Theoretical and Empirical Researches in Urban Management
Volume 17 Issue 2 / May 2022

AN ANALYSIS OF A LOW-INCOME HOUSING REGARDING FUNCTIONALITY AND ACCESSIBILITY REQUIREMENTS AND POST-OCCUPANCY EVALUATION

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Abstract
Using prefecture-level panel data of cities in the Yangtze River Delta Urban Agglomeration(YRDUA) from 2006 to To solve the Brazilian habitation issues, several social programs were developed over the year by the Federal Government, initiating social housing in the country. This paper aims to analyze the functionality and accessibility in a social housing located in southern Brazil. Therefore, a qualitative-quantitative collection was performed, based on Post-Occupancy Evaluation (POE) - interview and Walkthrough - and analysis of the performance standard in the criteria of functionality and accessibility. A statistical study was also performed on the measure of similarity and

the method of connection of the nearest neighbor. It was noticed that, although there are few criteria in which the houses don't accord to the standard, the standard is not satisfied with the dwellings.
Keywords: Low-income Housing.Social Housing Post-Occupancy Evaluation. Building Performance. Satisfaction.

1. INTRODUCTION

Aiming to solve the dwelling problems in Brazil, several social housing programs were developed through the years by the Brazilian government, starting with the named Social Interest Housing (HIS). It is included in this context the program My House My Life (MCMV), created in 2009. Besides offering housing, these programs fit as public strategies for promoting social inclusion, as they provide citizens a referential of property and individuality (PEREIRA, 2007).

However, the construction model applied by MCMV is not necessarily the most efficient, for, according to Hybiner et al. (2014), it presents low project quality execution mistakes and lack of maintenance. At this juncture, HIS must comply with both the required performance standards and users' satisfaction in order to characterize, in fact, as a convenient housing for the population.

Moreover, it is worth noting that a home isn't characterized by a Building Only, but also by its aggregating factors, such as ownership of the housing, feeling of belonging to the house, and also external factors, e.g., its location and community in which it is inserted (PALERMO et al., 2007). Pereira (2007) stated that the meaning of housing depends on each user's experience in their social and cultural context.

Hence, it is necessary to emphasize the importance of the housing project's design since it is at this stage that the performance of the enterprise is defined. In the design phase, measures are adopted that make environments more suitable for human needs, including the appropriate size of the rooms and dimensions for installing furniture inherent to the ambient. To address these issues, was created in Brazil, NBR 15575 – Housing Building Performance (ABNT, 2013), which are determined minimum standards to be followed to offer comfort to its residents.

Nevertheless, the visualized objective on the projecting stage often does not fit the built ambient. Therefore, the final consumer must be sought, and their satisfaction with the enterprise must be investigated through the Post-Occupancy Assessment (APO). This evaluation can be carried out in several ways to analyze the positive and negative aspects of the house from the resident's perspective.

Because of this, it is advisable to evaluate the MCMV dwellings by the established by the Brazilian norm NBR 15575 (ABNT, 2013), which standardizes minimum parameters for a residence to offer an adequate standard of living users. As a result, the research is based on inquiring if the construction standard is within the norms considered minimum for good human coexistence, using the criteria of functionality and accessibility.

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Howbeit, the project assessment alone is not enough to determine whether the household meets all the requirements for convenient housing. Therefore, there was also a Post-Occupancy Assessment to verify user satisfaction with housing.

Therefore, this work sought to emphasize the importance of meeting a minimum habitable standard in HIS programs as accessibility and user functionality and exploring the divergences between what is recommended by NBR 15575 (ABNT, 2013) and the well-being of the domiciled.

2. LITERATURE REVIEW

HIS are alternatives for people who do not have their own home and live in unfavorable conditions in inadequate places for the basic needs of human beings. The models of housing units commonly offered are standardized, being divided into living room, two bedrooms, bathroom, kitchen, and service area. (VILLA; SARAMAGO; GARCIA, 2008).

The MCMV program started with the intention of building one million homes and promote the country's economic growth (RUBIN; BOLFE, 2015), which, according to CEF (2018), was accomplished in its first phase.

For Rubin and Bolfe (2015) and Moreira and Pina (2012), although it is necessary to apply social policies such as the MCMV, housing should not be built to solve the housing problem in numbers without considering the urban and architectural quality of the enterprise criticism applied to the MCMV program, which emphasizes the number of homes and not the real needs of residents.

NBR 15575 (ABNT, 2013) applies the concept of performance for evaluation, which is used to determine the potential of components or systems produced by a manufacturer, that is, it expresses whether or not a product meets consumer requirements (SANTOS FILHO, 2015. Post Occupancy Assessments (APO) can still be carried out to analyze dwellings, a method that can promote, among others, the technical-constructive assessment and functional assessment (LOPES; ORNSTEIN, 2010).

The APO is a set of techniques and methods for evaluating the performance of built buildings that consider user satisfaction and the technical point of view of specialists. Throught is possible to indicate the recommendations and interventions for each case and apply the improvements in future similar projects. (PREISER; RABINOWITZ; WHITE, 1988, VILLA; SARAMAGO; GARCIA, 2015).

Within this framework, several authors have sought to evaluate HIS based on NBR 15575 (2013) or by different APO methods, which can be used as a study tool to apply new research.

In works that analyze the compliance with NBR 15575 (ABNT, 2013) from the insertion of the minimum layout of the standard in the projects, it is verified that, in order to incorporate all the minimum furniture required by the standard, there is no compliance with the circulation areas and minimum areas needed for the standard, as shown by research by Almeida, Viana and Kalil (2011), Santos, Oliveira and Sposto (2016) and Hyiner et al., (2014). These authors also denote problems regarding the absence or insufficiency of housing for PCD.

In works carried out by APO, conclusions diverge. Freitas, Añaña and Schramm (2013) performed APO and found that the most cited positive points were that the house has a bathroom and space for family accommodation, tranquility, and quality of construction. Neighborhood and "own" homes were other positive features highlighted by residents. The worst points were insufficient space, problems with sewage installations, and lack of floor and ceiling coverings.

There also was a significant portion of inhabitants who responded that there was nothing negative about the house (FREITAS; AÑAÑA; SCHRAMM, 2013).

On the other hand, Morais, Carneiro and Barros Neto (2014), using questionnaires, came across expressive criticisms related to the topic "neighborhood" (access to leisure, commerce, public transport) and "local policing". There was dissatisfaction with the leisure areas and safety devices. Regarding the communal space of the housing unit, the floors of the rooms (since the units were delivered only with a subfloor) and the functioning of the intercoms (not installed by the construction company) were considered negative. Acoustics and natural ventilation were also items where residents were unsatisfied (MORAIS; CARNEIRO; BARROS NETO, 2014).

Another study was executed by Villa, Saramago and Garcia (2015) with APO application through Walkthrough in two projects. Both had adequate urban infrastructure, although only one had a bus line and public services, such as a health center and school.

Additionally, Silva et al. (2017) analyzed three blocks of HIS through a technical survey with photographic records and the application of a questionnaire. The authors found that 78% of households considered their current housing better than the previous one. However, dissatisfaction was noted with the size of the house, lack of urban structure in the neighborhood (there are no schools, daycare centers, police, or health posts), lack of security, and lack of public transport. It was also observed that more than half of the houses had already been renovated and walls or fences were installed in front of the houses, and in 70% of the cases, there had been expansions in the buildings. Dissatisfaction with the circulation area was also highlighted, especially in the kitchen. It is evident that there is slight possibility of expansion in the kitchen and service area. (SILVA et al., 2017).

