Special Session: Recent Conservation Research at Iglesia San José, Puerto Rico

Introduction

The convent church of San José is considered by most scholars to be one of the earliest religious structures built by the Spanish in the New World in the 16th century. As such, it is of enormous historical, architectural and religious significance at the local, regional and international levels. Located within the original walled city of Old San Juan, a UNESCO World Heritage site, the monastery and church complex display four centuries of architectural design and masonry traditions including extraordinary Isabelline Gothic vaults of Catalan double shell construction. This dedicated session of papers presents new research in the recent and on-going investigation and preliminary conservation of the convent church and the 17th century Capilla de Nuestra Señora (la Virgen) del Rosario.

Session Track: Iglesia San José: Restoration of a 16th Century Church
Session Code: CS16a
Paper: New Research at Igelsia San José, San Juan, Puerto Rico: Historical, Architectural, Archaeological and Structural Investigations
Presented by
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Beatriz del Cueto, FAIA, Pantel, del Cueto & Associates, Guaynabo, Puerto Rico; and Edmund Meade, P.E., Robert Silman Associates, P.C., New York, NY, USA

Abstract - Paper 1: *New Research at Iglesia San Jose,San Juan, Puerto Rico:Historical, Architectural and Archaeological Investigations - Beatriz del Cueto and Agamemnon Pantel*

The Iglesia San José Church was constructed from 1532 to 1735 by the Dominican Order of the Catholic Church as part of the order's monastery complex in Old San Juan, Puerto Rico. Over four centuries of harsh climatic exposure, deferred maintenance, and aggressive restoration have all shaped the present building. Its recent closure to the public, approximately ten years ago, resulting from unsafe conditions, has led to a complete study and re-evaluation of this major architectural and religious landmark. The structure was systematically surveyed between the years 2004-2006 to document and assess the condition of its fabric utilizing a range of investigative techniques. The application of Ground Penetrating Radar (GPR) across the entire floor of Iglesia San José was utilized in conjunction with GPR Slice software to determine the existence of physical evidence of building campaigns and modifications to the temple through time. This data, together with the historical and architectural analysis of the building, have led to new insights into the evolution of the church, and helped to pinpoint some of the causes of the present-day conservation issues. The conservation issues of Iglesia San José have presented unique problems due to the complex evolution of the building. Its multiple and sustained expansions, stabilizations, repairs, and retrofitting have resulted in a series of construction episodes which utilized Old World templates but modified them to local materials, workmanship and climatic conditions.

Abstract - Paper 2: *Technological Transfer from the Late Antique and Medieval Mediterranean Architecture to the New Word – Arturo Zaragoza Catalan*

Gothic architecture, in its development in the coastal countries of the Mediterranean between the 13th and 14th century, marks considerable formal and structural differences with that which was constructed in central Europe. Historical research shows how the novel techniques and formalities of northern France reached the Mediterranean in the 13th century, inserting themselves in the powerful local construction traditions. They gave way to a mixed art, which, perhaps, only in our time, are we in a position to appreciate. Some of these techniques, which have their origin in the first millennium of our era, arrived early in the New World. One should not be surprised to find the mediaeval and Mediterranean ceramic vessels in Puerto Rican roof vaults; the old Roman system of diaphragm arches in the Yucatan and Panama; brick vaults without soffit and Byzantine tradition in Uruguay; magnificent examples of stone cutting in Santo Domingo; or, later, the brick blocked vaults of mediaeval origin in the United States of America. All of these techniques had very diverse origins. Some of them as brick vaults without soffit and the naves of diaphragm arches were born out of a need to conserve wood. It should be remembered that this is a scarce product in the Mediterranean.

The constructive systems which arrived in the New World by cultural tradition, but lacking a logic in their adaptation to the land eventually disappeared. Others, such as the brick blocked vaults, had their surge in 16th century Europe by nature of their fire resistance. It should be remembered that after the terrible and unforgettable fire in the general hospital of Valencia in 1545, the new building was constructed of fire-proof materials. Over four hundred years later, the same techniques, and for similar reasons, realized their expansion in the New World. The methods of construction in which we have fundamentally based our presentation are three: the naves of diaphragm arches, the transept vaults and mortar lightened with ceramic vessels and brick vaults.

Abstract - Paper 3: *The Structural Aspects of Stabilizing and Restoring Iglesia San Jose, San Juan, Puerto Rico* - Edmund P. Meade, P.E.

Iglesia San Jose is built of unreinforced masonry. The construction detailing includes load bearing masonry walls, gothic stone ribs and vaulting, brick and clay barrel vaulting, and the use of hollow clay pots as the structural infill between the ceiling vaults and the exterior roof surfaces. This use of hollow clay pot has only been demonstrated on one other building in the New World. This Old World construction technique on a church in the New World has created interesting challenges for the structural preservation of this building. Our presentation will discuss our investigative techniques and our findings to date.

The structural work on the church began in the Fall of 2002. The first phase of work called for the identification of any immediate hazards that may be present (such as sections of the stone vaulting that needed to be secured). The next phases included determining the best steps for temporarily stabilizing the ceiling of the north and south transepts, the large stone arches that flank the main dome, and the apse; these elements of the church were in the poorest condition. This work included the installation of temporary shoring and bracing and scaffolding that rose from the ground level up to the underside of the church ceiling. The shoring was designed to support the dead loads of the roof and ceiling if original structural elements were to fail.

Our presentation will focus on the efforts to stabilize and investigate the condition and the construction detailing of the church. This work included non-destructive evaluation of various

interior and exterior structural elements, the selective and careful probing of several ceiling and roof sections, and the careful measurement of the building.

