THE PENNSYLVANIA BLUE PROJECT

Documentation and Conditions Survey of the Exterior Marble Masonry

THE SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PENNSYLVANIA

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1.0 Introduction

Independence National Historical Park (INHP) is home to several of the most significant monumental public buildings of the early American republic. Three of these buildings, the First Bank of the United States (1795-97), the Second Bank of the United States (1818-24) and the Merchant's Exchange (1832-33), span a period when Philadelphia served as the nation's capital, and then as its financial and cultural center. Reflective of this history, these three buildings physically embody and communicate the wealth and promise of the new nation through their developed academic neo-classicism and then unprecedented use of monumental masonry construction with local stone resources. The preservation of these buildings as architectural icons of American federalism and finance was formally recognized with the establishment of Independence National Historical Park in 1959.

The increasing importance of monumental masonry construction in establishing the various styles and modes of American building began in the early nineteenth century with the revival of Greek classicism. White marble, cut and assembled to evoke the architectural prowess of the ancients, was promoted as the material of choice. The massive and easily accessible beds of Pennsylvania marble, also known as Pennsylvania Blue or Montgomery County marble, quarried just north of the city, was an important regional building stone for public and domestic structures during the first half of the nineteenth century. Benjamin Latrobe's Bank of Pennsylvania (1798-1801, demolished c.1870) and William Strickland's Bank of the United States (1818-1824) (Fig. 1) were among the first monumental stone structures to showcase the area's famous marble. On May 8, 1811, Benjamin Latrobe delivered an anniversary oration before the Society of Artists of the United States in Philadelphia, extolling the importance of the city's precious marble resources:

> The beautiful marble with which this neighborhood abounds, and the excellence of all other building materials, give to Philadelphia great advantages in this branch of the fine arts. The first building in which marble was employed as the principal material of its front, is the Bank of the United States…Only one year after its completion the Bank of Pennsylvania was built…such a building so different from all that had preceded it in form, arrangement, construction, and character…[that] the style of this single building has given to the Philadelphian architecture, even in our plainest brick dwellings, a breadth of effect and response vainly sought in other cities.

By the middle of the nineteenth century, poor performance of the stone and improved transportation systems that increased the availability of other marbles from Maryland, Massachusetts and Vermont all contributed to the demise of Pennsylvania marble as a building stone. Once a building stone acquires a record of poor weatherability and is no longer commercially viable, there usually is little motivation for continued use of the material. In most cases, it is only years later through renewed conservation studies of deterioration and treatment

of historic buildings that information about the properties and performance of specific building materials and technologies is updated or reevaluated. In the case of Pennsylvania marble, its short-lived fame and restricted use have resulted in limited scientific study of its deterioration and conservation.

In December 1994, in response to observed stone failure at the Second Bank of the United States, a preliminary assessment of the exterior masonry and characterization and analysis of the stone was initiated by the National Park Service (INHP) and conservator Virginia Naudé. This led to temporary protection and emergency stabilization of critical areas of the entablature for public safety. Historically there has been periodic dimensional loss of the marble through spalling on the columns and along the entablature. Additionally, in unsheltered areas of the ashlar walls, many stones display a deep pattern of loss through contour scaling of the stone faces. (See Section 3.0 – Construction and Conservation History)

In 1996 the Architectural Conservation Laboratory (ACL) of the University of Pennsylvania in conjunction with Independence National Historical Park (INHP) began a program of stone characterization and physio-mechanical testing of potential consolidation methods for the Pennsylvania Blue marble.[1] In 1999 following these initial studies, a multi-phased conservation plan was developed and initiated with the Park beginning with the preparation of a detailed CAD-based survey of the exterior masonry conditions and the compilation of a history of past repairs and treatments to the building.[2] Phase 1 of the survey began with the north and west elevations in 1999. Also during this period, preservation staff from the Northeast Cultural Resources Center Building Conservation Branch of the National Park Service executed pilot mortar repairs. The exterior masonry conditions survey was brought to completion during Phase 2 of the project, surveying the south and east elevations in 2003. Presently, all of the exterior masonry has been carefully inspected and the conditions recorded, digitized drawings produced, and preliminary assessments formulated. Data gathered from the exterior masonry survey will be used in preparation for GIS-based diagnostic assessment and remedial and preventive intervention, beginning with the portico columns.

The National Park Service now has the opportunity to provide the most comprehensive research on Pennsylvania marble and its conservation due to the prominence of these three monumental buildings at Independence National Historical Park. While each building possesses distinct conditions that must be recognized individually, there is much that can be gained by addressing the full range of variations in the use, performance, and weathering of the marble and by comprehensively surveying and cataloguing the conditions across all three buildings. In addition,

[1] Jocelyn Kimmel. "Characterization and consolidation of Pennsylvania blue marble, with a case study of the Second Bank of the United States, Philadelphia, PA" (master's thesis, University of Pennsylvania, 1996).

a wider testing program can be implemented to evaluate treatments, repairs and preventive measures to address existing damage and minimize future marble deterioration and loss, and to predict areas of the stone predisposed to future failure. This program, named **The Pennsylvania Blue Project**, has the potential of providing much needed information on the history, use, properties, deterioration and treatment of Pennsylvania marble as used in thousands of buildings found throughout the city and surrounding region.

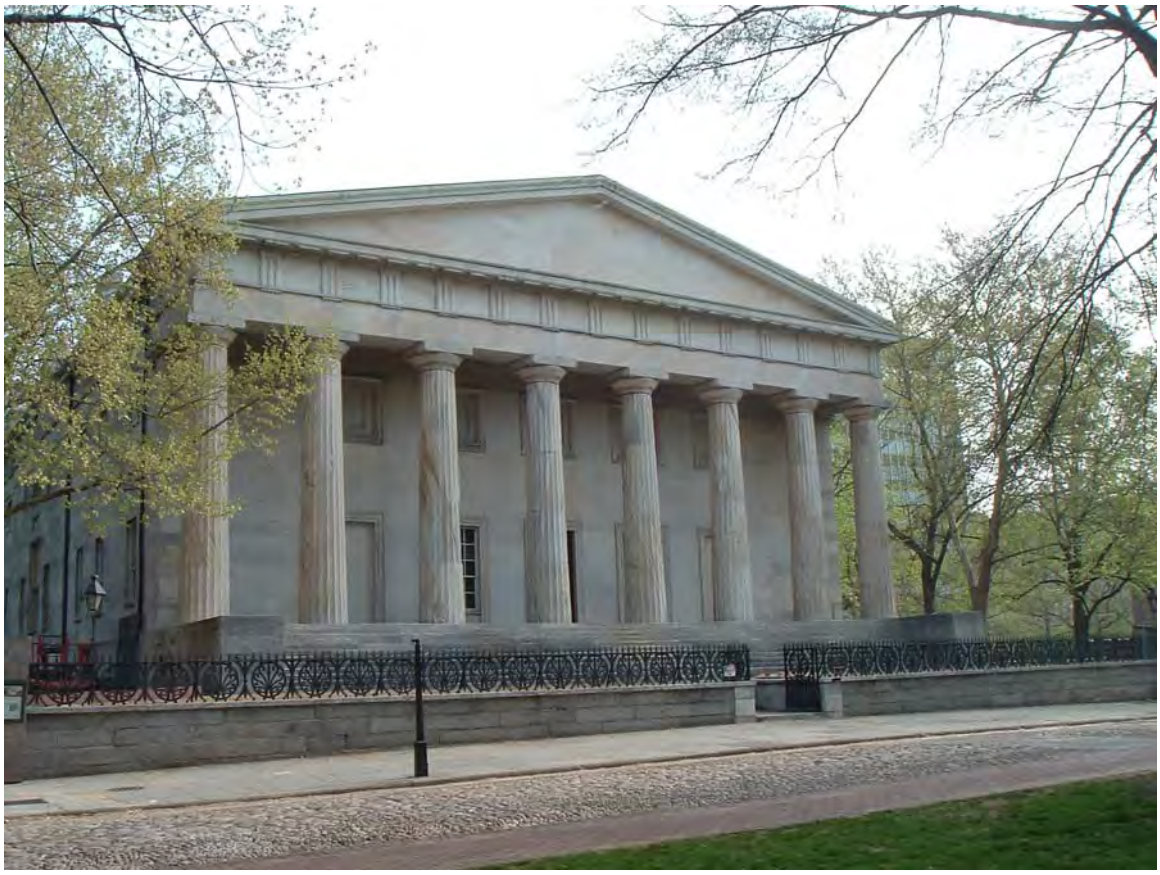

Figure 1: North Elevation of the Second Bank of the United States, April 2004.

[2] Report compiled by Frank Matero, Dawn Melbourne and James Toner. "Construction and Conservation History of the Second Bank of the United States," 1996, Historic Architect's File, INHP.

2.0 Project Overview

2.1 Phase 1 (1999)

The development of a conservation plan for the Second Bank of the United States will require several phases of research and investigation (some already completed) including archival documentation, condition survey and recording, laboratory and field analysis, and testing of proposed treatment interventions. Components of this research have been underway since 1986; however, Phase 1 of exterior conditions recording began with a detailed survey of the marble masonry of the north portico and façade (the main entrance to the Second Bank from Chestnut Street), and the full west elevation. The survey was conducted from June 7 through July 16, 1999. A total of six graduate and post graduate interns from the Architectural Conservation Laboratory of the Graduate Program in Historic Preservation at the University of Pennsylvania conducted a complete investigation of both elevations with the use of movable scaffolding and 60' and 45' high lift cranes with extending booms.

Rather than recording all surfaces with rectified photographs to survey conditions, the existing Historic American Buildings Survey (HABS) drawings from a 1939 survey were digitized and refined. The dimensions of architectural features and joint lines were verified in the field and corrected or added as needed. Once the coursing and stone dimensions were finalized, the base drawings were used to record detailed conditions of the masonry. Only critical areas that displayed complex deterioration patterns (e.g. column drums) were digitally photographed during the survey for later comparison.

Teams alternated between recording conditions in the field and digitizing those conditions in AutoCAD over the new drawings. During the six-week field school, all elevations of the portico including the columns, pediment, ceiling, flooring, and stairs as well as the entire west elevation were surveyed and digitized. Two interns continued for a three-week period beyond the field school to check and complete the survey drawings.

In addition to the field survey and subsequent drawings, a searchable database in Microsoft Access, a website, and report were created. For the database, each stone on the drawings was assigned a number, and each condition was entered as a separate category allowing the user to find all the conditions for any numbered stone, or to query and determine how many, or which stones have a particular condition. All conditions were eventually imported into ArcView to allow for greater diagnostic manipulation.

A complete set of digital and printed documents from this project (see Section 7 and Appendices) have been submitted to the National Park Service at INHP and the Architectural Conservation Laboratory at the University of Pennsylvania. All field notes, computer files, and correspondence have been deposited in the Archives at INHP.

2.2 Phase 2 (2003)

The exterior condition assessment was completed in 2003 with a detailed survey of the marble masonry on the south and east façades. Phase 2 of the survey was conducted from June 2 through July 11, 2003 by a total of five graduate and post graduate interns from the ACL of the Graduate Program in Historic Preservation at the University of Pennsylvania. Movable scaffolding and a 60' high lift crane with double articulated extending booms were used for recording and documentation purposes. (Fig. 3)

AutoCAD® line drawings from the 1999 survey were modified and adapted to the south and east elevations to be used as base drawings for conditions recording. The drums of the columns were accurately measured while all other joint lines on the ashlar walls, steps, and floor were carefully approximated by eye.

For surveying purposes, the team divided the conditions into five groups and assigned each group to one team member. This decision was made in order to ensure consistency across the survey in an effort to combat against the sometimes subjective nature of conditions recording despite detailed glossaries. All conditions recording of the entire east elevation and south portico including the columns, pediment, ceiling, mutules, entablature, floor, and stairs was completed during the six-week field school. Three interns continued for two to three weeks beyond the field school to begin the digitization process. One intern continued over the course of the fall and winter to complete digitization and lay out the final set of drawings.

Documentation in the form of digital photography was also made during time spent in the field. When an exemplar condition was found, it was photographed for use in the revised glossary. Unique conditions and complex deterioration patterns were also photographed, along with construction details that could only be seen with the aid of the high lift or scaffolding. (Fig. 2)

Digitization was a three-step process using Photoshop, AutoCAD, and ArcView software. First, all field drawings were scanned and rectified in Photoshop and then montages were created for each respective elevation or architectural element. The next step included importing these images into AutoCAD, where they were digitized. Scanning and montaging the field drawings

and then drawing over them using AutoCAD guaranteed the highest level of accuracy for conditions recording. CAD digitization was completed in October 2003.

While the conditions recorded in Phases 1 and 2 of the survey remained essentially the same (with some adjustment), the final drawings appear different. This is a result of the decision to use ArcView beyond its analytical capabilities; it is also useful for displaying and representing data. Not only does ArcView offer far more colors and hatches than AutoCAD, it is also easier to manipulate and fine-tune the conditions layers. With over thirty conditions represented on any given drawing, it was essential for them to be displayed in as clear and logical a manner as possible.

Using GIS as a part of the digitization process has also allowed the data to be used for future analysis of the stone's performance and deterioration. ArcView will allow an in-depth study of correlations between conditions to help determine how and why certain conditions appear in certain places over time. Eventually, the GIS software can be used to help predict where future deterioration might occur. Before any analysis can begin, however, all of the 1999 Phase 1 drawings must be ArcView compatible and therefore converted from their current AutoCAD format. Hopefully, this will occur in the near future.

Final layouts of the Phase 2 drawings were made using Adobe InDesign software and then converted into portable document files (.pdf's) with Adobe Acrobat. The final set was completed February 2004 and a complete set of the condition assessment drawings and digital files have been submitted to Independence National Historical Park. All field notes, correspondence, and digital files are also archived at the Architectural Conservation Research Center at the University of Pennsylvania.

Figure 2: A view of the capital blocks on the south elevation, July 2003.

3.0 Documentation and Archival Research

Several sources were consulted while searching for specific information on the Pennsylvania Blue marble. Research was mostly conducted at the Independence National Historical Park (INHP) office and the libraries of the University of Pennsylvania.

The majority of the information found came from the files of the Historical Architect at INHP that contain information from state Geological Surveys and student research on the Pennsylvania quarries. A ledger in the collection of INHP from the Henderson Quarry contains a balance of entries of deliveries for the construction of the Second Bank beginning April 20, 1819 and ending March 16, 1820. The first entry describes a delivery: "April 20, to 38 feet Marble delivered at the prison yard @ 140/100 foot -- $53.20." The prison yard referred to is the Walnut Street prison formerly located one block southwest of the Second Bank; it was a prison for Tories, prisoners of war, debtors and felons used from 1775-1835. The prison was located on one of William Penn's original civic squares from Walnut Street south to Locust Street. It has not been determined whether the prison was used solely to stockpile the marble or if prison laborers provided some of the rough finishing of the marble slabs. Subsequent entries in the ledger provide dates and quantities of marble slabs delivered, but contain no additional information.

At the University of Pennsylvania, searches were conducted on Franklin, the library search system. No matches were made for any specific information on Pennsylvania Blue marble or Marble Hall or Henderson quarries in Montgomery County, Pennsylvania. Due to the time limitations of the first phase of the project, and with the emphasis on recording physical deterioration conditions, additional archival research was not conducted at other Philadelphia institutions such as the Free Library, the Athenaeum, the Historical Society of Pennsylvania or the American Philosophical Society.

At the INHP Archives, two folders entitled "Construction — Rehabilitation and Restoration / Second Bank of U.S." dated October 1964 and January 1965 contain specifications and architectural drawings for the repair work to the exterior marble columns and the platform construction around the bank (see Section 4.0). Although no documents identify exactly what repairs were done to the columns, drawings show that thru-bolts and dowels were to be driven through the columns for stabilization. Four archival boxes containing documents relating to "Construction Project Records for Second Bank Site Development, 1961-1978" were also examined at the INHP Archives. The majority of documents in these boxes, such as transmittal forms and weekly summary reports, relate to the 1971-1973 restoration of the building which consisted mostly of interior work. The documents also contain information relating to the wrought iron fencing and grates that were installed on the south façade of the building. Within these

boxes, however, one document dated October 6, 1969 written by Joe Petrak indicates that, in 1967, Hydrozo “Clearstone” was used to waterproof the exterior marble of the Second Bank. The stone was scrubbed before the treatment was applied. Another document, dated November 10, 1975 mentions re-attaching a portion of an exterior stone column with an epoxy adhesive, although no documents indicate exactly what installation methods were utilized.

Figure 3: Team member John Glavan recording conditions on the columns of the south elevation, Summer 2003.

4.0 Construction and Conservation History[3]

This section chronicles the construction and restoration of the exterior of the Second Bank including all past remedial interventions and maintenance. The section will start with the building's construction from 1819 to 1824 and proceed chronologically. The majority of primary sources was found while searching the Historic Building File, the Historic Architects File, and the Photographic File at the Archives of Independence National Historical Park. Most reports were located in the Historic Building File, while most correspondence was found in the Historic Architects File.

During construction the marble was quarried, cut, and dressed according to traditional stone masonry practices. Prison labor was used for sawing the marble blocks into thick veneer for the facing of the brick masonry building. Financial records indicate that saw blades and sawing sand were purchased for the task.[4] Frame saws used for this purpose were similar to iron blade wooden saws, but without the teeth. Wet sand, used as the abrasive, was placed in a groove in the stone. The mason moved the sand back and forth with the saw blade, replenishing the wet sand as needed.[5] The slabs were then hauled from the prison to the construction site, where the work was finished. Financial records indicate that the columns were fluted and rubbed at the construction site.[6] The marble slabs cut for ashlar siding were also rubbed. The term "rubbing" the stone referred to honing the stone to a smooth surface with either an abrasive sandstone block or a hard rock with wet sand.[7] Financial records show that pumice stone was purchased, which could have been used for this purpose.[8] No documentation was found describing mortar composition, however the mortar used in 1865 was referred to as "lime cement" which indicates that lime and sand were also probably employed during the original construction.[9]

Subsequent cleaning seemed to follow traditional stone masonry methods as well. In 1844, William Strickland reported to Collector Judge Blythe that "the whole of the interior as well as the

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[3] Compiled by James Toner, Dawn Melbourne and Frank Matero, 1996.

[4] Robert J. Colborn, "Historical Data," Chapter 2 of "Historic Structure Report of the Second Bank of the United States" (Philadelphia: n.p., 1962), 5, Historic Building File, INHP.

[5] Charles McKee, *Introduction to Early American Masonry*, National Trust/Columbia University Series on the Technology of Early American Building (Washington, D.C.: Preservation Press, 1980), 5, Historic Building File, INHP.

[6] Colborn, 5.

[7] McKee, 30.

[8] Colborn, 5.

[9] Superintendent John Rier to Acting Assistant Architect B. Bertly, 26 October 1865, Historic Architects File, INHP.

exterior required a thorough cleansing and repair, particularly in the items of carpentry, masonry, painting & glazing.... The marble columns and architraves of the principle business room required scrubbing with pumice stone, to remove the dust of the years...."[10] Although the use of pumice was mentioned for cleaning the interior marble, it is possible that a similar cleaning technique was used on the exterior stone as well. In 1873, Superintendent John McArthur told Supervising Architect A. B. Mullett that the Ionic carved capitols, fluted columns, molded bases, and antae were rubbed clean as part of an overall project to improve the "large room of the Custom House."[11] No primary source was found identifying what materials were used to clean the stone. Today, the interior marble is in good condition, with the capitals and fluting retaining good detail and little evidence of soiling.

Stone deterioration on the Bank triggered more stone repair in the early 1920's. Some loose stone was removed from the columns by 1 November 1922. The stone deterioration was considered severe enough for the federal government to request from the Obelisk Waterproofing Company of New York and the Avron Company of Philadelphia estimates for waterproofing the entire exterior of the structure. The surviving correspondence shows only the estimate from the Obelisk Waterproofing Company made in 1922.[12] The Obelisk Company gained notoriety (and its name) for applying hot paraffin wax on Cleopatra's Needle in New York City in 1885.[13] Paraffin has a low melting point, which during hot days causes atmospheric particulates to adhere to the surface. Photographs from 1940 show the building uniformly soiled, which might be explained by the hot wax treatment.[14] In 1923, Edward Crane, consulting architect, reported that several pieces of marble had fallen off, especially from the columns. He recommended that the building should be cleaned, repointed, and waterproofed. The use of a waterproof compound "could do no harm and might prove a real preservative." For cleaning, he recommended that soap and water should be applied with a stiff brush.[15]

The dark deposits seen in the 1940 photographs suggest cleaning was not pursued, triggering further treatment efforts. In May 1942 the exterior marble was cleaned and waterproofed, but no

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[10]William Strickland to Collector Judge Blythe, 9 December 1844, Historic Architects File, INHP.

[11]Superintendent of Public Buildings John McArthur to Supervising Architect for the Treasury Department A. B. Mullett, 7 January 1873, Historic Architects File, INHP.

[12] President F. S. Condit of the Obelisk Waterproofing Company to Stewardson & Page, Estimate, 31 August 1922, AIA Archives and Library.

[13] Erhard M. Winkler, *Stone in Architecture*. 3rd edition. Springer-Velag: Berlin, 1994. pp 182-183.

[14] "Old Philadelphia Custom House" (Philadelphia: n.p., 1947), 2 Historic Building File, INHP. This phenomenon was also observed at Trinity Church, N.Y.C. around the same time period.

[15] Architect Edward Crane to Supervising Architect James A. Whitmore, 16 February 1923, AIA Archives and Library.

records were found describing the reagents, tools, or methods used.[16] Photographs show that the columns and the ashlar of the south façade were cleaned from the bottom up, with the northern elevation being done at about the same time in a similar pattern.(Fig. 4) The east and west façades were cleaned in sections starting at the southern and northern ends working towards the middle.[17] Later reports were more complete with a 1961 report by Grant Simon recommending thirteen different methods for preserving the marble; however, no indications have been found that his cleaning recommendations were followed. Simon wanted the marble cleaned with water and brushes. More difficult areas were to be washed by hand with brushes supplemented with steam pressure at less than 100 psi. He recommended that the most difficult areas be cleaned with the previously mentioned steam pressure and by hand, supplemented with sand. After restoration, the exterior would be cleaned with water, and where necessary, scrubbed with fiber brushes on an annual basis. He discouraged the use of water repellents, detergents, or chemical solutions. Only water was to be allowed.

Marble repairs were to follow specific procedures, and some of them are familiar to contemporary conservators. He recommended the removal and repointing of all defective and loose pointing. Tapping with a light mallet would reveal any incipient spalls on the columns. (Fig. 5) Any loose or deteriorated marble on the column caps or upper horizontal surfaces could be removed and replaced with “colloidal materials,” presumably a synthetic-based composite repair. No mention was made as to exactly what materials were used. The open seams were carefully cleaned and

Figure 4: South façade, in process of being cleaned, 1942.