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Thus, from the research performed, it was found that several works do not meet the performance standard or do not meet user expectations as they should. In this way, Hybiner et al. (2014) conclude that the aspects addressed by NBR 15575 (ABNT, 2013) still need to be better incorporated into HIS projects.

Nevertheless, Freitas, Añaña e Schramm (2013highlight the fact that HIS residents with inadequate spaces are not dissatisfied with their housing but instead resigned.

Plus, in several cases, it is emphasized that residents who want to make changes or expansions at home, prioritize essential aspects such as adding walls around the house. There is also great dissatisfaction with the infrastructure of the neighborhoods in which the projects are located.

3. MATERIALS AND METHODS

For the execution of this study, a HIS was analyzed in the city of Toledo - PR, southern Brazil. First, it was determined the number of samples statistically needed. After that, the methodology used to obtain the results regarding user satisfaction were the Walkthrough and the structured interview. For the diagnosis regarding the performance standard, the architectural projects of the HIS were evaluated. Finally, a cross-reference was made between the data obtained to examine the points in common and in disagreement between the assessment of the domiciled and that required by NBR 15575 (ABNT, 2013).

The research was based on the parallel activities of APO and analysis of the performance standard to, in the end, perform the comparison of the data obtained; to find a relationship between user satisfaction and the recommended by NBR 15575 (ABNT, 2013).

3.1. STUDY CASE: JARDIM DAS ORQUIDEAS HOUSING COMPLEX

The study was implemented in the Jardim das Orquídeas Housing Complex, located in the city of Toledo-PR. This subdivision was determined for the research because it serves the population that falls into Range 1 in the MCMV program (income up to R$ 1,800.00), the factor of interest in this work.

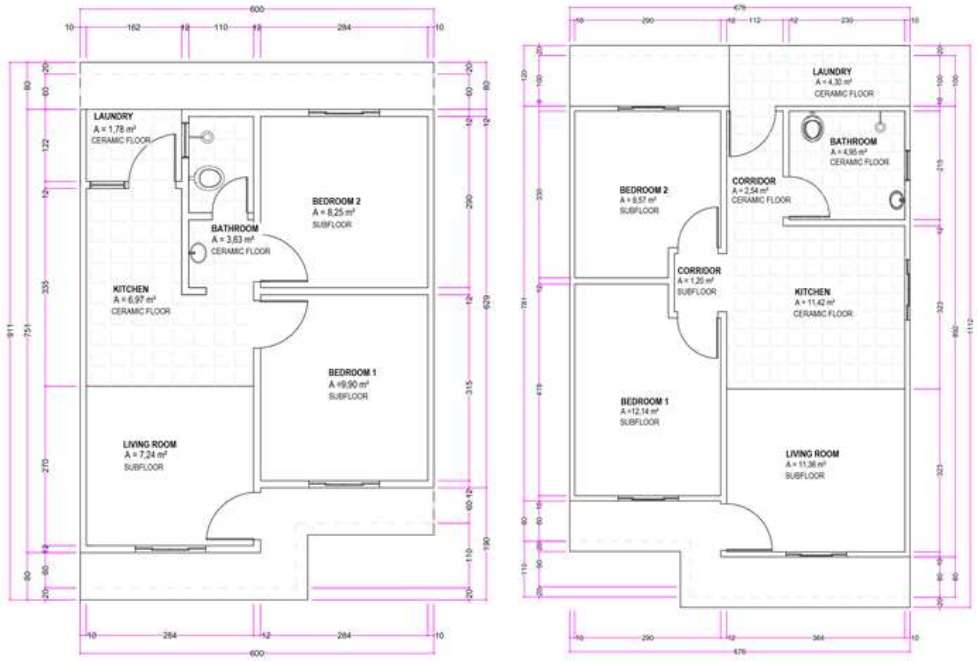
This development is of the MCMV type, consisting of 244 dwellings, eight of which are adapted for PWD. The houses were built in lots of 136 m², 150 m², 182 m², 200 m², 225 m², 275 m², and 300 m², delivered in 2011.

The dwellings are divided into adapted, semi-detached and non-detached houses. The difference between the semi-detached and non-detached houses is just the thickness of an external wall, totaling 41.82 m², as shown in Figure 1-a.

The eight adapted dwellings of the set adapted for PWD have a different architectural design, as shown in Figure 1-b, totaling an area of 56.97 m².

As can be seen, each house has two bedrooms, a bathroom, an integrated kitchen with a living room, and a service area. There were no divisions of the lots, neither by sidewalls and at the back nor fences at the front. The main difference between the semi-detached houses and the others is the size of the lot. In semi-detached houses, the houses occupy the entire width of the land.

The determination of the sample is given by the formula of the estimation error calculation of a proportion and 95% confidence interval. In this way, it was decided to conduct the research with 50 dwellings, being 46 standard houses, and four houses adapted for PWD. The choice of places to be visited was random.



a b

FIGURE 1 - FLOOR PLAN OF THE HOUSES OF THE JARDIM DAS ORQUÍDEAS HOUSING COMPLEX
Source: Adapted from the Department of Housing and Urbanism, Toledo – PR.

3.2. DATA COLLECTION

The post-occupancy evaluation was carried out based on interview and walkthrough instruments.

The interview was of the structured type, which consists of a questionnaire. A script was elaborated based on the questionnaires carried out by Bonatto, Miron and Formoso (2011), Peruzzo (2008); Morais, Carneiro and Barro Neto (2014); Freitas, Añaña and Schramm (2013), which was submitted for the ethics committee.

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In the interviews, responses that address the house's original design were prioritized, without considering satisfaction after possible renovations or expansions. For this purpose, a short script was chosen, as shown in Table 1:

TABLE 1 - QUESTIONNAIRE APPLIED IN THE INTERVIEW

1 GENERAL INFORMATION ABOUT RESIDENTS	
Number of residents, age, sex, and family composition	
Previous residence	( ) rented house/apartment ( ) owned house/apartment ( ) irregular ( ) other
Localization of the previous residence	( ) another city ( ) same neighborhood ( ) another neighborhood ( ) another
In relation to the last house, this is:	( ) better ( ) worse ( ) even
Motivation to buy this house	
Quality of life post-occupation	( ) better ( ) even ( ) worse

2 SATISFACTION WITH THE SURROUNDINGS					
	Great	Good	Regular	Bad	Terrible
Access the street to the complex					
Street drainage					
Public street lighting					
Garbage collection					
Selective garbage collection					
Distance between complex and school					
Commerce					
Bus stops					
Bus lines					
Squares/leisure area					

3 SATISFACTION WITH EACH ROOM					
	Great	Good	Regular	Bad	Terrible
Kitchen size					
Kitchen furniture layout					
Service area size					
Service area furniture layout					
Living room size					
Living room furniture layout					
Dorm size					
Dorm furniture layout					
Number of Sockets and Switches					
Location of sockets and switches					
Amount of windows					
Location of windows					

4 USER PREFERENCES
What is the worst room in the house? Why?
And the best? Why?
Do you miss some space in your home? Which?
Does anyone sleep in a room other than the bedroom?
Have you carried out renovations/expansions in the house? Which are? Why?
Do you want to carry out expansions in the house? Which are? Why?
Would you like/consider moving house? Why?
5 GENERAL COMMENTS

Source: Authors (2022).

