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Evaluation of Habitability and Housing Quality: Case Study of the Águas Claras Residential Complex in Araçatuba – São Paulo.

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Avaliação da Habitabilidade e Qualidade de Moradia: Estudo de Caso do Residencial Águas Claras em Araçatuba – São Paulo.

RESUMO

Objetivo - O objetivo principal deste estudo é analisar a qualidade habitacional do conjunto residencial Águas Claras, desenvolvido no âmbito do programa Minha Casa Minha Vida, em Araçatuba (SP), em conformidade com os parâmetros definidos pela norma brasileira.

Metodologia - A metodologia empregada baseia-se no estudo de caso, com foco na análise dos parâmetros de habitabilidade estabelecidos pela NBR 15575. A análise é centrada na dimensão da habitabilidade, considerando sete critérios: i) estanqueidade, ii) desempenho térmico, iii) desempenho acústico, iv) desempenho lumínico, v) saúde, higiene e qualidade do ar, vi) funcionalidade e acessibilidade, e vii) conforto tátil e antropodinâmico.

Originalidade/Relevância - Este estudo se insere em uma lacuna teórica relacionada à avaliação sistemática da qualidade habitacional em editais de projetos do programa Minha Casa Minha Vida, uma vez que muitos estudos focam nos aspectos econômicos ou urbanísticos, mas poucos abordam sistematicamente os requisitos técnicos da NBR 15575. A temática é relevante academicamente por destacar a necessidade de avaliações técnicas abrangentes para a melhoria da qualidade de vida nos empreendimentos habitacionais populares.

Resultados - Os principais resultados indicaram que o Residencial Águas Claras atendeu plenamente aos critérios de estanqueidade, saúde, higiene e qualidade do ar, e conforto tátil e antropodinâmico; cumpriu parcialmente os critérios de desempenho térmico e acústico e não atendeu aos critérios de desempenho lumínico e acessibilidade.

Contribuições Teóricas/Metodológicas - O estudo reforça a importância do uso da norma NBR 15575 como referência metodológica para avaliações da qualidade habitacional, propondo um modelo prático de análise que pode ser replicado em outros empreendimentos habitacionais.

Contribuições Sociais e Ambientais - Ao evidenciar falhas e acertos na qualidade habitacional, o estudo oferece subsídios para a formulação de políticas públicas mais eficazes, que busquem não apenas o acesso à moradia, mas também a melhoria da qualidade de vida e do bem-estar ambiental dos moradores de empreendimentos populares.

PALAVRAS-CHAVE: Habitabilidade. Moradia. Habitação de Interesse Social. Estado de São Paulo.

Evaluation of Habitability and Housing Quality: Case Study of the Águas Claras Residential Complex in Araçatuba – São Paulo.

ABSTRACT

Objective - The main objective of this study is to analyze the housing quality of the Águas Claras residential complex, developed under the Minha Casa Minha Vida program in Araçatuba (SP), in accordance with the parameters defined by the Brazilian standard.

Methodology - The methodology is based on a case study, focusing on the analysis of the habitability parameters established by NBR 15575. The analysis centers on the habitability dimension, considering seven criteria: (i) watertightness, (ii) thermal performance, (iii) acoustic performance, (iv) lighting performance, (v) health, hygiene and air quality, (vi) functionality and accessibility, and (vii) tactile and anthropodynamic comfort.

Originality/Relevance - This study addresses a theoretical gap related to the systematic evaluation of housing quality in project calls under the Minha Casa Minha Vida program, since many studies focus on economic or urban aspects, but few systematically address the technical requirements of NBR 15575. The topic is academically relevant as it highlights the need for comprehensive technical evaluations to improve the quality of life in popular housing developments.

Results - The main results indicated that the Águas Claras Residential Complex fully met the criteria for watertightness, health, hygiene and air quality, and tactile and anthropodynamic comfort; partially met the criteria for thermal and acoustic performance; and did not meet the criteria for lighting performance and accessibility.

Theoretical/Methodological Contributions - The study reinforces the importance of using NBR 15575 as a methodological reference for housing quality evaluations, proposing a practical analysis model that can be replicated in other housing developments.

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Social and Environmental Contributions - By highlighting the strengths and weaknesses in housing quality, the study provides support for the development of more effective public policies, aiming not only to ensure access to housing but also to improve the quality of life and environmental well-being of residents in popular housing projects.

KEYWORDS: Habitability. Housing. Social Housing. State of São Paulo.

Evaluación de la Habitabilidad y Calidad de la Vivienda: Estudio de Caso del Conjunto Residencial Águas Claras en Araçatuba – São Paulo.

RESUMEN

Objetivo - El objetivo principal de este estudio es analizar la calidad habitacional del conjunto residencial Águas Claras, desarrollado en el ámbito del programa Minha Casa Minha Vida, en Araçatuba (SP), de acuerdo con los parámetros definidos por la norma brasileña.

Metodología - La metodología empleada se basa en un estudio de caso, centrado en el análisis de los parámetros de habitabilidad establecidos por la NBR 15575. El análisis se enfoca en la dimensión de la habitabilidad, considerando siete criterios: i) estanqueidad, ii) desempeño térmico, iii) desempeño acústico, iv) desempeño lumínico, v) salud, higiene y calidad del aire, vi) funcionalidad y accesibilidad, y vii) confort táctil y antropodinámico.