[16] "Old Philadelphia Custom House," 2.

[17] National Park Service, INHP Archives, Photograph Collection, Unaccessioned, Second Bank of the United States, May 1942.

then closed with a filler adhesive and spalled ashlar was replaced by either marble dutchmen or composite repairs.[18] Today, yellow patches on the columns are visual indications that organic amended repairs were used to fill the cracks; epoxy repairs were mentioned in later records.

An August 1963 report by Gary Dysert recommended the brush application of "P-56 Brick and Stone Cleaner" after a successful test on Old City Hall. The test was conducted on twelve square feet of brick and 17.3 square feet of dressed stone at Independence Hall. The two coats were applied, left to stand for a half hour, and then washed off with water and scrubbed with a stiff bristle brush. The chemically active ingredient of the cleaner was identified as ammonium fluoride. According to the records, the `P-56' cleaner produced a white haze on the surface. A solution of sodium bicarbonate was recommended for use to remove the residue.[19] The test was judged to clean without any ill effect to either the stone or brick. There are indications that the cleaner was used on other buildings.

Figure 5: North portico, column 1, incipient spalling. 1961.

Some care was taken to report deteriorating exterior stone from 1964 to 1965. On 21 January 1964, a fragment of marble fell off the top of the column on the east end of the north façade.[20](Fig. 6) In July 1964, Architect Joe Petrak reported that a large area of spalling on the shaft of the northwest column was clamped in place and needed "extensive repairing or partial replacement."[21] In 1965, missing panels and terraces were restored to the original configuration using new marble. He also reported, "some spalling at new marble work due to hard mortar used."[22]

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[18] Grant Simon, "Report on the Preservation of the Exterior Masonry of the Buildings" (Philadelphia: n.p., 1961), 5-6, Historic Building File, INHP.

[19] Gary Dysert, "A Report on the Use of Fluoride Brick and Stone Cleaners" (Philadelphia: n.p., 1963), 1-3, Historic Building File, INHP.

[20] National Park Service, INHP Archives, Photograph Collection, Unaccessioned, Second Bank of the United States, 21 January 1964.

[21] Joseph Petrak, "Historic Structure Report of the Second Bank of the United States" (Philadelphia: n.p., July 1964), 17, Historic Building File, INHP.

[22] Penelope Batchelor, "Census of Treated Historic Buildings" (Philadelphia: n.p., 1982), 5-7, William Brookover's File, INHP.

Figure 6: North portico, column 1, dimensional loss. 1964. Note fresh loss of upper area in 1961 photograph (Fig. 5).

The January 1964 report of spalling stone preceded the extensive restoration and conservation work performed on the Second Bank that summer. The northern and southern steps, terrace, and cast iron railing were restored to the original design of William Strickland in 1964. Architect Joe Petrak reported that "at the present time cleaning and pointing of the marble is in progress and is being done by the day-labor force. The surfaces were cleaned with fluoride solutions and clear water, and the results were satisfying. "[23] Park Architect Penny Batchelor reported that the fluoride solutions were applied with soft bristle brushes and rinsed with clear water.[24] Photographs taken in July and August of 1964 indicate the cleaning patterns for only the north and south façades. (Fig.7) For the north façade, the scaffolding was first erected on the eastern side of the portico. The workers started cleaning at the apex of the raking cornice and then proceeded down to the columns and ashlar stones. The scaffolding was first set up on the west side of the south façade beyond the sides of its porticoes. The pediment was cleaned from top to bottom, and then the columns and the ashlar were treated in the same manner.[25]

On 9 March 1969, Joe Petrak reported to the Superintendent that the exterior marble treatment was completed in June of 1967. The marble was scrubbed prior to waterproofing."[26] Hydrozo "Clear-Stone" was then applied on the entire masonry as a water repellent.[27] Clear-Stone

[23] Petrak, 23.

[24] Batchelor, 1-2.

[25] National Park Service, INHP Archives, Photograph Collection, Unaccessioned, Second Bank of the United States, 17 August 1964, negative # 8613, photograph by W.A. McCullough.

[26] Joseph Petrak to the Superintendent, Memorandum, 9 October 1969, Historic Architect Files, INHP.

[27] Batchelor, 5-7.

Figure 7: South portico in process of being cleaned. 1964.

contains 2 ¼% silicone solids as produced by the General Electric Co., Silicones Division.[28] In March 1974, Harold Heller mentioned that in the 1960's a siliconate was applied to the Second Bank "which today [1974] remains quite clean. On close examination of this building, it was found that surfaces exposed to the weather are not [any longer] protected but areas such as the protected surfaces of the columns still repel water."[29] Traces of this water repellent still exist (See Section 8.0).

In the early 1970's, the Second Bank was rehabilitated to become the National Portrait Gallery. A museum quality HVAC system and other new internal systems were installed. Marble cleaning and repairs were carried out on both the interior and the exterior of the building during this period.

Revised specifications mentioned that new marble should have a tooled weathered surface or a rubbed sanded surface to match existing stone. New marble was used for both Dutchman repairs and new construction. Some windowsills might have been repaired in this fashion, however most appear to have been tooled with a point chisel. The Dutchman repairs were to be epoxied tightly into place in carefully cut out deteriorated sections. Specifications state what should have rather than what actually occurred.[30] The Historical Architect's office of Independence National Historic Park has architectural drawings that indicate where new stone-blocks were placed in the early 1940's, early 1960's, and the early 1970's building campaigns.

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[28]Penelope Batchelor, "1974-1976 Construction Phase Masonry Construction Methods Used," Appendix VI of "Historic Structure Report Historical and Architectural Data First Bank of the United States" (Philadelphia: n.p., 1981), 228, INHP.

[29] Harold Heller, "An Approach to the Restoration and Preservation of the First Bank," Appendix V of "Historic Structure Report of the First Bank of the United States" (Philadelphia, n.p., 1981), 206-221, INHP. Recent SEM-EDS analysis has verified the presence of silicon-based coatings on the protected portico walls.

[30] Denver Service Center, "Specifications Adaptive Restoration and Rehabilitation Second Bank of the United States" (Philadelphia: n.p., 1973), 4-9, Historic Building File, INHP.

Windowsills and other marble blocks that displayed damage too shallow for Dutchmen were repaired with cement mortar patches. Notes from the contract and construction negotiations describe how damaged exterior marble sills were to be built up back to their original profiles so that the water drained away. The repair material was to be Weld-crete from Larson Products Corporation in Rockville, Maryland. It was used in a "fortified topping process, which allows feather edging". One part 'Weld-crete to three parts water was specified, the Weld-crete used in place of water as an admix to the original cement mix. The final product was to match the original stone sills in color and texture. Any loose spalling layers of the stone were to be taken off before being patched.[31] Today, there are remains of what appear to be concrete patches on the lowest south portico windows. Dense cement repairs there tend to trap any water that seeps through the protective surface, thus causing more spalling than otherwise might occur.

The interior polished marble in the main banking room was cleaned using two methods. With the first method, the marble cornice stone was cleaned with FINOLA Abrasive Scouring Powder, made by Masury Columbia Company, Melrose Park, Illinois 60160. This method was mixed with water, and the marble was scrubbed with steel wool. The powder was ineffective on the marble columns and capitols, which were cleaned with Wyandotte Detergent Powdered Abrasive Cleaner. This powder was added to a five to one mix of water and Clorox (sodium perchlorate) until a paste was made. The poultice was trowelled onto the stone, and allowed to remain on the surface for a minimum of 24 hours. Later, the poultice was washed off with clean water and a bristle brush."[32]

Figure 8: Interior column capitol cleaned with a poultice. 1974.

[31] Craig Morrison, Notes, Meeting with Mike Callaghan Marble Shop, Historic Architect's Files, INHP.

[32] Penelope Batchelor, Notes, 12 December 1973, Historic Architect's Files, INHP.

A photograph taken on 2 May 1974, documented an original column capitol had been cleaned with a poultice.[33](Fig. 8)

Figure 9: Worker cleaning spray paint vandalism. 1971.

Some marble deterioration was carefully recorded during the 1970's. In April 1971, a worker was photographed painting an unidentified cleaner onto spray paint graffiti on the north façade.[34] (Fig. 9) A color slide taken in September 1975 shows yellow patches on the N-2 column, indicating old epoxy repairs.[35] In 1975, Penny Batchelor noticed that a "rather sizable" piece of marble was on the verge of spalling off from the column next to the west of the north façade [Column 1]. "The piece is below waist level facing northwest." She suggested that the piece could be secured "with an epoxy glue used for stone repairs" on the First Bank at the west doorframe.[36] The epoxy used for the east façade for the First Bank was 10% Epi-rez 510 made by Celanese Coatings, Inc. in Louisville, Kentucky. The solvent was methyl ethyl ketone, and the mixing standards were followed according to United States Patent No. 3,795,533.[37] It is not clear if this treatment was executed.

Records made during the 1980's and 1990's document the deterioration of the marble, the location of some of the minor repairs, and the maintenance practices of the period. The building sustained damage from both vandalism and stone decay. One photograph taken in November 1983 shows that pigeon guano stained the marble as well as "Roost-NO-More" pigeon control.[38] On 15 July 1985, Bill Brookover inspected scratched graffiti with "the words `George W. 1776'

[33] National Park Service, INHP Archives, Photograph Collection, Unaccessioned, Second Bank of the United States, 2 May 1974, negative # 157.4315.32, photograph by Eisenman.

[34] National Park Service, INHP Archives, Photograph Collection, Unaccessioned, Second Bank of the United States, April 1971, negative #10307A, photograph by W.A. McCullough.

[35] Color Slide, September 1975, William Brookover's File, INHP.

[36] Penelope Batchelor to Superintendent of INHP, Memorandum, 10 November 1975, Historic Architect's File, INHP. Note: Only dimensional loss is recorded on the described location on the 1999 condition assessment drawings. Therefore, the repair was ether not made or failed.

[37] Penelope Batchelor, "1974-1976 Construction Phase Masonry Conservation Methods Used," Appendix VI of "Historic Structure Report First Bank of the United States" (Philadelphia: n.p., 1981), 227, INHP.

[38] William Brookover Photograph, 1986, William Brookover's File, INHP.

carved into a column" in the north portico, designated N-4 by the Naudé report. The graffiti was lightly scratched into the marble surface and could be easily removed using soft bristle brushes and water.[39] Scratched graffiti is currently visible on several columns on the north and south façades. A few fragments of marble fall from the building every few years. On 7 October 1986, John Kornich found a piece of fallen marble on the west end of the north portico, probably from the cornice.[40] On 28 April 1989, two pieces of marble were found at the south façade in the alley way and on the porch near the S-1 column.[41]

Only small-scale repairs were conducted in the 1980's and 1990's. On 8 May 1986, a small fragment of marble was readhered with epoxy on column S-2, as designated by the Naudé Report.[42] (Fig. 10) The type of epoxy was not recorded. From 1983 to the present, several fragments of marble had fallen off and were epoxied back in place by a stonemason, without any documentation. During the same time period, a mason installed Dugan limestone patches with a polymer-bonding agent. To prepare a patch, the shallow areas of the damaged stone were cut away with a four-inch diamond blade to insure a good key.[43]

Figure 10: South portico, column 2, marble epoxy repair. 1986.

Recent maintenance procedures may be equally problematic to accurately document. For example, the pigeon guano was "cleaned" with city water on the north and south portico paving. The dirty rinse water washed down the steps and over the west edge of the portico. As a result, the guano was deposited on the stair risers, the west wall of the portico, and the terrace-paving wall.[44] Today, dark deposits near the bottom of the north and south portico ashlar indicate that dirty water also splashed

[39] William Brookover to General Foreman Ross Flanagan, Memorandum, 13 August 1986, Bill Brookover's File, INHP. 38.

[40] John Kornich, Report to Historic Architects, 7 October 1986, Bill Brookover's File, INHP

[41] Report to Historic Architects, 28 April 1989, Historic Architect's File, INHP.

[42] National Park Service, INHP Archives, Photograph Collection, Unaccessioned, Second Bank of the United States, 8 May 1986, photograph by William Brookover.

[43] Stone Mason Frank Doyle, Conversation with Author, August 1995.

[44] William Brookover to Ross Flanagan, Memorandum, 13 August 1986, William Brookover's File, INHP.

against the portico walls and columns. Bird guano can introduce both phosphate and nitrate salts into the marble as well.[45] Recently, calcium chloride was the preferred deicing salt for the steps and walkways of the Second Bank, thus introducing chlorides into the marble.[46]

More attention has been paid to the building recently. Bird netting was installed around the pediment during March 1994, which reduced pigeon access and guano.[47] In November 1999, a piece of the cornice fell; and in response, bird netting was installed around the projecting cornice. In December 1994, Virginia Naudé and Bill Brookover inspected the exterior marble over two days. She advised that immediate repairs should be confined to the traditional mortar or marble repairs until more complex treatments are thorougly tested."[48]

In conclusion, the Second Bank was built and repaired using traditional methods and materials during the early nineteenth century. There were three exterior cleaning and waterproofing campaigns performed on the building in the twentieth century. Around 1922 to 1923, the building was cleaned with soap and water and probably waterproofed with hot paraffin wax. The second cleaning and waterproofing treatment occurred in 1942 but without any mention of any of the compounds or the methods used. In 1964, the exterior marble was cleaned with aqueous fluoride solutions (possible P-56 Brick and Stone Cleaner) and waterproofed with a siliconate, Hydrozo "Clearstone." Reports of marble deterioration preceded the 1923 and the 1964 treatments. Minor mortar and epoxy repairs as well as Dutchmen were performed at intermittent times in the twentieth century, often after marble spalled. Not all of the repairs and patches were recorded. In 1996 as part of a long-range conservation program for the exterior masonry, the Architectural Conservation Laboratory of the Unversity of Pennsylvania began a renewed program of stone analysis, treatment testing, and masonry conditions survey.

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[45] Erhard M. Winkler, 230.

[46] William Brookover Commentary on Memorandum from District Ranger to Safety officer, 30 January 1992, William Brookover's File, INHP.

[47] William Brookover, Conversation with Author, 30 August 1995.

[48] Naudé, Virginia. “Survey of Exterior Marble, Second Bank of the United States, Philadelphia, PA.” 1994, 18-19.

5.0 Marble Decay: An Overview

In developing a conservation program for any masonry building, a variety of factors must be considered including the age and history of the building, the chemical composition and mechanical properties of the stone, the nature of its decay mechanisms, and the rate of deterioration relative to building location and environment.

Marble is a carbonate-based metamorphic rock which like most building stones, will undergo alteration and decay from a wide range of factors including pollution and freeze-thaw, salt, and thermal cycling. The mineralogical composition and grain structure of each type of marble will ultimately determine how vulnerable it is to decay from weathering. While all marbles are susceptible to chemical dissolution from acidic agents, the texture and fabric of the rock will dictate to a large degree its specific response to weathering. Degree of foliation, presence of secondary minerals such as micas, graphite and pyrite, and grain size and shape will all affect its durability. Mechanical damage, often indicated by cracking, will result by overloading the cohesive grain-to-grain strength of the marble.

The original stone of the Second Bank is of two varieties: a coarsely crystalline creamy white marble and a light blue banded or mottled marble. Both are interbedded with dark blue to black siliceous dolomite. The marble is weakly metamorphosed and contains abundant micaceous inclusions and the calcite is not strongly recrystallized. The marble is loosely textured, with a marked foliation (or planar) fabric forming a series of parallel planes that are weakly held together. The dominant mineral is light blue calcite grains ranging in size from 100-400 microns, angular to sub-rounded in shape and nearly of pure calcium carbonate. There are also small amounts of magnesium and iron.[49]

Mechanical damage can occur in several ways. Columns and other supports can crack by tensile, compression or shear forces while smaller architectural elements can fail from traffic or construction vibrations. Long-term stresses cause plastic deformation or creep. More dramatic damage can occur from blasting or seismic shock. Quarry blasting is often used to extract rock for construction. The explosion triggers a stress pulse that the rock can absorb and store. As the pulse pressure lessens, the internal stresses are released by stone fragmentation and microcracking. The resultant cracking and spalling provide moisture and salt entry causing greater damage.

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[49] Elaine S. McGee. "Marble Characteristics and Deterioration." In *Philadelphia Merchants' Exchange Conservation Strategy. Environmental and Cultural Resources Research Monograph No. 1* (Washington, D.C.: National Park Service, 1992), 13.

Salt crystallization is considered potentially one of the most damaging mechanisms to stone buildings, especially when a building is in a climate prone to frequent wet-dry cycles. Salt crystallization begins when salts are dissolved in water and are transported through the pores of the stone. Salts can also be deposited on the surface from the atmosphere, evaporating groundwater, or contaminants such as bird guano, cleaning treatments, and deicing salts. Precipitated surface salts, or efflorescence, cause less damage than those crystallizing within the pores of the stone. Such subflorescence can exert sufficient internal disruptive pressure to overcome the grain-to-grain cohesive strength of the stone matrix. The amount of damage depends on many factors: most notably the species and combination of salts, the microclimate, and the porosimetry of the stone. Moreover, the presence of salts promotes condensation and rising damp which escalates the entire process. Most marbles are fairly dense with porosities of one percent or less; however as the grains become detached from internal mechanical stresses, porosity can increase deterioration.

Acidic attack from dry and wet deposition or from inappropriate acidic cleaning will dissolve the calcite and dolomite matrix and form gypsum crusts. Secondary mineral inclusions such as pyrite can accelerate this decay by producing sulfuric acid, which can also convert the calcite to gypsum. The formation of gypsum distorts surface details and is more vulnerable to loss as it is 25 times more soluble than calcite and its expansive structure is weakly attached to the unaltered stone substrate. The presence of expansive clay secondary minerals can also swell and produce mechanical stresses in the stone when wet or erode away more easily than other less water-sensitive inclusions. Carbon dioxide in rainwater forms carbonic acid, which over time converts calcium carbonate to soluble calcium bicarbonate.

The weathering of crystalline marble is a complex interaction of several decay mechanisms and varies according to the particular structure and composition of the marble as well as its orientation in the building. The surface of the Pennsylvania Blue marble is vulnerable to surface weathering (i.e. disaggregation) because its calcite structure is weakly metamorphosed with poorly interlocking grain boundaries, and it has a large percentage of inclusions. Dimensional expansion-contraction and chemical dissolution of the calcite grains start the release of locked-in stresses by the anomalous thermal behavior of calcite, and by the expansive action of trapped moisture. Dilation occurs resulting in crumbling and cracking of carved details and edges. Disaggregation (friability) and flaking are the first indications of surface erosion and dissolution. Wet marble exhibits lower strength and hardness and dry climate conditions trigger evaporation that transports soluble calcite to the stone surface and leads to case-hardening. Freeze-thaw cycling exacerbates loss of the case-hardened surface and causes flaking and contour scaling, especially where the foliation of the marble is parallel or oblique to the surface. Thermal cycling and its associated mechanical cracking are most prevalent on the columns and especially on the

column fluting. Thermal expansion of calcite is not uniform. When heated, the calcite crystal expands along the long axis but contracts along the short axis. Spalling is triggered by the same mechanisms as cracking, but the internal stresses are relieved when parts of the stone detach in concentric “spalls”. Severe spalling on the rear face of the columns of both porticos suggests other factors may also be at play. The presence of heavy black gypsum crusts in these areas, attributable to the lack of rain water washing, may be exacerbating detachment by the crystallization of gypsum in the microcracks. In summary, cracking and grain loss occurs when internal stresses from metamorphosis are released during quarrying, stone working, diurnal and seasonal thermal expansion, or by moisture expansion. Cracking occurs at grain boundaries and boundaries between the calcite and weaker secondary minerals. (Fig. 11)

The specific deterioration of both types of Pennsylvania Blue marble at the Second Bank must be studied in greater detail to establish a hierarchy of decay mechanisms affecting the building overall or in specific locations based on stone type, orientation, environment and microclimate, and previous treatment.

Figure 11: Existing conditions on the columns of the south elevation. Summer 2003.

6.0 Existing Conditions

6.1 Condition Recording and Assessment: A Conservator's Guide

The idea of a procedurally rigorous survey of field conditions, including the integration of various forms of information (e.g., construction and maintenance records, existing photographs, environmental data, etc.) and various methods of recording, for the purposes of ***diagnostic*** assessment of a building including its fabric and systems, has been an important step in developing both accurate and holistic approaches to building and site conservation. Such field surveys force the building conservator to account for every possible ***etiological*** relationship between material, construction, design, environment, use, and maintenance, through the detailed recording of conditions in the present and over time. By recording condition in conjunction with other physical aspects of a structure or site during the initial phases of documentation, and by considering what such conditions mean throughout a project, the condition survey becomes a powerful diagnostic tool for answering a range of research questions ultimately concerned with design, performance, alteration, treatment, and maintenance.

Through the development of clearly defined, causal-free terminology based on a descriptive recording of observed ***symptoms***, the condition survey can at once document the type, extent, location, pattern, severity (degree) and status (active/inactive) of observable ***phenomena***. Past conditions may also be recorded using historical images and detailed descriptions when available. In so doing, and in conjunction with other data sets (such as compositional analysis, use and maintenance history), condition recording assists in the explanation of decay mechanisms, as well as providing diachronic ***evidence*** for the construction, use, and repair or neglect of the building and site.

A symptomatic recording of conditions attempts to describe what one sees at time present according to physical appearance. A condition survey usually occurs at one brief moment in the life of the structure or site, yet a structured approach to the evidence – visible and invisible – allows a temporal reading of what was, is, and will or might be. Causal explanation can then follow based on a reading of site evidence along with associated environmental and structural monitoring, material analysis, historical research, etc. Even without archival images of past conditions, a detailed survey of current conditions can trace the physical progression of weathering through relative time by way of shifting patterns, extent, severity, or even type transformation of decay such as disaggregation into scaling or flaking and eventually loss.

Since immediate and ultimate causes may be open to several interpretations, it is imperative that the survey be as accurate and free from assumptions as possible. However it is also important to realize that the act of interpretation begins the moment the recording process occurs, if only by its selecting of conditions chosen for observation.

Conditions are the incidental residual result of events and processes. Conditions, like stratigraphic deposits, are a by-product of many factors: use, aging, neglect, repair -- the whole array of human and natural factors. If conditions are recorded as evidence, a more accurate account of cause/effect relationships can be established and appropriate interventions conducted. The built environment, like its natural geological counterpart, is a collection of unique outcomes at once constantly changing through differential weathering, yet similar in the predictability of the natural entropic and anthropic processes responsible for the change. This obvious yet important observation reinforces the role condition surveys can play in identifying the unique combination of factors responsible for material change. Despite the fundamental information condition surveys provide on the type and extent of material damage and the diagnosis of material and building failure, there exists a general lack of coordinated recording standards in architectural conservation. To this end, a detailed, illustrated condition glossary was developed for the marble of the Second Bank (Appendix C).

