

Technical protocols of heritage preservation from risk and vulnerability analysis. The case of the vernacular architecture of Quingeo (Azuay, Ecuador)

Protocolos técnicos de conservación patrimonial desde el análisis de riesgos y vulnerabilidades. El caso de la arquitectura vernácula de Quingeo (Azuay, Ecuador)

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ABSTRACT

The vernacular architecture of the rural Parish of Quingeo (Azuay, Ecuador), and therefore, the buildings of its parish downtown, are affected by globalization, neglect, and the scarcity of management and technical preservation tools led to their deterioration. This background motivates the analysis, identification, and prioritization of risks and vulnerabilities of this architecture, taking three priority cases of study; wall stratigraphy, the risk analysis matrix, and the principles of preventive preservation, as tools little applied in rural built heritage, but are very useful to understand the evolutionary process, and improve the protection and enhancement. The results obtained determine three types of specific protocols; 1) monitoring and control, 2) periodic maintenance, and 3) management. Such instruments are viable as a strategic axis for nearby territories, such as Quingeo.

Key words: vernacular architecture; risks; heritage management; heritage preservation; technical protocols.

RESUMEN

La arquitectura vernácula de la parroquia rural de Quingeo (Azuay, Ecuador), y por ende, las edificaciones de su centro parroquial, son afectadas por la globalización, el abandono y la escasez de herramientas de gestión y conservación técnica que han ocasionado su deterioro; este antecedente motiva la realización del análisis, identificación y priorización de riesgos y vulnerabilidades de dicha arquitectura tomando 3 casos prioritarios de estudio; se usan la estratigrafía muraria, la Matriz de análisis de riesgos y los principios de la conservación preventiva, como herramientas poco empleadas en el patrimonio edificado rural, pero de gran utilidad para entender el proceso evolutivo, y mejorar la protección y puesta en valor. Los resultados obtenidos son la determinación de 3 tipos de protocolos concretos; 1) de seguimiento y control, 2) mantenimiento periódico y, 3) de gestión. Dichos instrumentos son viables como eje estratégico a territorios cercanos, tales como Quingeo.

Palabras clave: arquitectura vernácula; riesgos; gestión patrimonial; conservación patrimonial; protocolos técnicos.

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1. INTRODUCTION

Vernacular architecture represents the process of community, social, constructive, and cultural appropriation, and the transmission of knowledge and wisdom of a collective over time. These constructions are containers of multiple meanings due to a continuous process and adaptation of cultural patterns in the immediate context and according to their particular circumstances. Nevertheless, not all vernacular architecture is historical and, in its absence, heritage.

In this particular framework, this research focuses on historical vernacular architecture, which encompasses those works and ensembles belonging to concluded periods or that have lost their original functionality and are part of the cultural heritage (Pérez Gil 2017); the community recognizes the specific material (materials and pre-industrial techniques) and immaterial values that characterize its historical, anthropological identity, that is, they belong to and represent cultural periods of the past of that community (Pérez Gil 2018: 3).

Several studies (Torres Zárate 1999; Tillería González 2010; Flores Camarillo 2011; Mejía Pretel *et al.* 2021) and the Charter of Built Vernacular Heritage (1999) consider that this architecture has been violated by cultural homogenization, globalization, and abandonment, leading to its possible disappearance. Furthermore, although its vulnerability to changes in the urban and social structure is indeed indisputable, its disappearance, according to Pérez Gil (2017) as such, is not literal; as long as there are people, there will continue to be cultural and traditional manifestations, embodied in buildings (Oliver 1989), as long as these correspond to the tradition and indigenous resources of the community to which they belong (Pérez Gil 2018: 4-5). In this way, it can be established that historical vernacular architecture in the world, as exemplified by the case of Quingeo (Ecuador), lives through a process of abandonment (Cinieri and Zamperini 2015; Chaos Yeras 2015), and its cultural-anthropological contributions and technological and material interventions usually respond to external patterns, which puts at risk its material, historical, documentary and cultural values, same that is part of the identity and historical tradition of a certain place. From a cultural point of view, the latter is intrinsically exposed to transformations and adaptations; however, their origin and historical importance tend to disappear in a globalized world.

In several Andean settlements, particularly in the Ecuadorian Austro, vernacular architecture represents the typical construction and recognition of the identification of a locality and its importance in the historical line of architectural, urban, and social development (Hermida and Mogrovejo 2014: 31-32). While in developed urban centers, their conservation and management, from the technical, social, and public administration aspects, is the basis of their physical permanence, the reality is different in rural areas. The public-private importance of the city, the constant change, and social disengagement have caused the neglect of cultural heritage, demonstrated through the lack of and inadequate management and conservation (Cabrera-Jara and Bernal-Reino 2020: 11-13). This limits the protection of historic vernacular buildings, having even become a focus of negativity and appearing as an impediment to promoting local development. Quingeo, a unique parish in rural Ecuador, is an exemplary case; to this and its territory, the vernacular buildings contributed to its declaration as a Cultural Heritage of the Nation in 2009; nevertheless, it shows neglect, little citizen empowerment, deterioration, and vulnerability to various risks.

Both nationally and locally, studies involving the risk and vulnerability factors faced by vernacular buildings in Ecuador have been developed. Thus, researchers such as Godoy Carrera (2014), Aguirre Ullauri *et al.* (2017), Carvajal and Heras (2020), and Herrera Mera (2021), adapt and define methodologies focused on external and internal vulnerabilities and risks, to enhance their management and preservation conditions. Other researchers have proposed similar cases. Angeleri (2011) establishes a study of the external and internal physical risks affecting vernacular buildings in Mendoza (Argentina) to assess them and define a technical management tool to design preservation plans, strategies, and measures.

Similarly, Santander Cjuno (2018) establishes the methodological scopes of risk management essential for protecting Peru's immovable historical heritage. To this end, a methodological basis for minimizing risks seeking to correctly orient resources, prioritize actions, and consider public and private financial investment in decision-making to protect and manage cultural heritage is developed. Antúnez Perez *et al.* (2012) apply the vulnerability and risk matrix to assess the state of preservation of heritage buildings in Seville (Spain) to determine restoration and preventive preservation measures.

In this context, the application of methodologies and principles associated with risk analysis and preventive preservation is established as an integrating source of in-

formation and specialized solutions in favor of heritage constructions, particularly vernacular ones, since they allow defining tools that establish their reality, and thus determine technical actions that; 1) respond to the dimensions of vulnerability and risks; and, 2) guarantee their operation and maintenance. Thus, this research addresses such needs under the case study method (downtown Quingeo) to analyze the damages, and risks and, in turn, establish protocols, measures, or technical conservation actions while strengthening the collective memory and cultural identity that represent Quingeo in the Ecuadorian

territory. The methodology proposed by the Cultural Heritage Institute of Spain (IPCE, in Spanish) is considered a base instrument adapted and complemented.

2. METHODOLOGY

The methodology proposed is defined in two phases: the first or preliminary phase includes two stages. Stage 1, i.e., the collection of preliminary information consisting of 4 sub-stages, and Stage 2, which corresponds to the wall stratigraphic analysis, applied to three representa-

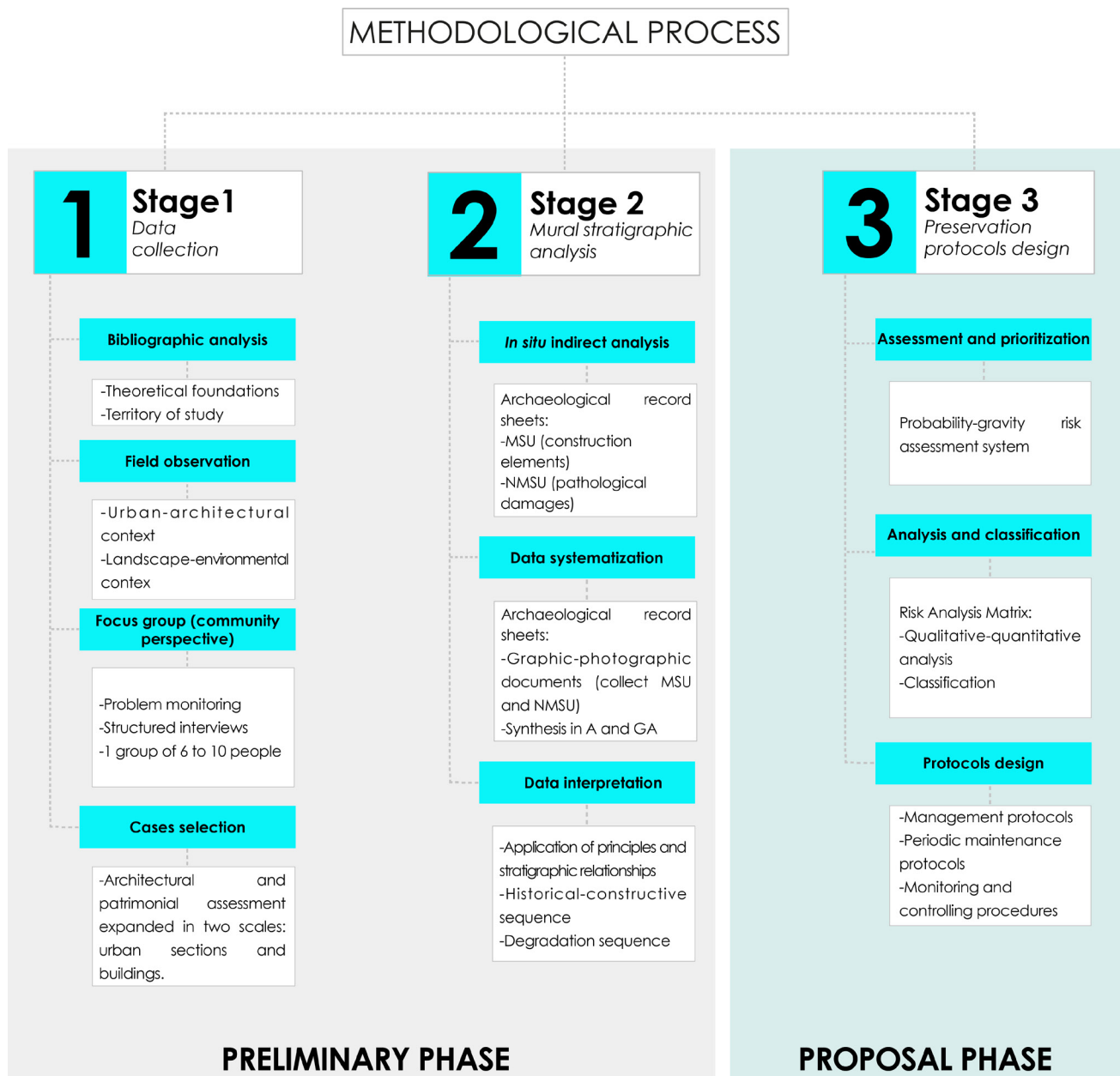


Chart 1. Distribution of the methodological process applied (phases, stages, and sub-stages).

tive case studies to define their historical-constructive context. This stage consists of 3 sub-stages.

The second phase or proposal phase is Stage 3; therefore, it establishes the design of heritage preservation programs based on three sub-stages. It aims to determine the technical actions necessary for conserving the vernacular architectural heritage in downtown Quingeo. The phases, stages, and sub-stages are in detail in Chart 1.

Likewise, it should be emphasized that the proposed methodology is specifically oriented to the study of vernacular architecture of historic settlements, that is, isolated or grouped constructions, whose architecture, unity, and integration in the landscape give them significant values for society, history, science or art (UNESCO 1972: 2). In this research this statement applies to architecture that has undergone a process of heritage preservation.