For the in loco analysis, the Walkthrough method was used, which, in this case, was a visit by the evaluator in the study environment, that is, in the vicinity of the dwellings.

To collect data from the housing complex, the surroundings of the buildings were investigated. For better use of this resource, a checklist was used in addition to the use of photographs of the area analyzed externally.

The checklist was prepared based on the items pointed out by Morais, Carneiro, and Barro Neto (2014), regarding the surroundings of the housing complex. It contains components such as the presence of paved streets, shoulders, and bus stops, as well as essential services to the population, such as daycare centers, schools, and health centers.

3.3. DATA TREATMENT

In the sequence of the application of the questionnaire, it was carried out in the items referring to the satisfaction of the users regarding the surroundings and the rooms. The Ridits quantification method was applied. The quantifications obtained were analyzed using the multivariate statistical technique of Cluster Analysis (AA) of individuals and variables. This analysis aims to group the variables so that the elements belonging to the same group are similar to each other regarding the frequency of occurrence. Data analysis was processed with the help of the R software (R Core Team, 2017) and auxiliary packages such as Vegan (OKSANEN et al., 2016) and Graphics (R Core Team, 2017).

The grouping of variables was constructed using Pearson's correlation matrix, using the dissimilarity measure proposed by Rencher (2002). The agglomerative hierarchical grouping method was used, where each object or observation starts in its own group, and the single linkage or nearest neighbor method (Single linkage) was used. In this method, the similarity between two groups was defined by the two elements most similar to each other, where two groups that are most similar concerning distance were combined into a single cluster.

3.4. LAYOUT EVALUATION ACCORDING TO NBR 15575 (ABNT 2013)

The evaluation of the layout aimed to verify if the functional organization of the spaces was compatible with the needs of the residents. For this purpose, furniture with the minimum dimensions required by NBR 15575 (ABNT, 2013) was inserted.

Thus, the layout that most favors free movement was explored, despite the amount of furniture needed for the place. After defining the furniture arrangement, a checklist was used, prepared according to the furniture with the minimum dimensions required by NBR 15575 (ABNT, 2013) in each room, together with the minimum spacing needed around each furniture.

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3.5. DATA ANALYSIS

The results obtained by APO were tabulated and graphically demonstrated with photos of the place. The conclusion regarding compliance with the performance standard was presented in a table.

To make the comparison, data on users' satisfaction with the housing were used, and it was verified whether the standard covers factors that generate discomfort for the resident or whether the items that the standard encompasses do not affect the quality of housing in the user's perception.

4. RESULTS AND DISCUSSION

4.1. DATA FROM POST-OCCUPANCY EVALUATION

About the period in residence, 88% of people have lived in their houses since the county delivered the construction. Other people bought or rented from the beneficiaries of the places, even though that act was illegal.

Within the reasons for moving, the main one is about the opportunity of buying a house and getting rid of rent, because 72% of the interviewed people have previously lived in rented houses and 58% said this is the reason for moving to Jardim das Orquídeas.

Regarding the number of families members, in 34% of the cases, the families were composed of four people, with 28% of three people and 22% of two.

Analyzing the basic structure of the residences, it was observed that plenty of times the construction did not meet the needs of the families, which stimulated many forms of house modifications.

4.1.1. Standard houses

Non-adapted houses showed that there were external area modifications in 26,1% of the cases, with 21,7% of the families expressing the will to make changes and 17,4% of people having constructed garages in the unities. Moreover, 19,6% of the houses had one or more attached bedrooms, while 21,7% of the families wanted to implement this modification.

External area reformation refers to porch construction, which can be explained by being low-cost work. There is also a regional cultural factor: the habit of people gathering around on the porch in their free time, especially in the summer.

In the same way, 34,8% of the analyzed non-adapted houses had their kitchens already modified, while 10,9% of people wanted to make those changes. Another room pointed as the worse one in the

residences was the bathroom, which is 8,7% of the cases only were reformed, while another 13% wanted to apply it.

The houses' blueprints can explain the low number of bathroom reformations: the room was located between the bedroom and the kitchen, so it wasn't easy to expand. Also, most of the families gave priority to reforming other parts of the residence.

In general, it was possible to observe that wealthier families have ever reformed their residences, and 26,1% of the interviewed people have not made any changes – only 3 stated the will of not implementing any modification.

The interviewees' answers about reformation are shown in Table 2.

TABLE 1 – REFORMATION OR EXPANSION IN THE JARDIM DAS ORQUÍDEAS CONDOMINIUM

ROOM	REFORMATION OR EXPANSION MADE	WILL OF REFORMATION OR EXPANSION
NO REFORMATION	26,1%	32,6%
KITCHEN	34,8%	10,9%
BEDROOM	29,6%	21,7%
LIVING ROOM	15,2%	2,2%
BATHROOM	8,7%	13%
LAUNDRY ROOM	10,9%	4,3%
EXTERNAL AREA	26,1%	21,7%
GARAGE	17,4%	0%
ANOTHER RESIDENCE	13%	0%
WALL PAINT	2,2%	0%

TABLE 2 - FREQUENCY DISTRIBUTION (%) OF THE ROOMS' FEATURES

QUESTION	VERY BAD	BAD	REGULAR	GOOD	VERY GOOD
2.1 KITCHEN SIZE	40	36	4	20	0
2.2 KITCHEN FURNITURE DISTRIBUTION	36	34	12	16	2
2.3 LAUNDRY ROOM SIZE	62	16	12	10	0
2.4 LAUNDRY ROOM FURNITURE DISTRIBUTION	12	32	16	34	6
2.5 LIVING ROOM SIZE	12	36	14	30	8
2.6 BEDROOM SIZE	6	22	12	56	4
2.7 BEDROOM FURNITURE DISTRIBUTION	6	24	6	60	4
2.8 NUMBER OF SOCKERS AND SWITCHES	12	8	14	52	14
2.9 SOCKERS AND SWITCHES' LOCATION	12	8	14	52	14
2.10 NUMBER OF WINDOWS	2	4	14	64	16
2.11 WINDOWS' LOCATION	4	4	14	62	16
2.12 BATHROOM SIZE	42	28	12	12	6

Moreover, 13% of the interviewed residents have built other houses on the land for their relatives. This fact shows these families' need for larger spaces.

39,1% considered the kitchen the worst room in the house, and 45,7%, the bathroom. In addition, 34,8% thought the bedroom was the better room, while 37% expressed that the living room has that feature.

Reformation and expansion of the houses reflected the users' satisfaction with the residences. Table 3 shows the rooms' categorization into grades from 'Very Bad' to 'Very Good'.

Through the cluster analysis, it a dendrogram was built, which is represented in Figure 2 and shows the answers' similarities.