- **DIAGNOSIS -** The conclusion reached by detailed analysis. (Greek-to discern, literally to perceive apart)

- **ETIOLOGY -** The study of causes, origins, reasons. The cause of a disorder as determined by diagnosis

- **EVIDENCE –** The data on which a judgment or conclusion may be based, or by which proof or probability may be established, present and plainly visible, clear, obvious (Latin-*evidens*-to see completely)

- **PHENOMENA –** An observable event or occurrence that is directly perceptible by the senses (from the Greek-to appear or show).

- **SYMPTOM –** Any circumstance or phenomenon regarded as an indication or characteristic of a condition or event; a departure from normal appearance.

6.2 Conditions Recorded: Phase 1

A detailed glossary of conditions was developed and tested for the field survey of the marble of the north portico and west elevation. Several goals were defined that led to the final identification and classification of conditions:

- **Only after completely mapping conditions and understanding the broader deterioration patterns can more specialized types of analysis be utilized to explain cause-effect relationships.**
- **Conditions recorded were classified according to severity and degree or type of action required.**
- **The conditions recorded included inherent compositional defects within the stone, the influence of weathering conditions in the surrounding environment (temperature, moisture, structural and thermal stresses, accumulation of airborne pollutants), previous repairs, and historic loss. In this way, patterns of decay can be studied over time and in combination with former repairs and maintenance.**
- **The glossary should be adaptable to other buildings within INHP, particularly the First Bank and Merchant's Exchange so that marble conditions and data can be compared across a wider spectrum of case studies.**

6.3 Conditions Recorded: Phase 2

The glossary of conditions developed during Phase 1 of the survey was used as a basis for Phase 2. After careful study in the field, however, several major and minor modifications were made to some condition definitions. The following table indicates those conditions with definitions which were **moderately** changed:

	Definitions	
Condition	**1999**	**2003**
Orientation of Foliation Planes		addition of "face-oriented" stones
Moderate Cracks	less than 1/8"	1/16-1/8"
Deteriorated Mortar Joint	mortar present in joints is friable	mortar present but eroded back 1/2" or more in depth
Dimensional Loss	4"sq., 1" deep	2" sq., 1/2" deep
Stone Redressing	did not exist	added
Surface Unique	did not exist	added

It is of utmost importance to notice two **major** changes concerning the definitions of *differential (surface) erosion* and *contour scaling*. These conditions occur frequently on all façades of the Second Bank and play a significant role in the building's deterioration patterns. While their specific definitions can be read in the glossary, the most important difference between the 1999 and 2003 definitions is that what was recorded as s*urface erosion* in 1999 was identified as *flaking* in 2003. It was also determined that the description used to define *surface erosion* in 1999 is better characterized as *differential erosion*. The second major change to the conditions glossary was the re-working of the definition of *contour scaling*. The Phase 2 team ascertained that *contour scaling* is, in essence, *flaking* to a greater extent and so modified the definition to reflect this change.

Aside from the definitions, the classifications of the conditions were also changed. Phase 2 conditions were grouped according to whether they were *subtractive* or *additive*. All other conditions were categorized as *other*. Colors used were based on and represent these groupings.

The 2003 glossary was also updated with new photographs taken by team members in the field.

Figure 12: Working from the high-lift on the south elevation, summer 2003.

7.0 Condition Assessment Drawings

DEFINITION	GRAPHIC	SCHEMATIC

Orientation of foliation planes

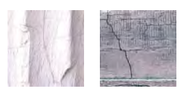
Stones display a pattern of orientation based on their foliation planes. For edge-oriented stones, the position of these planes can be (a) horizontal, (b) vertical or (c) diagonal to the ground. For face-oriented stones, foliation planes are (d) parallel to the face of the stone.

Mineral inclusions

Stones may display large mineral inclusions as veins or phenocrysts. These inclusions are at least ½ inch in diameter and noticeably larger than prevailing foliation patterns. They are typically (a) raised in relief or (b) weathered out and distinctive in color and texture from the surrounding stone matrix.

Network cracking

A patterned network of fine intersecting cracks occurring on the surface of the stone, often in association with mineral inclusion-rich areas.



Moderate cracks

Cracks that are 1/16-1/8 inch (1.6-3.2 mm) wide, of varying orientation and depth. These can be either (a) structural or (b) those that occur along foliation planes.

Major cracks

Cracks greater than ¼ inch (3.2 mm) wide, of varying orientation and depth. Usually associated with (a) deformation / displacement or (b) incipient spalling.

Friability / Flaking

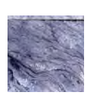
Surfaces with (a) active disaggregation of individual grains and / or (b) shallow flakes that dislodge under finger pressure.

Differential erosion

Surface weathering defined by (a) large areas of coarse texture, (b) localized loss greater than ¼ inch in depth (e.g. along foliation planes), or (c) reduction of surface details (e.g. weathered arrises or edges).

Contour scaling / Exfoliation

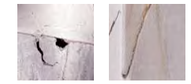
Distinctive localized or overall patterns of stepped irregular surface loss associated with cracks and foliation planes, and the loss is greater than ⅛ inch in depth.



DEFINITION	GRAPHIC	SCHEMATIC

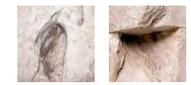
Incipient spalling

Surface planar discontinuities that have become partially separated from the parent stone. The detached area can be detected visually and audibly by sounding. The angle of separation will be approximately 0-60° from the surface plane of the surrounding stone and usually in association with foliation.



Dimensional loss

Localized stone loss greater than 2 square inches in area and at least ½ inch in depth as measured in plane with the surrounding stone surface.

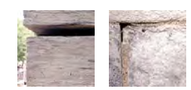


Deformation / Displacement

Movement and cracking or separation of the stone or stones resulting in the shifting of stone surfaces more than ½ inch out of plane. Relative planar shifts recorded as (+) or (-).

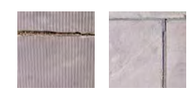
Open joints

Stone joints where the pointing mortar is completely lost.



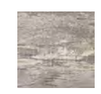
Deteriorated mortar joint

Stone joints where the mortar is still present but eroded back ½ inch or more in depth, or noticeably cracked and partial.



Efflorescence

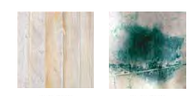
White crystalline, water-soluble deposits on the surface or within the pores of the stone indicating the presence of damaging salts.



Metallic staining

Localized discoloration resulting from the weathering of either (a) intrinsic (mineralogical) or (b) extrinsic (copper or iron accessories) sources, usually black/ brown (iron) or blue/green (copper) in color.

Intrinsic Metallic Staining
Extrinsic Metallic Staining



Encrustation

Formation of gray to black particulate deposits in protected areas that are noticeably more concentrated than the prevailing soiling patterns.

Microflora

Zones of biological growth including algae, fungi, and lichens visible as a black, greenish or brown discoloration. Many of these areas are on the lower sections of the building, under windowsills, and along the cornice area at the tree line.

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GLOSSARY OF MASONRY CONDITIONS

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

PROJECT SUPERVISORS:
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FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG CS-1

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

DEFINITION	GRAPHIC	SCHEMATIC

Chemical bird repellent treatments

Residue of chemical gels and coatings used on horizontal surfaces to deter birds from landing and nesting on the building.

Sealant repair

Presence of elastomeric sealants used as a masonry repair or pointing material.

Repointing

All non-original mortars used for repointing joints, usually gray or white in color.

Stone dutchman

Stone infill repair (a) set into the surrounding masonry, with or (b) without associated adhesive or mortar.

(a) (b)

Filled cracks

Repairs to cracks executed at any time:

(a) less than ¼ inch in width.

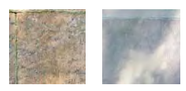
(b) greater than ¼ inch in width.

(a) (b)

Tooling marks

Stones that are relatively protected still display their original surface tooling marks. The tooling marks are a relative indicator of the degree of surface weathering of the stone. The condition was recorded only where the tooling is evident on at least 50% of the stone's surface.

T



original stone replacement stone

Composite repairs

A mortar or resin based system, used as a surface repair for losses greater than 3/4 inch in width but not for cracks.

DEFINITION	GRAPHIC	SCHEMATIC

Stone replacement

Physical and/or archival evidence that complete stones or sections of the building, terraces, or perimeter walls have been replaced. Include date if known.

DATE

1938 1976

Previous coatings

The presence of a coating on the stone surface, generally off-white or pale yellow in color.

Stone redressing

Tooling marks that indicate the selective redressing of stone to address advanced surface deterioration.

Defective mechanical features

Building systems and/or anchoring hardware that is contributing to a stone deterioration condition.

Condition - unique

Any condition or physical alteration to the original fabricated surface of the building which does not fit within the existing set of categories. Numbering is sequential but does not reflect a specific order to the conditions.

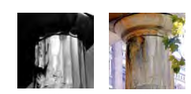
3

(3) Spall fallen and collected

Historic conditions

Historic photographs that provide a time-based comparison of stone loss, weathering, and soiling patterns.

1923



1963 2003

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GLOSSARY OF MASONRY CONDITIONS

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

PROJECT SUPERVISORS:
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FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SPONSORED BY:
NATIONAL PARK SERVICE
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INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

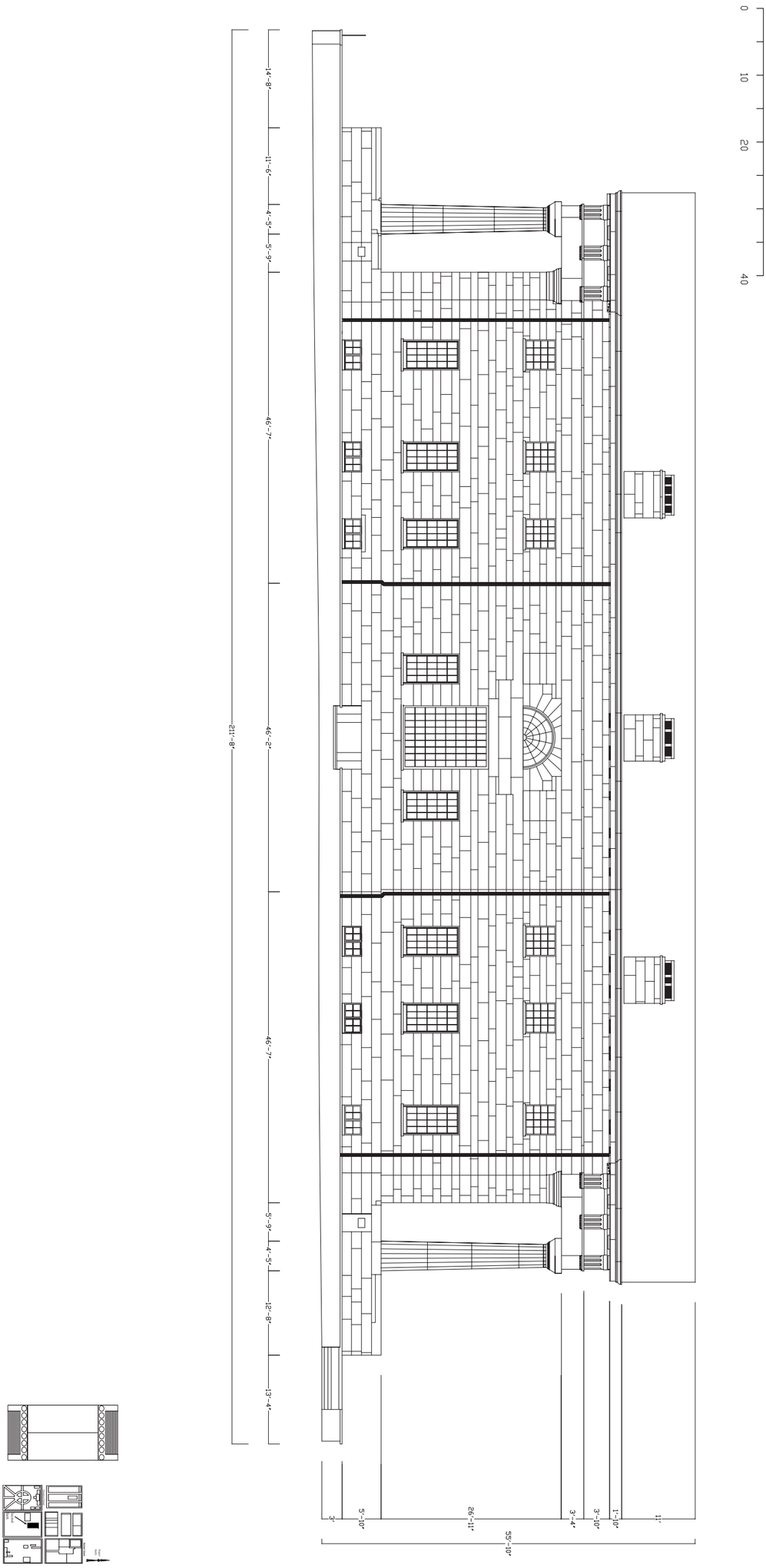
CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG CS-2

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA



SECOND BANK OF THE UNITED STATES

INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

EAST ELEVATION

PROJECT SUPERVISORS:
CHARLES TONETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

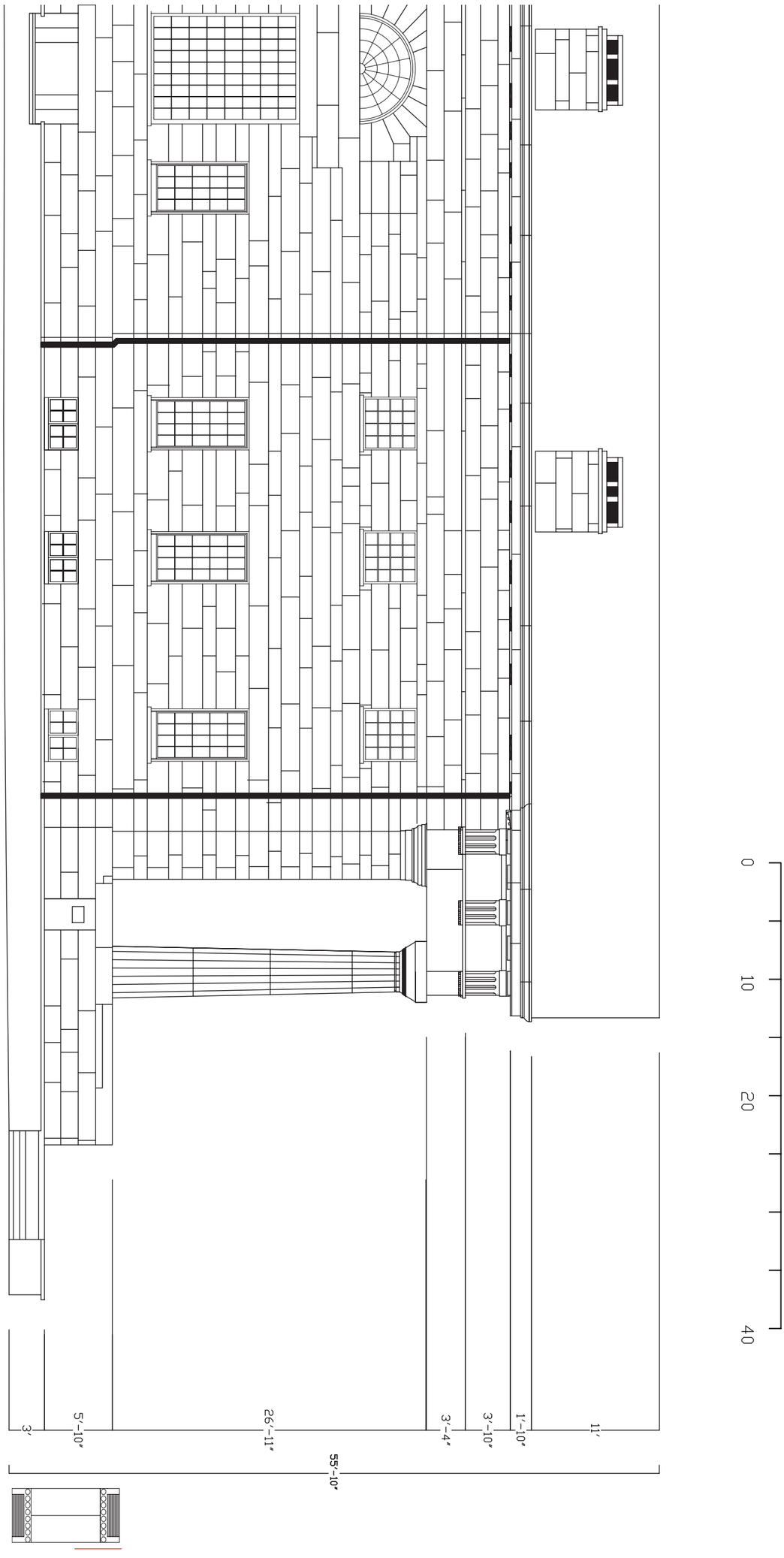
SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 101



SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

EAST ELEVATION
NORTH HALF

PROJECT SUPERVISORS:
CHARLES TONETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

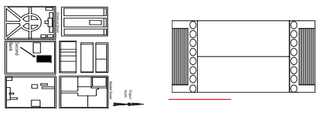
SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

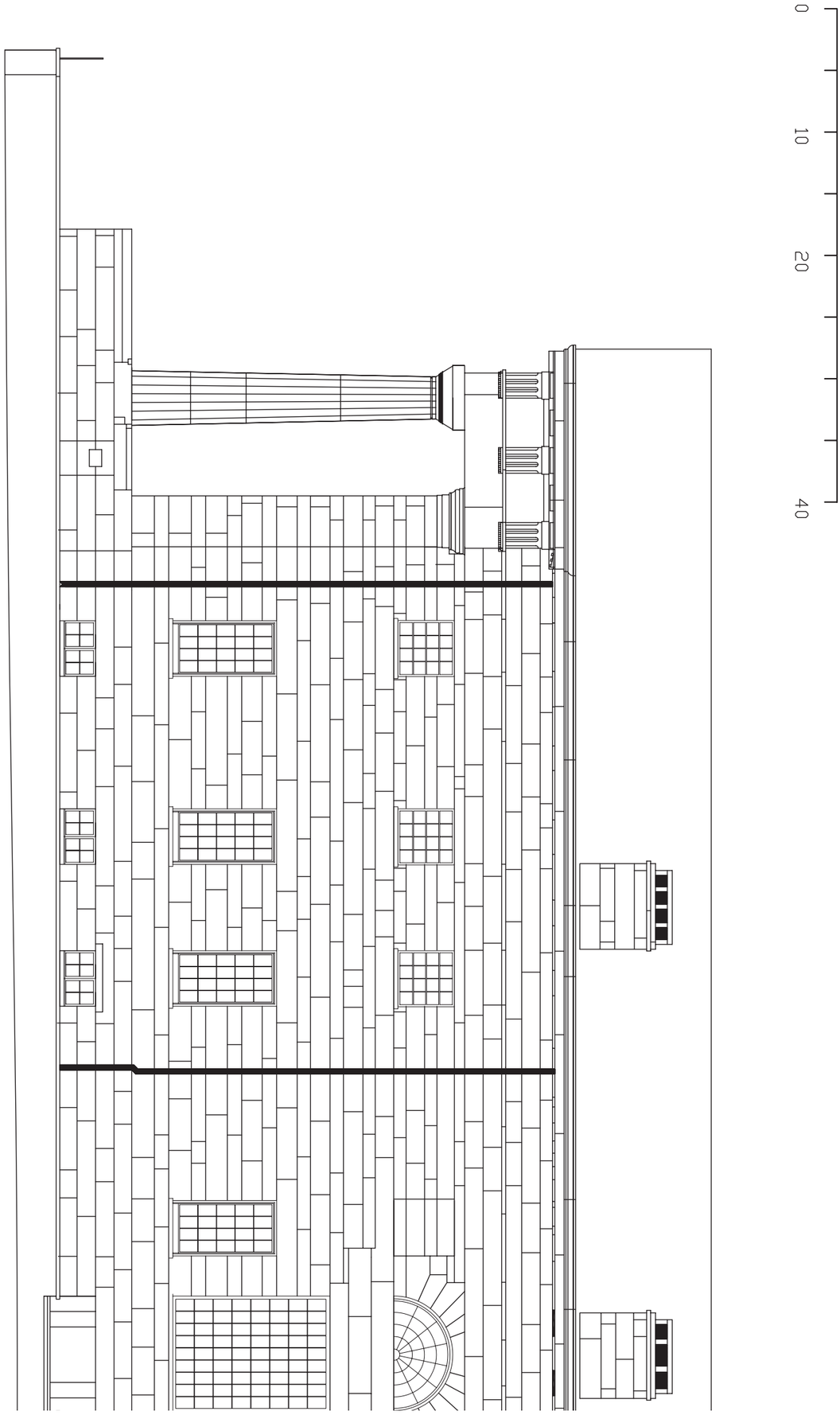
CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 102





SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

EAST ELEVATION
SOUTH HALF

PROJECT SUPERVISORS:
CHARLES TONETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

