

**Title: Heritage Construction Systems: Characteristics and Case Studies in Costa Rica.
From a historical perspective that allows us to understand the evolution of
construction systems, identifying the cultural and technological influences that shaped
these techniques.**

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Abstract: Heritage building systems are architectural expressions that reflect the history, culture, and identity of a community. In the case of Costa Rica, the country boasts numerous traditional construction systems that have endured over time. This research aims to delve into the characteristics of historical building systems in Costa Rica while providing case studies that describe their construction. Special attention is given to the significance of these systems for the preservation of cultural heritage and sustainable construction.

Keywords: building systems, heritage, Costa Rica, traditional architecture, sustainability.

Introduction:

Heritage building systems represent the historical and cultural heritage that has left a significant mark in different parts of the world. In the case of Costa Rica, these traditional architectural systems are a living testament to social development and adaptation to the natural environment. In this research work, we will analyze the characteristics of the heritage building system in Costa Rica, emphasizing its diversity and cultural significance. Furthermore, case studies will be presented to illustrate the construction process of these systems, as well as their importance for contemporary sustainable development.

In terms of management context, the country implements non-invasive techniques that allow for pathological studies in these buildings. Typically, studying the buildings is necessary to identify existing pathologies within them. Traditionally, the techniques used are quite basic, focused on visually identifying lesions in materials, and destructive processes involve taking samples for analysis. As a result of these practices, the proper and scientifically supported use is proposed, justifying the decisions made (Albizurez, n.d.).

I. Characteristics of Heritage Building Systems:

Traditional building systems in Costa Rica are characterized by their adaptation to the environment and the use of local materials. These systems reflect the close relationship between the community and its natural surroundings, resulting in architectural designs that efficiently uses available resources. Some common features include the use of materials such as wood, mud, stone, and bamboo, as well as specific construction methods to ensure the durability and sustainability of the buildings. Some of these systems include:

- **Adobe:** Adobe is a traditional building system that creates bricks from mud and sun-dries them. This material is widely used in the construction of houses and historical buildings in Costa Rica, especially in rural areas. Many of these buildings are known as vernacular

architecture, which represents a showcase of the culture and processes of societies settled in various geographic spaces, adding authenticity to the architectural ensembles that surround them (Paola Cristina Vallejo Choez, 2019).

- **Masonry:** Masonry is a building system that uses a mixture of clay, lime, and stone to construct walls. This method was employed during the colonial era and is evident in a number of historical buildings in the country, such as churches and old houses.



Notes The previous photograph shows the house Esperanza Castillo Rovira en Liberia, Guanacaste. Declared Historical-architectural Heritage on September 19, 2014 under decree #38535-C, Gaceta #180. IPhotography1.
<https://micostaricadeantano.com/2020/12/16/casa-de-la-cultura-liberia-guanacaste-1851-1900/>

- **Wood:** Wood is a widely used material in traditional Costa Rican architecture. It is used to construct houses, churches, and bridges. The most common construction technique is the wooden frame, where columns and beams form the building's structure. This building system is often characterized according to architectural studies, pathologies, and xylological research that promote the conservation and enhancement of the property. (Costa Rica Institute of Technology)

- **Stone:** Stone has been used to build monuments, churches, and old houses in Costa Rica. In some cases, the technique of "desbastado" is employed, where stones are carefully cut and joined without the use of mortar.

- **Bahareque:** Bahareque is a building system that combines wood and clay. It involves placing wooden columns and beams filled with a mixture of clay and straw. This method was widely used during the colonial era and can be found in some old constructions in the country. Estos son solo algunos de los sistemas constructivos utilizados en el patrimonio de Costa Rica. Cada región del país puede tener sus propias características y métodos de construcción específicos, reflejando la diversidad cultural y arquitectónica de ese país. El uso del ladrillo y el metal en el patrimonio arquitectónico de Costa Rica ha dejado una importante huella en la historia del país. Durante siglos, estos materiales se han utilizado ampliamente para

construir estructuras icónicas tanto en áreas urbanas como rurales. A continuación, se presenta una reseña histórico-arquitectónica de su uso en Costa Rica:

