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CONCRETE REPAIR BULLETIN

September/October 2025 Vol. 38, No. 5

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September/October 2025

Vol. 38, No. 5

International Concrete Repair Institute  
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Saint Paul, MN 55114

ON THE COVER: Learn more about using sandwich FRP products on page 29. Photo courtesy of QuakeWrap Inc.

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*Fig. 1: Charleston County Courthouse as viewed March 2025, after rehabilitation, from the steeple at St. Michael's Episcopal Church on the corner of Broad and Meeting streets.*

# PRESERVING THE PAST:

## RESTORATION OF THE 18TH CENTURY CHARLESTON COUNTY HISTORIC COURTHOUSE

BY DAVID G. TEPKE, KALEN MCNABB, NEAL FRASIER, DIPAYAN JANA AND PAUL WOOD

### Introduction

The Charleston County Historic Courthouse is located in the historic district of Charleston, South Carolina, on the corner of Meeting and Broad streets as part of what commonly is known as the “four corners of the law” (Fig. 1). It was constructed between 1788 and 1797 using the remains of the exterior first-floor walls and foundations from the South Carolina Provincial Statehouse (constructed 1753-1760) that was mostly destroyed in a 1788 fire.<sup>1</sup> Occupied for official business by 1792 after being “sufficiently complete,”<sup>1</sup> the three-story mass masonry building is clad with scored stucco and includes four major architectural stucco-clad engaged masonry columns. It serves as an important historic landmark and functions still today as both a tourist attraction and courthouse for official business. This article discusses key aspects of assessment, design and exterior restoration completed between 2018 and 2024 to address safety concerns and implement historically sensitive repairs for preserving the Historic Courthouse.

## Owner Motivation for Evaluation and Restoration

Charleston County Facilities Department is faced with safety, preservation, environmental resilience and architectural responsibilities in maintaining its structures on the lower Charleston peninsula. As the area is a popular tourist destination with older buildings adjacent to sidewalks, prevention of falling façade components posing potential safety hazards is of critical importance. Charleston is in an area prone to hurricanes and flooding while additionally being located in a high seismicity zone with structurally questionable surface soils. Moreover, close proximity to the coast with warm, humid, salt-laden conditions promotes and hastens natural deterioration. Due to historic significance and a desire to preserve the overall aesthetic, building maintenance projects in the lower peninsula must undergo review from the City of Charleston and Charleston Board of Architectural Review (BAR). For the most significant historic structures, such as the Courthouse, local preservation organizations and the South Carolina Historical Society may also provide guidance and input. Integration of stakeholders and consultants with various experience is crucial for successful projects.

Throughout its nearly 250-year existence, the Courthouse has experienced natural disasters, transformations, and repair and restoration projects that have shaped its current state (Fig. 2). Since the large renovation project in 2000 to bring the Courthouse back to its 1792 appearance, the county observed progressive deterioration in the façade, including spalling stucco, corrosion of inserts and coating failures (Fig. 3). Numerous hurricane protection anchor points, critical to protection systems deployed annually or more frequently, had failed. While public safety is of primary concern to the county, Charleston County Facilities Department is also responsible for preserving the aesthetic and function of the Historic Courthouse for the benefit of current and future generations. Thus, the county sought an

assessment focused on safety, aesthetic quality and water management with consideration for the historic nature of the building and adherence to preservation guidelines approved by the BAR. ASTM E2270, *Standard Practice for Periodic Inspection of Building Facades for Unsafe Conditions*<sup>2</sup> covers periodic inspection of façades for unsafe conditions. Although this standard has not been adopted by code or ordinance in the City of Charleston, the county proactively saw benefit in its use as a guide for reviewing this critical structure and requested provisional implementation as part of the assessment.

## Assessment

### Archival Review and Local Stakeholder Input

Multiple sources were found in the archives to piece together historical timelines, significant events, previous repair and alteration approaches, and human interests. Documentation from the owner, Charleston County, as well as information from the Library of Congress, Preservation Society of Charleston, Charleston BAR, Historic Charleston Foundation, books by historians, and previous preservation reports were studied and considered. These included letters, plats, submittals, drawings, preservation and architectural reports, photos and other information, as broadly represented in Figure 4. Materials samples also were found in

the archives, along with documentation on previous materials testing that classified building components. Anecdotal information obtained from curators and local stakeholders, as well as that documented in archives, was useful in appreciating the value and significance of the structure. These documents, in combination with Historic Preservation Briefs, city guidelines, feedback from the BAR and city architects, formed the basis for preservation and helped shape the development of the investigation and repair approach.