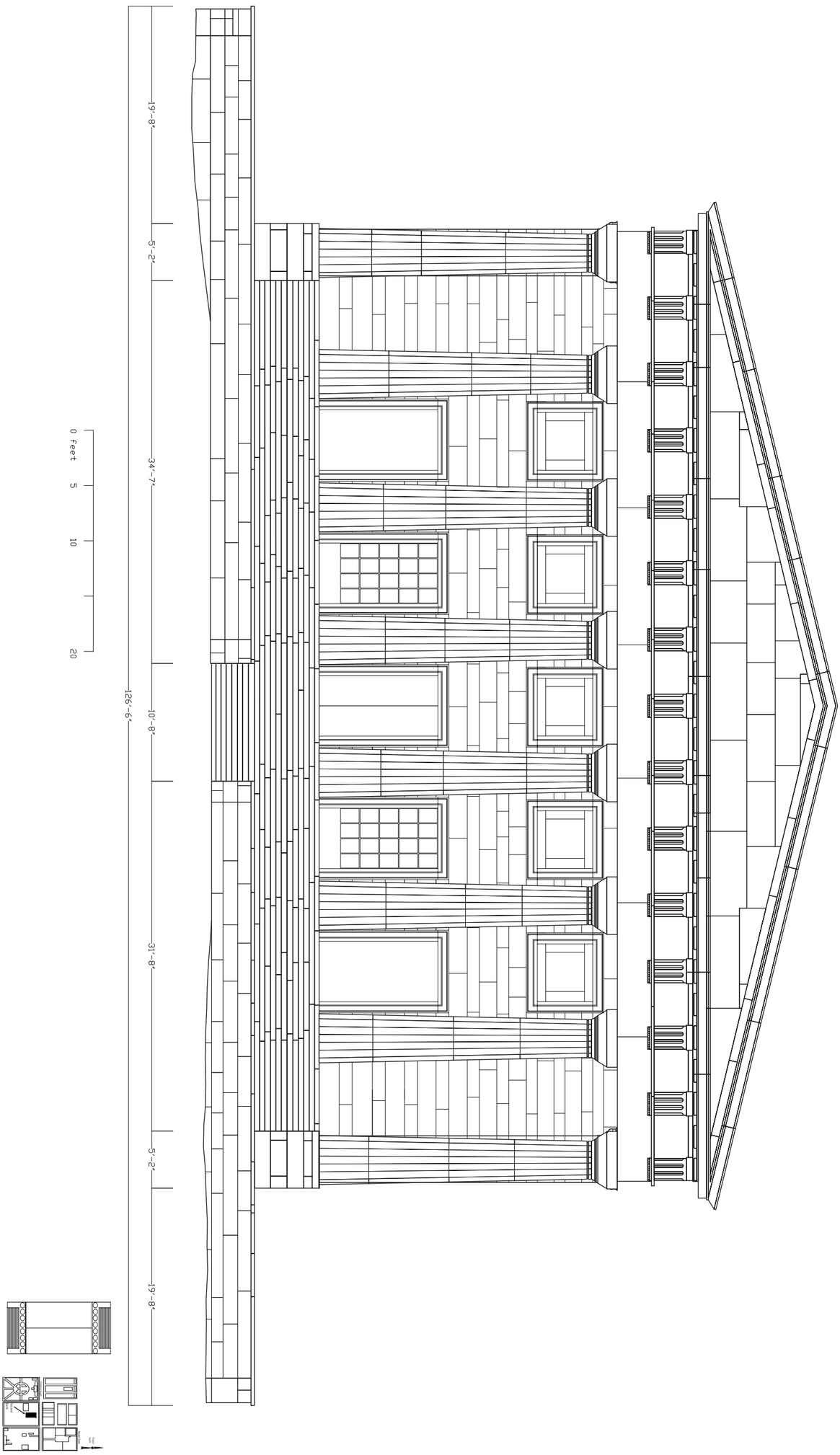
SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 103



SECOND BANK OF THE UNITED STATES

INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

SOUTH ELEVATION

PROJECT SUPERVISORS:
CHARLES TONETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 104

CONDITIONS LEGEND

- Open Joint
- Deteriorated Joint Mortar
- Major Crack
- Moderate Crack
- Network Map Cracking
- Friability/Flaking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimentional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Repointing
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non-Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation/Displacement
- Mineral Inclusion
- Defective Mechanical System
- Railing Remnant
- Foliation Orientation

EAST ELEVATION
SOUTH HALF

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOIN HOWARD

KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 105

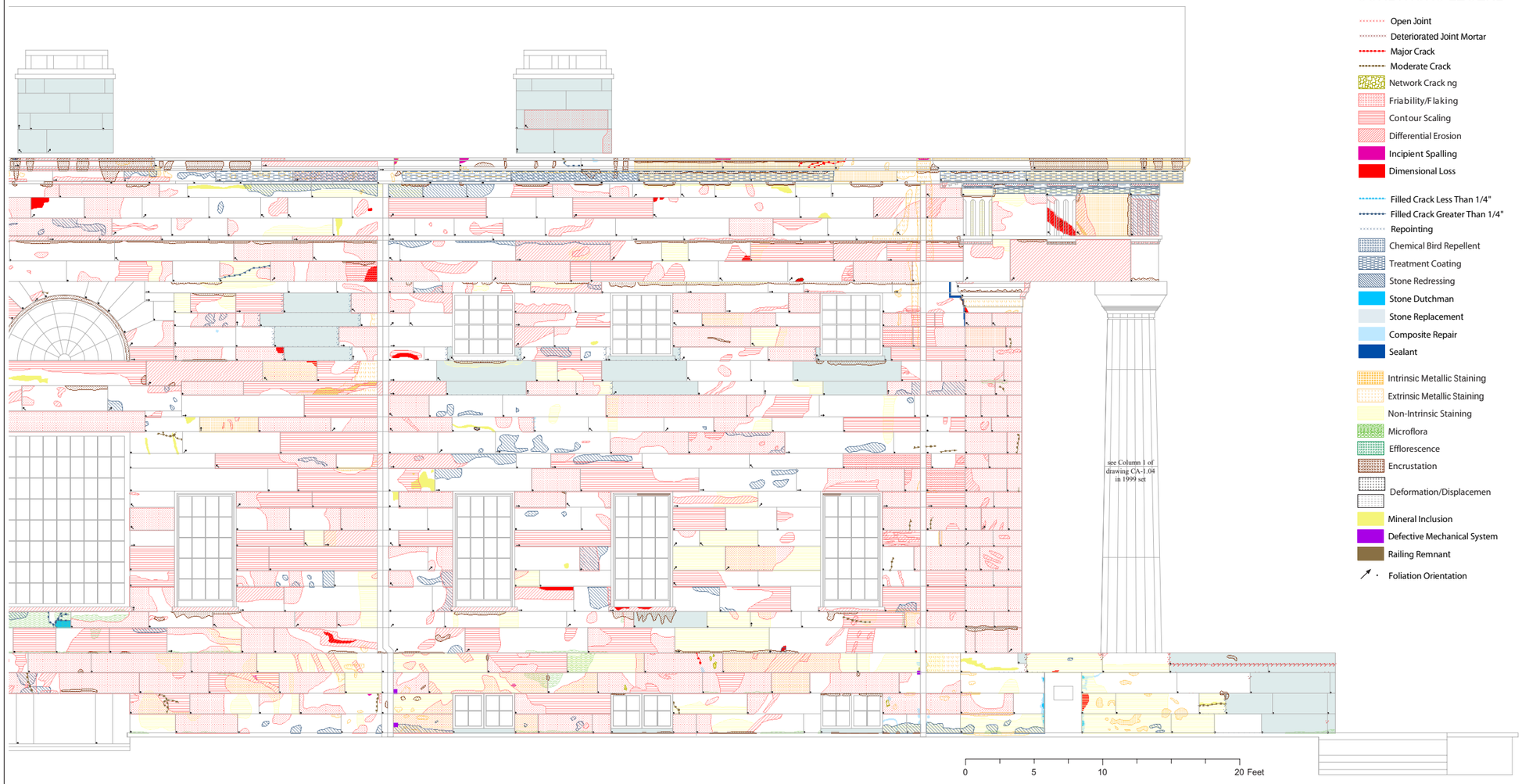
SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

PHILADELPHIA, PA

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK

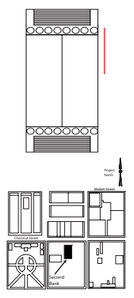
PROJECT SUPERVISORS:
CHARLES BRUNNETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA



CONDITIONS LEGEND

- Open Joint
- Deteriorated Joint Mortar
- Major Crack
- Moderate Crack
- Network Crack ng
- Friability/Flaking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimensional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Repointing
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non-Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation/Displacemen
- Mineral Inclusion
- Defective Mechanical System
- Railing Remnant
- Foliation Orientation



EAST ELEVATION NORTH HALF

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

PROJECT SUPERVISORS:
CHARLES TOMLETT, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

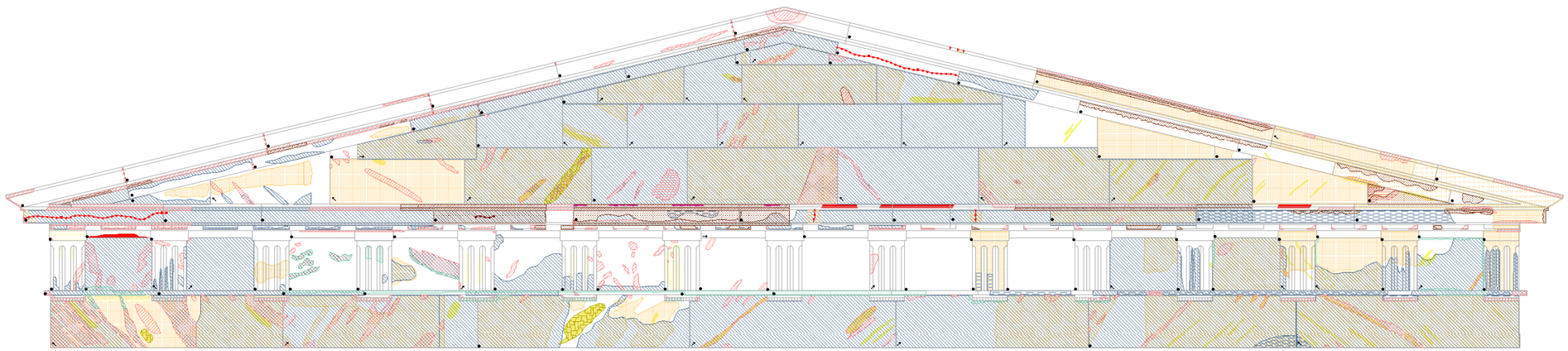
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

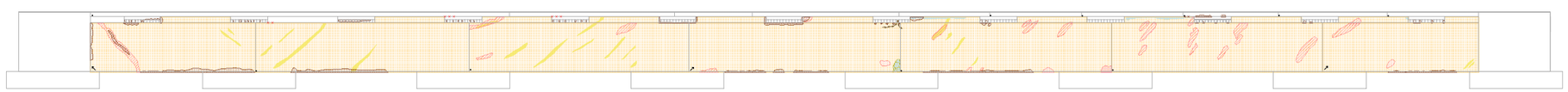
DWG 106

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

PEDIMENT AND EXTERIOR ENTABLATURE FACE



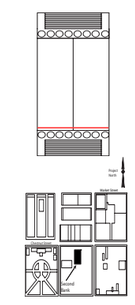
INTERIOR ENTABLATURE FACE



0 2.5 5 10 Feet

CONDITIONS LEGEND

- O en Joint
- D teriorated Joint Mortar
- Major Crack
- Moderate Crack
- Network Ma Cracking
- Fria bility/F laking
- Contour Scaling
- Differential Erosion
- Inci i nt S alling
- Dimensional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Re ointing
- Chemical Bird Re ellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Unit Re lacement
- Com osite Re air
- Sealant
- Foliation Orientation
- ntrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non- ntrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- D formation/Dis lacement
- Mineral nclusion
- Defective Mechanical System
- Railing Remnant



SOUTH PORTICO
PEDIMENT AND ENTABLATURE

CONDITION ASSESSMENT:
JOHN GL-AVAN
LAUREN HEGERTY
JOIN HOWARD

KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

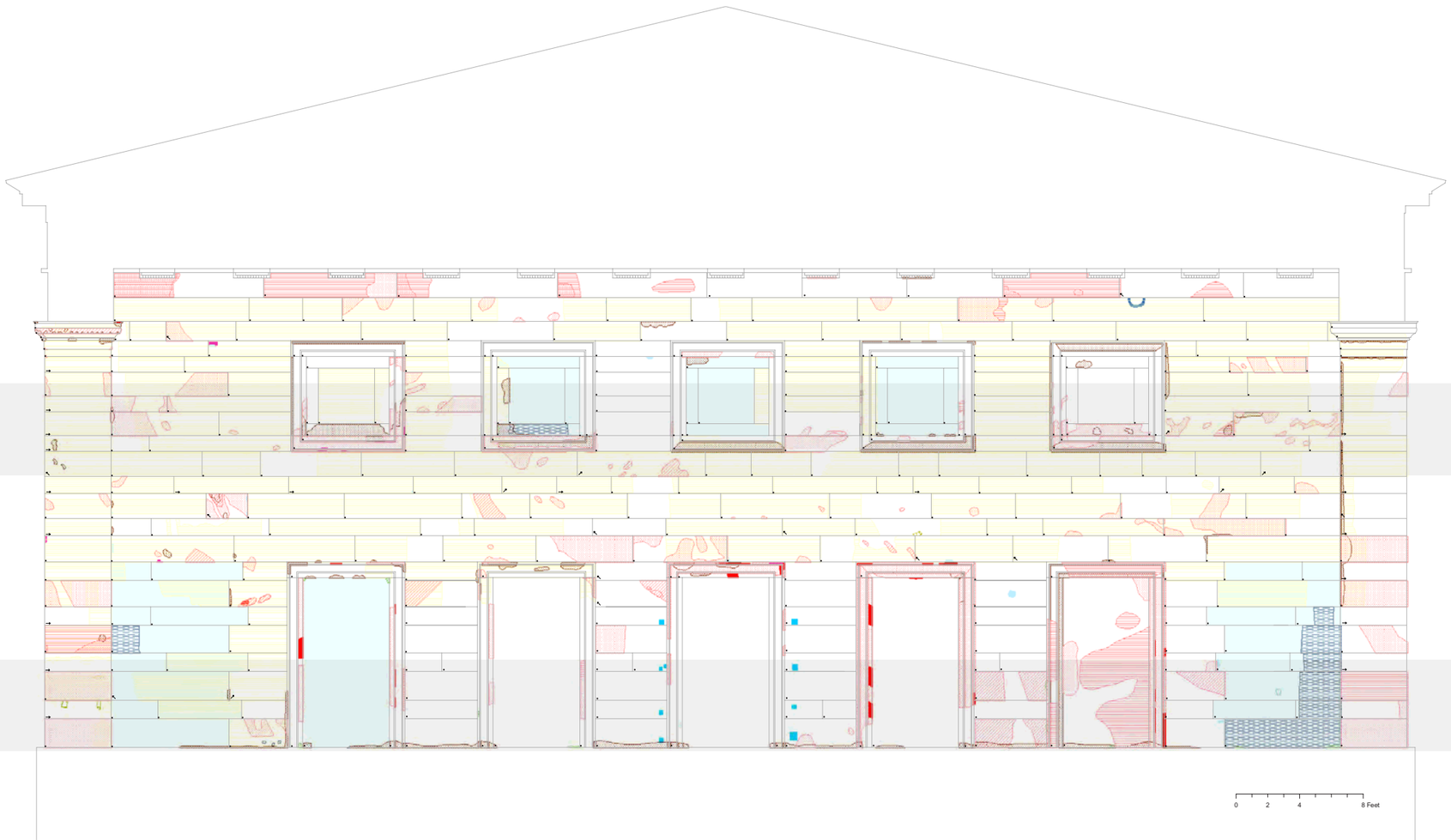
DWG 107

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

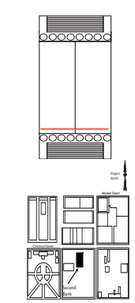
PROJECT SUPERVISORS:
CLAUS TONNETT, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA



CONDITIONS LEGEND

- Open Joint
- Deteriorated Jo nt Mortar
- Major Crack
- Moderate Crack
- Network Map Cracking
- Friability/F laking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimensional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Repoint ng
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non-Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation/Displacement
- Mineral Inclusion
- Defective Mechanical System
- Railing Remnant
- Foliation Orientation



SOUTH PORTICO
REAR WALL

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

PROJECT SUPERVISORS:
CHARLES SOUTHWORTH, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

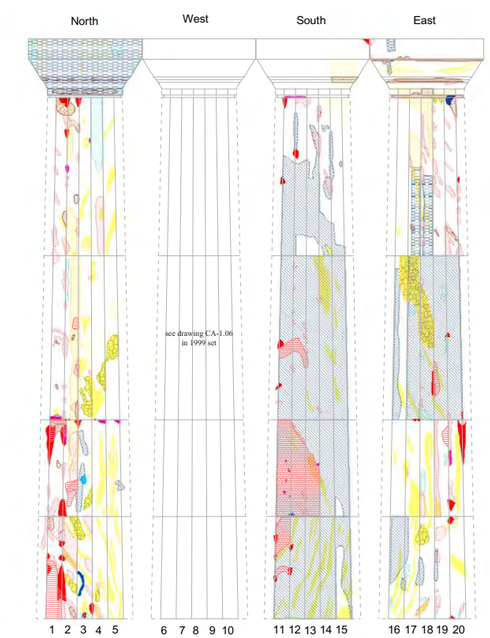
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

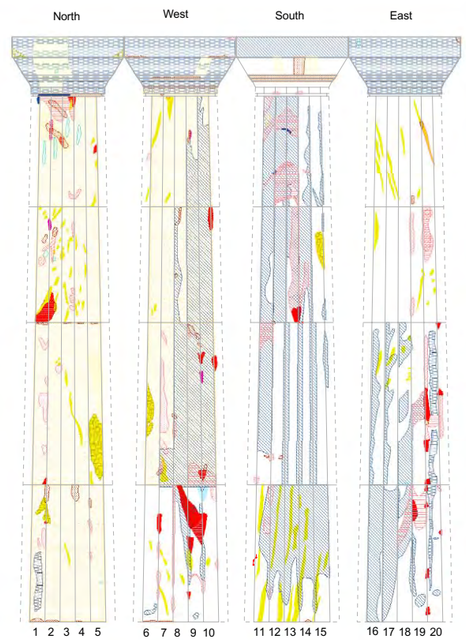
DWG 108

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

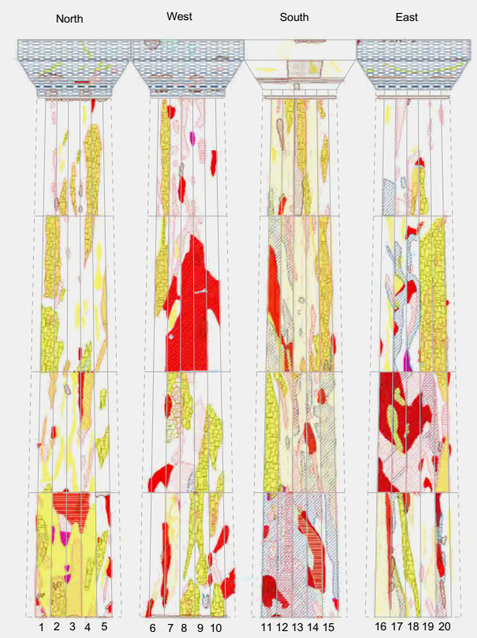
COLUMN NUMBER ONE



COLUMN NUMBER TWO



COLUMN NUMBER THREE

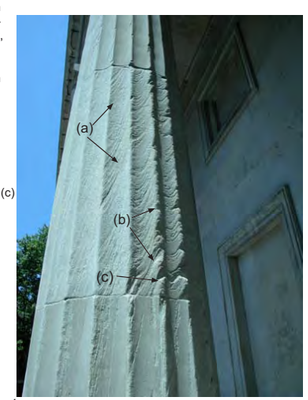


COLUMN NUMBER FOUR

1: Column 3 flutes 14-18 (drum 3). An example of (a) stone re-dressing (b) differential erosion, and (c) incipient spalling.

2: Column 3 flutes 17-18 (drum 2). An example of (a) contour scaling, (b) differential erosion, and (c) significant dimensional loss.

3: Column 1 flutes 16-21. An example of (a) a mineral inclusion, (b) stone redressing, and (c) dimensional loss.



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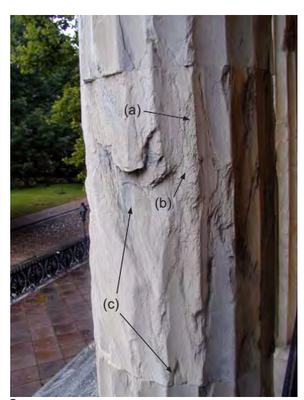

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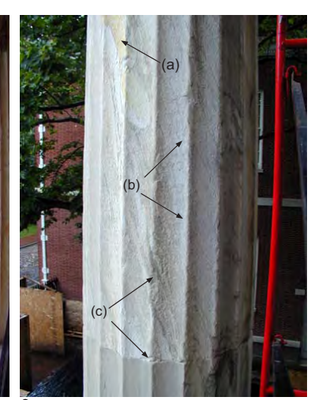
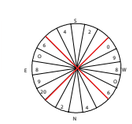


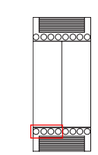
3

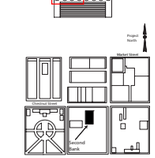
CONDITIONS LEGEND

- Open Joint
- Deteriorated Joint Mortar
- Major Crack
- Moderate Crack
- Network Cracking
- Friability/Flaking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimensional Loss
- Filled Crack Less Than 1/4
- Filled Crack Greater Than 1/4
- Repointing
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Foliation Orientation
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non- Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation/Displacement
- Mineral Inclusion
- Defective Mechanical System
- Railing Remnant



Column Fluting Plan





SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

PROJECT ARCHITECT:
CHARLES STONE
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SPONSORED BY:
NATIONAL PARK SERVICE
CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
LUIN HOWARD

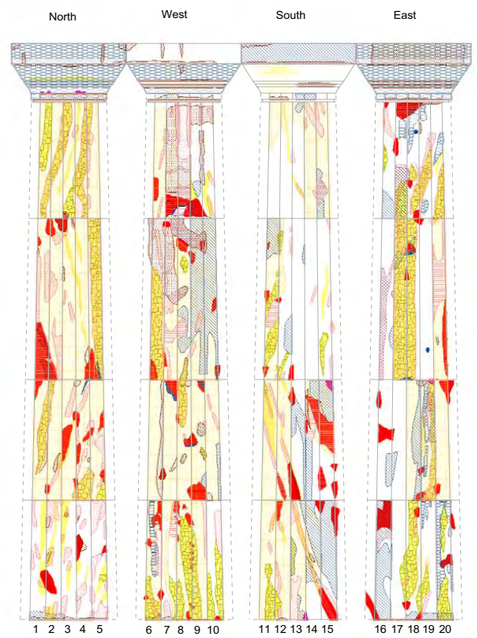
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

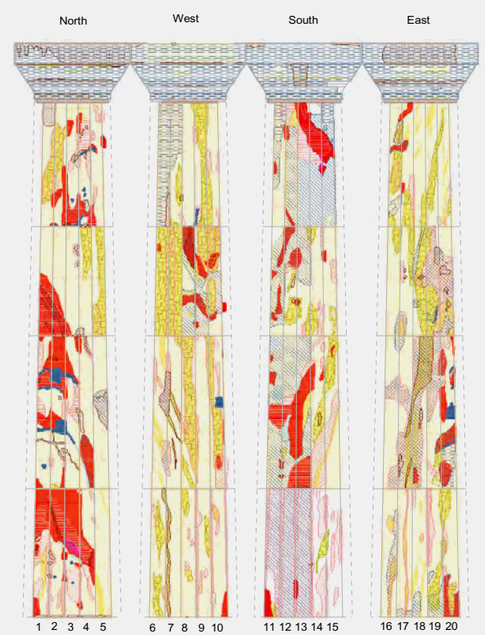
DWG 109

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

COLUMN NUMBER FIVE



COLUMN NUMBER SIX



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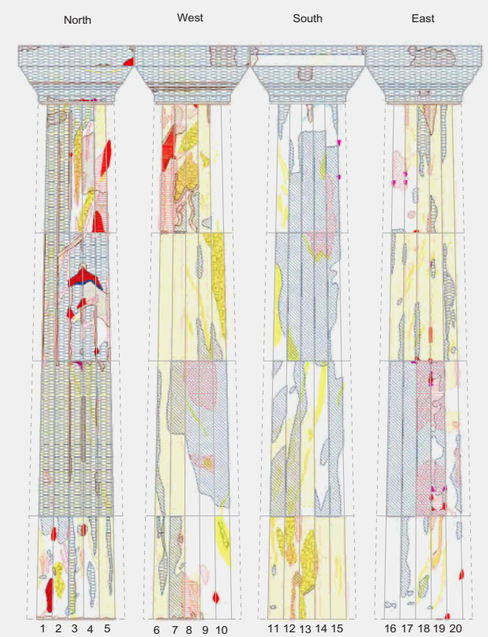
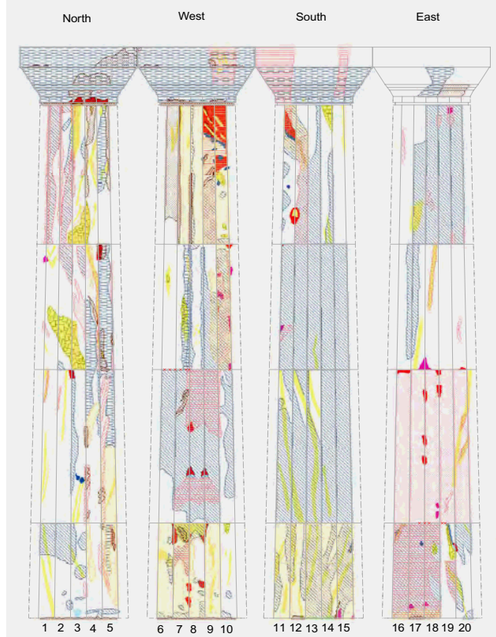


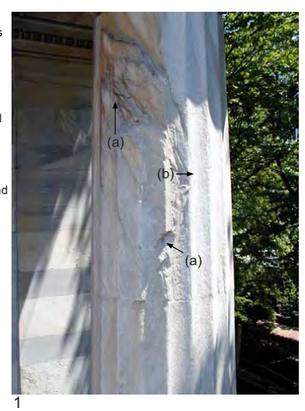
COLUMN NUMBER EIGHT



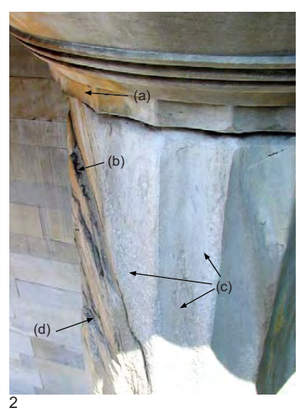
1: Column 8 flutes 8-13. An example of (a) dimensional loss and (b) stone redressing.

