



# The Importance of Preserving the Structural Concept of Historic Monuments: The Case of the Quinta San José in Azogues, Ecuador

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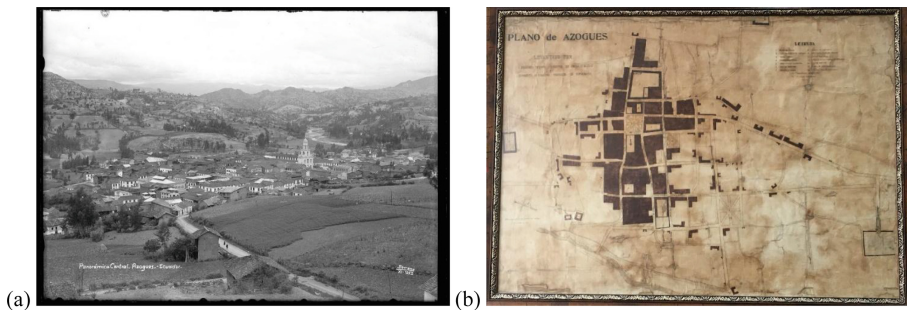
**Abstract.** The processes of intervention in architectural heritage assets are preceded by research and technical approaches that, in themselves, are an important challenge for conservation and an essential part for their proper execution. This theme is reaffirmed in the case presented in this document. The Quinta San José in the city of Azogues is a monument of high value for the local community and recognized by the State as national heritage. However, its deteriorated condition, as a result of previous interventions, has caused a high degree of vulnerability and not a few damages to its construction system, with progressive degradation triggered not only by natural causes. In response, the Municipality of Azogues (capital of the Andean province of Cañar, located in south-central Ecuador) promoted the development of a comprehensive recovery proposal, combining wisdom and innovation, preserving its memory, but also characterizing it as a vehicle for sustainable development and applying good practices in heritage management. Quinta San José is the result of a complex conjunction of constructive moments with the use of materials, vernacular technologies and different qualities. Based on its understanding, the presented project proposes specific solutions from consolidations to more radical and complex actions of replacement or re-proposition of elements with better design and resistance qualities, which will be clearly shown as new additions or prostheses that can be read appropriately, without misleading, understanding the heritage itself as a source of creativity.

**Keywords:** Adobe · bahareque · construction technologies · restoration · reinterpretation

## 1 Introduction

The Quinta San José is a construction that originated in the early twentieth century on the outskirts of the then small city. Its constructive impulse is linked to the social and economic growth of a family of straw hat exporters, the Calle Molina family, who developed a project based on a humble peasant house, which they complemented and enlarged (in line with the family's history) until it became a visible cultural asset of the city. “it

is a slow, progressive process, of multiple approximations both to its current physical reality and its underlying reality, immaterial and not visible without the help of research processes from adjuvant disciplines” (Cardoso 2016), which is clearly reflected in its vernacular nature. Indeed, at the beginning of the twentieth century, when it began its construction process, Azogues was a small settlement strongly consolidated and built using local technologies: favoring the presence of earth as the dominant material, solving the constructions through the use of adobe or bahareque (quincha) of very good workmanship. A particularity of this property lies in the coexistence of these technologies, to which is added the use of stone with earth mortars and wooden structures with *enduelados* (vertically boarded walls) of the same material, especially to solve part of the upper floors. The construction was located on a hill overlooking the landscape and the concept of the quinta comes from a typology typical of Ecuador, which corresponds to houses located on the periphery or in the countryside, framed by nature (Fig. 1).



**Fig. 1.** Image and Map of Azogues 1916. Authors: Pacheco Cordero, 1916. Source: Municipality of Azogues (cited in historical study).

The cultural property is basically composed of two large bodies, built with different technologies. The oldest, the upper part, which is located in the corner of the house, probably uses structures of the first vernacular construction in adobe, especially in the lower walls; the upper part is solved with endueled wood while the new main body is built with a technology typical of the place: the Bahareque or Quincha on which, this article pays special attention.