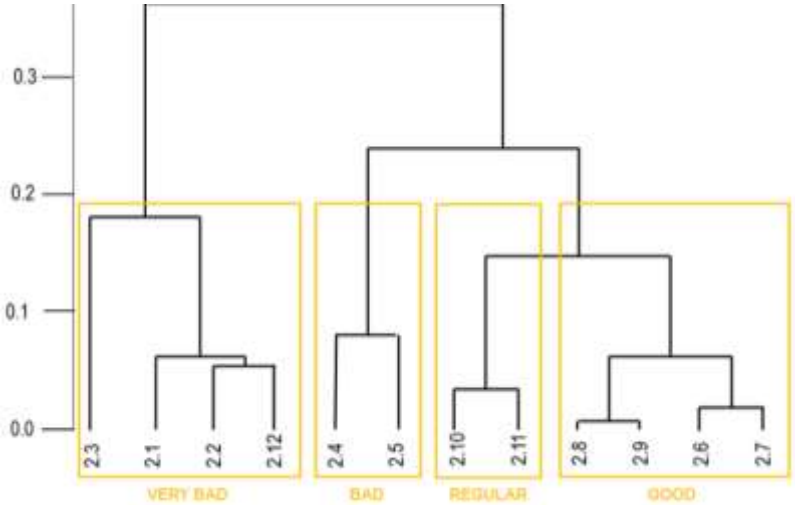

FIGURE 2 – DENDROGRAM BUILT WITH THE ANSWERS ABOUT ROOMS' SATISFACTION
Source: Authors (2022).

It can be observed that, considering the five categories, there were four different groups only. The 'Very bad' group is composed of variables 2.1 (Kitchen size), 2.2 (Kitchen furniture distribution), 2.3 (Laundry room size), and 2.12 (Bathroom size).

In a particular way, inhabitants showed dissatisfaction at the kitchen design, which all residents used simultaneously, and the size and furniture distribution interfered with the people flow. It even reflected that the kitchen was chosen by 39,1% of the people as the worst room in the house.

The dissatisfaction with the laundry room was explained, by the interviewed people, by fitting the washing machine and the washtub only, with no suitable space for other items, such as ironing boards and cabinets also, people dislike that it's external to the house.

Moreover, criteria 2.4 (Laundry room furniture distribution) and 2.5 (Living room size) were statistically classified as 'Bad'. The main complaint about the living room was related to its integration with the kitchen

because the space was mainly used to accommodate household appliances and kitchen furniture, which reduced the area for the living room furniture such as television and couches.

'Regular' category comprises criteria 2.10 (Number of windows) and 2.11 (Windows' location). Also, the last group was formed by the 'Good' category and the variables 2.6 (Bedroom size), 2.7 (Bedroom furniture distribution), 2.8 (Number of sockets and switches), and 2.9 (Sockets and switches location). In general, the residents were satisfied with the bedrooms. People have mentioned that the quantity was enough of the sockets and switches, but the quality was lower than expected.

None of the groups has reached the criteria 'Very Good'. In addition to this, there were many reformations, which is why it is possible to conclude that the houses' design could not provide well-being to the residents.

4.1.2. Houses adapted for people with disabilities

These houses had a different design than the other ones. That is why their residents had to face additional problems. Therefore, the interview results showed distinct points in comparison to other constructions. 50% of these people, in particular, stated the worst room of the house was the kitchen, and 75% agreed that the best space was the living room.

About the reformations, residents of the four analyzed houses have ever implemented changes in the external area. Knowing that there were wheelchair users amongst these people, the families had to fix the unevenness of the land and street with proper entrance ramps to enable users' mobility. Although there were already modifications in the external area, 50% would like to promote improvements in this part of the house, and 50% would build another bedroom.

In this group, interview participants stated they did not miss space inside the residence, and only one family showed interest in moving to another house.

Of all interviewed families about the adapted and non-adapted houses, the people's majority complained about the electrical infrastructure when asked about any general comments about the residence. Even aware of the shortcomings, 80% stated the current houses were better than their previous ones. The same amount said their life quality has improved since they moved to the condominium. However, 16% considered the residence worst than the previous one, while 4% thought there was no difference. 14% stated their life quality has dropped, and 6% that it remained the same.

It can be observed the people's majority attributed this improvement to the absence of charging rent and to the low installment of the house, which caused significant differences in the families' money balances. Also, that's why 72% of the interviewed people alleged not willing to move from the house.

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4.1.3. External components of the housing state

From the interviews, data was collected about the satisfaction with the houses' surroundings, from the residents' point of view. Table 4 shows those results.

TABLE 3 – FREQUENCY DISTRIBUTION (%) OF THE HOUSES' SURROUNDINGS

MATTER	VERY BAD	BAD	REGULAR	GOOD	VERY GOOD
3.1 ACCESS STREET TO THE CONDOMINIUM	0	2	6	78	14
3.2 STREET DRAINING	4	2	4	72	18
3.3 STREET LIGHTING	2	6	12	72	8
3.4 GARBAGE COLLECTION	0	0	6	42	52
3.5 SELECTIVE GARBAGE COLLECTION	6	28	32	30	4
3.6 DISTANCE TO THE SCHOOL	6	28	32	30	4
3.7 COMMERCE	0	2	16	46	36
3.8 BUS STOPS	0	2	20	38	40
3.9 BUS LINES	18	38	22	20	2
3.10 SQUARES AND RECREATION AREA	0	2	6	78	14

Source: Authors (2022).

It was obtained in the following dendrogram, in Figure 3.

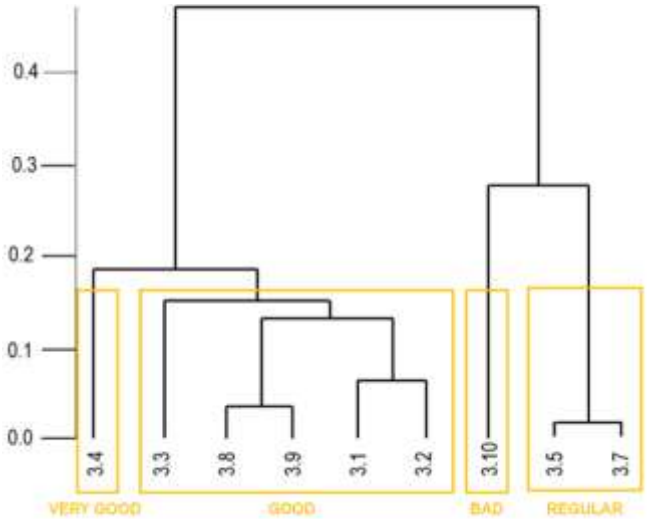

FIGURE 3 – DENDROGRAM OF THE ANSWERS ABOUT SURROUNDINGS
Source: Authors (2022).

The groups formed by items 3.5 (Selective garbage collection) and 3.7 (Commerce) presented the same frequency distribution, having a "Regular" classification. Two groups were formed with a single variable: 3.4 (Garbage collection) classified as "Excellent" and 3.10 (Squares and leisure area) as "Bad".

Allied to the method of interviews, for the evaluation of the surroundings of the complex, the Walkthrough was used, where it was possible to observe the aspects of the infrastructure of the housing complex.

In line with the situation of the allotment's streets, it was noted that paved streets are found along the entire length of the subdivision, and according to the users' responses, they are satisfied with this aspect of the complex, as can be seen on the dendrogram.

Although there are no horizontal shoulder demarcations, it is possible to identify the space destined for vehicle parking by painting the curb. Due to the lack of distinction, there is also no place for particular vacancies for the elderly and PCD.