2.1. Preliminary Phase

Stage 1: Data collection

It begins with the method of bibliographic analysis of both theoretical foundations and the study territory to provide an expanded overview. Subsequently, field observation is applied to understand the territory from its material, immaterial, and landscape pre-existences. Two record forms are applied to focus on: 1) urban-architectural context, and 2) landscape-environmental context. These include the following factors of analysis: historical-cultural, urban-architectural, constructive-technological, and landscape-environmental.

The qualitative *focus group* technique is also used, addressed to a group of 6 to 10 people from the community above (downtown Quingeo). According to the methodology proposed by Krueger (1997), the recommended number of participants should not exceed 10, nor be less than 6, so that the opinions of the focus group, can be obtained and systematized effectively and objectively to define, monitor, and expand the problem from this perspective. Likewise, it seeks to establish social relevance in developing and conserving heritage assets. A three-level structured interview was applied; 1) urban-architectural and landscape-level; 2) socioeconomic and cultural level; and 3) heritage management and conservation level, the results of which are shown in detail in Chart 2.

Lastly, the specific selection of buildings is made through an extended architectural and heritage valuation. The Instructions for registration and inventory of real estate are utilized, as well as the Technical Regulations for

Application of focus group in the downtown Quingeo community

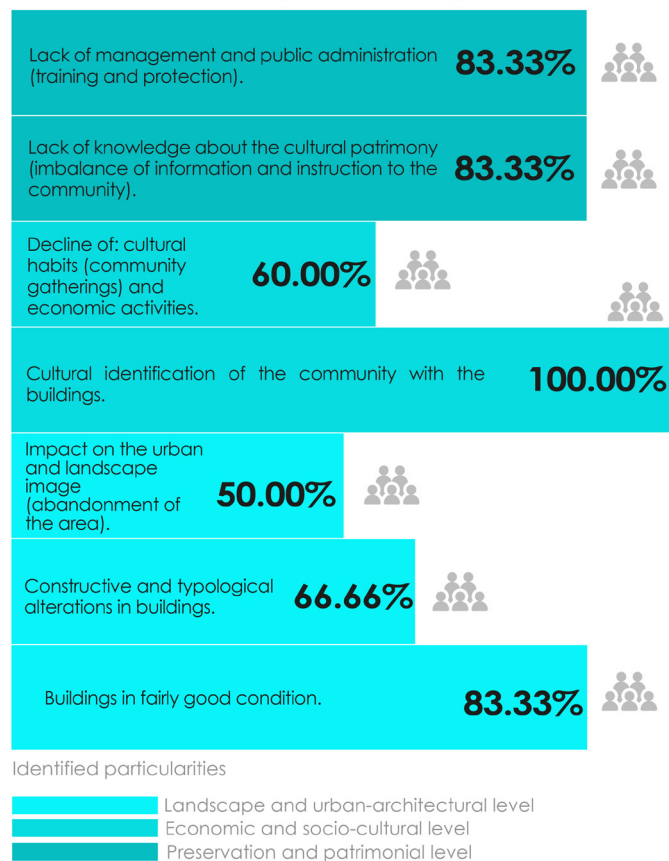


Chart 2. Application of focus group in the downtown Quingeo community.

the Inventory, Declaration, Delimitation, De-linking (INPC 2019), and Loss of quality of heritage real estate of the National Institute of Cultural Heritage (INPC, in Spanish) (INPC 2011: 62-71). However, technical, historical, urban-architectural, aesthetic-formal, functional, technological, social, and landscape parameters are included.

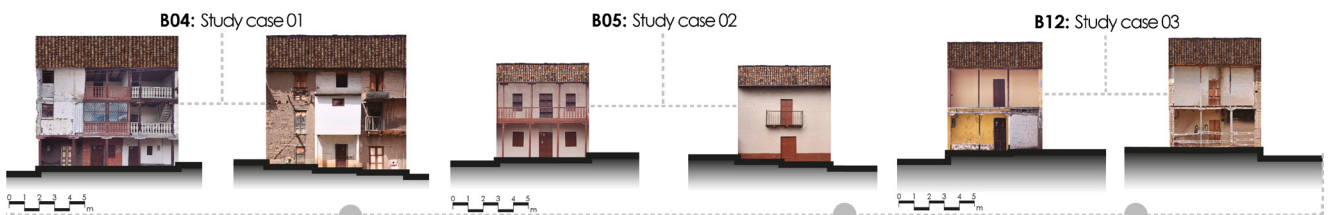
The set of resources focuses on two levels: 1) urban-architectural sections and 2) buildings. In the first case, the eight urban-architectural sections that constitute the head Parish of Quingeo are included, allowing us to determine the one with the greatest potential according to the research objectives. Subsequently, in this urban-architectural section, the buildings that comprise it are analyzed, and three priority case studies are selected for analysis. On the other hand, the highest score is established for selecting the urban-architectural section and the buildings through a high, medium, and low score. In both cases, the highest valuation range/grade of protection (high heritage value with absolute protection) is considered (Chart 3).

Resulting architectural-urban section for definition of study cases



Technical parameters/valuation characteristic	Total Score	Value / Grade of protection
<ul style="list-style-type: none"> Antiquity/Most antiquity, XIX Century. Aesthetic-formal/ Vernacular and traditional influence. Typological-functional/Original use (housing). Technological-constructive/ traditional and autonomous construction systems and techniques, and local materials. Historical-symbolic-testimonial/ Technological product not very common in rural areas. Urban-architectural environment/ Valuable urban section. Landscape environment / Adaptation to the natural context. 	<p>78 pts</p>	<p>High patrimonial value/Absolute protection</p>

Resulting study cases



Technical parameters/valuation characteristic	Total Score	Value / Grade of protection
<ul style="list-style-type: none"> Antiquity/ Two periods: republic, 19th century and modern, 20th century. Aesthetic-formal/Vernacular style and homogeneous architectural language. Typological-functional/Constant in its morphology - original function. Technological-constructive/ Preserve the technology and materials traditional and autochthonous. Historical-symbolic-testimonial/ They refer to the conformation of the territory and provide evidence of local wisdom. Urban-architectural environment/Architectural homogeneity of the urban section. Landscape environment/Social Attitude and materialization of the place and visual impact. 	<p>B04 84 pts</p> <p>B05 96 pts</p> <p>B12 87 pts</p>	<p>High patrimonial value/Absolute protection</p>

Chart 3. Definition of the study cases (amplified valuation).

Stage 2: Application of mural stratigraphy

From the three case studies, the Wall Stratigraphy method established by Parenti (1997) and Doglioni (1997, 2002) is used to establish correlations between the different construction elements, the inclusions and interventions that constitute and are present in the buildings, and the pathological lesions that affect them (Brogiolo and Cagnana 2012). Three processes are applied:

1. *In situ stratigraphic reading to record*: a) the construction elements and processes, which are typified by means of mural stratigraphic units (MSU), and b) the constructive pathologies, characterized using negative mural stratigraphic units or interfacial stratigraphic units (NMSU) (Brogiolo 2010). They collect those functional and geometric deformations caused by fissures, cracks, ruins, or demolitions, plus all the lesions originated by the action of physical, chemical/biological, and anthropic agents (Brogiolo and Cagnana 2012; cited in Martín Talaverano *et al.* 2018) in the materials that constitute each constructive element. It is worth mentioning that they act as essential elements to describe the processes of equilibrium, instability, and degradation in the evolutionary sequence of the building (Brogiolo 2010).
2. *Information systematization through graphic* (plans and elevations) and photographic (orthophotos) documentation of the elevations of the case studies. This is because the research focuses only on readings at the transversal-exterior or façade level since it was impossible to access the buildings and complete the survey. This documentation also allows confronting, purifying, and collecting the MSUs and NMSUs, which, due to their numerous identification in the *in situ* reading, are synthesized through activities (A), and these in groups of activities (GA) (Caballero Zoreda 1996; cited in Blanco-Rotea 1999: 35-39).
The previous processes are collected in archaeological files with the technical-constructive descriptions of each MSU that conforms to the building. The NMSU and their relation of origin and incidence with the MSU.
3. *Data interpretation* from the MSU, NMSU, A, and GA, which are subjected to the application of the anteroposterior relationships and stratigraphic principles (Harris 1991; Caballero Zoreda 1995) to construct the stratigraphic diagram under the Har-

ris Matrix method (Harris 1991) and thus define the relative type historical-constructive sequence and the degradation sequence (Brogiolo and Cagnana 2012).

In the first case, the architectural elements that conform to the buildings are ascribed to specific historical phases in a diachronic or synchronic manner as appropriate. This is possible thanks to the historical and photo-historical documentation from the National Institute of Cultural Heritage of Ecuador (INPC, in Spanish) (INPC 1988, 2009, 2014). For its part, the second considers the practices and experimentations of pathological analysis according to the experiences of various authors (Brogiolo and Cagnana 2012; Brogiolo and Faccio 2010; Brogiolo 2014; Causarano 2017; Martín Talaverano *et al.* 2018; Aguirre Ullauri *et al.* 2020). In this way, pathological lesions such as NMSU are related in the stratigraphic diagram in terms of representing MSU or temporal phases (Martín Talaverano *et al.* 2018). The following considerations apply to interpret them rigorously and relate them to the historical-constructive sequence.

Pathological lesions are integrated as stratigraphic elements diachronically in the historical-constructive sequence, under the logic that these can be caused at a specific time and remain active throughout the historical-evolutionary process of the buildings (Martín Talaverano *et al.* 2018). To establish such connotation in the stratigraphic matrix of the cases, the concepts of; 1) *active movement* or pathological processes that have been active in the first temporary phases or post-remaining phases and have not been stabilized by any subsequent constructive activity; and 2) *arrested movement* or those pathological processes active since the first temporary phases or post-remaining phases, temporarily canceled or stabilized by a subsequent constructive activity are considered. Those allow recognition of which parts of the architectural structures have been stabilized and which have not, and in which phase or temporal moment (Martín Talaverano *et al.* 2018) it has occurred.