Originalidad/Relevancia - Este estudio se inserta en una laguna teórica relacionada con la evaluación sistemática de la calidad habitacional en licitaciones de proyectos del programa Minha Casa Minha Vida, ya que muchos estudios se centran en los aspectos económicos o urbanísticos, pero pocos abordan sistemáticamente los requisitos técnicos de la NBR 15575. La temática es académicamente relevante al destacar la necesidad de evaluaciones técnicas integrales para mejorar la calidad de vida en los desarrollos habitacionales de interés social.

Resultados - Los principales resultados indicaron que el Residencial Águas Claras cumplió plenamente con los criterios de estanqueidad, salud, higiene y calidad del aire, y confort táctil y antropodinámico; cumplió parcialmente los criterios de desempeño térmico y acústico; y no cumplió con los criterios de desempeño lumínico y accesibilidad.

Contribuciones Teóricas/Metodológicas - El estudio refuerza la importancia del uso de la norma NBR 15575 como referencia metodológica para evaluaciones de calidad habitacional, proponiendo un modelo práctico de análisis que puede ser replicado en otros desarrollos habitacionales.

Contribuciones Sociales y Ambientales - Al evidenciar las fallas y aciertos en la calidad habitacional, el estudio proporciona insumos para la formulación de políticas públicas más eficaces, que busquen no solo el acceso a la vivienda, sino también la mejora de la calidad de vida y el bienestar ambiental de los residentes de proyectos habitacionales de interés social.

PALABRAS CLAVE: Habitabilidad. Vivienda. Vivienda de Interés Social. Estado de São Paulo.

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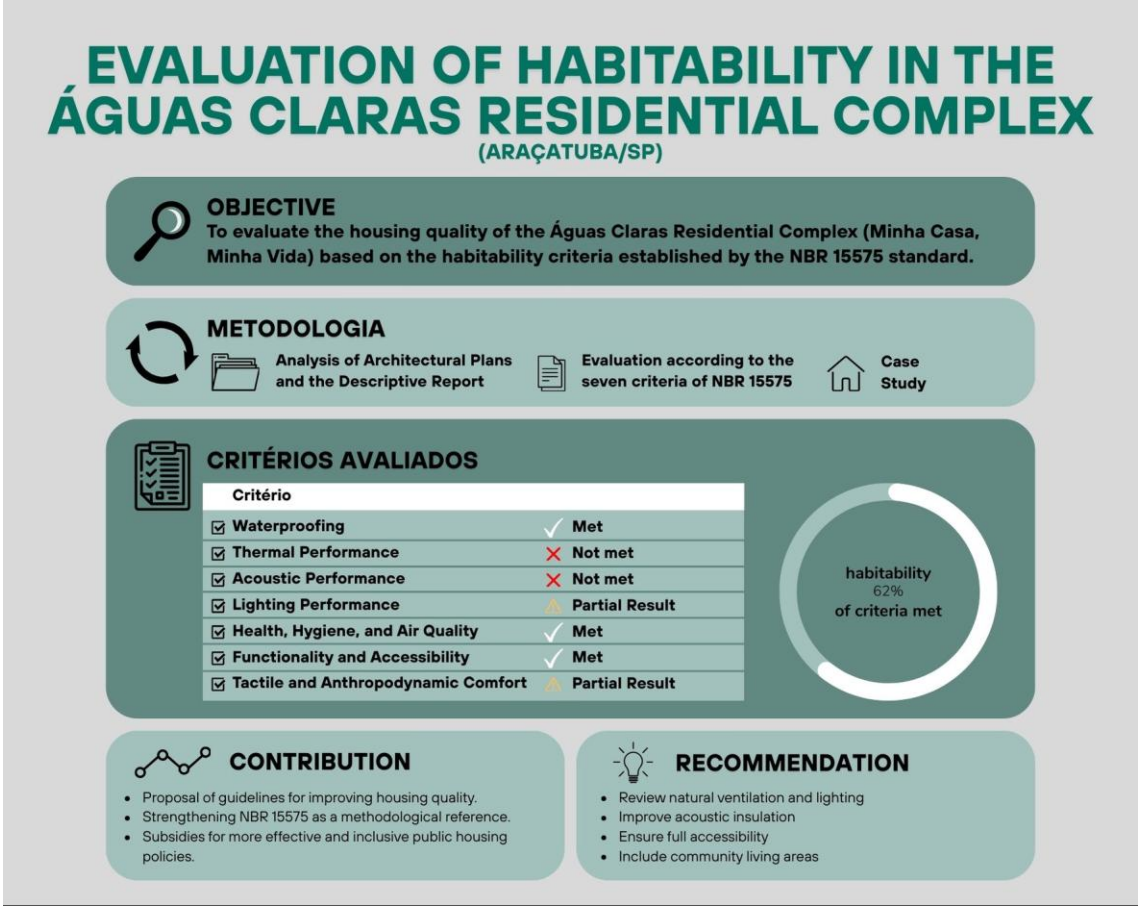
GRAPHICAL ABSTRACT



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1 INTRODUCTION

The Universal Declaration of Human Rights of 1948 emphasizes housing as a fundamental right, while the International Covenant of 1966 further qualifies this right, defining "adequate housing" as essential for quality of life (UNITED NATIONS, 1992). Beyond the physical space, housing must address several aspects to enhance the residents' lives. General Comment No. 4 from the Committee establishes seven criteria for adequate housing: (i) Security of tenure; (ii) Availability of services and infrastructure; (iii) Affordability; (iv) Habitability; (v) Accessibility; (vi) Location; and (vii) Cultural adequacy.

