0   200   500m

Source: TFG_Juliana Arantes, edited by author, 2016.

Figure 243 – Photomontage: Beginning of invasions (left); current invasions (right)

Source: Authors, 2016.

4.3.11, PARTIAL CONSIDERATIONS

The following frame summarizes the main determinants of resilience regarding the physical-urban order, in terms of weaknesses and potentialities observed in the study area of the Shopping Park neighbourhood.

Frame 32 – Conditioning Factors of Resilience: physical- urbanistic order

Resilience Factors: physical-urban order		
Aspects	Weaknesses	Potentials
Land-use	- Although these land subdivisions are according to the municipal legislation on land subdivision, the areas for these uses (green areas, leisure areas, and so on) are still poorly consolidated, only land demarcations without qualification, projects or adjustments for the use of the population.	- Some commercial, institutional and service places are currently distributed as part of the residence, an annexed space, on a smaller scale. This demonstrates how the residents of the region continue to adapt their residences to condition more opportunities and varieties of services and shops for the neighbourhood.
Social facilities (leisure, sport, culture, safety, security)	- Insufficiency - in the region there is only one Community facility (CEU) to meet the demand of 2,634 families - Residents consider that the CEU (community centre) is not as useful as it should be; there are faults in its operation, infrastructure and activities offered. - Insecurity is reflected in how residents use the community centre. Many people do not attend to the centre mainly due to drug trafficking, which usually happen in there. - 65.8% consider the amount of social facilities is insufficient. 78.4% are dissatisfied with the quality of health facilities, and 48.6% with education. - Large accumulation of garbage and litter, especially in areas that are not yet eligible for public use. - Green areas without qualification for use are considered vulnerable points, which cause insecurity in the residents.	- Despite the negatives aspects, the community centre (CEU) is one of the locals' favourite places. - Due to its location and activities offered, community centre (CEU) presents potential that can bring people together in order to develop a better neighbourhood. - Community centre (CEU) is considered as the main leisure facility at the neighbourhood - Despite the problems of green areas and permanent protection areas (close to water courses), some residents still like to use the space for activities such as fishing, barbecue, and so on. - The relevance and the several proposals suggested in the co-production (e.g. linear park) for the improvement of the area around the river shows that, despite the negative points, some residents recognize the importance of the permanent protection areas (close to water courses).
Infrastructure (water, sewer, rainwater, electricity, paving, street lighting, waste, cleaning services, internet, telecommunications)	- Irregular walkways, broken and maintenance-free. 71.7% of the interviewed population showed dissatisfaction about the condition of the sidewalks, and 54% of the sidewalks analysed present some problem. - The financial limitation prevents the residents invest their few resources to repair the pavement	- The sidewalk is the main point of contact between close neighbours, although it is not appropriate and confortable, they equip with chairs and meet to talk and watch the children play at their doors. The wide streets and the little flow of cars stimulate the permanence of these children establishing the permanence and conviviality of the

	and when they do, lack technical knowledge to build the accesses, harming other residents on the sidewalk. (Steps and steep ramps on sidewalks causing obstruction of passage). - Accumulation of building tailings obstructing passage on sidewalks (Dumpsters are not adequate, their openings contribute to spreading plastic bags and household waste when placed before collection.) - 71% of the population consider that accessibility for people with restrictions is bad to terrible. Although there is a ramp at all corners, the state of the sidewalks prevent you from following the path and requires the residents to use the street as a pathway, then the street is shared between pedestrians, cyclists and vehicles. - Rainfall collection is insufficient and intensified by topography. - The streets have poorly traffic signs. Traffic signs are limited to signs and stop paint and there is no other than horizontal signage. - Lack of medium and large size trees on the street - Some residents reported that the houses were delivered with a small tree seedling and they cut it to prevent them from damaging the sidewalks, unpleasant neighbours staying in their doors to enjoy the shade, or even to avoid dirt. Thus, there is a lack environmental awareness and technical knowledge about vegetation, so they only see the negative points. - Lack of maintenance and cleanliness on sidewalks and streets, 65% say they see neighbours throwing trash on the street/vacancy land, but only 5% assume they do - Lack of public lighting - creates insecurity - 65% consider that there is neglect with maintenance and cleaning of the neighbourhood. Lack of Selective Waste Collection and recycling centre in neighbourhood	residents.
Transport	- Number of bus lines and	

	frequency of public transport is insufficient (65% classify public transport as medium to totally unsatisfactory). - Lack of cycle paths, which is not friendly cycling. - Although the blocks have an acceptable perimeter for the movement of pedestrians, the way of implantation of the subdivision has very long and steep streets, which is not friendly walking for pedestrians.	
Density		- The low density (0.01 person / m²) promotes the adaptability and flexibility of the residences.
Commerce/business (income generation)	- Houses adapted for the trade can generate problems of coexistence with neighbours	- Adapted homes for commerce are convenience to the neighbourhood. - Considerable percentage for the number of "informal" trades. According to the questionnaire, 15% of respondents reported that they built some kind of commercial attachment in their home. This may relate to the percentage of residents (30%) who said they use their home to earn extra income.
Violence	- 70% of respondents complained about safety and reported that they feel completely unsafe or insecure in their neighbourhood. - Sites that do not yet have buildings and / or qualification for use by residents are also marginalized. This is because the place has no use, flow of people and lighting, which ends up generating even more insecurity in the community.	- 33.3% of the residents consider the street safe, but 41% do not agree. This fact divides opinions, but the result shows that the community interviewed feels safer on their own street than in the neighbourhood as a whole.
Food (agrocity)	- They do not explore the whole site that they have. They could cultivate more plants in their places and also in the vacancy lots.	- The only community garden in the region is the NGO Estação Vida - Most of the residents cultivate some kind of plant. According to the interviewees, 52.5% produce some kind of food at home.
Income	- The Shopping Park neighbourhood presents a profile of nuclear families with low schooling and income. - Most households have only one worker (53.8%), which means that this person is financially responsible for the whole family with a salary of around $ 1,000 to 2,000 (238-400 GBP).	- 30% said they use their own home to earn extra income.
Flows (people, cars)	- Little flow during weekdays.	- Greater flow in the surroundings

		of the equipment and commerce of larger scale. - Increased flow of people on the streets during the weekend.
Informal arrangement	- There are illegal occupations in the areas of permanent preservation, located 50m from the water spout, dumping sewage directly into the river - contaminating both soil and water resources	

Source: Authors, 2017.

4.5. DIAGNOSTICS MAPS

According to France, Ornstein and Ono (2011), the Diagnostic Map has the objective of systematically presenting the main aspects identified in a building/neighboUrhood and the information classification according to the priority levels, in light of the relevant technical standards, making possible the use of Diagnosis of POEs in the design process. In addition, this systematisation facilitates the organisation of information in a database for standardised buildings. This systematic presentation, through diagnostic maps, can be a contribution to make the incorporation of the APO into the design process more practical and objective.

The Diagnostic Maps presented below were elaborated from the cross-cutting of the main results of the three applied tools (questionnaire, walkthrough and co-production) in the evaluation in the "Shopping Park" case study. They were divided into two scales: HOUSING UNIT (aspects related to private dwellings) and URBAN (aspects related to urban insertion in the collective / public sphere). The results were presented according to three aspects of analysis: PHYSICAL, SOCIAL and ENVIRONMENTAL. For each item of analysis were indicated, when existent, their respective parameters.

Figure 244 – Diagnostic Map – Urban Scale – General Aspectas

DIAGNOSTIC MAP - URBAN SCALE - GENERAL ASPECTS

ADAPTED HOUSES FOR TRADE

ABSENCE AND / OR LACK OF CONTINUITY OF BICYCLE LANES

PROBLEMS WITH NEIGHBORHOOD MAINTENANCE AND CLEANLINESS

- Adapted homes for commerce is convenience to the neighborhood

- Houses adapted for the trade can generate problems of coexistence with neighbors

- Lack of Selective Waste Collection

- Lack of recycling center in neighborhood

- 65% consider that there is neglect with maintenance and cleaning of the neighborhood.

- 48.5% spend more than 30 minutes travelling from home to work

- Low density (Gross density 100 hab/ha and Net density 296 hab/ha) helps the residences' adaptability and flexibility

- Lack of continuity in cycle paths, which does not facilitate cycling

- Number of routes and frequency of public transport is insufficient

- 65% rate the public transport from regular to totally unsatisfactory

- 60% use public transport as the main way of transportation. The reasons are, first mainly because they do not have another way of transport (65%), second consider buses with more affordable cost (37.5%), and last because public transport cause less damage to the environmentonly (2.5%)

- Although the blocks have the perimeter acceptable for pedestrian circulation, its implantation has a very long subdivision and steep streets, which do not favor walking.[1]

BENCHMARKS
1- Institute of Transport and Development Policy and LAB CIDADE / Methodology USP. 2014.

PHYSICAL   SOCIAL   ENVIRONMENTAL

⬢ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION
◆ DATA COLLECTION   □ RESEARCHER'S PERCEPTION

WEAKNESS   POTENTIALS

Source: Authors, 2016.

Figure 245– Diagnostic Map – Urban Scale – Streets and Sidewalks

2/4

DIAGNOSTIC MAP - URBAN SCALE - STREETS AND SIDEWALKS

SIDEWALKS IN BAIRRO SHOPPING PARK - PROBLEMS WITH QUALITY AND MAINTENANCE

STREETS AND SIDEWALKS WITH NO PROPER SLOPE

DISCONTINUOUS CYCLE PATHS

▣ The sidewalk is the main point of interaction between nearest neighbors. Although there is no public furniture, the community adapts the sidewalk by inserting chairs and usually meet to talk and watch their children play at their doors.

◆ There are informal arrangement in the areas of permanent preservation, located 50m from the watercourse, sewage pouring directly into the river - contaminating both the soil and water resources.

■ Lack of medium and large-sized trees when there is no public lighting.

● Some residents recognize the need for medium and large-sized trees on the sidewalks, and say that if there were more trees the neighborhood would be more pleasant and beautiful.

● ■ Some residents reported that the houses were delivered with a seedling plant. However, they cut them off to prevent from damaging and avoiding dirty in the sidewalks. Also, the absence of trees would keep unwanted neighbors out of their doors to enjoy the shade. Thus, there is a lack of environmental awareness and technical knowledge about vegetation. In other words, residents only see the negatives.

■ Accumulation of construction waste blocking the circulation [2]

■ ● Accumulation of garbage and plastic bags on the streets and sidewalks

◆ 65% reported seeing neighbors throw trash on the street, but only 5% assume they do

▣ Dumpsters are not adequate, their openings contribute to spreading plastic bags and household waste when placed before collection times.

▣ Narrow sidewalks; despite the sidewalks being within the standard, it does not support large trees.

● The streets are poorly signposted. Traffic signs are limited to signs and stopcocks and there is no other horizontal signage. [4]

■ The pavement of the sports center has great conservation status and is very accessible and signposted.[3]

▣ Insufficient rainwater capture and enhanced by topography.

● Very steep and long street, which makes it difficult for locals to walk

■ ● Uneven, broken and maintenance-free sidewalks. 71.7% of the interviewed population showed dissatisfaction about the condition of the sidewalks, and 54% of the sidewalks analyzed present some problem.

■ ● The financial limitation prevents the residents from investing their few resources to repair the pavement, and when they do, there is a lack of technical knowledge to construct the accesses, harming other residents when they cross the sidewalk. (Steps and steep ramps on sidewalks causing circulation obstruction)

● ● 71% of the population consider that accessibility for people with restrictions is from bad to terrible. Although there ramp on every corner, the state of the sidewalks prevent from following the path and requires the residents to use the street as walking, so the street becomes shared between pedestrian, cyclists and vehicles.

BENCHMARKS
2- Posture Code - Law nº 10.741 of April 6, 2011: deliberates on the state of conservation of the built or not.
3- NBR 9050-CRIT. Referring to Fig.
4- Brazilian Transit Code

PHYSICAL SOCIAL
ENVIRONMENTAL

⬢ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION
◆ DATA COLLECTION   □ RESEARCHER'S PERCEPTION

🔴 WEAKNESS   🟢 POTENTIALS

Figure 246– Diagnostic Map – Urban Scale – Social Facilities

DIAGNOSTIC MAP - URBAN SCALE - SOCIAL FACILITIES

3/4

N

Legend:

- RESIDENCE
- INSTITUTIONS
- COMMERCIAL AREAS
- SERVICES
- LEISURE
- UNCONSOLIDATED COMMERCIAL AREA
- UNCONSOLIDATED INSTITUTIONAL AREA
- UNCONSOLIDATED RECREATIONAL AREA
- INTERVENTION AREA

- PRIMARY HEALTH CARE UNIT
- POLICE STATION - DEACTIVATED
- NGO (ESTAÇÃO VIDA)
- CHURCHES THAT WORK WITH SOCIAL ACTIVITIES IN THE NEIGHBORHOOD
- FREE SPACES FOR LEISURE AND RECREATION
- PUBLIC NURSERIES / PUBLIC SCHOOLS OF EARLY CHILDHOOD EDUCATION
- KINDERGARTENS / PRIVATE DAY CARE
- PUBLIC SCHOOLS OF PRIMARY AND SECONDARY EDUCATION AND / OR TECHNICAL

● Residents consider that the community center (CEU) is not as beneficial as it should be, with faults in its operation, infrastructure and activities offered

● Despite the negatives aspects, the community centre (CEU) is one of the locals' favorite places

● Due to its location and activities, the community centre (CEU) presents potential that can connects the community in order to develop a better neighborhood

● The community centre (CEU) is consider as the main reference of leisure equipment

⬡ 70% of residents feel insecure in their neighborhoods

● Insecurity is reflected in how residents use the community center. Many people do not attend to the centre mainly due to drug trafficking, which usually happen there.

⬡ 74.3% consider cleaning and conservation from regular to very poor

■ The existing leisure and culture facilities are considered acceptable according to ITDP.[1]

⬡ 65.8% consider the amount of social facilities are insufficient

⬡ 78.4% are dissatisfied with the quality of health facilities, and 48.6% with education

◆ Failure - the area has only one community centre (CEU) to meet the demand of 2,634 households

PHYSICAL SOCIAL ENVIRONMENTAL

⬢ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION
◆ DATA COLLECTION   ☐ RESEARCHER'S PERCEPTION

WEAKNESS   POTENTIALS

Source: Authors, 2016.

Figure 247– Diagnostic Map – Urban Scale – Green Areas and Recreation

DIAGNOSTIC MAP - URBAN SCALE - GREEN AREAS AND RECREATION

FACILITIES THAT THE RESIDENTS MOST FEEL MISSING, AND ALSO PLACES OF ACCUMULATION OF WASTE; INFORMAL ARRANGEMENT.

LEGEND:

- Basic Health Unit
- Public Hospital
- Traffic Signaling
- Public Daycare
- Public High School
- Recreation Center
- Linear Park
- Echologic Park
- Ecopoint
- Supermarket
- Lottery
- Gas Station
- Police Station
- Bus Shelter
- Places of accumulation of waste and informal arrangement.

● Green vacant areas are vulnerable points that cause insecurity to residents

● Despite the problems, some residents still like to use the river space for activities such as fishing, among others.

● The interest and the various suggested proposals (eg linear park) for the improvement of the area around the river shows that, despite the negative points, some residents recognize the importance of the area of permanent preservation areas.

● Over 51.3% are dissatisfied with the quality of green areas and recreational spaces

● 65% of residents see neighbors throwing trash in vacant areas, but only 25% assume they throw garbage in vacant areas.

● Large accumulation of debris and litter, especially in areas that are not yet eligible for community use.

◆ There are illegal occupations in the areas of permanent preservation, located 50m from the water spout, dumping sewage directly into the river - contaminating both soil and water resources

● Lack of lighting - leads insecurity

PHYSICAL / SOCIAL / ENVIRONMENTAL

⬡ QUESTIONNAIRE ■ WALKTHROUGH ● COPRODUCTION
◆ DATA COLLECTION ☐ RESEARCHER'S PERCEPTION

● WEAKNESS ● POTENTIALS

Source: Authors, 2016.

4.4 PHYSICAL-ARCHITECTONIC ORDER ANALYSIS

4.4.1. DESIGN (SITUATION, FORMAT, DIMENSIONS)

The study area covers the allotments Jacarandas I and II Park, Residencial Xingu, Tapajos, Sucesso Brasil, Vitoria Brasil, Villa Real and Villa Nueva, constituting the Shopping Park neighbourhood. These subdivisions comply with the guidelines established for Special Zones of Social Interest (ZEIS), with 200m² of area sized in 8 meters width by 25 meters length. Conceived with the intention to offer "decent housing" to the population, the housing complex today presents a scenario of constructive, social and environmental problems.

According to Mascaró (2010), low ground declivities, between 2% and 8% are ideal for urbanisation because they allow drainage systems to operate in good conditions. Declivities between 15% and 30% are potentially unstable; however, it is suitable to use, as long as observed some care, such as working terraces and levels in as narrow cuts as possible, following the contour line; To situate buildings in the cutting region, and not at the area filled with soil, avoiding to amplify the weight supported by the slope; Ensure adequate waterproofing of plateaus so that water does not cross its subsoil turning it prone to landslides.

Located in an area with a 12% declivity, the lots at Shopping Park are positioned perpendicularly to the direction of land trimming and the lack of adequate containment waterproofing and soil drainage solutions, combined with the total mitigation of the native vegetation cover, make the houses structurally vulnerable to the effects of landslides. Another consequence of this situation is the existence of significant differences between private lands and between them and the street causing, among other things, the need for ramps built by the residents. These ramps occupy inadequate areas and affect accessibility at the analysed housing complex.

Regarding the housing unit, it is given that the Minha Casa Minha Vida Program (PMCMV) establishes a minimum area of 32 m² for a single-storey house with 2 bedrooms, with no service area and a minimum area of 36 m² for adapted units. By means of Walkthrough analysis, it was verified that both have an internal useful area of 33.42 m², highlighting the first inconsistency between recommendation and execution in the adapted houses.

The semi-detached houses have the dimensions of 5.84 m width by 6.39 m length for each unit, and they are separated by walls shared between the bedrooms of the houses with 14.5 cm of thickness. These walls do not transcend the ceiling in height, worsen the acoustic discomfort and the lack of privacy as the main problems reported by residents, while 82% of respondents consider the semi-detach as the main negative aspect of the house.

As presented in topic 2.8 of Data Collection, the Minha Casa Minha Vida Program has strict rules for partitioning and dimensioning of rooms (according to the needs of the traditional nuclear family), limited by the minimum dimensions necessary for the organization of specific, often incompatible with those previously possessed by residents or simply not found at popular shops. Then, it is observed that the spaces are often not sufficient to fit necessary furniture, impairing storage.

Figure 248 - Closed conformation and conflicting flows. Figure 249 - Lavatory as circulation room.
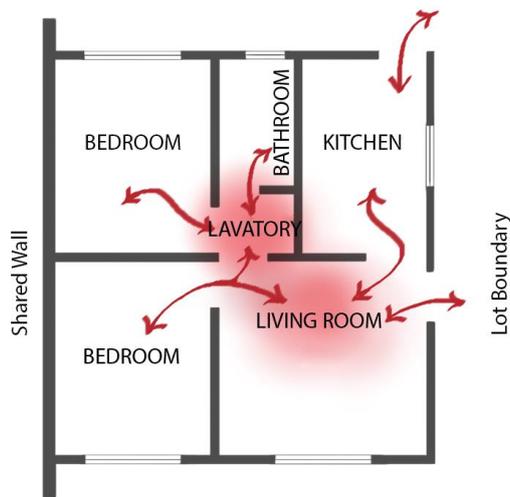
Source: Authors, 2016.   Source: Authors, 2016.

The house is divided in living room, kitchen, 2 bedrooms and a bathroom in a closed conformation and built in the technique of self-supporting bricks, being hazardous to carry out refurbishments by the residents, who are often unaware of the terms of the Owner's Manual and do not have specialised technical assistance. Figures 248 and 249 illustrate the organisation of the rooms in the house, whose disposition sacrifices the privacy of the lavatory as well as the arrangement of furniture in the living room, becoming these on circulation rooms. It is also possible to observe that the possibilities of enlargement from the original core are restricted to the front and back of the lot, and can easily compromise the functionality and salubrity of the house, by obstructing openings for ventilation and insulation. Regarding that, it is given that 42.5% of the surveyed people are dissatisfied with the division of the rooms of the house.

Nevertheless, 80% of the residents surveyed reported having made some kind of modification and / or improvement, using their own resources and aware of the possibility of losing the property warranty. The lack of planning for expansion lead to obstructing openings for ventilation and lighting, interfering with the comfort and salubrity of the building. Since the original design does not provide an area to handle the clothes and to carry out domestic maintenance, this is main subjected area of reforms and extensions towards the external area of the unit.

Despite the limitations and difficulties faced, the residents' efforts to improve their welfare, motivated by the achievement of the "dream of own home", are admirable. However, interventions in the homes without adequate technical assistance often generate losses in the medium and long term, similar to the benefits. As an example, there is the generation of residues resulting from the conduction of unassisted reforms, which occupy the fronts of their own lots or vacant lands clandestinely, clogging storm drain inlets, attracting venomous animals and making the neighbourhood aesthetically unpleasant. In addition, the unhealthy condition generated by the obstruction of openings to the exterior of the unit impairs the residents' welfare and health. After all, the high cost involved in reforms overloads the income of families that were originally socially and economically vulnerable, highlighting the importance of discussing and reviewing housing projects of social interest.

4.4.2. CONSTRUCTION SYSTEMS AND MATERIALS

Overall, 71.8% of the residents surveyed agree that the buildings on the block are of a fair or poor quality, or very poor. Several factors testify against the quality of materials and finishes in the housing units granted, with 47.5% of those interviewed carrying out reforms to solve technical problems. The first and most obvious inadequacy refers to the sidewalks of the housing complex. Initially composed of a 90 cm width

main passage lined by 30 cm width green strips, after 7 years of finished, the poor quality of the material caused its accelerated deterioration, impairing the path (Figure 250).

Figure 250 - Deterioration of sidewalks.

Figure 251 - Reforms and creation of ramps.

Source: Authors, 2016.
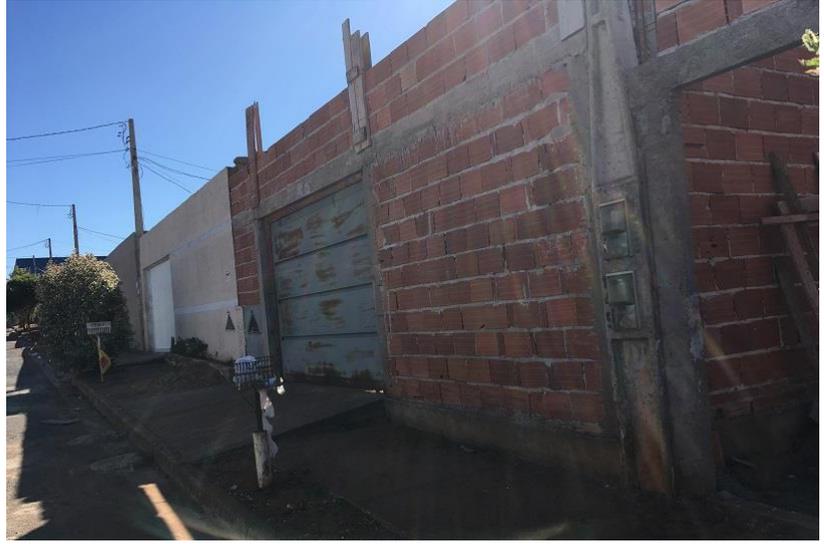
Source: Authors, 2016.

Some dwellers have re-constructed their sidewalks, however, and as mentioned, the creation of ramps to overcome the gap between the street and the home sometimes occupies partially or totally the circulation area, defining a not accessible path (Figures 252, 253 and 254). It is assumed that the poor quality and deterioration encourages the maintenance of degradation by residents, who aggravate the situation by practising improper deposition of residues and / or building materials on sidewalks (Figure 254). Thus, it is common for people with reduced mobility to compete for space with vehicles in the street, favouring accidents. By means of the interview, it has been observed that more than 70% are in fact dissatisfied with the quality and accessibility of the sidewalks (Graph 127).

Figure 252 - Level gap between the house and the street.

Figure 253 - Not accessible path.

Source: Authors, 2016.

Source: Authors, 2016.

Figure 254 - Photomontage: Deposition of residues.

Source: Authors, 2016.

Graph 127 - Aspects evaluated about sidewalks.
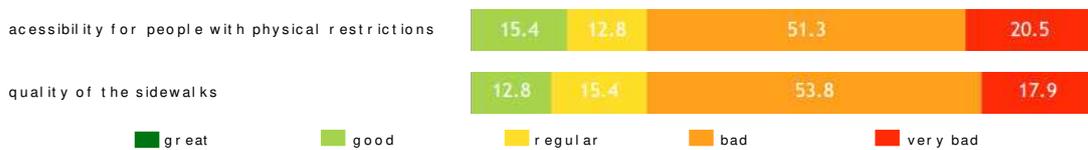
Source: Authors, 2016.

Regarding the housing unit, whose constructive technique is load-bearing masonry, the main pathologies identified by means of Walkthrough analysis were superficial cracks and capillary water infiltrations in the external walls. According to NBR 15575, water tightness of the building to water is of major importance to avoid wear of materials and components (leaching, corrosion, etc.), as well as the proliferation of fungi, respiratory diseases, among other problems. In the units visited, there are recurrent leaks through cracked tiles, aggravating the effects of infiltration on the walls, causing mould and dilations and contractions not foreseen in the project, favouring the advent of these superficial cracks in the walls. According to the residents, the main cause of leaks on the roof was the installation of the water heating system in a niche inadequately sealed in the roof, favouring the detachment and displacement of the tiles and damaging the waterproofing of the roof (Figures 255, 256 and 257).

Figure 255 - Installation of water heating system.

Figure 256 - Superficial cracks.

Figure 257 - Superficial cracks near the door hinge.

Source: Authors, 2016.

Source: Authors, 2016.

Source: Authors, 2016.

Regarding the overall appearance of the unit, 76.3% consider it acceptable or beautiful. However, expressive 75% consider the quality of construction and finishing materials poor or regular. Such dissatisfaction may originate from the concession of houses with ceramic coating only in wet areas (bathroom and kitchen), which ones, according to reports, demanded purchase and fitting on the initiative of the residents, without later reimbursement. In addition, counter-flooring was given with inadequate inclination also generated spending to be corrected and may have prevented proper settlement of ceramic coatings there. In Walkthrough analysis, the low performance of the ceramic coating placed in the wet areas was observed, presenting porosity, darkening and detachment in two houses visited (Figures 258 and 259).

Figure 258 - Water infiltration.

Figure 259 - Porosity and darkening of ceramic coating.

Source: Authors, 2016.

Source: Authors, 2016.

After all, it is evident the importance of proposing well-resolved and detailed projects with a superior quality of execution, considering all the factors involved and interdependent constructive systems, determining their longevity and guaranteeing the welfare of people. It is important to consider that the realisation of reforms without technical knowledge and / or instruction may cause collective damages since the incorrect

interference in a constructive system can compromise the functionality of others in an unforeseen way. Since more than 50% of the residents interviewed reported that the house is a material investment and a place with which they identify themselves, while 91.4% use it as a place of leisure and shelter, proposing more appropriate and well-designed project solutions, as well as readaptations for existing projects, are essential factors to ensure the success of the program and to promote its continuity.

4.4.3. MAINTENANCE

The PMCMV Owner's Guide establishes recommendations for cleaning and organising the home in order to maintain its functionality and beauty "for a long time". That is a series of tips on how to maintain: the doors and windows; the walls, floors and ceilings; the bathroom, kitchen and service area; the electricity; as well as tips for coexistence, resource saving and security. Some non-recommended behaves are mentioned repeatedly, such as renovations and extensions without the Public Administration approval and ART / RRT issuance by specialised professionals, or the use of buckets with water or conventional cleaning products to clean the floor, under risk of infiltrations and leaks. These recommendations draw special attention for distancing themselves from the reality observed in the neighbourhood Shopping Park, as the construction of small constructions in the back of the lot without approval and washing of the internal environments common practices among the residents.

Figure 260 - Areas where there are residues dposition (brown).

CALÇADA

LEITO CARROÇÁVEL
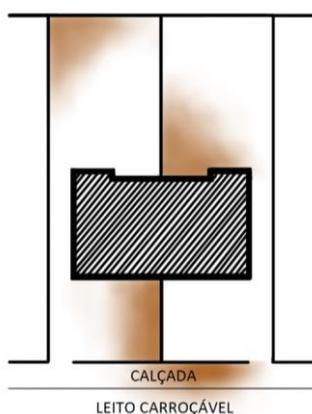
Source: Authors, 2016.

Figure 261 - Residues placed behind a house.

Source: Authors, 2016.

Figure 262 - Wall between private lots in risk of tipping

Source: Authors, 2016.

Most respondents (65%) say it is easy to keep their homes clean, mainly because of their small size. However, in Walkthrough analysis, it is noticed that most of the houses visited do not meet the guidelines of the Code of Posture of Uberlandia (Law nº 10.741 of April 6, 2011 - Chapter IV), which states that any land, whether or not built, must be kept in a perfect state of cleanliness and conservation, avoiding the deposition of litter and residues of any nature. Self-construction is a feature inherent in the habitational complex, so it is often observed that there are inadequately stored construction materials on the front and sides of the private lots, as well as on the sidewalks and backs, as shown in Figure 261. Beyond causing sanitation problems, the presence of soil, sand and other materials combined with the constant ventilation characteristic of this neighbourhood brings dirty to the interior of the residences, demanding more intense cleaning than the recommended wet fabric can provide.

The Code of Postures presents the responsibility of the landowner for its enclosure and maintenance, while NBR 15575-6 states that building systems must not show any ruptures, instabilities or falls that could endanger the physical integrity of the occupants or passers-by in the vicinity of the property. Concerning this subject, there were some worrying cases during the Walkthrough analysis, and in one of the houses visited the wall that borders the adjacent private land demonstrates risk of tipping that could endanger the safety of residents in both residences, as illustrated in Figure 262.