It could be noted that the pavements do not have a tactile floor, recommended by NBR 9050 (ABNT, 2014) for the mobility of people with impaired vision. Despite this, the width required by the standard of at least 1.20 m is met on the most pavement. The lane gets narrower in places with access lanes, which should not happen.

There are access lanes for wheelchair users at all intersections in the complex, although they do not respect the slope of 8.33% on the sides. It can also be noted that the street indication plate is located on the sidewalk without an obstacle indication for people with visual impairments, which may cause accidents.

Still, on the access lanes, in some cases, there is no international access symbol, in addition to the slope being wrong. It was also possible to notice cracks in the sidewalks, making it difficult for people in wheelchairs, strollers, children, and the elderly to pass.

As for the lighting poles and bus stops in the subdivision, a scheme was prepared (Figure 4), which indicates the locations of the poles and bus stops.

As can be seen, there is a considerable amount of lighting poles, and as mentioned above in the interviews, the residents are satisfied with the public lighting in the place, having been statistically classified as “Good” (Figure 3). The bus stops were also positively evaluated by the interviews. However, only bus stop 1 is accessible.

Regarding the bus line, there was also a majority of positive responses. In both cases, they were classified by the residents as “Good”, as can be seen in Figure 3. However, when the bus routes are researched, it appears that there is only one bus line serving Jardim das Orquídeas, which leaves the terminal and the last stop is at the stop next to the Municipal Child Education Center (CMEI). According to the responsible company. Viação Sorriso de Toledo (2019), on weekdays, the frequency of buses is every thirty-four minutes. On Saturdays, every half hour, and Sundays and holidays, buses leave at one-hour and five-minute intervals. This was the only complaint from the locals: the hours during Sundays and holidays. Regarding public trash cans, only one was found nearby, which was located inside the children's playground, with no indication of the type of waste for which it was intended. There were small markets

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(grocery stores) of residents in the set (items 1, 2, 3, and 4); however, through the interviews, it is possible to perceive that in the case of purchases of food and hygiene materials, many residents prefer, due to the better value for money, go to the larger supermarkets, which are located approximately 2.5 km from the Jardim das Orquídeas allotment. Thus, as indicated in Figure 3, this group fit in "Regular" statistically. There are only two places for entertainment: a playground (item 5) and a multi-purpose arena (item 6).

FIGURE 4 - DIAGRAM INDICATING THE BUS STOPS AND LIGHT POLES PRESENT IN THE VICINITY OF THE JARDIM DAS ORQUÍDEAS SUBDIVISION
Source: Authors (2022).

Other components observed are in Figure 5.

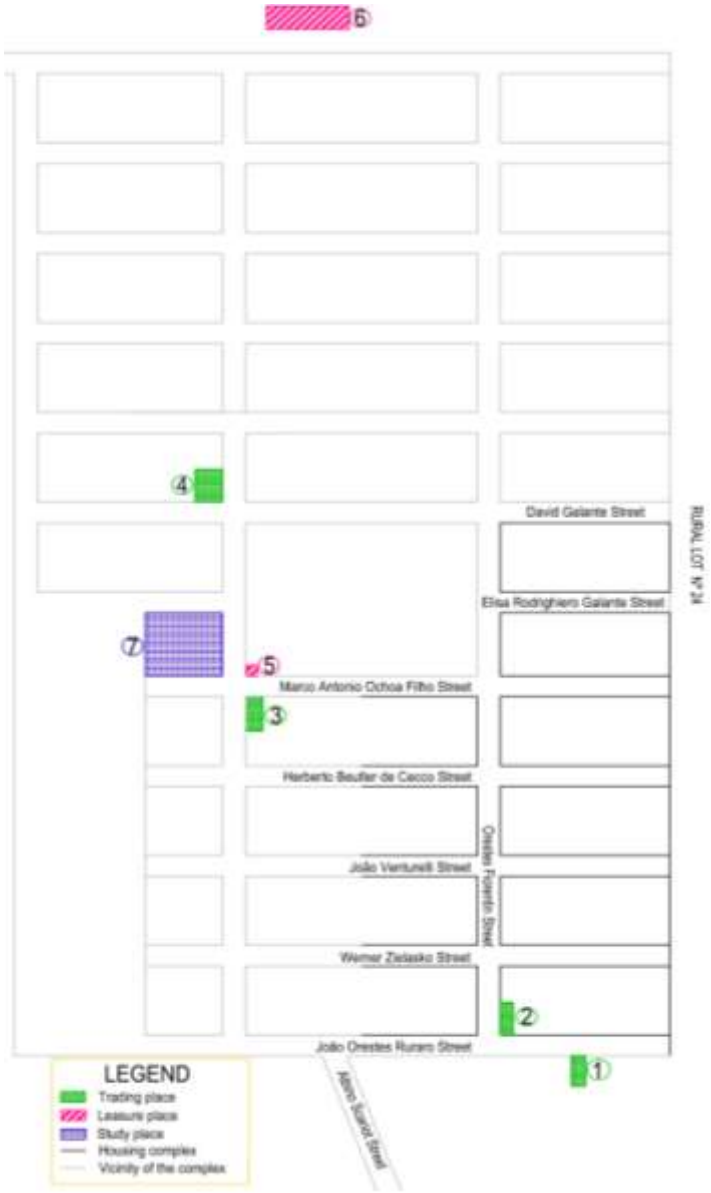

FIGURE 5 - COMMERCE, SQUARES, AND CMEI CLOSE TO THE HOUSING COMPLEX

Implementing the multi-purpose arena, composed of a skate park, synthetic soccer field, and multi-sport court, was an initiative of the city hall in January 2019, which aims to encourage the practice of sports and increase the quality of people's health (TOLEDO, 2019). There are neither in the playground nor in the multipurpose arena devices for PWD use. Despite the presence of these two spaces for leisure, the residents are unhappy with the areas provided, being the only group in the complex's surroundings to be classified as "Bad". Based on the comments made by residents, this note is attributed to the fact that there are no places for leisure aimed at the adult population near the complex and the lack of security that residents feel in these places. Leisure places such as squares and playgrounds are also marked in Figure

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5. Regarding public safety, the nearest Police Station is located 7 km from the subdivision. However, in the interviews, it is quite relevant by the residents the mention that there is a constant police patrol. Even during the Walkthrough, it was possible sometimes to notice the 19 BPM car in Jardim das Orquídeas. Nearby the complex also is the Municipal Child Education Center (CMEI), indicated in Figure 7, item 7. It is important to note that the CMEI only serves children aged zero to three years. From four years old, children study at the School of Early Childhood Education and Elementary Education Initial Years (1 km away) and later at the Middle and High school – (1.7 km away). About Health Units, the ones closest to the residences for primary care are 2.5 km from the complex (BRASIL, 2019). As for urgencies and emergencies, the nearest place is located 4.5 km away.

4.2. LAYOUT APPLICATION FROM THE NBR 15.575 (ABNT, 2013)

4.2.1. Standard house

Based on the requirements of NBR 15575 (ABNT, 2013) regarding the furniture needed for homes and their minimum dimensions, the layout that best suited the conditions is shown in Figure 6, which, although it demonstrates the most appropriate layout as recommended by the NBR 15575 (ABNT, 2013), did not meet all specifications.