The quality of housing is critical to the well-being of residents, directly influencing their quality of life. Assessing this quality guides the planning of construction projects, setting criteria for habitable conditions. In addition to meeting physical requirements, buildings must address the individual needs of families, fostering a connection between inhabitants and the built environment. Logsdon (2019) and Montaner (2011) stress the importance of considering residents' needs to ensure satisfaction. Housing quality goes beyond technical criteria, seeking to create spaces that allow for meaningful living experiences, positively impacting people's lives, as highlighted by Pallasmaa (2016).

Residents strive to transform their homes into habitable spaces, establishing personal connections with their environment. This has led architects and engineers to better understand space and human behavior, giving rise to the psychology of housing. Beyond providing shelter, it is crucial to consider residents' emotional and mental aspects (Spink, 2020). Public housing policies should address not only physical needs but also the emotional and mental well-being of inhabitants.

Due to cost constraints, social housing (HIS) often features reduced areas, compromising technical and functional quality. Many of these units fail to meet habitability, functionality, and privacy requirements. The lack of specific study and planning that takes local and cultural aspects into account results in low-quality housing disconnected from its surroundings. Consequently, many HIS developments do not meet residents' needs and expectations (Logsdon et al., 2019).

Ermínia Maricato (2001) addresses the right to the city, noting that more than half of Brazil's population faces difficulties in accessing housing. To address this issue, integrated policies that consider social and economic contexts are necessary, including reforms in land division. Public authorities must balance public and private interests while fostering social participation in planning. Maricato highlights that social housing must ensure the right to the city for the poorest, countering the prioritization of private interests that push low-income populations to underprivileged peripheral areas. Harvey (2012) agrees, emphasizing the need for political governance to mediate interests and criticizing public authorities' favoritism towards the real estate market. To create a democratic and diverse city, it is vital to defend the rights of excluded populations and implement social housing programs in locations that benefit the entire population.

The implementation of social housing without proper consideration for the urban environment has become a trend in Brazilian cities, resulting in the exclusion of low-income

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populations from privileged areas due to the dominance of private interests (Vieira; Salcedo; Pasquotto, 2024).

Trindade (2012) differentiates the right to the city from the right to housing, stating that the former involves equal access to well-located areas and services, often hindered by capitalist logic. Lefebvre (1988, as cited in Trindade, 2012) conceptualizes the city as a space for social class interaction. In Brazil, urban growth driven by private interests has resulted in socio-spatial segregation, favoring the wealthy. Maricato (2001) and Trindade (2012) emphasize the need for state intervention to guarantee the right to the city for the poorest populations by balancing public and private interests. Beyond construction, the location of housing and access to the city are critical for quality of life, requiring planning that considers the dwelling and its significance to residents.

Pallasmaa (2016) underscores that technology cannot replace the human need for an emotionally meaningful home. A house transcends its physical structure, representing protection and evoking memories, balancing the residents' private and public lives. Housing integrates memories and aspirations, serving as a stage for daily rituals and evolving with the family. It must offer comfort to enable residents to feel secure and share their experiences. A lack of identification with housing can lead to frustration, as architecture has the potential to comfort or disrupt. Effective architecture requires a detailed study of spaces, aligning design with residents' cultural needs while ensuring spatial quality and habitability.

Meeting housing needs appropriately is crucial to avoiding negative consequences in people's lives, such as depression, social exclusion, and violence. Poor housing quality can lead to marginalization and stigmatization (Montaner, 2011, p. 147). Montaner highlights transitional areas, essential for connecting public and private spaces, and community areas, which are fundamental for social interactions while contributing to thermal efficiency and energy savings. He also notes that aesthetic values are tied to culture and local context, influencing how spaces are perceived and how residents identify with them.

The city of Araçatuba, in the State of São Paulo, is home to the Águas Claras Residential Complex, a project promoted by the Municipal Government and implemented through the Minha Casa Minha Vida Program for families with a monthly income of up to four minimum wages. This study focuses on analyzing the construction of the housing units in the Águas Claras Residential Complex to determine whether they meet the established parameters and minimum requirements for adequate housing according to Brazilian standards. It does not critique the Águas Claras Residential Complex but provides analyses to guide future housing developments and empower residents to demand better living conditions. The goal is to promote quality of life through constructions that meet minimum quality criteria.

In conclusion, ensuring adequate housing goes beyond the act of construction; it represents a complex challenge involving politics, planning, and an understanding of human needs. The Águas Claras Residential Complex in Araçatuba exemplifies these challenges. It is essential for public policies to prioritize the right to the city and the right to housing, balancing public and private interests. Architecture and urban planning must focus on human well-being, creating welcoming and inclusive spaces.

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2 OBJECTIVES

This study aims to analyze the housing quality of the Águas Claras Residential Complex, located in the city of Araçatuba, State of São Paulo, based on the habitability criteria established by NBR 15575 (ABNT, 2013). The analysis will be conducted through the examination of the descriptive memorial and the architectural plans of the development.

3 METHODOLOGY

To achieve the proposed objectives, the method used was structured into four main axes: (I) Literature Review; (II) Data Collection for the Case Study; (III) Analysis of the Residential Complex according to the habitability criteria established by NBR 15575; and (IV) Results.

The literature review aimed to understand spatial quality, the physical dimension of housing, the requirements necessary to improve residents' quality of life, aspects and concepts beyond physical housing, and rights related to housing and the city. To support and structure this study, works by authors addressing the right to the city (Maricato, 2001; Trindade, 2012), habitation (Pallasmaa, 2016), and adequate housing and habitability (Montaner, 2011) were consulted.

