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The residential architecture of the Modern Movement in the Cerro Municipality Neighborhoods [1950-1964]

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Abstract: The Modern Movement has left a wide and varied architectural repertoire, clearly visible, in the urban landscape of Havana. Although the specialized literature has addressed certain edges, there are still little explored territories that deserve their study, in order to contribute to achieving a more complete and comprehensive vision of this legacy on a national scale. The research analyzes the residential architecture of four modern neighborhoods of the current Cerro municipality, by identifying features and qualities of their buildings. It was methodologically structured in three stages, which included field work and archiving, and theoretical, empirical, quantitative and qualitative methods were used in combination for the analyses. The study made it possible to demonstrate the coexistence of unique works and serial housing complexes, with high construction and design quality, harmonically conceived for predetermined contexts, that constitute a living testimony of the architecture of the peripheral areas of Havana in the 1950s.

Key words: housing; modern architecture; Modern Movement; Cerro Municipality; Havana

1 Introduction

In Cuba, the Modern Movement reached conceptual and expressive maturity in the 1950s, following a gradual process of identity-seeking that extended into the following decade [1]. Creativity during this period encompassed responses to ecological parameters, the revival of local elements of traditional architecture, the application of the principles of European rationalism that had migrated to the United States, and the creative fusion of indigenous traditions with prevailing trends in developed countries and Latin America [2]. The exploration of geometric forms and relationships spanned all architectural programs; in the area of roofing, it yielded attractive and structurally daring solutions; and its contribution to volumetric expression and its influence on interior spatial-environmental relationships were particularly significant.

Design in residential architecture was more heavily influenced by the Americas. While at the urban scale, the pattern of dispersed settlements used in the United States was adopted, at the architectural scale similar conceptual premises were employed as in Latin America and the Caribbean, such as the assimilation of tradition, adaptation to the natural context, response to climatic requirements, and the use of the expressive qualities of materials and finishes. Adaptation to tropical climate conditions was taken as the starting point for the spatial design of individual dwellings, laying the foundations for a distinct identity defined by a spatial arrangement that maintained the division between social, private and service areas [3]. Among the most important contributions of this stage are spatial continuity, interior-exterior transparency, large openings

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—featuring grids, light and shadow filters, and clear or tinted glass—and the presence of vegetation to blur the boundary between interior and exterior spaces [4].

The value placed on modern architecture, as well as the efforts undertaken to ensure its visibility, recognition, and protection, have spurred studies and research in various countries. The existing body of work is very extensive, and the gaps in official histories must be filled to achieve a more accurate and comprehensive view of architectural modernity in Havana. While for a long time, conservation efforts worldwide focused solely on the ancient, current theoretical perspectives view the past of all eras positively and consider both the exceptional and the representative—with cultural significance—to be valuable. This includes what was once considered "minor architecture" [6]; however, despite its aesthetic values, little progress has been made in protecting it [7].

In Cuba, there has been a notable increase in interest in studying this architecture. Various studies have demonstrated the existence in Havana of abundant examples of the Modern Movement with valuable attributes, both architectural [8–10] and urban [11]. Between 1940 and 1960, the residential subdivisions built on the outskirts of Havana for the so-called middle class became sites for large-scale experimentation with Modern Movement (MoMo) architecture [5]; however, very little is known about their legacy. Possibly due to their distance from central areas, their more modest and less pretentious character, and the use of serialized architectural models, their unique features have not been given the attention they deserve, and their dissemination has been limited, leaving them on the margins of studies on the subject.

This paper presents partial results of a larger research project aimed at bringing to light the largely unexplored heritage of Havana's Modern Movement. The study focused on the representative architecture of four neighborhoods that emerged in the 1950s within the territory of the current Cerro municipality (hereinafter, the Study Area): Parcelación Buenos Aires, Residencial Casino Deportivo, Alturas de Palatino, and Santa Catalina. This research began in 2017 [12] and subsequent partial results[1] [13, 14], as gradual attempts to bring this valuable heritage to light (Figure 1).

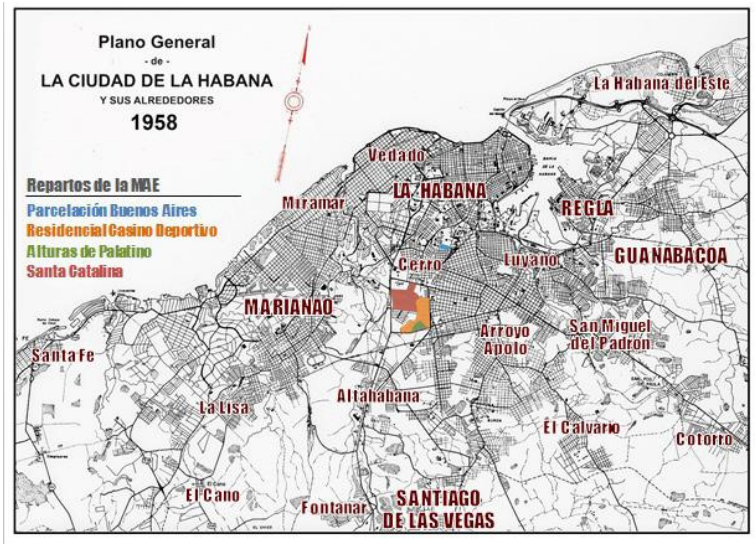


Figure 1. Location of the four selected neighborhoods on a 1958 map of Havana. Source: photographic archive of the Ministry of Public Works, with annotations added by A. J. Rouco, 2022

The significance of Cerro has historically been associated with its oldest urban area, around the street of the same name and its immediate surroundings—an area that features valuable examples of 19th-century neoclassical architecture, which was designated a protected zone in 1986 and recognized as having high historical and cultural value in 2000 [15]. However, its residential developments from the 1950s—which coincided with the consolidation of a modern architectural

style with a strong national character—are scarcely mentioned in the literature or in legislative documents related to the protection of cultural and heritage values. In these areas, the construction of detached houses and mid-range apartment buildings predominated, featuring notable expressive and technical solutions, as well as great variety within the language of modern architecture; these served as models for the work carried out by the revolutionary government beginning in 1959.

In the analysis of architecture and urban planning, different approaches have historically been employed, shaped by ideological and cultural positions as well as the researcher's interests. This study took into account theoretical works by four Cuban authors [7,16-18] and five research studies with similar scientific profiles and levels, but in diverse contexts national [19-23]. Although their general objectives differ, they converge on the evaluation of the contextual, formal, functional, environmental, and structural characteristics and responses of the object of study, as well as the general and specific factors that led to its creation. Their study made it possible to identify the following variables and parameters for this research: urban location and relationship with the immediate context (lot characteristics and use, and outdoor spaces); formal solution (volumetry, roof shape, and compositional elements); functional solution (functional organization and interior spaces); structural solution (vertical structure, horizontal structure, staircases, cladding, and woodwork); and environmental qualities (integration with nature, response to environmental requirements, and spatial continuity).