Similarly, the correlation of pathological lesions in the stratigraphic diagram is supported by the mentioned lesions are movements or pathological processes that occur relatively in the architectural structures, which define the possibility of relating some parts of the buildings with others (Martín Talaverano *et al.* 2018). From the stratigraphic view, it is possible to understand the physical-destructive coexistence as evidence of the existing or potential deterioration of the materials (Aguirre Ullauri

Application of mural stratigraphic analysis

Study case 02 (B05)

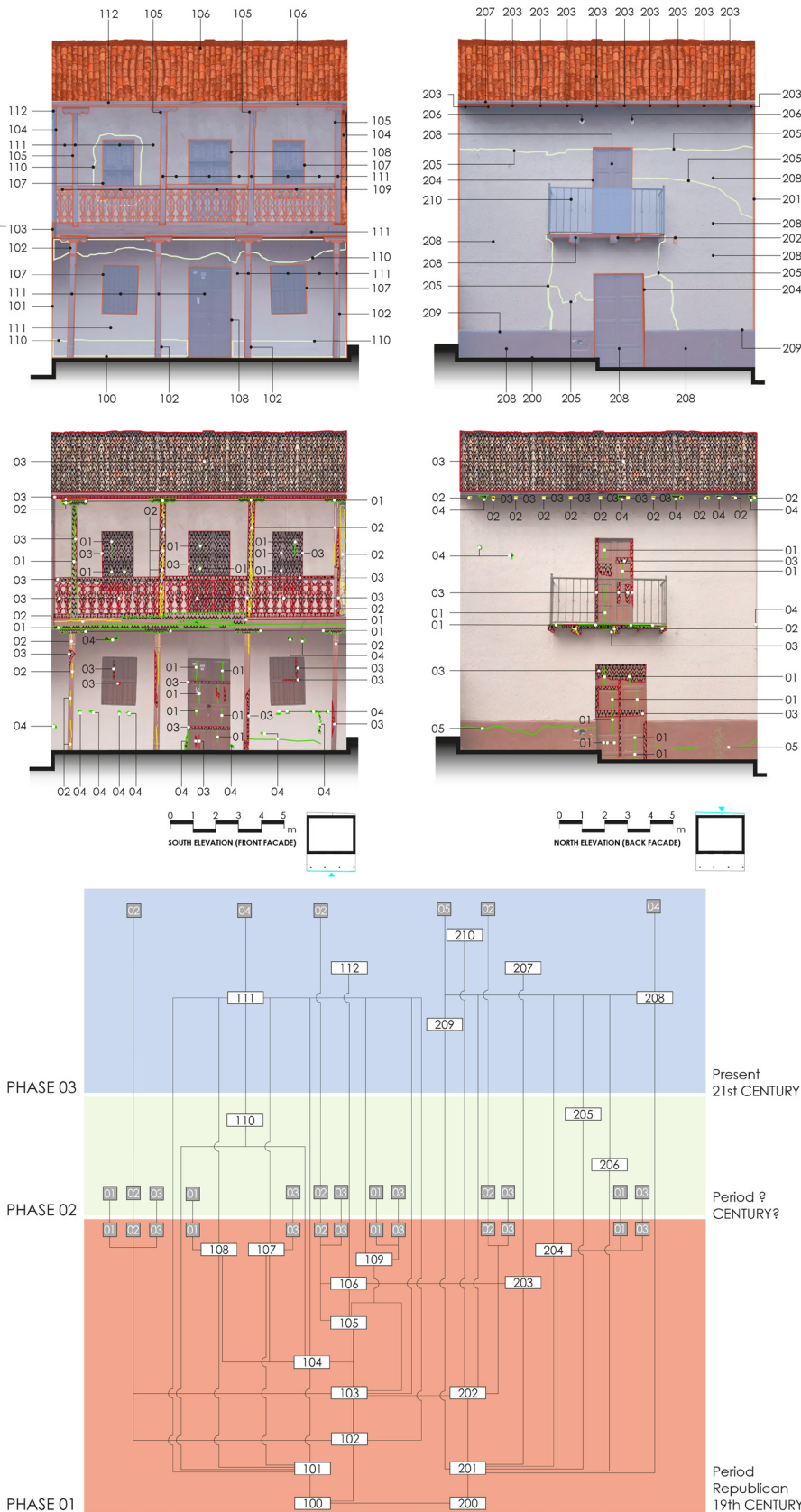


Figure 1. Application of mural stratigraphic analysis in the study cases: Case study 02

et al. 2020) that make up the MSU. This applies due to the existing incomplete documentation on the pathology of the buildings.

Although it has been possible to identify, observe and compare certain pathological processes through photo-historical evidence (INPC 1988, 2009, 2014), it has not been possible to establish their origin precisely. Thus, some elements are contrasted with others to determine objective hypotheses of their temporal origin. Consequently, the historical-constructive and degradation sequence of the case studies is obtained comprehensively. Figure 1 explains technically and graphically how the methodological process mentioned above was applied; the example of case study 2 has been replicated in the others.

Finally, the results of the application of wall stratigraphy in the case studies have made it possible to describe the constructive and destructive singularities that require greater attention for the intervention and conservation of the historic vernacular architecture that comprises downtown Quingeo.

2.2. Proposal Phase

Stage 3: Heritage preservation protocols design

From Stage 2 onwards, three key processes are conducted: 1) assessment and prioritization of the damages and alterations, 2) analysis and cataloging of the damages and alterations, and 3) design of heritage conservation protocols. The latter are designed according to the structure specified in the *Guía para la Elaboración e Implantación de Planes de Conservación Preventiva* (IPCE 2019), and in line with the results obtained from the Risk Analysis Matrix (Mora Horta 2016).

1. *Assessment and prioritization of alterations and damages:* the assessment system is applied based on the basic parameters of the probability of occurrence and severity of deterioration (Tab. 1). This involves: 1) the assessment of the damages considering the severity-probability of the deterioration; and 2) prioritization through the magnitude of prioritization of the alterations and damages. The severity-probability score and level obtained are considered. Two considerations are applied: 1) assessment scores greater than or equal to 3 points and 2) the severity-probability / prioritization magnitude ratios: severe-medium / medium or medium priority;

Risk assessment and prioritization system based on the basic parameters of probability of occurrence and severity of deterioration

PROBABILITY OF DETERIORATION	SEVERITY OF DETERIORATION			
		Slight	Severe	Very serious
	Low	1	2	3
	Medium	2	3	4
High	3	4	5	

PRIORITIZATION MAGNITUDE (defined by the probability-severity score)				
Low or minimal likelihood	Moderate or low priority	Medium or medium priority	High or high priority	Very important or top priority
1	2	3	4	5

Estimated considerations for the definition of scores

SEVERITY OF DETERIORATION SCALES

Slight: the alteration/damage or identified risk in the property can be established with preventive preservation measures. It does not require immediate direct intervention, nor does it hinder its cultural use.

Severe: the alteration/damage or identified risk requires preventive and corrective preservation measures. At the same time, it requires limited direct treatments and interventions. It does not hinder cultural use, but special conditions must be met.

Very serious: the alteration/damage or identified risk in the property requires preventive preservation, corrective, and restoration measures. It also requires immediate direct treatment and intervention. In turn, cultural use is compromised and/or made impossible.

PROBABILITY OF DETERIORATION SCALES

Low: the occurrence of the alteration/damage or risk has a sporadic, non-repetitive, or cyclical probability, and in turn, it has adequate processes and means of preservation and patrimonial management.

Medium: the occurrence of the alteration/damage or risk has a low probability of frequency, although it may be progressive over time. At the same time, the processes and adequate means for preservation and patrimonial management are limited.

High: the occurrence of the alteration/damage or risk is repetitive, progressive, or cyclical with constant frequencies. Adequate conservation and patrimonial management processes as well as means of preservation and management are non-existent.

Table 1. Risk assessment system based on the basic parameters of the probability of frequency of occurrence and severity of impact. Data adapted from “*Guía para la Elaboración e Implantación de Planes de Conservación Preventiva*” (IPCE 2019).

2. *Analysis and classification of the prioritized alterations and damages:* the Risk Analysis Matrix (Tab. 2) is applied to reach an objective and reasonable consensus to develop indicators to treat, evaluate, and identify the alterations and damages objectively (Mora Horta 2016: 3-38). This allows the damages to be classified into three types of procedures and action protocols, i.e.: 1) management, 2) periodic maintenance, and 3) monitoring and control procedures. To achieve this, two sub-processes are established:

Risk Analysis Matrix

PROBABILITY (P)	3	High	P high (3) * I low (5) 5 points Moderate risk level Monitoring and control procedures	P high (3) * I medium (10) 30 points High risk level Periodic maintenance protocols	P high (3) * I high (20) 60 points High risk level Periodic maintenance protocols
	2	Medium	P high (3) * I medium (10) 10 points Acceptable risk level Management protocols	Medium P (2) * Medium I (10) 20 points Moderate risk level Monitoring and controlling	P high (3) * I medium (10) 40 points High risk level Periodic maintenance protocols
	1	Low	Low P (1) * Low I (5) 5 points Acceptable risk level Management protocols	Low P (1) * Medium I (10) 10 points Moderate risk level Monitoring and control procedures	Medium P (1) * High I (20) 20 points Moderate risk level Monitoring and control procedures
			Low	Medium	High
			5	10	20
			IMPACT (I)		

Estimated considerations for the definition of scores

PROBABILITY SCALES (P)
Low probability: the frequency or progression of the alteration/damage is improbable.
Medium probability: the frequency or progression of the alteration/damage is occasional.
High probability: the occurrence or progression of the alteration/damage is frequent.

IMPACT SCALES (I)
Low impact: the alteration/damage would not cause the collapse of the building, but it would have a slight and superficial impact on its physical, constructive, architectural, and cultural damage.
Medium impact: the alteration/damage would cause significant problems or losses in the building and would have a moderate impact on its physical, constructive, architectural, and cultural damage.
High impact: the alteration/damage would cause the collapse of the building, and would have a critical impact with losses in its physical, constructive, architectural, and cultural damage.

Table 2. Risk Analysis Matrix. Data adapted from “Guía práctica - Armado una precisa matriz de riesgos” (Mora Horta 2016).

- Qualitative and quantitative analysis of the prioritized alterations and damages through the product of probability (P) and impact (I) (P*I). The result determines a specific score for each damage.
 - Classification of the prioritized alterations and damages, where the scores obtained in the specific analysis are considered, resulting from probability (P) and impact (I), i.e., the risk level-protocol type relationship is defined.
3. *Protocols designed for heritage preservation:* actions, measures, and/or processes are structured to allow efficient management and preservation of the architectural heritage of downtown Quingeo. To

develop them, the *Guía para la Elaboración e Implantación de Planes de Conservación Preventiva* is applied, considering three typologies (IPCE 2019: 71-94):

- Monitoring and controlling procedures to determine systematic and technical actions for detecting situations that may cause or aggravate deterioration, and the elimination or minimization caused by existing alterations and damages.
- Periodical maintenance protocols that establish monitoring and physical intervention actions, according to deterioration risks based on: 1) periodical inspections based on observed damages, vulnerability areas, 2) state of conservation, and constructive pathological damages; and, interventions focused on technical solutions for repair, replacement, and cleaning.
- Management protocols for: 1) the creation of standards for heritage preservation, and 2) the process optimization.

3. RESULTS AND DISCUSSION

Understanding the historical-constructive context and the pathological process of the case studies is vital in understanding the architectural reality, the current State, and possible future events in the buildings of downtown Quingeo. Those specific features operate as a viable basis for preserving and managing the heritage architectural conditions. At the same time, they favor the planning and efficient measures to be taken.

3.1. Identification and prioritization of alterations and damages

The vernacular patrimonial architecture makes it possible to define a vision of the events in conserving the downtown Quingeo complex. It allows for establishing risk indicators and identifying and prioritizing inadequate management, pathological lesions / destructive actions, and constructive alterations. From the latter, negative actions are identified and valued since they come from foreign contributions that cause the dissolution of the expressions of the historical, anthropological culture of the settlement, nor do they express the adaptation or continuity of the native anthropological culture of the settlement. As a result, the following situations predominate:

1. *Inadequate or non-existent records*: the analyzed buildings presented heritage documentation through inventory sheets prepared by the INPC in 1988, 2009, and 2014, with limited and incomplete information, i.e., deficiencies. On the architectural documentation side, a schematic level of planimetry was evidenced, with no update since 1988. Furthermore, no information is recorded on the constructive-destructive processes and transformations.
2. *Physical alterations caused by handling and use of the cultural property*, as well as alterations or losses resulting from poor monitoring and control procedures: are associated with two categories: a) typological-morphological-functional alterations and b) technological-constructive alterations (Fig. 2). These are social actions and manipulations without technical planning due to the use of the properties, or the lack of monitoring and management of the parties in charge of the real estate heritage in the territory. A detailed description is given below:

The typological-morphological-functional alterations include the demolition of constructive elements representative of the architectural identity of the downtown Quingeo settlement, the language of the local rural buildings, and even of the region. This situation is particularly evident in walls, balconies, balusters, and exterior steps, which leads to significant variations in the typology of the buildings. At the same time, spatial alterations are evident in accesses and/or vertical circulations, galleries, and exterior walls. Such elements have been affected by implementing constructive solutions without planning, although they imply new activities and conditions of habitability and, therefore, actual needs of the users at the cost of changes in the original conformation. Aggregates (spaces) are also recognized by closing galleries or portals and adding rooms.