From the point of view of the maintenance and cleaning of the neighbourhood is remarkable the residents' dissatisfaction. 65% believe that the region where they are inserted is abandoned or totally abandoned, which is justified by the high amount of waste present in various places of the urban system (squares, empty lots, streets, sidewalks, flowerbeds, etc.) surpassing the municipal litter collection system capacity (Figures 263 and 264). The habit of disposing of residues without adequate conditioning damages the aesthetics of the neighbourhood and the health of the residents in several aspects. Institutional green areas with no occupancy plan become open dumps, adding to the absence of vegetation on the streets, to the dust and heat characteristic of Uberlandia, the bioclimatic aridity characterises the place. It is observed that 67.5% of the inhabitants feel the lack of garden areas, however, most of them prefer not to invest in their cultivation due to the difficulty of maintenance and / or lack of knowledge for planting and / or financial resources, among others reasons, which does not make the scenario portrayed more optimistic.

Figure 263 - Waste deposition at the Square.

Source: Authors, 2016.

Figure 264 - Waste deposition in empty lot.

Source: Authors, 2014.

4.4.4. SERVICES

Unfortunately, the low-income and unhealthy conditions in which these families live are not compensated for by the public infrastructure and facilities present in the neighbourhood.

The NBR 15575 establishes that, for buildings or housing developments with defined implantation site, the projects must be developed based on the geomorphologic characteristics of the place, being properly evaluated the risks of landslides, floods, erosions and others. PMCMV houses are located in a region with significant declivity. The problem lies in the implantation of the houses perpendicular to the contour lines, what increases the speed of water flow, which can lead to erosion and sanding-up the Uberabinha River.

The Uberlandia Code of Civil Works establishes that it is mandatory to link social housing to urban water and sewage networks, but does not deliberate about the obligation to provide rainwater collection systems. Given this, the non-execution of a rainwater collection system allows the construction companies to save invested money, causing losses to the municipal sewage network, which receives the amount of rainwater from the entire housing complex and must pay for the maintenance of overloaded sewage infrastructures. Added to this is the insufficiency of culverts in the streets, overloading the sewer system and causing backflows during the rainy season, which can compromise the functionality of the infrastructure as well as, ultimately, the structural stability of housing units and security of users.

Also in relation to this subject, it is given that the majority of the houses visited in analysis Walkthrough present return of gases in the inspection boxes or in the bathroom, pointing out the existence of design or execution failures of the sewage infrastructure. The backflow of gases through sanitary appliances can denote the absence or obstruction of a safety part called Ventilation Branch, which allows the dissipation of the gases from the decomposition of sanitary sewers. Such pathology demands urgent attention since these gases are extremely flammable and favour the occurrence of fires inside the building, for example, by means of the spark from a simple lighting of lamps.

As mentioned, the location of the allotment put some houses in a difficult situation in relation to the topography, especially in lower levels, where the proposed project resulted in a great gradient of level differences that led to the need for important earthmoving services. The situation is aggravated by the fact that some units were executed and given without the installation of containment walls, exposing them to the risk of landslides and consequent structural collapse.

Public lighting is provided in an agreement between the energy company (CEMIG) and City Hall and barely covers the streets and common areas, being one of the main complaints of the residents. In relation to the use of solutions that minimise the consumption of electricity, all houses in the housing complex have a solar heating system, for heating the shower water, which contributes significantly to reduce energy expenditure.

The main measures for energy saving reported are: turn off the lights after use (77.5%); use energy-saving lamps (37.5%); and disconnect equipment out of use (35%). Only 15% of the respondents reported paying attention to the purchase of energy saving equipment, and most of the electrical equipment observed in the homes does not have *Procel* Energy Efficiency Label, which optimises performance and energy consumption. This may be due to the fact that these are the most expensive and inaccessible equipment for the residents interviewed, even though they are the ones that provide the lowest energy consumption and consequently lower spend energy consumption, offsetting the initial investment.

Regarding consumption and measures for water saving, it is observed that: 50% reported brushing their teeth with the water tap closed; 47.5% reuse water from the washing machine to wash the house; 37.5% soapy dishes with closed tap; 35% take short baths (between 5 and 10 minutes); 27.5% use the washing machine a few times a week and at its maximum capacity; and only 10% have equipment and / or water-saving devices.

Most of the residents (87.5%) reported seeking to save energy and water in order to reduce the bills at the end of the month. However, many are dissatisfied with the high cost of accounts, with 61.3% saying that the cost-benefit ratio in relation to the consumption of water, energy and transports is unsatisfactory or regular. The average monthly electricity consumption measured in Walkthrough is between 60 and 170 kWh without accounting the expressive consumption usually generated by an electric shower, since the house has a solar heating system for water. It is assumed by the researchers that the inexistence of water heating costs encourages spending on other equipment, raising energy consumption and justifying the perception on the referred "high bills".

4.4.5. INTERNAL LAYOUT

According to the Code of Civil Works of Uberlandia, social housing is considered to be those whose total area of the building does not exceed 70 m², constructed according to standard projects elaborated by the Municipal, State and Federal Public Authorities. PMCMV housing units usually follow the same pattern of urban layout and insertion. They are semi-detached houses (or not) set in lots of 200 m² with 32 m² of constructed area each, containing a living room, kitchen, bathroom, 2 bedrooms and external service area. It is known that the first interventions by the beneficiaries of housing programs after occupation are, in order of priority: the construction of walls, roofing for the external areas and ediculas to expand useful areas or accommodate new rooms and eventually small businesses for subsistence and supplementation of family income. The positive aspect of this modality of the program (horizontal projects) is that the size of the terrain allows a significant use of its constructive potential through expansions carried out by the residents.

Such modifications reflect the user's desire to take ownership of the environment by making it more suitable to their needs, often dispensing professional technical assistance, either because of lack of knowledge or low purchasing power. The prediction of projects of social interest housing capable of being modified and evolving over time is an old demand whose implementation would exponentially increase the degree of user satisfaction as well as the safety and comfort of the community.

However, as explained above, the rooms of the house are thought to be based on the accommodation of a certain layout, with certain specifications of furniture that do not necessarily reflect the reality and conditions of acquisition of the residents, resulting in the conformation of enclosed spaces, tight and not flexible . That is, it is a problem of incompatibility between the nuclear family profile considered at the time of the project proposal and the variability of family profiles benefited by social programs, justifying their general dissatisfaction with the small size of the house. The enclosed conformation of the house offered is even more problematic when combined with the self-supporting wall construction system used, causing serious structural risks when removing or modifying elements without specialised technical assistance.

Referring to the previous topic (Walkthrough Analysis of the Housing Unit – Proposed Division), according to Pereira (2015), there are 9 human needs that must be considered when compartmentalizing a house: (1) to enter / move; (2) to interact with family and visitors; (3) individual work / recreation; (4) preparing meals; (5) serving meals; (6) sleep / rest / study; (7) personal hygiene; (8) treating clothing; and (9) perform household maintenance. Some activities, such as individual work / recreation (3), clothing (8) and home maintenance (9), were simply ignored in the proposed project and are the main reason for extensions. These extensions complement the demand for living spaces and services, as well as other activities considered incompatible, when in the external area the dwellers interact with themselves and visit, work / recreate individually, prepare meals and serve meals, (PEREIRA, 2015) uses that mutually overlap, featuring a problematic distribution of activities in the house (Figure 265).

Figure 265 - Uses overlapping in each room.
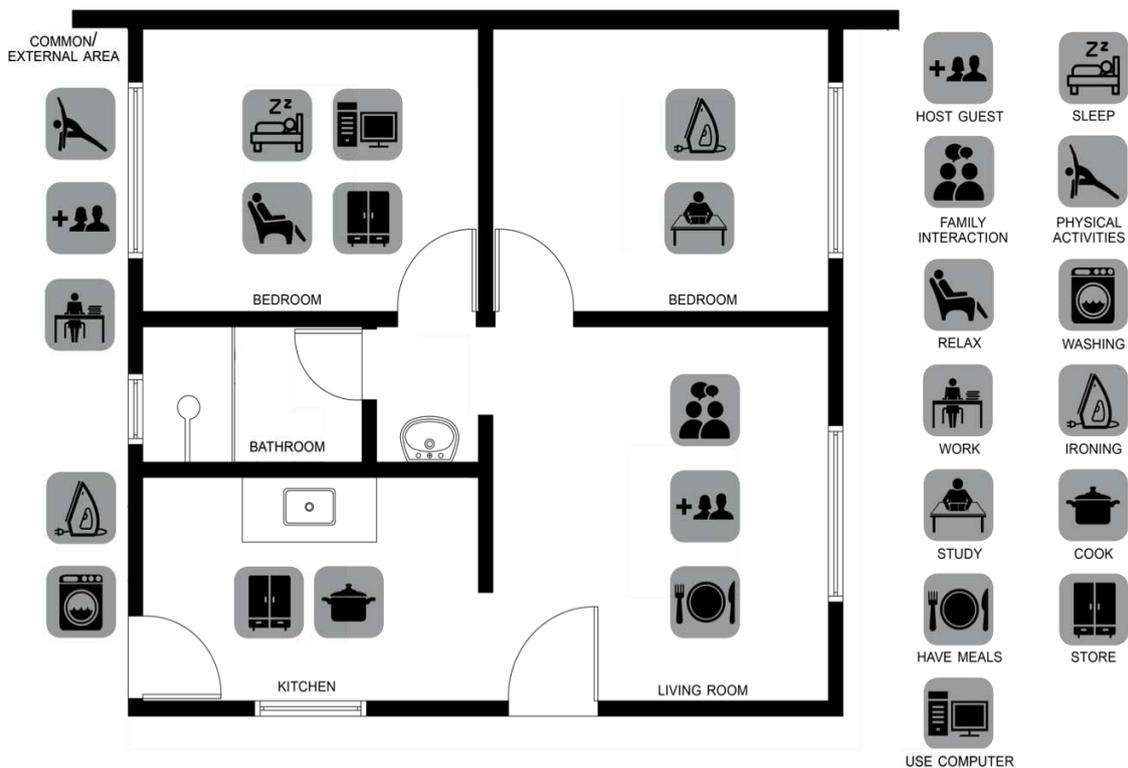
Source: Authors, 2016.

Due to the small size and rigid conformation of the rooms of the house, combined to the multiplicity of overlapping uses that characterise this type of minimum housing, the areas of all the rooms are considered insufficient or regular for the good performance of the activities. The housing project ignores the variability of contemporary family profiles and their evolution over time, making mistakes by taking as assumption certain ways of inhabiting and organising the residential space. The configuration of the housing unit analysed is aimed to the typical nuclear family profile, composed of father and mother and children in a scenario in which more than half of the interviewees do not correspond to this reality.

Graph 128 - Family profiles

| (40) | 45.0 | 22.5 | 10.0 | 2.5 | 10.0 | 7.5 | 02.5 |

- nuclear family
- single parent family
- one person
- dinc (couple with no children)
- extended nuclear family (parents + children + relatives)
- extended single parent family (one of the parents + children + relatives)
- elderly couple
- cohabitation

Source: Authors, 2016.

Graph 129 - Rooms' division evaluation.

- very well divided
- well divided
- medium
- badly divided
- very badly divided

| rooms' division | 40.0 | 17.5 | 32.5 | 10.0 |

Source: Authors, 2016.

Natturally, 60% of the surveyed consider the division of rooms at home poorly resolved or medium, while 75% consider it to be small, with kitchen, bedrooms and bathroom / lavatory being the most problematic rooms in this regard. On the other hand, when asked about furniture, 56.4% of the respondents believe they have sufficient pieces, while 53% reported that their previous furniture fitted satisfactorily in the current residence. However, when asked about the ease of furnishing the rooms, dissatisfaction predominates, especially in the kitchen, bedrooms and bathrooms, due to their small size (Graph 130).

Although many of the surveyed believe that it is difficult to furnish the house, the majority affirms to perform the storage function satisfactorily in the bedrooms and kitchen (90% and 87.5% of respondents, respectively), which are, along with the bathroom, the most critics of the house in the matter of storage. In these rooms, of restricted use to the residents, cabinets, shelves, sideboards and shelves occupy the space in width and height. Thus, although it is difficult to furnish the room, the inhabitant does so, compromising or even sacrificing circulation, lighting, ventilation and, consequently, hygiene, as shown in Figures 266, 267 and 268.

Regarding the use, the main problem verified in the houses concerns the difficulty for storage, notably in the kitchen, bedrooms and bathroom. In general analysis, more than 45% of respondents reported having difficulty storing objects at home. Another action whose performance calls attention, as a result of the frequency with which it occurs, is the realisation of meals. 92.5% of the interviewees eat meals at home every day, of which 30% report performing this activity unsatisfactorily. Since the kitchen has extremely small dimensions and the room is configured as a circulation space, making it difficult to dispose of adequate furniture (see graph 130), the residents have been obliged to eat on the sofa or standing in inadequate ergonomic conditions.

Graph 130 - Rooms' size evaluation.

kitchen	30.8	2.6	38.5	28.2
laundry	46.2	7.7	23.1	23.1
bedroom	2.6	25.6	10.3	46.2	15.4
bathroom	25.6	12.8	46.2	15.4
living room	5.1	46.2	2.6	30.8	15.4

Source: Authors, 2016.

Figure 266 - Difficult access to the stove.	Figure 267 - Difficult access to the stove.	Figure 268 - Overhead cabinet affect 2.

Source: Authors, 2016.	Source: Authors, 2016.	Source: Authors, 2016.

4.4.6. ADAPTATION AND REFURBISHMENT

From the foregoing, it is visible that the Resilience of the environment and the human being seem to coexist with cracked walls, dirty and bumpy streets and financial limitation. Thousands of people inhabit this space and seek to make it better and more coherent to their needs, despite the precariousness they experience, feeling remarkably happy as owners and effective managers of the home. Although there are several problems experienced, most of the residents (67.5%) report identifying themselves with their residence and another 77.5% feel they are now well adapted to it.

In order to understand how the residents adapted to their residence, the number of people who changed their house was identified, and 92.3% reported having altered the original project. It is fact that all the rooms in the house were modified, with interventions on the external area and laundry, followed by interventions in the kitchen, living room, bathroom and, finally, bedrooms, as shown in Figure 269. The recurrence of renovations at the external area and laundry is justified by the simple fact that these rooms were not foreseen in the project, forcing the residents to bear the costs of its construction. After all, observing the general ranking, the laundry is the room whose size today most satisfies the interviewees, with 47.5% of respondents satisfied, precisely because it is a room totally customised by the user, proportionally to the extent of their financial limitations.

Confirming the predominant dissatisfaction with the dimensions of the rooms in the house, it is given that the main motivation to carry out reforms in the house was its reduced size, with 80% of the interviewed widening rooms. Solving technical problems and enhancing privacy and comfort were other frequently reported motivations for reform. As a result, the main reforms were the construction of external / internal walls (77.5%), the construction of roofs in the external area (67.5%) and the addition or removal of walls to accommodate expansions (57.5%), as Graph 131 shows. Since 70% of the interviewees reported feeling

insecure about their neighbourhood, it is given that the construction of external walls is the first measure for adaptation adopted by the residents, in order to overcome a situation of disturbance experienced.

Figure 269 - Modifications in each room.

Source: Authors, 2016.

Graph 131 - Reasons for reforming.
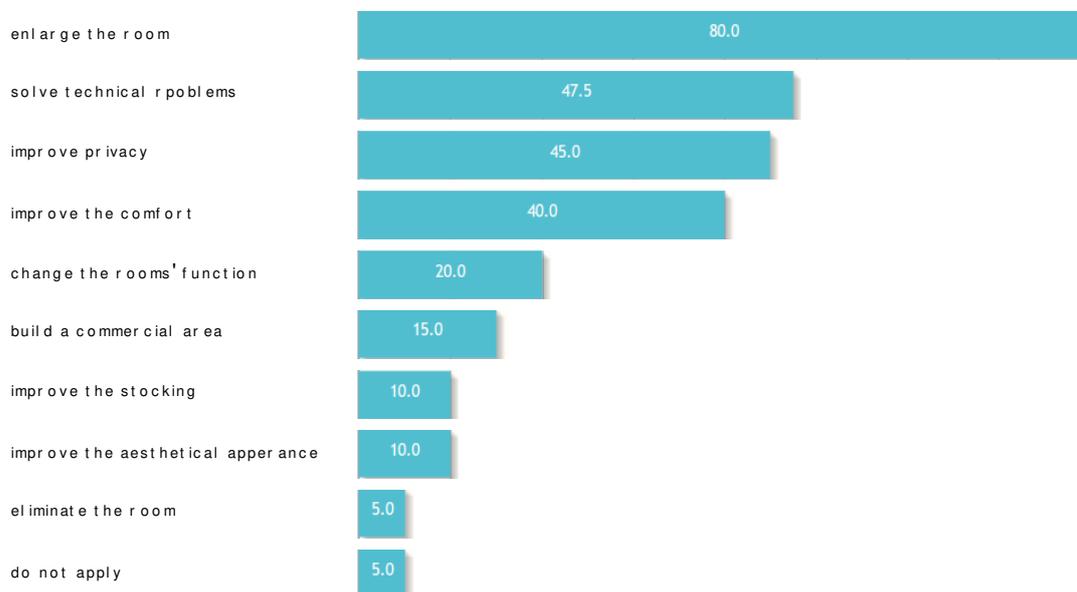
Source: Authors, 2016.

Analysing the previous household's condition and family composition of the interviewees, there is an increase in the number of people living alone (from 2.5% to 10%) as well as couples without children, from 5% to 10% of the total. Many residents reported having divorced after purchasing their own property, while some couples are starting life there, justifying the change observed. Another family modality that gained prominence was the extended nuclear family, which went from 5% to 10% of the total, being composed of couples, children and other relatives of the family.

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Such family compositions influence the way the residents modify and adapt to the original house, with the construction of ediculas in the back of the house or adaptations of the initial layout to accommodate more people, be they family members or third parties. Figure 270, 271, 272 and 273 illustrate both situations, observed during Walkthrough analysis, and in the first case the owner intends to rent the built-in housing for the daughter and son-in-law, while in the latter, the owner houses daughters and grandchildren, which sleep together in the same room (in two bunks and with dressers arranged around). In this interim, it is interesting to remember that the second room with which the residents feel most dissatisfied with their size is the bedroom (more than 62% of the total), preceded only by the kitchen (70%). In addition, significant 61.3% of the interviewees showed dissatisfaction with the ease of furnishing the bedrooms and the bathroom, and the kitchen is once again the object of predominant dissatisfaction, with 66.7% of the total. Such information indicates the importance of providing solutions for sleeping and cooking environments that are more appropriate in terms of size and ease of furnishing, in order to reduce users' discomfort. Despite this, it is interesting to note that the bedroom is the room with the fewest interventions rate, once only 25% have reformed it, which indicates that, although problematic, the priority for reforms are the other rooms.

Figure 270 - Expansion and adaptation of the residence.
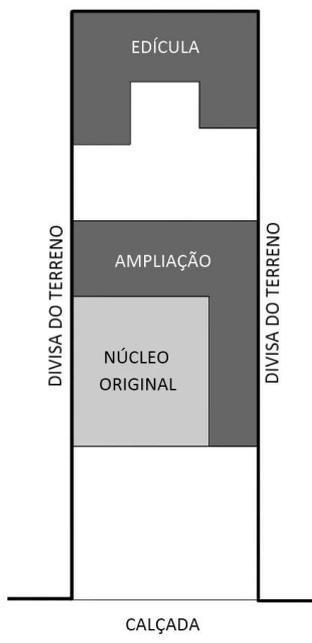
Figure 271 - Example of adaptation: edicula built behind the original core.

Source: Authors, 2016.

Source: Authors, 2016.

Figure 272 - Shared bedroom.
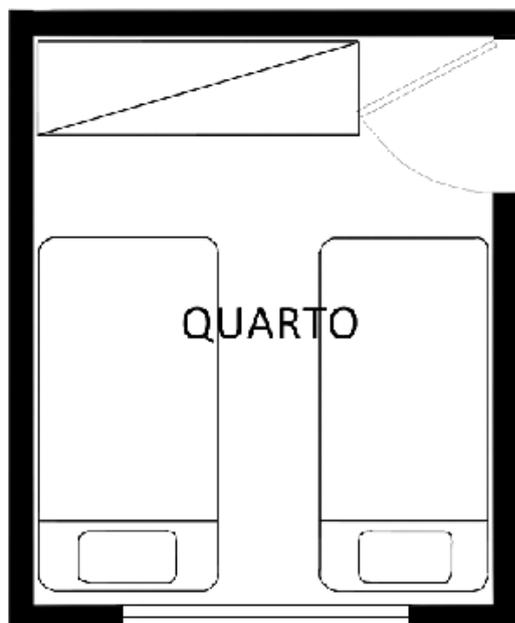
Source: Authors, 2016.

Figure 273 - Shared bedroom.

Source: Authors, 2016.

Reforms in the original design of the houses occur gradually and to the extent that there is availability of income and manpower on the part of the residents. One interesting information that emerged during the Co-production experiences was the fact that often remodelled houses have their own mason the dweller, reducing costs and optimising resources, which is not the reality of all. Going beyond the isolated question of hiring labour, it is a consensus that the high cost involved often makes it impossible to carry out reforms compatible with the needs of the residents, frequently being used materials of inferior performance and low durability. In addition, scarcity of resources determines a sequence of priorities in the adaptation process, which can last for long years and still fail to achieve an adequate and / or satisfactory outcome. After all, the loss of the warranty of the property is the smaller of the problems resulting from the realisation of reforms without sufficient resources and specialised assistance. The malpractice and recklessness of many residents when they intervene in the original project, including those involved in the construction, cause risks to the integrity of the building and the security of the people, increasing the situation of vulnerability they a priori already are inserted in, in a constant waste of environmental, financial and human resources.

Figure 274 - Dweller refurbishing her own house.

Source: Authors, 2014.

The fast growth characteristic of Uberlandia draws more and more the attention of the private initiative for execution of urban social initiatives. Even in the period of financial crisis experienced, real estate production remains an economic and social lever for millions of Brazilians. Accelerated urbanisation brings with it urban problems such as housing deficit, inefficiency of the transport system, school dropout, increased crime, poor income distribution, inadequate disposal of waste and depredation of the environment (atmosphere, water, soils, fauna and flora). The natural, hydrological and geological resources that permeate the city are transformed and often suppressed according to political and economic interests, giving rise to urban infrastructure and parcelable areas, whose work in them gives it exchange value (VITAL, 2012).

From the point of view of housing of social interest, which comes in response to the issue of housing deficit, it is true that the adaptive capacity and resilience of the human being makes it able to overcome any difficulties and limitations imposed, in this case, by the provision of standardized models , with low constructive quality and inconsistent housing. However, as seen, this is a frequently misguided adaptation movement that does not guarantee quality of life for its population or the preservation and recovery of threatened intellectual and natural resources. On the contrary, it generates burden of family income, disorders with constant reforms, besides the waste and inadequate disposal of residues in areas destined for preservation, resulting from self-construction without adequate technical guidance.

It is important to know deeply the dynamics of adaptation of these houses and to propose revision and creation of mechanisms for Resilience, in order to meet the socioeconomic and environmental demands that are imposed simultaneously. The variability of the measures adopted to adapt the residence proves the divergence between the parameters of the PMCMV and the reality experienced by the Brazilian population, especially that benefited by social programs, generating a series of problems not foreseen by the residents who have just reached the dream of home ownership. The consequences compromise the functionality and quality of the urban system as a whole, setting against the program and sweeping the hopes of the less favoured people. There is a need for a review of paradigms in Architecture and Urbanism, in favour of cities that are better resolved, more Resilient and effectively Sustainable, whose central point should be the identification and knowledge of the real characteristics and needs of the final user of the building.

4.4.7. ADAPTATION FOR COMMERCE

As seen previously, the proximity of the neighbourhood to Uberlandia Shopping Mall makes it possible to meet some eventual commercial needs. At a distance of less than half an hour, by public or individual transport mean, the population has access to department stores, movie theaters, stationery shops, restaurants, pharmacies, hypermarkets, etc. However, the high value of public transport today and the fact that it is a shopping mall with a high concentration of stores destined to the public with high purchasing power diminish the potential of this establishment in effectively meeting the needs of this population.

Although the housing program restricts the creation of commercial areas in lots to small-scale activities such as the manufacture of handicrafts or small confections, 15% of the respondents reported having some type of commercial establishment or service in their home. In spite of the fact that the urban zoning plan has territorial bands destined to the commercial activity, occurring in certain routes of differentiated hierarchy, the high cost of the lands located there and its distance from the peripheral residences areas do not favour the consolidation of the intended use and occupation.

With this in mind and for a lower initial cost, many residents have adapted their homes to perform commercial and service activities, turning them into a source of income and subsistence. However, the vast majority of these adapted homes are subject to precarious situations and contrary to the current legislation. Despite this, the public administration does not inhibit these practices, which often represent for families survival and also significant convenience for the neighbourhood.

Figure 275 - House adapted to commerce.
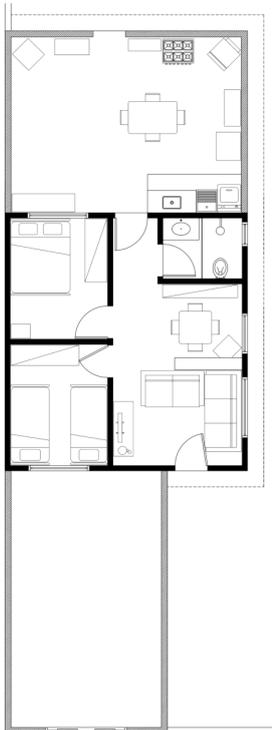
Figure 276 - House adapted to commerce.
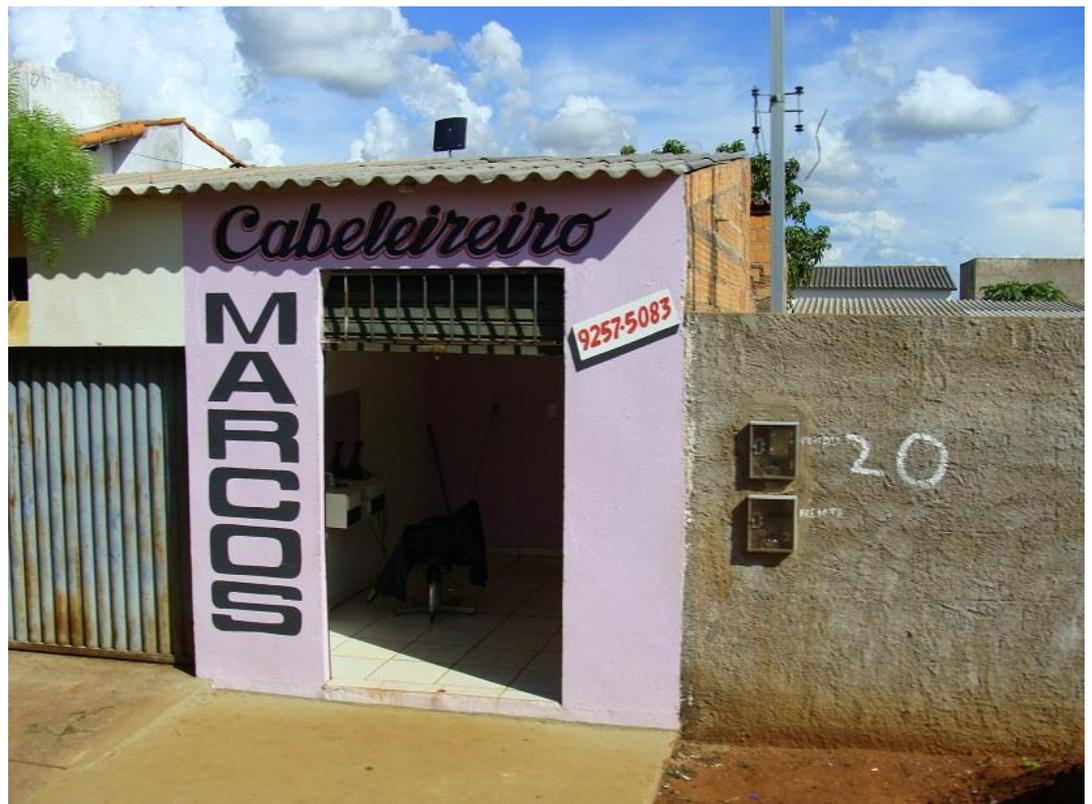
Source: Authors, 2016.

The main activities observed in the study area, which modified the space of the housing units were bakeries, grocery stores, beauty salons, bicycles and rubber shops. In addition, there is an expressive amount of interviewees who claim to use the residence to acquire extra income (30%), which does not necessarily

imply the construction of additional rooms or significant spatial modifications. The main activities observed in this regard refer to the production of food to order.

The main complication resulting from the creation of extra rooms, whether for commerce or housing, refers to the interference in the conditions of environmental comfort and salubrity throughout the building. In one of the units evaluated in Walkthrough, the construction of a front room to house as a beauty salon obstructs the ventilation and natural light of one of the rooms . In the same house, the covered external area occupies the rear portion of the ground, isolating the openings in that region. The occupation of the lateral and frontal distance bands added to the paving of practically the whole terrain constitute an irregular situation with the urban restrictions for ZEIS, as shown below.

A number of dual functionality solutions were found for commercial or service housing units in the Shopping Park neighbourhood, ranging from well-resolved with a high standard of finish to those of difficult compatibility, as shown in Figure 277. Although this is a measure of adaptation and resilience of the community as a whole, the situation of such trade can cause a series of problems such as the aforementioned loss of sanitation in the building and the wear and tear of the neighbourhood relations due to the production of odours and noises incompatible with the location. It is, therefore, a fragile situation of informality, counterbalanced by the convenience of these initiatives for the community, which constantly bets on the uncertain as a way of sustaining.

Figure 277 - Patterns of disposal of commercial or service rooms.