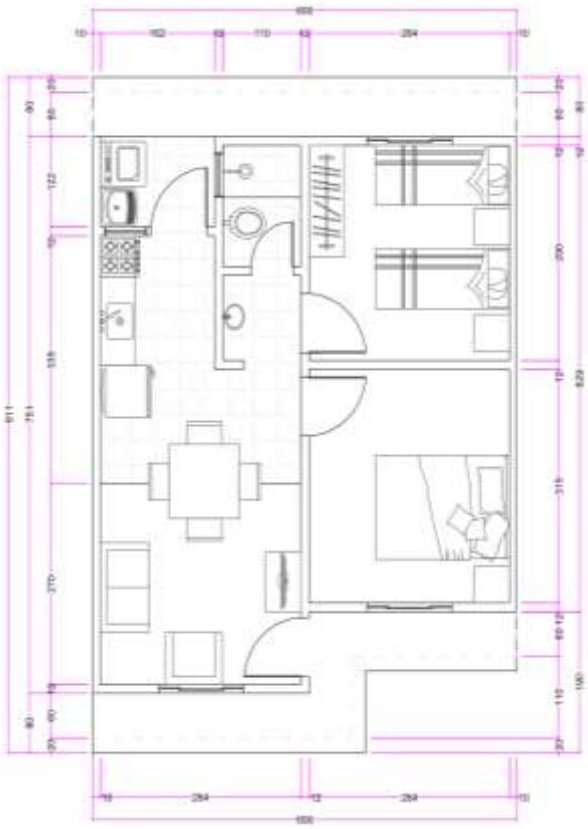

FIGURE 6 - LAYOUT ACCORDING TO THE REQUIREMENTS OF NBR 15575 (ABNT, 2013)

In the kitchen, although it has a minimum width of 1.50 m, all standard furniture does not fit since the table for four people exceeded the kitchen demarcation, invading the delimited area of the room. Despite this, there is still room for the minimum required circulation of 0.75m from the table's edge. However, the room reduces its size so that the width is less than 2.40 m, which is the minimum required by NBR 15575 (ABNT, 2013). However, it still has the minimum furniture required.

The bathroom has exactly the width required by the standard (1.10m) and has a shower and toilet. Even though the washbasin is on the outside, there is no prohibitive indication of this situation in the performance standard. There is no mention that the door, when open, interferes with the circulation space in front of the toilet. The laundry also meets the recommendations regarding minimum circulation - 0.50 m in front of the tank and washing machine - and the mandatory furniture - tank and 20 L machine. However, it is located in an open house area, being protected only over the roof's eaves.

Regarding the bedrooms, the main bedroom fulfills all the prerogatives of the standard, being possible to rent a double bed, wardrobe, and a bedside table and provide a minimum circulation of 0.50 m in the room. However, in the second bedroom, even though the two beds can fit, and up to two bedside tables and a wardrobe, the circulation between the beds and the closet is less than the 0.50 m required by the regulations. These situations are described, in summary, in Table 2.

TABLE 1 - COMPLIANCE WITH NBR 15575 (ABNT, 2013) ACCORDING TO ANNEX A

RIIM	MINIMUM QUANTITY OF FURNITURE	MINIMUM DIMENSION	COMPLIANCE WITH MINIMUM CIRCULATION	OBSERVATIONS
KITCHEN	Does not comply with NBR 15575 (ABNT, 2013).	Complies with NBR 15575 (ABNT, 2013).	Complies with NBR 15575 (ABNT, 2013).	The table takes up space in the living room.
LIVING ROOM	Complies with NBR 15575 (ABNT, 2013).	Complies with NBR 15575 (ABNT, 2013).	Complies with NBR 15575 (ABNT, 2013).	-
LAUNDRY ROOM	Complies with NBR 15575 (ABNT, 2013).	-	Complies with NBR 15575 (ABNT, 2013).	Belongs to the outside area of the house.
BEDROOM 1	Complies with NBR 15575 (ABNT, 2013).	-	Complies with NBR 15575 (ABNT, 2013).	-
BEDROOM 2	Complies with NBR 15575 (ABNT, 2013).	-	Does not comply with NBR 15575 (ABNT, 2013).	-
BATHROOM	Complies with NBR 15575 (ABNT, 2013).	Complies with NBR 15575 (ABNT, 2013).	Complies with NBR 15575 (ABNT, 2013).	-

Source: Authors (2022).

It can be seen from Table 2 that most requirements of the regulation are met in the housing complex.

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4.2.2. Adapted house for PWD

In the case of housing adapted for PWD, NBR 15575 (ABNT, 2013) refers to NBR 9050 (ABNT, 2014) as a regulation that must be consulted so that the place is accessible. The layout with the minimum standards was included, and the analysis was based on the two standards. The proposed design is shown in Figure7.

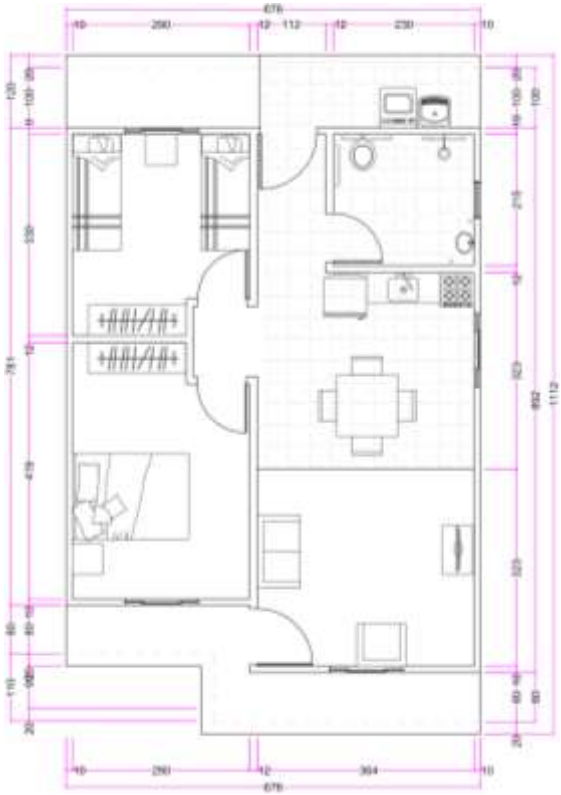

FIGURE 7 - - LAYOUT AS PER THE REQUIREMENTS OF THE NBR 15575 (ABNT, 2013)
Source: Authors (2022).

From Figure 7, it can be seen that it was possible to include all the furniture with the minimum dimensions in the house, as preceded by NBR 15575 (ABNT, 2013).

Circulation areas are regulated by NBR 9050 (ABNT, 2014), which requires a minimum maneuvering area for people with reduced mobility. The standard considers that for crossing an isolated obstacle of up to 40 cm, a circulation width of at least 80 cm must be present. With obstacles above 40 cm, the minimum width must be 90 cm. In this criterion, all rooms in the house are met.

Nonetheless, with regard to 90º displacement, the accessibility standard requires a rotation radius of 1.20 m. Knowing this, it is observed that it was not possible to reconcile the furniture needed by NBR 15575 (ABNT, 2013) in the bedrooms, kitchen, and corridors. This requirement was met in the bathroom and the living room.

In the bathroom, as shown in Figure 10, there is enough space for a 360º rotation of a person in a wheelchair, as regulated. However, the project did not specify a non-slip floor in the box, which the standard requires to prevent slipping.

