Analysis of Historical Buildings: San Jose Church, San Juan, Puerto Rico

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Abstract

An ongoing study conducted by the author is aimed at deriving a better under-standing of the history, architecture, and structural characteristics of San Jose Church.
This paper discusses various aspects of the architectural history of the building as well as a preliminary assessment of the structural performance of the barrel vaults that cover the Central Nave of the church.

Introduction

The San Jose Church (figure 1) is one of the first works of architecture built in the New World by the Spaniards in the 16th Century. Elements of the Gothic style are found in the construction of the stellar rib-vaults above the Main Chapel and Transept of the church (figure 2) and barrel vaults, of the Italian Renaissance period, cover the Central Nave (figure 3) of this most exceptional example of religious architecture in the Americas.

Architectural plans for the church were completed in 1523, during the bishopric of Alonso Manso, the first bishop of the New World, and the construction of the master walls and foundations of the building were built in 1532. The church was dedicated to Santo Domingo during its early period and later on was named Iglesia de Santo Tomas; and since the 19th century Iglesia de San Jose.

The Dominican Friars built San Jose Church adjacent to their Monastery. The convent, a two-story square structure, was built in brick and masonry and was finished by 1530. The Friars received Royal financial

assistance from Spain in 1548 in order to finish the construction of the church. Then, it is reasonable to conclude that by the middle of that century the Gothic vaults, covering the Main Chapel and the Transept of the church, were completed. Furthermore, they were surely finished by 1559, the year in which the mortal remains of Juan Ponce de Leon (the first governor of Puerto Rico) were brought over from Cuba so that they could be laid to rest in the church [1].

It is during the period covering the years 1635 - 1641 that the Transept of the church is rebuilt with the addition of the Central Nave and lateral chapels. Thus, we may consider that it is during this period that the construction of the church proper (Main Chapel, Transept, Central Nave and lateral chapels) is finally completed. Therefore, it took c.1532- 1641 (109 years!) to finish the construction of the building. Elements related to natural disasters, socio-economic and political causes, and military interventions; undoubtedly contributed to delays in the construction of the church. Indeed, there is much history within the walls of San Jose Church, a topic for further investigation by the author.

It is not until the 18th century (c.1770) that barrel vaults, perforated by lunettes, were built to cover the Central Nave of the church [2], thus replacing the old wooden roof-structure.

The San Jose Church has been, in the past and continues to be in the present, of great historical significance to the people of Puerto Rico. The architectural vari-ations of the building attest to an interesting record of the cultural changes that have occurred in Puerto Rico throughout its five centuries of history.

Architecture

San Jose Church is designed in the form of a Latin cross (figure 4). It has a single central nave and adjoining lateral chapels. A high choir is located at the entrance of the church. Both the Main Chapel and the Transept are covered with Gothic vaults of stelliform groins and adorned with orbs and shells in the rib junctions and the boss. The Main Chapel, the Transept and the groined lateral chapels belong to the Isabelline Gothic architecture, whereas the vaults of the Central Nave are of the Italian Renaissance period.

Variations in the building styles of San Jose Church are evidence of the changes in architecture during the decades that elapsed while the church was being completed.

The principal architectural characteristics of this church are as follows:

Main Chapel: The Main Chapel of San Jose Church is the oldest architectural element of the building. It is an excellent example of Isabelline Gothic Style, particularly in the stelliform domed-vaults . These vaults are made of masonry and stone blocks. Construction materials which, in addition to brick and wood, were commonly employed in the construction of buildings during that period [1].

Transept: The Gothic vault covering the Transept is as old as the Main Chapel of the church. The vault, build with stone blocks, gives the space an air of dignity with its ribbed arms fully extended to the side chapels. A layer of bricks protects the exterior shell of the transept and an outer protective covering is reinforced with concrete and steel beams to increase the rigidity of the structure. This work was done in 1953 [1].

Central Nave: The Central Nave is covered by barrel vaults in which lunettes were introduced to accommodate clerestory windows (figure 3), thus allowing more light to penetrate the nave. This architectural adjustment is a departure from the "tubular" barrel vault employed by the early Spanish church architecture.