ÁREA COMERCIAL

ÁREA RESIDENCIAL
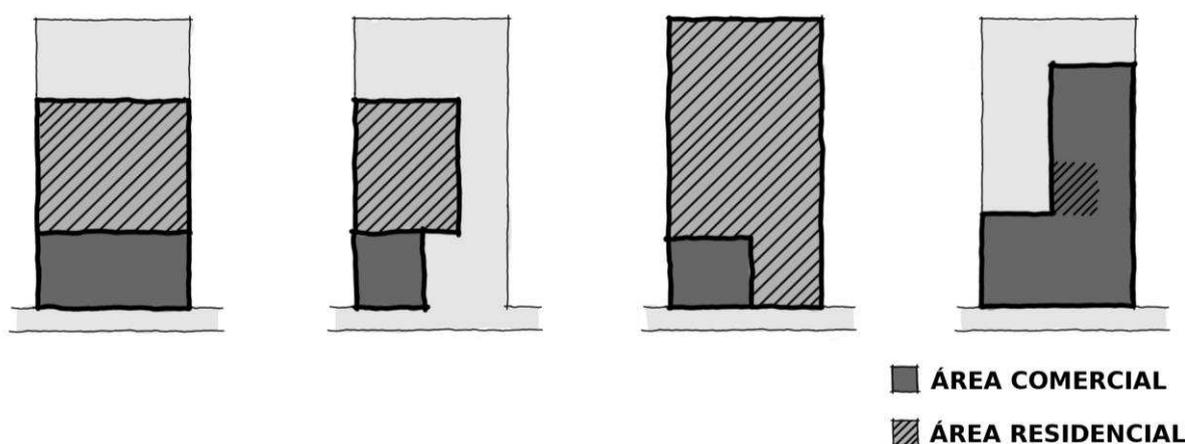
Source: Authors, 2016.

4.4.8. COMFORT (NOISE, TEMPERATURE, HUMIDITY, LIGHT)

The main problem reported by dwellers in terms of environmental comfort, with more than 48.7% of respondents reporting dissatisfaction or partial satisfaction, is the lack of sound insulation between the semi-detached units. With 11.5 cm external walls and a 14.5 cm shared walls, some residents reported being able to talk to their neighbours through the wall between the bedrooms, sharing even unwanted noises. In fact, in two of the semi-detached units evaluated in Performance Analysis, the noises shared between bedrooms (where semi-detachment occurs) are clearly audible. The gap between tiles and lining in these houses is shared according to the original design delivered, which amplifies the sound propagation between the houses, as shown in Figure 278. In another set of houses where the semi-detached wall was erected up to the roof acoustic performance was reasonably better, and the shared noises remained audible but hardly intelligible. In quantitative analysis, it was verified that only the house whose semi-detached wall reaches the roof achieves the minimum performance level established by Standard 15575-1, presenting a noise level difference of 46 dB between rooms.

In homes that carry out commercial activities or animal breeding, the problem takes on catastrophic proportions, jeopardising the privacy and quality of coexistence between neighbours. This finding highlights the disregarding of the recommendation of the Building Code, which establishes that roofs and external walls, as well as those that separate autonomous units from a building, must meet minimum conditions regarding insulation and acoustic conditioning, thermal insulation and impermeability. From the results observed in the Performance Analysis it is clear that the resolution of the acoustic problem experienced in the neighbourhood is a mere question of constructive detail, in which the elevation of the shared wall towards the edge of the roof stands out as the first and simplest alternative to provide Improvement in the quality of life of this population.

Figure 278 - Noise transference through walls and lining.
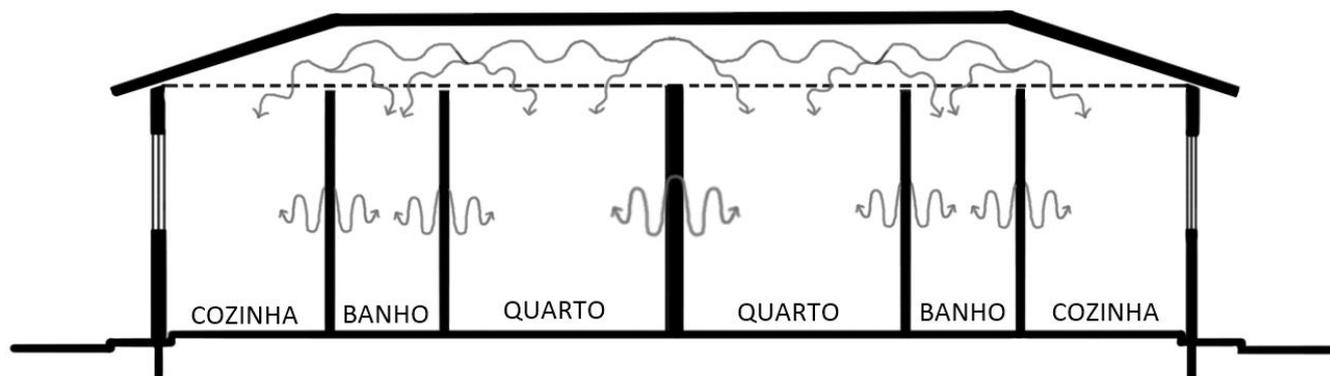
Source: Authors, 2016.

It was possible to verify from the application of Questionnaires, Walkthroughs and Measurements in loco that the climatic situation experienced inside the house is potentially problematic. It can also be said that, in proportion to the quantity and amplitude of the reforms carried out, it is perceived that this sensation varies and / or becomes complex, as described below.

Regarding Temperature, the data collected in Questionnaires point to a certain climatic constancy, with more than 50% of respondents evaluating rooms as neutral or comfortable. Residents reported that special cold or heat situations occur, such as in the bedrooms, perceived as cold rooms by 30% of the respondents, or the laundry perceived as hot by 22.5%. The bedrooms have more shaded facades in relation to the other rooms, due to the shared wall. As a result, they receive lower insulation and ventilation, favouring low thermal amplitudes throughout the day, which may justify the feeling that this place is cooler than the other rooms in the house. In the original design, the laundry room is limited to the presence of a tank in the rear portion of the room, without any type of insulation to protect against the sunshine or inclement weather. Since the predominant climatic sensation in Uberlandia is of heat and dryness for most of the year, this area destined to perform domestic services is exposed to the rigours of the climate, justifying the residents' dissatisfaction.

Even in adapted or completely reformed units, there is a predominantly positive perception of the temperature by the users. Nevertheless, from the Performance Analysis undertaken in four neighbourhood units on a typical summer day, it is observed that none of the houses meets the minimum performance set by NBR 15575-1 for the Bioclimatic Zone 4 in which Uberlandia is located, where the internal temperature of the house must be less than or equal to the external temperature. On the contrary, the internal temperature of all the houses was measured between 0.7 and 2.9 ºC above the external one, configuring a situation of significant heat discomfort. Since the questionnaires were applied during the winter, it was observed that the temperatures experienced at the time were milder, which may have led the interviewees to transmit a partial perception regarding climatic comfort inside the residence, reflecting their momentary sensations.

Ventilation is a positive aspect of housing, with more than 62.5% of respondents satisfied. Nevertheless, observed residences that have undergone transformations in the Shopping Park neighbourhood deal with mould in some rooms, since ventilation openings and sunshine are often obstructed by the building's evolution over time. The existence of cracks in ceramic tiles increases this situation, causing situations of suffocation mainly in the bathroom and kitchen, where ventilation is precarious, according to 37.5% and 25.5% of the respondents, respectively. In the same way, illumination becomes precarious when enlargements are made without planning, but it is very satisfactory in almost all rooms of the original project, except for the bathroom, where 37.5% of the interviewees feel dissatisfied. The Performance Analysis highlights this situation by verifying that all the rooms of the house meet the minimum level of light performance provided by NBR 15575-1, except for those adjacent to extensions built or under construction.

Considering the above, it becomes evident the hidden trap under the proposed realisation of the dream of house ownership itself. Apparently, this is a spatially well-designed design proposal, with a specially planned layout; Structurally, using an efficient and low-cost building system; And environmentally, complying with minimum performance parameters. However, the misconception lies in adopting an obsolete family profile as a project leader and not predicting its evolution and interaction with time and space, deriving from this the majority of the problems experienced by the population benefited by social programs after the occupation. Some of the consequences listed are the material wear and tear of the building, due to the difficulties involved in its maintenance and adaptation, as well as the wear and tear between neighbourhood relations and the residents themselves. Given the vulnerability that previously characterised this population, there is a need to think of better-adapted housing proposals while proposing low cost and viable solutions for the already consolidated units.

4.4.9. PRIVACY

From the obtained results in interviews, visits to the housing unit and co-productions, it was confirmed that the privacy relations are especially delicate aspects in the general problems of the Shopping Park neighbourhood. Although the results point to a partial satisfaction in terms of privacy among residents, with 68.4% of respondents satisfied or neutral, in Walkthrough analysis it is noticed that the environment does not favour individuality and recollection, since it is frequent the sharing of bedrooms for more than 3 people, such as siblings or relatives in other degrees. It is assumed that the preconditions of housing did not differ significantly in this aspect, characterising a public accustomed to such condition and justifying the satisfaction they reported regarding privacy among residents.

In terms of privacy in relation to the street, 63.9% are dissatisfied or neutral, a concept that is associated with the feeling of insecurity on the part of 47.5% of the interviewees, due to the non-construction of walls and the negative perception in relation to the behavior of the neighbours, mainly related to drug consumption and trafficking. In spite of this, less than 25% of the interviewees assume that they have difficulties of relationship with immediate neighbours. Such information suggests simple alternatives for resolution, which contemplate the creation of devices capable of guaranteeing protection and at the same time interface between lots and between lot and street. At the same time, there are some cases in which the lack of resources for the construction of walls in all the facades of the land caused a situation of friendship between neighbours, as shown in Figures 279 and 280, where 4 houses share the backs and the residents maintain a healthy relationship.

Figure 279 - Shared backs of 4 lots   Figure 280 - Frontal facade of 2 of the houses whose backs are shared.

Source: Authors, 2016.

Source: Authors, 2016.

After all, 82% consider semi-detaching as the main problem of the housing unit, whose physical properties and the fact of being shared make it impossible to maintain privacy between neighbours. This effect is aggravated when the amplification invades the obligatory lateral distances, often causing the same situation of sound propagation on the other side of the lot. Some residents reported having suffered depression due to the annoyance generated by the existence of shared noises between dwellings. This finding again points to the importance of providing constructive alternatives that are easily feasible to solve the problem of the acoustic discomfort experienced in the dwellings.

It is assumed that the frontal, lateral and fund distances and coefficient of utilisation prescribed by the Land Use and Occupancy Law are respected in the original housing unit. However, after modifications made by the residents, it is possible to observe that this does not prevent the residents from occupying the entire free area of the lot, whether with paving, roofing or buildings themselves. Such extensions often disregard the recommendations of the Building Code regarding the positioning of minimum openings and distances between buildings, which, among other things, impedes privacy among neighbours, especially between residences that are not separated by external walls.

4.4.10. PREVIOUS HOUSING

Among the seven family profiles identified in the interview with residents of the Shopping Park neighbourhood, the nuclear family and single-parent family currently predominate. This situation was not different in the previous dwelling of the interviewees. What is observed after the change to the current neighbourhood are changes in proportions, with the number of nuclear families decreasing from 55% to 45%, while the number of single-parent families increased from 22% to 25% of the total. At the same time, there is an increase in the number of people living alone (from 2.5% to 10%) as well as couples without children, from 5% to 10% of the total. Many residents reported having divorced after purchasing their own property, while some couples are starting life there, justifying the change observed. Another family modality that gained prominence was the extended nuclear family, which went from 5% to 10% of the total, being composed of couples, children and other relatives of the family.

More than half of the interviewees reported preferring, in a wide judgement, the previously experienced housing conditions. 65% of respondents believe that the location of these homes was better than the current situation. In addition, more than 50% of respondents had larger and better-finished homes, although monthly expenditures were significantly higher because they were predominantly rented dwellings. After all, when evaluating the conditions of the previous dwelling, it is evident the dissatisfaction with the current dwelling, although the current acquisition situation allows optimisation of the family budget, through financing with payment of symbolic instalments over the years. The access to public equipment seems to

compensate the expense with rent, pointing to the existence of a poor quality in the provision of basic urban services in the housing complex of the Shopping Park neighbourhood.

4.4.11. PARTIAL CONSIDERATIONS

The following frame summarizes the main conditioning factors of resilience in relation to the physical-architectural order, in terms of weaknesses and potentialities observed in the housing units of the Shopping Park neighbourhood.

Frame 33 – Conditioning Factors of Resilience: physical-architectonic order

Conditioning Factors of Resilience: Weaknesses and Potentialities		
Aspects	Weaknesses	Potentialities
Design (Sitution, Format, Dimensions)	- Vast constructive, social and environmental problems. - Deployment of lots perpendicularly to the contour lines and not provision of prop walls: houses subject to floods and landslides. - Difference of level between sidewalks and lots demand construction of ramps on the sidewalk - harms accessibility. - Accessible houses have an area inferior to the 36 m² established by the MCMV Programme. - 82% of the residents interviewed consider semi-detaching as the main problem. - 42.5% of the interviewees are dissatisfied with the division of the rooms of the house. - 80% modified the house, aware of the possibility of loss of the guarantee of the property. - Reforms without planning cause obstruction of Windows and entrances, impairing comfort and circulation. - High cost involved with reforms overburden income of families originally vulnerable socially and economically.	- A remarkable effort in the search for improvements and quality of life, motivated by the achievement of the "dream of the own home".
Construction Systems and Materials	- 71.8% of people consider buildings on the block regular or bad. - 47.5% carried out reforms to solve technical problems. - 70% are dissatisfied with the quality and accessibility of the sidewalks. - Surface fissures and capillary infiltration in external fences. - Gutters through the tiles due to the installation of water heating system without adequate sealing. - 75% consider the quality of construction and finishing materials poor or regular. - Finishes prematurely worn in wet areas.	- 76.3% consider the house acceptable or beautiful. - 50% consider their home as a material investment and a place with which they identify themselves. - 91.4% consider it as a place of leisure and refuge.
Maintenance	- Disposal of improperly stocked building materials in the lot.	- 65% say it is easy to keep the residence clean because of its small

| | | size.

- 67.5% would like to have more landscaped areas. |
|---|---|---|
| Services | - Inexistence of public rainwater drainage-overloads sewers.
- There are houses with reflux of gases through sanitary appliances.
- Only 15% reported own energy-saving equipment.
- Only 10% have water saving devices.
- 61.3% affirmed that the cost-benefit ratio is unsatisfactory or regular in relation to water, energy and transport consumption. | - Solar heating system, for heating the shower water, contributes to energy saving.
- 87.5% reported seeking to save energy and water in order to reduce the bills.
- Main measures to save energy: turn off the lights after use (77.5%); use energy-saving lamps (37.5%); and turn-off equipment out of use (35%).
-50% reported brushing their teeth with the tap closed; 47.5% reuse water from the washing machine to wash the house; 37.5% soap dishes with closed tap; 35% take short baths (between 5 and 10 minutes); 27.5% use the washing machine a few times a week and at it maximum capacity. |
| Internal Layout - Functionality | - Interventions in order of priority: construction of walls, roofs for external areas and new little houses detached.
- The rooms are dimensioned according to distorted furniture (to fit in the plan), generating real tight and little flexible environments.
- Activities such as individual work / recreation, dressing and domestic maintenance, disregarded in the proposed project proposal, being the main reason to carry out extensions.
- 60% judge the Division in rooms of the house as badly resolved.
- 75% consider the house as small, being kitchen, bedrooms and bathroom / toilet the most problematic rooms in that sense.
- More than 50% are unhappy about the ease of furnishing the rooms.
- Cabinets occupy environments in height and width, obstructing openings and circulations.
- Tight spaces and furniture obstructing circulations and openings hinder ergonomics and healthiness. | - The dimensions of the lot allow customization of the house.

- Above 87.5% claim to stock well in the kitchen and bedrooms, despite the spatial restraint. |
| Adaptation and Refurbishment | - Interventions in self-supporting constructions without technical assistance risk structural stability.
- 92.3% reported having changed the original design.
- 80% wanted to expand the house.
- Main reforms: construction of walls | - The use of self-supporting constructive system, due to its popularity, allows residents' autonomy when performing interventions.

- 67.5% reported identifying themselves today with their residence. |

	(77.5%), construction of roofs in the external area (67.5%) and addition or removal of walls to accommodate expansions (57.5%). - Main rooms renovated were external area and laundry. They were not foreseen in the project. - Inside the residence, most of the users (60%) are dissatisfied with the size of the kitchen and bedrooms. Despite this, the bedrooms were the least modified rooms (25%), indicating the priority given to other rooms. - Scarcity of resources defines priorities in the adaptation process, which can last for long years. - High cost involved often makes it impossible to carry out quality reforms. - Malpractice and recklessness during interventions puts structure and safety at risk. - Inadequate disposal of waste from self-construction impacts the environment.	- 77,5% feel well adapted today. - Laundry has a higher satisfaction rate in relation to its size (47.5% satisfied) due to the fact that it is a totally customized room by the users. - Existence of dwellers who work with the construction industry (masons, servants, máster builders), who conduct the reforms in their houses.
Adaptation for Commerce	- High cost of lots at the commercial stripe of the allotment makes it impossible to consolidate commercial activities. - 30% use the residence to acquire income. - 15% have modified the house to conduct business or services. - Expansions toward the front or bottom of the lot obstructs openings and circulations, damaging healthiness. - Unregulated activity generates problems of coexistence, mainly due to noise and garbage disposal in lots.	- Situation of informality, counterbalanced by the convenience of these initiatives for the community.
Comfort (Noise, Temperature, Humidity, Light)	- 48.7% reported dissatisfaction with acoustics, due to the lack of acoustic insulation in the shared wall. - The internal temperature of all the houses was measured between 0.7 and 2.9 ºC above the external one, configuring a situation of significant heat discomfort. - Ventilation in bathrooms and kitchen is precarious, according to 37.5% and 25.5% of respondents, causing mold. - 37.5% are dissatisfied with the lighting in the bathroom (room often obstructed by enlargements).	
Privacy	- 82% consider semi-detaching as the main problem of the housing unit. The lack of acoustic insulation compromises the privacy of the housing unit. - The rooms do not favour individuality and recollection, since there are rooms shared by more than 3 people.	- Inexistence of external walls promoted friendship between neighbours in some cases.

	- 69.3% are dissatisfied with privacy in relation to the street. 47.5% feel insecure, mainly due to the lack of external walls. - 25% have difficulty living with neighbours.	
Previous Housing	- 65% of respondents believe that the location of the previous dwelling was better in relation to the current situation. - 50% of the interviewees owned bigger and better finished houses. - Access to mobility and public facilities compensated for the rental expenses in the previous dwelling, evidencing the low quality of urban life in *Shopping Park*.	

Source: Authors, 2017.

4.6 DIAGNOSTIC MAP – HOUSING UNIT SCALE

The following Diagnostic Maps present the results obtained through the HOUSING UNIT scale (related to the private aspects of the dwellings), based on the cross-checking of the main results of the three applied tools (questionnaire, walkthrough and co-production) in the evaluation of the "Shopping Park" case study, elaborated as described in item 4.4 on page. 298[13]

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[13] [...] They were divided into two scales: HOUSING UNIT (aspects related to private dwellings) and URBAN (aspects related to urban insertion in the collective / public sphere). The results were presented according to three analysis aspects: PHYSICAL, SOCIAL and ENVIRONMENTAL. For each analysis' item were indicated, when existent, their respective parameters.

Figure 281– Diagnostic Map – Housing Unit Scale – Whole House

DIAGNOSTIC MAP - HOUSING UNIT - WHOLE HOUSE

1/7

EXAMPLE OF ENLARGEMENT

FISSURE EXAMPLE

INFILTRATION EXAMPLE

ACOUSTIC PROBLEM

COZINHA | BANHO | QUARTO | QUARTO | BANHO | COZINHA
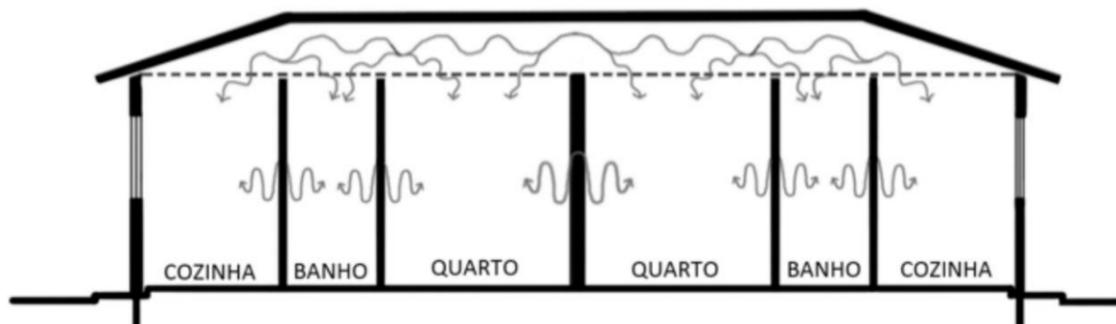
- The houses do not match the needs of most existing family profiles, justifying their dissatisfaction with the small size of the rooms.
- High costs involved with reforms overload the income of families originally vulnerable, socially and economically.[1]
- Difficulty of adaptation after moving to new house, mainly due to the lack of acoustic privacy.
- Feeling of belonging derived from the realization of the "dream of own house" justifies the initiative of the residents to adapt their residences.
- 91,4% use the house as a leisure and "refuge" space.
- 30% use the residence to acquire extra income, which reinforces its value.
- 7,5% are generally satisfied with the residence and 77,5% have adapted well to it.
- Spontaneous incorporation of principles of bioclimatic architecture when carrying out reforms, demonstrating the ability to adapt to situations of various discomfort and disruption.

- In the reforms there is, eventually, concern with environmental comfort when carrying out interventions (house 03 - wall of cobogos for ventilation and lighting in the kitchen).
- 57.5% carry out recyclable waste separation and 76.3% separate the oil from other organic waste.
- Realization of expansion through self-construction, using recycled materials, as a more common form of adaptation, as well as the reduction in the number of belongings of some residents.

- Customizing the residence is a source of satisfaction for the users.
- Enclosed design and constructive technique in self-supporting masonry make it difficult to carry out functional and safe renovations.
- 42,5% are dissatisfied with the division of the rooms, mainly in relation to the lavabo as circulation room.
- 75% consider the quality of construction and finishing materials poor or regular.
- 47,5% undertook reforms to solve technical problems, such as the precariousness of finishes and defects in electrical and hydrosanitary infrastructure.
- Fissures in the cover cause leaks and infiltrations in the house, damaging finishing materials.
- 80% have made reforms to increase and improve the house.

- 82% consider twinning as the main negative aspect of the house, since there is no appropriate acoustic insulation on the shared wall.
- Regular thermal performance causes internal temperatures between 0.7 and 2.9ºC higher than external, characterizing a situation of considerable heat discomfort.

BENCHMARKS
1- Intersindical Department of Statistics and Socioeconomic Studies (DIEESE): deliberates about minimum incomes able to satisfy the needs of a citizen.

PHYSICAL | SOCIAL | ENVIRONMENTAL

⬢ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION
◆ DATA COLLECTION   □ RESEARCHER'S PERCEPTION

WEAKNESS   POTENTIALS

Source: Authors, 2016.
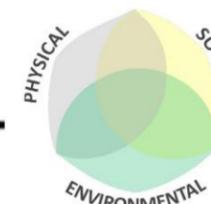
Figure 282– Diagnostic Map – Housing Unit Scale – Living Room

DIAGNOSTIC MAP - HOUSING UNIT - LIVING ROOM

2/7

LIVING ROOM PROPOSED LAYOUT

LAYOUT ROOM - INAPPROPRIATE FURNITURE
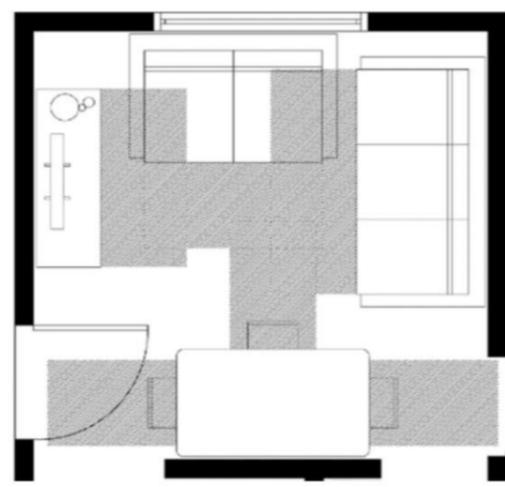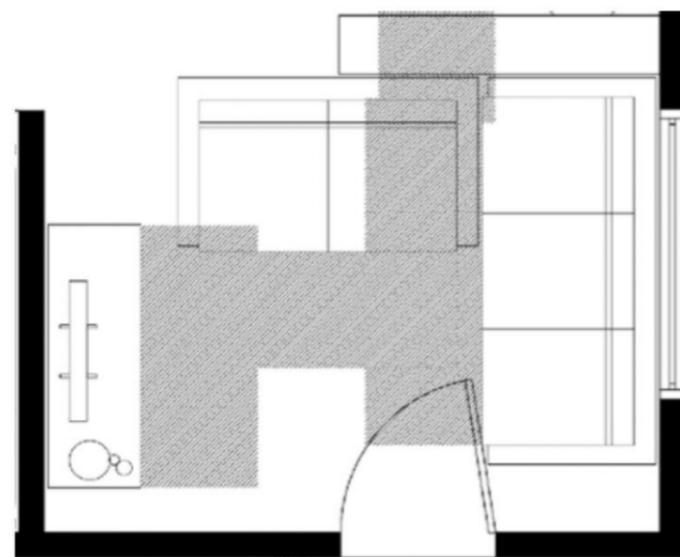
■ Reduced size limits the coexistence and good performance of the activities of the room since there is not enough space for everyone and / or the movement between furniture is impracticable.

▫ Room modified / expanded by many respondents - significant financial impact.

■ Insufficient ventilation area[2] (Required: 0.8 m²; Existing: 0.67 m²)

● 45% are dissatisfied with the small size of the room.[1]

● 40% have extended this room.

● 46,2% have difficulty furnishing the room.

■ Approved layout design features furniture with unreal dimensions, inferior to those required for good performance of the essential activities in this room - socializing, serving meals, working and recreating.

BENCHMARKS
1 - Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Dissertation by Gabriela Moraes Pereira: Deliberates on the ideal dimensions of the rooms in function of the quantity and quality of furnishings necessary to the development of the essential activities in each one .
2 - Code of Works - Complementary Law nº 524, of April 08, 2011: Decides on the size of the squares depending on the area of the room.

PHYSICAL SOCIAL ENVIRONMENTAL

⬡ QUESTIONNAIRE ■ WALKTHROUGH ● COPRODUCTION
◆ DATA COLLECTION ▫ RESEARCHER'S PERCEPTION

WEAKNESS POTENTIALS

Figure 283– Diagnostic Map – Housing Unit Scale – Kitchen

DIAGNOSTIC MAP - HOUSING UNIT - KITCHEN

3/7

KITCHEN PROPOSED LAYOUT
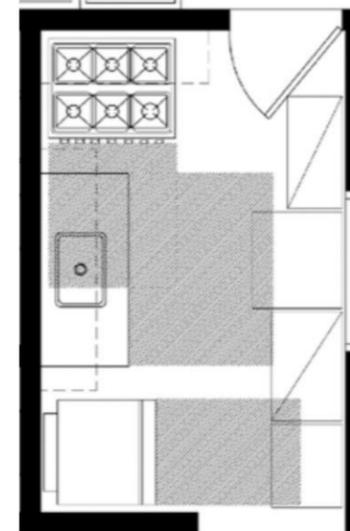
LAYOUT KITCHEN - INAPPROPRIATE FURNITURE / CIRCULATION OBSTRUCTION / FLOOR

■ Reduced size limits coexistence.

◻ Room modified / expanded by most of the respondents - significant financial impact.

■ Insufficient ventilation area [2] (Required: 0,48 m²; Existing: 0,43 m²)

■ Lighting and ventilation compromised by the layout of furniture and extension.

■ Rear and side enlargements obstruct openings.

■ Furniture arrangement obstructs openings and compromises movement, making it difficult to store belongings properly.

● 70% are dissatisfied with the reduced size of the room.[1]

● 66.7% have difficulty furnishing the room.

● 42.5% have extended this room.

■ Low-quality of finishing materials delivered do not withstand conventional cleaning, resulting in browning, porosity, and detachment.

BENCHMARKS
1 - Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Dissertation by Gabriela Moraes Pereira: Deliberates on the ideal dimensions of the rooms in function of the quantity and quality of furnishings necessary to the development of the essential activities in each one .
2 - Code of Works - Complementary Law nº 524, of April 08, 2011: Decides on the size of the squares depending on the area of the room.
3 - NBR 15575 - Part 3

PHYSICAL   SOCIAL
ENVIRONMENTAL

◆ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION
◆ DATA COLLECTION   ◻ RESEARCHER'S PERCEPTION

WEAKNESS   POTENTIALS

Source: Authors, 2016.

Figure 284– Diagnostic Map – Housing Unit Scale – Bathroom

4/7

DIAGNOSTIC MAP - HOUSING UNIT - BATHROOM

BATHROOM PROPOSED LAYOUT

EXAMPLE OF A LAYOUT RENOVATED BATHROOM
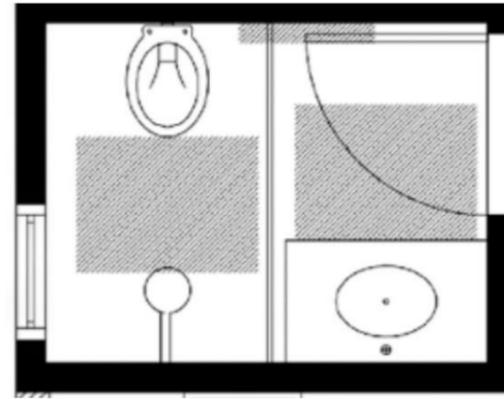
EXAMPLE OF FLOORING BATHROOM - DETACHMENT // DIFFICULTY OF FURNISHING
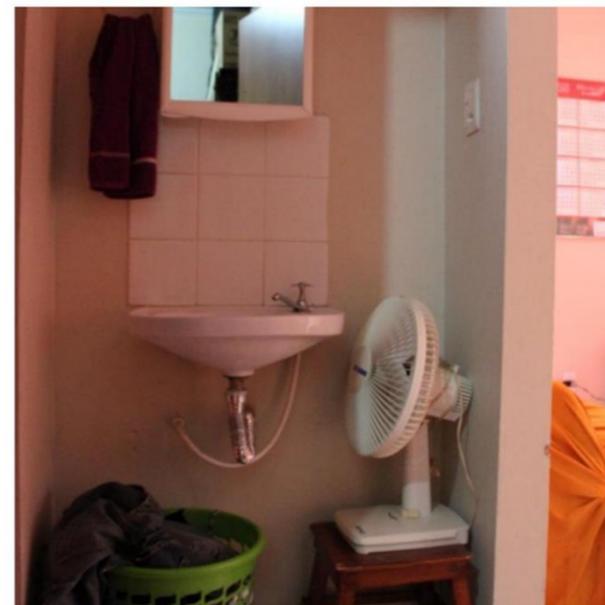
● 31,6% feel lack of privacy.