Because excavations and material sampling were proposed, approval of the investigation plan and extraction locations was required by the BAR. Early in the process, it became apparent that inclusively involving stakeholders in the process would be a vital part of preservation due to the importance of the structure to the city and its residents. For this project, numerous meetings were held on-site with city architects, and comprehensive presentations were made to the BAR to receive feedback on the approach. Members of local preservation societies were engaged for input. The design team was assembled to include firms with expertise in materials, local historic preservation, structural repair and service-life extension. Throughout the project, an approach of open dialogue was encouraged.

### Summary of Test Methods and Assessment Plan

A façade inspection was conducted using authorized portions of ASTM E2270 Sections 9 and 10. Archives provided a large volume of information that was used as a basis for planning the assessment. Both site and laboratory testing were necessary for confirming material characteristics, evaluating the mechanisms and extent of current distress, and evaluating for the possible presence of hazardous materials. Further, coating distress observed at the Courthouse was not easily explained by the archival information that indicated use of a breathable, compatible coating system. Ten stucco cores and a limited number of other

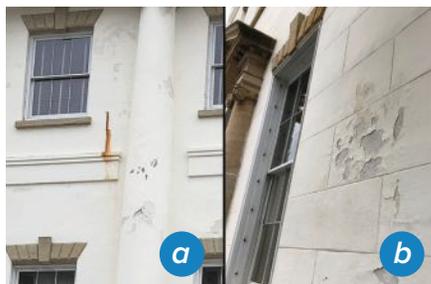


Fig. 3: (a) Examples of stucco, coating and corrosion distress and (b) close-up of coating distress that motivated the county to commission the assessment and evaluation.

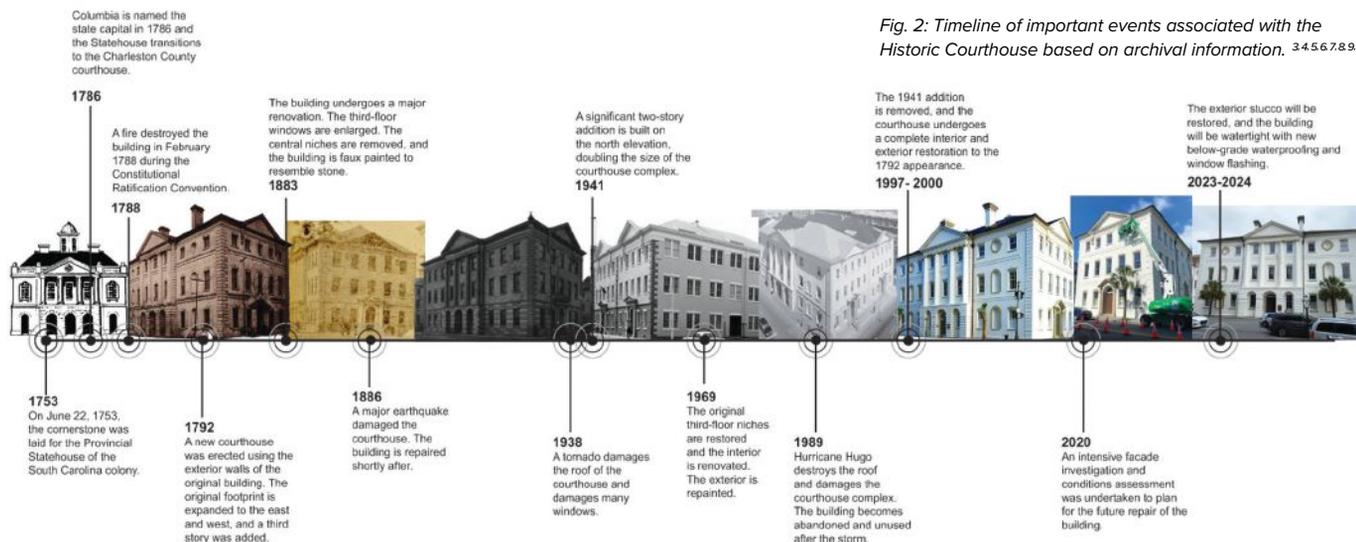


Fig. 2: Timeline of important events associated with the Historic Courthouse based on archival information. 3,4,5,6,7,8,9,10