Table 3 presents a summary of the regulations met in each room.

TABLE 2 - COMPLIANCE WITH NBR 15575 (ABNT, 2013) ACCORDING TO ANNEX A AND NBR 9050 (ABNT, 2014)

ROOM	MINIMUM QUANTITY OF FURNITURE	MINIMUM DIMENSION	MINIMUM CIRCULATION /MANEUVER AREA	OBSERVATIONS
KITCHEN	Complies with NBR 9050 (ABNT, 2014).	Complies with NBR 9050 (ABNT, 2014).	Does not comply with NBR 9050 (ABNT, 2014).	-
LIVING ROOM	Atende à NBR Complies with NBR 9050 (ABNT, 2014).	Complies with NBR 9050 (ABNT, 2014).	-	-
LAUNDRY ROOM	Complies with NBR 9050 (ABNT, 2014).	-	Does not comply with NBR 9050 (ABNT, 2014).	Belongs to the outside area of the house.
BEDROOM 1	Complies with NBR 9050 (ABNT, 2014).	-	Does not comply with NBR 9050 (ABNT, 2014).	-
BEDROOM 2	Complies with NBR 9050 (ABNT, 2014).	-	Does not comply with NBR 9050 (ABNT, 2014).	-
BATHROOM	Complies with NBR 9050 (ABNT, 2014).	Complies with NBR 9050 (ABNT, 2014).	Complies with NBR 9050 (ABNT, 2014).	-

Source: Authors (2022).

As for the dimensions of the doors, the internal ones meet the minimum specification of a span of 80 cm, and the external ones have a span of 90 cm. However, NBR 9050 (ABNT, 2014) requires a distance of 30 cm or 60 cm (depending on the direction of displacement) about the side of the handle with the wall perpendicular to the door.

In the case of doors present in adapted houses, only the bathroom door has the required free space, regardless of the direction. The bedroom doors meet the regulations in the order of exiting the room. The hallway door to the laundry room complies with the norm towards the entrance of the house and the door of the room towards the exit of the house.

The project of accessible houses includes the minimum furniture required by NBR 15575 (ABNT, 9050). However, it should be noted that furniture with different dimensions is necessary depending on the resident's needs. This case was not considered in the study because neither NBR 15575 (ABNT, 2013) nor NBR 9050 (ABNT, 2014) indicate standards for this furniture in household cases.

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4.3. COMPARISON BETWEEN COMPLIANCE WITH THE STANDARD AND USER SATISFACTION

It could be seen, in non-adapted houses, that the most problematic room from the residents' point of view, the bathroom, is conforming to NBR 15575 (ABNT, 2013). The fourth, which presents a circulation problem according to the regulations, satisfies the residents in general.

According to the standard, the kitchen must provide storage space over the sink and cabinet. However, in practice, only these places are insufficient to store all the utensils – especially considering that most families live with three to four people. For this reason, residents reported that they placed storage spaces on the two walls of the kitchen, making the space insufficient for the movement and even permanence of more than one person.

Added to all of this, there is the exit door at the back of the house connected to the kitchen, making it even more challenging to circulate because, for one person to enter, the other must leave the hallway, completing the tasks challenging.

Regarding the bathroom, although it meets the prerogatives of the norm, the residents complain significantly about the space - even reporting that it is necessary to enter the bathroom box space to be able to close the door and use it.

In addition, according to residents, the space in the shower, measuring 70 cm, is too tiny for comfort while showering. In this sense, families also complain that they need to provide bathing for minor children or older adults who cannot do it alone.

The norm also indicates that you can place the laundry in an outdoor area in one-story houses. However, many residents were unhappy with this configuration, suggesting that there is no service area in the home. Many complaints come from the fact that, even with coverage, because walls do not protect during rainy weather, it is not possible to use the area intended for this activity. In addition, the fact that the place is small, although it meets the standard's requirements, also generates discontent.

These aspects show a contradiction between what is recommended in the norm and what is experienced in practice by the residents. Therefore, it can be seen that NBR 15575 (ABNT, 2013) does not contemplate the real needs of the residents, which is even quantified by the interviews, since the most indicated room as the worst in the house, the bathroom, listed as worse by 45.7% of residents, is one of the normatively correct. Figure 8 shows a diagnostic map based on interviews and regulations in the standard houses of Jardim das Orquídeas.

In regards to the houses adapted for PWD, the adversity focuses, in addition to the minimum amount of furniture, on the lack of dimensions required for these, both by NBR 15575 (ABNT, 2013) and by NBR 9050 (ABNT, 2014), because, depending on the physical disability, adjustments may be necessary, including the furniture of the rooms.

In such manner, by the layout applied, there is the impression of free circulation space, with restriction only on displacement at 90º for wheelchair users. However, except for the bathroom - which in these houses were to the inhabitants' satisfaction - even people who were not wheelchair users complained about the lack of space to arrange the furniture. Figure 9 shows the Diagnostic Map of the adapted houses based on the APO and regulations.