Subsequent phases of our investigation and analysis will include the completion of laser dimensional surveys of the church and the installation of electronic monitors (that will measure the movement of select portions of the church). Our presentation will briefly outline the future phase of creating of our structural models of the building (using the results from the laser surveys and our computer analysis software), the identification of those areas of the building that are expected to be experiencing high levels of structural distress (either in the form of higher than allowable material stresses or greater than acceptable amounts of displacement), and the review of these results with the actually documented areas of distress and the recorded amounts of movement (including the review of the data from the electronic monitoring equipment).

The goal of the project team and the Owner is to provide the best long-term structural and architectural repairs to this international architectural landmark. This presentation will focus on our stabilization and investigation efforts to achieve this goal.

The Rosario Chapel, Session Codes: CS16b and CS16c

The conservation study of the 17th century Capilla de Nuestra Señora del Rosario required a coordinated effort of laboratory and field research: a detailed digital condition survey executed in AutoCAD and GIS, an examination and technical analysis of the various interior dome paintings, and a performance-based investigation of the brick dust renders on the dome as a viable material for its restoration and water-proofing. Once completed, these studies led to the development and implementation of an emergency treatment program focused on the stabilization of the detached mural paintings and the weatherproofing of the exterior dome. Analysis of the interior plasters revealed an extremely high ratio of brick dust to lime, rendering the plasters weak and susceptible to moisture, leading to detachment and collapse. The later application of membrane roofiing over the traditional exterior argamassa skin of the dome created serious moisture retention within the dome masonry and threatened the mural paintings. Emergency treatments included the combined use of hydraulic lime grouts and thickened acrylic dispersions to re-secure the detached and delaminated interior plaster. Finally through the compilation of historical recipes and analysis of samples from documented buildings in Puerto Rico, samples of the argamassa were laboratory tested and mock-ups installed on the dome of the chapel. Performance evaluations will be conducted after one year on both the interior and exterior of the dome in preparation for full-scale restoration of the Chapel.

S**ession Track:** Iglesia San José: Restoration of a 16th Century Church
Session Code: CS16b
Paper: Investigation, Analysis and Emergency Treatment of the Dome Murals of the Capilla de Nuetra Señora del Rosario
Presented by
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Abstract
During the course of investigation of Iglesia San Jose a complex series of mural paintings in the dome of the Capilla de Nuestra Señora del Rosario dating from the 17th to 20th centuries were discovered. To date these are believed to be among the earliest surviving large-scale mural paintings in the Caribbean. The primary objectives of this investigation were to: document existing painting campaigns, establish a chronology of paintings through analysis of materials and techniques, evaluate the conditions of the paintings, determine possible deterioration mechanisms, and propose and implement recommendations for their conservation and interpretation. In-situ documentation including ortho-recified color digital photography and mapping of the plaster conditions and visible painting campaigns in AutoCAD and ArcView were conducted, followed by a materials analysis of substrates, binders, and pigments. Test methods included gravimetric analysis and XRD of plasters, polarized light microscopy of paint layers, EDS analysis of pigments, and FTIR analysis of binders.

The results of this study found six distinct mural campaigns and established a chronology which attributed painting phases to the Dominican, Jesuit, and Vincention orders of the Catholic Church. Substrate analysis revealed a lean plaster mix in the preparatory layer as an intrinsic cause of

failure, further aggravated by continued water infiltration. Water ingress has created an environment where chloride salts and biological growth are contributing to paint failure and detached and falling plasters. Emergency treatments were implemented using hydraulic lime grouts and acrylic dispersion adhesive injections to reattach the plaster substrate as the interior was gradually dried.

Session Track: Iglesia San José: Restoration of a 16th Century Church
Session Code: CS16c
Paper: Argamasa Applied as a Water-Resistent Masonry Surface Finish on the Dome of the Capilla de Nuestra Señora del Rosario

Presented by
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Jill Verhosek, Graducate Program in Historic Preservation/University of Pennsylvania, Philadelphia, PA, USA

Abstract
The ornamented dome of the Capilla de Nuestra Señora del Rosario was found to retain evidence of a hydraulic brick dust render known as argamassa; Roman technology perpetuated by the Spaniards and brought to the New World where it proved highly effective in the wet tropical climate of the Caribbean. The primary objective of the research was to analyze the composition and evaluate the properties of argamasa in order to determine its potential use as a restoration material. In order to properly characterize and assess the performance of the material, the investigation included: historical research of the material's use and function, an analysis and evaluation of existing samples, and material fabrication and laboratory testing.

Traditionally, layers of argamasa were applied like stucco to the exterior of the masonry dome, which provided protection against a harsh tropical climate. This building technology, dating back to Ancient Rome, was eventually replaced with modern impervious roofing materials visually and physically incompatible with the church. At present, the deterioration of contemporary surface membranes has exposed the masonry substrate making it susceptible to moisture infiltration, salts, biogrowth, and pollutants. The reintroduction of traditional materials would improve the current conditions of the chapel, facilitate the re-establishment of historical appearances, and potentially revive an almost forgotten building technology.

Historical research of the material, the analysis of existing argamasa, the availability of local building materials, and the identification of optimal performance properties provided the necessary framework in developing a testing program to assess the critical characteristics of argamasa. Based on historic formulations, samples were fabricated according to standardized tests, cured over a 28-day period, and were tested and evaluated in the non-cured state for various physical, chemical, and mechanical properties including: flow, stiffness, shrinkage, cracking, carbonation depth, and early splitting tensile strength. Early data yielded satisfactory results when compared to control samples without crushed brick. A complete assessment of the performance of argamasa will be conducted once testing is completed in future phases of research.