This article presents the general features of residential architecture between 1950 and 1964 in the Study Area (SA) and analyzes its specific characteristics and contextual relationships.

2 Materials and methods

The study was conducted using a combination of quantitative and qualitative research methods, with a predominance of the latter, which allowed for the processing and interpretation of information obtained through various channels and its organization in accordance with the objectives pursued.

During the fieldwork, using various techniques (observation, data collection, photographic records, and interviews), the distinctive features of the architecture in the selected neighborhoods were identified, and an initial selection was made for the Architectural Study Sample (ASS), which was recorded in preliminary data sheets. This process was subsequently supplemented by an analysis of primary documentary sources in various city archives, which enabled the selection of the final ASS and the creation of a second form detailing the specific characteristics of each structure.

The data were processed using quantitative methods (organization and tabulation) and qualitative methods (triangulation and interpretive case studies) to define the results through comparative, induction-deduction, and analysis-synthesis processes, based on the behavior of the variables and parameters defined in earlier stages of the research.

As a result, the general aspects of architecture in the SA were described and compared, as were the specific architectural solutions of the ASS and their contextual relationship, which made it possible to obtain a broader and more detailed view of the architecture specifically designed for the site.

2.1 Preliminary classification

The residential architecture of the SA reflects a wide variety of design, management, and construction patterns. For this study, the buildings were classified according to two aspects derived from the research process: the diversity of gradation within the average standard and the coexistence of serial models with unique or singular buildings.

- Based on their uniqueness

In this regard ─ which was evident from the fieldwork and later corroborated by archival review ─ two types of housing were defined: standard-type dwellings and unique dwellings. Standard-type dwellings share common elements that allow them to be grouped together; consequently, the remaining projects were classified as unique dwellings, their primary characteristic being the notable differences between them.

Standard-type dwellings, conceived between 1953 and 1959, consisted of developments built by private developers, who acquired a specific number of identical lots within a block or portion of a block, either for individual sales by catalog or for public lotteries (Figure 2). In these cases, the consecutive replication of a model created an unforgettable image of its developers within a given territory[2] [14].

- According to their standard

Although the buildings in the SA lie close to the limits of so-called economical and middle-class dwellings, during the analysis and evaluation process, it was observed that there were gradations within that standard.

As a starting point, documents from the period related to the definition of economical dwellings were analyzed. Although the maximum floor area for affordable housing had been set at 85 m² as early as 1939 [25], Decree No. 3213 of 1948 on Economical Residential Zones [24] established, among other provisions, that lots in new subdivisions should have a frontage of no less than 10 meters by a depth of 25 meters (250 m² in area).

Furthermore, while precise limits were established regarding the area of housing, there were variations in the standards used to define other characteristics, possibly as a result of differing interpretations by the stakeholders and their interests. At the Pan-American Congress of Municipalities, held in Havana in 1939, architect, critic, and historian Luis Bay Sevilla proposed a draft "Affordable Housing Act" (1938) that was never implemented; eight years later, a law with the same name but different content was passed [26]. Likewise, the results of the competition for economical dwellings, organized in 1947 by the Provincial College of Architects of Havana, awarded prizes to projects with substantial differences in the elements that helped define the standard [27].

Consequently, after considering the diversity of patterns that shaped the development of architecture in the SA [3], this study decided to base its classification on two defining elements of economical dwellings: the living area of the dwelling and the lot area on which it stands. This made it possible to establish boundaries and group the housing units according to the gradation of their standard, as indicated below:

1) Standard 1 (E1): dwelling of up to 85 m² on a lot of up to 250 m².

2) Standard 2 (E2): dwelling larger than 85 m² on a lot of up to 250 m².

3) Standard 3 (E3): dwelling larger than 85 m² on a lot larger than 250 m².

The research was conducted in three stages, and the selection of the ASS was intentional.

First stage: Visual inspection. During fieldwork in the four districts of the SA, properties with formal characteristics that stood out in their context and a degree of integrity that allowed for the identification of their original attributes were pre-selected qualitatively and based on visual assessment. Serial buildings grouped into complexes were also included.

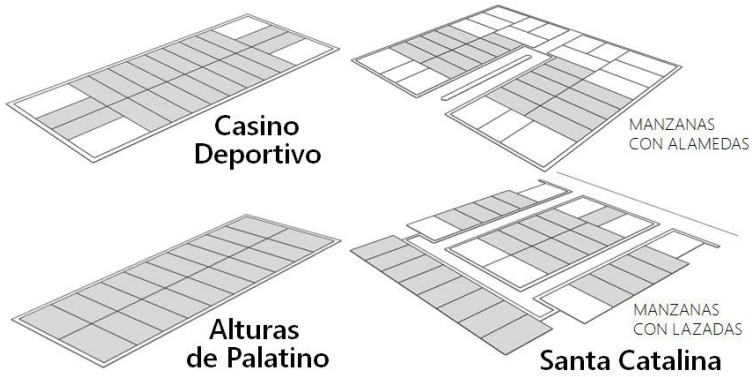


Figure 2. Regular city blocks in the selected neighborhoods, showing their typical lots, which were frequently used by developers of standard-type dwellings. Prepared by A. J. Rouco, 2020

This initial assessment of the ASS provided insight into the magnitude of the construction produced during the period and its general features, and to verify the existence of diverse architectural solutions and affiliations with trends of the Modern Movement. A preliminary data sheet was prepared for each property, containing location data, a current image, and a sketch of the building's urban setting.

Second stage: Archival review. A total of 1,064 property files from the four districts of the SA were consulted in the archives of the Provincial Directorate of Physical Planning of Havana (1,049), the National Directorate of Cuba (1), the Architect of the Cerro Community (10), and private owners (4).

This stage made it possible to narrow down the pre-selected sample. Properties were excluded if no documentation was found, or if the available documentation was severely deteriorated or illegible; those that included spaces incompatible with residential use (workshops, warehouses); or those whose approved plans differed from what was actually built; and those in which subsequent negative and irreversible modifications were made that altered their original spatial layout. This stage made it possible to identify the 64 projects that comprised the final ASS (Table 1).

Third stage: Desk research. A data sheet was created for each of the 64 buildings inventory with more specific data on their formal, functional, structural, and environmental features, as well as their location; and, in the case of row houses, the model and number of units per lot. Digital files were created containing photos of the projects and other documents, as well as relevant images of each property. These records served as the basis for conducting individual evaluations of the projects based on a review and study of their plans and descriptive reports, which made it possible to organize, group, tally, and tabulate data. They also provided general results, such as the total number of buildings planned during the period in the SA, based on their approval dates.