■ Insufficient ventilation area in the adapted house[1] (Required: 0.30 m²; Existing: 0.14 m²)

● 17.5% and 23.5% are dissatisfied with bathroom lighting and ventilation respectively.

■ Expansions behind the house obstruct ventilation

● 61.8% have difficulty furnishing the room.

● 60% are dissatisfied with the small size of the room.

■ Layout of the house features a toilet as a cloistered room and connection between other rooms, defining conflict between uses - living (living room), personal hygiene (bathroom / toilet).

■ Low-quality of finishing materials delivered do not withstand conventional cleaning, resulting in browning, porosity, and detachment.[2]

■ Failure to seat the floor causes water deposits[2].

BENCHMARKS
1- Code of Works - Complementary Law nº 524, of April 08, 2011: Decides on the size of the squares depending on the area of the room.
2 - NBR 15575 - Part 3
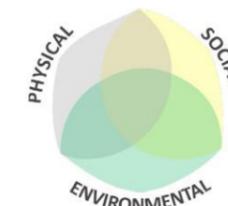
◆ QUESTIONNAIRE ■ WALKTHROUGH ● COPRODUCTION
◆ DATA COLLECTION □ RESEARCHER'S PERCEPTION

WEAKNESS   POTENTIALS

Source: Authors, 2016.

Figure 285– Diagnostic Map – Housing Unit Scale – Bedrooms

DIAGNOSTIC MAP - ROOM UNIT - BEDROOMS

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BEDROOMS PROPOSED LAYOUT

EXAMPLE EXPANSION - VENTILATION OBSTRUCTION AND ROOM LIGHTING

EXAMPLE OF OBSTRUCTION OPENINGS AND CIRCULATION IN THE ROOM
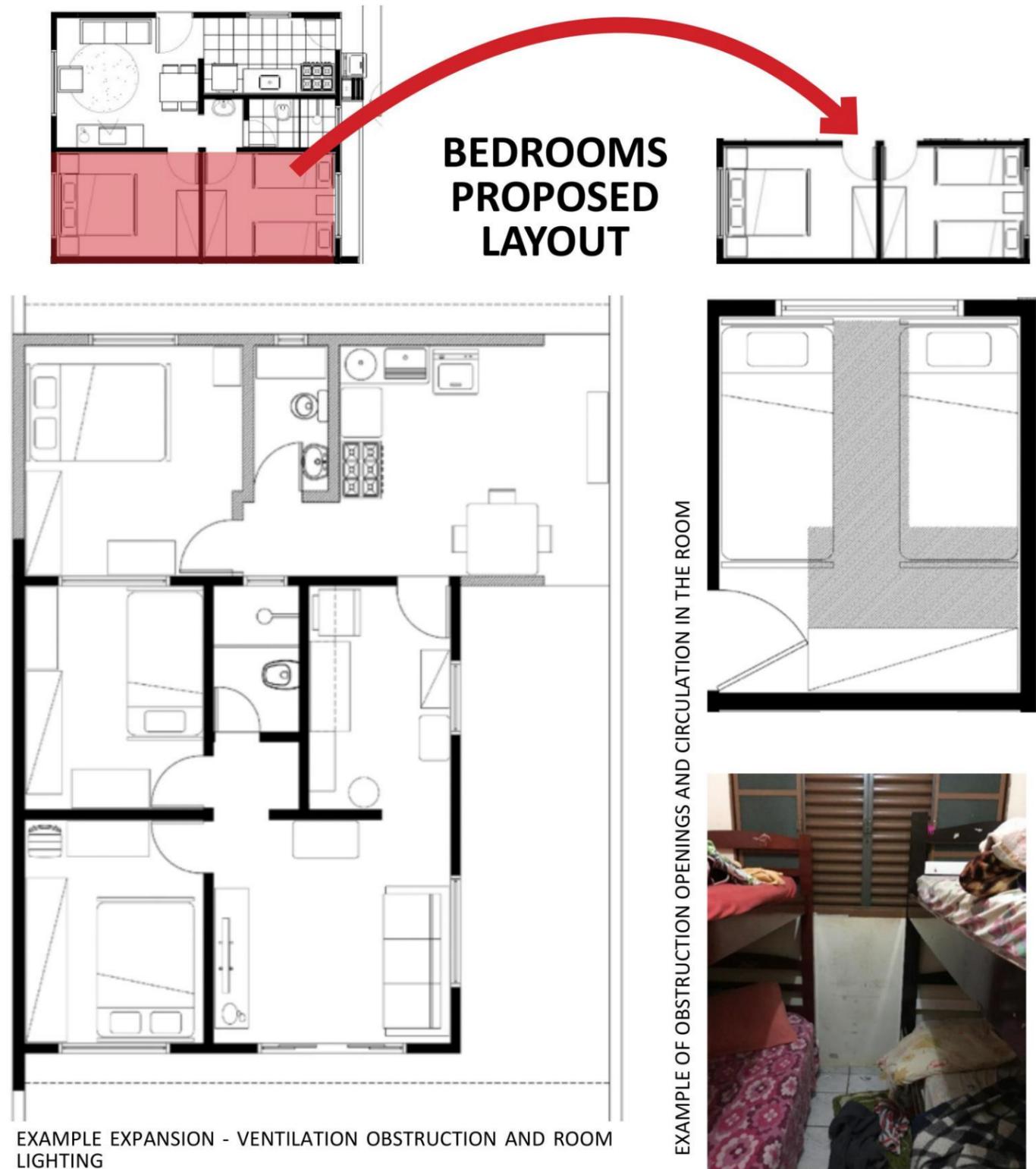
■ Reduced dimensions limit individuality.

■ Lack of acoustic privacy disturbs coexistence between neighbours.

▫ Although the majority of the residents reported satisfactorily performing the activities of sleeping (72%) and relaxing (65%) in this room, it is perceivable that the acoustic discomfort and the reduced size impair the good performance of these activities, evidencing a contradiction in the perceptions of the residents.

●● 55% are dissatisfied with the acoustic performance of the room.

■ The noise level difference between adjacent rooms (semi-detaching) does not meet the minimum level prescribed by the Performance Standard (Norma de Desempenho).

■ Lighting and ventilation compromised by furniture arrangement and enlargements

■ Extensions on the front and back of the house block openings.

■ Furniture arrangement obstructs openings and compromises circulation, making it difficult to store belongings properly.[3]

■ Gap between tiles and lining is shared by the terraced houses, amplifying propagation of noises.

● 62,5% are dissatisfied with the small size of the room.[1]

● 61,6% have difficulty furnishing the room.

● Only 25% have reformed this room (it is not a priority despite being problematic)

BENCHMARKS
1 - Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Dissertation by Gabriela Moraes Pereira: Deliberates on the ideal dimensions of the rooms in function of the quantity and quality of furnishings necessary to the development of the essential activities in each one .
2 - Code of Works - Complementary Law nº 524, of April 08, 2011: Decides on the size of the squares depending on the area of the room.
3 - NBR 15575 - Part 4 - Criterion 12.3.1
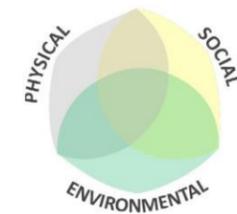
PHYSICAL   SOCIAL
ENVIRONMENTAL

◆ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION
◆ DATA COLLECTION   □ RESEARCHER'S PERCEPTION

WEAKNESS   POTENTIALS

Source: Authors, 2016.

Figure 286– Diagnostic Map – Housing Unit Scale – External Area

DIAGNOSTIC MAP - HOUSING UNIT - EXTERNAL AREA

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EXAMPLE OF BUILDING MATERIALS AND RUBBLE STORED IN LOT OF BACKGROUND

EXAMPLE OF BUILDING MATERIALS AND RUBBLE STORED IN LOT OF BACKGROUND

EXAMPLE HORTA AND VEGETATION IN LOT BACKGROUND

● 55% feel vulnerable to robbery and the entrance of strangers.

● 50% feel lack privacy in relation to their neighbours.

● High costs involved in building walls, paving and ramps overload family income.

●□ Scarce resources make access to technical assistance difficult when implementing reforms.

● 80,6% have a monthly income between R$ 1000 and 2000, below the standard able to satisfy the basic needs of the citizen, the amount of R$ 2765.44, according to DIEESE.

□ Realization of interventions in the lot and sidewalks without technical assistance and inadequate deposit of tailings contribute to the negative perception of the neighborhood's appearance, by 30% of respondents.

■ Accumulation of tailings of civil construction damages health, hygiene and aesthetics, causing problems of coexistence.

●■ Excessive waterproofing of the lot (52.5% paved outside area)

● 52,5% produce some type of food at home.

● 72,9% Have plants and 67.5% feel the lack of gardenareas at home.

● 57,5% separate waste between recyclable and common.

□ Dimensions of the lot allow significant use of its constructive potential.

● 60% have made improvements in this room.

■ Overlapping incompatible uses: clothing, preparing and serving meals, and doing household maintenance.[2]

■ Interventions without technical assistance lead to constructive problems and jeopardize the structural stability of the building as well as the comfort of its residents.

● 77,5% built walls to enhance security and privacy.

◆ Project delivered in steep region does not include retaining wall, putting at risk stability of building and security of the population.

BENCHMARKS

1- Intersindical Department of Statistics and Socioeconomic Studies (DIEESE): deliberates about minimum incomes able to satisfy the needs of a citizen.

2 - Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Dissertation of Gabriela Moraes Pereira: deliberates on compatibility between different uses, establishing essential, desirable, indifferent and undesirable combinations.
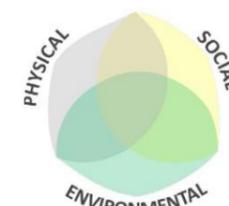
PHYSICAL SOCIAL ENVIRONMENTAL

⬢ QUESTIONNAIRE ■ WALKTHROUGH ● COPRODUCTION
◆ DATA COLLECTION □ RESEARCHER'S PERCEPTION

WEAKNESS POTENTIALS

Source: Authors, 2016.

Figure 287– Diagnostic Map – Housing Unit Scale – Laundry

DIAGNOSTIC MAP - HOUSING UNIT - LAUNDRY

7/7
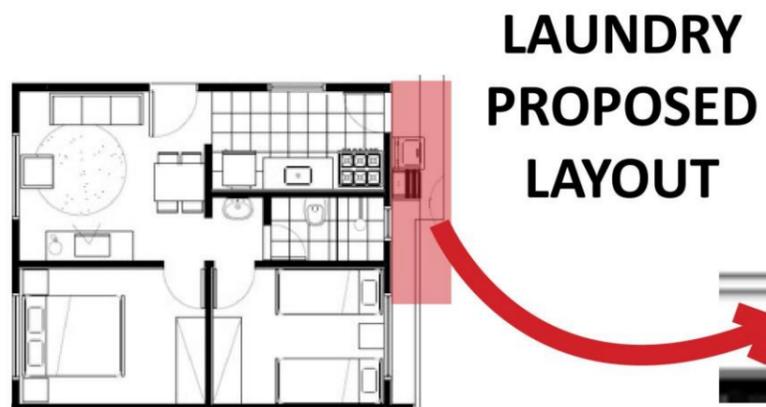
LAUNDRY PROPOSED LAYOUT
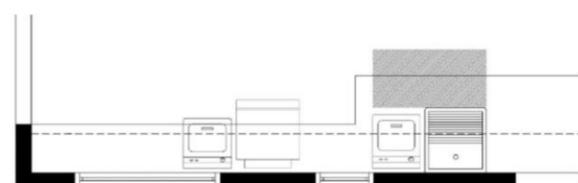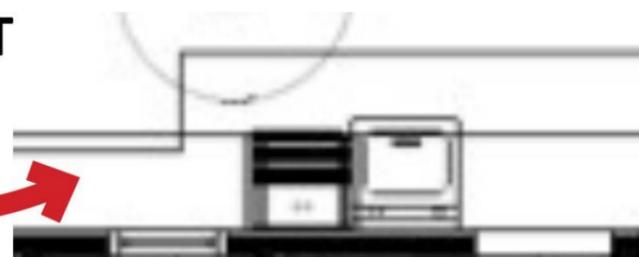
REFORMED LAYOUT AND LAUNDRY EXAMPLE
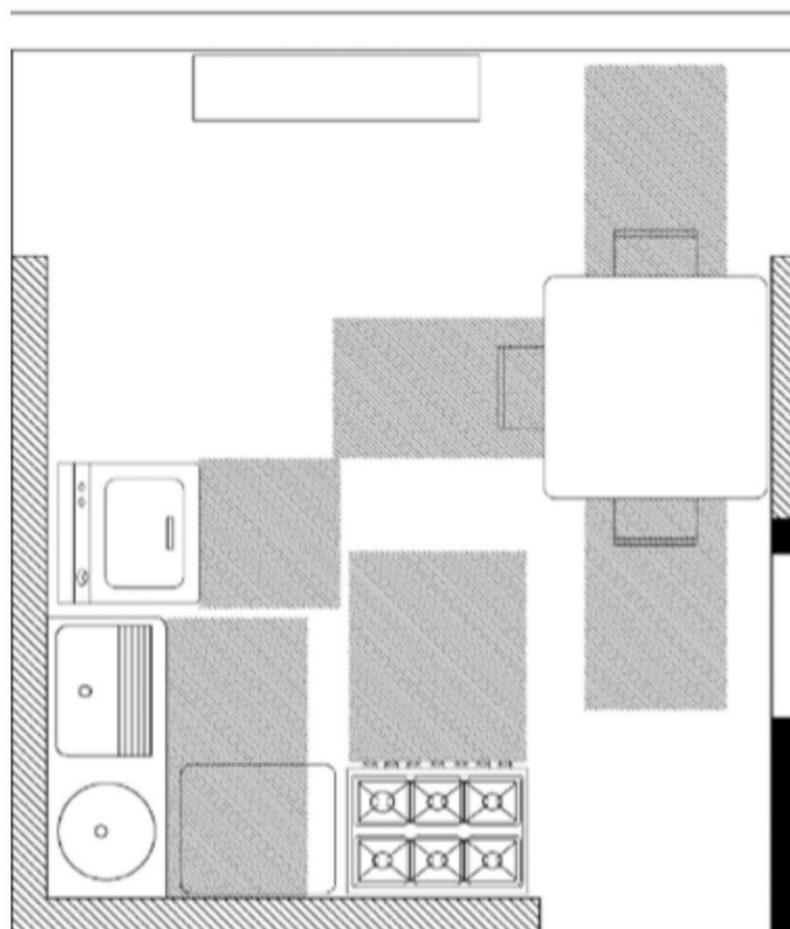
● ● High costs involved with reforms overload incomes of families originally vulnerable, socially and economically.[1]

▫ Room modified / constructed by most of the interviewees - significant financial impact.

● Area exposed to the weather makes it uncomfortable to take care of clothes in this room.

◆ Lack of project for this room makes it subject to the weather.

● 47,5% Are dissatisfied with the original reduced size of the room. [2]

● 50% have made improvements in this environment.

■ Overlapping incompatible uses: taking care of clothes, preparing and serving meals, and performing household maintenance. [2]

▫ It is the room that most satisfies users in terms of size today, with 47.5% of respondents satisfied, precisely because it is a totally customized room (importance of the possibility of customization).

BENCHMARKS
1 - Intersindical Department of Statistics and Socioeconomic Studies (DIEESE): deliberates about minimum incomes able to satisfy the needs of a citizen.
2 - Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Dissertation by Gabriela Moraes Pereira: Deliberates on the ideal dimensions of the rooms in function of the quantity and quality of furnishings necessary to the development of the essential activities in each one .

PHYSICAL   SOCIAL

ENVIRONMENTAL

⬟ QUESTIONNAIRE   ■ WALKTHROUGH   ● COPRODUCTION

◆ DATA COLLECTION   ▫ RESEARCHER'S PERCEPTION

🔴 WEAKNESS   🟢 POTENTIALS

4.5. RECOMMENDATIONS FRAME

4.5.4. SOCIOECONOMIC ORDER

Frame 34 – Recommendations Frame – Socioeconomic Order

RECOMMENDATIONS FRAME	SOCIOECONOMIC ORDER				
ASPECT	PROBLEM	PARAMETERS	RECOMMENDATIONS		
			USER	DESIGNERS	PUBLIC POLICIES
1. Demographic and Socioeconomic Aspects	-Low monthly income.	- Department of Statistics and Socioeconomic Studies (DIEESE)	-Be aware of how to get a social fare for water and energy bills through public entities; -Resources to make the rooms more flexible, in order not to sacrifice the household budget in reforms. Ex: Folding/ flexible furniture.	- Consider, during the design process, durability and maintenance of the construction materials, in order not to compromise the residents' income at a long term.	- Ensure compliance with minimum urbanisation parameters while in the evaluation and approval phase of new undertakings. - Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users.
2. Education	- Low education level; -Insufficient educational facilities.	- *ITDP* – Institute of Transport and Development Politics and *LAB CIDADE* / USP Methodology, 2014.	- Do technical courses; - Invest in superior education in order to obtain better Jobs and income; - Claim better education conditions.	- Design spaces that have enough area and infrastructure to meet the surrounding population demands.	- Invest in policies to encourage education in general; - Implement a sufficient amount of educational facilities to meet the population's demand.
3. Violence and Safety	- High level of drug traffic and robbery; - Bad relationship between neighbours; - Lack of a police station.	–	- Keep a good relationship between neighbours, - Create a surveillance system within the users themselves to help the fight against crime.	- Be careful with the projects, in order to create spaces that inhibit crimes and illegal activities. Ex: wide open spaces, good lighting and good visualisation from all sides; - To design spaces that increase urbanity and users' circulation, inhibiting the criminal practice.	- Implement a police station; -Increase policing frequency in the region - Implement social programs to combat drugs and violence.
5. Public Policies	- User's little knowledge about the existent policies; - Little participation in the activities, by the ones who are aware of the existent policies.	–	- Be better informed about the current activities in your neighbourhood; - Actively participate in activities and meetings.	- To design welcoming spaces that arouse the user's interest, and well as being a propitious space for community activities, meetings, etc.	- Increase dissemination of services and activities offered; - Ensure that the policies implemented move in the same direction as the needs of the population living there, ensuring a more constant participation of the residents.
6. NGOs and other agents	- Distance between the allotment and the NGO and Neighbourhood Association; - Little participation in the activities done by these entities.	–	- Be better informed about the current activities in your neighbourhood; - Actively participate in activities and meetings.	- To design welcoming spaces that arouse the user's interest, and well as being a propitious space for community activities, meetings, etc.	- Increase support for Non-Governmental Organisations.
8. Health	- Basic Health Unit does not attend the population demand – lack of infrastructure; - Distance to the nearest hospital.	- *ITDP* – Institute of Transport and Development Politics and *LAB CIDADE* / USP Methodology, 2014.	- Claim better infrastructure conditions.	- Design spaces that have enough area and infrastructure to meet the surrounding population demands.	- Implement sufficient health facilities, with adequate infrastructure, meeting the local demand; - Ensure that the existing equipment is located within a suitable distance range; - Provide efficient public transportation to ensure the population's access to the facility.

Source: Authors, 2016.

4.5.1. CLIMATIC NATURAL ORDER

Frame 35 – Recommendations Frame – Climatic Natural Order

<table>
<tr><td colspan="6" align="center">RECOMMENDATIONS FRAME | CLIMATIC NATURAL ORDER</td></tr>
<tr><td rowspan="2" align="center">ASPECT</td><td rowspan="2" align="center">PROBLEM</td><td rowspan="2" align="center">PARAMETERS</td><td colspan="3" align="center">RECOMMENDATIONS</td></tr>
<tr><td align="center">USER</td><td align="center">DESIGNERS</td><td align="center">PUBLIC POLICIES</td></tr>
<tr>
<td>1. NATURAL RESOURCES (Vegetation, soil, water)</td>
<td>• Lack of medium and large size afforestation
• Garbage in green areas
• High level of waterproofing of lots
• Narrow sidewalks tha do not acomodate large trees</td>
<td>• Brazilian Society of Urban Afforestation
• Afforestation Manual - CEMIG
• SOIL USE AND OCCUPATION, Law nº 525, of april 14, 2011. Chap. V - Art. 38/ CRIT. 8.8
• MUNICIPAL WORK CODE OF UBERLÂNDIA, Law nº 524, of april 08, 2011 – Chap. V - Art. 27</td>
<td>• Use the back of the lots to plant gardens and fruits.
• Plant adequate trees on the sidewalks
• Avoid waterproofing the whole lot
• Use external walls as vertical gardens</td>
<td>• Creation of an Ecological Park for the neighbourhood
• Awareness of the benefits of permeable areas as well as afforestation on sidewalks
• Use of the edge of the river for a linear park with leisure facilities
• Quarters with larger sidewalks
• Projects of afforestation with suitable trees</td>
<td>• Urban afforestation inventory
• Planting of vegetation along the roads and their maintenance
• Maintenance of green areas
• Awareness of the benefits of permeable areas as well as afforestation on sidewalks
• Implementation of the squares planned in the project</td>
</tr>
<tr>
<td>2. TOPOGRAPHY</td>
<td>• Inadequate allocation of the blocks
• Steep streets
• Irregular sidewalks</td>
<td>• NBR 9050 – Requirement 6.3
• NBR 9050 – Criterion 6.3.1</td>
<td>• Regular ramps linking both access and other sidewalks
• Access ramps for vehicles inside the lot (garage with slope)</td>
<td>• In the implementation of new neighbourhoods, the blocks' allocation must follow the same direction as the topography contour lines</td>
<td>• Intervention on the sidewalks to solve problems with access ramps for vehicles</td>
</tr>
<tr>
<td>3. POLLUTION / WASTE</td>
<td>• Lot as storage for construction materials leftovers
• Dumping of waste in public areas
• Waste accumumulation in lots
• Waste accumumulation in green áreas, streets and sidewalks</td>
<td>• Código de postura de Uberlândia, lei nº 10.741 de 6 de abril de 2011.- capítulo IV. Code of posture of Uberlândia, law nº 10.741 of April 6, 2011. - chapter IV.</td>
<td>• Awareness of the environmental and health problems that the accumulation of waste causes.</td>
<td>• Awareness of the environmental and health problems that the accumulation of waste causes.</td>
<td>• Implantation of Ecoponto.
• Deployment of Street Sweeping.
• Deployment of Selective Waste Collection.
• Awareness / information policies.</td>
</tr>
<tr>
<td>4. SHORTAGE (Water and energy)</td>
<td>• Waste of water and energy
• Low level of water saving
• Economy by financial factor and not by fear of scarcity</td>
<td>-</td>
<td>• Adopt strategies to reduce consumption
• Track consumption through accounts and hydrometer</td>
<td>• Awareness towards ways to avoid waste
• Projects with water reuse strategies
• Projects that take maximum benefit of natural lighting</td>
<td>• Awareness of ways to avoid waste
• Foster water and energy savings through exemptions and benefits in the bills</td>
</tr>
<tr>
<td>5. STRETCHED DRY SEASONS</td>
<td>• Health problems
• Increase in occurrence of fires</td>
<td>-</td>
<td>• Keep vegetation on lot and sidewalks.
• Preserve green areas of the neighborhood.</td>
<td>• Adopt architectural and landscape strategies that soften the feeling of low humidity inside the houses.
• Adopt urban and landscape strategies that soften the feeling of low humidity within the neighbourhood.</td>
<td>• Implementation of the squares planned in the project</td>
</tr>
<tr>
<td>6. CLIMATE CHANGE</td>
<td>• Period of high temperature
• Period of low humidity.</td>
<td>-</td>
<td>• Use of bicycle or walking for short-distance travel
• Composting and use of biodegradable waste to reduce greenhouse gases
• Recycling and reuse of materials thus avoiding the disposal and emission of gases generated by decomposition in dumps and landfills</td>
<td>• Adopt constructive strategies that ease the high internal temperatures, according to the bioclimatic zone of the project implementation.
• Adoption of renewable and less polluting energy sources
• Awareness of the consequences and ways of mitigating the impacts</td>
<td>• Investment in public tranport of high quality.
• Awareness / information policies.</td>
</tr>
</table>

			of global warming		
7. DESPESAS (ÁGUA E ENERGIA)	• High rates	-	• Adopt strategies to reduce consumption • Track consumption through accounts and hydrometer	• Insert in the project mechanisms to reduce the consumption of water and electricity. • Deploy rainwater reuse facilities	• Reduction of tariffs. • Foster water and energy savings through exemptions and benefits in the bills

Source: Authors, 2016.

4.5.3. PHYSICAL-URBANISTIC ORDER

Frame 36 – Recommendations Frame – Physical-urbanistic Order

RECOMMENDATIONS FRAME | PHYSICAL-URBANISTIC ORDER					
ASPECT	ISSUE	BENCHMARKS	RECOMMENDATIONS		
			USER	DESIGNERS	PUBLIC PLANNERS
1. LANDUSE	- Unconsolidated commercial, institutional and service activities, most of them are only land demarcations without qualification or buildings qualified for the use of the population. - 91% residential, 4% commercial, 4% services and only 1% institutional, considering the 6 lots.	- MCMV Program (Brazilian Social Housing Program Rules) - COMPLEMENTARY LAW No. 523 - on the parcelling of the land of the Municipality of Uberlândia and its districts.			- Ensure compliance with minimum urbanisation parameters in the implementation period, providing and consolidating all necessary infrastructure and equipment before the residents move to the location
2. FACILITIES	- there is only one community centre in good condition - Insufficient facilities for local population demand -There are many areas without planning, or landscape and architectural projects. They are in poor conditions for the permanence and conviviality of the residents. (in poor conservation)	- ITDP - Institute for Transport and Development Policy and LAB CIDADE / Methodology USP	- Adoption of empty sites for community uses and necessity as part of socialising, recreation and conservation - Preserve, maintain and use the facilities, which area already available		- Ensure compliance with minimum standards of urbanisation in the implementation period, providing and consolidating all the infrastructure and facilities needed before the residents move to the location
3. INFRASTRUCTURE	- Sidewalks in poor condition - Lack of signage and accessibility on streets and sidewalks - Construction site improperly disposed of on sidewalks - Street lighting - Missing selective collection - Dumpsters are not suitable - Rainwater harvesting	- MCMV Program (Brazilian Social Housing Program Rules) - Brazilian Technical Standard NBR 9050 / 2004- accessibility and urban accessibility guide - CREA-MG, 2006 - Technical Standard NBR 9283/1986 and NBR 9050/2004 - Urban Furniture and Accessibility.	- Maintain the sidewalks good conditions, avoiding the accumulation of garbage and household waste and construction. - Littering the trash - Collaborate in the selective collection and to send to organs that reuse the material, such as the NGO Estação Vida. - Adopt ways to recycle and reuse waste - Pay attention to materials and accessibility on sidewalks when paving or make reforms.	-Specification of superior quality and performance materials and finishes for side walking.	- Pay attention to higher quality materials and performance for sidewalks - Improve road signs and sidewalks - Review of the destination of recyclable waste - Campaigns for the cleaning and conservation of empty lots and permanent preservation areas. - Improve public lighting
4. TRANSPORT	- Public transport does not match with the population demand required	- ITDP - Institute for Transport and Development Policy and LAB CIDADE / Methodology USP	- Search for alternative ways of locomotion - Create ways of sharing private cars		- Try to meet the demand for public transportation - Bring more public transport options - Improve infrastructure for bicycle paths
5. COMMERCIAL AREAS	- Absence of medium and large-scale trade and services - Absence of variety and opportunities - Irregularity and opposition to legislation: prohibition of occupation of compulsory license, use and occupation. - Interference in the conditions of comfort and environmental health.	- MCMV Program (Brazilian Social Housing Program Rules) - NBR 15575 - Part 1 - Criterion 16.3.1 (Brazilian legislation)	- Consult specialists and / or study the best option to expand trading rooms in your residence. - Attempt to comply with the standard of posture in order to preserve health and good relations between neighbours, as well as the security of the community. -Attempt for the existence of alternative and often cheaper resources and construction techniques in solving problems arising from reforms in non-flexible environments.	- Resources to flexibility the environments to adapt the residences, with the purpose of conditioning more flexibility, consequently generating more opportunities and varieties of services and commerce for the neighbourhood -Provision of technical material readable and in language accessible to laypeople, making possible access to important information regarding construction, as well as demonstrating constructive alternatives capable of solving a lot of problems already foreseen.	- Ensure compliance with minimum urbanisation parameters in the implementation phase, providing and consolidating all necessary infrastructure before the residents move to the location - Review of project proposals for housing of social interest, foreseeing adequate adaptations of the dwellings for the generation of extra income -Review of project proposals for housing of social interest, considering the demands and limitations of

				contemporary users. - Proceed to regularise irregular areas, by offering counterparts.
6. SECURITY AND SAFETY	- High rate of drug and robbery trafficking; - Bad relationship between neighbours; - Lack of police station and frequent policing.		- Maintain relations of good coexistence between neighbours - To create a system of vigilance among the inhabitants themselves to assist in the fight against crime.-Attempt for the existence of alternative and often cheaper resources and construction techniques in solving problems arising from reforms in non-flexible spaces.	- To pay attention to the projects, in order to create spaces that are not conducive to the carrying out of crimes and illegal activities. Ex: wide open spaces, well lit and with visualization on all sides; - Designing spaces that encourage civility and movement of persons, by inhibiting the criminal practice.	- Deployment of police station -Increase policing and frequency of same in the region - Implement social programs to combat drugs and violence.
7. FOOD COMSUMPTION	- Low rate of utilization of the lot for food production either for own consumption or income generation - Residents understand that permeable area is area of greater dirt and demand greater cleaning care		- Better use of the lot to produce the food itself and / or generate extra income from the food production	- Flexibility and better representations (incentives) of projects that use the permeable area for food production	- Programs of incentives and learning of food production at home - Availability of seeds and seedlings of free plants
8 – INCOME	-Low monthly income.	- Inter-union Department of Statistics and Socioeconomic Studies (DIEESE)	- Consider how to get social tariffs for energy or light bills through public entities (eg CRAS) -Resources for flexibility in the environment so that the budget does not have to be sacrificed in reforms. Ex: furniture that can be folded, foldable and / or multifunctional. - To use their own residence to generate income, with the sale of products and the provision of services complying with the appropriate legislation (occupation of compulsory leave and respecting the conditions of environmental comfort and healthiness.	- Consider during project durability and maintenance of the materials, not to sacrifice the income of the residents in the long term. - Flexibility of residential project to adapt commercial area if necessary	-To guarantee compliance with minimum parameters of urbanization in the evaluation and approval phase of new ventures. -Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users. - Review of the guarantee of the house, because according to the manual of the resident, is allowed the addition of commercial area. However, still according to the manual, any alteration or remodelling in the home the owner loses the guarantee. - Proceed to regularize irregular areas, by offering counterparts to the population concerned.
9 - IRREGULAR OCCUPATION	- Irregular occupations consolidated in the areas of permanent preservation - Contamination of soil, river and springs due to sewage that is released directly	- Forest Code Law nº 12.651 / 2012	- Collaborate with complaints, supervision of permanent preservation areas		- Proceed to regularise irregular areas, by offering counterparts to the population concerned. - Review of the national housing program prioritising the less well-off social strata - To supervise the families and houses that are delivered in the MCMV program - Awareness programs for the population to understand the importance of natural resources

Source: Authors, 2016.