The technological-constructive alterations (Fig. 2) are emphasized because of the use of incompatible materials (cement, brick, iron, among others) with their techniques, finishing, structures, and original construction systems, which are associated with repairs and/or aggregates. In addition, the alteration of the original construction techniques was identified, as well as their replacement by contemporary ones (concrete construction system). These actions lead to the deterioration of the original materials despite their articulation with solutions and/or constructive artisanal interventions. It has

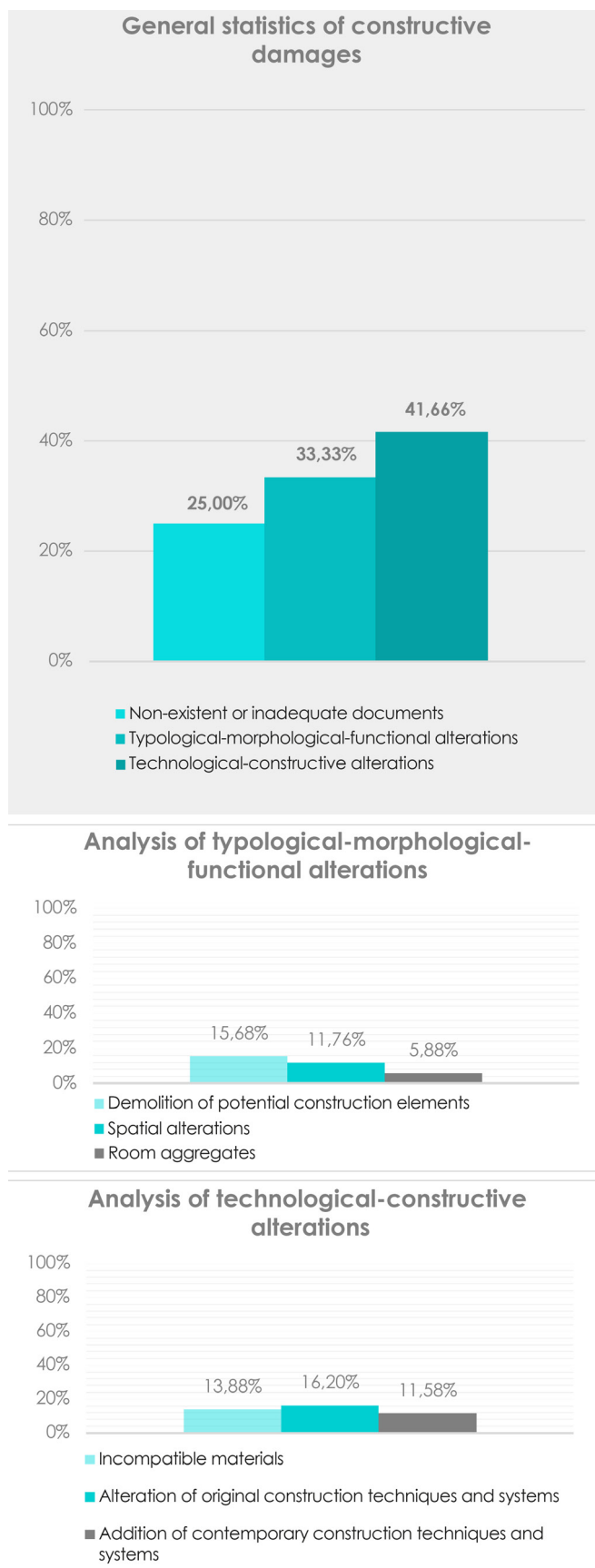


Figure 2. Statistical mosaic of identified construction alterations.

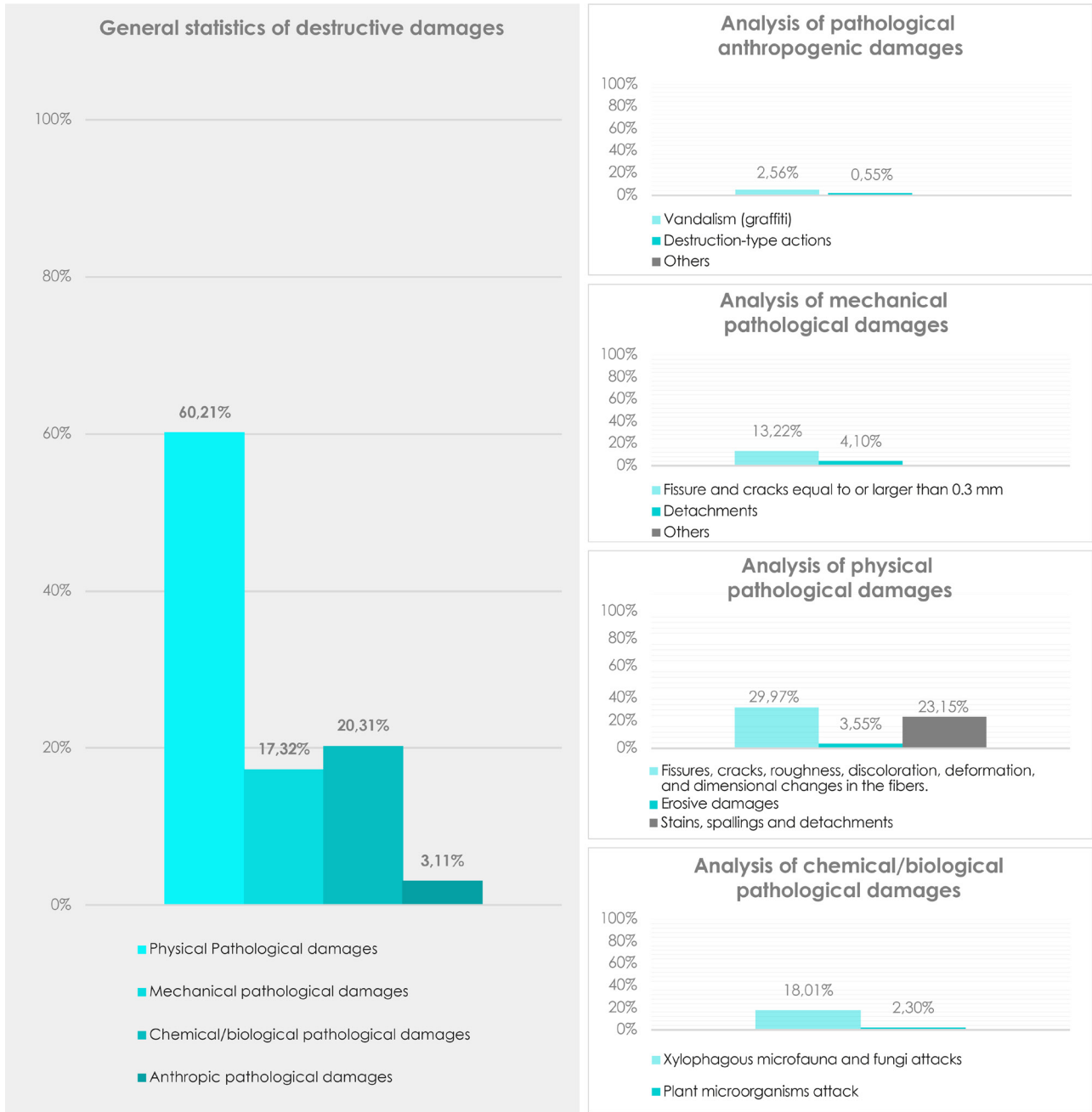


Figure 3. Statistical mosaic of the pathological damages identified.

also caused a devaluation of its heritage condition and the loss of its constructive

3. *Damages or losses caused by malicious acts, negligence in monitoring and control procedures, and non-existent or inadequate maintenance of property buildings and facilities* are related to anthropogenic pathological lesions in general (Fig. 3). Consequently, the study shows that graffiti and graffiti-like acts of vandalism affect the wall surfaces and the water and lime paint coatings. This situation is aggravated

by the lack of maintenance and a lack of administrative management.

4. *Physical damages caused by structural instability, poor monitoring and control procedures, and inadequate or non-existent maintenance of buildings and facilities* were recognized from the mechanical pathological damages (Fig. 3). Furthermore, the study determined that fissures, cracks (≥ 0.3 mm), and detachments in the crown and foundation of the walls mainly affect the earthen faces. These damages were

caused by the integrated destructive action (chemical, biological, and physical factors), derived from other elements or construction systems that depend on wood structural elements in the long term (Monj3 Carri3 and Maldonado Ramos 2001: 163-164). That is to say, the roof or mezzanine trusses, as they progressively lose their capacity, gradually transfer the loads to the walls inadequately, thus causing structural failures.

5. *Damages resulting from environmental conditions, biodeterioration, and inadequate or non-existent maintenance of buildings and facilities* physical and chemical/biological pathological damages (Fig. 3) are recognized in materials and construction elements.

In the case of physical damages, the following were identified: 1) degradation caused by sunlight and hygroscopy of the materials, like fissures, cracks, discoloration, deformation, and dimensional changes. They all affect structural elements (mezzanine, columns, and roof framing) and carpentry (windows, doors, and balconies); 2) erosive damages caused by wind and differential washing on the surface of the earthen masonry; and 3) yellow stains, peeling and spalling resulting from moisture seepage, loss of cohesion due to humidity, and poor quality of the material used in the coatings (water-based paint, latex, and lime).

Meanwhile, in the chemical/biological damages, there was a predominance of microfauna (xylophagous and fungi) attack on structural elements (mezzanine, columns, and roof framing) and wood carpentry (windows, doors, and balconies). This is due to the constant pathological symbiotic, that is, the simultaneous action of pathogenic agents (Lasheras Merino 2009: 833); by causing physical changes (fissures, cracks, roughness of the surface layer, and deformation of its fibers) in the wood, vulnerability is produced in the surface, which is favorable for an infectious process of xylophagous agents.

Assessment of identified alterations and damages

Out of the 7 constructive alterations and 8 destructive damages assessed (Fig. 4), five assessment ratios were predominant, which are detailed below:

1. *Severity-probability rate of severe-medium type and prioritization magnitude of medium or medium priority* refers to the fact that the damages and alterations require preventive and corrective preservation measures since it is possible that management may be limited or non-existent and may result in more sig-

nificant degradation. It is, therefore, necessary to test and/or implement processes and actions in the short term to reduce the risk. The following, in particular, represent such scenarios:

- *Alteration 01.* Inadequate or non-existent documentation.
 - *Alteration 03.* Typological-morphological-functional alterations: spatial alterations.
 - *Alteration 04.* Typological-morphological-functional alterations: additions or room additions.
 - *Alteration 05.* Technological-constructive alterations: use of non-compatible materials.
 - *Damage 06.* Physical pathological damages include yellowish stains, paint peeling and spalling, and lime coatings.
2. *Severity-probability ratio severe-high and magnitude of prioritization, very important or highest priority*, the damages and alterations require preventive, corrective, and restoration preservation measures, with immediate action on the original architectural language. It is necessary to apply and generate control, follow-up, and/or emergent maintenance procedures to reduce the damages, as this could compromise or prevent the use of the building. The following are included on this list:
 - *Alteration 02.* Typological-morphological-functional alterations: demolition of potential construction elements.
 - *Damage 04.* Physical pathological damages: fissures, cracks, roughness, discoloration, deformation, and dimensional changes in the fibers of structural elements and wooden carpentry.
 - *Damage 07.* Chemical/biological pathological damages: attack of xylophagous microfauna and fungi on structural elements and wood carpentry.
 3. *Severity-probability ratio of severe-high type and magnitude of high prioritization or high priority*, these problems require corrective conservation measures. Preventive processes also need to be implemented, planned, and improved to minimize risks, although the means to treat, maintain, and control issues such as the ones listed below are not available:
 - *Alteration 06.* Technological-constructive alterations: alteration of the original construction techniques.