The consolidation of the Quinta San José, benefits from several constructive impulses between 1915 and 1931, being this last year the one in which it enjoys greater completion and fullness, with a fundamental body that is constituted in the main element of the set: A large house of bahareque ennobled by moldings and ornaments of classic inspiration, with comfortable social spaces and an altana (or viewpoint) in which the initials of the owners stand out. Since the mid-twentieth century, the building has suffered progressive abandonment and since the twenty-first century it has been affected by “restoration” actions that aggravate its state of preservation. In 2018, restoration studies promoted by the Municipality of Azogues began, in order to return to the house its heritage values and structural consistency (Fig. 2).

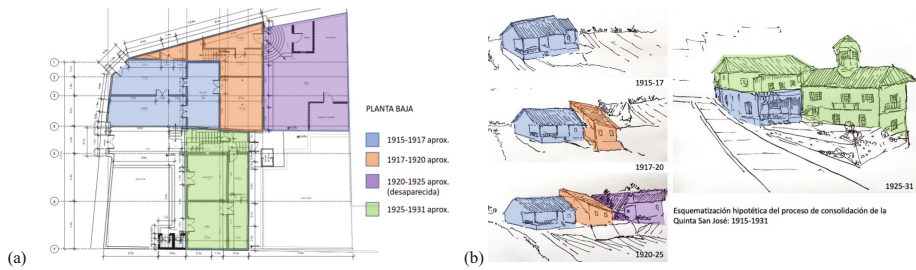


**Fig. 2.** Photograph of the facade of the house where the date 1931 can be seen at the top of the viewpoint. Source: Calle-Molina family archives. Courtesy of Teodoro Cordero Calle. n/d

## 2 Constructive Process

As sustained in the historical study of the Quinta San José, it is considered that the property has reached its constructive consolidation in 4 stages that are graphically exposed in Fig. 3a, b; the first phase corresponds to a small one-story building, which basically included two rooms with a porch and a vestibule. The second phase was built with the objective of enlarging and renovating the existing spaces; the construction of the first 2 phases occupies the highest part of the site, in the northeast corner of the site; its mezzanines have been resolved with a system of beams, leveling strips and wooden staves; The partitions and closings of the upper floor have been resolved with frame structures and wood coverings, adopting a structural criterion widely used in vernacular buildings, which consists of arranging the elements of greater weight, resistance and structural density on the lower levels and the lighter elements on the upper levels. The third stage of construction corresponds to an area that no longer exists, used for the storage of products; this space was later demolished to be replaced by sanitary batteries. Finally, the fourth stage of construction corresponds to a new building that connects both in uses and spaces to the pre-existing building. This building has been called the “Green House”, and it is precisely in this area that the analysis of this article will focus.

The construction of the Casa Verde is dated between 1925 and 1931 (Ullauri 2021), and is located towards the center-west of the lot, in the lowest part of the irregular terrain. It has 4 levels: a basement floor, a first floor with living spaces, a second floor with social rooms and a lookout or *altana* that combines with the roof. The structural solution of the block is based on wattle and daub walls. The spaces are resolved orthogonally to each other, and their total configuration in plan is rectangular in shape. The structural system on which it is based consists of a foundation of continuous stone walls, with adobe load-bearing walls and stone retaining walls at the basement level; on the ground, first and second floors, the walls are of wattle and daub, while the top floor, where the viewpoint is located, is made entirely of wood; the mezzanine systems are made of wood beams,



**Fig. 3.** (a) Construction stages of the project. Ground floor “Quinta San José”. Source: Project report (b) Diagrams of the construction evolution of Quinta San José from 1915 to 1931. Source: Project Memory

leveling strips and eucalyptus floors. In addition, the first upper floor has balconies, and the roof is made of an articulated wooden structure, reed and tile cladding.

In brief, the Green House manifests technological systems that apply materials found in the immediacy of the place; these processes have been developed over the centuries, have been transmitted between generations through on-site learning, and have been empirically refined (through trial and error actions) thus reaching levels of refinement and excellence.