4.5.2. PHYSICAL-ARCHITECTONIC ORDER

Frame 37 – Recommendations Frame – Physicial-architectonic Order

ASPECT	ISSUE	BENCHMARKS	RECOMMENDATIONS		
			USER	DESIGNERS	PUBLIC PLANNERS
1. Design	- Situation in a high declivity area without safety devices adopted: structural vulnerability and inaccessibility. -Inner useful area shorter than the 36 m² recommended: difficulty to furnish. -Closed design: does not favour functional extensions. -Semi-detaching as the main problem of the house- causes problems of privacy and acoustic comfort.	-Programa MCMV -Parâmetros Mínimos de Urbanização (??)	-Resources for flexibility of the rooms: retractable, folding and / or multifunctional furniture.	-Compliance with minimum design parameters. -Use of easy access and maintenance systems and materials in order to guarantee comfort and good performance indoors.	-Ensure compliance with minimum parameters of urbanization in the evaluation and approval phase of new ventures. -Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users.
2. Construction Systems and Materials	-Low quality of sidewalk materials. -Execution failures compromise performance and speed up system degradation.	-NBR 15575 – Parte 2 - Requisito 7.3 -NBR 15575 – Parte 4 - Requisito 7.2 -NBR 15575 – Parte 4 - Requisito 10.1 - NBR 15575 – Parte 4 - Requisito 10.2 -NBR 15575 – Parte 3 - Critério 10.2.1 -NBR 15575 – Parte 3 - Requisito 10.4 -NBR 15575 – Parte 3 - Requisito 14.2 -NBR 15575 – Parte 3 - Requisito 14.3 -NBR 15575 – Parte 3 - Requisito 14.4	-Integrate yourself of your rights and responsibilities, and fulfill them. - Observe carefully the conditions of integrity of the property at the time of delivery. -Do the maintenance as recommended in the user manual.	-Continuous follow-up of the construction site. - Offer of well-executed and detailed executive projects, in order to reduce the occurrence of execution errors, which endanger the users. -Specification of superior quality and performance materials and finishes.	-Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users.
3. Manteinance	-Finishing materials given do not withstand conventional cleaning. -Inappropriate disposal of waste: they attract undesirable animals.	-Programa MCMV -Código de postura de Uberlândia, lei nº 10.741 de 6 de abril de 2011.- capítulo IV -NBR 15575 – Parte 6 - Critério 15.2.1 -NBR 15575 – Parte 6 - Critério 15.2.2 -NBR 15575 – Parte 6 - Critério 15.3.1 -NBR 15575 – Parte 6 - Requisito 15.4 -NBR 15575 – Parte 6 - Critério 15.5.1	- Attempt to comply with the standard of posture in order to preserve health and good relations between neighbours, as well as the security of the community.	-Specification of superior quality and performance materials and finishes.	-Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users.
4. Services	- Sewage system overloaded: reflux in the interior of the residences. -Absence of retaining walls: risk to the integrity of residences. -Insufficient public lighting. -High cost of energy and water bills.	-NBR 15575 – Parte 1 - Critério 8.2.1.2 -NBR 15575 – Parte 1 – Adequação Ambiental 18.5 -NBR 15575 – Parte 5 – Requisito 10.1 -NBR 15575 – Parte 1 - Requisito 18.4.1 -NBR 15575 – Parte 6 – Critério 16.1.1 -NBR 15575 – Parte 6 – Critério 16.2.1 -NBR 15575 – Parte 6 – Critério 16.3.1	-Diagnosing the occurrence of gas or energy leaks -Mobilize with the community in order to identify collective demands and make them available to the public administration.	-Continuous follow-up of the construction site. - Offer of well-executed and detailed executive projects, in order to reduce the occurrence of execution errors, which endanger the users.	-Promote revision of urbanization parameters: obligatoriness of project and execution of rainwater drainage system in allotments; -Ensure compliance with minimum parameters of urbanization in the evaluation and approval phase of new ventures.
5. Internal Layout	-Conclosed design + self-supporting construction system: difficult adaptation and safety risk. -Project designed for a particular family profile does not contemplate the needs of contemporary users. -Difficulty on furnishing overcome by occupying rooms in height and width, compromising comfort and functionality.	-Programa MCMV -Funcionalidade e Qualidade Dimensional na Habitação – Contribuição à NBR 15575/2013 – Gabriela Morais Pereira -Código de obras municipal - Lei Complementar Nº 524, de 08 de abril de 2011	-Resources for flexibility of the rooms: retractable, folding and / or multifunctional furniture.	-Predict the evolution of the house in the time and space in order to turn easier the appropriation and adaptation by the users.	-Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users. -Review the PMCMV parameters related to the service area of the house.
6. Adaptation and Refurbishment	-Small size, technical problems and low privacy and safety and low comfort are prime reasons for refurbishments. -High costs involved makes reforms impossible. -Malpractice and recklessness pose risks to the integrity of the building and the safety of users.	-NBR 15575 – Parte 1 - Critério 16.3.1	- Attempt to comply with the standard of posture in order to preserve health and good relations between neighbours, as well as the security of the community.	-Provision of technical material in language accessible to laypeople, making possible the access to important information regarding the construction, as well as demonstrating constructive alternatives capable of solving a lot of problems already foreseen.	-Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users.
7. Adaptation for Commerce	- Irregularity and disrespect to current legislation: occupation of compulsory lateral spaces, use and occupation prohibited. - Interference in the conditions of environmental	-Programa MCMV -NBR 15575 – Parte 1 - Critério 16.3.1	-Attempt for the existence of alternative and often cheaper resources and construction techniques in solving problems		- Proceed with regularization of irregular areas, by offering counterparts to the population concerned.

	comfort and healthiness.		arising from reforms in non-flexible spaces.		
8. Comfort	- Absence of acoustic insulation: lack of privacy and wear and tear of the neighbourhood relationships. - Discomfort due to heat and cold in the laundry: room exposed to weather. - Occurrence of mold due to obstruction of openings by enlargements.	- Código de obras municipal - Lei Complementar Nº 524, de 08 de abril de 2011 – Artigos 50, 51 e 54.	-Attempt for the existence of alternative and often cheaper resources and construction techniques in solving problems arising from reforms in non-flexible spaces.	-Predict the evolution of the house in the time and space in order to turn easier the appropriation and adaptation by the users.	-Review of project proposals for housing of social interest, considering the demands and limitations of contemporary users.
9. Privacy	- Rooms that do not favour individuality and privacy. - Lack of privacy and security in relation to the street: no external walls. - Semi-detachment without proposal of acoustic insulation causes privacy problems.	-Índices Urbanísticos - lei complementar nº 525, de 14 de abril de 2011, Zoneamento do Uso e Ocupação do Solo – Cap. V - Anexo VII – Tabela 2 – Volumetria. Afastamentos, frontal, lateral e de fundo e Coeficiente de aproveitamento. -Lei Complementar Nº 524, de 08 de abril de 2011 – Artigo 75 -NBR 15575 – Parte 4 - Critério 12.3.1		-Specification of superior quality and performance materials and finishes. -Provision of technical material in language accessible to laypeople, making possible the access to important information regarding the construction, as well as demonstrating constructive alternatives capable of solving a lot of problems already foreseen.	
10. Previous Housing	- Reduced size of the current house. - Low quality of materials and finishes of the current house when compared to the previous one. - Low quality in the provision of basic urban services: current unfavourable location.		-Mobilize with the community in order to identify collective demands and make them available to the public administration.	-Understand the physical, environmental, social and economic conditions of the place where the housing complex is inserted in order to propose more heterogeneous urban zoning and benefit the population in terms of variety, proximity and accessibility.	

Source: Authors, 2016.

4.8 RECOMMENDATIONS FOR PROJECT STAGES

From the previous recommendations that aim to solve or minimize the problems found in the SOCIOECONOMIC, NATURAL-CLIMATE, PHYSICAL-URBAN, and PHYSICAL-ARCHITECTURAL orders presented in the previous frames, the following frame summarizes the recommendations that can be made through design, in a more detailed manner, in agreement with the existing project stages in the country, according to the norm NBR 13532 - Elaboration of projects of buildings - Architecture; Manual of orientation of projects of the Municipal Secretariat of Urbanism of Rio de Janeiro - SMU; SCRIPT FOR THE DEVELOPMENT OF THE BUILDING ARCHITECTURAL PROJECT (Document approved at the 77th Meeting of the Superior Council of the Institute of Architects of Brazil, held in Salvador, Bahia, and fee schedule of Architecture and Urbanism services of Brazil produced by CAU - Architecture and Urbanism Council).

The building architectural design comprises 5 phases, which are: PLANNING (data collection, architectural brief and feasibility studies), PRELIMINARY STUDY, PRE-PROJECT, LEGAL PROJECT and EXECUTIVE PROJECT.

In Brazil the design stages are defined as follows:

• DATA SURVEY FOR ARCHITECTURE: Stage for the collection of reference information that represents the preexisting conditions of interest in order to instruct the elaboration of the project, being able to include physical data (planialtimetric, cadastral, geological, water, environmental, climatic, ecological and other data); technical data; Legal and juridical; Social issues; Fire safety; Security against intrusion and vandalism; ergonomics; Computer and building automation; and others.

• ARCHITECTURAL BRIEF: Stage to determine prescriptive or performance requirements (user needs and expectations) to be met by the building to be designed.

• ARCHITECTURAL FESEABILITY STUDY: Stage for the elaboration of analysis and evaluations for selection and recommendation of alternatives for the design of the building and its elements, facilities and components.

• PRELIMINARY ARCHITECTURE STUDY: Stage destined to the design and representation of the approximate initial technical set and necessary information in order to understand the building configuration. It also might include alternative solutions and initial configuration of the architectural solution proposed for the project, considering the main requirements contained in the architectural brief.

• PRELIMINARY ARCHITECTURE OR PRE-EXECUTION PROJECT: Constitutes the final configuration of the architectural solution proposed, considering all the requirements contained in the architectural brief and the Preliminary Study approved by the client.

• LEGAL ARCHITECTURE PROJECT or Approval Project is a sub-phase to the preliminary project, developed, according to the previous case, concomitant or after it. It is the technical-legal configuration of the architectural solution proposed, considering the requirements contained in the architectural brief, the preliminary study or preliminary architecture project approved by the client and also according to to the technical presentation and graphic representation standards defined by the public agencies (in Special, City Hall, Fire and Public Services Department).

• EXECUTION ARCHITECTURE PROJECT is the sub-phase destined for the final design representation of the technical information of the building and its elements, facilities and components, complete, definitive, necessary and sufficient for the bidding and execution of the corresponding work services. Which means the set of technical documents (memorials, drawings and specifications) necessary for the bidding and/or execution (construction, assembly, manufacture) of the project. It constitutes the developed and detailed configuration of the Draft approved by the client.

RECOMMENDATIONS FOR PROJECT STAGES				
ORDERS				
STAGES	**SOCIO-ECONOMIC**	**NATURAL-CLIMATIC**	**PHYSICAL-URBANISTIC**	**PHYSICAL-ARCHITECTONIC**
PLANNING (Data Collection, Program Needs, Feasibility Study)	- Analyze the current family profiles of future users, ensuring that the needs program raised meets the current lifestyles of these families - Take into account the average income of these families: consider the project maintenance cost in long term; predict sustainability strategies that help reduce energy and water - Conduct participatory meetings to give space to the user's voice, their wishes and needs		- To understand the existing situation of the site, analyzing and identifying in the place and surroundings aspects such as historical and socio economic context, the urban environment, the land situation and current urban legislation, their potentialities and the expectations of the community and / or users of the site and so on. - Definition of a basic proposal aiming at understanding the psychosocial reality of the local population to be benefited directly and indirectly by the Project. - Characterization of the population's profile involved; - Attention to access and organization of the roads; - Assessment of existing urban vegetation: attending aesthetic functions, ambience and climate and planting possibilities; - Survey and analysis of bus lines, stopping points and respective frequency / time; - Review of the urban insertion of the MCMV Programme related to a more qualified and consolidated local, with more facilities and infrastructures.	- Ensure compliance with minimum parameters of urbanization in the evaluation and approval phase of new ventures. - Review of project proposals for social housing, considering the demands and limitations of contemporary users. - Promote revision of urbanization parameters: obligatoriness of project and execution of rainwater drainage system in allotments; - Review of MCMV Programme parameters related to the service area project.
PRELIMINARY STUDY	- Consider the project location in relation to existing public facilities, commerce and services - Conduct participatory meetings for discussion, with the user, about the main facilities and establishments required - Propose commerce/service strategies that can be led by the community itself - Assess site security level: predict vulnerable areas	- Study of the soil, hydrography, topography and vegetation of the area to be implanted the allotment. - Insolation study. - Study of the predominant winds in the city - Study of climatic variations throughout the year, in the city where the allotment will be implanted.	- Definition of the deployment concept, observe and meet the physical, environmental constraints of the site at the time of deployment. - To Understand the demands of the initial configuration of the intervention proposal, taking into account the needs of the program, the interrelationships with the actions of agencies and the community's wishes and the evaluation of the expected effects with the implementation of the Project in the area and its surroundings. - Provide courts with comfortable and walkable dimensions for residents and other pedestrians. - Evaluation of the effects, both positive and negative, of proposals for urban interventions (road system, drainage and others); - Traffic Studies, considering: analysis of the track capacity, calculation memory and other necessary elements;	- To understand the physical, environmental, social and economic conditions of the place where the development is inserted in order to propose more heterogeneous urban zoning and able to benefit the population in terms of variety, proximity and accessibility. - Provide the regularization of informal areas, through the offer of counterparts to the community.

			- Transport Study, considering the proposed changes to the collective transportation system (buses), making compatible with the new Road Traffic Project; - Paths, considering: paving, uses, accessibility according to ABNT NBR 9050 (Brazilian's benchmark) and special floors for orientation of the visually impaired; - Lighting study, with distribution pattern (considering: height for luminaires, spacing, etc.), with presentation of the basic stretches of lanes, blocks and leisure areas and the respective photometric worksheets; - Pre-selection of materials - poles, lamps and lamp types indicated. - Hydrological studies, determination of the hydrological parameters for the sub-basins. - Topographic Survey services should be completed at this stage	
preliminary draft	- Ensure flexible design considering family profile, and future transformations over time - Predict collective areas with activities that can strengthen the collective conscience - Assess the level of site security: provide spaces for entities that combat social vulnerability; propose community surveillance strategies.	- Foresee the preservation of the green áreas where the allotment will be implanted. Especially vegetation near the rivers. - Predict maintenance and revitalization of the course of the rivers, and enable the population to approach this region through the creation of parks and / or leisure areas. - In the allotment project, optimize the distribution of green áreas and recreation along the neighborhood, so that more people can have access to them. - Promote vegetation and the use of water as a landscape element in the allotment, so that the sensation of low humidity can be softened. - Implement the allotment in a way that prevents large cuts and landfills, as well as a large declivity of the streets. - Design of the blocks with larger sidewalks, so that it is possible to plant trees without obstruction of pedestrians. - Dimensioning of the pluvial system of the allotment and of the houses, according to pluviometric indexes of the project site. - In the houses, adopt constructive strategies according to the bioclimatic zone in which the project is inserted, in order to optimize the thermic performance of the dwellings, as recommended by NBR 15.220-3.	- Attend to the division of the houses lots, so that all are equally benefited. - Delineate the necessary infrastructure - Attention to the norms of the road system: with calculations considering: curve rays, number of lanes and width of the track, pedestrian band, width of sidewalks, location of shelters and signaling for bus stops, and so on. - In the landscape aspect, consider the existing plant variety, adapt the species to be used, sizing of the collars of the trees, report on the trees subject to removal with quantities, among others. For the party landscape is conditioning part of the local microclimate improvement. Ensuring environmental comfort to residents. - Regarding public lighting, the architect should consider the location of lampposts in the Urbanization Project (UR) indicating the interferences of the marquees, garages, trees, etc. - Regarding Urban Legislation: the architect can identify or suggest aspects that can be objects of reviews and other control standards of land use and urban postures and delimitation of the area to be further regulated by law, indicating the legal instruments, which can increase the proposed public investments.	- Forecast the evolution of the property in the time and space in order to facilitate the appropriation and adaptation by the users. - Use of easy access and maintenance devices to guarantee comfort and good performance indoors. - Use of resources for flexibilization of environments: furniture that can be folded, foldable and / or multifunctional.

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		- Predict the solar protection of the openings located on the façades with great solar incidence. - Predict greater use of sunlight inside the houses. - In the prediction of the evolution of the property, consider that the correct ventilation and natural lighting of the rooms must be maintained. - Implement rainwater and / or gray water reuse. - Adopt renewable and less polluting energy sources. - Insert in the project mechanisms to reduce the consumption of water and electricity. - Adopt architectural and landscape strategies that ease the feeling of low humidity inside the houses. - In the project, adopt constructive techniques that generate less waste.		
LEGAL PROJECT	- Promote participatory meetings to give the community awareness about their rights and duties. - Provide training activities that reinforce collective awareness: management and community leadership courses.	- In the project of the allotment, predict green areas, adequate the expected population density. - Respect the Permanent Preservation Areas. - In the project of the property, respect the minimum permeable area required. - Dimension the ventilation and natural lighting openings according to current legislation.	- This step is the approval of the competent public bodies for execution and detailing the preliminary design.Therefore, all previous information should be complemented and standardized according to the current standards, established by the relevant technical sectors, of all spheres (Municipal, State, Federal and private) involved, through their Manuals and Project Norms, Technical Norms (ABNT), Legislation, among others.	- Compliance and supervision of minimum design parameters (lateral distances, occupancy rates, soil permeability, accessibility), as well as minimum recommended dimensions for residential environments.
EXECUTIVE PROJECT	- Establish a Residents' Association and their leaders, so that they can follow the construction process more closely until the delivery phase. - Promote, throughout the the project execution, booklets, workshops and training courses that can guarantee the best adaptation of the user to the place, involving topics such as: technical aspects of construction; sustainable practices; flexible do-it-yourself furniture, etc.	- Use materials and finishes that cause less environmental impact.	- The executive project constitutes the completion of the basic design, with the information and details required for execution of the work in accordance with the relevant standards of the Brazilian Association of Technical Standards - ABNT. Thus, the architect should considerate the details of infrastructure such as sewage, lighting, street lighting, drainage, guide drawings, road profiles, among others.	- Offer of well-executed and detailed executive projects, in order to reduce the occurrence of execution errors, which endanger users. - Specification of materials and finishes of better quality and superior performance. - Supply of technical material readable in a language accessible to laypeople, making it possible to access important information related to construction, as well as demonstrating constructive alternatives capable of solving a lot of problems already foreseen. - Assiduous work follow-up.

Source: Authors, 2017.

PART 5
METHODOLOGY REVIEW

This project has used advanced techniques of Post-Occupancy Evaluation (POE) and Co-production to develop methodological procedures of analysis in housing developments of social interest. The analysis focused on the adaptability and resilience of the built environment in meeting the needs of its residents and the environmental impact resulting from these ongoing transformations. In order to fulfill the proposed objectives, it was carried out: (i) bibliographic research - theoretical foundation and definition of terms and concepts used; (Ii) exploratory research – data collection and information of the study object and (iii) applied research - development and application of POE and Co-production in a case study. The analysis focused on three elements: (i) BUILT ENVIRONMENT – set of houses constructed, contemplating the scales of the neighbourhood, the block and the unit, and the relations of impact between the built and natural environment; (Ii) AGENTS - agents that interfere in the social dynamics of the place; (iii) USERS - residents of the built set of houses. The evaluation focused on the socioeconomic, functional, behavioral and environmental aspects of the built environment. Seeking a better operationalization of the previously mentioned methodology, the work was divided in 5 parts, in which each researcher of the team contributed more specifically:

1. GENERAL CHARACTERISTICS - state of the art, description of the housing program, general characteristics of Uberlandia city and the object of study;

2. SOCIAL, DEMOGRAPHIC, AND ECONOMIC DATA - ongoing NGOs, churches, social organizations and municipal authorities;

3. URBAN INSERTION - location, physical characteristics, mapping of land use, height of buildings, construction and land use regulations, facilities, public transportation and environmental impact.

4. COMMERCE AND SERVICES - adaptation of residential buildings to serve as retail store, typologies, spatial distribution, pedestrian flows, and the main products available.

5. HOUSING UNITS - built system, typologies, space use, adaptations, materials used in construction, average energy cost per household.

The aspects to be evaluated were determined in each group indicated above in which the tools were associated. Subsequently the tools were elaborated one by one, always complementing each other's results (Frame 39). This complementation, often called multiple methods, aimed to adjust possible variances and inconsistencies of the obtained data.

Frame 39 - Used tools on evaluating Shopping Park Neighbourhood.

TOOLS
DIGITAL QUESTIONNAIRE
Description: Quantitative method that seeks to collect data from a series of questions answered by users. A highly recommended method when there are a varied number of people involved in an evaluation process. Its main advantages are: being a quick method; possibility to work with larger group of respondents and/or vast areas; impartial answer, which means anonymity allows safety and a great freedom of response; and greater uniformity in the evaluation.
Means: Digital with 180 questions lasting on average 40 mins each.

Sample: 40 houses located in an allotment of 200 houses (20% of the whole community)
Date/place: July 5 th to 11 th, 2016 - 40 residences in a block located at Shopping Park's Neighbourhood
WALKTHROUGH
Description: Quanti-qualitative method of analysis based on quality concerns for measuring and descriptive and qualitative identification of positive and negative aspects of environment, also allowing acheck of the current situation. The analysed themes are: i) Surroundings, ii) Allotment, iii) Housing.
Means: Script on paper and textual and photographic recording.
Sample: Chosen as representative housing lots, considering key variants, such as the solar orientation and the different geographical positions of the allotment.
Date/place: July 8th and 11th, 2016 – 4 residences in the same block located at Shopping Park's Neighbourhood.
CO-PRODUCTION
Description: Qualitative and participative evaluation method where the researcher remains impartial, working as a facilitator on production and management of space by the involved parties. According to Petcou and Petrescu (2015), it is not only about an alternative way to face unmet public demands, but also a way to provide effective access to the city.
Means: Script on paper, mapping techniques, textual and photographic recording and group dynamics.
Sample: 8 people at the 1st Co-production and 10 people at the 2nd – Invitations through brochures, advertisements, and WhatsApp messages, for those who have participated on Questionnaires and Walkthroughs.
Date/place: July 9th and August 7 th, 2016, at the Center of Unified Arts and Sports (CEU).

Source: Auhtors, 2016.

Some authors indicate that, in order to understand the complex problems of researching in the area of environment and behavior, it is necessary to accept both quantitative and qualitative methods, configuring what is known as multiple methods (Villa, 2013). This is because research based on a single type of information collected through a single technique is usually seen as suspicious or even presentingdubious results, since all methods have positive and negative points, and their applications depend on the characteristics of the problems addressed in the object in question (Marans and Ahrentzen, 1987). Kish, in 1987, pointed out three criteria to evaluate statistical and methodological delineations: representativeness, randomness and realism. Hardly a single study would present all these qualities, even if they were the predominant features of observation, experiment and data collection. When choosing one or other of these methods, a compromise solution with the final result of the work is necessarily assumed (Günther, 2006; Günther, Elali and Pinheiro, 2004). In this sense, the application of several methods to the collection of different types of data on the same phenomenon counterbalances the deviations / trends (bias) in a method with the deviations of the other methods used, since one can assume that the techniques used for each method have different deviations in those investigations (Lay and Reis, 2005, p.23).

Because, the number and variety of measuring tools have been expanded in evaluations of the built environment, it is recommended that thechoice used to to confirm evaluations usingmultiple methods, is based on the careful planning of the evaluations. This is because, depending on the choice of tools, this set of multiple methods, initially designed to counterbalance the deviations and trends of evaluation, may function inversely, moving in and concentrating on some points and arguments evaluated to the exclusion of other essential areas of consideration.

In the specific case of our study, the co-productions required a major focus of attention in order to bring different profiles of residents, ages, professions, among others, which gave a greater variety in the answers obtained, thus expanding their universe beyond their own individual considerations. In essence, co-production can result in a whole understanding that is greater than the sum of its parts, in terms of a community exercise, where different viewpoints inform eachother.

5.1 GENERAL OBSERVATIONS ON METHODOLOGICAL PROCEDURES

The research reported here was based mainly on these considerations when outlining its methodological procedures, highlighting the approach of multiple evaluation methods about quantitative and qualitative aspects of housing. The research has also considered the possibility of replication of the techniques in large scale, using for this a web platform specifically developed for the research and of portable equipment like the e-tablet for collection and compilation of information. Such methodological improvement are justified in order to bring possible solutions to the frequent problems in the field of housing evaluation: i) the efficiency of the evaluation results; ii) the issue of the privacy of the residents evaluated; iii) the possibility of greater interaction between the researcher and the resident in the evaluation; iv) reduction of the evaluation time; v) reduction of evaluation costs; vi) the effectiveness on data tabulation of evaluations' results; and (vii) the capacity of the evaluation to constitute itself as the process of transformation of the place. Each of these aspects is detailed below.

5.1.1. EFFECTIVENESS OF EVALUATION RESULTS

A frequent discussion relies on the reliability and consistency of the data obtained through quantitative surveys, based on questionnaires with answers that vary from the lowest to the highest value. It was initially considered that multiple choice questionnaires obtained the truth about the ways of living of the evaluated ones. However, the research here indicates that the high levels of overall satisfaction obtained in these evaluations are due to the contextual situation and do not necessarily reflect the constructive quality of the dwelling and its levels of environmental comfort (Kowaltowski et al., 2006). Therefore, we sought, in this particulary study, to provide a set of evaluative methods of the living space that provide results that are increasingly faithful to reality. The issue is not limited to the design of the tool used, but also includes the development of evaluative resources (such as the co-production sessions) that increasingly involve the resident evaluated in the proposed discussion, thus increasing the validity of the results obtained. In this case, the use of colors in the response fields (green for positive, yellow for neutral and red for negative) of the digital questionnaire was an important facilitator of the fidelity of the responses through the graphical interface. Colors help people categorize their impressions into positive (often related to green) and negative (often associated with red) patterns, also facilitating rare situations when respondents could not read. The results of the application of questionnaires were very close to the results of the walkthrough. However, co-production proved to be a very relevant tool of the research, as it allowed a deep gathering of the collective desires, expectations and ways of living of the residents of the evaluated groups.

A review of the questionnaire by the researcher is always recommended at the end of each application, which can contribute greatly to the improvement of the tool (see comments on "tool impressions").

5.1.2. PRIVACY OF EVALUATED RESIDENTS

Much of the difficulty with housing evaluations lies in the fact that the researcher has to deal with the intimate and particular aspects of the residents. Thus, both the data collection and its interpreting may suffer distortions due to the higher or lower degree of exposure desired by the interviewee. In these cases, depending only on the verbal expression of the residents may lead to misunderstanding. It is suggested, therefore, to incorporate into the evaluation well qualified professionals for the observation and interpreting of subjective and abstract aspects, especially during the development of dynamics such as co-production, when an understanding of body language and expressions can contribute to a greater precision in the analysis of the data. In the context of this research, co-production was performed which needed the presence of researchers who, in addition to monitoring the participatory dynamics, also reported on their main impressions, both from the point of view of the methodology itself and from the results obtained (see comments in "impressions about the co-production "). It was noticed that, although the majority of the residents initially rejected participation in the opinion and satisfaction surveys, when they became aware of the relevance of the research and that, although on a small scale, this would be the tool of modification and qualification of their city, they enthusiastically participated in the proposed evaluation. Thus, in many

moments of this research, the process has surpassed the final product - in this case, the results obtained. It is important to note that the interest of the residents is closely linked to the desire for improvements in the infrastructure of the houses and the neighbourhood inserted.

5.1.3. POSSIBILITY OF GREATER INTERACTION BETWEEN THE RESEARCHER AND THE RESIDENT IN THE EVALUATION

Due to the difficulties of extracting intimate and personal data from the residents, there is a particular need to associate more traditional methods (POE) with more interactive methods (e.g. co-production) in the housing evaluation process. It is believed that the efficiency of the methods used together increases as the resident is attracted and recognized in the research. The means of interactivity between the exploited graphic resources and the residents should be tested in order to achieve these goals. The discussions and presentations proposed in the co-production have proved to be an efficient tool in showing the inhabitants other ways of appropriating space, which in many cases were not part of their consideration. Such an attitude could awaken in the residents a critical reassessment of their houses. Questions about the collective housing and the role of the citizen in the construction of a better city were also raised. The positive involvement of some residents in research has demonstrated an initial formative contribution to future improvements in the MCMV program, even though this may take some time to gestate. During the dynamics, some residents showed greater commitment and concern with the areas of collective use of the neighbourhood. In the co-production sessions, several proposed projects for public spaces, which have collective areas planned and mainly landscaped and equipped (banks, flowerpots, toys, lighting, games, etc.) were presented to the participants of the group and obtained, almost entirely, approval. Careful facilation is needed when using co-production sessions to ensure all participants have an equal voice, otherwise the session outcomes can be distorted by a few vocal individuals. Researchers undertaking the facilitation co-production paid considerable attention to this issue, to ensure that all voices were heard. Interestingly, it was the women in the community who were the most vocal in these sessions, and this has to be taken into account in any evaluation of the research results from these sessions.