- **Masonry:** Construction consisting of stone masonry walls combined with mortar is one of the oldest building systems used in Costa Rica. During the colonial period, many churches and colonial castles were erected using brick technology. These structures are characterized by thick and sturdy walls, ensuring the stability and durability of the building. Notable examples include the Church of Orosi and the Church of San José de Orosi, both in the province of Cartago. These buildings are considered cultural heritage and represent the craftsmanship of the era. In the 19th century, masonry remained the dominant construction system. However, neoclassical, and eclectic architectural influences were introduced, adding decorative details such as columns and stucco to the buildings. A prime example of this period is the National Theater of Costa Rica in San José, built in 1890-1897, combining brick elements with metal details.

In the context of neocolonial architecture in Hispanic America, it exhibited diverse variations. It emerged in the early 20th century, following the Mexican Revolution, because of social and cultural movements advocating for creole and mestizo identities. It was constructed using various bahareque techniques, later transitioning to reinforced concrete, confined masonry, and the associated structural principles. This style can be observed in significant public works (from Casa Amarilla to the Legislative Assembly, numerous schools, and municipal palaces) as well as in commercial and residential buildings, particularly for the upper classes in aristocratic neighborhoods like Escalante in San José and San Francisco de Heredia. (Fernández, 2010)



Notes. The previous photograph shows the San José de Orosi church, Cartago IPhotography1. <https://www.muniparaiso.go.cr/lugar/13/iglesia-de-orosi>



Notes The photo above shows the Casa Amarilla, San José IPhotography1. Fuente: El Ministerio de Relaciones Exteriores y Culto. <https://www.chepetown.com/blog/casaamarilla>

Metal:

The use of metal in Costa Rican architecture became more prominent in the 20th century, thanks to technological advancements and the influence of international architectural trends. The introduction of metal structures allowed for the construction of tall buildings with bolder architectural designs.

In the mid-20th century, Costa Rica experienced a boom in modernist construction, during which metal structures and prefabricated systems were employed for residential, commercial, and industrial buildings. Noteworthy is the "Escuela Metálica" (Metallic School) in San Rafael de Heredia, built in 1930, which was a pioneer in the use of metal in school construction in the country.

An example of this architecture is the Buenaventura Corrales Bermúdez School, known as the "Edificio Metálico" (metallic building). This structure holds great value for Costa Rica,

both architecturally and symbolically, as it represents the materials of the educational reform by the liberals and stands as clear evidence of the scope of popular education.



Notes. The previous photograph shows the Buenaventura Corrales Bermúdez School, San José IPhotography1. <https://cambiopolitico.com/el-edificio-metalico/88102/>

II. Case Studies:

This section will present representative case studies of heritage building systems in Costa Rica. The construction process of each system will be described in detail, highlighting the techniques and materials used.

Case Study: Ujarrás Ruins

The Ujarrás Ruins in Cartago, Costa Rica, are an important historical and archaeological site dating back to the 18th century. The structural and architectural analysis of these ruins allows us to understand how they were designed, constructed, and their current state of preservation.

The ruins of its colonial church are located about 1 kilometer from the northwest shore of Lake Cachí. This ancient "calicanto" construction (lime and stone masonry) is all that remains of the first "calicanto" church built in Costa Rica during the 17th century, approximately between 1686 and 1693.

In pre-Hispanic times, it was a place of certain importance, where there was a settlement of the Huetares indigenous people. Its name is a Castilianization of the name of the Huetar king Uxarrací. In early 1563, a monarch named Tuxustí reigned in Ujarrás, who along with other

indigenous kings visited Mayor Juan Vázquez de Coronado on January 1 of that year in the city of Garcimuñoz.