- *Damage 01.* Mechanical pathological damages: fissures and cracks equal to or greater than 0.3 mm in earthen walls.
 - *Damage 03.* Mechanical pathological damages: cracking at the base and crown of the earthen walls.
 - *Damage 05.* Physical pathological damages: erosive damages in the earthen walls.
4. *Severity-probability ratio of severe-low type and moderate prioritization magnitude or low priority* can stabilize the problems damages and alterations with heritage management and preservation measures. Nonetheless, the means of monitoring and controlling are restricted and need to be verified as
5. *Severity-probability ratio of moderate-high type and medium prioritization magnitude or medium priority* can stop the damages and alterations with precautionary preservation measures. Nevertheless, verifying,
- *Alteration 07.* Technological-constructive alterations added to contemporary construction techniques and systems.
 - *Damage 02.* Anthropical pathological damages: Vandalic actions such as graffiti and excoriation.

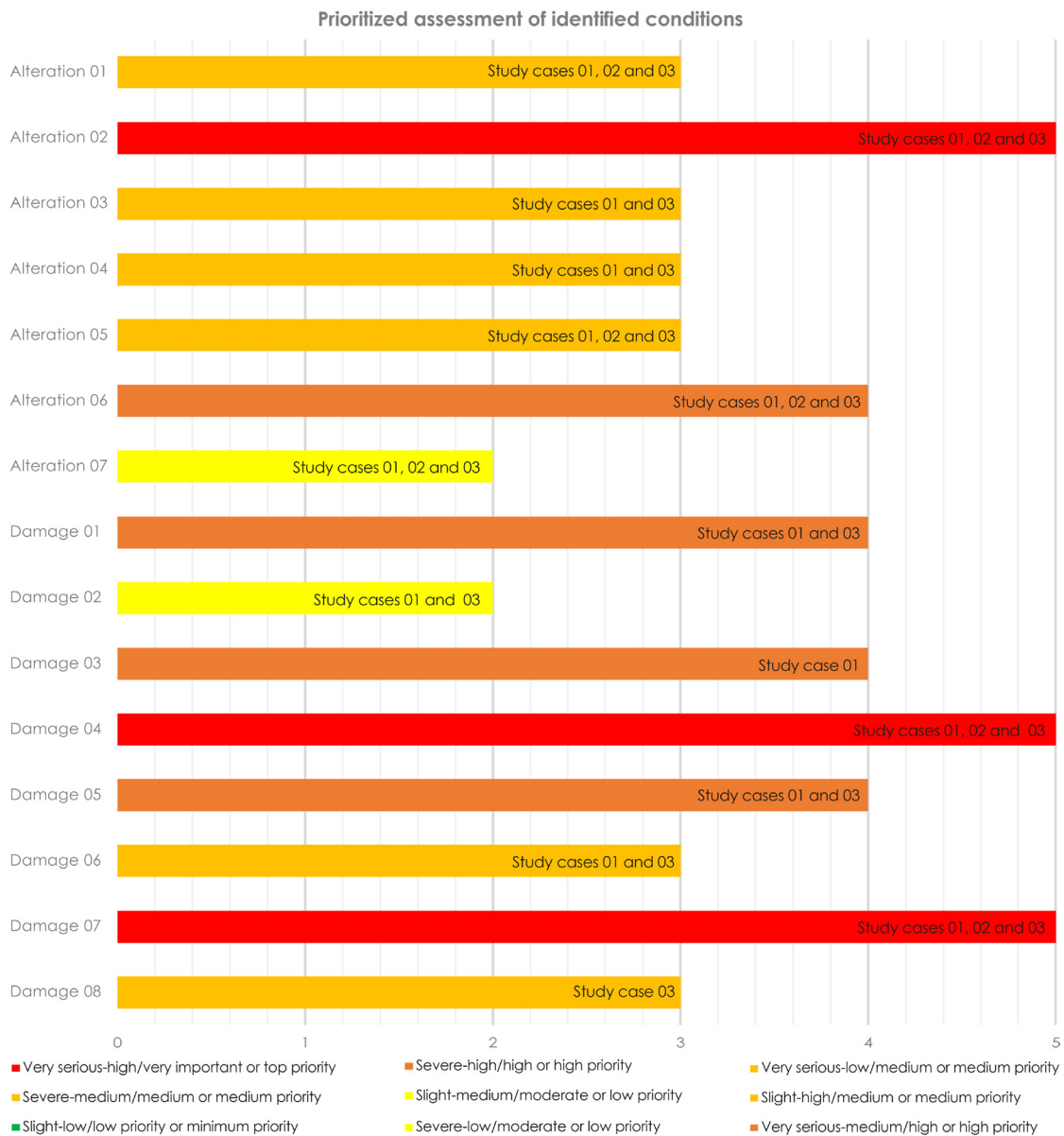


Figure 4. Severity probability and the magnitude of prioritization resulting from the prioritized assessment of the identified alterations and damages.

improving, or conducting processes and improvements in the short term is necessary to maintain, control, and reduce the risk. The following damage is identified in this situation:

- *Damage 08.* Chemical/biological pathological damages: vegetable microorganisms attack on concrete masonry.

Prioritization of identified alterations and damages

Once the assessment of the alterations and damages is completed, they are prioritized (Chart 4). This led to the definition of the levels of urgency, which refer to the determination of specific actions, measures, and/or technical protocols.

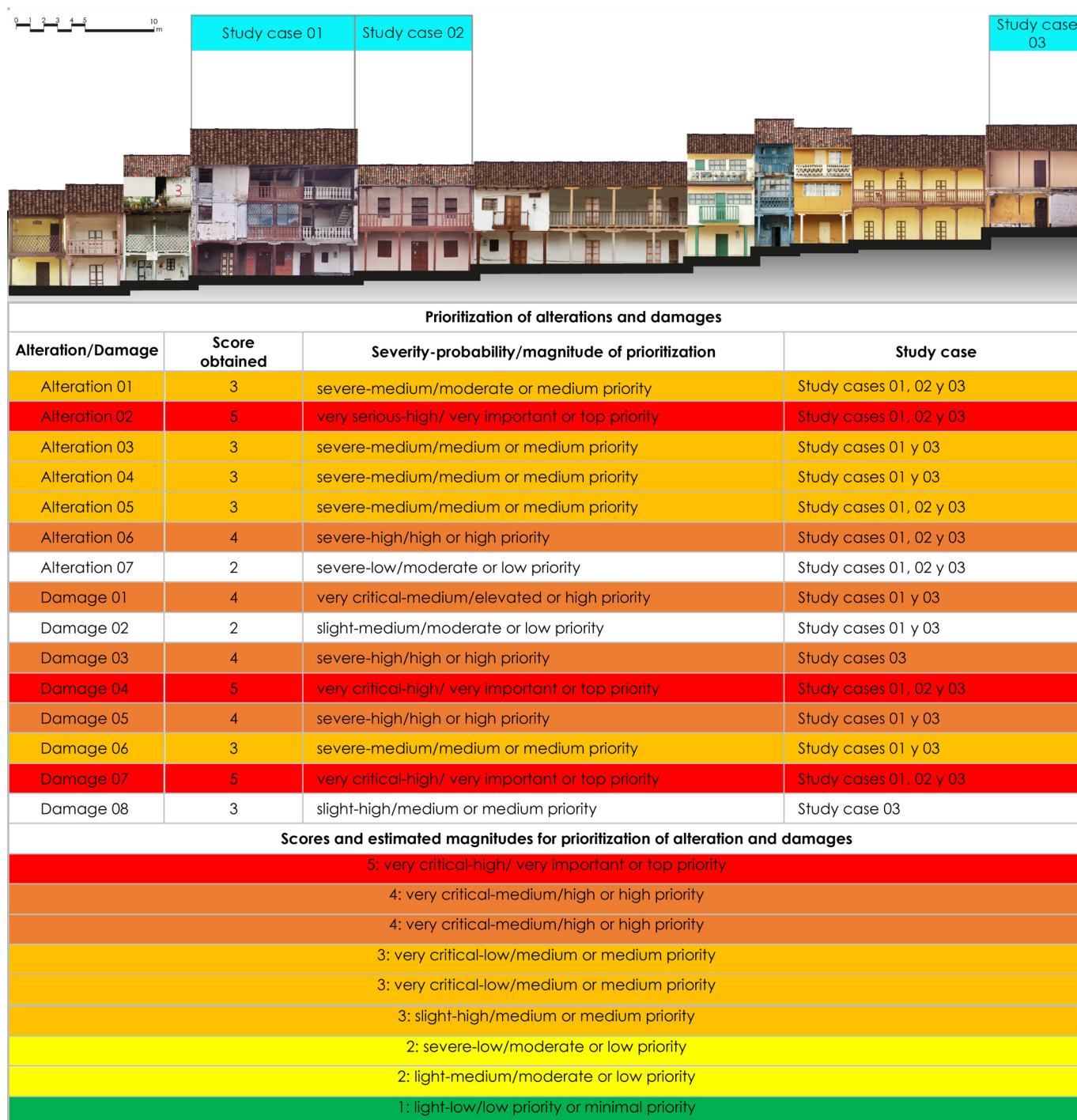


Chart 4. Prioritization of identified alterations and damages.

Chart 4 shows: 1) the alterations (01 to 06) and damages (08, 10 to 14) resulting from immediate action, and with predominance in the constructive-destructive process of the case studies, from typological, morphological, functional, and constructive transformation activities; and deterioration from pathological damages that have affected the significant constructive elements of the buildings. This is the deterioration that needs to be addressed immediately since there is a risk of decline and loss of the architectural-heritage conditions of the heritage buildings of Quingeo; and 2) the alteration (07) and damages (09, and 15) that did not qualify as a man-

datory need for action. These do not require immediate attention to the buildings because they do not impede their use, nor do they directly affect their constructive characteristics (structural capacity), or their architectural-heritage conditions.