### 3 The Structural Concept

It is essential to keep in mind that the structure is the result of the conjunction of elements properly arranged and interrelated, and that they work in an integral and systemic way, having as purpose to transfer the actions to which the building is subjected, to the points where the whole is supported on the ground, trying in every instance to guarantee security, stability and firmness. This consideration is immanent to each type of architecture, and solving it has its own creative, local responses, which becomes a feature of identity of the architectural culture of the place. Thus it is clear that the structure as a whole (and its solutions) not only plays a leading role in the normal subsistence of a building, but also preserves a series of wisdom and knowledge that are part of the architectural vernacular of the place.

"Each part or element that forms the structural system depends on the others and exists in function of the whole; the structure refers to the materials that constitute the resistant elements, the shape and section of these elements, the way in which they are joined and combined, and in general, of the system that in a combined manner makes it possible to adequately fulfill the utilitarian destination for which the project was planned; the structure must guarantee that any deformation is not excessive and interferes with the normal functioning of the activities contained in the building, as well as that no inadmissible degradations or anomalies occur. "

(Barrera 2017)

The Quinta San José has a mixed construction system that includes brick masonry, wood and bahareque in particular. The bahareque or Quincha system itself, in turn,

is a mixed system, since it is composed of a wooden frame which is filled with cane covered with a mixture of mud and straw; in this system, each material fulfills a specific function: the wood constitutes the resistant soul of the bahareque construction, since with its horizontal and vertical pieces, it configures the frame that is braced and stiffened with the diagonal pieces; the cane serves as an additional reinforcement of rigidity of the wood frame and provides a solid and uniform base for the application of the mud layers; Finally, the mud and straw form the final layer that formally concludes the bahareque, their combination includes local materials with a low carbon footprint, but at the same time provides thermal and acoustic insulation, with efficient results for the climatic demands of this region of Ecuador (Fig. 4).



**Fig. 4.** Image of the construction technology applied. Source: Project report

#### 4 Fragility Behind the “Restorations”

Between 2014 and 2018, the building underwent a process of intervention in which, in addition to the inclusion of technologies foreign to its structural nature, the mezzanines, rear and facade walls were partially shored up and the roof covering was removed. This intervention is configured as the main source of recent pathologies detected, since it is particularly worrying that for the installation of the scaffolding and shoring system (without a clear project concept of intervention) (Barrera 2021), the integrity of the original wooden and bahareque elements was seriously disrupted, putting the entire architectural complex at risk, since even the external scaffolding weighed down the already vulnerable structures of the heritage house that was to be restored.

This scaffolding system (which instead of being self-supporting affected the vernacular structure) has been one of the biggest problems to be solved, since it has affected not only the general structural design but also the bahareque masonry elements, since walls have been perforated for their fastening, breaking the cane, loosening the mud, allowing the entry of humidity into the mud mass; However, the most aggressive part of these interventions has to do with the cutting and breaking of wood pieces, which prevents the guarantee of lateral stability in complete bahareque segments, resulting in the alteration of the integral geometry of the building.

At the foundation level, a voluminous reinforced concrete reinforcement has been included, a material foreign to the traditional construction system and of an irreversible nature. For its construction, risky excavations were carried out with the overthrow of the original adobe basement walls. However, reinforced concrete is not the only material that is inconsistent with the original construction system, since in most of the wooden joints, metal profile reinforcements have been inserted in an attempt to solve problems of deformation in the floor structures.

This intervention was not executed in a technical manner or with minimum delicacy, as these foreign elements are directly supported on the same beams that it is intended to reinforce, excessively stiffening the joints and increasing the weight that causes the deformations that should be attacked. This intervention breaks and profoundly disrupts the vertical continuity of the wooden pieces up to the foundation; it inserts foreign elements that cannot be hidden or concealed in the expressive context of the property, separates and eliminates vertical, horizontal and diagonal pieces of the internal frames of the bahareque panels, causing, as already mentioned, a considerable reduction in the structural elasticity of the bahareque originally entrusted to the bracing of the structural assembly and to the complementary cladding systems using local reeds (Fig. 5).