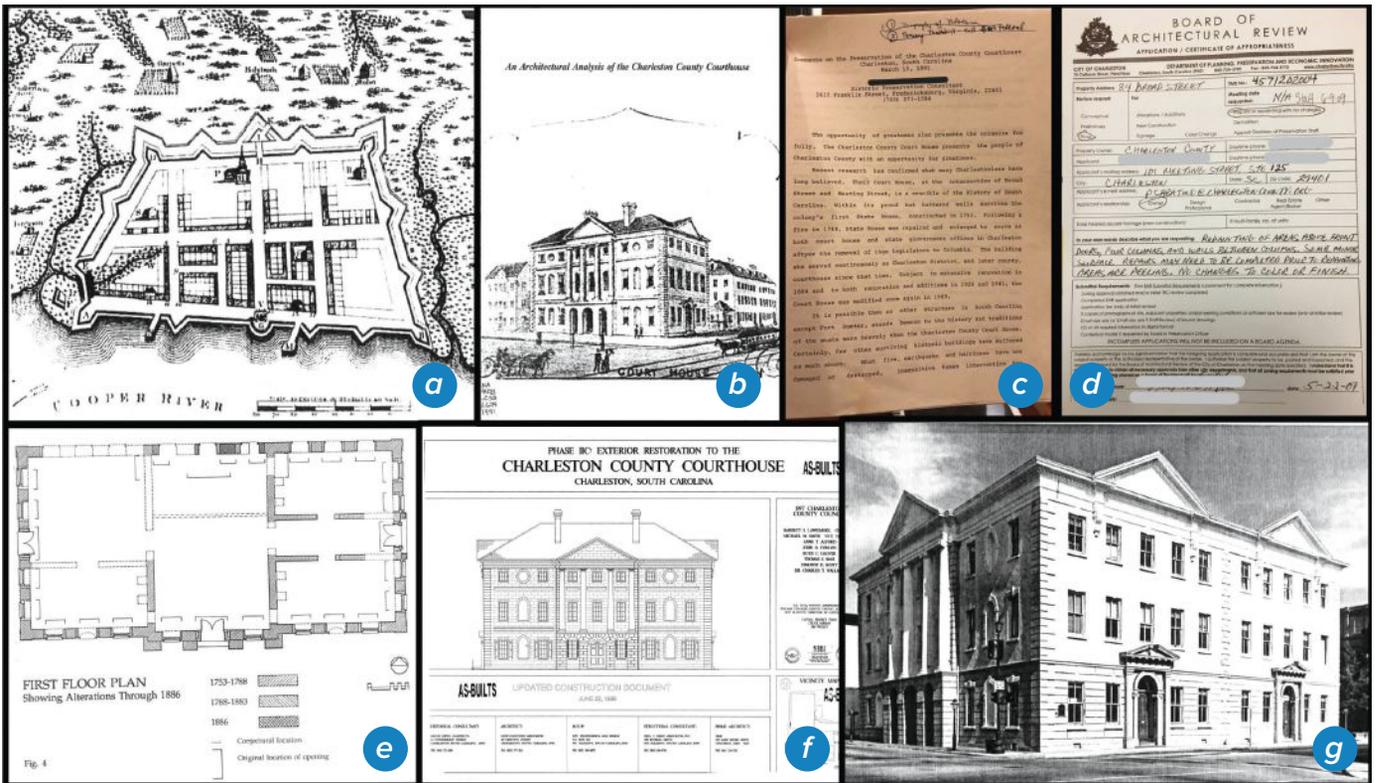


Fig. 4: Representative examples of drawings, schematics, letters, renderings and reports retrieved from archives: (a) plan of Charles Town from a survey by Edward Crisp in 1704 as presented in reference <sup>1</sup>, (b) report cover from reference <sup>11</sup>, (c) example of letter regarding previous repair<sup>12</sup>, (d) example of previous Architectural Review Board submittal,<sup>12</sup> (e) figure in reference <sup>1</sup> with historical alterations, (f) cover sheet of design documents from circa 1997 restoration project<sup>12</sup> and (g) photo of the Courthouse after 1941 addition as obtained from reference <sup>1</sup>.