5.1.4. REDUCTION OF EVALUATING TIMES

Overly extensive investigatory techniques can compromise the quality of the results obtained in evaluations of housing spaces, since the resident soon tires and feels unmotivated to answer so many questions. The traditional forms of application of questionnaires and interviews are printed versions, formulated and applied by trained professionals *in loco*, or even filled by the resident himself (this can generate self-doubts by the participant in the completing the forms and, therefore can lead to irregularity of the results). On the other hand, light touch evaluations can compromise the depth of data obtained, leading to a superficiality in post-occupancy evaluations. In this pilot POE, a balance was sought in the form of collection (use of the e-tablet), and in the quantity and depth of information (evaluated attributes). It was found that the e-tablet questionnaire reduced the mean time of application (a mean reduction of ten to twenty minutes compared to the paper questionnaire applied in previous research) and have also facilitated a better understanding of the semantic differential questions as distinguished by color. There was a positive acceptance of the new tool by the residents, mainly by those who handled the e-tablet to answer the questions. With an average time of thirty minutes of completion, the questionnaire met the initial expectations of this research, without compromising the expected depth. Another important aspect of research efficiency is the performance of the pre-test. This is because the tool's pre-test is fundamental for checking the information and the initial feedback of the respondents regarding the evaluation method developed.

During the application of the questionnaire in a digital medium, notes were made by the researchers in order to improve the proposed tool. These observations were analyzed by the executing research team and improvements were implemented in the tool. The main observations indicated by the respondents were: (i) despite the digital mean, they found the questionnaire too long; (Ii) some questions have proved to be

repetitive in practice; and (iii) some questions have proved to be confusing and incomprehensible in practice. These indications were corrected and implemented in the revised questionnaire.

5.1.5. REDUCTION ON EVALUATION COSTS

The traditional applications of questionnaires and / or other techniques printed on paper can lead to high costs for research, as well as the use of envelopes, folders, labels, among others. In addition, the use of such materials leads to unnecessary waste, leading to a greater environmental impact. In this survey, operating costs were greatly reduced due to the use of portable e-tablet equipment - a positive aspect which this research intends to be a pilot for another evaluations at the national level. The reduction of evaluation costs was also influenced by the efficiency and reduction of the data tabulation time of the results.

5.1.6. EFFECTIVENESS OF DATA TABULATION OF EVALUATION RESULTS

Traditionally in POE, data tabulation consumes a significant part of the research time, because the classic forms of POE application in dwellings rely on techniques and methods printed on paper, in which the results are counted manually. There are digital media programs that can help with this count, but there is still a need for the transmission of information from the printed medium to the digital medium - consuming much of the research time that could be used for data analysis. In the context of this study, the time gained in the tabulation and counting of results was used for more elaborated analyses and corrolation of results, since the developed software alloweddifferent ways of comparing data from the questionnaires. Such a tool made possible both the data comparison, according to parameters established by the researcher, and allowed a didactic interaction with the residents through a digital interface of the evaluation questionnaire.

5.1.7. CAPACITY OF EVALUATION TO CONSTITUTE THE PROCESS OF TRANSFORMATION OF THE PLACE

Places and people can be improved, in different ways and levels, from the contact with the information derived from evaluations. Cole, in 2005, already pointed to new configurations of evaluative processes, considering and reconciling their role of evaluation and as tools for transformation of the market such as its range, as well as how they area able expose the relations between environment, society and economy. Through such methods, synergistic links can be discovered, playing a relevant role on intensifying the dialogue between a greater number of agents and the project team (Cole, 2005). The author makes a distinction between the evaluation tools as product or process. The product concept covers all aspects of assessment methods related to the scope of performance problems, including how they are structured, marked and communicated. These technical characteristics are largely dictated by the authors and researchers of the field in question and, currently, represent the main focus of the discussion. On the other hand, the process, covers a number of issues related to its use, including the maintenance and development of the evaluation system and in particular its implementation, the project team and the involvement of other stakeholders, as basis for decision-making. The distinction between product and process makes it possible to emphasize that the development of evaluation tools is only a means to an end and not an end in itself. It also avoids over-focusing on the constant improvement and comparison of the technical characteristics of the methods, rather than considering the equally important issues of the context in which they operate, how they are being applied, and their power to respond to new agendas.

In this study, we ensured the transmission of the information evaluated by the researchers involved and the proposed processes through the application of the questionnaires and the co-productions, but it is believed that the way in which this information was perceived and absorbed by the respondent residents is quite variable. The scope of this stage of the research did not allow us to evaluate these aspects more deeply, nor which interventions have already happened on the way of life and living conditions of each citizen evaluated (which will be evaluated in later stages of the research - steps 2 and 3). However, what is known is that, in this evaluation process, several demonstrated interest and involvement of the population evaluated in relation to their dwelling and the numerous thematic derivations resulting from the process. In the dynamics of co-production, this involvement could be better perceived, mainly due to the more interactive

characteristics of the proposed evaluation process and the organization and constant participation of researchers in the process. Moreover, part of this enthusiasm of the residents with the assessment could be attributed to the confidence the researchers gained during the evaluation process.

However, it is known that the great lack of this population on being heard and valued as an integral and conducting part of their neighbourhood and city could justify part of this involvement, since, in the proposed evaluation process, the residents were given voice and the opportunity to dialogue about their problems, desires and expectations with the research group people. In this sense, it is perceived that the very realization of the evaluation helps to create expectations in the population evaluated in relation to their dwelling, especially in the resolution of serious, frequent problems that are difficult to deal with. Given these expectations, it is believed that the results of this research can, besides guiding decisions for future projects more appropriate to its public, directly assist in the reparative actions and implementation of the evaluated sets of houses. In addition, such a process could contribute to the construction of better informed and, consequently, more critical and participatory citizens in their communities. At the same time, such expectations, whether raised through the interviews or the co-production sessions, need to be carefully managed, in order not to unintentionally disillusion the participants. The results and recommendations need to be carefully presented back to the residents in further co-production sessions, which explain also what the likely possibilities are of developing these actions in reality, and what is required to realise them.

Finally, both the application of the methodology proposed by the research and the interdisciplinary exchange of knowledge among researchers in the area of architecture, computation, statistics and psychology enabled improvements in POE and Co-production tools. The systematic analysis of the data provided key ramifications and referrals of the research, mainly because it was an approach that considered quantitative and qualitative methods. Through the questionnaire and walkthrough, it was possible to collect numerical data regarding residents' satisfaction, while co-production deepened the understanding of the residents' vision and feelings about the quality of the environment in which they live. The co-production allowed the residents' expression beyond a standardized format of answers, enriching the data obtained through the questionnaires applied, revealing conscious and unconscious aspects of the residents in relation to their dwellings. The co-production sessions can also help to develop a sense of empowerment in the residents, through active collective dialogue, in a way which individual questionnaires and interviews cannot.

The methodological procedures developed, as well as the results obtained in this pilot POE, suggest that it should be possible the replication of this tool at the national level, contributing effectively to the improvement of the dwellings, the city and consequently the quality of life of Brazilian citizens participating in the MCMV program.

5.2 SPECIFIC OBSERVATIONS ABOUT THE TOOLS

During the application of the tools (digital questionnaire, walkthrough, co-production) notes were made by the researchers in order to improve them further. These observations were analyzed by the research executing team and improvements were implemented. These improvements aimed at enhancing the proposed tools in order to make them more suitable for future applications. The following are the main observations made and improvements for each tool.

5.2.1 COMMENTS ON THE QUESTIONNAIRE

• In general, some respondents found it too long and repetitive;

• questions such as "what's your position in the family group and what kind of family you belong to" are confusing;

- the income question was flawed by not having the option of "less than R $ 1,000". It should be considered the existence of smaller income brackets, more consistent with the local reality;

- questions that have a scale of 5 answers (very satisfactory, satisfactory, regular, bad, very bad) end up confusing some results which do not indicate a positive or negative predominance;

- explore open questions more, as these are valuable. Most respondents added several comments in addition to the questionnaire responses that could be recorded in some way to the survey;

- respondents had difficulty evaluating temperature, acoustics, and ventilation in each room. There is a lot of contradiction in this case, and satisfaction is often evaluated as optimal while the measurement confirms bad indexes. In this case, it is clear that the performance analysis (walkthrough) and physical monitoring of such aspects is fundamental to confirm the results.

- the respondents showed some difficulty in responding to the activities they perform in each room of the house;

- In some cases the researchers had to explain and clarify the questions to the respondents, encouraging them to respond, suggesting that the questions are too complicated or jargon ridden.

- In general, people had difficulty understanding some of the terms of the questionnaire, and it was necessary to "popularize" the vocabulary at the time of application by the researcher;

- insert in the questionnaire questions related to accessibility within the residence;

- residents were very receptive to the research;

- the questionnaire gave the residents plenty of freedom once they knew they were anonymous.

5.2.2 COMMENTS ON THE WALKTHROUGH

Aspects:

- In the urban scale, items related to waste, such as the availability of ecopoints; selective collection; existence, location and quality of the bins on the sidewalks;

- In terms of the housing lot and the access to home, many residents had to build ramps or stairs which represents income impacts and interferes with accessibility;

- Within the housing lot, the need to build retaining walls was necessary for safety purposes, and created a major income impact for the owners;

- Within the housingunit, there was an evaluation of storage in general, and the availability of furniture suitable for this;

- In the urban area, the topography was not seen. Although the item 'urban insertion' describes the implementation of the blocks it is disregarded the implantation in this topography;

- The natural lighting item could be attached to the light performance item (performance analysis), just as the privacy item among neighbuors could be combined with acoustic performance (performance analysis).

- Separate the evaluation items, "signaling and conditions of circulation" in the item "accessibility".

Parameters:

- In the urban scale, the item public transport does not take into account the price of transportation given the social condition of the residents;

- The same omission is true for occasional uses for recreational, cultural, educational and health equipment. Only the existence of transport is not enough to make the place accessible – it needs to affordable and frequent;

- Within the scope of the unit, some parameter is needed to take account of the useful house area that considers not only the family composition and the possibility of full accomplishment of basic domestic activities, but also   indicate an ideal / minimum amount of area per room or per inhabitant;

- Within the scope of the housing unit, some parameter is needed for extensions in the case of units that do not have an evolutionary feature, which is the case of the evaluated units;

- Within the unit, seek better parameters to evaluate internal doors, electrical installation;

- Within the unit, there is a lack of parameters for the condition of the painting and solar heating system;

- Within the housing lot, there is no parameter that quantifies the conservation of the lot, since lots that did not present a wall were so well preserved, or better than those that presented;

- Lack of calibration of measurement equipment does not guarantee accuracy in results;

Application:

- In the scope of the housing unit, to evaluate the accessibility of an adapted unit, the chosen house should be inhabited by a wheelchair resident;

- Within the unit, the need for the participation of the neighbouring house for acoustic evaluation did not make it possible to carry out the measurement in the houses that were selected for the walkthrough, it might be necessary to make a prior appointment with the residents.

5.2.3 OBSERVATIONS ON CO-PRODUCTION

Each co-production session in Shopping Park was timed to last 2 hours, in order not to overstretch the time for participants. The sessions were structured with a brief introduction, followed by a workshop and then a summary of the workshop by the researchers.

At each co-production session 3 in total), new strategies were implemented in order to obtain different results and to build on the results of the previous co-production session, always aiming at the activation of resilience in the Shopping Park neighbourhood. For this, modifications focused on three main aspects: (i) Place of co-production session meetings; (ii) Approach to the problem during the co-production session; (iii) Dissemination and communication methodology before, during the session, and afterwards. The first Co-production session, entitled "Collective Coffee", inaugurated the partnership between the community, local NGOs and the academy and allowed mutual recognition on the main problems and needs of the neighbourhood. The meeting was initially intended for people who answered the Questionnaires, however, the low participation on the day led the researchers to invite passers-by to participate, but this achieved little success. Some conclusions were drawn from this first experiment (Frame 40).

Frame 40 - Experiences and Recommendations of Co-production 1.

EXPERIENCES	RECOMMENDATIONS
- It was believed that the breakfast offer would work as attract participation, and this actually occurred. It is not yet known precisely whether the attracted people were in the meeting solely because of the food supply.	- Be aware of the real involvement of people in co-production activities, avoiding the presence of people interested only in the food supply. Think of alternative incentives apart from food and drink.
- It was decided to hold the meeting in a private environment in order to accommodate food and allow the presentation of slides in a comfortable way for researchers and residents. However, it was soon realized that people (mostly adults) felt constrained to enter the environment and formally present themselves, reducing popular participation in the event.	- Hold meetings in less "oppressive" environments, such as the lobby of Poli, or in the square itself, favoring approximation. - Invest more in dissemination and communication, as well as in the visual appeal of the group.

Source: Auhtors, 2016.

In the second Co-production, the change in strategy was first reflected in the title of the event, redefined as "II Meeting to Renew Shopping Park", which emphasized the group's objective without direct allusion to rewards. The meeting was made public in the neighbourhood the previous week, when personal telephone numbers of the residents were collected, which enabled them to be reminded of the meeting the day before, via the WhatsApp group entitled "RENOVA SHOPPING PARK". This technique did not work particularly well – see table 17 for comments. At this meeting, the focus was kept on the scale of the neighbourhood, this time aiming to identify its positive aspects. However, even the residents' favourite places were the subject of intense criticism and complaint, triggering the difficulty of seeing positive aspects when there are problems that call for more attention. The reduced participation of the invited public was again observed, which this time completely differed in representation from that present in the first Co-production. On this occasion, some guidelines for subsequent actions were outlined (Frame 41).

Frame 41 - Experiences and Recommendations of Co-production 2.

EXPERIENCES	RECOMMENDATIONS
- Reflective approach to the neighbourhood (with negative and positive aspects) highlighted the predominance of problems, giving vent to a feeling of pessimism among residents, detrimental to the cohesion and motivation of the group.	- Give focus to the choice and design of elements to effectively qualify the neighborhood, in a change of approach to the problem.
Use of the WhatsApp group as a channel for solicitations and complaints, generating impatience between neighbors and successive loss of members who left the group. - Little interest of the residents to use the WhatsApp group as a communication channel of the group that was formed, with moments of total "absence" and disinterest after disclosures related to the group's activities.	- Invest in the publicity, communication, and visual appeal of the group, with the production of banners and banners to attract participants on the day of the event as well as constant update on the activities of the group in WhatsApp, in order to keep it active and attractive.

Source: Auhtors, 2016.

The third co-production session of Renova Shopping Park took place on Children's Day and was allocated in a room that gave direct access to Poli Square, and was a success in terms of participation, with more than 40 people present. Its format was similar to that of the previous meeting, in addition to the display of banners and banners in the vicinity of the place. However, through a register made with small gifts, it was again confirmed that the public differed completely from the other meetings, being composed mostly by passers-by who were attending the presentations of Children's Day in the square. As people approached, they were informed about options for neighborhood improvement and encouraged to choose one. Some residents stayed on site to monitor the progress of polls and encourage neighbors to participate, demonstrating a certain degree of engagement with the cause hitherto not observed in other meetings. The results of this last meeting generated certain reflections, as described in frame 42.

Frame 42 - Experiences and Recommendations of Co-production 3.

EXPERIENCES	RECOMMENDATIONS
- Although there was a significant numerical participation, once again, the absence of participants from the first Co-productions was noticed, pointing to the need of validation of the results, with the original community evaluated, in subsequent events, since there is no evidence yet that an Ecopark would be a critical intervention, able to activate resilience of the community. As such, it was felt more appropriate to focus on the fundamental issue of poor housing quality in the first instance as the next step, and as a way of giving residents some tangible improvement in their own homes before tackling any community wide issues.	- Rethinking the research group's referrals and considering investment in problem solving of the housing unit as a way to legitimize the group within the local community and thereby increase the participation and engagement of a fixed audience, effectively contributing to the activation of local resilience.

Source: Authors, 2016.

PART 6
CONCLUSIONS

Rethinking housing in all its stages is of fundamental importance to ensure the quality of any built environment, from the briefing and design stage and through construction to its subsequent use. The participation of the residents in this holistic process guarantees not only a better attendance to the needs of the users, such as the increase of the resilience and adaptability, but also makes possible the establishment of qualitative guidelines for future projects/constructions. The current social and climate changes observed require an urgent review of urbanisation strategies around the world in order to reduce the environmental and social impact as well as develop the resilience of built environment. The low quality of architecture and urbanism increases the social vulnerability that afflicts millions of people with difficult access to housing. In many cases, when government housing programs attempt to face this deficit, it frequently has resulted in the construction of highly unsuitable neighbourhoods and homes, which in most cases forces the residents to make changes to buildings that in turn are not necessarily prepared for such adaptations, leading to a great waste and inefficiency.

The results from this specific study reinforce the arguments shown above, since the houses sampled present innumerable constructive, functional and environmental problems. High levels of dissatisfaction were observed in relation to the limiting repetition of typologies, as well as inability of such typologies to attend to different family profiles. There are several transformations which Brazilian society has passed through, such as: the inclusion of women in the labour market and the consequent change in social roles; the emergence of different non-traditional family profiles (such as singles and couples without children); and the introduction of innovative technologies and equipment in the residential environment, leading to the emergence of other forms of domestic leisure, transformations in the notions of privacy and individuality, and also the growth of homeworking.

Thus, as a consequence of not attending to the new functions of domestic spaces, remodelling and changes in low-cost housing are very frequent (almost an obligation). In this case study, the main alterations were made when the typology was that single-family houses. The inadequacy of the houses, evidenced by the study evaluations, also occurs due to the lack of enough space to accommodate even the basic traditional demands, generating an overlap of activities in certain rooms, making it difficult to install basic equipment and so disregarding the residents needs for storage of their belongings. During a visit to the sampled houses, there was an undesirable "competition" between furniture and equipment and internal circulation.

As a result, the number of constructions and interventions carried out in the houses is very large. These interventions are made in a natural and intuitive way by their residents who make them according to their economic possibilities and low level of information. The residents are very resilient in terms of looking for creative ways of adapting to the new reality provided for them, both in relation to their dwelling and regarding the neighbourhood in which they find themselves. When evaluating modified houses, problems of various orders are perceived. As these alterations were not foreseen in the original project, the residents usually create cross-circulation, harming the privacy of the more intimate zones (such as bedrooms and baths), as well as reducing the comfort conditions of users regarding natural ventilation and illumination. Despite these difficulties, the level of appropriation of the spaces by the residents can be rated as high, since each action taken in a house started from the familiar and contextual demands. In this sense, it was noticed

that the low residential density of the Shopping Park neighbourhood, represented by the horizontal and individual single hoses, actually presented itself as a benefit (resilience) for its residents who could have freedom to extend their houses within their own lot boundaries.

The research also points out that the residents' dissatisfaction is not restricted to houses. It also extends to the way these houses are inserted in the city and their relationship with the urban space. Housing developments on the outskirts of the city seem to be a recurrent problem from the production of MCMV Programme, already identified by other surveys. However, even when evaluating better-located neighbourhoods, such as Shopping Park, the satisfaction levels regarding the presence of collective, health, safety, education and commercial facilities remains low. It seems that the problem goes beyond the question of urban insertion- it also concerns the production of proposals with urban and architectural designs which are more strongly connected to the ways of living and living, as well as their impact on the environment in which they will be Inserted.

On the impact of these houses on the natural environment, some key questions could be perceived. The houses had energy and water consumption well below the local average, as well as great level of recycling from household waste. However, this fact does not seem to be related to some public policy established in this direction (the exemption is given by the solar water heater, included in the original design). It is the result of the socioeconomic condition of the residents. Thus, they are driven by necessity to save resources in various ways, which increase the resilience of the place. This applies mainly to the private sphere (home), since in the public sphere one can note an excess of garbage deposited on the streets of the neighbourhood. However, they had nowhere to dump their bulk waste, and they did try to put it in various neat piles, and also the rubbish bins available in the street were provided useless. It should be noted that such actions observed in the private sphere of the neighbourhood represent a much more personal issue of resource economy than a collective conscience of diminishing the environmental impact of the place.

From the results obtained from this evaluation, three fields of analysis can be done in order to increase the resilience and adaptability of Affordable Housing (AH): The first one is about how the results of the evaluations can improve future projects of the same nature, and the second is about the search for broader and ongoing methodologies of co-production aiming to increase the resilience of the places. Finally, there is a need to undertake physical experimental interventions on pilot houses to test for optimal interventions that can improve housing conditions at minimal cost.

Regarding the first field, our main conclusions point out that the supply of resilient and adequate AH projects depends on a very wide number of factors, such as taking into account the characteristics of the site of implantation (their dimensions and Climatic conditions) and the characteristics of the public to which the project will be destined. Only from this carefully defined and integrated information, will it be possible to guarantee the final quality of the units and neighbourhoods. Therefore, the results obtained demonstrate the urgent necessity to improve the spatial and environmental quality standards set out by the MCMV Programme, in order to attend widely to the needs of its users and the provided environment in which they move in to. Over standardization, lack of care about environmental impact as well as the failure to predict ways of adapting the houses physically to the different lifestyles should be extensively reviewed by those involved in the program's management. In this sense, the results of this study indicate that the broad knowledge of housing issues - involving public, collective and private - is essential, aiming to develop concepts, guidelines and parameters for more appropriate projects. The results from POEs produced in this study, added with those of other studies involving socioeconomic data, may help to guarantee more resilient and sustainable projects, which are economically viable and with higher levels of satisfaction. Finally, we trust that the fruits of these evaluative actions, and accurate information about the real needs and ways of life of the residents, can structure positive agendas in the future of AH in Brazil, considering an active role of each agent in the process of its production.

Regarding the second field concerning the development of methodologies, we realised that co-production could, in longer terms, contribute to the increase of the resilience of place. Although the first two sessions of co-production demonstrated a low level of engagement from residents, the third one was more successful and there is a lot of potential in relation to the search for solutions to the demands identified through this emancipatory and participatory process. In this sense, this research project will be continued and the co-production actions with the case study defined in two subsequent stages (2 and 3) will be carried out in 2017 and 2018.

The final field to consider is the need to prove the case for this study being undertaken in the first place, by carrying out at least some kind of pilot intervention that can take the findings of this study from beyond the research bookshelf and into the field itself as a successful pilot house intervention, potentially related to improving acoustic performance in the first instance. It became very clear to the researchers from both the co-production sessions and the wider studies undertaken in Shopping Park, that residents have been saturated with previous questionnaire initiatives and promises, and are looking to see any new initiative prove itself. The academics are in a strong position to work with other stakeholders, such as NGOs and industry, working in the local area, in order to identify possible resources (e.g. building materials, re-used materials) for creating physical interventions to improve the housing in the first instance. Small moves, correctly designed, and working directly with the residents themselves, can lead to big changes in the long term. Training is also needed in the area to help the residents to help themselves. The study identified that there is already a significant work resource within the community of capable builders and electricians who could be encouraged to join in with an initial pilot study. Any pilot intervention would need to be carefully monitored in order to evaluate and modify, if necessary, the proposition before planning a wider implementation.

In terms of the research partnership for conducting this project, it was found that the two institutions involved, the [MORA] housing survey of FAUeD / UFU and the SSoA [People, Environment and Performance research group] of the University of Sheffield - TUoS) were able to share Knowledge in the areas of POE, Co-production, Adaptability and Resilience, developing an international understanding for developing local solutions (Shopping Park Neighbourhood). This stage of research has provided the basis for its continuity (stages 2 and 3), structuring a fundamental partnership between both institutions. It has also promoted excellence in research and know-how through the exchange of knowledge between two POE and Co-production groups in England and Brazil, including innovative methodologies for exploring cultural, environmental, technical and functional aspects of the built environment. In particular, in the Shopping Park Neighborhood case, the partnership has addressed interdisciplinary aspects through a combination of architecture, social sciences and engineering methods.

The results of this research aim to disseminate the information on social housing neighbourhood, identifying aspects to be improved in new projects to be developed by the government seeking to increase the adaptability and resilience of the built environment. This experience was able to promote a real and practical difference to Brazilian residents by providing detailed guidelines for more adaptable and resilient housing project in a local context, and the possibility of developing constructive interventions in the future.

PART 7
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ANNEXES

TOOL 1: QUESTIONNAIRE – RESILIENCE PROJECT – SHOPPING PARK

AGREEMENT

Do you accept answer this questionnaire? Before you continuous, please read and check if you agree with the following sentence: "I understand that my participation is volunteer. I also understand that all the information will be treated with maximum confidentiality and my anonymity will be respected in every moment. Moreover, all the data collected will be used only for scientific academic purposes. "

ACCEPT ( )   DO NOT ACCEPT ( )

Identification for research organisation (house number): _____ Street: _____ Date: /   /   Time: _____

1. RESPONDENTS' CHARCATERISTICS

a. What is your gender? F ( ) M ( )

b. What is your age? ( ) 15-20 ( ) 20-30 ( ) 31-40 ( ) 41-50 ( ) 51-60 ( ) 61-70 ( ) 71 or more

c. What is your education level?

( ) No education ( ) Incomplete Elementary School incomplete ( ) Elementary School complete ( ) High School incomplete ( ) High School complete

( ) Higher Education incomplete ( ) Higher Education complete ( ) Postgraduate

d. What is your family's position?

( ) householder ( ) partner ( ) children ( ) son-in-law daughter-in-law ( ) grandchildren ( ) father/mother ( ) mother-in-law / father-in-law ( ) grandparents ( ) brother or sister ( ) friend ( ) other

e. What was your previous family profile (before you move in)?

( ) Nuclear family (couple + children) ( ) single parent (parent + child) ( ) single person ( ) childless couple ( ) elderly couple

( ) Extended nuclear family (couple + children + relative) ( ) expanded single-parent family (parent + children + relatives) ( ) cohabiting (without family ties)

f. What is your current family profile?

( ) Nuclear family (couple + children) ( ) single parent (parent + child) ( ) single person ( ) childless couple ( ) elderly couple

( ) Extended nuclear family (couple + children + relative) ( ) expanded single-parent family (parent + children + relatives) ( ) cohabiting (without family ties)

g. What is your family income (R$)?

( ) 1.000 - 2.000 ( ) 2.001 - 4.000 ( ) 4.001 - 6.000 ( ) 6.001 - 8.000 ( ) 8.001-10.000 ( ) More than 10.000

h. Is there any person working for you? ( ) Yes   ( ) No. If yes: ( ) Monthly-paid worker ( ) Daily-paid worker ( ) Both

i. Is there any person working for you at night staying in your place? ( ) Yes, regularly ( ) Yes, eventually ( ) No

j. How many people are working in your family currently? ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) more than four ( ) no workers

k. What field each of them are working? _____

l. This property is: ( ) rented   ( ) owned ( ) financed ( ) borrowed

m. What year did your family move in to this place? _____

n. What was the situation of the previous housing?

( ) house ( ) apartment ( ) cohabitation (back) ( ) farm (rural) ( ) slums tenements ( ) slums ( ) room ( ) camping site

( ) homeless ( ) other

o. The previous house was ( ) rented ( ) owned ( ) financed ( ) borrowed ( ) invaded

p. Where it was located (neighbourhood)?_____

q. What was your satisfaction level with your previous house? ( ) Much Better ( ) Better ( ) Regular ( ) Worse ( ) Much Worse

r. Comparing with your current house, how was it size? ( ) Very Bigger ( ) Bigger ( ) Equal ( ) Smaller ( ) very Smaller

s. How was the house finishing? ( ) Much Better ( ) Better ( ) Regular ( ) Worse ( ) Much Worse

t. How was the location? ( ) Much Better ( ) Better ( ) Regular ( ) Worse ( ) Much Worse

u. How was the monthly house's expense? ( ) Much Bigger ( ) Bigger ( ) Equal ( ) Less ( ) Much Less

v. How is your health? ( ) Very Bad ( ) Bad ( ) Regular ( ) Good ( ) Very Good

w. Do you have cell phone? ( )yes ( )no. If yes, how many? ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) More than 4

x. Why do you use cell phone? ( )talk ( ) send messages ( )use internet.

y. If you use Internet, for what do you mostly use? ( ) Facebook ( ) WhatsApp ( ) News ( ) Movies ( ) Music ( )other social networks

z. Do you have computer or e-tablet? ( )yes ( )no. If yes, how many? ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) More than 4

z2. Does your house has cable TV? ( )yes ( )no.