Table 1. Architectural Study Sample by district based on the total number of existing buildings. Source: authors, 2020

Selection Of The Architectural Study Sample	Residential Developments				
	Buenos Aires	Casino Deportivo	Alturas De Palatino	Santa Catalina	Total
Total buildings	74	798	123	106	1101
Total detached dwellings	30	694	117	106	947
Of total buildings (%)	40.5	87	95.1	100	
Study Sample					
First stage	6	59	14	51	130
Of total detached dwellings (%)	20	8.5	12	48.1	
Second stage	3	29	5	27	64
Of total detached dwellings (%)	10	4.2	4.3	25.5	

3 Results

3.1 General characteristics of the Architectural Study Sample

The largest number of projects is located in Santa Catalina, a neighborhood known for high-quality design and a wide variety of architectural solutions, and Casino Deportivo, which had high occupancy during the study period. A smaller number are located in Buenos Aires, a neighborhood with numerous apartment buildings, non-residential structures, or mixed-use buildings, and in Alturas de Palatino, due to its low occupancy during the study period, consisting primarily of standard-type dwellings (Figure 3).



Figure 3. Examples from the Architectural Study Sample. Unique dwellings in a) Parcelación Buenos Aires, b) Residencial Casino Deportivo, and c) Alturas de Palatino; standard-type dwelling in d) Santa Catalina. Source: A.J. Rouco, 2020

Of the 64 buildings, 62 are single-family residences and two are designed for two households within the same family. They were built between 1953 and 1963, with 40 of them constructed between 1956 and 1960. They have between one and two main stories, and in some cases may additionally have a basement and a mezzanine, or both.

The sample includes 52 unique homes, with notable differences in volume, facade design, roofs, exterior finishes, and spatial-environmental solutions, demonstrating the variety found in the SA. Of the 32 serial models identified during fieldwork, 12 were selected; 116 units were built in the SA based on these designs, accounting for 37.3% of all standard-type dwellings in the area. From the companies with the highest number of units and models built, between two and three models were selected from each, with variations in standard specifications and number of stories.

According to the standard classification established in this study, the ASS is dominated by homes with more than 85 m² of usable area (61 examples, 95.3%) and those situated on lots larger than 250 m² (42 examples, 65.6%) (Figure 4).

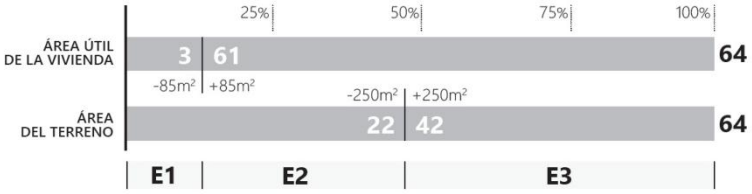


Figure 4. Architectural Study Sample. Standard classifications. Source: authors, 2020

3.2 Urban location and relationship with the immediate context

a) Lot characteristics

Although corner lots generally offer greater visibility and help highlight the buildings within their contexts, curiously, nearly 80% of the ASS consists of homes located on intermediate lots. They are in the majority in both Casino Deportivo and Santa Catalina, while they make up all the homes in Buenos Aires and Alturas de Palatino. This indicates that attractive

solutions were conceived regardless of the building's location within a block or neighborhood.

In the ASS, lots exceeding 250 m² with frontages greater than 10 m constitute the majority, since they include all the homes in Santa Catalina and three in Alturas de Palatino. Half of the ASS in Casino Deportivo and two-thirds of those in Buenos Aires have areas of up to 250 m². Only six examples occupied more than one lot—all of them intermediate in size—four of which were in Casino Deportivo, where small, narrow lots predominated.

Most lots are regular in shape; only three examples are irregular, and the rest are semi-regular. Almost all are situated on flat land; only nine in Santa Catalina were built on sloped sites.

b) Lot occupancy

Almost all the buildings comply with the floor area ratio (FAR) required by the building regulations (67% maximum), even those designed for corner lots, which had the disadvantage of having a garden strip on two sides of the lot and a smaller area available for construction.

In construction projects, this aspect was demonstrated using numerical data, such as the percentage set aside for open areas. The files reviewed indicate that 97% of the projects exceeded the established 33% limit. According to calculations made during this study, in 62.5% of the projects, open areas exceed 50% of the lot, and in 37.5% of the projects, they exceed 60%.

c) Outdoor spaces

Garden strips range from 2 to 5 meters in width. However, on large or double lots in the Casino Deportivo neighborhood, their depth was intentionally increased to provide greater privacy or to allow the building to be better appreciated from the urban space. In neighborhoods where the road and garden strips were narrower, the latter generally served as an environmental extension of the public space. In the E1 homes, the depth of the garden strip allowed for parking one car (Figure 5).

In buildings situated on flat land, the topography was altered, foundations were used to raise them above ground level, or terraced flower beds were incorporated. In other cases, the main facade was designed with an irregular floor plan or was rotated relative to the street to create gardens with varying dimensions and characteristics. Some examples combined the above variations (Figure 5).



Figure 5. Gardens: a) continuity of public space, b) irregular and deeper, c) with terraced flower beds, visual illusion, and access boundary. Source: A.J. Rouco, 2020

In more than half of the projects, the widths of the perimeter walkways exceed the minimum requirement. In E1- and E2-type homes, this variation allowed them to be used as patios or service entrances. E3-type homes feature large dirt patios located at the rear of the lot. In the standard-type dwelling units in Santa Catalina, the central areas of the city blocks were designed as large, continuous interior green spaces with trees. The patios of E2-type homes vary in size, as they depended on the area occupied by the building. In multi-story designs, they are larger and feature vegetation. In single-story E2 homes and E1 homes, the area designated for the patio is minimal, generally paved, and used as a service area.

On sloped lots, the topographical irregularities were incorporated into the garden design, creating access routes to the homes with stepped paths, cantilevered ramps, or a sequence of terraces that simultaneously bridged both distance and elevation.

Most pedestrian access routes consist of a straight path, although oblique, broken- line routes also exist, or entry is provided via a vehicular access[4]. They are designed as flat, stepped, or ramped paths—supported or cantilevered depending on the topography—and constructed of reinforced concrete or terrazzo, either cast in place or assembled from precast sections, which help to give each project its own unique character.

3.3 Formal solution

a) Volumetry

The diversity of solutions is determined by the number, shape, and arrangement of the volumes on the lot, and is directly related to their spatial organization, which follows floor plans with two, three, or, exceptionally, up to four bays, and which may extend from front to back or run parallel to the street. The buildings may constitute a compact, articulated, or irregular volume, and their definitive formal expression is complemented by compositional elements that also suggest a certain stylistic affiliation within the Modern Movement (Figure 6).