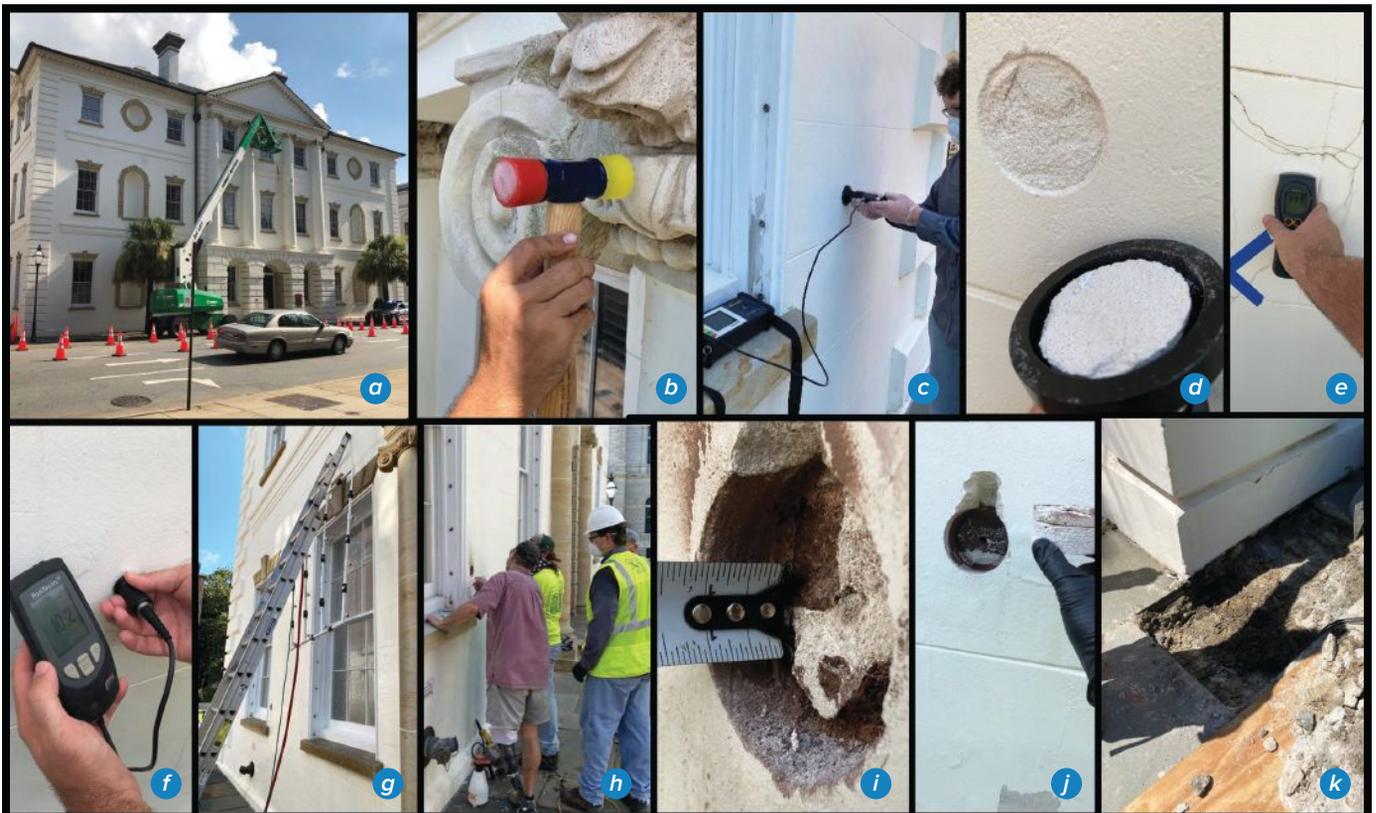


Fig. 5: Site testing: (a) general overview of assessment, (b) sounding of surfaces, (c) coating adhesion testing, (d) coating adhesion testing failure mechanisms, (e) radio frequency moisture testing, (f) coating thickness testing, (g) window leak testing, (h) surface review, (i) measurement of stucco thickness, (j) core sample and (k) below-grade excavation.