According to Pereira, Shitsuka et al. (2018), "A case study is a detailed description and analysis of a case that presents particularities making it unique." This method aims to gather data and insights that can enrich the topic under discussion. Yin (2015) highlights that case study research requires in-depth analyses and descriptions, utilizing both quantitative and qualitative data. Qualitative research, which does not employ statistical instruments, is often the focus of most studies, as noted by Dalfovo, Lana, and Silveira (2008). In this article, a qualitative method will be exclusively used, with data collection conducted through the examination of: (I) the project and (II) the descriptive memorial.

The Águas Claras Residential Complex, part of the Minha Casa Minha Vida program in Araçatuba, São Paulo, was selected as the case study due to its status as a federal housing development aimed at facilitating access to affordable housing. Additionally, it was the most recently completed residential project, with accessible plans and descriptive memorials available for analysis, and it was already inhabited.

The analysis of the housing in the Águas Claras Residential Complex will be conducted based on the habitability criteria established by NBR 15575 (see Table 1).

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Table 1 – Description of Parameters

PARAMETER	DESCRIPTION
Waterproofing	Waterproofing analyzes exposure to rainwater and moisture from the soil and the use of the residential building. "These items must be considered in the design, as moisture accelerates deterioration mechanisms and leads to the loss of habitability and hygiene conditions in the built environment" (ABNT, 2013, p. 20).
Thermal Performance	According to NBR 15575, the housing complex must meet thermal performance requirements, taking into account the defined bioclimatic zone (ABNT, 2013, p. 21).
Acoustic Performance	The housing unit must provide adequate acoustic insulation for external enclosures regarding airborne noise from outside the building and proper acoustic insulation between common and private areas, as well as between private areas of different autonomous units (ABNT, 2013, p. 25).
Lighting Performance	During the day, it is important for the interior areas of a residential building to receive appropriate natural lighting, whether through direct sunlight or adjacent indirect sources. At night, artificial lighting must be efficient to ensure safe and comfortable occupation and circulation within the indoor spaces. This combination is essential for the well-being of the residents (ABNT, 2013, p. 26).
Health, Hygiene, and Air Quality	The materials, equipment, and systems used in the building must not release products that pollute the air in confined spaces, resulting in pollution levels above those observed in the surrounding environment (ABNT, 2013, p. 34).
Functionality and Accessibility	For the architectural designs of housing units, it is suggested to provide at least sufficient space in the rooms of the residential building for the placement and use of the standard furniture and equipment listed (ABNT NBR 15575, 2013, p. 35).
Tactile and Anthropodynamic Comfort	"Do not hinder the normal activities of users of residential buildings, such as walking, leaning, cleaning, playing, and similar actions" (ABNT NBR 15575, 2013, p. 37).

Source: NBR 15575. Organization: Authors (2024).

Based on these results, design guidelines were proposed to improve construction quality, addressing weaknesses such as thermal, acoustic, and lighting performance, as well as accessibility.

4 ANALYSIS METHOD: HABITABILITY ACCORDING TO NBR 15575 OF THE ÁGUAS CLARAS RESIDENTIAL COMPLEX – MINHA CASA MINHA VIDA PROGRAM

The Federal Government launched the Minha Casa Minha Vida Program (PMCMV) during Luiz Inácio Lula da Silva's administration (Law 11.977; 07/07/2009). The program offers attractive financing conditions for low-income families to acquire housing in urban areas. The PMCMV involves several agents, including the Ministry of Regional Development, Ministry of Economy, the Federal Savings Bank (CEF), the Federal District, States and Municipalities, and private construction companies (CAIXA: Minha Casa Minha Vida - Programas da União; 2021). Non-profit organizations and program beneficiaries also participate.

The resources to fund PMCMV housing units come from the Residential Leasing Fund

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(FAR), with transfers from the Federal Government's General Budget (OGU). The program's beneficiaries include families with monthly incomes of up to R$1,800 (Tier 1), up to R$2,600 (Tier 2), up to R$4,000 (Tier 3), and up to R$9,000 (Tier 4) (Salcedo, 2023).

At the Águas Claras Residential Complex in Araçatuba, beneficiaries are families with monthly incomes of up to four minimum wages. The complex comprises 1,200 housing units, with typologies featuring single-story houses of 55 m².

Habitability is crucial to ensuring housing quality, providing comfort and safety to meet the daily needs of residents. The analysis of the Águas Claras Residential Complex adhered to the habitability criteria defined by NBR 15575, covering aspects such as waterproofing, thermal, acoustic, and lighting performance, health, hygiene, air quality, functionality, accessibility, and comfort. These criteria are essential for the well-being of occupants and the overall quality of life within society.

Pasquotto and Salcedo (2023) address habitability as an essential component of the right to adequate housing. They highlight that habitability goes beyond the mere existence of shelter, encompassing aspects such as physical security, sufficient space, protection against weather and health risks, as well as thermal, acoustic, and lighting comfort. The authors emphasize that habitability must be considered in public housing policies, especially in social housing programs, to ensure that the dwellings provide dignified living conditions for their occupants, do not perpetuate social inequalities, and do not compromise urban sustainability.

The Águas Claras Residential Complex is located in Araçatuba, São Paulo State (Figure 1), situated beyond the Eliéser Montenegro Magalhães Highway, approximately 7 km from the city center.