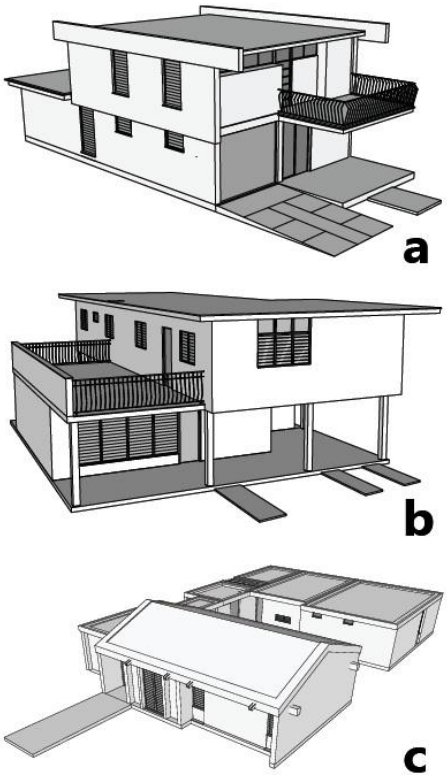


Figure 6. Volumetry: a) compact, b) articulated, c) irregular. Prepared by: Victor M. Báez (a and c), 2016; and Antonio Febles (b), 2020

Some buildings consist of a compact volume with a simple rectangular geometric shape, which may contain one or two stories and a semi-underground garage. This is the most common variant in neighborhoods with small lots and narrow frontages, where building regulations of the time required a separation from adjacent properties, necessitating solutions with a width of two bays in order to optimize land use and, at the same time, achieve more spacious interior areas. In many cases, to increase the outdoor space available for patios and gardens, homes were designed with more than one level or spanned more than one lot. Compact designs on larger lots can consist of three bays and feature a central courtyard. These can be found in both standard and unique home designs, typically in Type E2 layouts.

In the articulated form, the interconnection of pure volumes along Cartesian axes predominates, within a balanced spatial arrangement. It is frequently used in two-story homes to establish functional differentiation, and on smaller lots, where highlighting the stairwell as an articulating axis serves as a design strategy. The variation in volumes corresponds to the different floors; generally, the lower floor runs longitudinally along the lot, while the upper floor runs transversely to it. On lots that accommodate more than two bays, the solutions are less straightforward, with a predominance of single-story floor plans in H, C, or L shapes, where the differences are determined by the number, shape, and dimensions of the volumes. This layout is most common in unique dwellings of types E2 and E3.

Irregular floor plans are common in single-story homes, which depart from the standard volumetric organization of a rectangular block with a front entrance. Their floor plans take the form of a continuous block, whose perimeter features recesses and projections that create gardens, terraces, and patios. This characteristic can also be observed in their vertical section, where formal variations are generally determined by differences in the shape of the roofs or the gable in some areas. They are most commonly used in unique dwellings of types E2 and E3, as well as in E1 and E3 standard-type dwellings.

Due to their visibility on an urban scale from various angles, a greater expressive variety is observed in corner buildings or those situated on large lots with wider and deeper gardens. These designs feature a larger area and an articulated or irregular volumetry; they are generally more expansive and varied based on the location of pedestrian and vehicular entrances and the incorporation of the latter into the lot.

b) Roof shape

The use of geometric shapes and various types of supports is common. The complexity of the roof design increases proportionally with the neighborhood's architectural standard, and its distinctive features lend individuality to each building. Flat slabs (continuous and stepped), sloped (gable or inverted gable), folded, curved (vaulted or inverted), or mixed (Figure 7).

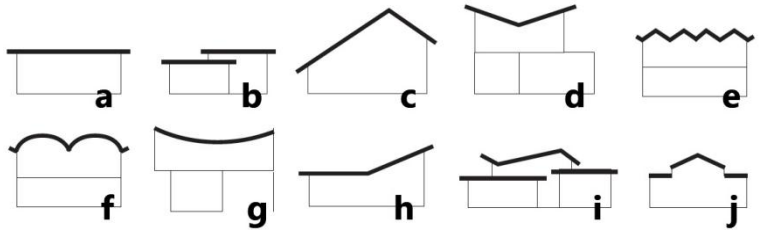


Figure 7. Diagrams of roof shapes: a) continuous flat, b) stepped flat, c) gable sloped, d) inverted gable sloped, e) folded; f) vaulted; g) inverted curvature, h), i), and j) mixed. Prepared by A.J. Rouco, 2020

The most striking forms are used on the most prominent structures, with which they establish a geometric and proportional relationship; they cover the social areas and are situated facing the main facades or in locations easily visible from the urban space.

In all examples from Buenos Aires and many from the Casino Deportivo, the slabs are flat, with or without eaves. This is the most common solution in lower-standard housing, which is why it is observed particularly in E1 units and some E2 units. In general, these correspond to buildings constructed between 1953 and 1957, reflecting the influence of rationalism in a national context where experimentation with irregular roofs was still in its infancy.

In Buenos Aires, the gable posts between the building's component blocks varied. At Casino Deportivo and Alturas de Palatino, attempts to achieve greater differentiation can be observed, ranging from roofs that are fully or partially sloped outward or inward, with steeper pitches, and even regular or asymmetrical folds, as well as the only example of vaulted slabs in the SA.

Santa Catalina is home to the greatest experimentation with geometric forms and relationships. Its designers conceived the most varied sequences of flat roofs and diverse heights, asymmetrical and pronounced slopes, as well as a greater mix in the compositions. More pronounced eaves were used, which even became central elements of the formal expression. The scale of some parapets was increased to simulate volume, and custom-designed gargoyles were added. In other cases, the parapets were designed to slope downward to function as drip edges and provide sun protection.

In standard-type dwellings, different patterns were adopted, although in all cases the design solutions were less complex to facilitate mass production. Those built for lotteries were simpler: solid flat slabs or porches with shorter supports. However, some of the homes marketed for sale by catalog featured solutions that combined flat slabs with gabled roofs.

Seventy-five percent of the ASS, which includes all standards, features eaves of varying lengths, although in multi-story homes they are only found on the roofs. In types E2 and E3, it is common to find extended eaves that accentuate the horizontal axis; their designs are distinctive and more complex in examples designed after 1957. A small percentage feature eaves with parapets, and the three standard-type dwellings in Santa Catalina have parapets without eaves. In these cases, the roof is perceived as a volume and takes on greater prominence in the building's expressive design—a distinctiveness further emphasized by rainwater-draining gargoyles.

While in Buenos Aires there were hardly any openings cut into the roofs, in the other three developments they were designed on different scales, were generally located along the eaves, and ranged from sequences of small openings to large openings with vegetation growing through them. In some residences in Santa Catalina, skylights were also incorporated into service areas and small courtyards within interior social spaces to allow filtered light to enter.

c) Compositional elements

A wide variety of compositional elements can be observed in the ASS, whose dimensions and positioning within the volumes influence the achievement of various design outcomes (rhythm, contrast, continuity, emphasis). The most common are: lines, planes, textures, and the framing of openings.

Lines and planes can be horizontal or vertical, openwork or solid, of varying thicknesses and geometric shapes, and function as columns, walls, or roofs. Horizontal planes are identified as the roofs of open spaces that connect the home to the exterior, such as entryways, porches, covered terraces, and carports[5]. In some cases, their upper surface is used as a terrace or balcony, generally protected by solid, openwork, or transparent railings, or a combination of these. Vertical planes can be solid or openwork and are used to divide outdoor spaces, accentuate the facade, or support horizontal planes in open spaces. Although some are horizontal or sloped, most of these elements are columns—either isolated or in sequences—used as vertical supports in covered outdoor spaces.