2: Column 8 flutes 12-15. An example of (a) intrinsic metallic staining. (b) sealant, (c) stone redressing, and (d) dimensional loss.

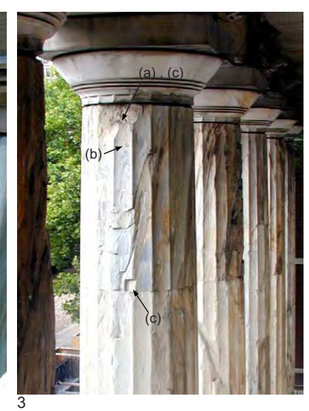
3: Column 5 flutes 17-20. Various conditions including (a) contour scaling, (b) sealant , and (c) dimensional loss.



1

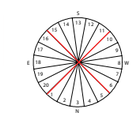


2

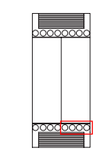


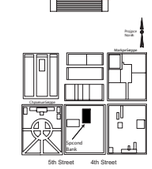
3

0 3 6 12 Feet



Column Fluting Plan





CONDITIONS LEGEND

- Open Joint
- Deteriorated Joint Mortar
- Major Crack
- Moderate Crack
- Network Cracking
- Friability/Flaking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimensional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Repointing
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Foliation Orientation
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non-Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation / Displacement
- Mineral Inclusion
- Defective Mechanical Systems
- Railing Remnant

SOUTH PORTICO
COLUMNS 5 - 8

PHILADELPHIA, PA

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INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

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INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 110

PROJECT SUPERVISORS:
CHARLES MONTGOMERY, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
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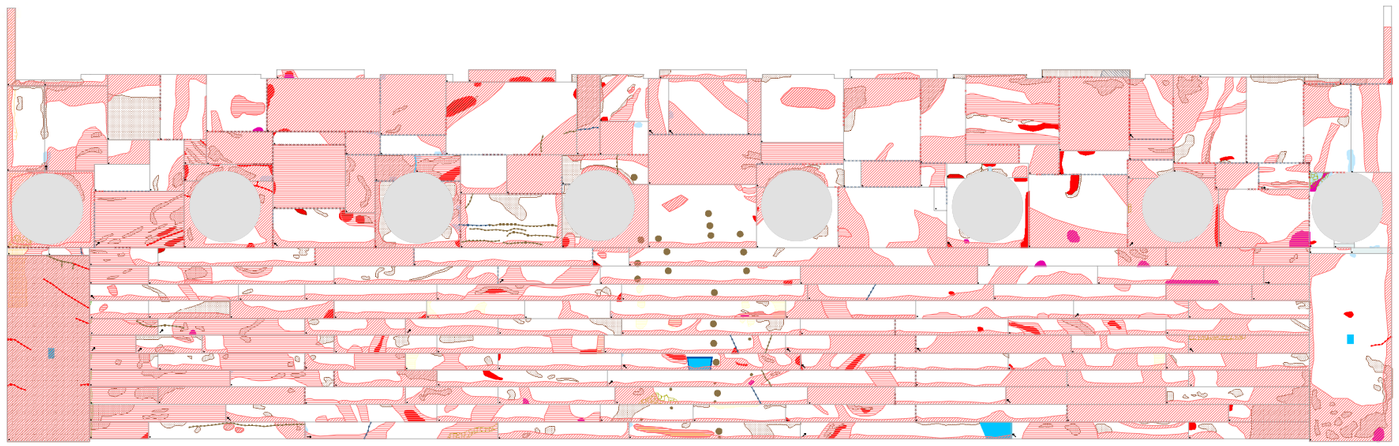
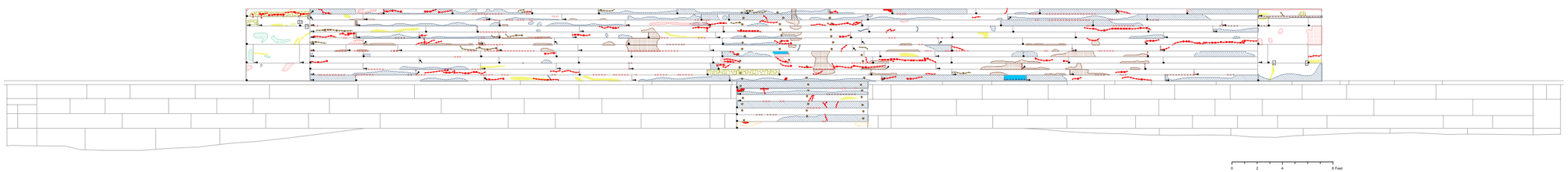
FLOOR AND STAIR TREADS

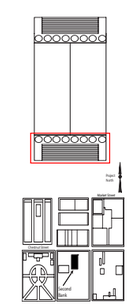


STAIR RISERS



CONDITIONS LEGEND

- Open Joint
- Deteriorated Joint Mortar
- Major Crack
- Moderate Crack
- Network Cracking
- Friability/Flaking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimensional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Repointing
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Foliation Orientation
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non- Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation/Displacement
- Mineral Inclusion
- Defective Mechanical System
- Railing Remnant



SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

SOUTH PORTICO
FLOOR AND STAIRS

PROJECT SUPERVISORS:
CHARLES TONETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SPONSORED BY:
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CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

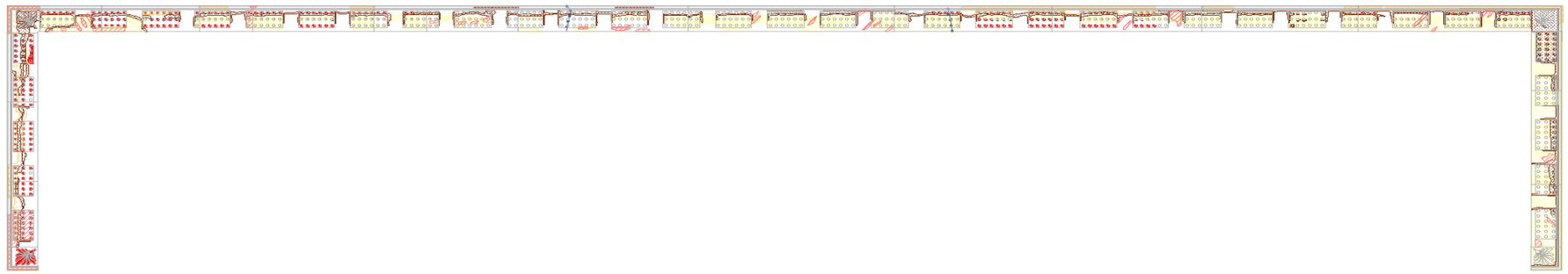
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA

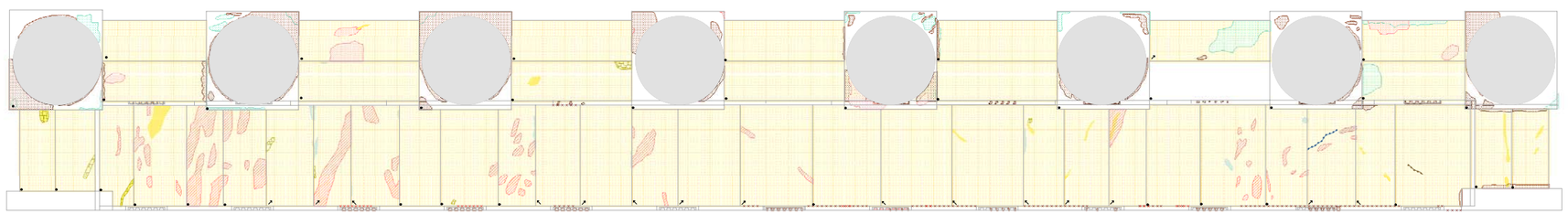
SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 111

SOFFIT



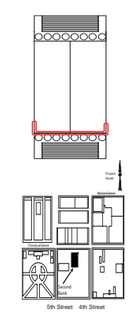
REFLECTED CEILING



0 2 4 8 Feet

CONDITIONS LEGEND

- Open Joint
- Deteriorate Joint Mortar
- Major Crack
- Moderate Crack
- Network Cracking
- Friability/Flaking
- Contour Scaling
- Differential Erosion
- Incipient Spalling
- Dimensional Loss
- Filled Crack Less Than 1/4"
- Filled Crack Greater Than 1/4"
- Repointing
- Chemical Bird Repellent
- Treatment Coating
- Stone Redressing
- Stone Dutchman
- Stone Replacement
- Composite Repair
- Sealant
- Foliation Orientation
- Intrinsic Metallic Staining
- Extrinsic Metallic Staining
- Non-Intrinsic Staining
- Microflora
- Efflorescence
- Encrustation
- Deformation/Displacement
- Mineral Inclusion
- Defective Mechanical System
- Railing remnant



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INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

SOUTH PORTICO
CORNICE SOFFIT AND CEILING

SPONSORED BY:
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CRM OFFICE
INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

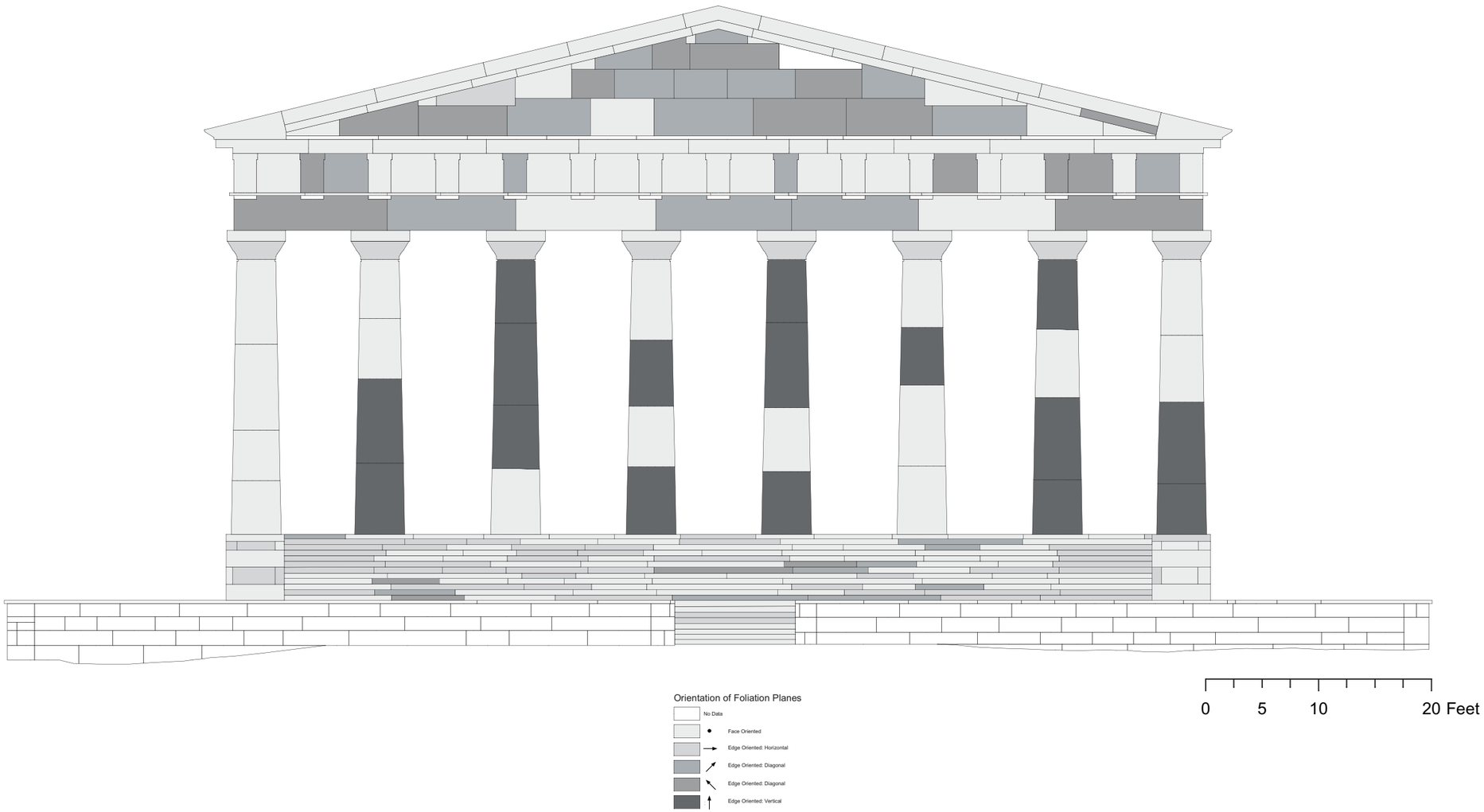
KERRY JOHNSTON
SOPHIA MIDDLEBROOK

PROJECT SUPERVISORS:
CHARLES STOTT, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 112

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
THE GRADUATE PROGRAM IN HISTORIC PRESERVATION THE SCHOOL OF DESIGN UNIVERSITY OF PENNSYLVANIA



SOUTH PORTICO
ORIENTATION OF FOLIATION PLANES

CONDITION ASSESSMENT:
JOHN GLAVAN
LAUREN HEGERTY
JOHN HOWARD

KERRY JOHNSTON
SOPHIA MIDDLEBROOK

SITE RECORDING: SUMMER 2003
DATA INPUT: FALL 2003

DWG 113

SECOND BANK OF THE UNITED STATES
INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

PROJECT SUPERVISORS:
CHARLES SOUTT, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

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Orientation of Foliation Planes

- No Data
- Face Oriented
- Edge Oriented: Horizontal
- Edge Oriented: Diagonal
- Edge Oriented: Diagonal
- Edge Oriented: Vertical

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INDEPENDENCE NATIONAL HISTORICAL PARK, PHILADELPHIA, PA

PROJECT SUPERVISORS:
CHARLES TONETTI, INDEPENDENCE NATIONAL HISTORICAL PARK
FRANK MATERO, ARCHITECTURAL CONSERVATION LABORATORY, UPENN
PROJECT MANAGER:
JOHN HINCHMAN, ARCHITECTURAL CONSERVATION LABORATORY, UPENN

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CONDITION ASSESSMENT:
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ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
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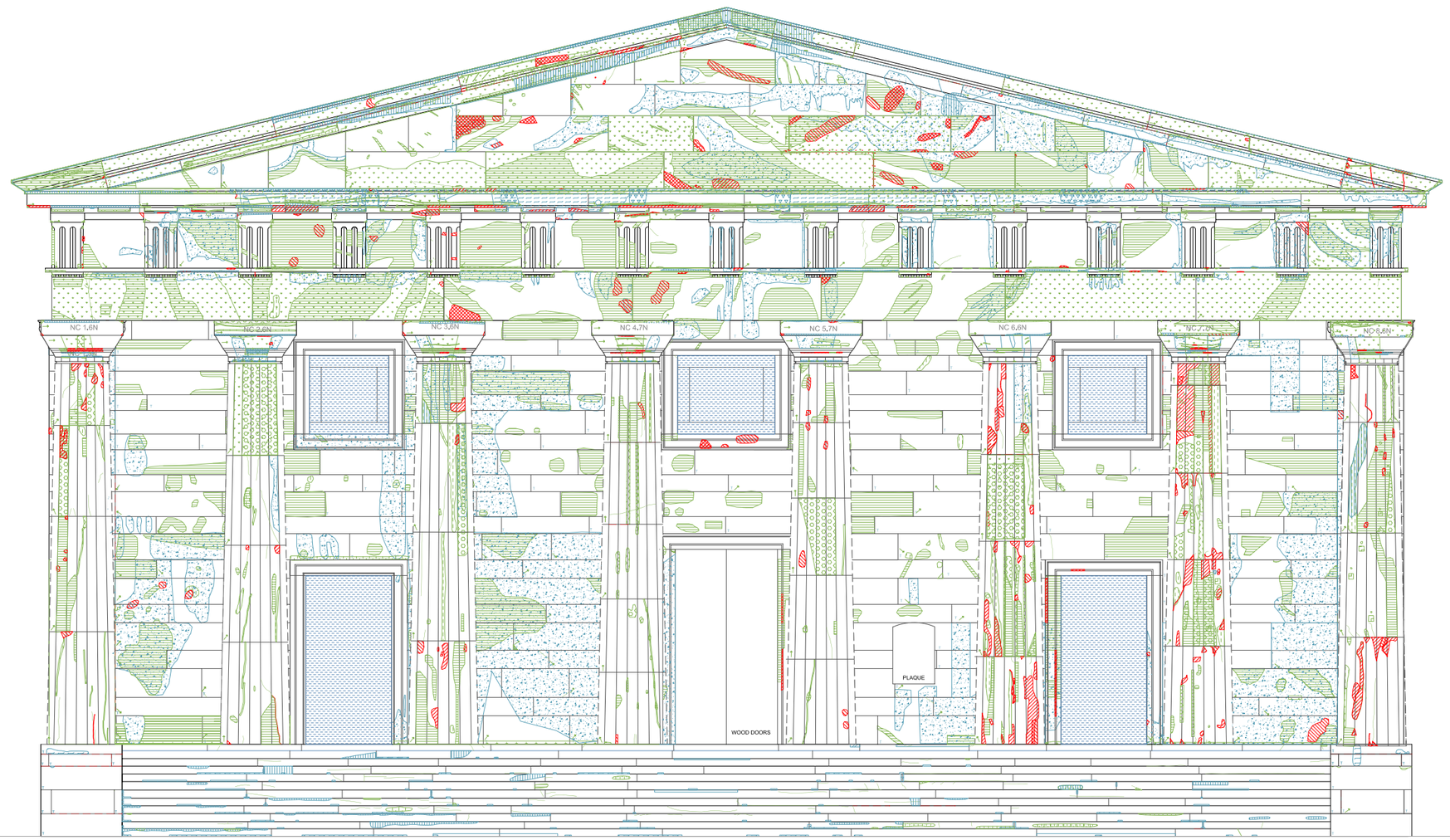
EAST ELEVATION
FOLIATION ORIENTATION

DWG 114



REQUIRES INTERVENTION

- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING

- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE

- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

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PHILADELPHIA, PA 19106

ARCHITECTURAL CONSERVATION LABORATORY
UNIVERSITY OF PENNSYLVANIA
PHILADELPHIA, PA 19104

PROJECT DIRECTOR:

PROJECT COORDINATION:

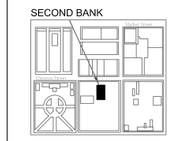
PROJECT MANAGER:

PROJECT CONSULTANTS

TECHNICAL SUPPORT:

DOCUMENTATION TEAM:

SECOND BANK



PROJECT NORTH

NORTH PORTICO
COLUMNS AND BACKWALL

ISSUE DATE:

REVISION:	DESCRIPTION	DATE

CA-1.01

SCALE: 1/4 inch = 1 foot

NOTE: ASSOCIATED DATABASE FILE BY STONE NUMBER, BINDERS OF PHOTOGRAPHS AND ARCHIVAL RESEARCH, AND MATERIALS TESTING DATA ARE STORED AT INHP ARCHIVES AND THE ACL LABORATORY AT THE UNIVERSITY OF PENNSYLVANIA

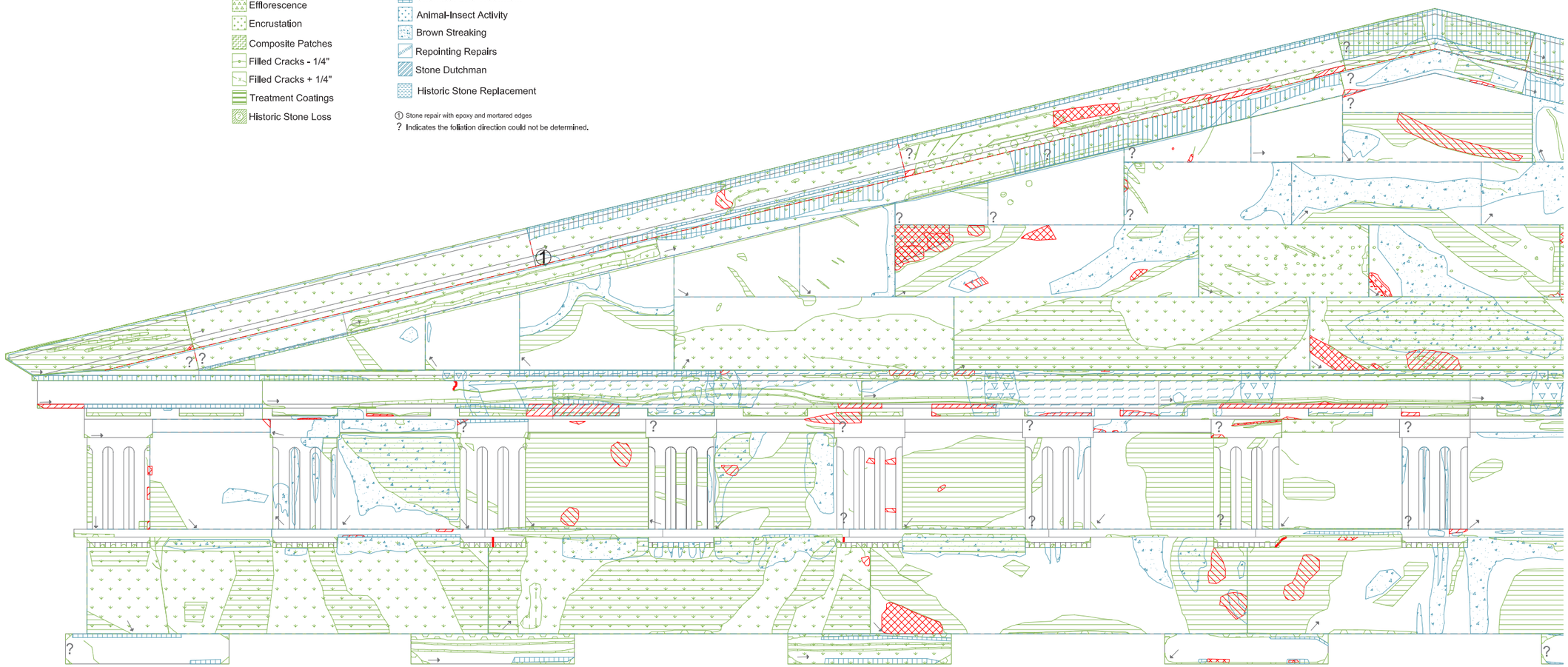
PHASE two | PLOTTED:
CONDITIONS ASSESSMENT SURVEY:

REQUIRES INTERVENTION
- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING
- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

ROUTINE MAINTENANCE - OBSERVATION
- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

① Stone repair with epoxy and mortared edges
? Indicates the foliation direction could not be determined.