Figure 1 – Location: State and City.

Source: Google Earth modified by the authors (2024).

The development (Figure 2) consists of 1,270 lots, on which 1,200 single-story houses were built in two phases: I) In the first phase, 499 units were constructed, starting on April 16, 2012, and delivered on April 5, 2014; II) In the second phase, 701 units were constructed, starting on October 4, 2012, and delivered on November 15, 2014. The housing complex, built by the construction company Tecol, is part of the Minha Casa Minha Vida program.

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Figure 2 – Site Plan of the Águas Claras Residential Complex

Source: Google Earth modified by the authors (2024).

The housing quality in the Águas Claras Residential Complex is analyzed based on the parameters established by NBR 15575: waterproofing, thermal performance, acoustic performance, lighting performance, health, hygiene, and air quality, functionality and accessibility, and tactile and anthropodynamic comfort.

4.1 Waterproofing

According to NBR 15575, waterproofing evaluates exposure to rainwater and moisture from the soil and the use of the residential building. Upon analyzing the project and the descriptive memorial, it was found that the measures adopted to meet the NBR parameter include the construction of a dual-pitched roof with eaves ranging from 0.40m to 0.50m to protect the walls from direct rain and ceramic ridge caps for sealing. The tiles, installed with a 35% slope as specified by the manufacturer, facilitate water runoff. The rainwater drainage system includes gutters, and the tiles used, either French or Roman, comply with ABNT specifications. To ensure resistance and impermeability, the wooden roof structure was coated with varnish, enhancing its resistance to moisture, while the walls were treated with a primer and sealer to reduce water absorption and ensure proper substrate adhesion.

The descriptive memorial also specifies that the plumbing was executed with solderable PVC pipes, with metal connection ends using RL-type fittings, fixed with cement and sand mortar in a 1:4 ratio. After assembly, the pipelines were subjected to hydrostatic pressure with the reservoir filled before being coated. Deflections, angles, and branches required for pipe arrangements were made with fittings suitable for each case, ensuring no issues with leaks or moisture in the structure. The sewage connection points cover all wet areas (kitchen, bathroom, and laundry area), and the piping was installed with a 2% slope, connected to the public sewer network. To prevent odor backflow, water seal devices were used, and the entire sewage system was tested with smoke to identify any potential leaks.

4.2 Thermal Performance

According to NBR 15575, housing complexes must meet thermal performance requirements, taking into account the corresponding bioclimatic zone (ABNT, 2013, p. 21). The city of Araçatuba is located in bioclimatic zone 5 (ABNT, 2005), and as per NBR 15220-3, specific construction parameters must be followed.

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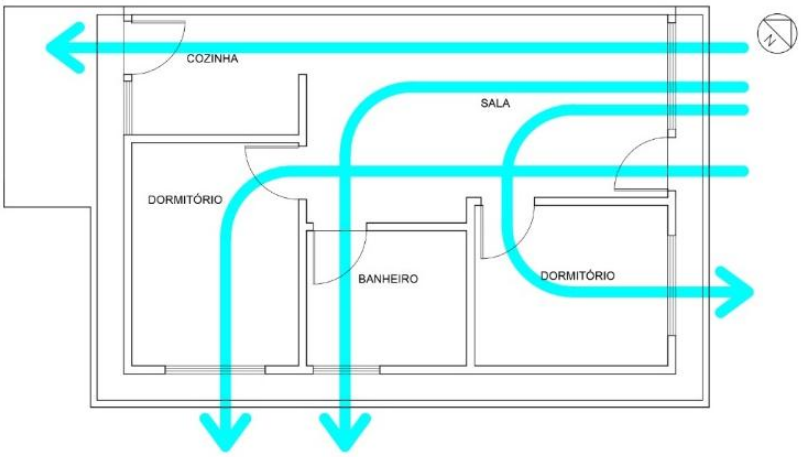
Among these parameters, openings should range between 15% and 25% of the floor area. However, it was observed that only the bedrooms of the building comply with this requirement. Additionally, walls should be light and reflective, and the roof must be insulated. For bioclimatic zone 5, cross ventilation during summer and heavy internal walls for winter are recommended. Nevertheless, the analysis of the floor plan reveals the absence of heavy walls, and cross ventilation is inadequate, with straight wind currents and a considerable distance between the points of entry and exit (Figure 3).

Figure 3 – Wind Circulation.



Source: Project (2011) provided by the construction company Tecol, modified by the authors (2024).

The window openings and sills in the building do not comply with the requirements of NBR 15575, which stipulates an opening size of 15% to 20% of the room area. However, the Municipality of Araçatuba - SP, lacking its own building code, follows the Sanitary Code of the State of São Paulo, as per Decree No. 12,342 of September 27, 1978, which establishes a different percentage, set at 12.5% (1/8 of the floor area). Based on this parameter, the building meets the required dimensions.

This situation creates a conflict, as NBR 15575 is a federal guideline that should prevail over state and municipal regulations. However, the standard itself recommends that, to avoid discrepancies, designers adhere to state and municipal regulations, even if they differ from federal guidelines.

4.3 Acoustic Performance

NBR 15575 requires housing units to provide adequate acoustic insulation against external noise and between common and private areas. However, the analysis of the project and the descriptive memorial did not identify specific elements or references to acoustic insulation planning to meet these requirements.