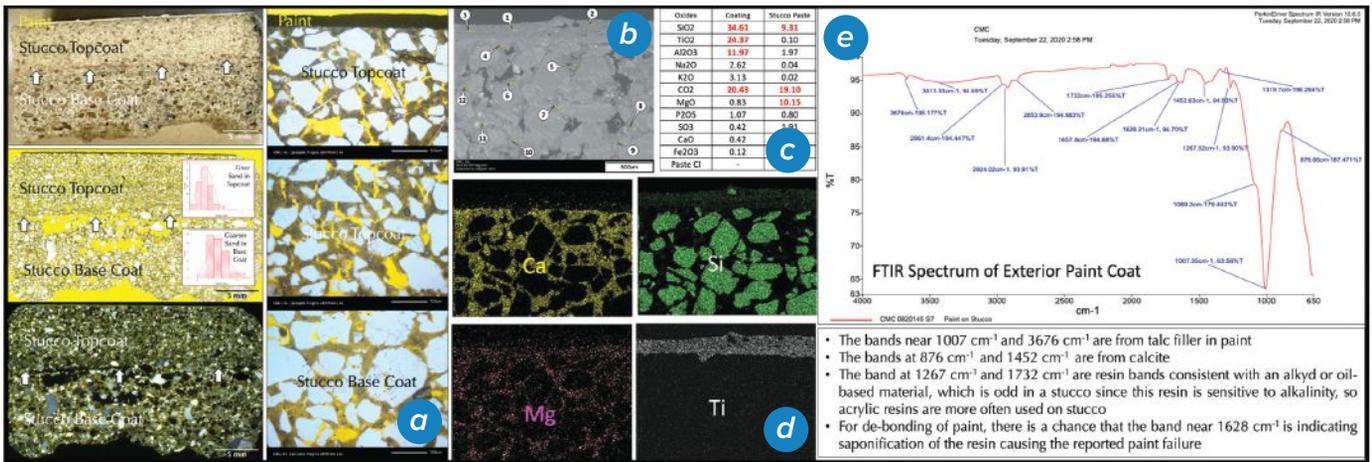


Fig. 8: Examples of analytical images and data representation: (a) sawcut and thin sections, (b) backscatter electron image, (c) x-ray elemental oxide compositional analysis of paste and coating, (d) x-ray elemental maps, and (e) FTIR spectra of paint coating removed from stucco.



Fig. 6: Identified stucco and coating distress, and test locations.

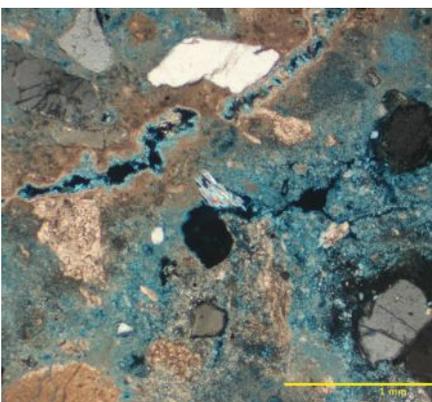


Fig. 7: Cross-polarized light image of the 18th century foundation bedding mortar containing oyster shell, quartz sand and carbonated lime grains.



Fig. 9: Courthouse, as photographed in 2024 with screening during restoration.

samples were extracted for materials testing. Nondestructive testing by sounding was conducted on representative portions of the façade, with nonmetallic hammer and water testing implemented on selected windows. Façade coatings and stucco conditions were evaluated using physical thickness measurements and nondestructive ultrasonic coating thickness testing, radio frequency moisture detection as generally described in SSPC-Guide 23,<sup>13</sup> and tensile bond strength testing in general accordance with ASTM D7234.<sup>14</sup>

A mortar sample was evaluated per ASTM C1324,<sup>15</sup> and multiple coated stucco samples were evaluated per ASTM C856<sup>16</sup> and other advanced analytical techniques. A below-grade excavation was also conducted to investigate any previous waterproofing and conduct further masonry testing. Supplemental hazardous materials testing by an environmental subconsultant revealed no asbestos or lead in the areas planned for restoration. Figure 5 shows photos representing site testing and sample procurement.