By mid-1564, however, the town of Ujarrás, along with Atirro, Corrosí, and Turrialba, had rebelled against Spanish authority. The Spaniard Agustín de Hinojosa made a raid on Ujarrás, and Vázquez de Coronado himself went to the location to try to pacify the indigenous people. However, new clashes occurred, and by the end of February 1568, another Ujarrás king named Turichiquí led a major uprising against Mayor Pedro Venegas de los Ríos, involving the indigenous people of Guarco, Turrialba, Ujarrás, Corrosí, and Atirro. (Paraíso Municipality, n.d.)



Notes. The previous photograph shows the ruins of Ujarrás, Cartago IPhotography1. <https://www.muniparaiso.go.cr/lugar/14/las-ruinas-de-ujarras>

The Ujarrás Ruins primarily consist of the remains of an old colonial church built in 1693 and expanded in the 18th century. The church is dedicated to the Virgin of the Immaculate Conception. Now, I will describe the architectural and structural aspects of the ruins:

Floor Plan and Layout: The Ujarrás Church was constructed with a rectangular floor plan, typical of colonial churches in Costa Rica. The main nave extended longitudinally and was flanked by two side chapels. The main entrance is on the western façade, and the main altar is at the opposite end.

Construction Materials: The Ujarrás Ruins were mainly built using sun-dried adobe bricks, a common construction technique during the colonial era. Adobe involves mud bricks dried in the sun and bonded with lime mortar. Stone is also used in corners and structurally significant areas to reinforce the structure.

Walls and Foundations: The church walls are thick and solid, showcasing a robust and durable structure. These walls serve a crucial structural function, supporting the weight of the roof and other architectural elements. The foundation is made of stone to ensure the stability of the structure.

Domes and Cupolas: There likely are colonial-style domes and cupolas within the church. These architectural elements provide an elegant aesthetic while efficiently distributing the load from the roof to the walls.

Roof and Rooftop: The church roof is a gabled roof, typical of Spanish colonial architecture. It was probably constructed with a wooden framework and covered with clay tiles. Unfortunately, over time and due to neglect, the original roof covering has likely been largely lost.

It's important to note that this description is based on historical information and there might be variations or alterations in the ruins due to natural wear and tear, human interventions, or events such as earthquakes. For a more accurate and detailed analysis of the Ujarrás Ruins, it's recommended to consult specialized sources or visit the site in person.

Case Study: Adobe Houses in the Cartago Region.

Below, for contextualization purposes, factors, and specifications of the historical context of the Cartago province are mentioned:

Among the recognizable urban landmarks was the block where the town hall and the governor's house were erected, which is the same location where the Cartago Municipal Palace is situated today. The Main Square, the Parish Church, and the Franciscan Church are also evident, all in the same locations as they are today, where they have remained since then. The San Juan de los Navoríos hermitage, no longer in existence today, can also be observed on the map, which was situated where JASEC's headquarters are now and where, until a few weeks ago, Manuel de Jesús Jiménez's house stood.

Fernández Esquivel describes these constructions as "adobe and tile, without protection or precautions for their proper preservation, so much so that at the beginning of the 17th century, the Parish Church of Santiago, facing 'Juan de Ocón y Trillo' Street [now calle 2], collapsed due to poor conservation and construction" (Franco Fernández, cited in op. cit. p, 8).

This information allows us to gain insight into the constructions of the era. While private buildings are not described, it is possible to infer that houses within the urban area were also made of adobe and tile. However, they would hardly have been in the same poor conditions as public buildings, as their inhabitants and users were members of the emerging Cartago aristocracy, descendants of the first conquerors, and even conquistadors themselves, like Juan Solano, who lived in the northern half of block number four on the map, or behind the governor's house and on the street that bore his own name. This meant that the inhabitants of this area would provide themselves and their families with a dwelling befitting their social and economic status, which also allowed them to properly maintain their buildings. On the other hand, outside the city, the dwellings of the displaced—mulattoes, freed blacks—were concentrated (Rina Cáceres Gómez, "La Puebla de los Pardos en el Siglo XVII" in *Revista de Historia, Costa Rica*, Universidad Nacional, Universidad de Costa Rica, July/December 1996, p. 34). They lacked the status and means to procure suitable shelter, and inhabited

thatched huts whose construction was guided by materials and technologies more aligned with local traditions (Carlos Luis Fallas Pastor).