4.4 Lighting Performance

NBR 15575 requires buildings to receive adequate natural lighting during the day and

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efficient artificial lighting at night to ensure comfort and safety. The use of natural light should take into account the solar trajectory, influenced by location and time of year (BARBOSA, 2017). However, the descriptive memorial and the project do not mention studies or considerations regarding the orientation of the buildings to optimize natural lighting. On the other hand, the electrical installations followed the specifications of NBR 5410 for artificial lighting.

4.5 Health, Hygiene, and Air Quality

NBR 15575 requires that materials and systems used in buildings do not release substances that pollute the air in enclosed environments. The analysis of the project and the descriptive memorial indicates that care was taken during construction to ensure cleanliness, safety, and hygiene. The roof and walls were treated to prevent moisture, mold, and paint detachment. The electrical and plumbing installations adhered to ABNT standards to prevent leaks and contamination. After construction, a thorough final cleaning was performed, ensuring the quality of the indoor environment.

4.6 Tactile and Anthropodynamic Comfort

NBR 15575 requires that the normal activities of users in residential buildings must not be hindered. The project's descriptive report indicates that the finishes follow a harmonious and neutral standard, aiming to avoid discomfort for residents. Aesthetically, the materials were chosen to maintain uniformity. The project analysis confirms that the minimum dimensions and appropriate heights for mobility were followed in accordance with the standard.

4.7 Functionality and Accessibility

According to NBR 15575, housing unit designs must ensure sufficient space in the rooms for the installation and use of standard furniture and equipment. The floor plan provided by the construction company shows that the property includes a 15.77 m² living room, a 4.5 m² kitchen, a 6.96 m² bedroom, another bedroom of 8.35 m², and a 4.85 m² bathroom.

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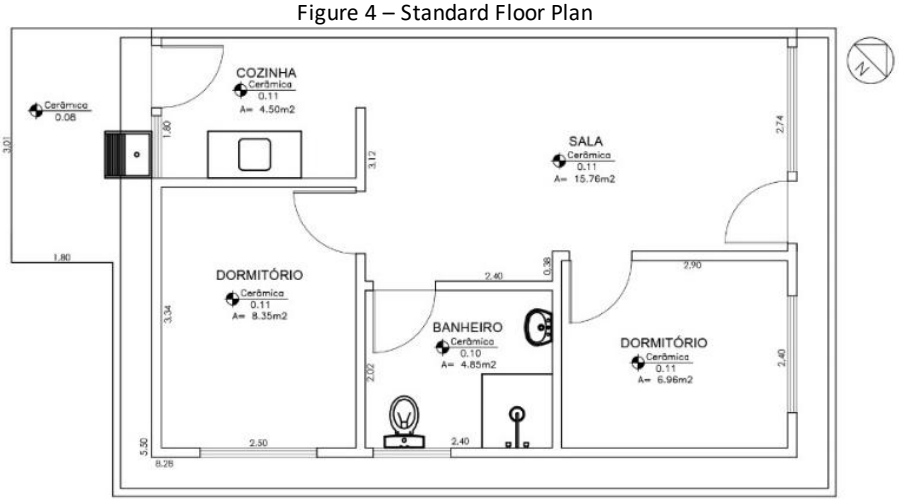
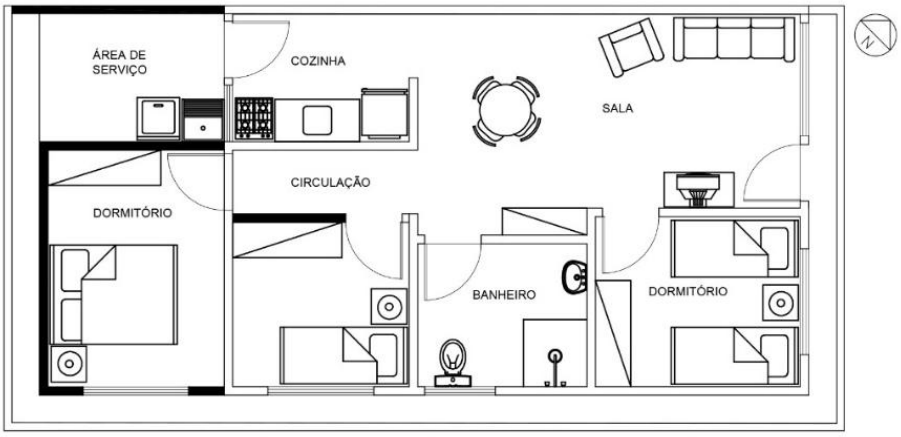
Figure 4 – Standard Floor Plan



Source: Project provided by the construction company Tecol (2011).

In compliance with NBR 15575, the planning includes and delivers a floor plan that allows for the expansion of the housing unit (Figure 5), with specified measurements and layout, enabling the addition of a new bedroom or room according to the residents' needs. Montaner (2011) highlights the importance of ensuring that the building provides a minimum level of habitability in terms of dimensions and spaces, while also being adaptable to the residents' needs. The space should be flexible, allowing for adaptation to the individual activities of each family without restricting the environment to a single function or definition.

Figure 5 – Floor Plan with Expansion



Source: Project provided by the construction company Tecol (2011).

In addition to providing a floor plan that includes the possibility of expansion, the construction company also delivers two distinct layout plans. The first is a basic floor plan (Figure 6), designed to accommodate the minimum necessary furniture, ensuring the functionality of the spaces and meeting the essential needs of the residents.