2. SURROUDINGS (NEIGHBOURHOOD)

a. Classified the quality of the public facilities at your neighbourhood

Public transport

( ) Very Satisfactory ( ) Satisfactory ( )Regular ( ) Unsatisfactory ( ) Very Unsatisfactory

Health

( ) Very Satisfactory ( ) Satisfactory ( )Regular ( ) Unsatisfactory ( ) Very Unsatisfactory

Education

( ) Very Satisfactory ( ) Satisfactory ( )Regular ( ) Unsatisfactory ( ) Very Unsatisfactory

Culture

( ) Very Satisfactory ( ) Satisfactory ( )Regular ( ) Unsatisfactory ( ) Very Unsatisfactory

Leisure (squares and parks)

( ) Very Satisfactory ( ) Satisfactory ( )Regular ( ) Unsatisfactory ( ) Very Unsatisfactory

b. How do you feel regarding to your neighbourhood? ( ) Very Happy ( ) Happy ( ) Medium ( ) Sad ( ) Very Sad

c. Your neighbourhood is:

( ) Very Beautiful ( ) Beautiful ( ) Medium ( ) Ugly ( ) Very Ugly

( ) Very Pleasant ( ) Pleasant ( ) Medium ( ) Unpleasant ( ) Very Unpleasant

( ) Completely Maintained ( ) Partially Maintained ( ) Medium ( ) Abandoned ( ) Completely Abandoned

( ) Completely Included ( ) Partially Included ( ) Medium ( ) Excluded ( ) Completely Excluded

( ) Completely Safe ( ) Partially Safe ( ) Medium ( ) Unsafe ( ) Completely Unsafe
d. What is your satisfaction level regarding to heath treatment at your neighbourhood? ( ) Very Bad ( ) Bad ( ) Regular ( ) Good ( ) Very Good
e. How long do you usually take to arrive at the health care? ( ) 5-15 min ( ) 16-30min ( ) 31-45 min ( ) 45-60 min ( ) more than a hour
f. What do you mostly need at your neighbourhood?_____
g. Have you ever seen lack of any of these things at your neighbourhood? ( )water ( )light ( )waste collection ( )other_____

3. ALLOTMENTS/ BLOCKS

a. What are the negative aspects of living here? (Multiple choices)
( ) Lack of safety ( ) Lack of neighbours interaction ( ) Long distances from the public facilities ( ) Reduced house space ( ) Difficulty on neighbours interaction ( ) Terraced houses ( ) Others

b. Level of satisfaction regarding with general aspects of the block:

Quality of the constructions	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Appearance	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Cleaning and conservation of the public spaces	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Level of neighbour interaction	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Cost-benefit relation – water/ energy/ transport	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Quantity of facilities of common use	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Quality and conservation of green areas	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Accessibility for people with physical restrictions	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Privacy in relation to the street	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Safety in relation to the street	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Quality of the sidewalks	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Quality of the streets	( )Great	( )Good	( )Regular	( )Bad	( )Very bad
Street singling	( )Great	( )Good	( )Regular	( )Bad	( )Very bad

4.HOUSING UNIT

a.   What does this residence means for you: (Multiple choices)
( ) a place where are people that I like ( ) an investment ( ) a place which I identify ( ) a place that I only sleep
( ) a place where are my belongs ( ) a place which I can do my activities ( ) a place where I mostly spend my time ( ) safe place
b.   Do you use this residence for leisure activities? ( ) Yes ( ) No
b1. Which are? ( ) Read ( ) Prepare meals ( ) Internet access ( ) Play some instrument ( ) Wacth TV ( ) Play ( ) Use computer
( ) Handicraft ( ) Dance ( ) Other
c. Do you use your house to earn an extra income? ( ) Yes ( ) No
c1. How? ( ) catalogues products ( ) Home cooking business ( ) Handcraft ( ) Sells products
( ) Working at the Internet ( ) Washing and ironing for others ( ) Caregiver for non relatives ( ) Commerce ( ) Services

d. Level of satisfaction regarding with general aspects of your residence:

Location in relation to the city	Very close	Close	Medium	Distant	Very far
Proximity to facilities and general services	Very close	Close	Medium	Distant	Very far
Proximity to the workplace	Very close	Close	Medium	Distant	Very far
Safety against robbery and strangers entrance	Very safe	Safe	Medium	Not Safe	Completely unsafe
Residence's External appearance	Very beautiful	Beautiful	Medium	Ugly	Very ugly
Quality of the construction and finishing materials from original design	Great	Good	Medium	Bad	Terrible
Cleaning and maintenance easiness	Great	Good	Medium	Bad	Terrible
Residence size	Very big	Big	Medium	Small	Very small
Rooms' division	Great divisions	Good divisions	Medium	Bad divisions	Terrible divisions
Did your previous furniture fit in the new residence?	Totally fitted	Partially fitted	Half fitted	Few fitted	None fitted
Currently quantity of furniture in your residence	Totally enough	Enough	Medium	Not enough	Completely Insufficiently
Neighbours' privacy	Completely private	Reasonable Privacy	Medium	Little privacy	No privacy
Family's privacy	Completely private	Reasonable Privacy	Medium	Little privacy	No privacy
How much do you identify with your house	Very much	Reasonable	Medium	A little	Not at all
How much did you adapted to your house	Very much	Reasonable	Medium	A little	Not at all

e. Regarding to each room, choose your level of satisfaction:

LIVING ROOM

Size:	Great	Good	Regular	Bad	Terrible
Furnishing easiness:	Great	Good	Regular	Bad	Terrible
Temperature:	Very Cold	Cold	Pleasant	Hot	Very Hot
Lighting:	Very Bright	Bright	Regular	Dark	Very Dark
Ventilation:	Well Ventilated	Ventilated	Regular	Stuffy	Very Stuffy
Acoustic:	Very Quiet	Quiet	Regular	Noisy	Very Noisy

BEDROOM

Size:	Great	Good	Regular	Bad	Terrible
Furnishing easiness:	Great	Good	Regular	Bad	Terrible
Temperature:	Very Cold	Cold	Pleasant	Hot	Very Hot
Lighting:	Very Bright	Bright	Regular	Dark	Very Dark
Ventilation:	Well Ventilated	Ventilated	Regular	Stuffy	Very Stuffy

Acoustic:	Very Quiet	Quiet	Regular	Noisy	Very Noisy

BATHROOM

Size:	Great	Good	Regular	Bad	Terrible
Furnishing easiness:	Great	Good	Regular	Bad	Terrible
Temperature:	Very Cold	Cold	Pleasant	Hot	Very Hot
Lighting:	Very Bright	Bright	Regular	Dark	Very Dark
Ventilation:	Well Ventilated	Ventilated	Regular	Stuffy	Very Stuffy
Acoustic:	Very Quiet	Quiet	Regular	Noisy	Very Noisy

LAUNDRY

Size:	Great	Good	Regular	Bad	Terrible
Furnishing easiness:	Great	Good	Regular	Bad	Terrible
Temperature:	Very Cold	Cold	Pleasant	Hot	Very Hot
Lighting:	Very Bright	Bright	Regular	Dark	Very Dark
Ventilation:	Well Ventilated	Ventilated	Regular	Stuffy	Very Stuffy
Acoustic:	Very Quiet	Quiet	Regular	Noisy	Very Noisy

KITCHEN

Size:	Great	Good	Regular	Bad	Terrible
Furnishing easiness:	Great	Good	Regular	Bad	Terrible
Temperature:	Very Cold	Cold	Pleasant	Hot	Very Hot
Lighting:	Very Bright	Bright	Regular	Dark	Very Dark
Ventilation:	Well Ventilated	Ventilated	Regular	Stuffy	Very Stuffy
Acoustic:	Very Quiet	Quiet	Regular	Noisy	Very Noisy

f. Regarding to the activities that you usually do at your place:

Host guest

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Interact with the people that live with you

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How do you realise	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Relax (read, listen to music, etc):

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Work

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Study

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Have meals

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Use the computer

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Do physical activities

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Sleep

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Wash and iron clothes

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

Cook

Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area

Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	
Stock up things						
Where do you do	( ) Living room	( ) Bedroom	( ) Kitchen	( ) Bathroom	( ) Laundry	( ) Common Area
Frequency	( ) Everyday	( ) Almost everyday	( ) Some days	( ) Rarely	( ) Never	
How well	( ) Very well	( ) Well	( ) Regular	( ) Bad	( ) Very Bad	

A.

g. Have you done any change from the original design? ( ) Yes ( ) No

h. Which were the main reasons for the alterations? If necessary, mark more than one option.
( ) enlarge the room   ( ) eliminate the room ( ) improve the finishing ( ) improve the comfort ( ) solve technical problems ( ) reduce the room
( ) change the room's function ( ) improve the aesthetical appearance ( ) improve privacy ( ) improve the stocking ( ) install a commerce

i. Which were the rooms altered?
( ) Living Room   ( ) Bedrooms   ( ) Bathroom   ( ) Kitchen   ( ) Laundry   ( ) External Area

j. What was done in the reform? ( ) Removal/addition of a wall ( ) Change of finishing ( ) Painting ( ) Change of windows and doors
( ) Installation of wardrobes and cabinets ( ) Plaster placement   ( ) Electric Installations   ( ) Constructions of walls( ) Increase/ change of roof   ( )
Paving of the external area ( ) Hydraulic and sanitary facilities instalment ( ) Creation of leisure areas   ( ) Creation of rooms for commerce

5. ENERGY EFFICIENCY AND SUSTAINABILITY

a. What do you do to save water? If necessary, mark more than one option.
( ) Brush teeth with the tap closed ( ) Use the washing machine with maximum capacity ( ) Own appliances that save water
( ) Soap the dishes with the faucet closed ( ) Reuses water from the washing machine to wash the residence ( ) Do not save water
( ) Take quick baths (5 to 10 minutes)

b. What do you do to save electricity? If necessary, mark more than one option.
( ) Turn off the lights after you leave the room ( ) Uses economic lamps (like fluorescent and LED)   ( ) Turn off the appliances that are not in use
( ) Buy house appliances which save energy ( ) Do not save electric energy

c. Why do you save water and electricity? If necessary, mark more than one option.
( ) To reduce bills ( ) Fear from rationing in dry periods ( ) Do not save electricity
( ) To cause less damage to the environment ( ) Do not save water

d. About the waste from your residence
d1. Do you separate recyclable waste from organic waste? ( ) Yes ( ) No
d2. Do you know where the city's recycled waste go to? ( ) Yes ( ) No
d3. Do you separate oil waste from other kinds of waste? ( ) Yes ( ) No
d4. Do you usually see your neighbour throwing litter on the street? ( ) Yes ( ) No
d5. Do you usually discard your waste on the street? ( ) Yes ( ) No
d6. Do you usually discard your waste in vacant lots? ( ) Yes ( ) No

e. Do you produce any food at home? ( ) Yes ( ) No.
f.1. If yes, which? ( )vegetables ( )fruits ( )legumes ( )eggs ( )chicken ( )pork

g. Do you consume any product produced in your neighbourhood? Which? _____

h. About organic food (produced without pesticides/ hormones/ transgenic)
h1. Do you consume organic food? ( ) Yes ( ) No ( ) Sometimes
h2. What type of organic food do you eat? (If necessary, mark more than one option.)
( ) Vegetables ( )Fruits ( ) Juices ( ) Cereals ( ) Animal Origin ( ) Others ( ) None
h3. Why do you consume organic food? (If necessary, mark more than one option.)
( ) Health concerns ( ) Its cultivation process is environment friendly ( ) Is more tasty ( ) Do not consume organic food
h4. Why do you not consume organic food? (If necessary, mark more than one option.)
( ) High prices ( ) Difficulty of finding in the market ( ) I think it is unnecessary ( ) Do not know

i. In relation to the presence of vegetation in your residence:
i1. Do you have plants in your residence? ( ) Yes ( ) No
i2. What type of plants do you have? (If necessary, mark more than one option.)
( ) Garden ( ) Medicinal ( ) Decorative ( ) None
i3.Do you miss Garden or green areas in your residence? ( ) Yes ( ) No

j. What is the average time of commuting between your residence and your work place?
( ) Until 30 min ( ) From 30 to 45 min   ( ) From 45 min to 1h   ( ) From 1h to 1h30 min ( ) From 1h30 min to 2h   ( ) More than 2h

l. What is the main type of transport do you usually use?
( ) bus   ( ) Motorcycle   ( ) Car ( ) Bicycle   ( ) Motorcycle taxi / taxi   ( ) Foot   ( ) Others

m. In relation to the main transport you use, indicate the reason: (If necessary, mark more than one option.)
( ) fast speed ( ) Cost less ( ) Can go to all the places in town ( ) environmental friendly
( ) shared with other people ( ) Do not have any other way of transportation.

TOOL 2: WALKTHROUGH – RESILIENCE PROJECT – SHOPPING PARK

1. SURROUNDINGS	
Researcher _____ date _____ time _____	

Attribute:		**Urban insertion - location**
Technical parameter:		According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP Size and pattern of the blocks
Evaluation	**Method:**	Data sources for measuring effect: The project set of contiguous projects, maps, aerial photographs and / or updated satellite (maximum one year before the presentation of the proposal) of the project site location and information collected visiting the analyzed area.
	Description:	**Blocks size** Average of the perimeter of the blocks from the project, or group of neighboring businesses, and all the blocks immediately adjacent to it (s). • Fully permeable courts, such as squares and parks not surrounded, have the perimeter measure equal to zero, since it does not constitute any barrier to pedestrian movement. • Cases in which the project, or set of them, is located in the urban expansion fronts, it should only be considered the courts already splitted. 1 - Identify the blocks that will be included in the evaluation, which can be of three types: When the development project is included in existing blocks or when the project draws new courts. For both types of previous courts should also be considered the immediately adjacent blocks, ie those that have direct contact with the project. 2 - Calculate the perimeter (measured in meters) of all identified blocks according to the previous item and adding them. 3rd sum of the perimeters of blocks / number of blocks = average circumference of the blocks (m)
	Result:	□ GOOD - until 500 meters □ ACCEPTABLE – 500 to 800 meters □ INSUFFICIENT – more than 800 meters

Attribute:		**Relation with the surroundings**
Technical parameter:		According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP Percentage that relates to the immediate surroundings
Evaluation	**Method:**	Fonte de dados para efeito de medição: Projeto do conjunto de empreendimentos contíguos, Mapas, fotografias aéreas e/ou de satélite atualizadas (no máximo um ano antes da apresentação da proposta) do sítio de localização do projeto, Imagens de satélite (acervo Google Maps), fotos aéreas e cartografia e informações colhidas em visita à área onde se localiza o terreno do empreendimento.
	Description:	1rst Measure the total perimeter (s) project (s) evaluated. If the area is home to two

		or more contiguous developments, consider the total area of the complex
		2nd Identify the perimeter portions that make contact effectively urban environment, according to the details of this indicator, and add their lengths.
		3rd Divide the second value by the first to calculate the final percentage as calculated below.
		Perimeter contact effectively urban environment / total perimeter of the site x100 = results in%
	Result:	□ GOOD – 100% □ ACCEPTABLE – 40% ou mais
		□ INSUFFICIENT – menos de 40%

Attribute:	Public Transport
Technical parameter:	According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP Number of lines, frequency and route.

	Method:	To meet the parameters of this indicator can be used: The project design or contiguous ventures. Maps, aerial photographs and / or updated satellite (made more than one year prior to submitting the proposal) of the project site. digital maps and updated data of public transport lines available on the Internet or provided by the municipality, municipal transport company or operating company of this service.
Evaluation	**Description:**	Check the frequency and period of operation on weekdays from identified transport lines. The frequency should be measured in-between peak hours (between 10h and 16h) on weekdays. If the information on frequency of lines do not specify the intervals at peak times and in-between ones, use the average range for the working day available. **Indicator 1 - Number of lines:** Distances max. 1 km (distance walk) from bus stops and the nearest housing unit to the center of the polygonal evaluated object. Itineraries are considered the paths traveled by bus lines, rail transportation, BRT, boats and others. Only they are considered different itineraries those who establish a distance of 2 km from each other by any stretch of the journey. The qualification should be based on:: GOOD; 4 or more itineraries. ACCEPTABLE; at least 3 itineraries and INSUFFICIENT; for 2 or less itineraries **Indicator 2 - Frequency and Itinerary:** he evaluation will be made only for the in-between peaks period from 10h and 16h, in order to guarantee an acceptable standard shipping service even outside of peak hours. GOOD - frequency up to 10 min and 24 hrs period of operation, ACCEPTABLE - 11 to 20 min and operation for 17 hours and INSUFFICIENT - over 20 min and less than 17 hrs.

	Result:	□ GOOD, Have for each route identified in Indicator 1, at least one row rated GOOD. That is, 3 choices of itineraries with good attendance and good operation period.
		□ ACCEPTABLE, have for every itinerary in Indicator 1, at least one row rated as acceptable. That is, with 3 options routes frequency and acceptable operating period.
		□ INSUFFICIENT If any of the routes identified in Indicator 1 does not have at least one line classified as acceptable.

Attribute:	Leisure and culture facilities
Technical parameter:	According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP Distance from the blocks' centre

	Method:	To meet the parameters of this indicator can be used: The project design or contiguous projects; municipal database; Satellite images (like Google Maps), aerial photos, maps etc; Information gathered in the field.
Evaluation	Description:	A 15 minute walk is equivalent to approximately 1,000 meters and a 20 minute walk to approximately 1,400 meters. **Compulsory daily uses:** free areas for leisure and recreation (the space must havelandscaping in good condition, furniture for leisure, physical activities and an area for sports). **Compulsory eventual Uses:** Area for sports practice **Complementary daily uses:** Gym **Complementary eventual Uses:** Public library, restaurants, bookshop or stationery **Complementary Sporadic Uses::** Cinema, Urban park, sports gynasium, stadium, theathre, museum or cultural centre. Check if the walking distance on public roads between the closest entrance of the housing unit (or building) to the center of the polygonal of the site. Regarding Mandatory Uses, evaluate the service capacity and if there is availability to meet the new developments. It also can be served by more than one device, as long as everything is accessible within a 15 minute walk for everyday use, 20 minutes walk or 30 minutes by public transport to any uses and 1 hour total travel by public transport for sporadic use.
	Result:	□ GOOD - All required uses are available, with capacity to absorb the new demand, and there are all complementary uses. □ ACCEPTABLE - All required uses are available, with capacity to absorb the new demand and from the complementary there are all he eventual uses (if there were more uses would be 7) and at least 3 sporadic uses. □ INSUFFICIENT - There is no provision of all required uses, considering the capacity to absorb the new demand AND / OR less of 4 and 3 of any sporadic and complementary uses respectively.

	Educational facilities
Technical parameter:	According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP

		Distance from the blocks' centre.
	Method:	To meet the parameters of this indicator can be used: The project design or contiguous projects; municipal database; Satellite images (like Google Maps), aerial photos, maps etc; Information gathered in the field. * In any complementary uses it was recorded 2 instead of 7, as they are half of the existing uses.
	Description:	A 15 minute walk is equivalent to approximately 1,000 meters and a 20 minute walk to approximately 1,400 meters. **Compulsory daily uses:** Public Kindergartens and Early Childhood Education Public Schools. **Compulsory eventual Uses:** Public Elementary School and Public High School USOS **Compulsory Sporadic Uses:** Higher education institution **Complementary eventual uses:** Higher Education Institution and School of further training. Check if the walking distance on public roads between the closest entrance of the housing unit (or building) to the center of the polygonal of the site. Regarding Mandatory Uses, evaluate the service capacity and if there is availability to meet the new developments. It also can be served by more than one device, as long as everything is accessible within a 15 minute walk for everyday use, 20 minutes walk or 30 minutes by public transport to any uses and 1 hour total travel by public transport for sporadic use.
	Result:	□ GOOD - All required uses are available, with capacity to absorb the new demand, and there are all complementary uses. □ ACCEPTABLE - All required uses are available, with capacity to absorb the new demand and there are at least 2 of complementary eventual uses. □ INSUFFICIENT - here is no provision of all required uses, considering the capacity to absorb the new demand AND / OR for less than 2 of the complementary eventual uses.

Attribute:	**Service and commerce**	
Technical parameter:	According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP Type of goods and services available / from the city centre or the blocks' centre	
	Method:	To meet the parameters of this indicator can be used: The project design or contiguous projects; municipal database; Satellite images (like Google Maps), aerial photos, maps etc; Information gathered in the field. * In the complementary sporadic use it was recorded 1 instead of 3, as they are half of the existing uses.
	Description:	A 15 minute walk is equivalent to approximately 1,000 meters and a 20 minute walk to approximately 1,400 meters. **Compulsory daily uses:** Markets, greengrocers **Complementary daily uses:** butcherys; bakeries; Restaurants (pizzeria, cafeteria etc); hair saloon; gym; ATM; technical assistance and repair, and Lojas de material de construção.material construction stores.

| | | Compulsory eventual Uses: supermrket and ATM
Complementary eventual Uses: Social Assistance Reference Centre, police station, post office, clothes and shoes stores, homeappliances, Restaurants, Banks, Technical assistance and repair, etc..
Compulsory Sporadic Uses: Administrative Centre (INSS, City Hall, etc.)
Complementary Sporadic Uses: Supermarket, registry office.

Check if the walking distance on public roads between the closest entrance of the housing unit (or building) to the center of the polygonal of the site. Regarding Mandatory Uses, evaluate the service capacity and if there is availability to meet the new developments. It also can be served by more than one device, as long as everything is accessible within a 15 minute walk for everyday use, 20 minutes walk or 30 minutes by public transport to any uses and 1 hour total travel by public transport for sporadic use. |
|---|---|---|
| | **Result:** | □ GOOD - All required uses are available, with capacity to absorb the new demand, and there are all complementary uses.

□ ACCEPTABLE - All required uses are available, with capacity to absorb the new demand and there are at least 4.7 and 1 of complementary uses for daily, eventual and sporadic uses respectively.

□ INSUFFICIENT - There is no provision of all required uses, considering the capacity to absorb the demand of less than 4.7 and 1 of complementary uses for daily, eventual and sporadic uses respectively. |

Attribute:		**Health facilitites**
Technical parameter:		According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP
Distance from the blocks' centre.
Evaluation	**Method:**	To meet the parameters of this indicator can be used:
The project design or contiguous projects; municipal database;
Satellite images (like Google Maps), aerial photos, maps etc; Information gathered in the field.
* In the complementary daily and eventual uses it was recorded 1 instead of 4 and 7, as they are half of the existing uses.
	Description:	A 15 minute walk is equivalent to approximately 1,000 meters and a 20 minute walk to approximately 1,400 meters.

Complementary daily uses: Pharmacies;
Compulsory eventual Uses: Health Units and Pharmacies
Complementary eventual Uses: Medical Centre or Specialised Clinics
Compulsory Sporadic Uses: Public Hospital

Check if the walking distance on public roads between the closest entrance of the housing unit (or building) to the center of the polygonal of the site. Regarding Mandatory Uses, evaluate the service capacity and if there is availability to meet the new developments. It also can be served by more than one device, as long as everything is accessible within a 15 minute walk for everyday use, 20 minutes walk or 30 minutes by public transport to any uses and 1 hour total travel by public |

		transport for sporadic use.
	Result:	□ GOOD - All required uses are available, with capacity to absorb the new demand, and there are all complementary uses.
		□ ACCEPTABLE - All required uses are available, with capacity to absorb the new demand and there are at least one complementary daily use and one complementary eventual use.
		□ INSUFFICIENT - There is no provision of all required uses, considering the capacity to absorb the demand of less than one complementary daily use and one complementary eventual use.

Attribute:		**Accessibility (according to NBR 9050)**
Technical parameter:		According to the Brazilian Technical Norm NBR 9050 / 2004- accessibility and urban accessibility guide - CREA-MG 2006
		NBR 9050 CRIT. 6.3.2 Coatings (Pg.55)
		NBR 9050 CRIT 6.12 External circulation (Pg.73)
		NBR 9050 CRIT 8.8 Landscape Ornamentation and Urban ambience - Vegetation (Pg.130)
		NBR 9050 CRIT. 5 Information and signalling (Pg.30)
		Adequate material, signalling and traffic conditions. (Conservation status, circulation axis' width).
Evaluation	**Method:**	Visual Analysis and Measurement in loco
	Description:	**Signalling**
		The international symbol of access must set the accessibility of services and identify areas, buildings, furniture and equipment urban, where there are elements accessible or usable by people with disabilities or reduced mobility. Signs must be posted in a place visible to the public, and is mainly used in the following locations when available: entrances; parking lots, areas of embarkation and disembarkation of passengers with disabilities.
		Adequate Material
		The coatings and finishing materials must have smooth surface, firm and stable features, and no trepidation for devices with wheels and slip under any condition (dry or wet).
		Avoid the use of patterning on the floor surface which may cause feelings of insecurity (for example, prints that by drawing contrast or colour can give the impression of three-dimensionality).
		Circulation Conditions
		Levelled sidewalks, free from obstacles.
		Paving with minimal circulation wiidth of 1.20 m
		Presence of ramp in commercial areas and public facilities
		Ramp on the corners of the blocks
		Landscape Ornamentation and Urban Ambience
		The planting and weed control should ensure that the elements (branches, roots, twigs of shrubs and trees) and its protections (low walls, railings or unevenness) do not interfere with accessible routes and pedestrian circulation areas.
		In areas adjacent to accessible routes and pedestrian circulation areas, the

vegetation cannot have thorns or other characteristics that might cause injury; roots that damage the floor or dangerous toxic components.
Existence of tactile symbols.

	Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:	Street paving		
Technical parameter:	According to the Brazilian Technical Norm NBR 9050 / 2004- accessibility and urban accessibility guide - CREA-MG 2006 NBR 9050 CRIT. 6.3.2 Coatings (Pg.55) NBR 9050 CRIT 6.12 External circulation (Pg.73) NBR 9050 CRIT 8.8 Landscape Ornamentation and Urban ambience - Vegetation (Pg.130) NBR 9050 CRIT. 5 Information and signalling (Pg.30) Adequate material, signalling and traffic conditions.		
Evaluation	Method:	Visual Analysis	
	Description:	**Signalling** The international symbol of access must set the accessibility of services and identify areas, buildings, furniture and equipment urban, where there are elements accessible or usable by people with disabilities or reduced mobility. Signs must be posted in a place visible to the public, and is mainly used in the following locations when available: entrances; parking lots, areas of embarkation and disembarkation of passengers with disabilities. **Elevated crosswalk on street crossings/ junctions** Elevated crosswalk is the elevation of the roadway level, composed of a high levelled area, marked with pedestrian crosswalk and transposition ramp for vehicles. It intends to promote the correlation between the levels of sidewalks on both sides of the road and must provide transverse slope of up to 3%. **Lowering of the sidewalks for pedestrian crossing** The sidewalks should be lowered next to the pedestrian crossing tracks, with or without light, and whenever there focus on pedestrians. In low traffic volume streets, the lower level must be provided at the corners, even if there is no pedestrian crosswalk.	
	Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:	Sidewalks paving		
Technical parameter:	According to the Brazilian Technical Norm NBR 9050 / 2004- accessibility and urban accessibility guide - CREA-MG 2006 NBR 9050 CRIT. 6.3.2 Coatings (Pg.55) NBR 9050 CRIT 6.12 External circulation (Pg.73) NBR 9050 CRIT 8.8 Landscape Ornamentation and Urban ambience - Vegetation (Pg.130) NBR 9050 CRIT. 5 Information and signalling (Pg.30) Adequate material, signalling and traffic conditions.		
Ev	Method:	Measurement in loco and visual analysis	

	Description:	
		Adequate Material The coatings and finishing materials must have smooth surface, firm and stable features, and no trepidation for devices with wheels and slip under any condition (dry or wet). Avoid the use of patterning on the floor surface which may cause feelings of insecurity (for example, prints that by drawing contrast or colour can give the impression of three-dimensionality). **Circulation Conditions** Levelled sidewalks, free from obstacles. Paving with minimal circulation wiidth of 1.20 m Presence of ramp in commercial areas and public facilities Ramp on the corners of the blocks **Landscape Ornamentation and Urban Ambience** The planting and weed control should ensure that the elements (branches, roots, twigs of shrubs and trees) and its protections (low walls, railings or unevenness) do not interfere with accessible routes and pedestrian circulation areas. In areas adjacent to accessible routes and pedestrian circulation areas, the vegetation cannot have thorns or other characteristics that might cause injury; roots that damage the floor or dangerous toxic components. Existence of tactile symbols. **Signalling** The international symbol of access must set the accessibility of services and identify areas, buildings, furniture and equipment urban, where there are elements accessible or usable by people with disabilities or reduced mobility. Signs must be posted in a place visible to the public, and is mainly used in the following locations when available: entrances; parking lots, areas of embarkation and disembarkation of passengers with disabilities.
	Result:	□ Attends □ Do not attend

Attribute:		**Urban furniture**
Technical parameter:		According to the Brazilian Technical Norm NBR NBR 9283/1986 and 9050/2004 - Urban Furniture and Accessibility. CRIT. 8 Urban Furniture (P. 113) CRIT. 8.2.1 Public Transport boarding point CRIT. 8.2.2 Pedestrian traffic lights CRIT. 8.3 Public telephones CRIT. 8.4 Thelephone booth CRIT. 8.5 Drinker CRIT. 8.6 Litter bins and containers for recycling CRIT. 8.8 Landscape Ornamentation and Urban Ambience CRIT. 8.9 Public Seats
Evaluation	Method:	Measurement in loco and visual analysis
	Description:	As for accessibility: It is recommended that all furniture meets the principles of universal design, as concepts and principles covered in each criterion. To be considered accessible, urban furniture should provide the user with security

		and autonomy of use; ensure appropriate size and space for approach, reach, manipulation and use, posture and user mobility according to the circulation and manoeuvre area; be designed so as not to be a suspended obstacle; Be designed in order to not have sharp corners, edges or other sharp or perforating projections; be located along an accessible route; outside the free range for movement of pedestrian and be signalled.
	Result:	□ There is urban furniture and they are accessible. □ There is urban furniture, but only part of them is accessible. □ There Is no urban Furniture or it is not accessible.

Attribute:		**Vegetation**
Technical parameter:		According to the Brazilian Society for Urban Forestation, http://www.labs.ufpr.br/site/wp-content/uploads/2014/07/cavalheiro_anaisdecongressos_cbau_1992.pdf http://www.labs.ufpr.br/site/wp-content/uploads/2014/09/cavalheiroetal_artigoscompletos_sbau_1999.pdf http://www.revsbau.esalq.usp.br/artigos_cientificos/artigo68-versao_publicacao.pdf Number of free public spaces per inhabitant.
Evaluation	**Method:**	Addition of all green areas in square meters (m²) divided by the population of the study area. (Here, in the parks and squares categories)
	Description:	Expresses the amount of free space for public use, in km² or m², by the number of inhabitants. **About the vegetation preservation:** The Master Plan of Uberlândia, Complementary Law No. 432 of 19 October 2006, has an environmental policy in art. 14, item III, "to ensure the protection of water and plant resources, reduction of drainage problems and the creation of areas for recreation in the design of parks, conservation areas and protected areas." **About the vegetation amount:** According to the international literature, the 12 to 13 m² values refer only to neighborhood parks and district parks. The Brazilian Society for Urban Forestation (SBAU) proposed a minimum rate for public green areas for recreation value of 15 m² / inhabitant (SBAU, 1996).
	Result:	□ Attends □ Do not attend

2. LOT
Pesquisador _____ data _____ horário _____ Unidade:_____ _____

Attribute:	Dimensions	
Technical parameter:	According to the Land Division law, SUPPLEMENTARY LAW No. 523 OF 7 APRIL 2011. According to urban parameters of Land use and occupation Law, LAW SUPPLEMENTARY No. 525, OF 14 APRIL 2011.- ANNEX VII Minimum lot dimensions.	