The barrel vaults of San Jose Church are an adaptation of the cross-groined vault used by the Romans in medieval times. The shape of each bay; that is to say, the relationship between the width, length, and height of the spaces covered by a single ribbed vault and bounded on plan by transversal arches; is very wide in relation to its length between the transversal arches. The width of the bay is about twice its length (figure 4). The high stone vaults are carried on short pedestals resting on an arcade wall . It is interesting to analyze the structural approach to the basic problem of supporting the weight of the stone vault. This is discussed in the following section.

Barrel Vaults

As mentioned earlier, the Central Nave is covered with barrel vaults of the Italian Renaissance period. Transverse lunettes penetrate one-third of the barrel vaults intersecting them at right angles to the longitudinal axis of the vault (figure 3). This creates a structural condition whereby the vault concentrates the loads and thrusts on four points of support at each bay, the short pedestals resting on the arcade walls (in contrast with the tubular barrel vault used by the Spaniards in early church architecture and in which the vault rested on continuous supports).

This architectural arrangement is very similar to the cross-vaulted structure used by the Romans in medieval times. These early cross vaults were created by the intersection of two semicircular barrel vaults. As in San Jose Church, transverse arch rings of stone blocks were used to stiffen the vault at each bay. The semicircular cross vault concentrated the loads and thrusts of the vault structure upon four points of support by reducing the material of the "original" barrel vaults.

This is illustrated in Figure 5 , showing the intersection of two semicircular barrel vaults and how the loads are channeled down the groin intersection.

At San Jose Church, the weight of the vault at each bay, must be carried entirely on the four short pedestals (located at the springing of the vault, ie: stiltings) connected to the arcade walls and also on outside buttresses set against

these walls. These buttresses are relatively small and more like classical pilasters than any form of flying buttress of the French Gothic system.

One of the most important structural details still to be ascertained is to validate the structural actions of the barrel vaults , as described previously, and to determine the actual structural interaction of these barrel vaults with the other structural elements of the primary structure of the church. The author is planning to further this investigation to derive a better understanding of not only the structural aspects of the building , but also of the architecture and history of San Jose Church.

Conclusion

Further work on the project remains to be undertaken to properly study the structural interaction of the various elements comprising the primary structure of the church. These concerns relate to the structural interaction of the barrel vaults covering the Central Nave with the lateral Domed-Chapel and the Gothic vaults of the Transept and then in turn, with the Main Chapel's Gothic vaults of the church. This would enable to predict structural action and locate possible areas of distress to prevent damage, a very important aspect in the conservation and preservation of historical buildings.

In addition to the structural and aesthetic concerns, historical issues relevant to the culture of Puerto Rico are of primary interest to the author. After all, these were in fact , the primary forces that contributed to the realization and development of the physical aspects of the country , in particular, the city of San Juan, and to the heritage endowed by the Spaniards to the people of Puerto Rico.

References

1. Tobar, Emilio P.C.M. La Iglesia de San Jose: Templo y Museo del Pueblo Puertorriqueno, Imprenta La Milagrosa, San Juan, Puerto Rico, 1963.

2. De Hostos, Adolfo. Historia de San Juan, Ciudad Murada, Instituto de Cultura Puertorriquena, San Juan, 1966.

West Facade - San Jose Church

South Facade - San Jose Church

Figure 1. San Jose Church, San Juan, P.R.

