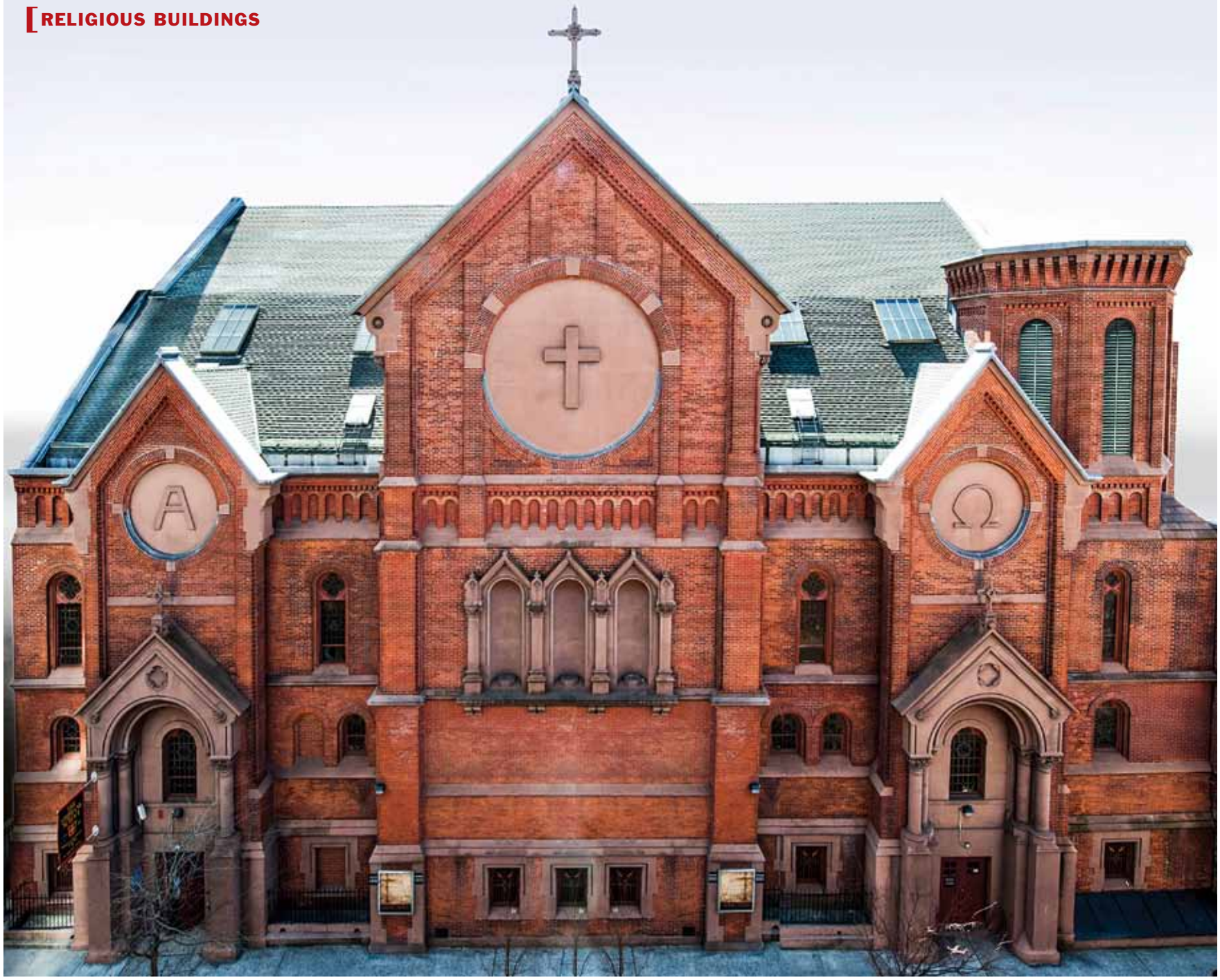

Plaster Consolidation

St. Stephen's Church in New York City, home of tromp l'oeil murals by Constantino Brumidi, is once again a safe haven, thanks to plaster consolidation and testing of the ceiling. **By Neal Mednick, Historic Plaster Conservation Services**

THE CHURCH OF OUR LADY of the Scapular & St. Stephen, known as St. Stephen's Church, is a Roman Catholic parish church located in Manhattan, New York City. Built in 1854, the church was designed by noted architect James Renwick Jr. who also designed St. Patrick's Cathedral and Grace Church.