Evaluation	Method:	Measurement in loco
	Description:	Being located in the Social Interest Special Zone - Minimum size of the lot of 200m and minimum frontage of 8 meters
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	House site location	
Technical parameter:	According to the Urban Indicators - SUPPLEMENTARY LAW NO 525 OF 14 APRIL 2011, the Use and Land Use Zoning - Chapter V -. Annex VII - Table 2 - Volumetry.	

Evaluation	Method:	Measurement in loco
	Description:	The lot situation must respect frontal, lateral and back clearances, according to the complementary law above. Located in a Social Interest Special Zone I. Lateral Clearance – 1,5m according to chapter V Frontal Clearance– 3,0m according to chapter V Back Clearance - 1,5m according to chapter V Maximum occupation rate - 80%
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	Legislation	
Technical parameter:	According to the construction code of Uberlandia, complementary law No. 524 of 08 April 2011./parcelamento soil, complementary law No. 523 of 7 April 2011. / use and occupation, complementary law No. 525, of April 14, 2011.	

Evaluation	Method:	Measurement in loco and visual analysis
	Description:	The lots must attend the laws above in regards to its dimensions, minimum frontage, minimum clearances, utilisation coefficient, occupation rate and permeability.

	Result:	□ Attends	□ Partially attends	□ Do not attend

	Attribute:	**Vegetation**		
	Technical parameter:	According to the afforestation manual CEMIG - (p. 54) and Law of Use and Land Use, Complementary Law No. 525 of 14 April 2011. Chapter V - Art. 38 / CRIT.. 8.8 Landscape Ornamentation and urban ambience - vegetation - NBR 9050		
Evaluation	**Method:**	Measurement in loco		
	Description:	**About the permeability rate:** As condições da absorção das águas pluviais nos lotes deverão ser preservadas, com a manutenção de no mínimo 20% (vinte por cento) da sua área, livre de impermeabilizações e construções. Para os lotes com área inferior a 200 m² (duzentos metros quadrados), a taxa permeável deverá ser de 10% (dez por cento). **About the vegetation's location:** • At least four meters distance from poles • One meter distance from the garage entry. • A two-meter manholes and 60cm underground pipes. • A two meters distance from corners. • In plantations planning across the vacant lots, the seedlings should be placed four meters away from the limits, avoiding future problems with access to the building. **About accessibility:** The planting and weed control should ensure that the elements (branches, roots, twigs of shrubs and trees) and its protections (low walls, railings or unevenness) do not interfere with accessible routes and pedestrian circulation areas. In areas adjacent to accessible routes and pedestrian circulation areas, the vegetation cannot have thorns or other characteristics that might cause injury; roots that damage the floor or dangerous toxic components.		
	Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:		Relation with the surroundings
Technical parameter:		According to ITDP - Policy Institute of Transportation and Development and LAB CITY / Methodology USP
		According to the Land Divisin Law, SUPPLEMENTARY LAW No. 523 OF 7 APRIL 2011.
		Proximity of available services and facilitites
Evaluation	**Method:**	Data sources for measuring effect:
		The project consists of the set of contiguous projects, maps, aerial photographs and / or updated satellite (maximum one year before the submission of the proposal) the site location of the project and information gathered on visit to the area where the project evaluated is located.
	Description:	Close, preferably in continuous areas of land intended for institutional use and public recreation, including their areas for education, health, social action, culture and leisure;
		Evaluate the diversity of local uses (other than residential) and the supply of equipment, shops and services in the vicinity. Some uses need to be close to the houses as they imply daily trips with small children or shopping for everyday supplies. Facilities, commerce and services with eventual uses, daily or time-consuming trips, considering the ages of users (young or adult). In addition, facilities, commerce and services whose use is sporadic and non-essential, but very important for ensuring the quality of urban insertion of future developments.
		Compulsory daily Uses: Public Kindergartens and Early Childhood Education Public Schools.; free areas for leisure and recreation (the space must havelandscaping in good condition, furniture for leisure, physical activities and an area for sports); Markets, greengrocers.
		Complementary daily uses: Açougues, Padarias, Farmácias, Restaurantes (pizzaria, lanchonete etc.), Salão de beleza, Academia, Lotéricas ou caixas eletrônicos, Assistência técnica e reparação (eletroeletrônicos, eletrodomésticos, veículos, bicicletas etc.), Lojas de material de construção (casa de ferragem, vidraçarias etc.).
		Compulsory eventual Uses: butcherys; bakeries; Restaurants (pizzeria, cafeteria etc); hair saloon; gym; ATM; technical assistance and repair, and Lojas de material de construção.material construction stores.

		Complementary eventual Uses: Higher education institution, Social Assistance Reference Centre, police station, library, post office, clothes and shoes stores, homeappliances, Restaurants, Banks, Technical assistance and repair, Medical Centre or Specialised Clinics, etc.
		Compulsory Sporadic Uses: Administrative Centre (INSS, City Hall, etc.); Higher education institution; Banks.
		Complementary Sporadic Uses: Cinema, Urban park, sports gynasium, stadium, theathre, museum or cultural centre, hypermarket, registry office.
		Check if the walking distance on public roads between the closest entrance of the housing unit (or building) to the center of the polygonal of the site. Regarding Mandatory Uses, evaluate the service capacity and if there is availability to meet the new developments. It also can be served by more than one device, as long as everything is accessible within a 15 minute walk for everyday use, 20 minutes walk or 30 minutes by public transport to any uses and 1 hour total travel by public transport for sporadic use.
		For daily use is necessary the existence of all Compulsory Uses and a percentage of Eventual Uses accessible within a maximum of 15 minutes (1000 m) walking distance.
		For eventual uses is necessary the existence of all compulsory uses and uses a percentage of affordable Complementary uses accessible within a 20 minutes (1400m) reach by foot or 30 minutes by public transport.
		For sporadic use is necessary the existence of all Required Uses and a percentage of complementary eventual Uses in within 1 hour of total travel by public transport.
	Result:	□ GOOD - All required uses are available, with capacity to absorb the new demand and there are all complementary uses. These uses are a distance away (and safely) Maximum 1,000m. for everyday use. Within 20 minutes of travel on foot or 30 minutes of travel by public transport, for eventual uses. And accessible to 1h offset with public transport use, for sporadic use.
		□ ACCEPTABLE - All required uses are available, with capacity to absorb the new demand and there are at least 4.7 and 3 of complementary uses, a distance away (and safety) of a maximum of 15 minutes, 20 minutes walk and 30 minutes by public transport, and 1h shift to use of public transport for everyday uses, eventual and sporadic respectively.

		□ INSUFFICIENT - There is no provision of all required uses, considering the capacity to absorb the new demand AND / OR less than 4, 7:03 complementary uses a distance away (safely) with a maximum of 15 min, 20 min displacement walk or 30 minutes of travel by public transport and until 1pm trip with public transport use for everyday uses, eventual and sporadic respectively.

Attribute:		**Privacy**
Technical parameter:		According to the Urban Indicators - SUPPLEMENTARY LAW NO 525 OF 14 APRIL 2011, the Use and Land Use Zoning - Chapter V -. Annex VII - Table 2 - Volumetry. Frontal, lateral and back clearances and utilisation coefficient.
Evaluation	**Method:**	Analysis from measurement in loco
	Description:	The lot situation must respect frontal, lateral and back clearances, according to the complementary law above. Located in a Social Interest Special Zone I. Lateral Clearance – 1,5m according to chapter V Frontal Clearance– 3,0m according to chapter V Back Clearance - 1,5m according to chapter V Utilisation coefficient – 2,5
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:		**Hygiene and cleaning conditions**
Technical parameter		According to Uberlândia posture code, Law No. 10741 of April 6, 2011.- Chapter IV
Evaluation	**Method:**	Visual Analysis
	Description:	ABOUT THE LANDS, BUILT OR NOT Art. 14. Every owner of land, built or not, is obliged to fence them, keep them weeded, drained and in perfect state of cleanliness and conservation, preventing them from being used as a garbage dump, debris and waste of any kind , and cleaning by burning is also banned.

	Result:	□ Attends	□ Partially attends	□ Do not attend

3. HOUSING UNIT	

Researcher _____ date _____ time _____

Unit:_____

Attribute:		Dimensions – useful area		
Technical parameter:		Minha Casa Minha Vida Programme		
Evaluation	Method:	Project Analysis		
	Description:	Stantard typology for simple-storey house: -02 Bedrooms, living room, kitchen, bathroom and laundry area; -Transition: minimum floor area of 32 m² (not computed service area). -Accessibility: Minimum floor area of 36 m² (not computed service area).		
	Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:		Proposed division		
Technical parameter:		Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Gabriela Morais Pereira		
Evaluation	Method:	Project Analysis		
	Description:	Have spaces compatible with the nine individual human needs and the family group: 1 - Enter / circulate 2 – Interact with family and visits 3 - Work / individual recreation 4 - Prepare meals 5 - Serve meals 6 - Sleep / rest / study		

		7 - Personal Hygiene
		8 - Treat clothing
		9 – Housekeeping
	Result:	□ Atende □ Atende Parcialmente □ Não Atende

Attribute:		**Proposed zoning**
Technical parameter:		Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Gabriela Morais Pereira
Evaluation	**Project analysis:**	Project Analysis / Measurement in loco
	Description:	The distribution of activities, according to the cultural, social and economic context of the project's insertion site should consider a more appropriate on the need to approach / detachment and integration / separation between activities, as exemplified in the Relationship Matrix established by the author (Figure 71, p. 178).
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:		**Rooms' useful area**
Technical parameter:		Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Gabriela Morais Pereira
Evaluation	**Method:**	Project Analysis / Measurement in loco
	Description:	For the architectural design of housing units, should provide at least the availability of spaces to meet the nine essential household activities indicated by the arrangement of furniture / equipment, use area and sufficient and appropriate circulation, according to the Functional matrix established by the author (Table 23, p. 176).
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:		**Circulations**
Technical parameter:		Functionality and Dimensional Quality in Housing - Contribution to NBR 15575/2013 - Gabriela Morais Pereira
Evaluati	**Project analysis:**	Project Analysis / Measurement in loco

	Description:	Provide minimum circulation according to the space usage of each furniture / equipment established by the author (Table 23, p. 176).
	Result:	☐ Attends ☐ Partially attends ☐ Do not attend

Attribute:		**Ceiling height**
Technical parameter:		Municipal Construction Code - Complementary Law No. 524 of April 8, 2011
Evaluation	Method:	Project Analysis / Measurement in loco
	Description:	Minimum ceilign height of 2,60 m in rooms of long stay (bedrooms, living room and kitchen) and 2,40 on rooms of short stay (bathrooms, halls, and laundry areas).
	Result:	☐ Attends ☐ Partially attends ☐ Do not attend

Attribute:		**Extension possibility**
Technical parameter:		**NBR 15575 – Part 1 - Criteria 16.3.1**
Evaluation	Method:	Project Analysis and User Manual
	Description:	In the design and implementation of the evolutionary character of buildings – meaning those already marketed with extension prediction – the developer or builder must attach the specifications and construction details to the property manual. This is necessary to expand the building as a whole, floor, roof and building installations, considering the dimensional coordination and the physical and chemical compatibility with the materials available regionally, wherever possible.
	Result:	☐ Attends ☐ Partially attends ☐ Do not attend

Attribute:		**Accessibility**
Technical parameter:		Norms for Persons with Disabilities - Law No. 13,146, of July 6, 2015 NBR 9050
Evaluation	Method:	Project Analysis
	Description:	The housing should provide for the minimum of 3% of total units under the Statute of Persons with Disabilities, for people with physical disabilities or reduced mobility, these units must be adapted according to NBR 9050.
	Result:	☐ Attends ☐ Partially attends ☐ Do not attend

Attribute:		Natural ventilation
Technical parameter:		Complementary Law No. 524 of April 8, 2011 - Articles 50, 51 and 54.
Evaluation	Method:	Project Analysis / Verified in loco
	Description:	The internal compartments are not considered sufficiently insulated, illuminated and ventilated when its farthest point of the opening is at a distance equal to or greater than twice the ceiling height. For insulation, lighting and ventilation, all long stay rooms (bedrooms, living room and kitchen) or short stay ones (toilet) should have direct relation with an open space, free and clear of any type of construction. The ventilation area of the compartments must be of at least 50% (fifty percent) of the illumination area required. So, in rooms of long stay (bedroom, living room and kitchen) the ventilation area should be of at least 1/12 of the floor area, and rooms of short stay (toilet) 1/16 of the floor area
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:		Structure
Technical parameter:		**NBR 15575 – Part 2 - Requirement 7.3**
Evaluation	Method:	Verified in loco
	Description:	The structure should not cause displacement or excessive cracks to construction elements linked to the structural system, taking into account the permanent actions and use actions, nor block the free functioning of elements and components of the building, such as doors, windows, nor affect the building installations.
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:		Seals
Technical parameter:		**NBR 15575 – Part 4 - Requirement 7.2** **NBR 15575 – Part 4 - Requirement 10.1** **NBR 15575 – Part 4 - Requirement 10.2**
Eval	Method:	Verified in loco

	Description:	As for seals:
		This should limit travel and cracks to acceptable values in order to ensure the free operation of elements and components of the residence.
		As for leaks:
		Façade - are to be watertight due to incidents from rain or other sources.
		Internal walls – should not allow water infiltration through their faces when in contact with wet areas.
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	**External windows**
Technical parameter:	**NBR 15575 – Part 1 – Criteria 13.2.6**
	Complementary Law No. 524 of April 8, 2011 - Articles 50, 51 and 53.
	NBR 10821

Evaluation	Method:	Project Analysis / Measurement in loco / Verified in loco
	Description:	**About Natural Lighting and Ventilation**:
		The natural lighting of living rooms and bedrooms, is provided through doorways or windows. In the case of windows, it is recommended that the height of the sill be positioned at a maximum of 100 cm from the inner tread, and the dimension of the headband at a 220 cm maximum span from the inner tread.
		According to the Municipal Working Code - Complementary Law No. 524 of April 8, 2011, the area of the openings destined to insulation and lighting of the compartments should be of at least 1/6 of the area of long stay rooms and 1/8 area of short stay rooms, and the ventilation openings must be of at least half the area for lighting.
		Behaviour according to the use:
		The NBR 10821 specifies the performance requirements for the use of window frames, that they must have: air permeability, water tightness, wind resistance, handling resistance, safety in handling and shading operations of the frames of the bedrooms.
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	Doors		
Technical parameter:	NBR 15575 – Part 1 – Criteria 17.2.1		

	Method:	Verified in loco		
Evaluation	Description:	The elements and components of the housing (latches, handles, cremones, guillotines, etc.) must be designed, constructed and assembled so as not to cause injury to users.		
	Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:	Coverage		
Technical parameter:	NBR 15575 – Part 5 - Criteria 7.1.2 NBR 15575 – Part 5 - Criteria 10.2		

	Method:	Verified in loco		
Evaluation	Description:	**About resistance:** The buildings must be resistant to wind action, preventing rupture, instability, chunking or damage to any coverage component subject to suction and pressure impacts. **About Leaks** It should be sealed against rainwater, preventing the formation of moisture and thus, preventing the proliferation of insects and microorganisms.		
	Result:	□ Atende	□ Atende Parcialmente	□ Não Atende

Attribute:	Electrical installations		
Technical parameter:	NBR 15575 – Part 1 - Criteria 8.2.1.2 NBR 15575 – Part 1 – Environmental Adequacy 18.5		

	Method:	Verified in loco / Project Analysis
Evaluation	Description:	The NBR 15575 says that the electrical installations of residential buildings must be designed according to the NBR 5410 and other International Standards applicable, and that special attention should be given to prevent the risk of ignition of

materials in short circuit function and overvoltage.

The electrical installations should favour the adoption of solutions, case by case, and to minimize energy consumption, including the use of natural lighting and ventilation and alternative energy-based heating systems.

Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:	Hydraulic installations

Technical parameter:	NBR 15575 – Part 5 - Requirement 10.1
	NBR 15575 – Part 1 - Requirement 18.4.1
	NBR 15575 – Part 6 – Criteria 16.1.1
	NBR 15575 – Part 6 – Criteria 16.2.1
	NBR 15575 – Part 6 – Criteria 16.3.1

	Method:	Verified in loco
Evaluation	Description:	**About leaks:** Prevent leaks when subjected to pressure provided for the project. According to **Annex VIII.** **About water use and reuse:** The wastewater from the hydro-sanitary systems should be directed to public collection networks and, if they are not available, there should be used systems to prevent contamination of the local environment. **About dimensions of the hot and cold water installations:** The building system of hot and cold water should provide water pressure, flow and volume compatible with the use associated with each point of use, considering the possibility of simultaneous use. **About dimensions of the sewage system:** The building sewage system must collect and remove the flow rates that are usually discharged by the devices without overflow, soil contamination or return into unused devices. **About dimensions of gutters and conductors:** Gutters and drivers must support the design flow, calculated from the rain intensity adopted for the town and for a certain return period.

	Result:	□ Attends	□ Partially attends	□ Do not attend

Attribute:	**Tabletops, hydraulic parts, metal**	
Technical parameter:	**NBR 15575 – Part 6 – Criteria 17.1.1**	
Evaluation	**Method:**	Verified in loco
	Description:	**About the equipment's ergonomic adaptation:** The utilized parts, including manoeuvring records, must have steering wheels or devices with shape and dimensions that can provide torque or operating force in accordance with the rules of each product specifications, and are free of burrs, roughness or protrusions that might cause injury.
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	**Painting**	
Technical parameter:	**-**	
Evaluation	**Method:**	Verified in loco
	Description:	Verify if the units were delivered with internal and external painting.
	Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	**Vertical and horizontal coatings**	
Technical parameter:	**NBR 15575 – Part 3 - Criteria 10.2.1** **NBR 15575 – Part 3 - Requirement 10.4** **NBR 15575 – Part 3 - Requirement 14.2** **NBR 15575 – Part 3 - Requirement 14.3** **NBR 15575 – Part 3 - Requirement 14.4**	
Evaluation	**Method:**	Verified in loco
	Description:	**About leaks:** Flooring systems must be tight against rising moisture, considering the maximum height of the water table expected to exist on the construction site. The wet areas of flooring systems should prevent the passage of moisture to the other constructive components of the house.

	Moisture resistance:
	Withstand exposure to moisture, in normal use conditions, without deterioration in its properties that can compromise their use.
	Chemical resistance:
	Withstand exposure to chemical agents commonly used in the unit or present in household cleaning products.
	Mechanical resistance:
	Withstand the mechanical stresses associated with the normal use conditions for each specific environment.
Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	**Solar heating system**
Technical parameter:	-

Evaluation

Method:	Verified in loco
Description:	Heating enough water for the use of all residents throughout the day.
	Heating water to an adequate temperature for the bath.
	Hot water tap mixer is located on the left side of the shower box.
Result:	□ Attends □ Partially attends □ Do not attend

Attribute:	**Privacy within neighbours**
Technical parameter:	**Lei Complementar Nº 524, de 08 de abril de 2011 – Artigo 75**
	NBR 15575 – Parte 4 - Critério 12.3.1

Evaluation

Method:	Project Analysis/ Measurement in loco
Description:	The terraced houses should have for each house unit, a minimum free private area of 11,50m², with minimum size of 1,50m.
	In the soundproofing performance, the average standardized difference level, DnT,w, between terraced housing units, where at least one of the shared wall's room is a bedroom, must be ≥45 dB.
Result:	□ Attends □ Partially attends □ Do not attend

Attribute:		**Hygiene and cleaning conditions**
Technical parameter:		**NBR 15575 – Part 6 - Criteria 15.2.1** **NBR 15575 – Part 6 - Criteria 15.2.2** **NBR 15575 – Part 6 - Criteria 15.3.1** **NBR 15575 – Part 6 - Requirement 15.4** **NBR 15575 – Part 6 - Criteria 15.5.1**
Evaluation	**Method:**	Verified in loco
	Description:	**About the biological contamination of the water in the system of drinkable water:** A ll apparent installation components should be made of washable and waterproof material to prevent permeation of dirt or bacteria growth, or even biological activity. **About the contamination of drinking water from the building system:** The buried facilities system components must be protected against the entry of animals or foreign bodies and liquids that can contaminate drinking water. **About gases leaks in the sewage system:** The sanitary sewer system should be designed in order to not allow break of the water seal.
	Result:	□ Attends □ Partially attends □ Do not attend

3. HOUSING UNIT	
Attribute:	**Thermal Performance**

	Technical parameter:	**NBR 15575-1**
Evaluation	**Method:**	Measurement *in loco*
	Description:	**Measuring period:**

The chosen day for analysis should correspond to a typical day in the area, summer or winter, preceded by at least one day with similar characteristics. The typical day is characterised by the external temperature of the cities set out in tables A.2 and A.3 of Annex A of NBR 15575-1. For cities that are not included in the tables, the nearest city in the same bioclimatic zone (NBR 15220-3) should be taken as the typical day, and should have an altitude of the same order of magnitude.

NBR 15220-3 establishes eight bioclimatic zones in Brazil. The software "Zoning Bioclimatic of Brazil" available for download at <http://www.labeee.ufsc.br/downloads/softwares/zbbr>, makes it possible to identify in which Bioclimatic Zone each Brazilian city is inserted.

Internal Temperature (Ti):
The evaluation of the thermal performance of buildings, through measurements *in loco*, should be made in real scale buildings (1: 1).
Measure the dry bulb temperature of the air in the center of the dorms or rooms, at the height of 1.20 m from the floor.
Position the equipment and wait 5 minutes for stabilization.
Carry out the measurements preferably in the hottest time (for typical summer day) or colder (for typical winter day) of the day.
In a housing complex of single and multi-storey buildings, choose one or more units, which make it possible to evaluate under the conditions established below:
• Summer: dormitory or room window facing west and another exposed wall facing north;
• Winter: dormitory or living room window facing south and another exposed wall facing east;
• If the orientation of the windows of the enclosures does not exactly correspond to the previous specifications, prioritize the units that have the largest number of exposed walls and whose window orientations are closer to the specified orientation.
Whenever possible, the walls and windows of the prototypes should be clear (no buildings or nearby vegetation that modifies the incidence of sun and / or wind).

External Temperature (Te):
The external temperatures used should be those recorded by the weather station of the city, at the same time that the internal temperature is measured.

Evaluation criteria:
For the typical summer day, the maximum daily air temperature values for long-stay rooms (rooms and dormitories, without the presence of internal heat sources such as occupants, lamps and other equipment) must always be less than or equal to the value of the outside air temperature. Below are the performance levels according to the bioclimatic zone where the project is inserted:

Performance Level	Criterion	
	Zones 1 to 7	**Zone 8**
Minimum	$T_{i,max} \leq T_{e,max}$	$T_{i,max} \leq T_{e,max}$
Intermediary	$T_{i,max} \leq (T_{e,max} - 2°C)$	$T_{i,max} \leq (T_{e,max} - 1°C)$
Superior	$T_{i,max} \leq (T_{e,max} - 4°C)$	$T_{i,max} \leq (T_{e,max} - 2°C)$ e $T_{i,min} \leq (T_{e,min} + 1°C)$

For typical winter days, the minimum daily values for indoor air temperature of extended dwelling rooms (rooms and dormitories) should always be 3 ° C higher than the minimum daily outdoor air temperature for the typical winter day. Below is the performance levels

according to the bioclimatic zone where the project is inserted:

Performance Level	Criterion	
	Zones 1 to 5	**Zones 6 to 8**
Minimum	Ti,min ≥ (Te,min. + 3°C)	In these areas, this criterion need not be verified.
Intermediary	Ti,min ≥ (Te,min. + 5°C)	
Superior	Ti,min ≥ (Te,min. + 7°C)	

Result:	□ Superior	□ Internediary	□ Minimum	□ Do not attend

Attribute:	**Light Performance**

Technical parameter:	**NBR 15575-1**

Evaluation	**Method:**	Measurement *in loco*
	Description:	Calculate the Daylight Factor (FLD) of each environment, which is the percentage of diffuse light from outside that reaches the interior of the environment.

Perform internal and external measurements in the horizontal plane, using portable luxmeter, error maximum 5% of the measured value, preferably in the period between 9h and 15h, measurements on days with cloud cover greater than 50%, without occurrence of precipitations.

Internal Measurement:
• Measurements made with artificial lighting deactivated, without opaque obstructions (windows and curtains open, internal doors open, no clothes extended on the clotheslines, etc.);
• Measurements in the center of the room, 0.75m above ground level.
• Measurements at the central points of corridors inside or outside the unit.
• In the case of housing Developments consisting of single or two-storey houses, consider all the typical orientations of the different units.
• There can be no direct sunlight on the luxmeter.

External Measurement:
• Simultaneously with each measurement inside the environments, measure the external illuminance in a shaded location near the environment in question.

Evaluation criteria:
The Daylight Factor - FLD is given by the relation between the internal illuminance (Ei) and the external illuminance to the shadow (Ee), according to the following equation:
FLD = 100 X (Ei / Ee).
The following are the levels of light performance of each environment according to the FLD found:

Room	FLD (%) for all performance levels		
	Minimum	**Intermediary**	**Superior**
Living room; Bedroom;	≥ 0,50	≥ 0,65	≥ 0,75

Dinning room / kitchen; Service area.			
Bathroom; Inner corridor or stairway to unit; Common use corridor (buildings); Common staircase (buildings); Parking / garages / parking	Not required	≥ 0,25	≥ 0,35

Result:	□ Superior	□ Internediary	□ Minimum	□ Do not attend

Attribute:	Acoustic Performance

Technical parameter:	-

	Project analysis:	Measurement *in loco*

Description:

To check the noise level that is transmitted between the terraced houses select a house to be noise-emitting and one to be noise-receiving. In the issuing house, select two rooms to make noise, one that has a common wall with the neighbouring house, and one that is further from the neighbouring house.

Position a sound source (sound box) in the center of the selected room (closed doors and windows) facing toward the neighbouring house.

Qualitative evaluation:

Check the perception of the sound between the two houses, in the noise-emitting house, select the first room (twinning wall) to emit an human speech audio, and with the help of the decibelimeter, adjust the volume so that it reaches an average of 85 Decibels, to simulate a loud speech. Always place the decibel meter at a minimum distance of 50 cm from the walls and at a height of 120 cm from the floor.

Simultaneously, in the noise-receiving house, check in all rooms the perception regarding the level of intelligibility of the speech that is emitted in the neighbouring house, and classify as non-audible, audible/do not understand, audible/understand with difficulty and clearly audible.

Perform the same process, but emitting sound from the other selected room (farthest from the neighbouring house).

Below table F.8 of NBR 15575-4, estimates the degree of acoustic isolation between adjacent environments based on the level of speech intelligibility between them.

High speech intelligibility in the adjacent enclosure	Sound insulation, DnT,w [dB]
Clearly audible: listen and understand	35
Audible: hears, understands with difficulty	40
Audible: does not understand	45

Evaluation

| Not audible | ≥50 | |

Quantitative evaluation:

Measure the level of noise transmitted between the two houses. First, in silence (without noise emission) measure and record the noise level of all rooms in the receiving house. Carry out measurement in the center of each environment at a height of 120 cm from the floor.

Later, in the first room of the emitting house, keep the sound box with the same volume of the qualitative measurement, but emitting a sound without much variation of intensity. Measure with the decibel meter, and record the average internal noise level.

Simultaneously, at the receiving house, measure and record the noise level in the center of all rooms, with one decibel meter at a height of 120 cm.

Perform the same process, but emitting the sound from other selected room (farthest from the neighbouring house).

Perform the calculation of the noise difference between the transmitting rooms and all receiveing rooms, to verify how much sound is transmitted from one house to another.

For evaluation criteria, use the result of the sound level difference between adjacent environments, according to the table below, which is part of Table F.10 of NBR 15575-4.

Element	DnT,w [dB]	Performance Level
Wall between autonomous housing units (twinning wall), In situations where there is no dormitory environment	40 a 44	Minimum
	45 a 49	Intermediary
	≥ 50	Superior
Wall between autonomous housing units (twinning wall), in the case where at least one of the environments is a dormitory	45 a 49	Minimum
	50 a 55	Intermediary
	≥ 55	Superior

* Use decibelimeters to measure the sound pressure level in dB(A), which must be read in rapid response (fast), for ten seconds, to record the average value obtained during this period.

Result:	□ Superior □ Internediary □ Minimum □ Do not attend

Organization: ARANTES, 2016.

Organization: ARANTES, 2016.

Organização: ARANTES, 2016.

ANNEX 6 - REGISTRATION DATA OF COLLECTIVE COFFEE

NAME:

ADRESS:

TELEPHONE NUMBER/WHATSAPP:

E-MAIL:

DATE OF BIRTH:

OCCUPATION:

FAMILIAR PROFILE:

NAME:

ADRESS:

TELEPHONE NUMBER/WHATSAPP:

E-MAIL:

DATE OF BIRTH:

OCCUPATION:

FAMILIAR PROFILE:

NAME:

ADRESS:

TELEPHONE NUMBER/WHATSAPP:

E-MAIL:

DATE OF BIRTH:

OCCUPATION:

FAMILIAR PROFILE:

NAME:

ADRESS:

TELEPHONE NUMBER/WHATSAPP:

E-MAIL:

DATE OF BIRTH:

OCCUPATION:

FAMILIAR PROFILE:

09:15   Preparation of space: snacks, map, chart and slideshow.

09:30   First Activity: Individual questioning "What do you need?", "What is missing here?", "Where would be a good place for it?" "What would you like to have here?"

10:15   Collective discussion: free spaces, recreational facilities, health facilities, educational equipment, disposal of waste and neighbourhood relationship.

11:00   Presentation: The project and the work team.

11:15   Collective discussion: name selection to identify the project.

09:30   Preparation of space: snacks, map, chart and slideshow.

09:50   Beginning of music performance.

10:00   First Activity: Individual questioning "What is your favourite place in the neighbourhood?" "What are its positive and negative aspects?"

10:45   Collective discussion: "What can we do to improve this place"

11:30   Presentation: 1st Meeting Results and Other Experiences.

12:00   Visit to the Housing Unit with Professor Fionn

10:00   Reception and Explanations.

10:15   Start of voting and distribution of icecreams.

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