**Site Observations and Sampling Locations**  
Coating distress was largely observed at mass masonry substrates and where previous patches were installed and moisture levels were elevated. A previously repaired area with reinforced masonry substrate displayed significantly less coating distress, likely due to implemented modern waterproofing practices.

Stucco delaminations were located by sounding with a nonmetallic hammer per recommendations in Preservation Brief 22.<sup>17</sup> Delaminations believed to be in danger of detachment were removed by the assisting contractor during the investigation. Like the coatings, stucco delamination was most readily identifiable where mass masonry substrate exists, where portland cement patches were previously installed, and where elevated moisture levels were detected. Variable stucco thickness was identified across each elevation and was confirmed via cores. Figure 6 shows observed coating and stucco distress, as well as sampling locations for coatings and laboratory analysis.

### Analytical Laboratory Testing on Stucco, Mortar and Coatings

Petrographic analysis was conducted on a foundation bedding mortar sample, identifying the mortar as an oyster shell lime typical of 18th century Charleston construction. Petrographic findings correlated with archival resources to indicate that the Provincial Statehouse foundation was reused for construction of the Historic Courthouse.

Cores from all sampling locations verified archival and project record data by displaying a specific and unique chronology of repairs across all core samples. Specifically, traces of the original 19th century stucco were retained at the base of the samples, showing that the original render had been removed during earlier repair campaigns. The 2000 restoration stucco was well represented in each core, and the composition approximately matched the original project specifications. Figure 7 shows an example of cross-polarized light image of embedment mortar.

### Analytical Laboratory Coating Testing

Cores through coatings and full depth of stucco from distressed and sound locations were examined by analytical techniques including optical and electron microscopy and microanalyses, X-ray fluorescence spectroscopy (XRF) and X-ray diffraction (XRD) for respective chemical and mineralogical compositions of stucco, gravimetry and thermal analyses of stucco, and Fourier-transform infrared spectroscopy (FTIR) to study coatings. Representative laboratory images are shown in Figure 8.

Testing showed an alkyd resin-based paint containing titanium oxide pigment and talc filler and underlying two lime mortar layers of crushed silica sand (of noticeably different sand fineness in two layers) and dolomitic hydraulic lime having total stucco thicknesses ranging from 5/8 to 7/8 inch (16 to 22 mm). Alkyd components within the coatings are well-known to be susceptible to deterioration when used on cementitious materials in the presence of moisture. Evidence was identified for three potential causes for coating failures.



Fig. 10: Coating removal mock-up to demonstrate removal method: (a) overview of test areas and (b) surface after removal with minimal stucco damage.

1. Application of a pH-sensitive alkyd resin-based paint coat on a lime mortar base. FTIR studies found evidence of possible saponification of resin as a potential cause for peeling from the substrate.
2. Possible soft and dusty lime-based substrates with associated poor coating adhesion.
3. Potential excessive drying shrinkage from noticeably finer crushed silica sand in the stucco layer beneath coatings, which is seen from more severe shrinkage microcracks in that layer.

#### Recommended Scope of Repairs

After discussion with Charleston County, BAR and other interested entities, an overall approach was chosen for a more holistic repair and preservation compared to recent previous attempts of spot repairs and recoating of the stucco façade. Advice with respect to the magnitude of repairs, repairs to windows and architectural coatings was integrated from the city and its advisers. Recommendations consistent with those in the Secretary of the Interior's Standards for the Treatment of Historic Properties<sup>18</sup> were provided to the county. They included:

- Complete removal of systemically distressed coatings from the façade;
- Stucco repairs where integrity is lost per Preservation Brief 22;
- Installation of a new breathable mineral silicate-based coating to stucco surfaces;
- Repairs to windows in accordance with Preservation Brief 9<sup>19</sup>;
- Below-grade waterproofing to help mitigate contributory ground moisture;
- Replacement of failed hurricane window protection inserts; and
- Chimney repair.