C1 NORTH PORTICO PEDIMENT - East Half
SCALE 1/4" = 1' 0"

SECOND BANK
OF THE UNITED STATES

INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA

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PHILADELPHIA, PA 19106

ARCHITECTURAL CONSERVATION LABORATORY
UNIVERSITY OF PENNSYLVANIA
PHILADELPHIA, PA 19104

PROJECT DIRECTOR:
DORIS FANELLI

PROJECT COORDINATION:
BILL BROOKOVER
TODD HART

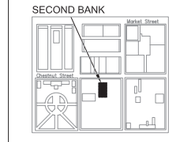
PROJECT MANAGER:
GUY MUNSCH

PROJECT CONSULTANTS
FRANK MATERO

TECHNICAL SUPPORT:
DPK&A
CYRA TECHNOLOGIES

DOCUMENTATION TEAM:
LORI AUMENT
ELSA BOURGUIGNON
CATHERINE DEWEY
CLAUDIA HARBERT
DIANE JACKER
MARNIE NEWMAN

SECOND BANK



PROJECT NORTH

NORTH PORTICO PEDIMENT

ISSUE DATE: AUGUST 12, 1999

REVISION:	DESCRIPTION	DATE

CA-1.02-a

0 2 4 6
SCALE 1/4" = 1' 0"

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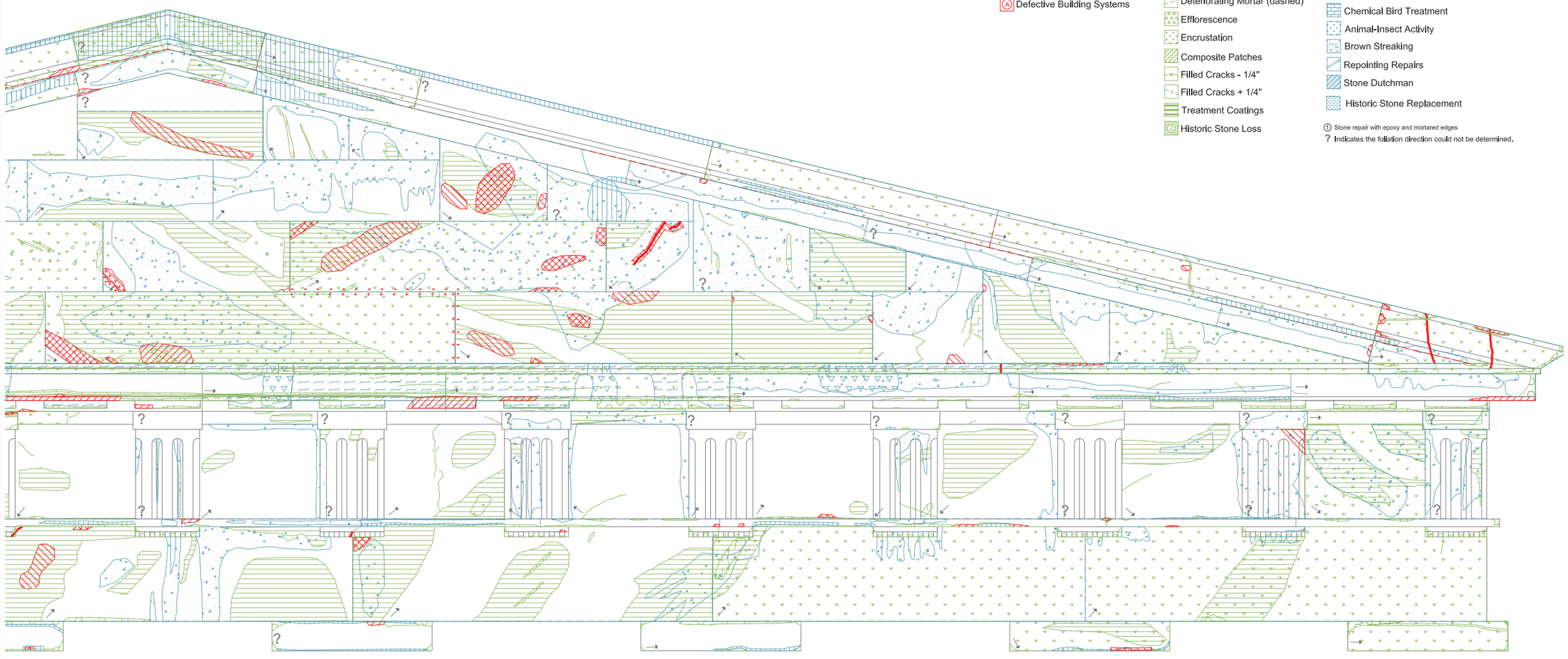
PHASE ONE | PLOTTED: 08/20/99 – GRM
CONDITIONS ASSESSMENT SURVEY: N–W ELEVATIONS



REQUIRES INTERVENTION
- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING
- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

ROUTINE MAINTENANCE - OBSERVATION
- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

① Stone repair with epoxy and mortared edges
? Indicates the foliation direction could not be determined.

1. Entire raking cornice has metallic staining from the roof

C1 NORTH PORTICO PEDIMENT - West Half
SCALE 1/4" = 1' 0"

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PHILADELPHIA, PA 19106

ARCHITECTURAL CONSERVATION LABORATORY
UNIVERSITY OF PENNSYLVANIA
PHILADELPHIA, PA 19104

PROJECT DIRECTOR:
DORIS FANELLI

PROJECT COORDINATION:
BILL BROOKOVER
TODD HART

PROJECT MANAGER:
GUY MUNSCH

PROJECT CONSULTANTS
FRANK MATERO

TECHNICAL SUPPORT:
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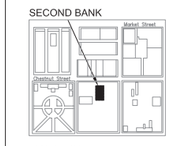
DIANE JACKIER
MARNIE NEWMAN

SECOND BANK



PROJECT NORTH

NORTH PORTICO PEDIMENT

ISSUE DATE: AUGUST 12, 1999

REVISION:	DESCRIPTION	DATE

CA-1.02-b

0 2 4 6
SCALE 1/4" = 1' 0"

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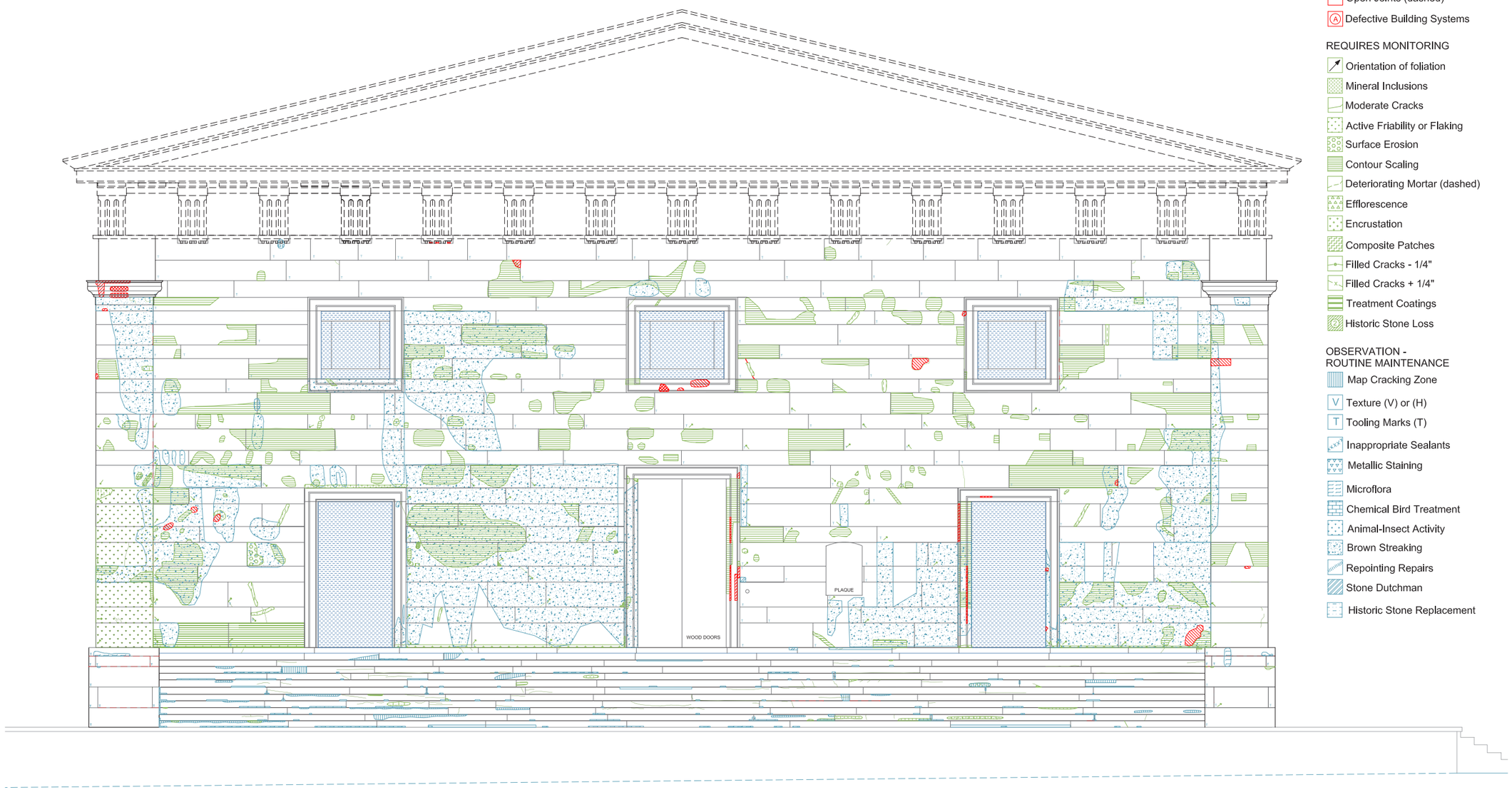
PHASE ONE | PLOTTED: 08/20/99 – GRM
CONDITIONS ASSESSMENT SURVEY: N–W ELEVATIONS



REQUIRES INTERVENTION

- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING

- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE

- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

SECOND BANK
OF THE UNITED STATES

INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA

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INDEPENDENCE NATIONAL HISTORICAL PARK
PHILADELPHIA, PA 19106

ARCHITECTURAL CONSERVATION LABORATORY
UNIVERSITY OF PENNSYLVANIA
PHILADELPHIA, PA 19104

PROJECT DIRECTOR:
DORIS FANELLI

PROJECT COORDINATION:
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TODD HART

PROJECT MANAGER:
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PROJECT CONSULTANTS
FRANK MATERO

TECHNICAL SUPPORT:
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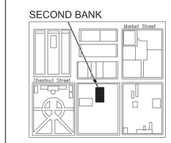
DIANE JACKIER
MARNIE NEWMAN

SECOND BANK



PROJECT NORTH

NORTH PORTICO FACADE BACK WALL

ISSUE DATE: AUGUST 12, 1999

REVISION:	DESCRIPTION	DATE

CA-1.03

0 2 4 6
SCALE 1/4" = 1' 0"

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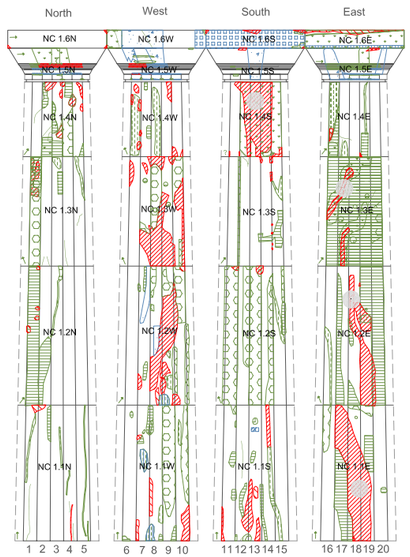
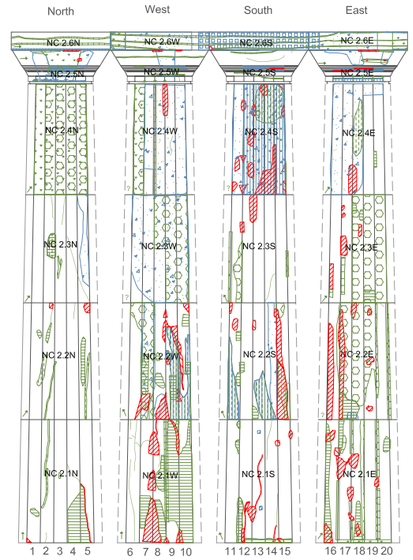
PHASE ONE | PLOTTED: 08/20/99 – GRM
CONDITIONS ASSESSMENT SURVEY: N–W ELEVATIONS

Easternmost Column Number One



Column Number Two



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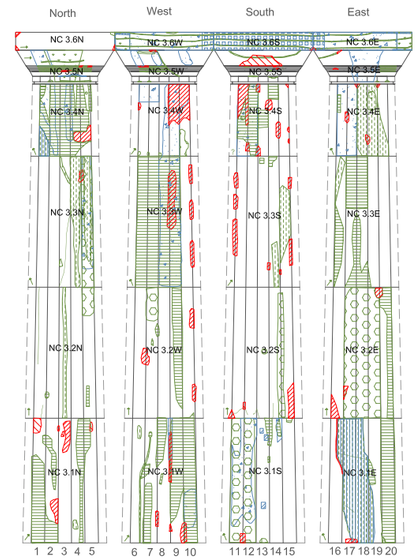
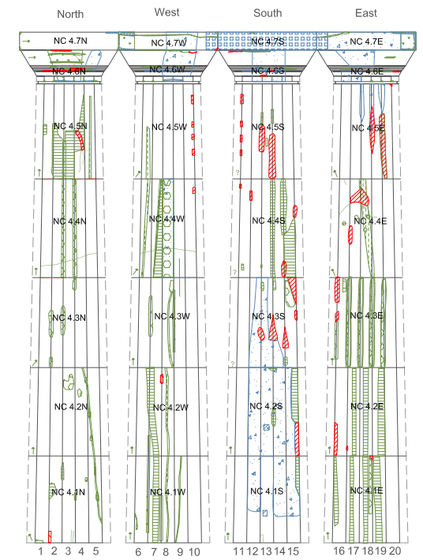


Column Number Four



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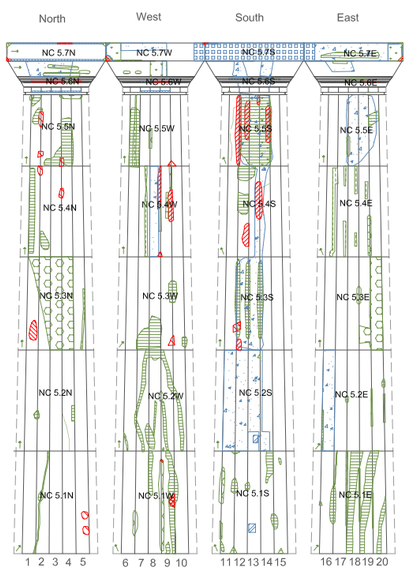

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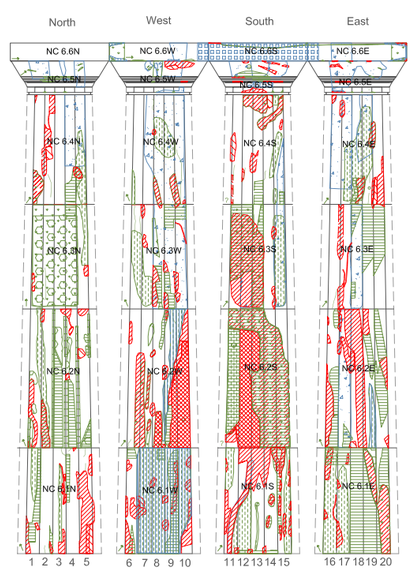

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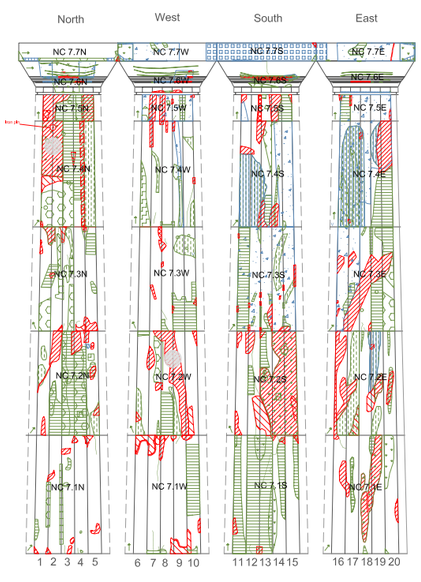

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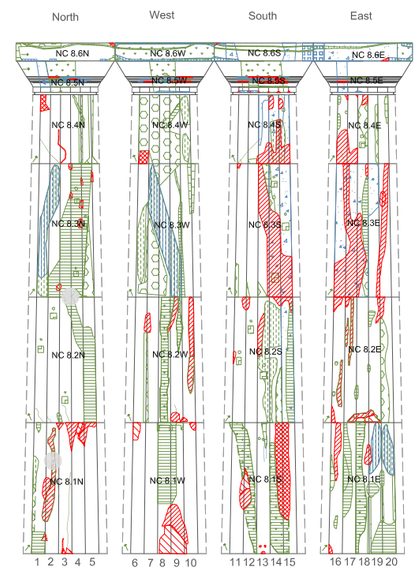

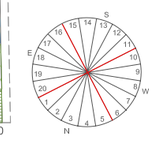

REQUIRES INTERVENTION

- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING

- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE

- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

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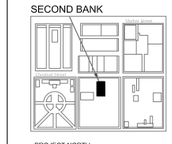

PROJECT NORTH

NORTH PORTICO
COLUMN ROLL-OUT

ISSUE DATE:

REVISION:	DESCRIPTION	DATE

CA-1.04

SCALE: 1/4 inch = 1 foot

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PHASE two | PLOTTED:
CONDITIONS ASSESSMENT SURVEY:

REQUIRES INTERVENTION

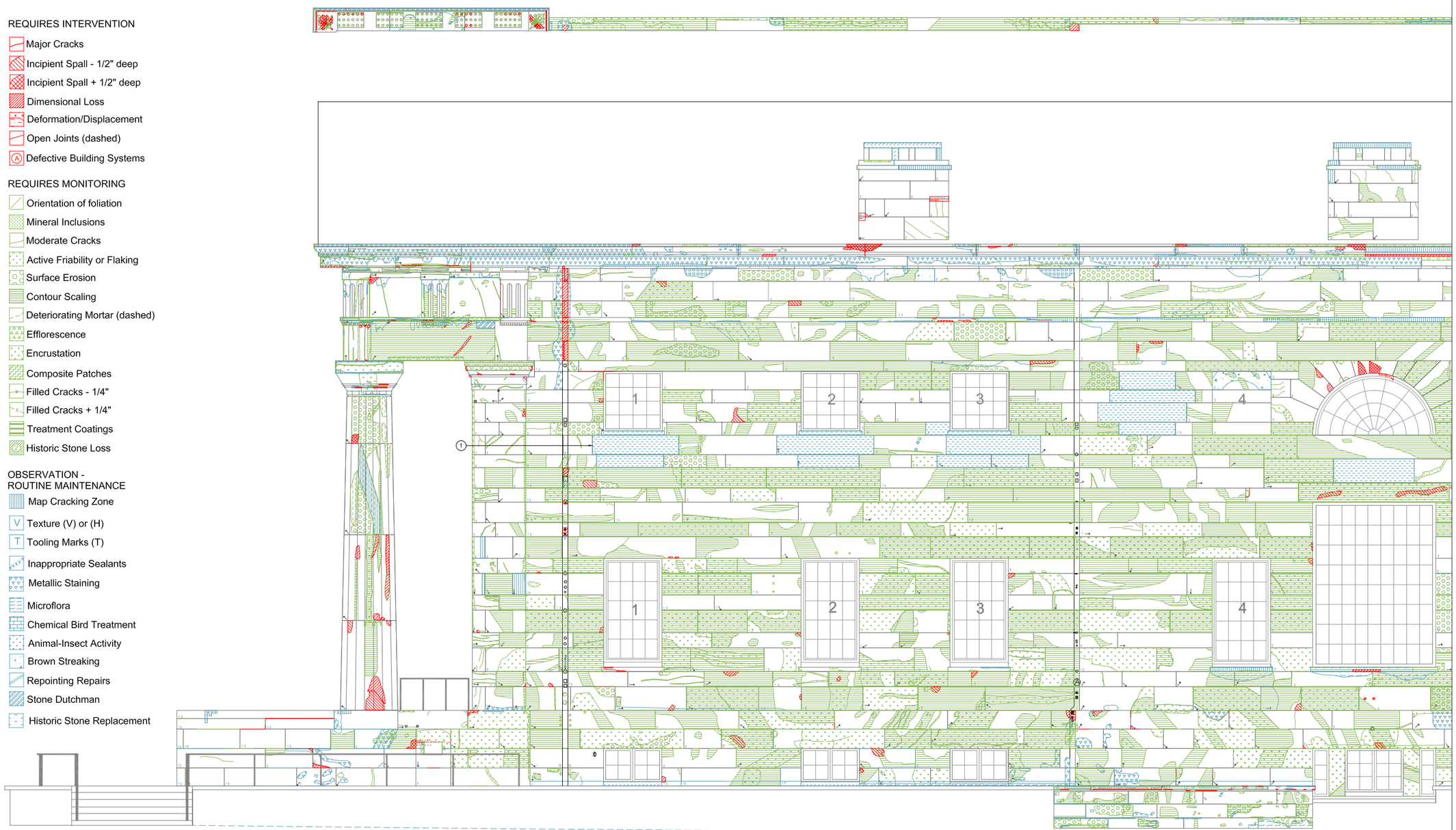
- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING

- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE

- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement



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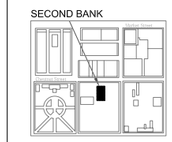

PROJECT NORTH

WEST ELEVATION
SOUTH HALF

ISSUE DATE:

REVISION:	DESCRIPTION	DATE

CA-1.05

SCALE: 1/4 inch = 1 foot

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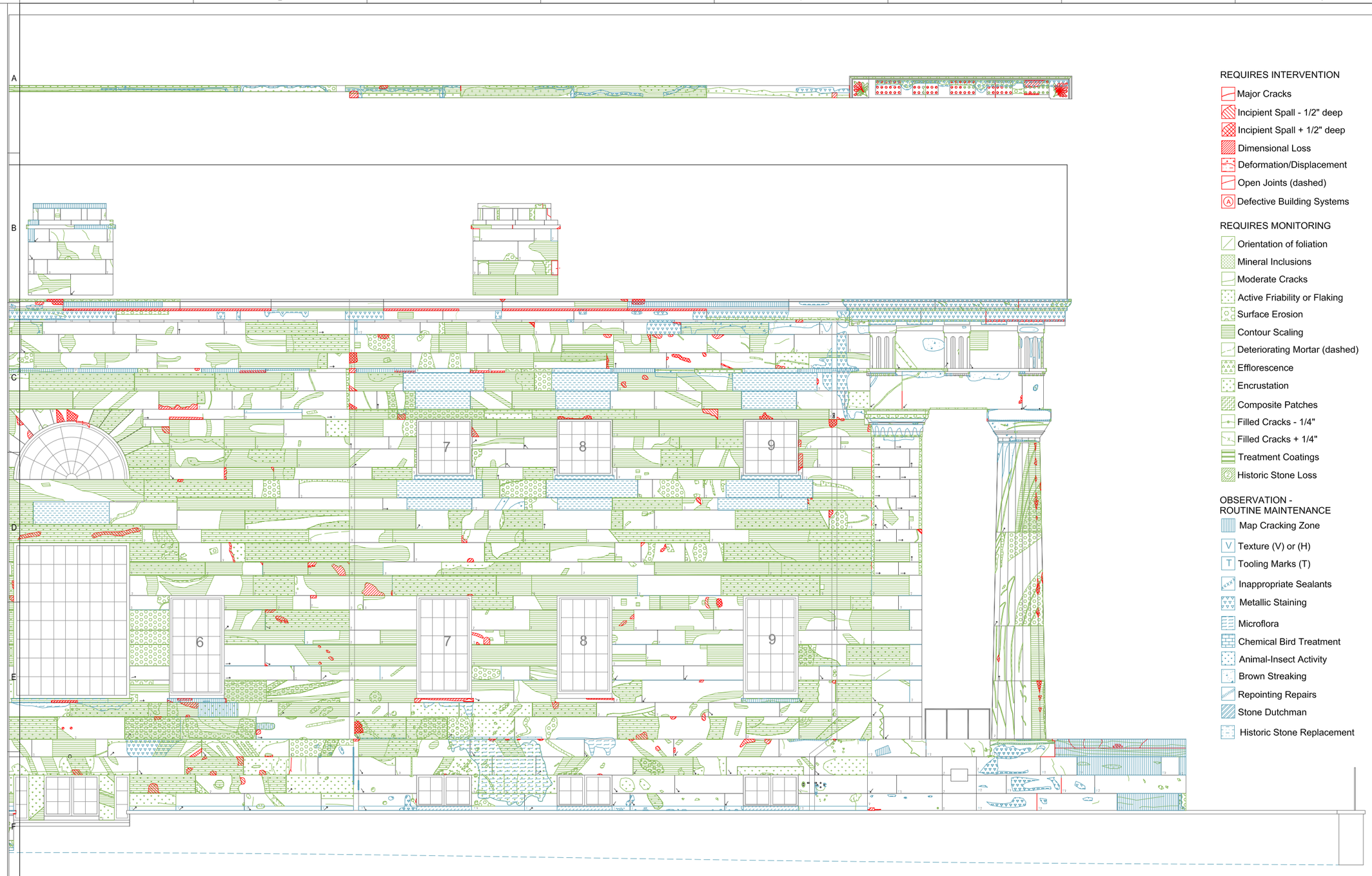
PHASE two | PLOTTED:
CONDITIONS ASSESSMENT SURVEY:



REQUIRES INTERVENTION

- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING

- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE

- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

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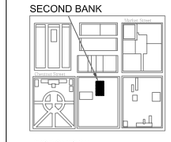

PROJECT NORTH

WEST ELEVATION
SOUTH HALF

ISSUE DATE:

REVISION:	DESCRIPTION	DATE

CA-1.06

SCALE: 1/4 inch = 1 foot

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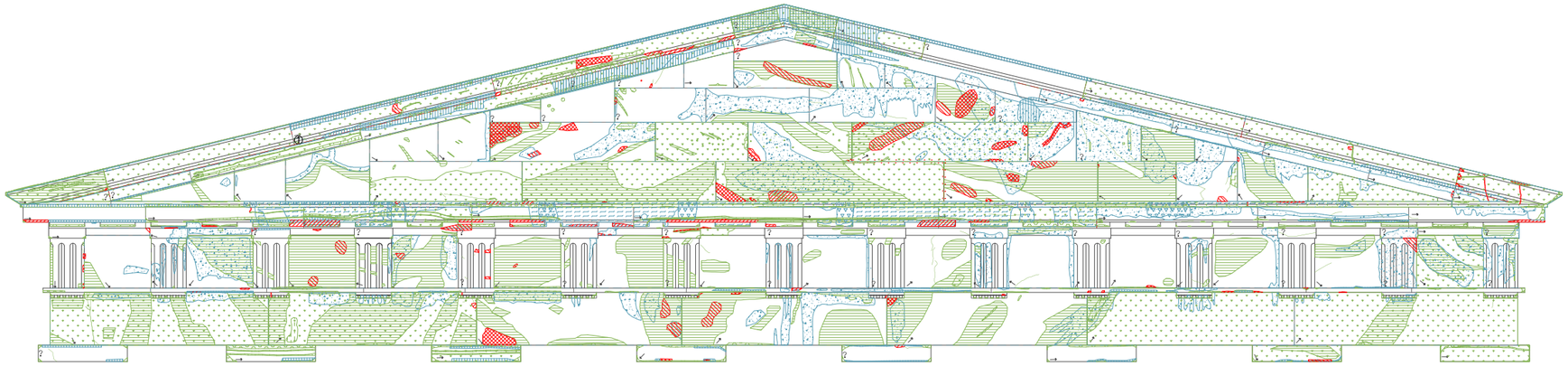
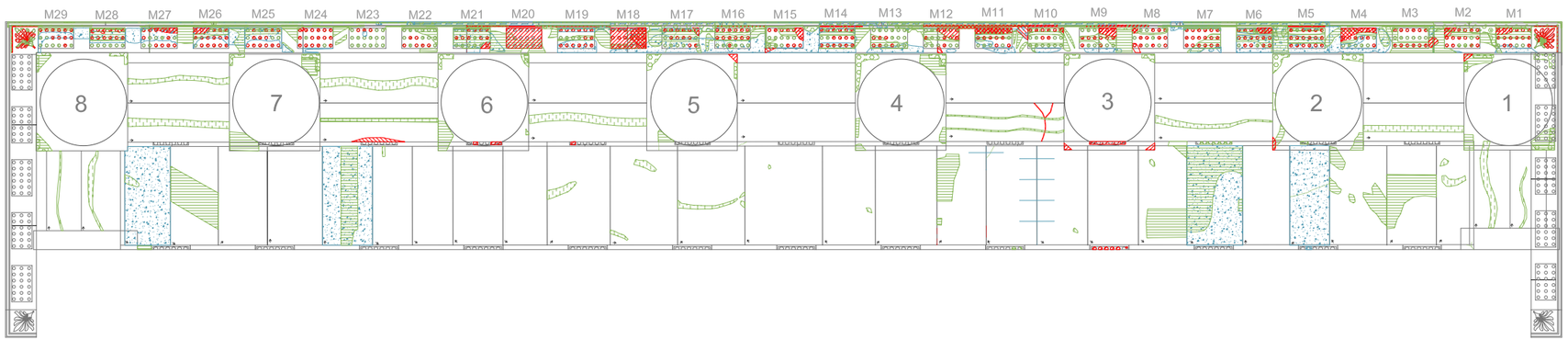
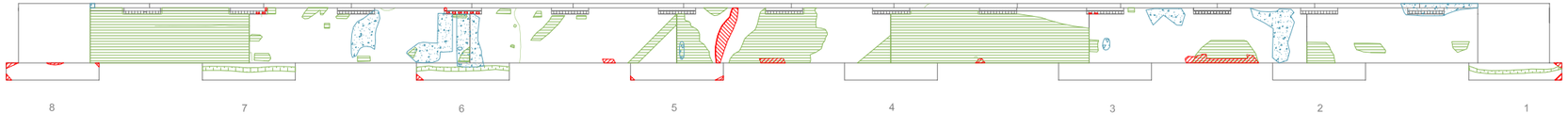
PHASE two PLOTTED:
CONDITIONS ASSESSMENT SURVEY:



1. Entire raking cornice has metallic staining from the roof





REQUIRES INTERVENTION
- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING
- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE
- Map Cracking Zone
- Texture (V) or (H)
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- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

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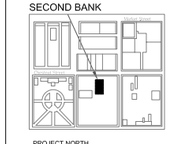

PROJECT NORTH

NORTH PORTICO
PEDIMENT AND UNDERSIDE OF MUTULES

ISSUE DATE:

REVISION:	DESCRIPTION	DATE

CA-1.07

SCALE: 1/4 inch = 1 foot

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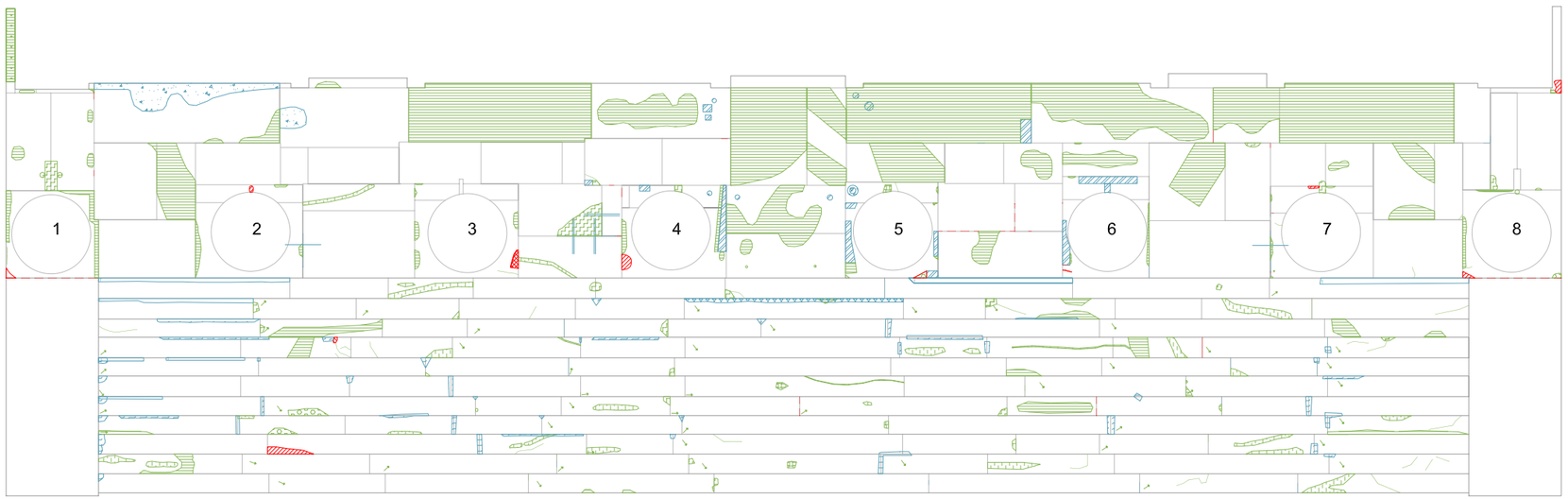
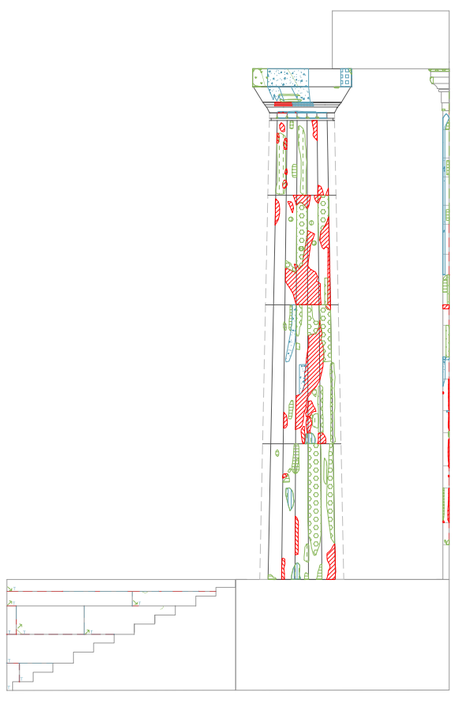
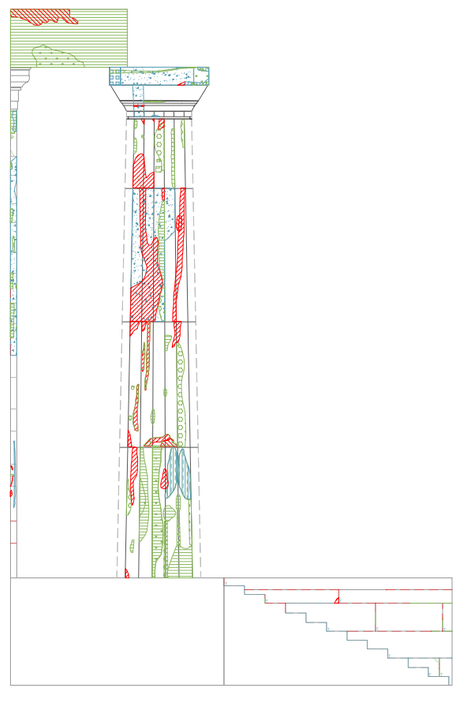
PHASE: two | PLOTTED:
CONDITIONS ASSESSMENT SURVEY:







REQUIRES INTERVENTION

- Major Cracks
- Incipient Spall - 1/2" deep
- Incipient Spall + 1/2" deep
- Dimensional Loss
- Deformation/Displacement
- Open Joints (dashed)
- Defective Building Systems

REQUIRES MONITORING

- Orientation of foliation
- Mineral Inclusions
- Moderate Cracks
- Active Friability or Flaking
- Surface Erosion
- Contour Scaling
- Deteriorating Mortar (dashed)
- Efflorescence
- Encrustation
- Composite Patches
- Filled Cracks - 1/4"
- Filled Cracks + 1/4"
- Treatment Coatings
- Historic Stone Loss

OBSERVATION - ROUTINE MAINTENANCE

- Map Cracking Zone
- Texture (V) or (H)
- Tooling Marks (T)
- Inappropriate Sealants
- Metallic Staining
- Microflora
- Chemical Bird Treatment
- Animal-Insect Activity
- Brown Streaking
- Repointing Repairs
- Stone Dutchman
- Historic Stone Replacement

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PROJECT NORTH

NORTH PORTICO
FLOOR AND STAIRS
AND INTERIOR RETURN WALLS

ISSUE DATE:

REVISION:	DESCRIPTION	DATE

CA-1.08

SCALE: 1/4 inch = 1 foot

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CONDITIONS ASSESSMENT SURVEY:

8.0 Material Analysis

Selective analysis was conducted on the Pennsylvania marble from the north portico in 1999. (see Section 8.2) Characterization included confirmation of the mineral content of the marble inclusions, black gypsum crusts, and the identification of brown streaking apparent on the façade that was believed to be residues of the earlier 1964 water-proofing.

Previous testing of Pennsylvania marble has been performed at different times for each of the three major Pennsylvania marble buildings in the park. The stone of the Second Bank was studied by Jocelyn Kimmel as part of a graduate thesis in 1996 and for the First Bank by Guy Munsch as part of a graduate thesis in 1998. Additionally, stone at the Merchant's Exchange was examined as part of a multi-year Conservation Strategy[50]. Further analysis and testing will proceed upon completion of the exterior conditions survey. Testing as required to evaluate specific treatment and repair strategies will also need to be incorporated into the future phases of the project.

Scanning electron micrographs (SEM) of collected samples from protected areas show a blistered coating on the surface of the marble. (Fig. 13) To confirm the visual observations, an X-ray (EDS) analysis was performed. A central target inside the opening of the coating was selected and an elemental spectra was recorded. A second target over the coated surface was then used for a second reading.

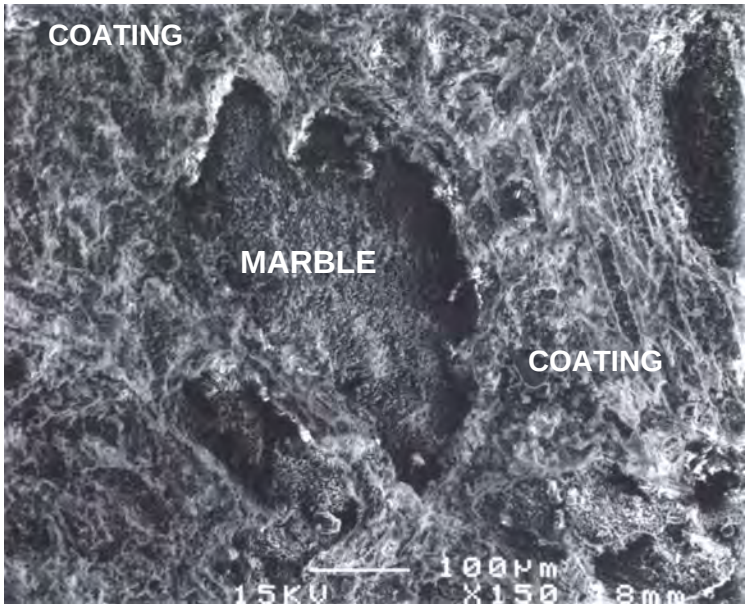


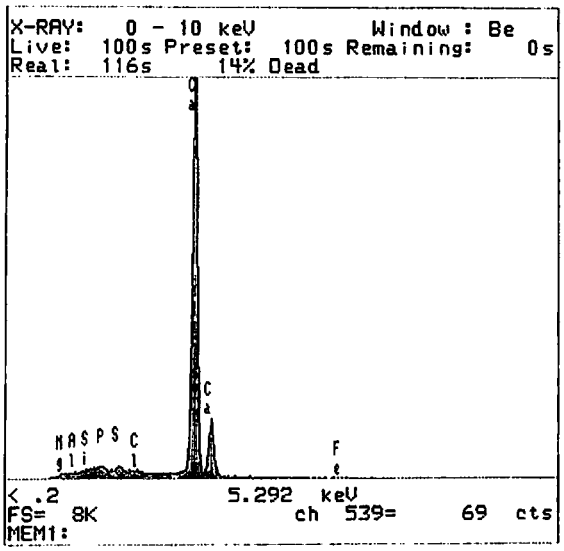
Figure 13: SEMicrograph of north portico sample (Magnification 150x).

[50] Brookover, McGee, Mossotti, Dolske and Sherwood, 1992

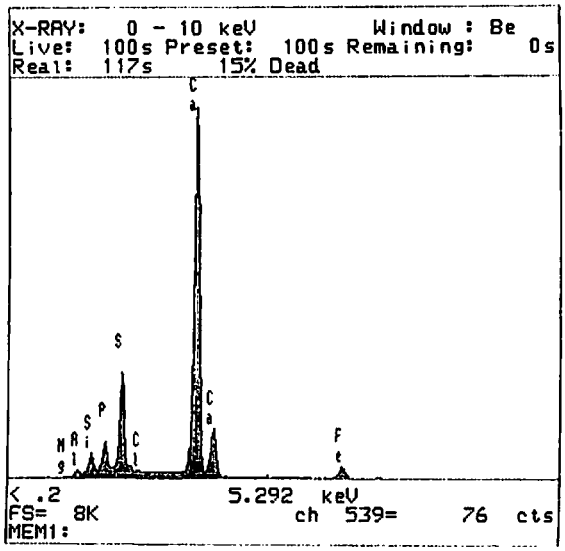
The spectra below on the left shows the marble surface without the coating. It exhibits a high calcite (Ca) peak with minimal readings for silicon (Si) and iron (Fe). The spectra below on the right, taken from the coated area, still has a high peak for the dominant mineral of the marble, calcite, but there is a substantial increase in the silicon and the iron peaks. The silicon confirms the presence of the 1964 silicone-based waterproofing polymer coating (Hydrozo-Clearstone). The presence of iron can be attributed to intrinsic accessory minerals present in the stone that would have naturally weathered off of the surface but is now held just below the surface of the film, contributing to the orange-brown staining on the surface of the marble.

Several samples were taken from the north façade of the Second Bank in 1999. Following are short summaries of a range of samples tested using X-ray diffraction analysis to confirm physical compositions of some of the more prominent inclusions, a white powdering on the surface, and soiling identified as gypsum and particulate sulfation crusts.

Analyses were conducted on stone samples using an X-Ray Diffraction Rigaku Diffractometer at the Laboratory for Research on the Structure of Matter (LRSM) at the University of Pennsylvania. The instrument was set at kilovolts and milliamps. The scans were run between 5 and 65 degrees 2T, at 2 degrees per minute. All of the samples were reduced into powder with a mortar and pestle. A glass slide was prepared by covering it with a thin layer of Vaseline and spreading the powder over it.