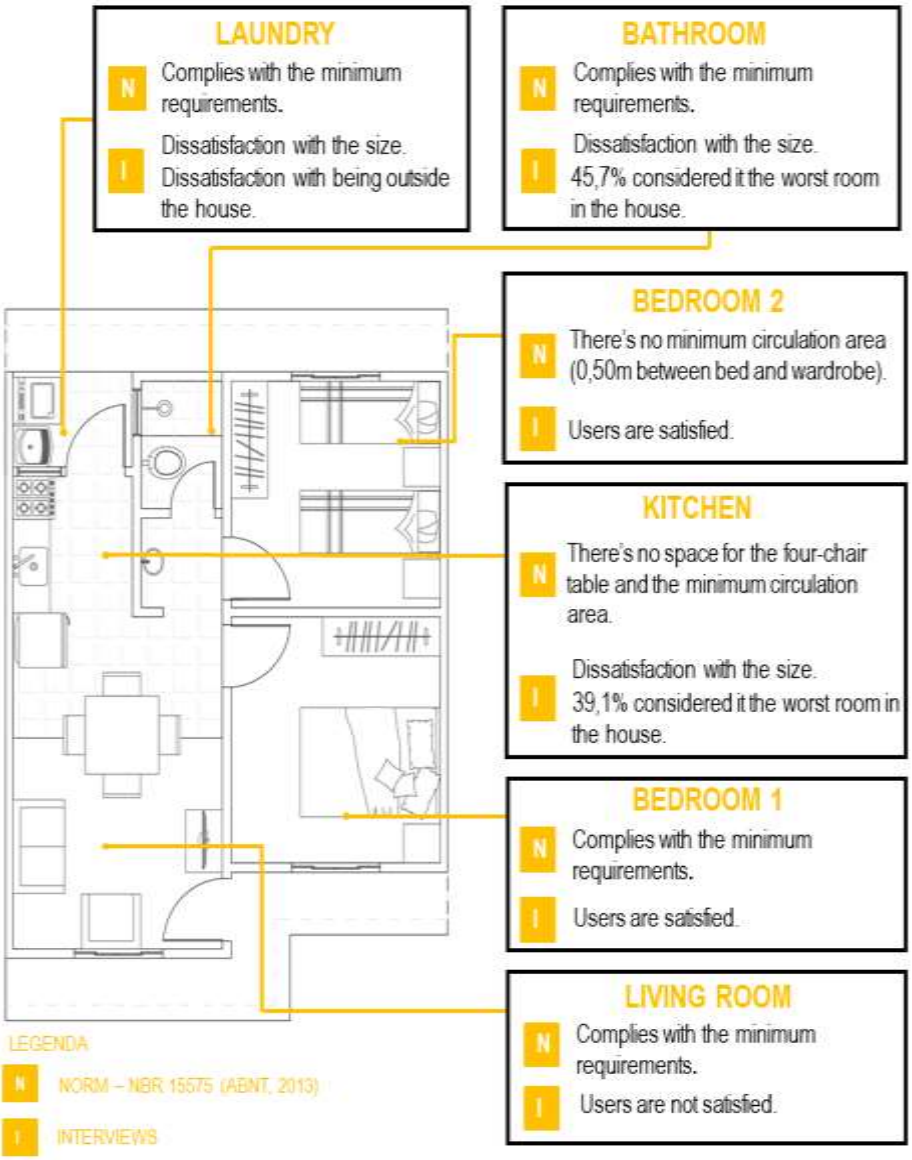

FIGURE 8 - DIAGNOSTIC MAP OF THE STANDARD HOUSES OF THE JARDIM DAS ORQUÍDEAS HOUSING COMPLEX
Source: Authors (2022).

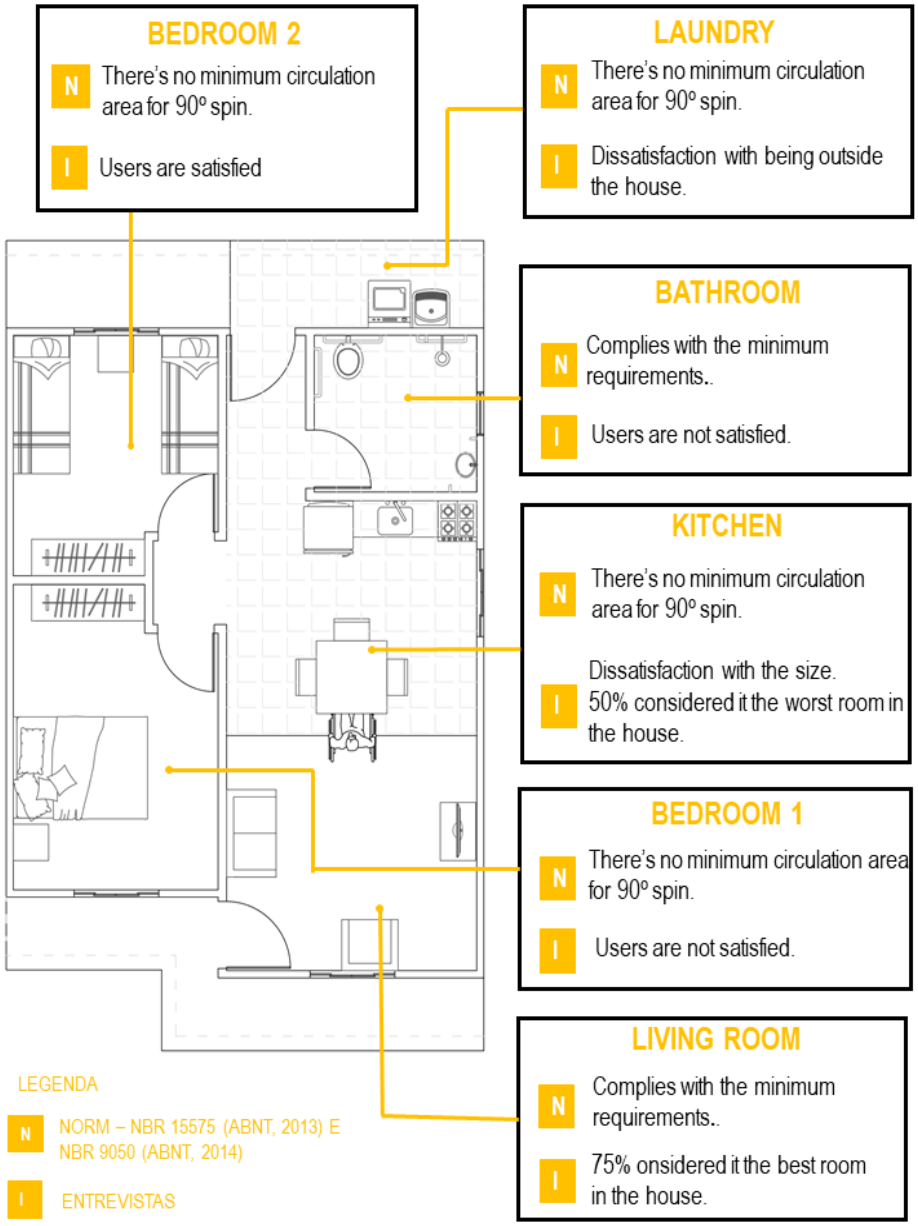

FIGURE 9 - DIAGNOSTIC MAP OF THE ADAPTED HOUSES FOR PWD IN THE JARDIM DAS ORQUÍDEAS HOUSING COMPLEX
Source: Authors (2022).

From the diagnostic maps in Figures 8 and 9, it can be seen that the fact that the regulations are met in a specific room does not guarantee the comfort of users in that place. This generates controversy about the function of the standard, whose objective of ensuring comfort conditions for the user is not being met.

This way, it is necessary to find out in which aspects there are more significant inconsistencies between user satisfaction and the normalized and define the appropriate way to solve this problem to write a standard that meets the needs of residents, especially HIS, which depend on houses with pre-defined projects but which, even so, deserve the comfort and security that a home can and should provide.

5. FINAL CONSIDERATIONS

On the subject of compliance with NBR 15575 (ABNT, 2013), it could be concluded that the regulation was not fully contemplated in the execution of the housing complex. However, it is necessary to consider that the rule came into force in its latest version after the delivery of Jardim das Orquídeas.

Notwithstanding, it is necessary to discuss the conception of a project of the people who will benefit from it. In this way, the designer's role is to develop the best proposal for residents to obtain comfort and quality of life in their homes. Therefore, not having a prerogative to follow is by no means a scam for the lousy quality of the work.

Using the interview method, it was notable, in the standard houses, the displeasure of the residents with rooms such as the living room and the bathroom - with complaints related to their dimensions and the consequent restriction of mobility in the spaces - despite being by the norm, signaling that the norm must be improved to meet the real needs of the residents in the analyzed criteria.

Concerning the adapted houses to PWD, it is essential to point out that they present different architectural projects from the others and the residents face other difficulties. From the interviews, it was possible to perceive that the relationship with the house is also analyzed from another perspective: while some situations can be uncomfortable, for PWD, if the condition is not adequate, it can become impossible to perform a task.

Even more significant was the compliance with which the residents accepted the house in all its faults - as most came from abusive rent situations, it is more advantageous to have a property, however problematic than to have nothing.

This view can even cause neglect by the designers and builders of HIS houses, who see that low-income people are satisfied with designed housing. That is why so many criticisms of the MCMV program are appropriate: there is no real intention to provide a safe and pleasant place for the resident but rather generate numbers to appear in the statistics.

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