The church features extraordinary paintings and tromp l'oeil murals by Constantino Brumidi, the Italian-American historical painter renowned for his work in churches and best known for his frescoes in the Capitol Building in Washington, D.C.

"Brumidi is one of the most important artists in American history," says Joe Grano, chair of The Constantino Brumidi Society. "His masterpiece, in the dome of the Capitol building, 'The Apotheosis of Washington,' may be the most widely viewed work of art in the country, seen by nearly three million people every year." Grano is lobbying the U.S. Postal Service to have a 2015 stamp made in Brumidi's honor, commemorating the 150th anniversary of the fresco painting of the "Apotheosis in Washington." In 2008, the Society also successfully lobbied Congress to award Brumidi, posthumously, the Congressional Gold Medal, its highest honor for civilian achievement.

Born and raised in Italy where he showed talent for fresco painting at an early age, Brumidi painted several Roman palaces and worked in the Vatican for three years. After the occupation of Rome by France in 1852, he immigrated to America and became a naturalized citizen in 1857. His first commissioned job in the U.S. was at St. Stephen's Church where he painted the "Crucifixion, a Martyrdom of St. Stephen" and an "Assumption of Mary."

"While Brumidi's paintings in St. Stephen's Church may not be as famous as his works in the Capitol, they remain extraordinarily powerful and undeniably important masterpieces," says Grano. "Every time I view the 'Crucifixion,' I want to get down on my knees."

Over the years, the church's 22,000-sq.ft. rib-vaulted wood lath and plaster ceilings became compromised, in part due to localized water infiltration and the ongoing transmission of moisture through the plaster. In 2005, the church was closed and an effort was made to stabilize the ceiling with a treatment application, reportedly based on an acrylic adhesive formula introduced in the 1980s by the late Morgan Phillips. For reasons that are uncertain, however, this particular treatment proved unsuccessful, and in May 2011, a section of the plaster ceiling collapsed. Out of concern for public safety, the church was again closed.

St. Stephen's church in NYC was designed by James Renwick, Jr., and built in 1854. All photos: Robert Watson

The Plaster Assessment

Shortly after the collapse, John Tiedemann Inc. (JTI) was called upon by Dave Maddox and Bram Hillegers, representing the Archdiocese of NYC, and project architect Arthur Sikula of Arthur John Sikula Associates, to inspect the ceiling and assess its condition. JTI has been restoring and preserving the interior of historic buildings, particularly churches, for more than 50 years.

Due to the collapse of ceiling plaster, the first phase of the assessment focused on identifying any additional parts of the ceiling that could pose a threat to public safety. This assessment involved the use of the JTI telescopic boom to facilitate a hand test of both the surface of the plaster and the hundreds of ornamental ribs that criss-cross the ceiling. The examination revealed some ribs in danger of falling. These were secured with mechanical straps. It is expected that permanent restoration of these decorative elements will occur at some time in the future.

The second phase of the assessment involved a thorough examination of the attic side of the ceiling, with gentle pull testing of the plaster keys and lugs to determine the extent to which they were friable and whether or not they were performing their designed task (i.e. holding up the ceiling). The assessment concluded that the plaster had not been remediated in 2005 and that the entire ceiling system was experiencing ongoing deterioration, with many of the plaster keys and lugs either broken or crumbling. It was apparent that the integrity of the ceiling was seriously compromised.

Following the second phase of the assessment, JTI's Ray Tiedemann asked Rod Stewart of Historic Plaster Conservation Services (HPCS) to design the scope of work required to stabilize the ceiling. HPCS has been consolidating plaster ceilings in heritage buildings for 25 years, employing its own new products and specialized tools that dramatically advance the Morgan Phillips approach.