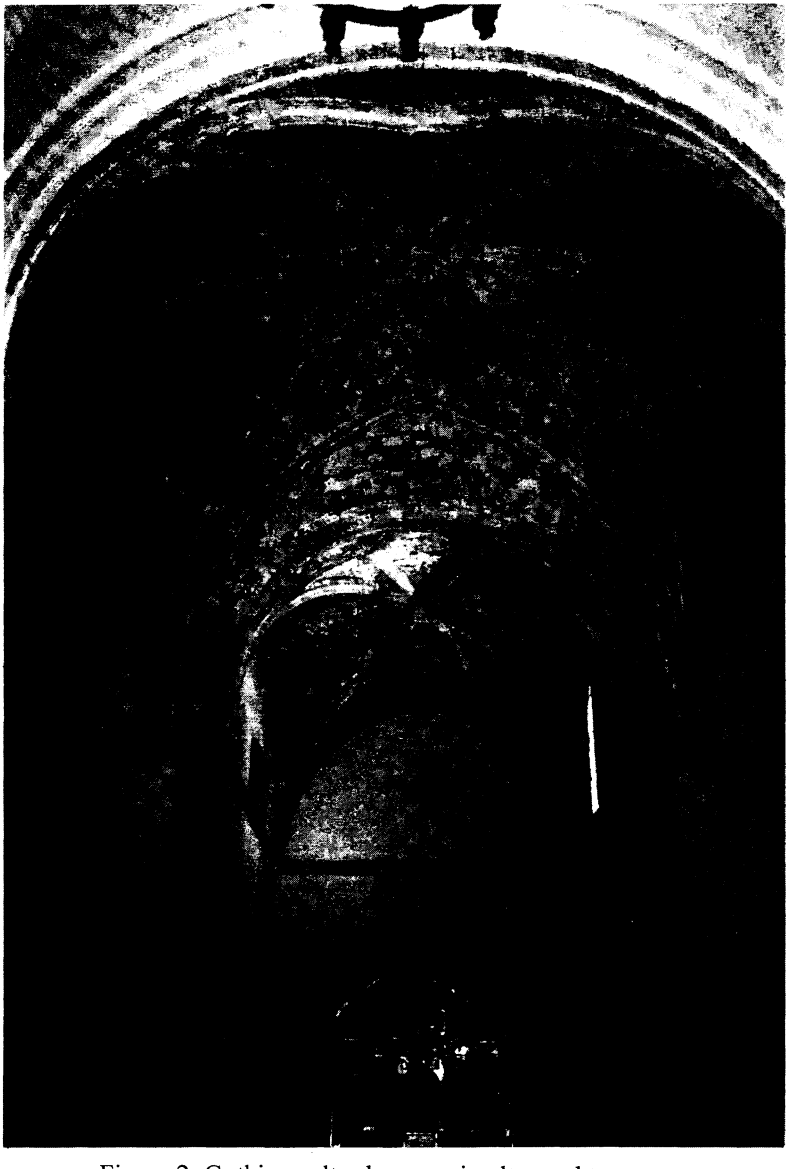

Figure 2. Gothic vaults above main altar and transept
San Jose Church

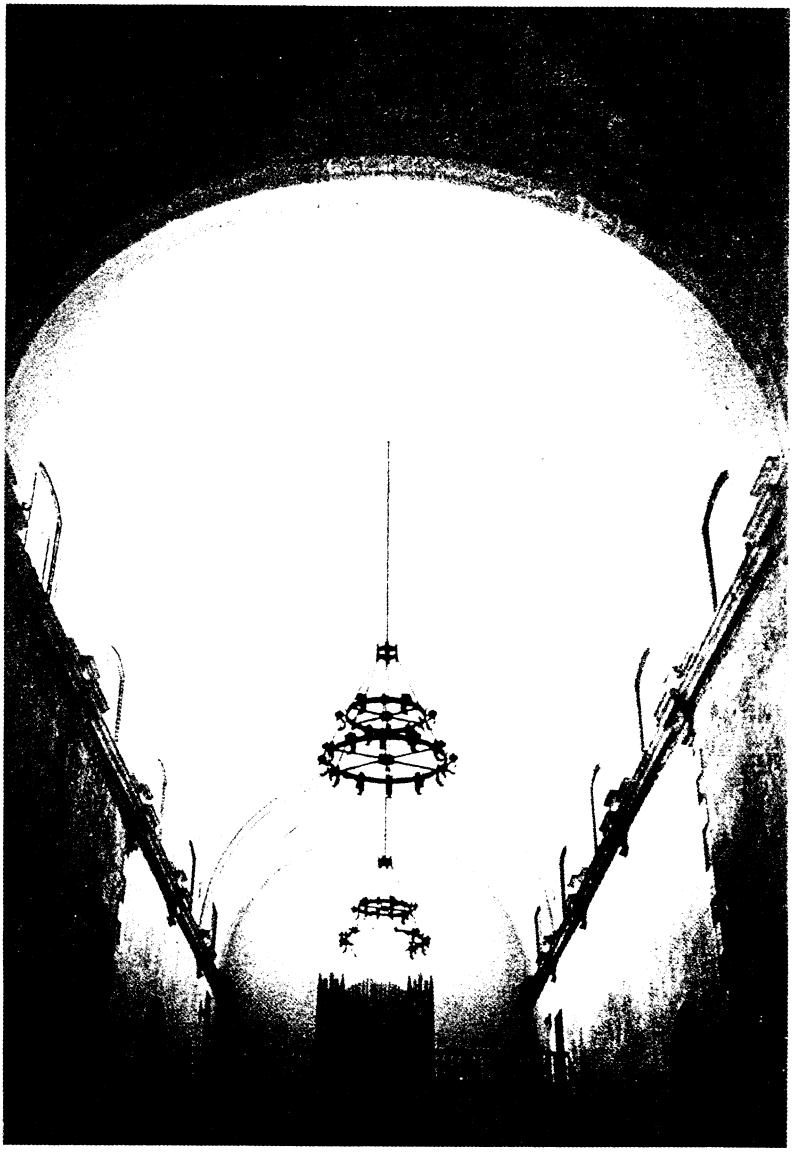

Figure 3. Barrel vaults avove central nave
San Jose Church