Texture refers to the finish of surfaces and their relationship to the overall expression of the structure. The most common examples include rustic stucco and cladding (made of natural or artificial stone), exposed materials (concrete,

bricks, or blocks), and surface irregularities created by variations in thickness in the base wall. In their various forms, these elements appear in numerous examples of the ASS. Columns, porticos, and textures were frequently used in the construction of M2 homes, where variations in form, geometry, material, and arrangement on the facades were employed, allowing for notable differences in the exterior appearance of a single model and avoiding monotony.

The window and door frames are generally projecting and may border woodwork panels or sections of the facade. They serve as accents on the building volumes and were used to provide protection from the sun and rain, as well as to block unwanted views.

The addition of one or more of these compositional elements—and their combination with the building's volumetry, roof shape, and enclosure elements—contributed to the diversity and uniqueness of the structures.

3.4 Functional solution

The analysis of the floor plans made it possible to identify and define the different functional zoning schemes used in the homes and their spaces.

a) Functional organization

In all cases, a spatial differentiation is achieved between areas for social, private, and service use, which are generally identifiable in the volumetric design. Access areas—comprising the spaces connecting the street frontage to the interior of the dwelling (entrances, terraces, foyers, and parking spaces). In multi-story dwellings, vertical circulation takes two basic forms: either it has its own dedicated space or it is integrated into another space, typically one intended for social use; in both cases, it is located in a central area of the building (Figure 8).

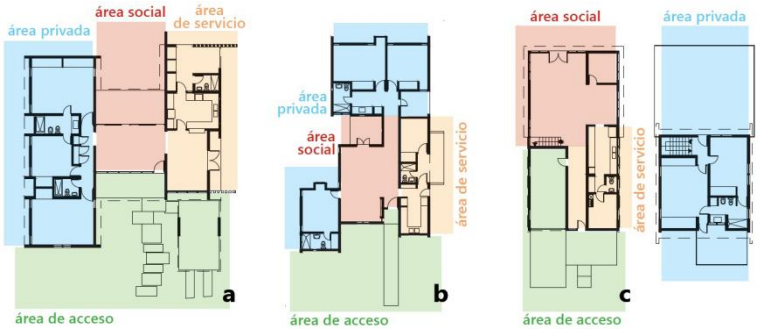


Figure 8. Functional organization: a) by bays or sections, b) by zones, c) by bays or sections on two stories. Source: A.J. Rouco, 2020

In both standard-type dwellings and unique dwellings, various functional layouts can be observed, with differences primarily determined by the dimensions of the lot and the required perimeter clearance (gardens, side walkways, and rear walkways). Narrow lots led to the use of functional layouts characterized by compact and somewhat longitudinal development, except in cases where two-story dwellings were designed to maximize outdoor open space.

For this study, the following zoning layouts were defined as predominant:

a) Single-story dwellings (30 examples): Functional areas are segregated by corridors, sections, or zones (73.3%). Entry areas take center stage and help achieve greater visual privacy from the outside (30%). Covered parking screens off access from the public street and contributes to the privacy of social spaces, which are arranged adjacent to the service area, serving as an intermediate strip between the entrances and the private areas located at the rear of the dwelling (56.7%).

b) Homes with two main floors (34 examples): Functional areas are segregated by floor (91.2%). Social and service areas are located on the ground floor, preceded by the entry areas. Generally, there is one bay for each area (44.1%), except where the garden strip is very narrow or nonexistent; in such cases, the service area precedes the social area, which is

located toward the rear with views of the plot's interior courtyards and gardens (14.7%). The upper floor is always reserved for the private area, which includes terraces and balconies.

Although subject to similar urban planning restrictions, larger lots allow for more flexible functional layouts (E3 homes). The designs move away from compact layouts and take on diverse, particularly articulated and irregular forms—such as H-, L-, or C-shaped floor plans—while maintaining the main entrance in the center of the building. The following pattern is observed:

• Single-story designs preserve the three-bay layout, which allows service areas to be organized on one side and private areas on the other, reserving the center for social spaces that serve as connecting areas. Some projects explore the possibilities of this layout in greater depth, and their floor plans exhibit notable differences in their bays—in terms of number, dimensions, and proportions, as well as the regularity of their perimeter. In others, the order or position of the functional areas is altered, with service areas placed in the center to serve as a connection, while social and private areas are located on either side.

• In homes with two main floors, however, the schemes of functional segregation by level are adopted in accordance with the volumetric solution—whether articulated or irregular—which yields unique and diverse forms and modes of connection. Likewise, the possibility of incorporating open spaces with greater formal and dimensional variations is fully exploited.

b) Interior spaces

The E1 homes have the minimum number of spaces necessary for domestic activities, but with more generous dimensions.

As required by urban zoning regulations, the entrance hall serves as the covered access area. The living room and dining room share a single space, or may be separate but with reduced areas. They include a kitchen, a bathroom, and at least two bedrooms with closets. The utility area is an open-air outdoor patio, and although they lack a garage or carport, their generous garden area allows for parking one car (Figure 9).



Figure 9. Interior spaces: a) porch, b) garage, c) vestibule, d) separate living room and dining room, e) irregular interior volume, f) private spaces. Source: A.J. Rouco, 2020

The diversity in the interior spaces of the E2 homes is notable, particularly between single-story and multi-story units; however, they also share features that allow them to be grouped together. In these homes, the unity between the carport and the entrance way sometimes makes them feel like a single space. Porches appear—small spaces that serve as the entry point to the homes, replacing the entrance way—and, in exceptional cases, they feature enclosed vehicle parking (garages).

The living room and dining room are separate spaces, visually connected through openwork elements such as staircases, latticework, or lightweight panels, and they extend onto terraces and interior gardens. At least one new social space is incorporated for specialized activities, such as music rooms, libraries, or studies, sometimes with their own bath--room and closet.

Two-story homes generally contain three bedrooms, all with closets, and most of them connect to the outdoors via terraces or balconies. In some cases, the master bedroom has a private bathroom and a walk-in closet.

Kitchens and bathrooms are larger. Additional bathrooms are added in social areas—for guests—and in service areas, and the main bathrooms separate their toilet and shower functions and include closets. Storage spaces are incorporated into the interior circulation areas. The service area is a small, partially covered or open-air outdoor patio connected to a larger open space. In two-story homes, these areas are larger; if they are open to the exterior, they function as covered terraces, and if they are enclosed, they serve as laundry rooms. Accommodations for domestic staff (a bedroom and bathroom) are included, generally located at the rear of the house, connected to the service area, and with separate access (in the serialized models promoted by El País, they are located on a mezzanine above the garage).

Generally, E3 homes share similar features with multi-story E2 homes, and there are no notable differences between standard and custom models. However, they have some additional features that set them apart.

In most cases, the front porch is absent, and the exterior entryway serves as both the reception area and the main entrance. Some parking areas are large enough for two cars and may be open (carport) or enclosed (garage).