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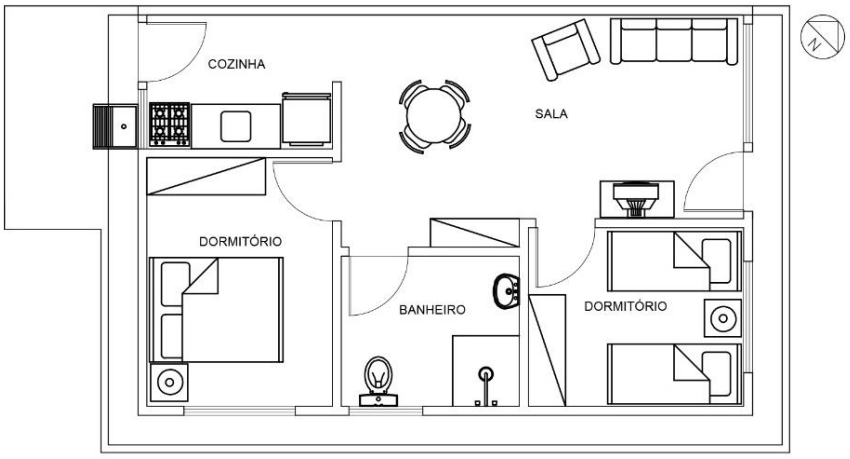
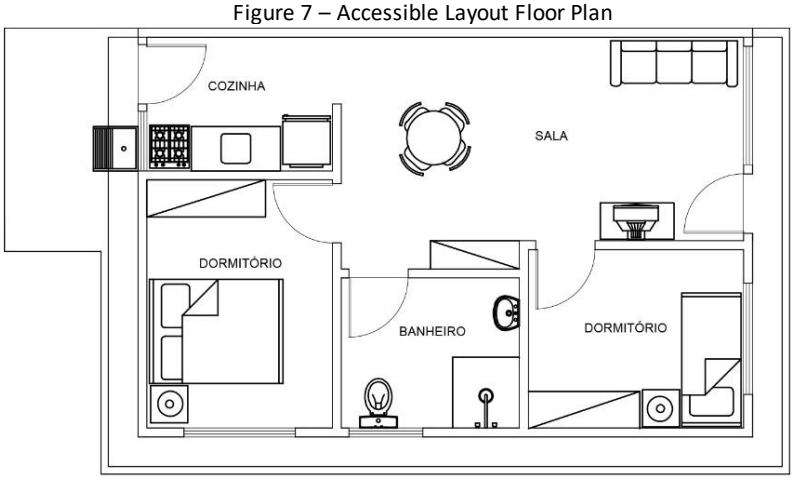
Figure 6 – Basic Layout Floor Plan



Source: Project provided by the construction company Tecol (2011).

In addition to the basic floor plan, the construction company also provides a second, more specific floor plan designed to meet accessibility needs, particularly concerning wheelchair maneuvering space, in compliance with NBR 9050 (Figure 7).

Figure 7 – Accessible Layout Floor Plan



Source: Project provided by the construction company Tecol (2011).

However, upon analyzing the floor plan related to wheelchair maneuvering space (Figure 8), it is observed that the required space for this maneuver is met only in the living room and one of the bedrooms. This limitation reveals that, although efforts were made to incorporate accessibility principles, full circulation in all areas of the housing unit has not yet been fully ensured.

Partial compliance with the requirements of NBR 9050 highlights the need for additional adjustments to the design to ensure that all areas of the residence are accessible to individuals with reduced mobility. Ensuring adequate wheelchair maneuvering space in all rooms is essential to provide an inclusive housing experience that respects the needs of all residents.

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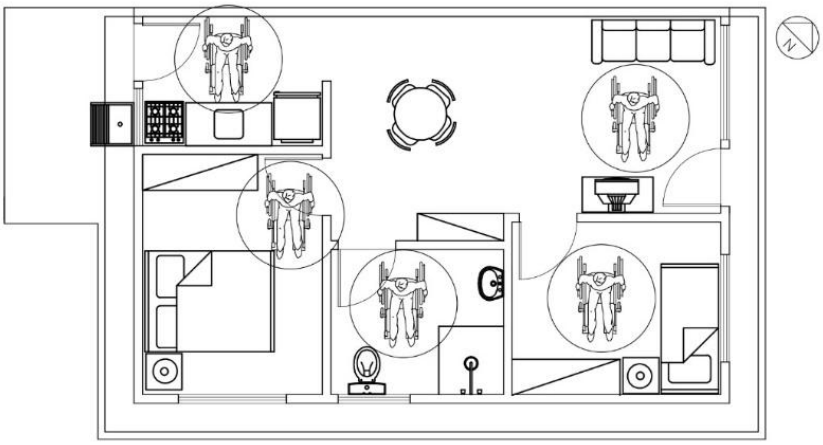
Figure 8 – Floor Plan with Wheelchair Maneuvering Space