**Fig. 5.** (a) Scaffolding system affecting various parts of the structure. (b) Pathology structural intervention in walls of wattle and bahareque walls to support scaffolding systems. (c) Cutting and breaking of wooden parts. (d) Reinforcement of metal profiles. Source: Own (2020)

## **5 Technical Solutions and Inspiration from Ancestral Wisdoms**

The interventions carried out in the Casa Verde in recent years have caused the generalized degradation of the structure, so it is difficult to affirm (given the current conditions and the presence of scaffolding, structures, joints and metal parts, etc., and perforations in the old Bahareque walls) that there is an admissible structural concept or that the structural system of the building itself has been taken into account in the search for solutions and perforations made in the old Bahareque walls) that there is an admissible structural concept or that the building's own structural system has been taken into account in the search for solutions: Deciphering the current situation proved to be extremely complex as it is even possible, that a part of the house is partially supported by the incorporated scaffolding (and vice versa), so it is very important that the restructuring processes follow an ascending order of consolidation, (foundations, first floor and upper floors) in such a way that progressively the house recovers its altered structural concept and offers safety for itself and its users.

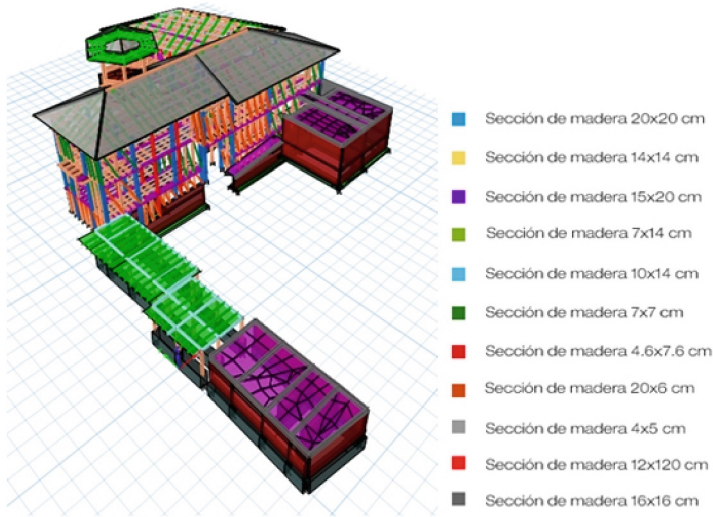
The loss of several bahareque spans and intercolumniation, the existence of others partially damaged or seriously affected, has required a clear position for the new recovery process: the proposal proposes a gradual recovery (without yet disrupting the present delicate structural condition), because although in some cases the form of recovery is clearly determined by the current condition -which is already reflected in the project approach- in others it is recommended to activate in situ processes, carrying out explorations and specific evaluations through limited and controlled destructive tests (scraping, small perforations, small removals of plastered surfaces, etc.), which will make it possible to verify, among other things, the state of the wooden pieces, the form of connection (or disconnection) verified, in order to recover the structural coherence of the bahareque system, re-articulating the globality of the structure, strengthening the degree of attachment of the bahareque "segments" to the main structures.

## **6 The Monument and the Restoration Experience as a School of Learning**

The challenge of the intervention in this project lies not only in the purpose of preserving the heritage property, but also in strengthening its permanence and durability over time. This will be achieved through a reasoned technical transformation that will allow, from the restoration project, to approach compliance with current construction regulations (previously nonexistent), which contemplates not only the resistant and constructive aspects to remain standing, but also a capacity installed in the structure itself to respond efficiently to the seismic risks that are typical of the Andean region of Ecuador.

In order to address the solutions, and inspired by the compositional foundations of the bahareque construction system, the decision was made to isolate the wood components, separate them from the reed and mud, and thus analyze - separately - their influence on the overall strength of the assembly. Through analysis based on mathematical models, it was possible to determine that the system of frames stripped of mud and cane does ensure the transmission of loads and is a reliable element in the event of a seismic event. As part of the conceptual restoration proposal, these racks are proposed to be clad with

glass (fastened in such a way that it does not interact with the plastic deformations of the building in the case of seismic events). The treatment of the glass allows the diffuse visualization of the resistant core of the traditional system, and at the same time becomes an additional source of natural lighting inside the building. The reinterpretation of the construction system on the one hand solves the structural problem but also contributes environmentally to the architectural solution, without detracting from the sincere language with which it transparently shows the intrusion of a contemporary workmanship (Fig. 6).