The living room has grown in size and has become the quintessential social area. The dining room offers greater privacy and is more closely connected to the kitchen. In addition to social spaces for specific activities, there are now offices or consultation rooms with separate entrances and internal access to the rest of the home.

The kitchen has a larger area, allowing it to double as a breakfast nook; it includes specialized equipment, longer countertops with more than one sink, and, in some cases, is connected to a pantry. Thanks to the increased lot size, in some cases a bedroom with an en suite bathroom is incorporated on the lower level. The remaining bedrooms are located on the upper level, and there may be a total of four.

3.5 Construction solution

a) Vertical structure (walls, columns, and frames)

The vertical structure primarily consists of load-bearing walls made of blocks or bricks, either clad, left exposed, or using mixed finishes, depending on the desired aesthetic—a result made possible by the high quality of the masonry materials used and the craftsmanship of the builders.

To accentuate certain aspects of the formal expression, some walls were given surface textures—whether recessed or projecting—by varying the position of the masonry units that composed them; sections of varying thicknesses were alternated, generally in association with woodwork panels; and some non-load-bearing walls were designed as lattices, constructed of bricks or blocks in various patterns, whose porosity promoted thermal comfort (Figure 10). In exceptional cases, load-bearing walls were also openwork, albeit only partially, and were complemented by porticos or columns in areas where spatial transparency was required. The porticos, made of reinforced concrete, feature elements with orthogonal cross-sections, and the columns not integrated into them are generally made of the same material or of metal, straight or slanted, with square, rectangular, or circular cross-sections.



Figure 10. Vertical structure: a) brick wall, b) block wall, c) openwork walls with projections, d) with structural eccentricity. Source: A.J. Rouco, 2020

In many projects, the structural solutions constitute an important component of the formal expression. Variations can be observed with evident structural eccentricity, or with bases and enclosures narrower than the walls, which create differences in the cross-section throughout their entire height.

b) Horizontal structure (floors and roofs)

The horizontal structures were designed to be reinforced concrete in all cases. The roof sections are generally 15 cm thick, except in solutions featuring folded or shell-like forms, which have thinner sections, and some sloped roofs with variable cross-sections. The beams may be exposed or concealed. In exposed designs, they have large cross-sections and form part of the formal expression. In roofs with prominent eaves, they are inverted and concealed by the parapets. When the intention was to perceive the building's roof as a simple horizontal plane, their use was avoided, and the dimensions of the eaves were increased along the entire perimeter.

c) Staircases

In multi-story dwellings, two basic solutions were adopted for the staircase: a dedicated space or one that forms part of another space, generally intended for social use. In some cases, stairwells transcend their functional purpose to acquire their own aesthetic qualities, with diverse, enclosed volumetric forms that rise prominently in height, and occasionally with textures or cladding on their surfaces that make them distinctive differences stem from the location and dimensions of their openings, the type and material of their window and door frames, and the use of translucent and colored glass. Staircases that integrate with other spaces contribute to their aesthetic enhancement through their design—almost always light and airy, with attractive forms (Figure 11).



Figure 11. Staircases: a) with multiple flights, b) orthopolygonal, c) with a central rib, d) with two supported ribs, e) with two suspended ribs, f) with cantilevered steps, g) mixed, h) attached to a vertical rib. Source: A.J. Rouco, 2020

Most staircases consist of one, two, or more flights and can be orthopolygonal, with a central or lateral rib, with cantilevered steps, supported by tension rods, attached to a vertical rib, or of mixed design. The most commonly used materials are colored integral terrazzo and wood. Some unique railing solutions are particularly noteworthy, such as those consisting solely of very thin linear metal elements—whether vertical or slanted—or of wooden latticework.

d) Finishes (render, cladding, and floor coverings)

Wall finishes suggest textures. The most common were: render, either smooth or rustic; cladding, made of either cut natural stone or artificial modular pieces; and leaving the base material exposed; although it is very common to find mixed solutions that combine the above variations. Some cladding featured murals or compositions with abstract designs, and the durability of the exposed walls was ensured by periodically applying a coat of varnish. The quality and uniformity of these textures give the building a flawless finish (Figure 12).

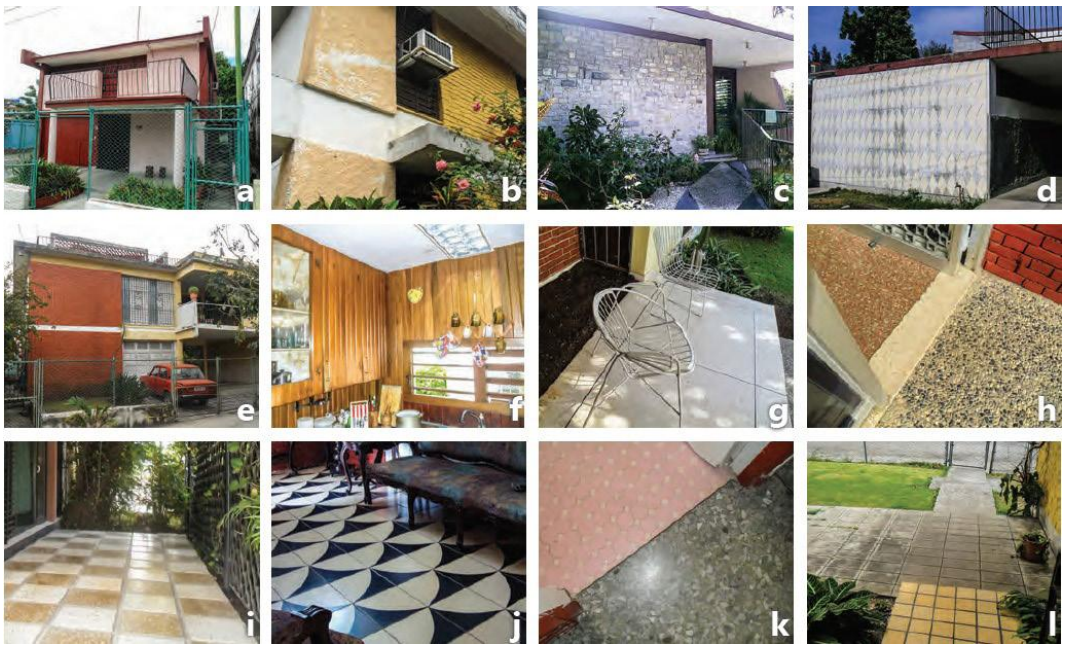


Figure 12. Wall finishes: a) smooth render, b) rustic render, c) natural stone cladding, d) cladding with artificial stones, e) mixed, f) interior wood paneling. Floors: g) polished integral terrazzo, h) washed integral terrazzo and terrazzo tiles, i) terrazzo tiles and relief terrazzo, j) hydraulic tiles, k) ceramic stoneware, l) washed concrete and non-slip tiles. Source: A.J. Rouco, 2020

Interior floors were differentiated by functional zones. The highest-quality, high-gloss floors — generally monochromatic or patterned terrazzo, in tile or integral form with bronze or marble grout lines—were reserved for social and private areas. Hydraulic tiles were used in service areas and servants' quarters. The flooring in parking lots and outdoor spaces was more rustic, and a cement surface or other slip-resistant material was used.

e) Carpentry

Although hardwood was the predominant material, in Buenos Aires and Casino Deportivo it is possible to find doors and windows made of aluminum, iron, and glass—modern materials for the time—primarily on the main facades of E2 homes and in covered spaces such as porches and terraces.