Analysis and classification of the alterations and damages

According to what was established in the assessment and prioritization of the conditions, they are analyzed and cataloged into different procedures and/or actions

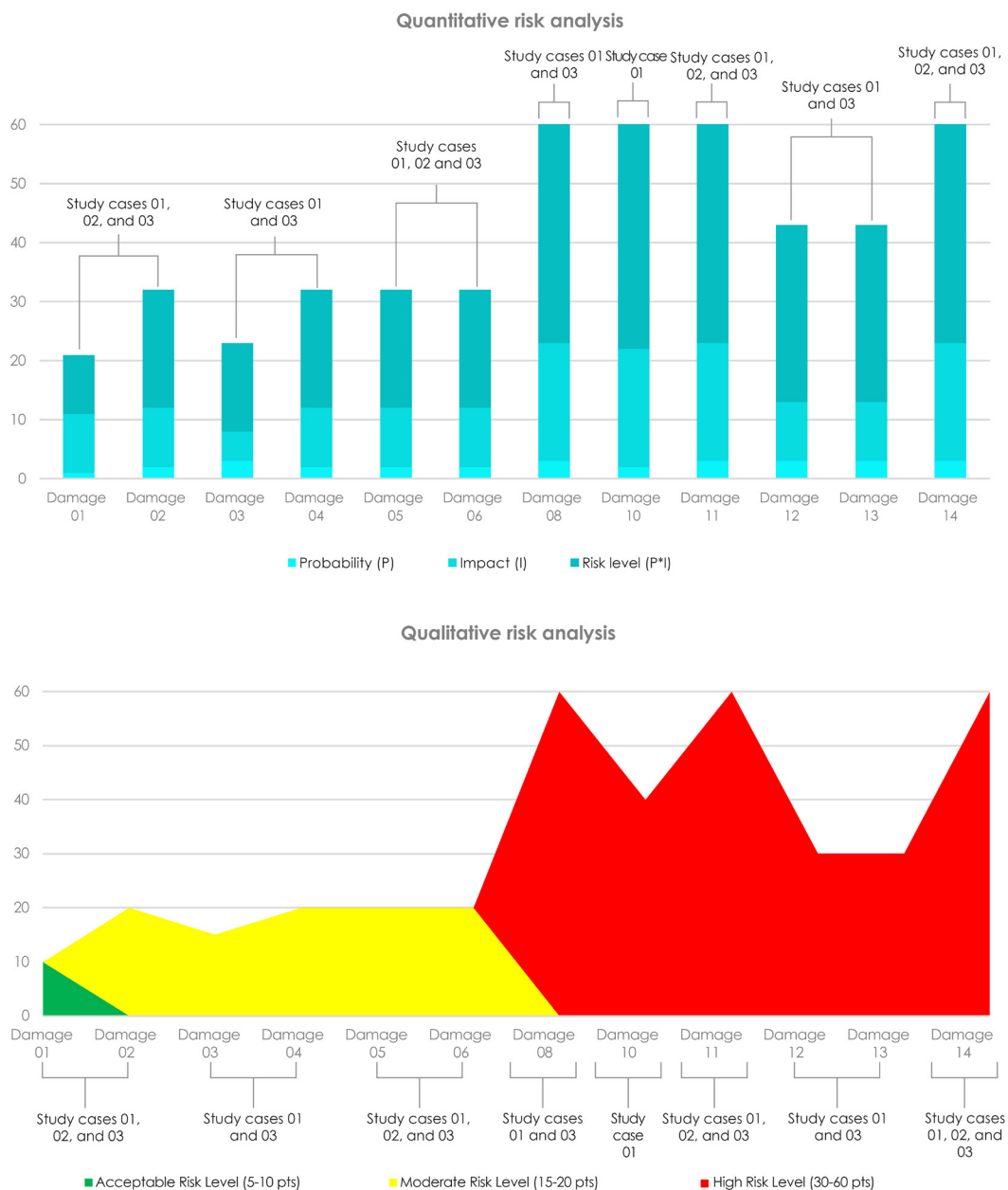


Figure 5. Results of the quantitative and qualitative risk analysis of the prioritized alterations and damages.

PROBABILITY (P)	3	High	15 points Alteration 04 Moderate risk level Monitoring and control procedures Study cases 01 and 03	30 points Damages 05 and 06 High risk level Periodic maintenance protocols Study cases 01 and 03	60 points Damages 01, 04 and 07 High risk level Periodic maintenance protocols Study cases 01, 02 and 03
	2	Medium	10 points Not rated any damage Acceptable risk level Management protocols	20 points Alterations 05 and 06 Moderate risk level Monitoring and control procedures Study cases 01, 02 and 03	40 points Damage 03 High risk level Periodic maintenance protocols Study case 01
	1	Low	5 points Not rated any damage Acceptable risk level Management protocols	10 points Alteration 01 Acceptable risk level Management protocols Study cases 01, 02 and 03	20 points Alterations 02 and 03 Moderate risk level Monitoring and control procedures Study cases 01, 02 and 03
			Low	Medium	High
			5	10	20
			IMPACT (I)		

Table 3. Risk analysis matrix and resulting categorization of the prioritized alterations and damages.

that allow a systematic and effective development for the design of technical protocols. By applying the Risk Analysis Matrix, the results shown in Chart 4 and Figure 5 are obtained, which present the quantitative and qualitative risk level of six alterations (01 to 06) and six prioritized damages (01, 03 to 07), as well as the cataloging of the type of procedure to be designed for each condition. Thus, it is obtained:

- *Alteration 01*, is associated with management protocols related to the acceptable risk level (Fig. 5), which suggests an analysis and improvement of procedures ensuring heritage preservation and protection (Tab. 3).
- *Alterations 02 to 06*, deal with monitoring and controlling procedures pertaining to the moderate risk level (Fig. 5). These define the need for systematic attention and follow-up to stop, eliminate, or minimize situations and/or activities that cause deterioration or losses in the buildings (Tab. 3).
- *Damages 01, 03 to 07*, are classified as periodic maintenance protocols that belong to the high-risk level (Fig. 5). These indicate planned and technical actions to preserve heritage properties' physical stability and functionality (Tab. 3).

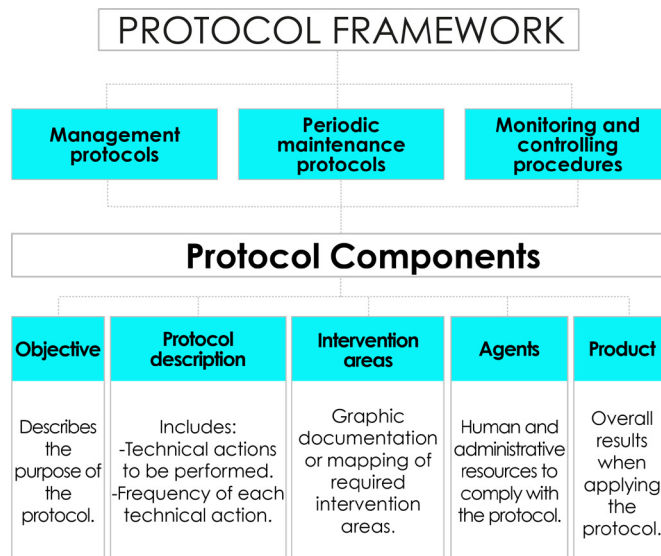


Chart 5. Proposed protocol framework for preserving and managing downtown Quingeo's heritage buildings.

Design of heritage preservation protocols

As a result of Chart 5 categorized alterations and damages, the protocol framework is oriented to provide technical guidelines to direct effective intervention actions following the architectural and heritage reality of downtown Quingeo and, therefore, support its conservation. Table 3 shows the general structure, establishing the three types of protocols and their components. Thus, seven types of protocols are conformed.

Based on the previous context, several measures have been defined. Firstly, management protocol 01 (Tabs. 4-5), aims to improve the technical processes in the documentation of downtown Quingeo's buildings and record the pathological, constructive, and intervention processes. This way, an effective approach and understanding are sought.

Secondly, monitoring and controlling procedures 01 and 02 were defined (Tabs. 4-5). These procedures aim to supervise the alterations of constructive intervention and transformation identified in the buildings through the control and protection of the original architectural, typological, spatial, and technological-constructive language.

Thirdly, periodical maintenance protocols 01 to 03 are determined (Tabs. 6-7). These establish preservation measures focused on preventive and corrective interventions for the physical recovery of the original parts of the building, i.e., wood construction elements (columns, mezzanines, roof trusses, balconies, and carpentry) and

MANAGEMENT PROTOCOLS, AND MONITORING AND CONTROLLING PROCEDURES											[Technical action]								
Type	PROTOCOL							OBJECTIVE	PROTOCOL DESCRIPTION										
	Alteration				Damage				Frequency										
	01	02	03	04	05	06	01		04	05	06	07	6 months to year	1 to 3 years	1 to 4 years	4 to 5 years	If necessary preventive intervention	Corrective intervention	Actions
MANAGEMENT PROTOCOL 01								To obtain technical documentation to improve preservation processes and vernacular buildings.										-Inventory updating -Architectural-graphic documentation. -Photographic and/or orthophotography documentation of constructive elements and existing spaces; remarkable findings (pathological or constructive) and constructive technologies.	
MONITORING AND CONTROLLING PROCEDURE 01								Blocking the demolition of constructive elements, spatial alterations, and addition of rooms, to avoid the loss of the architectural, typological morphological, and functional language that frames the patrimonial heritage condition.										Monitoring -In situ inspections and supervisions of the original architectural language of the buildings. To consider with greater importance: a) steps, b) balconies, c) walls, d) galleries, and c) gates.	
																			Controlling -The creation of an inventory for protecting the patrimony. For this purpose: a) To prepare a technical report containing: registration/verification, description, characterization, and valuation of heritage. b) To generate graphic-photographic documentation. c) To establish the level of importance, and in turn, define whether or not it is possible to intervene or transform the original architectural language.
																			-Inspection and control visits in intervention processes. That is to say, to verify according to the inventory of patrimonial protection that: a) The intervention actions of the constructive elements that can be modified, demolished, or transformed. b) The intervention actions are carried out only in the spaces or rooms allowed to be demolished or modified.
MONITORING AND CONTROLLING PROCEDURE 02								Avoid the use of incompatible materials and the alteration of original construction techniques, to reduce deterioration and maintain historical, technological, constructive, and socio-cultural values.										Monitoring -In situ inspections and supervisions of the original technological-constructive language of the buildings. a) Types of materials used, based on compatibility with existing materials. b) Types of construction techniques compatible or similar to the existing ones.	
																			Controlling -To remove the incompatible material detected in the building. It is taken into account: a) to remove plaster or cement coatings on the walls, and, b) to make new plaster with compatible or similar materials to those existing. -Repair of the affected material, where it should be considered: a) the use of compatible or existing materials in the building and, b) the application of compatible or existing construction techniques.
																			-Inspection and control visits in intervention processes. It is verified that: a) the construction materials to be used are compatible with the original materials and, b) that the intervention actions respect and use compatible or similar construction techniques.

Table 4. Detail of the technical actions of the management protocols, and monitoring and controlling procedures.

MANAGEMENT PROTOCOLS, AND MONITORING AND CONTROLLING PROCEDURES												[Intervention zones]					
PROTOCOL												PROTOCOL DESCRIPTION					
Type	Alteration						Damage						Case (C00)	Monitoring and controlling zones	Intervention mappings		
	O1	O2	O3	O4	O5	O6	D1	D2	D3	D4	D5	D6			D7	C01 (Case 01) 0 1.5 3 6 9 12 15 m	C02 (Case 02) 0 1 2 3 4 5 10 m
PERIODIC MAINTENANCE PROTOCOL 01													Building as a whole Applies to Cases 01 (C01), 02 (C02) and 03 (C03)		Not applicable	Not applicable	Not applicable
MONITORING AND CONTROLLING PROCEDURE 01													C01	Gateways			
													C02				
													C03				
													C01	Galleries			
													C02				
													C03				
													C01	Steps			
													C02				
													C03				
													C01	Balconies			
													C02				
													C03				
												C01	Walls				
												C02					
												C03					
												C01	Room aggregates				
												C02					
												C03					
MONITORING AND CONTROLLING PROCEDURE 02													C01	Construction techniques			
													C02				
													C03				
													C01	Use of incompatible materials			
													C02				
													C03				
													C01	Walls			
													C02				
												C03					
												C01	Plastering				
												C02					
												C03					
												C01	Coatings				
												C02					
												C03					
												C01	Construction systems				
												C02					
												C03					

Table 5. Detail of the areas and intervention mappings of the management protocols, and monitoring and controlling procedures.