**Fig. 6.** Structural system model. Structural system in 3D. Source: Own (2020)

Therefore, according to the project, there will be three ways to take on the challenge of progressively restoring the structural consistency of the Quinta San José, with regard to the bahareque structures that are part of the building: restoration, in the case of ascertaining an appropriate cohesion of the bahareque structures and the good state of conservation of the parts; renovation, if as a result of the exploration work it is determined that the bahareque panel has stability problems or has lost cohesion with the vertical wooden elements, then it is prudent that, given the impossibility of returning the structural cohesion of the walls with external accessories or prostheses, these are disassembled and rebuilt from the beginning; incorporation, the severely damaged or missing bahareque walls have been proposed as modern elements that close the spaces, with fine carpentry and abundant natural light. Thus, what is incorporated in the rear level of the first floor (towards the interior road), is a wooden structure inspired by the bahareque structures not only as an expression but as a structural proposal, which will open reflections, narrate the technology in a clear way and generate additional light to the internal environments of the Quinta.



The above-mentioned progressive intervention process from the bottom up will progressively remove the joints and other metallic elements that affect the structure, carefully remove the heavy scaffolding system arbitrarily introduced and thus, progressively return the “spirit” or structural concept to the building (Fig. 7).



**Fig. 7.** Intervention proposal, reinterpretation of bahareque to replace severely damaged walls. Source: Own (2020)

## 7 Discussion and Conclusions

The importance of preserving the structural concept of historic monuments, as has been visualized in this work, has multiple reasons: On the one hand, it is a decision that supports a position in favor of preserving the authenticity of the buildings, in apparently intangible aspects (such as a structural concept) but which are essential if the built heritage is understood beyond the resolved form: The processes, the materials, the knowledge contained and the solutions applicable to the environment become essential elements of this heritage.

The painful experience suffered by the Quinta San José has been taken as an opportunity that has triggered a series of rich theoretical and conceptual reflections for the approach of the project solutions. These solutions, in addition to the classic concerns of a restoration intervention, turn out to be inspiring to solve even critical aspects in which the questionable interventions caused the monument to incur, until offering solutions that reinsert the property in the contemporary world, not only in its new uses (a school of intergenerational learning, a space in which inherited construction technologies are deciphered, a space for the promotion of cultures and interactions, of artisanal creativity with exhibitions and workshops) but also in its structural conditions, capable of ensuring its own safety.

The Quinta San José of Azogues has also demonstrated that vernacular monuments can face complex conservation situations with imaginative responses framed in very current principles of restoration: Although the theory of restoration is a reference framework

in this project, it is not assumed in a dogmatic way, as a straitjacket. These theoretical principles are articulated with the understanding that these buildings are living heritage, which require maintenance (sometimes deep, as in this case) and deserve to be understood as such, as long as there is still in today's society, the ability to apply these processes based on ancestral knowledge, to restore these valuable monuments.

The vernacular built heritage of the southern region of Ecuador is a valuable heritage for many reasons: it is generally a product of community social action, it is solved using materials from the area, which makes it sustainable and low generator of environmental impacts, it is solved using ingenious construction systems that respond to creativity inherited over time, it generates affective relationships with the people who live in their environments, which connects with immaterial values, and its richness and constructive ingenuity can be a source of inspiration not only for its own conservation but also for contemporary architectural solutions, which can cover wide spectrums, from buildings applicable to social housing, to major infrastructures such as educational centers, temples, community and cultural facilities, etc.

If heritage is understood as a source of identity and inspiration, it is absolutely justifiable to make the greatest efforts for its conservation. This is a type of architecture that, in addition to the reasons expressed above, strengthens the personality of the urban-marginal and rural areas of many places in the Americas and particularly in Ecuador.

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