#### Restoration

Restoration activities for the \$2.5 million project were conducted between December 2023 and February 2025. Scaffolding and screening were erected along the entire building (Fig. 9). The building and adjacent streets remained open, requiring sidewalk protection and dedicated entry access. Two named storms, Debbie in August 2024 and Helene in September 2024, required alteration of protection to account for high winds and heavy precipitation. Temporary removal of historic bluestone surrounding the Courthouse required meticulous identification for

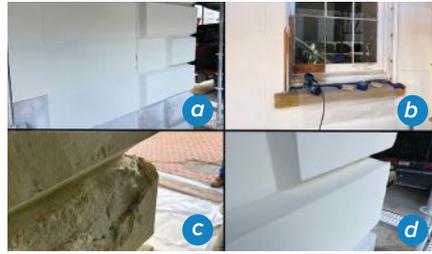


Fig. 11: Stucco and window restoration mock-ups: (a and b) overviews; (c and d) preexisting condition with severe stucco damage and demonstrated aesthetic through mock-up.

replacement after below-grade waterproofing was installed. The project required precise replacements to match existing strike lines and profiles. This was challenging given the number and shapes of quoins, niches and other architectural components.

#### Mock-Ups

County representatives, the city architect, BAR representatives, historic societies' representatives, engineers, conservators and contractor personnel attended mock-ups to confirm approaches and aesthetics. Of considerable importance to historic preservation stakeholders was minimizing replacements and limiting impact only to necessary areas and components. Chemical stripping of existing coatings was specified. However, the contractor was able to demonstrate tight control of limestone-based sandblasting with pressures carefully maintained for adequate removal and surface profiling, but minimal damage to soft stucco substrate (Fig. 10). Stucco and coating replacement mock-ups were required to demonstrate the profiling and aesthetic of the new mineral silicate coating system (Fig. 11). Heat-based and chemical-based stripping of coatings on wood windows were evaluated in the mock-up. Chemical stripping was ultimately used on the project due to ease of use and construction schedule. Mock-ups of the capital and console repairs were also carefully coordinated with the conservator, owner and product experts to select the proper repair mortar and color for the historical architectural features.

#### Site Conditions

During tactile removal and in-depth evaluation of stucco damage during construction, it became apparent that more areas included defective sublayers than originally thought based on representative testing. Although the harder exterior stucco layer was intact in many locations, softer layers beneath exhibited deterioration and powdery material with poor adherence to mass masonry substrate and poor suitability for receiving new overlying stucco. Thus, additional stucco replacement was elected, consistent with the areas of coating distress, elevated moisture and sheathing substrate such as gable roof surfaces and chimney walls.

In some locations, stucco was several inches thick, requiring reinforcement during



Fig. 12: Stucco: (a) deterioration, (b) conditions after removal to brick substrate, (c) example of reinforcement where thicker stucco conditions were encountered and (d) area after repairs. Note: Photos of similar areas.

replacement. This was particularly evident at niches and belts. Niches had significant coating and stucco deterioration with up to 8 inches of unsupported stucco, distinct layers of variable delamination and periodic portland cement-based patches. To support new stucco, intermediate layers of composite mesh were installed and fastened to threaded "U" pins anchored into the existing mortar bed (Fig. 12).

Local damage to sandstone capitals and consoles with intricate details was identified that required repair. Portions of these features are believed to date back to the 18th century construction; however, numerous repairs had been conducted with varying material color and composition. Cast repair mortars, carved sandstone replacements and molded-in-place repairs were considered. Molded-in-place repairs were selected due to the construction schedule and skilled labor available (Fig. 13).

During construction, an air gap was discovered between the window jambs and original mass masonry rough openings on the first floor. Bearing was reestablished at these locations to allow a full bearing condition for the new hurricane anchors that were installed into each window jamb.

#### Summary

A comprehensive, team-focused approach was used to evaluate safety concerns and restore the Charleston County Historic Courthouse (Fig. 14). Archival research from various sources proved helpful for supplementing field and laboratory data and gaining vital perspective on the physical evolution of the building. A thorough understanding of the building's physical history, stucco and coating distress mechanisms and current conditions allowed the owner and design team to effectively plan restoration. Challenges during construction included those associated with maintaining public access, implementing current technology while honoring historic values and minimizing impact to the building, and correction of unforeseen conditions that arose during construction. Collaboration by the owner (Charleston County), design and evaluation team (restoration engineers,



Fig. 13: Ornamental components: examples of (a) damage, (b) molded repair material after placement, (c) overview after shaving repair material and (d) close-up after repair.

material scientists and conservators), specialty contractor, local stakeholders and city architectural reviewers was key to successfully completing the project.

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Fig. 14: Courthouse in March 2025 after restoration.

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