PERIODIC MAINTENANCE PROTOCOLS											[Technical action]				
Type	PROTOCOL							OBJECTIVE	PROTOCOL DESCRIPTION						
	Alteration			Damage					Frequency				Actions		
	01	02	03	04	05	06	07		01	03	04	05		06	07
PERIODIC MAINTENANCE PROTOCOL 01								To enhance the constructive capacity of existing earthen walls in buildings by reinforcing and repairing their structural potential.	6 months to 1 year						-Control and monitoring of the structural condition of earthen walls.
									1 to 3 years						-Monitoring and immediate repair action in the event of mechanical damage or identified structural failure.
									1 to 4 years						-Structural strengthening; and repair of: a) cracks and fissures and, b) detachments in the earthen walls.
PERIODIC MAINTENANCE PROTOCOL 02								To reduce deterioration and improve the constructive capacity and physical integrity of the structural elements and wood carpentry of buildings.	4 to 5 years						-Cleanliness of the wooden surface. -Control and monitoring of the state of the treatments. -Visual control of: a) surface degradation by sunlight incidence, b) surface degradation by hygroscopy, and c) degradation by humidity.
									If necessary						-Monitoring and immediate repair of any damage caused by surface degradation resulting from sun-humidity and hygroscopy incidence.
									Preventive intervention						-Coat the surface of the wood with varnish or ecological protective paint (composed of raw material of vegetable-mineral origin) with exterior resistance.
									Corrective intervention						-Repair and filling of cracks, holes, and fissures. -Application of curative and protective chemical treatment (insecticide product and liquid of vegetable-mineral origin) to eliminate microfauna. -Application of chemical lightening treatment (110 volume hydrogen peroxide or 12% bleach) to eliminate discoloration and recover as much as possible its natural tone.
PERIODIC MAINTENANCE PROTOCOL 03								To avoid and reduce the surface degradation of earthen walls to protect their constructive and physical capacity, and thus their constituent material.							-Visual control of degradation caused by differential washing. -Control and revision of the roof and water filtrations. -Control and revision of coatings on earthen walls.
															-Supervise and ensure immediate action of any damage to the roof. -Supervise and ensure the immediate action of any damage to plastering or coatings.
															-Lime plaster on the earthen walls to protect their exposure. -Repairing the roof to prevent leaks. -If the earthen walls without lime or other material coatings have been eroded by wind and rain, repair them: 1) homogenize the deterioration, chopping the plaster or coating; 2) repair losses and damage of adobe and mortar joints; and 3) make plaster of empañete (mud, horse excrement, and straw). -If the earthen walls with plaster and lime have been eroded by wind and rainwater, repair them: 1) homogenize the deterioration, removing the lime coating and cleaning the affected area; 2) repair losses and damage to the plaster coating; 3) repair losses and damage to the lime plaster; 4) repair the damaged areas. 2) repair losses and damage to the plaster coating, and 3) carry out lime plastering.
PERIODIC MAINTENANCE PROTOCOL 04								To prevent deterioration and degradation of wall coverings through solutions that respond to gradual physical risks.							-Visual control of coatings and degradation by atmospheric agents. -Control and revision of the roof to avoid leaks.
															-To supervise and procure immediate action to repair any damage repair of any damage caused by atmospheric. -To supervise and ensure the immediate repair of any damage on roof.
															-To remove dirt and dust to ensure cohesion. -Quality control, type of paints, compatibility with pre-existing materials, and coating materials (lime or others). -Roof repair to prevent the impact of rainwater on the coatings. -Repair of peeling and spalling.

Table 6. Detail of the technical actions of the periodic maintenance protocols.

PERIODIC MAINTENANCE PROTOCOLS												[Technical action]					
Type	PROTOCOL							OBJECTIVE	PROTOCOL DESCRIPTION								
	Alteration				Damage				Frequency								
	01	02	03	04	05	06	07		6 months to 1 year	1 to 3 years	1 to 4 years	4 to 5 years	If necessary	Preventive intervention	Corrective intervention	Actions	
PERIODIC MAINTENANCE PROTOCOL 01								To enhance the constructive capacity of existing earthen walls in buildings by reinforcing and repairing their structural potential.									-Control and monitoring of the structural condition of earthen walls.
																	-Monitoring and immediate repair action in the event of mechanical damage or identified structural failure.
																	-Structural strengthening; and repair of: a) cracks and fissures and, b) detachments in the earthen walls.
PERIODIC MAINTENANCE PROTOCOL 02								To reduce deterioration and improve the constructive capacity and physical integrity of the structural elements and wood carpentry of buildings.									-Cleanliness of the wooden surface. -Control and monitoring of the state of the treatments. -Visual control of: a) surface degradation by sunlight incidence, b) surface degradation by hygroscopy, and c) degradation by humidity.
																	-Monitoring and immediate repair of any damage caused by surface degradation resulting from sun-humidity and hygroscopy incidence.
																	-Coat the surface of the wood with varnish or ecological protective paint (composed of raw material of vegetable-mineral origin) with exterior resistance.
																	-Repair and filling of cracks, holes, and fissures. -Application of curative and protective chemical treatment (insecticide product and liquid of vegetable-mineral origin) to eliminate microfauna. -Application of chemical lightening treatment (110 volume hydrogen peroxide or 12% bleach) to eliminate discoloration and recover as much as possible its natural tone.
PERIODIC MAINTENANCE PROTOCOL 03								To avoid and reduce the surface degradation of earthen walls to protect their constructive and physical capacity, and thus their constituent material.									-Visual control of degradation caused by differential washing. -Control and revision of the roof and water filtrations. -Control and revision of coatings on earthen walls.
																	-Supervise and ensure immediate action of any damage to the roof. -Supervise and ensure the immediate action of any damage to plastering or coatings.
																	-Lime plaster on the earthen walls to protect their exposure. -Repairing the roof to prevent leaks. -If the earthen walls without lime or other material coatings have been eroded by wind and rain, repair them: 1) homogenize the deterioration, chopping the plaster or coating; 2) repair losses and damage of adobe, and mortar joints; and 3) make plaster of empañete (mud, horse excrement, and straw). -If the earthen walls with plaster and lime have been eroded by wind and rainwater, repair them: 1) homogenize the deterioration, removing the lime coating and cleaning the affected area; 2) repair losses and damage to the plaster coating; 3) repair losses and damage to the lime plaster; 4) repair the damaged areas. 2) repair losses and damage to the plaster coating, and 3) carry out lime plastering.
PERIODIC MAINTENANCE PROTOCOL 04								To prevent deterioration and degradation of wall coverings through solutions that respond to gradual physical risks.									-Visual control of coatings and degradation by atmospheric agents. -Control and revision of the roof to avoid leaks.
																	-To supervise and procure immediate action to repair any damage repair of any damage caused by atmospheric. -To supervise and ensure the immediate repair of any damage on roof.
																	-To remove dirt and dust to ensure cohesion. -Quality control, type of paints, compatibility with pre-existing materials, and coating materials (lime or others). -Roof repair to prevent the impact of rainwater on the coatings. -Repair of peeling and spalling.

Table 7. Detail of the areas and intervention mappings of the periodic maintenance protocols.

concrete construction elements (load-bearing walls, and plaster). Moreover, the periodical maintenance protocol 04 (Tabs. 6-7) is determined, which resorts to the maintenance of lime plaster and paint to control, repair and maintain the damages; and to avoid future deterioration and the reproduction of other destructive processes. These constructive elements (wood and earth) showed the most aggressive damages, accentuating a possible loss of structural capacity. Thus, by applying the periodic maintenance protocols, the aim is to consolidate and repair the elements to avoid the partial or total collapse of the buildings.

Lastly, implementing management protocol 01 is necessary, which aims to technically enhance the architectural documentation of downtown Quingeo’s buildings and record all pathological, constructive, and interventionist processes for an effective approach and understanding of the preservation and protection. Likewise, the periodical maintenance protocols 01 to 04; the follow-up and control procedures 01 and 02 require the application of two key components and actors for their execution, these are:

1. Agents: establishes the administrative and human resources for executing the protocol framework, i.e., the team of trained technical professionals and the public institutions in charge of heritage preservation (Tab. 8).
2. Product: defines the expected verifiable when the proposed protocols are applied. There are two requirements for each type:

Specific product per protocol type is obtained in line with the objective and technical actions contained in the individual protocols. This is:

- Management protocols: To ensure the effective application and management of architectural heritage structures, it is necessary to provide: 1) inventory sheets and 2) architectural heritage documentation for the parties involved in the buildings.
- Periodical maintenance protocols arise from the periodic timely inspections, interventions, and compliance with the proposed technical actions taken on the buildings. Therefore, data collection sheets must be prepared, stipulating: 1) the inspection information and 2) the description of the interventions and treatments applied.
- Monitoring and controlling procedures: through mechanisms for monitoring and evaluating the

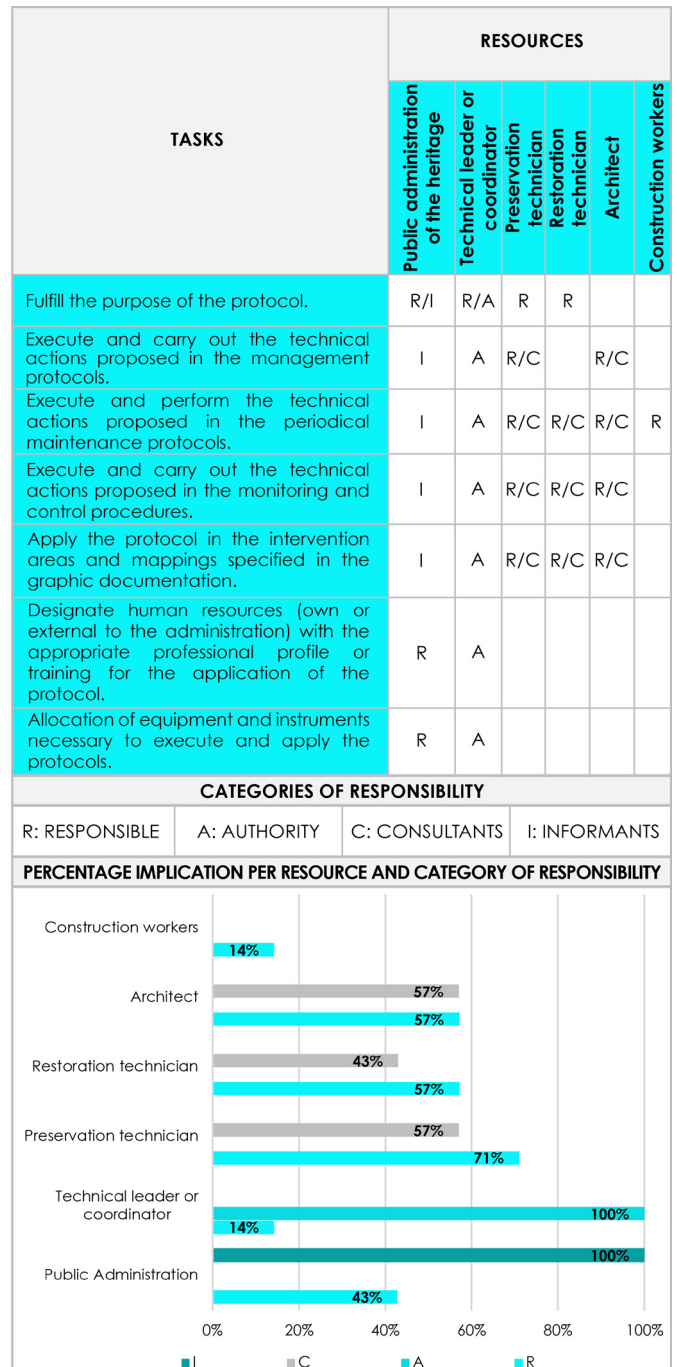


Table 8. Resulting RACI Responsibilities Matrix for the execution of the downtown Quingeo protocol framework.

protocol’s effectiveness. Thus, detailed follow-up and control records of the verifications conducted and any findings made during the inspections will be kept.