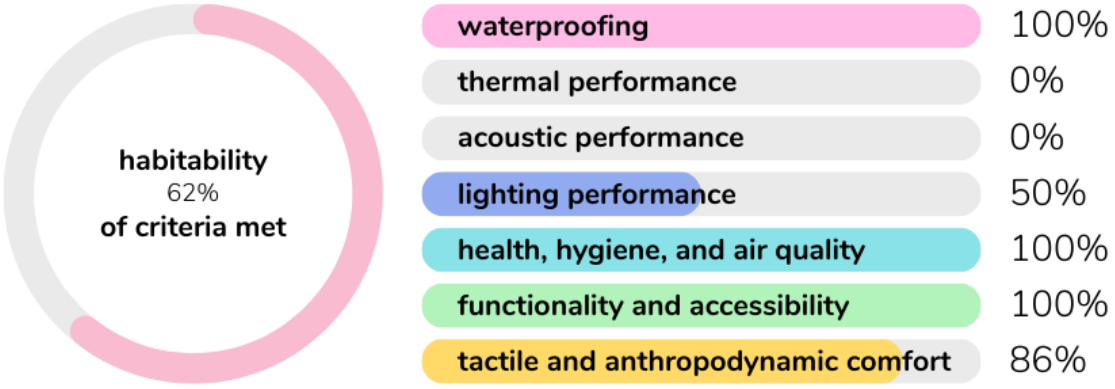
Source: Project provided by the construction company Tecol (2011) modified by the authors (2024).

The analyzed building complies with NBR 15575 with a ceiling height of 2.55 m, exceeding the minimum requirement of 2.50 m. The doors have an opening width of 80 cm, meeting accessibility requirements, and the installed equipment adheres to the specifications of NBR 9050. The floor plan of the Águas Claras Residential Complex also meets the minimum space requirements and includes basic furniture in accordance with the NBR 15575 standard, which features an annex with a table of basic furniture dimensions (For verification of the minimum furniture dimensions table provided by NBR 15575, refer to ANNEX F on pages 68-70).

5 RESULTS

The analysis of the project and descriptive memorial of the Águas Claras Residential Complex revealed that the building meets just over half of the habitability criteria outlined in NBR 15575 (Figure 9). While it satisfactorily complies with aspects such as waterproofing, health, hygiene, air quality, and tactile comfort, the project shows significant deficiencies in thermal, acoustic, and lighting performance, as well as accessibility, compromising its full adequacy to the residents' needs.

Figure 9 – Results



Source: Prepared by the authors (2024)

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The main positive aspects of the analyzed project include the strict application of furniture metrics within the residence, ensuring the presence of all furniture required by NBR 15575. Additionally, the availability of a basic floor plan, an accessible plan, and an expansion plan provides residents with the flexibility to modify the housing according to their needs. This aspect is essential, as highlighted by Pallasmaa (2016), who discusses the importance of creating a home where residents can feel comfortable and secure, fostering an identification with the space they inhabit (Figure 10). In the image, items highlighted in green represent those that were met, while items in red indicate those that were not met.

Figure 10 – Detailed Analysis of Habitability

Source: Prepared by the authors (2024).

To improve housing quality, periodic reviews of seals and drainage systems, window expansions, cross-ventilation techniques, the use of acoustic seals, and layout optimization to maximize natural lighting are recommended. Additionally, it is crucial that the layout remains

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accessible and flexible to meet the diverse needs of residents.

The analysis highlights the importance of an integrated approach to housing projects, considering both physical aspects and the impact on residents' quality of life. Montaner (2011) emphasizes the need to include community spaces that foster coexistence and social interaction. In the case of the Águas Claras Residential Complex, it was observed that the prioritization of the number of housing units came at the expense of creating communal areas for the resident population. Careful planning and adherence to habitability standards are essential to ensure that Minha Casa Minha Vida projects meet expectations and provide healthy, safe, and comfortable environments for residents.

6 CONCLUSION

This article analyzed the Águas Claras Residential Complex, built under the Minha Casa Minha Vida program in Araçatuba, SP, using the habitability criteria of NBR 15575. The research included a literature review, data analysis, and examination of project floor plans, revealing that the residential complex meets most requirements, such as waterproofing, health, hygiene, air quality, comfort, functionality, accessibility, and artificial lighting. However, the project shows significant deficiencies in thermal, acoustic, and natural lighting performance. The analysis underscores the importance of housing that goes beyond mere technical compliance, addressing the need to ensure residents' comfort and safety and their right to the city, which involves access to urban areas with better infrastructure and services.

Based on the identified weaknesses, guidelines were proposed to improve the thermal, acoustic, lighting, and accessibility performance of the residential complex, such as optimizing window design, selecting appropriate acoustic materials, and enhancing the layout to maximize natural light and space functionality. The study emphasizes that for housing policies like Minha Casa Minha Vida to fulfill their social role, greater collaboration between government, community, and experts is essential in the planning process. For future work, it is recommended to conduct in-person analyses and collect residents' perceptions for a deeper understanding of the quality of life provided. This ensures that future housing policies are aligned with residents' needs, promoting sustainable and inclusive urban development.

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DECLARATIONS

AUTHORS' CONTRIBUTIONS

Thamires Poi Prudêncio: Study conception and design; data curation; formal analysis; investigation; initial draft writing; critical review; final review and editing.
Rosio Fernández Baca Salcedo: Data curation; methodological development; critical review; final review and editing; supervision.
Geise Brizotti Pasquotto: Data curation; methodological development; critical review; final review and editing.

CONFLICT OF INTEREST STATEMENT

I, **Thamires Poi Prudêncio**, together with the co-authors **Rosio Fernández Baca Salcedo and Geise Brizotti Pasquotto**, declare that the manuscript entitled "Assessment of Habitability and Housing Quality: Case Study of the Águas Claras Residential Complex in Araçatuba – São Paulo":

1. **Financial Ties:** No institution or funding entity was involved in the development of this study.
2. **Professional Relationships:** No professional relationship relevant to the content of this manuscript has been established.
3. **Personal Conflicts:** No personal conflict related to the content has been identified.