At the outset, the project posed a unique and difficult challenge. The ceiling was in a terrible state of dilapidation similar to its 2005 condition but made worse by the presence of a sticky coating of resin drizzled all over the attic side. In short, the treatment in 2005 did not penetrate the plaster but instead left a large area coated in an impervious resin, which would prevent the HPCS consolidation and restoration products from gaining access to and infiltrating the plaster.

To address this problem, HPCS recommended using a Fein MultiMaster oscillating saw to cut every second plaster key and lug throughout the coated area. The purpose of this was to expose enough cross-sectional area of raw plaster to allow the consolidation products to thoroughly penetrate. No additional losses of plaster occurred from the cutting of keys and lugs. JTI carried out this difficult work.

After the keys and lugs were cut, the ceiling was treated with a variety of HPCS products designed to adhere the plaster to the wood lath substrate. This treatment effectively converted the ceiling from being a mechanically suspended system to an adhered system.

One of the critical challenges to plaster consolidation is ensuring that the product applications provide the strength required to adhere the ceiling for the long term without limiting the ability of the plaster to move in concert with the micro-movements of the building structure. If the ceiling is too rigid, the building's micro-movements will cause cracks. The HPCS consolidation and restoration products are specifically formulated to achieve this vital combination of strength and flexibility.

There were three main aspects to the treatment procedure, each involving HPCS plaster conservation products:

- Applying three increasingly concentrated solutions of CO F-20 Primer & CO F-50 Primer, and CO R-100 Consolidation Agent in such a way as to feed the materials into the plaster matrix;
- Replacing broken and sawed-off keys and lugs with AD Premixed Plaster Lug and Key Replacement; and
- Applying GR Non-Shrink Premium Plain Face Plaster Grout to fill space or voids created when the plaster had fallen away from close contact with the wood lath and could not be raised. GR Non-shrink was selected to prevent the stress that typically occurs with the shrinkage of normal adhesives.

JTI carried out all of the consolidation work, which took five months to complete.

Testing the Plaster Consolidation

Given the previous unfortunate experience of an expensive and failed plaster treatment in St. Stephen's Church, the professionals responsible for the building understandably required an independent third party to verify that the JTI consolidation program had achieved the program's objective. Sikula thereby commissioned Dean Koga of Building Conservation Associates (BCA) to develop and execute a protocol for testing the work.

The protocol was designed to evaluate the strength of the bond between the plaster and the wood lath. The testing was performed on December 13 and 14, 2011 by Ken and David Follett of Quality Restoration Works (QWR). Msgr. Lawrence Connaughton, pastor in residence at St. Stephen's, Sikula, Koga and Tiedemann observed the testing.

Above: Brumidi's first commission in the U.S. was at St. Stephen's Church where he painted the "Crucifixion, a Martyrdom of St. Stephen" (shown here) and an "Assumption of Mary."

Right: Weights were hung from the ceiling at St. Stephen's to test the strength of the plaster after it was consolidated.

The tests involved hanging increasing weight from the plaster ceiling. In total, six locations were bond tested, with a test-to-failure conducted at one location.

At each test location, a 9x4-in. rectangular section of plaster was isolated from the rest of the plaster ceiling by cutting through to the lath. A hook arrangement was attached to the isolated rectangle. The operating assumption was that the isolated plaster would act as a coherent plate and that the force of the load would be uniform across it.

The design load for a successful test was determined to be 30-lbs. per square foot (psf), which represents the weight of the plaster (5 psf) plus a safety factor of five times.

The results of the bond testing were as follows:

- Five test locations supported loads ranging from 33.8 psf to 39.5 psf – all well above the safety factor, indicating that the treatment program had succeeded in adhering the plaster to the wood lath.
- The test-to-failure location finally gave way at 188 psf, demonstrating that the adhered plaster has high integrity.
- All six tests significantly exceeded the success threshold criteria.

The procedure and testing results were presented to the 2012 APTI/PTN Conference in Charleston, SC, by Koga and Ken Follett in a joint paper titled, "Field Testing Acrylic Adhesive Plaster Repairs."

With the stabilization of the plaster ceiling complete, St. Stephen's Church is now ready for the next phase of restoration, involving the permanent reattachment of the decorative ribs, plus repairs and re-painting of surface plaster. The great works of Constantino Brumidi live on. **TB**