Global product for all protocols, i.e., the standard results that apply as a global need, regardless of the objective or action of each protocol. The products produced shall be:

- Support-graphic and photographic documentation through illustrative mappings in plans, elevations, and cuts, photographs, orthophotos, among others. This documentation will address the tasks that have been performed and fulfilled with the application of the protocol, as well as the registration of new particularities found in the buildings requiring intervention.
- Reports on the implemented protocol detailing: 1) executed tasks or activities; 2) possible incidents that may arise over time and that need to be addressed; 3) verification of the effectiveness-reduction of the technical actions of the protocol when applied to the damages; and 4) the conclusions of the technical work conducted.

3.2. Result of the proposed protocol framework

Based on those mentioned above and regarding the global result of the proposed protocol framework, the aim is to generate a base of technical processes associated with the minimum intervention. That is, to consider and reduce treatments and actions that avoid aggressive and transforming intervention in the architectural entities since real estate tends to become detached and lose its identity, concept, and original constitution with more processes.

This conclusion is based on the restoration theories of Camilo Boito and Gustavo Giovannoni, which have been taken from the adaptation and redefinition to modern times by various authors, such as Aparicio Marín (2017), Macarrón Miguel *et al.* (2019), and Pérez Gil (2020). Along with the regulatory framework and recommendations of international documents stipulated by ICOMOS and UNESCO, such as the Venice Charter (1964), Washington Charter (1987), Nara Charter (1994), Charter on the Built Vernacular Heritage (1999), Krakow Charter (2000), and Charter Principles for the Analysis, Conservation, and Restoration of Architectural Heritage Structures (2003).

The minimum intervention applied to the architectural reality of downtown Quingeo is considered an action that seeks to preserve and protect both the territory's physical structure and cultural and architectural values. Thus, its action is directed to a specific intervention or building areas that require technical interventions (Aparicio Marín 2017: 107-110). Similarly, it considers the maximum respect for its original characterizations, from

the constructive, formal, spatial, and functional aspects which define its original design. To this end, it suggests using treatments, techniques, materials, and construction systems compatible with the property and its cultural and historical values, which do not lead to mimetic additions that alter its architectural and historical authenticity (Olona *et al.* 2020: 100-113). According to this, the 7 proposed protocols act under the following intervention criteria.

Reversibility and minimal intervention, according to the Venice Charter (1994), Charter on the Built Vernacular Heritage (1999), and Charter Principles for the analysis, preservation, and restoration of heritage architectural structures (2003), seeks to emphasize the importance of maintaining the pre-existing architectural characteristics of the buildings both from a socio-cultural perspective to their physical potential and the need for preservation (ICOMOS 1964, 2003). Therefore, actions are taken to avoid inadequate interventions, which have been predominant in the historical-constructive process of the vernacular buildings of Quingeo. On the other hand, and at the same time, they establish reversible actions.

Accordingly, it is decided to consolidate and repair rather than replace the structures, architectural elements, and/or spaces that show evidence of bio-deterioration and physical deterioration to avoid undermining their authenticity and integrity (Ferrada Aguilar 2010). These references are in line with the stipulations from Camilo Boito and the Charter of Nara (1994) to Aparicio Marín (2017) and Macarrón Miguel *et al.* (2019), in which preservation should be minimal, consolidation, and/or repair actions should always be preferred to restoration. The objective is to protect the physical conception and thus the documentary character of the property, as well as its unity, authenticity, integrity, and cultural identity, as stated in the Charter on the Built Vernacular Heritage (1999).

Authenticity and integrity, act under the criteria of the Charters of Venice (1964), Nara (1994), the Built Vernacular Heritage (1999), Krakow (2000), and the Principles for the analysis, preservation, and restoration of architectural heritage structures (2003), so that the heritage preservation protocols respect the originality and unity of the buildings as much as possible. This means preserving spaces, materials, and original constructive and architectural elements because they are clear evidence of the territory's culture and the community's identity (ICOMOS 1964, 1994, 1999, 2003; Cristinelli 2004).

Differentiation between the existing and the intervened, associated with those stipulated by Camilo Boito and Gustavo Giovannoni, which were updated by Macarrón Miguel *et al.* (2019), Pérez Gil (2020); Krakow Charter (2000) and Charter Principles for the analysis, preservation, and restoration of heritage architectural structures (2003) (ICOMOS 2003; Cristinelli 2004). The protocols were thus determined to block the elimination of the differentiating elements of the heritage architectural characteristics with historical value in the evolutionary process of the buildings. The aim is to preserve the original construction through its architectural language (typology, morphology, and aesthetic-formal dimension), constructive (materials, techniques, and construction systems), and functional (spaces, rooms, among others).

Hence, the protocol framework respects the original configuration as it focuses on; 1) not generating false history since it deals with interventionist processes of consolidation and/or repair, where concepts, techniques, materials, and construction systems are compatible or similar to the pre-existing are applied, to manage unity-integrity, but with traces of the interventionist action; and, 2) the actions were proposed as a necessary and obligatory response to specific segments with possible loss of structural capacity in the buildings, as they are strictly necessary (ICOMOS 1994; Aparicio Marín 2017; Macarrón Miguel 2019). The latter also responds to the lines of action (replacement of materials and parts, adaptation and changes, and period restoration) stipulated in the Charter on the Built Vernacular Heritage (1999).

At this point, it should be emphasized that the conservation, management, and protection of the vernacular real estate of Quingeo (downtown and parish area) through the design of the protocol framework is based on the preservation of its original constitution which, indeed, allows the protection of the historical, socio-cultural and technological-constructive symbiosis of the buildings, but in turn, represents the population and its contributions to the definition of architecture. This proposal responds to an articulated base, which has defined limits, levels, and technical processes prioritizing the elements, conditions, and essential needs to improve the State of buildings preservation in Quingeo. In turn, and despite this projection, for success and potential development, the protocol framework requires two additional articulations; economic and social. Namely:

Economic articulation, is associated with economic and financial activities for public actors and citizens to

achieve feasibility and, consequently, success in the preservation of buildings. To this end, the theory contemplated in the existing national and local regulatory framework must be implemented. The first one states the obligation of sustainable financing and investments, oriented to the determination of economic and technical resources for research, preservation, enhancement, and social use of the cultural heritage of the Ecuadorian State (Constitución de la República del Ecuador 2008: 115-116; COOTAD 2019: 1-12; LOC 2016: 4-10). In other words, the technical proposal must contemplate the need for mixed investment resources (public and private) for the physical recovery of the architectural heritage from the financing and priority and accessible credits for the competent public administration in the territory; this is suggested for the second actor as well as for the citizens in general. This structure aims to facilitate management and preservation through 3 essential processes: 1) preparation of studies, 2) execution of works, and 3) institutional strengthening, both for the development of management plans and legal resources, as well as for the application of innovative and effective disciplines and tools in the documentation and technical action (INPC 2018).

Social articulation, from the citizen involvement for its validation or reform, as well as for its practical implementation. It is considered to promote and apply participatory, collaborative, and contributive co-creation as a key methodological sample in the conservation of heritage real estate (Bocanegra Barbecho 2017: 326-331) through a collaboration between the community of Quingeo and the society outside the territory, which allows the development of several work actions. In other words, society becomes a key party in heritage management and preservation. This broadens the understanding and knowledge of the cultural property in specific groups, institutional and/or political actors, for the development of research and activities according to its nature. Likewise, social co-creation makes it possible to recover the historical, symbolic, and identity link and appropriation between the community and the heritage real estate, reinforcing citizen empowerment and the dissemination and socialization of cultural heritage (Jirón Martínez 2017: 69-75).

In light of the above, the symbiosis of technical (protocol framework), institutional (financing and investment activities), and social (citizen participation) processes define a viable strategic axis for the enhancement and physical conservation of the vernacular architecture of Quingeo and nearby territories.

4. FINAL THOUGHTS

The historical vernacular architecture of downtown Quingeo has its own distinct heritage value. This is corroborated in the dialogue with its people, which defines not only its formal, representative, and aesthetic importance but also its anthropological and historical importance. Furthermore, it represents and belongs to cultural contexts overcome and without return by the community, with a high historical-constructive and remembrance load that acts as a testimony of collective inheritance and cultural meanings.

In like manner, and although it is clear that the vernacular architecture, as well as the historical vernacular architecture of Quingeo, contains a high anthropological and cultural condition and that the latter is continuous, in the case of downtown Quingeo this cultural dynamic has been undermined by external material expressions, which do not respond to an adaptation and effective use, but rather, tend to abandonment. This has caused the loss of the link between the buildings, society, and the immediate environment. Hence, conserving its historical and cultural testimony and authenticity is key. The need for physical conservation and legibility lies therein.

The protocol framework establishes measures and actions focused on avoiding, reducing, eliminating, and blocking: 1) *alterations of the architectural and constructive language* to avoid technological and aesthetic-formal loss since these are the anthropological expressions materialized by the historical culture of the settlement that is, those that define its heritage nature; 2) *physical and biological deterioration* of wood, earth, lime, and paint, to reduce the loss of constructive capacity and improve its state of conservation; and, 3) *lack of heritage documentation*, to streamline, improve and technically record the buildings.

In short, the potential of technical protocols for heritage conservation is to respond to vulnerable situations faced by architectural entities through the orientation of optimal, effective, precise, and appropriate technical measures. This, in turn, makes it easier to manage the protection, intervention, and/or restoration to provide significant benefits in their physical, cultural, and heritage preservation.

On the other hand, the research scope broadened the understanding and identified the consequent risk and vulnerability factors in the heritage architectural structures of downtown Quingeo. Those, apart from being indisputable evidence of inadequate public management, exemplify the

decline and even economic deterioration faced by the community and, therefore, by the owners of the heritage properties, who find themselves unable to invest. This situation has caused the buildings to be vulnerable to the various external agents of their immediate environment. However, with the aging and loss of physical features, abandonment has been triggered, the physical State of regular-bad conservation, and the lack of resources and knowledge of the locals to maintain them, all of which predict a scenario of irreversible material and immaterial losses.

The physical damage to the buildings has become a constraint for their occupation and an unsustainable problem for the population of Quingeo. Consequently, a negative cycle has been evidenced around the heritage vernacular architecture since the economic, socio-cultural loss, and the lack of basic and technical preservation knowledge have directly affected the urban-architectural and landscape-environmental context and citizen empowerment. Conclusively, the preceding comments do not exclude that for the proposal's success, it is essential to jointly apply defined approaches to the economic improvement of the Parish through a circular economic system that facilitates the comprehensive recovery of the rural settlement with the cultural heritage as the central axis. This implies the need to facilitate the connection of the different vital actors to overcome the socioeconomic, cultural, management, and preservation challenges the territory is currently facing.

TECHNICAL DATASHEET

All the figures present and reproduced in this writing are authored by the authors of the article. Tables 1 and 2 were elaborated and adapted, using as a basis the data and graphic content of the Cultural Heritage Institute of Spain (IPCE, in Spanish) and of the Risk Specialist Luis Humberto Mora Horta.

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