Depending on the housing standard, the main variations are observed in the shape, dimensions, and placement on the facades. The most commonly used doors were single- or double-leaf, folding, or sliding. For windows, Miami-style shutters were frequently used, with or without transom windows, or combined with panes of clear or tinted glass (Figure 13).



Figure 13. Windows: a) horizontal panels, b) vertical panels, c) wood and glass, d) metal and glass, e) and f) without a top frame, g) with colored stained glass, h) with unique geometry. Source: A.J. Rouco, 2020

The arrangements of the components in the window and door panels do not follow a specific pattern, although differences can be observed depending on their location in the E1 and E2 homes. In these cases, the most distinctive and attractive solutions are generally found on the main facades, while the rest of the facades typically feature two-panel, medium-height Miami windows, with or without transom windows. However, in designs that allow for greater freedom in the use of the site, there is a wide variety of combinations in the window panels, ranging from a single floor-to-ceiling window with shutters to small, translucent units located above the kitchen countertops.

3.6 Environmental qualities

a) Integration with nature

This aspect was taken into account from the very beginning of the housing developments. In Santa Catalina, the backyards of the standard-type dwellings formed a single green block that made use of the existing vegetation, while in the courtyards and gardens of all the developments, plants were selected based on their physical qualities and with the aim of achieving integration between nature and the building's design.

In gardens and front facades, taking into account their physical and morphological characteristics, the chosen plants adhered to the codes for landscaping used by the Modern Movement. In a clear reference to under American influence, one observes the presence of exotic, non-native plants — generally slender in form and with notable vertical growth (e.g., araucarias and slender palms)—which contrast with and balance the horizontal nature of the architecture into which they

are integrated. In interior courtyards, it is common to use plants with vertical growth—intended to be viewed from the outside—as well as tropical understory plants, such as taro and shade-providing plants, which are well-suited to the local climate. In backyards, it is common to find culinary herbs, aromatic plants, and fruit trees (Figure 14).



Figure 14. Integration with nature: a) irregular topography, b) terraced garden, c) slabs with vegetation, d) interior garden. Source: A.J. Rouco, 2020

Regarding topography, although only Santa Catalina had a group of buildings situated on slopes, the elevation changes in such cases are utilized to locate parking lots, garages, and service areas there, in order to respect the natural environment.

b) Response to environmental requirements

The 3Ps (patio, portal, and persiana)—elements identified by Eugenio Batista [28] as the ABCs of Cuban tropical architecture—function as follows in response to climatic requirements:

• Although patios are spacious only in the E3 designs, smaller spaces with a similar function are frequently incorporated into the articulated and irregular building volumes of types E1 and E2. Based on gardening and landscaping principles, the interior patios function as thermoregulatory elements for the interior galleries that surround them [29], creating areas of light and shade, and allowing the air to cool before entering the living spaces.

• In addition to the traditional entrance way, these homes feature other open, covered spaces (terraces, porches, balconies, carports, etc.) that have direct contact with the outdoors and serve the same climatic function: providing protection and shade for the facades.

• The use of shutters is widespread, both on facades and indoors, in vertical and horizontal panels of various sizes, fixed or adjustable, combined with clear or tinted glass—transparent or translucent—which together filter sunlight, control

light levels, and regulate the entry of wind and rain, as well as noise and exterior views (when made of wood).

Years later, Segre incorporated the puntal as a fourth P [6]. The taller struts are used to keep areas of higher temperature and thermal radiation away from occupants. This advantage is most evident in solutions with multi-level, sloped, folded, or curved roofs, which make up half of the ASS.

In addition to the 4Ps, other features provided climate-related solutions, such as eaves (75% of the ASS), which protect against rain and sun by shading the upper part of the openings—usually made of glass; lattices and frameworks, made of wood or clay, which absorb heat; and the permeability of the building envelopes.

Natural lighting is achieved primarily through the use of interior courtyards; glass panels on sheltered facades or in circulation areas, such as staircases and interior galleries; skylights in shaded sections of walls (due to eaves or other building components) or above kitchen countertops; and skylights in service areas. The geometric layout of the functional plans ensures that natural light reaches all rooms, including kitchens and circulation areas. This solution enhances visual comfort and eliminates the need for artificial lighting during the day, resulting in energy savings.

Although, according to González [30], it is not possible to establish a direct relationship between the volumetric design and ventilation performance, the latter can be enhanced by certain factors. The dispersed layout of the buildings within the blocks in these developments and the separation between them via approximately 3-meter-wide corridors allow for the formation of wind channels that redistribute breezes in all directions.

Homes with articulated and irregular volumes, featuring gardens, terraces, or interior courtyards, have more walls exposed to the exterior, with openings for air to enter and exit, thereby enabling cross-ventilation. In compact developments, all units have at least one wall with an opening facing the exterior, and the building does not exceed two bays in width; consequently, the wind's path through the interior is shorter and encounters fewer obstacles. In interior spaces, cross-ventilation is achieved through the placement of openwork or low walls, and windows with fixed or adjustable shutters, which allow air to pass from one facade to another. Likewise, the window openings in the perimeter walls are generally wider and more permeable. In multi-story buildings, air circulates vertically through the stairwell. For these reasons, it can be said that these homes were designed as boxes permeable to wind flow, and therefore did not incorporate air conditioning systems into their design.

In some designs, wood was used as interior wall cladding—typically in living areas and kitchens—to absorb the noise generated in those spaces.

Both the eaves and the design and placement of the window and door frames play an important role in providing protection from rain. Sloped roofs or roofs with short slopes facilitate the rapid drainage of water, either by free fall or through downspouts.

c) Spatial continuity

Spatial continuity is a feature that contributes to the creation of a favorable interior environment, which manifests itself in various ways. (Figure 15)

• It is common in homes of any standard to combine the living room and dining room into a single space; however, it is possible to distinguish between them. In solutions E1 and E2, the space tends to be a regular orthogonal layout, and at times the functional differentiation is established by a dividing element such as a staircase or built-in furniture.

• Horizontal spatial continuity is achieved through the sequential arrangement of spaces with irregular perimeters and diverse environmental qualities, connected by folding or sliding doors—or without them. These divisions may also be linked to staircases and other structural elements made of masonry, wood, or metal.

• Vertical spatial continuity, achieved through significant differences in column heights, is explicitly observed only in

one E3-type dwelling. In cases involving uneven terrain and a semi-underground garage, differences in floor levels were created, spatially linked vertically through the stairwell area.