Adobe houses are a traditional architectural form found in the Cartago region of Costa Rica. The architectural and structural analysis of these houses helps us understand their design, construction, and characteristics. Here, I will describe some important aspects of adobe houses in the Cartago region:

Construction Materials: Adobe is the primary material used in these houses. Adobe consists of bricks made from a mixture of clay, sand, plant fibers, and water, molded and sun-dried. These bricks are bonded using clay or lime mortar. Other materials used to a lesser extent include wood and stone for structural elements and finishes.

Architectural Design: Adobe houses in the Cartago region tend to have simple and functional designs. As a rule, they have rectangular or square floor plans and are typically one or two stories high. These houses often feature compact floor plans, with rooms arranged around a central courtyard or hallway.

It's worth noting that adobe houses reflect the historical and cultural context of the region, showcasing a traditional approach to construction that takes advantage of locally available materials and responds to the climate and needs of the area.

Walls: A distinctive feature of these houses is their brick walls. They are thick and sturdy, providing good insulation. Adobe walls can be up to half a meter or more in thickness, ensuring stability and the integrity of the structure. These walls possess the property of thermal inertia, meaning they can gradually store and release heat, helping to maintain a stable internal temperature.

Roof: Brick roofs typically have gabled designs, constructed with wooden frameworks, and covered with clay tiles. These roofs ensure effective rainwater drainage and protect the structure from inclement weather.

Structural Reinforcement: Structural reinforcement is commonly used to enhance the stability and strength of brick houses. This may involve the use of wood for beams and columns, as well as the implementation of chains or tie systems to distribute loads and prevent collapse during earthquakes. It's important to note that brick houses, despite the benefits of being environmentally friendly and energy-efficient, may also require periodic maintenance and repairs due to natural material wear. Additionally, local regulations and current construction standards must be considered to ensure the safety and quality of these houses.

This architectural and structural analysis of Adobe Houses in the Cartago area provides an overview of their characteristics. However, consulting specialized sources and local experts is necessary for more detailed and up-to-date information about these traditional designs.

III. Importance of Heritage Building Systems for Sustainability:

Heritage building systems not only represent valuable cultural heritage but also offer significant lessons in sustainability. These traditional systems efficiently utilize local resources, reduce environmental impact, and enhance resilience in the face of disasters.

This section will emphasize the importance of historical building systems in Costa Rica as a sustainable alternative to modern construction. Heritage building systems play a vital role in sustainable development by combining the preservation of architectural and cultural heritage with methods and materials that promote socially and environmentally responsible practices. Here are some reasons underscoring the importance of these building systems for sustainability:

Conservation of Cultural Heritage: Heritage building systems are an invaluable part of a community's history and identity. By preserving and using these systems, architectural heritage is protected and valued, fostering respect for the culture and traditions of the region.

Energy Efficiency and Environmental Sustainability: Historical building systems are often designed to harness available natural resources such as sunlight, natural ventilation, and local materials. These practices can help reduce reliance on traditional energy sources and minimize the environmental impact of building construction and operation.

Sustainable and Renewable Materials: Traditional building systems often employ natural and local materials such as wood, stone, brick, and lime, which are renewable and require less energy to produce than synthetic or industrial materials. Additionally, the use of these materials contributes to ecosystem protection and reduces the carbon footprint of buildings.

Adaptability and Flexibility: Heritage building systems are often highly adaptable and flexible over time. They allow for modifications and renovations without compromising their architectural essence and quality. This promotes building durability and avoids unnecessary demolitions, thereby reducing construction waste and resource consumption.

Economic and Social Value: Preserving and restoring heritage buildings through traditional building systems can generate economic opportunities and local employment. These projects often encourage cultural tourism and sustainable community development, contributing to the social and economic well-being of the region.

Incorporating heritage building systems into contemporary construction practices can contribute to a more sustainable built environment while honoring the cultural and historical significance of these architectural treasures.

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