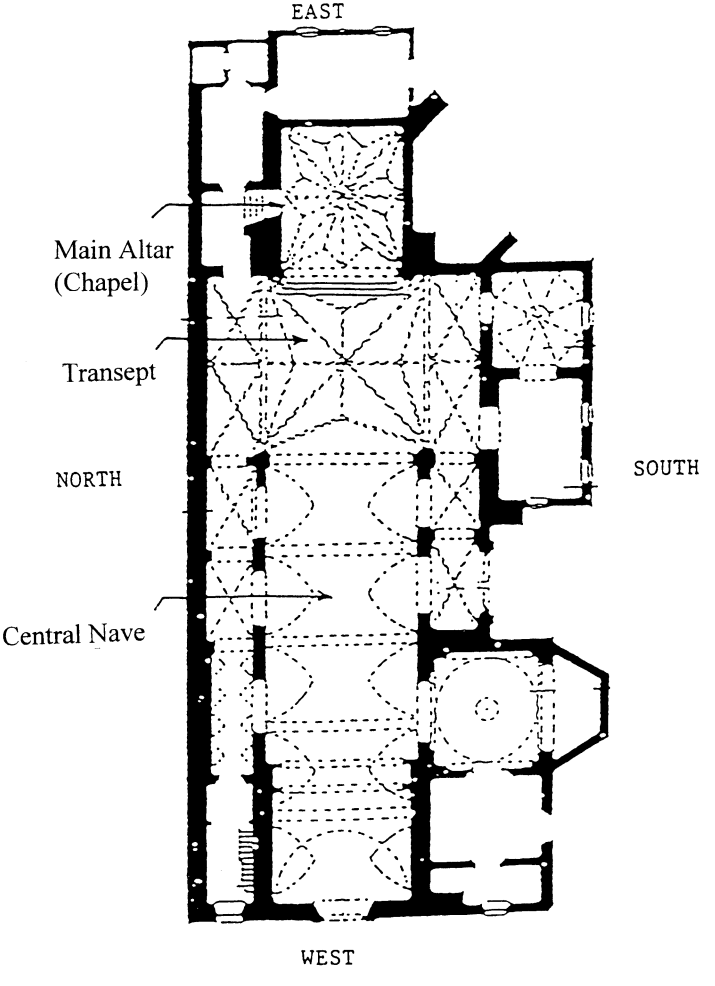

Figure 4. San Jose Church, San Juan, Puerto Rico

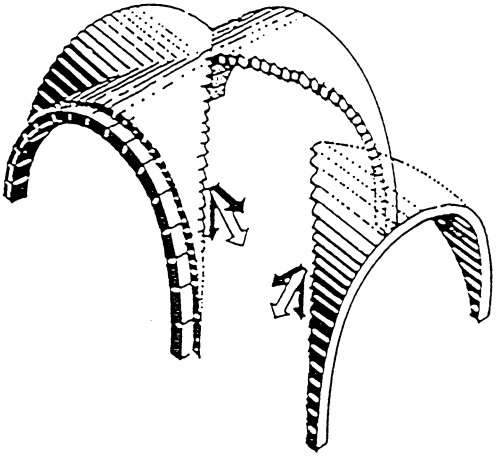

Figure 5. Cross vaults showing how loads are channeled down the groin