• Transparency in the enclosures is most common in E2 and E3-type homes. These homes feature large glass panels or sliding or folding doors, and may include combinations of both, which occasionally extend interior spaces—such as living rooms and dining rooms—toward terraces and porches that are generally protected by roofs or large eaves.



Figure 15. Spatial continuity: a) living-dining room, b) horizontal, c) vertical, d) interior-exterior. Source: A.J. Rouco, 2020

4 Discussion of results

4.1 Comparative analysis of the ASS among the selected neighborhoods

The regularity of lot layout resulting from rectangular block planning in three of the SA's districts favored their occupation by row houses, which served as essential benchmarks for the standards and quality of buildings constructed subsequently within them.

Although no major differences are observed in the gradation of standards, the existing differences are primarily associated with variations in the spatial and dimensional characteristics of the lots in each development and the requirements for their occupancy. As a result, in this regard, they can be ranked in ascending order as follows: Buenos Aires, Casino Deportivo, Alturas de Palatino, and Santa Catalina, and their influence is most clearly evident in the volumetric-spatial configuration, the interior functional organization, and the quality of the outdoor spaces. Nevertheless, all examples maintained the following: at least one parking space in one of its variants; an effective response to climatic requirements—ranging from their spatial qualities to the design of enclosures and protective elements; and a notable design quality in their formal components, encompassing their compositional elements and the materials and construction

solutions selected to achieve the desired aesthetic expression. This is evident even in the standard-type dwellings, which feature a variety of solutions and expressive characteristics that distinguish them from one another and from the rest.

In the Buenos Aires and Casino Deportivo neighborhoods, which are of a lower grade, the pre-established narrowness of the lots led to an organization of functional spaces organized into bays or sections, with the aim of achieving greater privacy from the exterior. Compact solutions were devised to make better use of the lot area, and the spaciousness and environmental diversity of the outdoor spaces were more successfully achieved in multi-story buildings. In these cases, the main facade was generally designed with greater detail, as it was the one visible from the urban space.

The buildings in Alturas de Palatino—and to a greater extent in Santa Catalina—feature a freer functional layout, a greater number of bays, and greater perimeter irregularity, which resulted in outdoor spaces that are more diverse in terms of function, number, and dimensions. The volumetric and spatial solutions are generally irregular and exhibit great compositional freedom, thanks to the availability of a larger land area, while the detailed design encompassed all of the building's facades. In Santa Catalina, there is greater variability in the design of the elements that make up the formal expression of the buildings, facilitated by its sloping topography and the irregularity of its lots, and supported by media coverage highlighting its significance.

Generally speaking, from an expressive standpoint, the details that reveal the various trends of the Modern Movement across the four neighborhoods range from orthodox rationalism—observed in works from the first half of the 1950s— with a particular emphasis on the design of facades, textures, and compositional elements, to later approaches to organicism and brutalism, seen in bold roofing solutions and structural eccentricity, large overhangs, more complex designs of facade elements, and a wide variety of volumetric-expressive arrangements, whose variations were similar to those developed simultaneously in other areas of the city.

5 Conclusion

This research report is the first document to present and highlight the architectural legacy of the Modern Movement within the territory of the current Cerro municipality in the city of Havana—a fact evidenced during the literature review by the absence of studies and publications on the subject—and it provides valuable insights into its development through the analysis of a set of architectural works in four of its modern neighborhoods that have not been previously studied.

Furthermore, it reinforces the view that in Havana's non-central and understudied urban areas, there are works of varying standards that possess values similar to those recognized in the specialized literature, and that these neighborhoods served as sites for the exploration of modern architecture between 1950 and 1965, contributing to the consolidation of a Modern Movement with distinctive national characteristics.

It demonstrated that the intensive development of the Study Area began with the construction of serial housing complexes promoted by private initiative, which quickly became catalysts for growth in these urban areas distant from the city center and served as essential benchmarks for standards and quality for buildings constructed there subsequently. These models, developed by various companies and facilitated by the regular layout of the lots, coexisted in a successful blend with notable unique or signature works, both of which responded to the social aspirations of the middle class and achieved an expressive balance within their urban contexts that endures to this day.

There is a wide variety of formal solutions, based on customized designs of volumes, roofs, and construction details tailored to expression, which point to local interpretations of the architecture that was simultaneously taking shape in the city during the period under study. Although some attempts demonstrating this trend can be observed between 1950 and 1955, this process intensified in the SA beginning in 1956, with an expressive quest that lasted into the following decade, during which organic and Brutalist architectural concepts were assimilated and reinterpreted in various projects with a

distinct national character.

Due to the private nature of the initiative and its management, the number and specialization of the interior spaces in the homes were defined by their developers and investors, in accordance with the aspirations of their clients. However, they possess characteristics that reflect variations within an average standard, as defined and established in this study. The variety in construction solutions corresponds to the personal expression of their creators and the individual design of each project based on the needs for which they were commissioned. From an environmental perspective, qualities are evident that are based on a balanced combination of tradition, ecology, and modernity. Alongside appropriate responses to climatic requirements, there are multiple ways of achieving spatial continuity and a coherent integration with nature.

The architectural works analyzed demonstrate high quality in both construction and design, as well as the assimilation of direct and indirect influences from the international, national, and Havana-based Modern Movement, which were adapted to local standards and specific conditions. In the examples analyzed, the same aesthetic and comfort features were employed as in those designed for the upper class, but on a smaller scale, due to the particularities of the land subdivision—the dimensional and environmental characteristics of the lots, as well as construction constraints—and the financial resources of their clients, who were generally workers, employees, and small business owners from the so-called middle class.

This study serves as a theoretical, conceptual, and historical foundation for future initiatives aimed at preserving the valuable residential architectural heritage of the Cerro municipality, and as a reference for best practices in future Cuban architecture.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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Note

[1] The authors have also presented papers at various national and international scientific conferences between 2017 and 2019.

[2] According to Decree 3213 of 1948, among the requirements to be met by low-income residential zones, it was stipulated that within the same subdivision, buildings must maintain uniformity, with six types or models could be adopted [24, p. 630].

[3] In the Study Area (SA), several dwellings were identified that cannot be classified as low-cost owing to their intrinsic features, even though they were built on lots designated as low-cost plots.

[4] This refers to a paved path, whose circular or elliptical shape allows vehicles to enter and exit the lot. Its purpose is to allow visitors to step out of their cars directly at the home's front door, sheltered from the sun and rain.

[5] Carport: an open-air parking structure or garage (according to Dicios English-Spanish dictionaries, available at: http://es.dicios.com/enes/carport). In this document, the term will be retained to identify covered vehicle parking areas that are open along their perimeter.

[6] Lecture "The theme of the door through examples", delivered by Roberto Segre on 21 September 1988, Faculty of Architecture, José Antonio Echeverría Higher Polytechnic Institute (unpublished document, notes taken by A.J. Rouco).