XRD, marble surface without coating



XRD, marble surface with coating

8.1 Analysis Summary

Samples taken from the north portico of the Second Bank of the United States, Philadelphia, PA.

8.1.1 Marble Dust

From an unknown area of the North façade (ground collection) XRD, Files Z12228.raw and Z12228.pks

Best match for marble dust is JCPDS spectrum 72 1651, calcium carbonate (calcite). The Pennsylvania Blue marble is mainly composed of calcite ($CaCO_3$). Secondary minerals from the marble did not display any prominent peaks.

8.1.2 Mineral Inclusion 1 (MI.1)

XRD, Files Z12229.raw and Z12229.pks

Best match for mineral inclusion 1 is JCPDS spectrum 83 0577, calcium carbonate. A secondary search was carried out on the spectrum of mineral inclusion 1 minus 82 0577. Two good matches of the resulting spectrum were JCPDS spectrum 06 0263, potassium aluminum silicate hydroxide (muscovite 2M#1) and JCPDS spectrum 40 0020, potassium magnesium aluminum silicate hydroxide. It is expected that calcite is the dominant mineral since almost all samples were sampled by scraping the stones, and are mixed with marble dust. The mineral inclusion is probably a type of muscovite.

8.1.3 Mineral Inclusion 2 (MI.2)

XRD, Files Z1 2230.raw and Z1 2230.pks

Best match for mineral inclusion 2 is JCPDS spectrum 06 0263, potassium aluminum silicate hydroxide (muscovite 2M#1). Second best match is JCPDS spectrum 76 0929, potassium aluminum oxide silicate hydroxide (muscovite 2M1). Calcite does not appear as a dominant mineral in this sample. It is probably a relatively pure sample of the inclusion, minimally contaminated by the marble dust. Mineral inclusion 2 is similar to mineral inclusion 1. It belongs to the muscovite mineral family.

8.1.4 Mineral Inclusion 3 (MI.3)

XRD, Files Z12231.raw and Z12231.pks

Best match for mineral inclusion 3 is JCPDS spectrum 77 2255, potassium aluminum silicate hydroxide (muscovite). Second best match is JCPDS spectrum 76-0929, potassium aluminum oxide silicate hydroxide (muscovite 2M1). JCPDS spectrum 40 0020, potassium magnesium aluminum silicate hydroxide, second best match for mineral inclusion 1, is the sixth best match for mineral inclusion 3. JCPDS spectrum 6 0263, potassium aluminum silicate hydroxide (muscovite 2M#1), best match for mineral inclusion 2, is the seventh best match of mineral inclusion 3.

Mineral inclusion 3 is similar to mineral inclusions 1 & 2. It belongs to the muscovite mineral family.

8.1.5 Mineral Inclusion 3 (MI.4)

XRD, Files Z12232.raw and Z12232.pks

Best match for mineral inclusion 4 is JCPDS spectrum 5 0586, calcium carbonate (calcite). A secondary search was carried out on the spectrum of mineral inclusion 4 minus 5 0586. The best match of the resulting spectrum was JCPDS spectrum 82 1572, silicon oxide. The second best match is JCPDS spectrum 76 0668, potassium aluminum silicate hydroxide (muscovite 2M1). A tertiary search was carried out on the spectrum of mineral inclusion 4 minus calcite (5-0586) minus muscovite (76 0668). The best match of the resulting spectrum was JCPDS spectrum 42 1340, iron sulfide (pyrite). Mineral inclusion 4 has a different color and appearance than mineral inclusions 1, 2 and 3. The first three were gray and very layered, almost fibrous. Number 4 was red brownish and of a smaller quantity. The best match of mineral inclusion 4 minus calcite is silicon oxide. (Note: As later testing confirmed evidence of a silicone based coating, the results of this test would seem to reflect the presence of the coating material on the marble sample.)

8.1.6 White Deposit 1 (W1)

XRD, Files Z12233.raw and Z12233.pks

Best match for the white deposit is JCPDS spectrum 70 0984, calcium sulfate hydrate (gypsum). The white deposit is present in areas which may not receive rain water washing through direct exposure or run off.

8.1.7 White Deposit 3 (W3)

XRD, Files Z12244.raw and Z12244.pks

Best match for the white deposit is JCPIDS spectrum 72 0596, calcium sulfate hydrate (gypsum).

8.1.8 Gypsum Crust 1 (G1)

XRD, Files Z12246.raw and Z12246.pks

Best match for gypsum crust 1 is JCPIDS spectrum 72 1650, calcium carbonate (calcite). A secondary search was carried out on the spectrum minus 72 1650. The best match of the resulting spectrum is JCPDS 6 0046, calcium sulfate hydrate (gypsum).

8.1.9 Gypsum Crust 2 (G2)

XRD, Files Z12247.raw and Z12247.pks

The best match for this sample is JCPDS spectrum 70 0095, calcium carbonate (calcite). A secondary search was carried out on the spectrum minus 70 0095. None of the matches

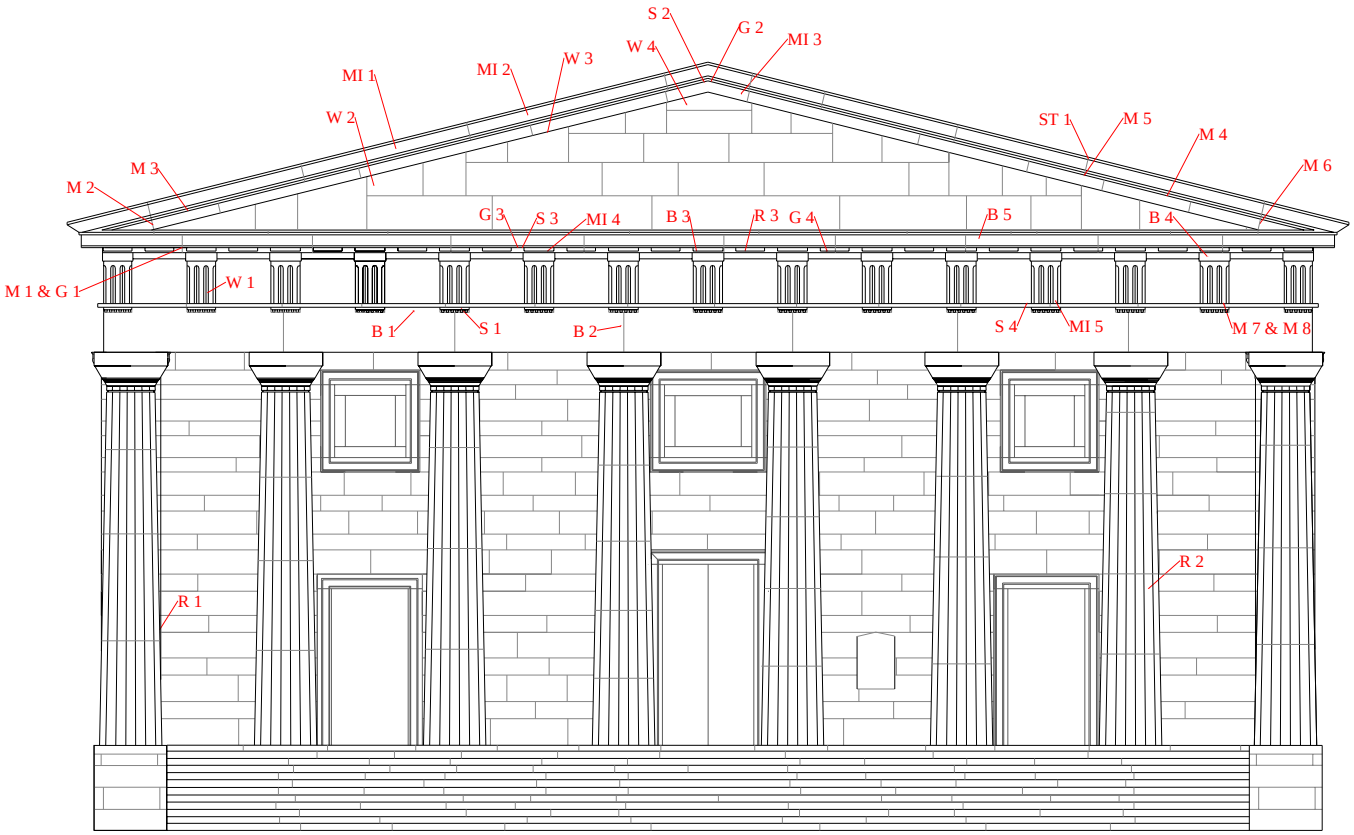
proposed by the database for the secondary search was appropriate for this type of sample, gypsum did not appear in the spectrum. The sample appears to be a soiled sample of friable marble, but is not in a deterioration state that has produced a true gypsum crust. The analysis underlines the difficulties in distinguishing a real gypsum crust deterioration pattern from a surface soiling of the marble.

8.1.10 Gypsum Crust 3 (G3)

XRD, Files Z12248.raw and Z12248.pks

The best match for this sample is JCPIDS spectrum 72 1652, calcium carbonate (calcite). A secondary search was carried out on the spectrum minus 72 1652. The best match of the resulting spectrum is JCPDS spectrum 6 0263, potassium aluminum silicate hydroxide (muscovite 2M1). A tertiary search was carried out on the sample, the third best match is 78 1253, silicone oxide (quartz alpha). The sixth best match is 36 0432, calcium sulfate hydrate (gypsum). The sample contains the dominant mineral from the marble, calcite, and from an apparent inclusion, muscovite, there are traces of the silicone treatment coating and of a mild gypsum crust.

8.2 Sample Locations



Locations and identification numbers of samples taken from the north façade in 1999.

9.0 Recommendations for Future Phases

- Emergency Interventions: Correct all defective building systems, re-point all open joints with a lime-based mortar, make temporary or limited experimental repairs to all spalls and areas of dimensional loss greater than 3” in diameter or as required.

- Use close range photogrammetry or laser scanning to monitor selected areas of stone alterations and loss and calculate rate of loss in the most vulnerable areas. Monitor cracks at key conditions to determine movement.

- Begin test pinning, patching and grouting methods to stabilize areas of deteriorated stone. Install a range of test panels to assess the performance of consolidants and water repellents as a follow up to the 1995 laboratory testing.

- Create a summary of all previous testing programs of Pennsylvania Marble done in conjunction with previous research projects at INHP, and determine the successes, the failures and the unknowns. Recommend which testing values can be accepted as a normal range for the performance of Pennsylvania marble and outline any new testing programs that must be completed in future phases.

- Explore opportunities for improving survey methodology and the potential for additional decay mapping with close-range stereophotogrammetry and laser scanning to determine deterioration patterns and rates.

- Pursue additional research and funding partnerships where appropriate. Develop a comprehensive plan for the exterior conservation and treatment of the Second Bank, the First Bank and the Merchant’s Exchange as needed. Explore this plan as an internal or external project both in terms of funding and staffing. Consider bringing the three projects together into one major initiative for NPS-INHP.

- Convert 1999 drawings into 2003 format using ArcView.

- Conduct a full analysis of the building using the analytical capabilities of GIS. Analysis should begin with the portico columns, as they exhibit the most complex deterioration patterns.

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11.0 Appendix

11.1 Appendix A. Guidelines

11.1.1 Phase 1 AutoCAD Guidelines

Phase 1 of the project was completed in AutoCAD 14 software by Autodesk. Future versions of this software or compatible software should be able to open these drawing files.

The following information summarizes the key coordination guidelines for Phase 1 of the project.

CAD LAYERS

Every condition recorded as well as distinct architectural features (i.e. joints) has been placed in its own layer. This allows conditions (layers) to be turned off or on to view the drawings in more than one relational context.

DRAWING FILES

Each elevational drawing has been developed and saved as a drawing file in the folder marked “xref”. The final drawings are composed of a single title block brought into paper space as an xref, with the elevation areas brought into model space. Multiple viewports have been used in paper space to compose the layout of the final drawings. Any raster images used in the drawings have been stored in a separate images folder.

LINE WEIGHTS

A single line weight was used for all of the conditions except for “major cracks”, which has a double thickness. Modifications to the line weights were made using the creation of a plot file (pc2 file). This plot file can be loaded through the print dialog box prior to sending the drawing to the plotter.

PLOT FILES

Plot files were created for these drawings at a full size sheet (34” x 22”) and half size sheet (17” x 11”). All drawings were plotted from a Hewett Packard DesignJet 750C Plus on Azon 27 lb. Premium Color Paper. Plot files must be configured to be compatible with the plotter to be used. The pen weights below will then need to be assigned and saved as a new plot file to be compatible with any plotter other than the model used for this drawing set.

AutoCAD PEN COLORS & LINE WEIGHTS

In general, set line widths to “0”. Plotted line widths and colors are determined by associating an AutoCAD color number (1 to 256) with a “pen” number of specific width in black and/or a color. The colors and weights used allow for the drawing conditions to be “readable” in both color and black and white. The following chart can be adapted for inkjet, laser, electrostatic or thermal plotting:

AutoCAD COLOR & PEN ASSIGNMENTS

Color/Pen No.	Color/Pen No.	Plot Size		Description/Example Use
100% no screen	50% screen	Pen Size Full Plot	Pen Size Half Plot	
1 (1) Red	Not used	0.009	0.005	Requires Intervention Conditions
75 (75) Med. Green	Not used	0.009	0.005	Requires Monitoring Conditions
145 (145) Med. Blue	Not used	0.009	0.005	Routine Maintenance-Observation Conditions
7 (7) White/Black	Not used	0.012	0.007	Outlines, text
8 (8) Grey	Not used	0.007	0.004	Stone Numbers
250 (250) Black	Not used	0.008	0.004	Thin black line
251 (251) Black	Not used	0.010	0.005	Medium black line
6 (6) Magenta	Not used	0.008	0.004	View Ports (Freeze for plotting)

For this project a full size plot is 34” wide x 22” high. A half size plot is 17” wide x 11” high. If an oversize plot is needed (125%) the size is 42.5” wide x 27.5” high.

11.1.2 Phase 2 Guidelines

A combination of Autodesk AutoCAD 2004, ESRI ArcMap 8.2, Adobe InDesign, and Adobe Acrobat software was used to complete the Phase 2 drawings. Final drawings are saved as portable document files (.pdf’s) and can be opened with Adobe Acrobat software. Drawings were plotted from Adobe Acrobat on both full size (36” x 24”) and half size (17” x 11”) sheets. All drawings were plotted from a Hewlett Packard DesignJet 1055CM. Sets of the plotted 1999, 2004, and updated 1999 drawings are in the collection of the archives of Independence National

Historical Park and at the Architectural Conservation Research Laboratory at the University of Pennsylvania.

ArcView COLORS & HATCH PATTERNS

ArcView software was used to display and represent the data because it offers a greater variety of colors and hatch patterns and allows for easier manipulation and fine tuning of the layers. The following table lists all of the conditions with the colors and hatches used to represent them in the final drawings:

SECOND BANK CONDITION SURVEY
COLORS AND HATCHES USED IN ARCMAP

CONDITION	COLOR	LINE/OUTLINE WIDTH	SYMBOL	PICTURE FILL	
Outlines	Gray 30%	.5	straight line		
Perspective (columns)	Gray 30%	.5	dashed 6:6		
SUBTRACTIVE CONDITIONS					
Open Joint	Mars Red	.5	Dike 2 Approx (Geology 24K)		xxxxxxxx
Deteriorated Mortar	Dark Umber	.5	Dike 2 Approx (Geology 24K)		xxxxxxxxx
Major Crack	Mars Red	.5	Square Marker Size 4		
Moderate Crack	Leather Brown	.5	Square Marker Size 4		
Network Map Cracking	Olivenite Green	.4		hacshd20	
Friability/Flaking	Med. Coral Light	.4		ordered20	
Contour Scaling	Med. Coral Light	.4	0° lines, separation=3		
Differential Erosion	Med. Coral Light	.4	45° lines, separation=3		
Incipient Spalling	Peony Pink			Solid	
Dimensional Loss	Mars Red			Solid	
ADDITIVE CONDITIONS					
Repointing Repair	Larkspur Blue	.5	Dike 2 Approx (Geology 24K)		xxxxxxxx
Filled Crack Less Than 1	Permian 3	.5	Squre Marker Size 4		
Filled Crack Greater Than 1	Larkspur Blue	.5	Square Marker Size 4		
Chemical Bird Repellent	Larkspur Blue	.4		ordered20	
Treatment Coating	Larkspur Blue	.4		620 Clay or Clay Shale	
Stone Redressing	Larkspur Blue	.4	-45° lines, separation=3		
Stone Dutchman	Big Sky Blue	.4		Solid	
Stone Unit Replacement	Cyan=5% Black=5%	.4		Solid	
Composite Repair	Sodalite Blue	.4		Solid	
Sealant	Ultra Blue	.4		Solid	

OTHERS					
Intrinsic Metallic Staining	Tertiary 2	.4		ordered40	
Extrinsic Metallic Staining	Tertiary 2	.4	Marker V size 5 (caves symbols) Separation: x=6, y=6		
NonIntrinsic Staining	Yucca Yellow	.4	0° lines separation =2		
Microflora	Fern Green	.4		smallwave2	
Encrustation	Cherrywood Brown	.4		ordered20	
Efflorescence	Jadeite	.4		ordered20	
Mineral Inclusion	Medium Yellow	.4		Solid	
Defective Mechanical Systems	Anemone Violet	.4		Solid	

11.2 Appendix B. Budgeting: Hours Allocated by Task

During both phases of the Conditions Assessment of the Second Bank, in addition to cumulative hours for the field school staff, the hours were broken down into specific work categories. These categories were used to assist in planning, staffing and expenses for future phases and to provide some baseline information to evaluate other assessment techniques or systems that may represent an improvement in savings of time, funding, or as a means to directing more of a focus towards the critical parts of the assessment process.

Over the entire field school period, hours were tracked for the following:

Phase 1

	6 Interns (total hours)	Manager
Archival Research	36	12
Field Survey	460.5	23
Digital Input	671.5	25
Photography/Imaging	10	18
Report Writing	13.5	56
Plotting	12	30
Coordination	193	69
Admin/Budget	0	18
Materials/Treatment Analysis	5	8
Total	1401.5 hrs.	259 hrs.

Comments relative to the above:

The areas for significant improvement are in the digitizing of the survey data and the coordination of the field work and digitizing.

Coordination as a category included a weekly meeting, reviewing drawings, adjusting surveys and the general operational types of tasks that occur on a daily basis.

The budgeted amount of time for management and coordination of the project (142 hours) was inadequate.

By using drawings for the baseline survey documents, photography hours were minimized.

These hours include the preparation work prior to the six week field school, and post- field school digitizing, plotting and report writing.

Phase 2

	5 Interns (total hours)	Manager
Field Survey	1000	
Digital Input	350	
Final Production	100	
Total	1450 hrs.	320 hrs.

Total Project **3430.5 person-hours**

11.3 Appendix C: Masonry Conditions Glossary

MASONRY CONDITIONS GLOSSARY

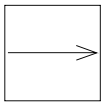
CONDITION

Orientation of foliation planes

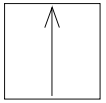
DEFINITION

Stones display a pattern of orientation based on their foliation planes. For edge-oriented stones, the position of these planes can be (a) horizontal, (b) vertical, or (c) diagonal to the ground. For face oriented stones, foliation planes are (d) parallel to the face of the stone.

GRAPHIC

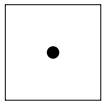


(a) edge-oriented horizontal



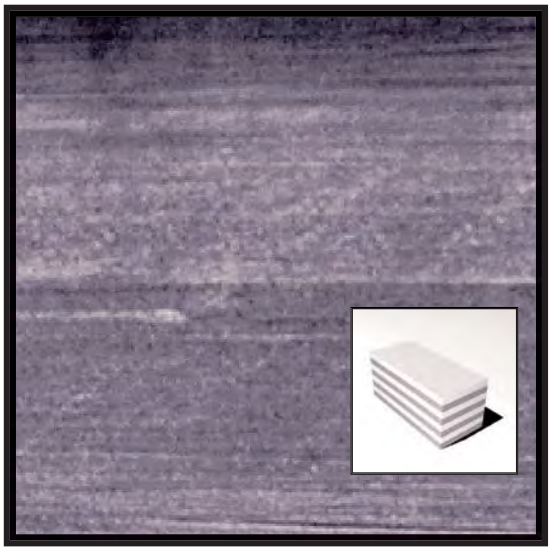
(b) edge-oriented vertical

(c) edge-oriented diagonal



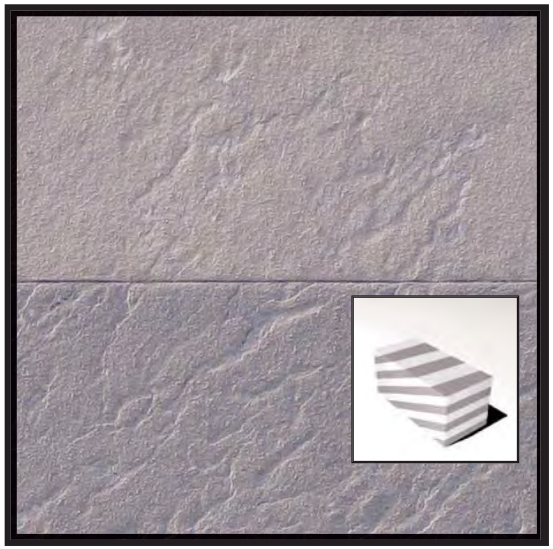
(d) face-oriented parallel

PHOTOGRAPHS

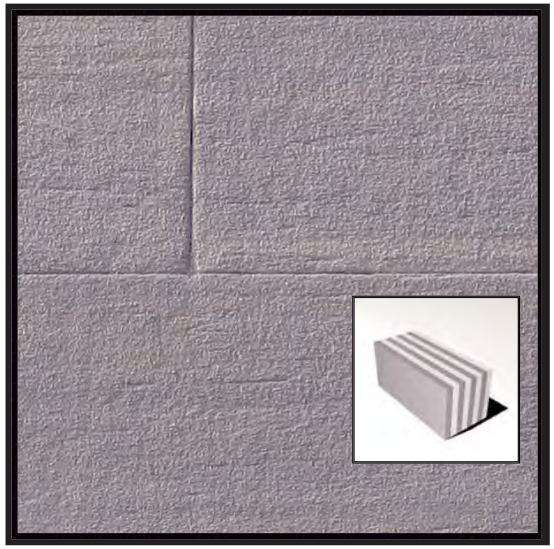


(a) edge-oriented horizontal

(b) edge-oriented vertical



(c) edge-oriented diagonal



(d) face-oriented parallel

CONDITION

Mineral Inclusions

DEFINITION

Stones may display large mineral inclusions as veins or phenocrysts. These inclusions are at least 1/2 inch in width and noticably larger than prevailing foliation patterns. They are typically (a) raised in relief or (b) weathered out and are often distinctive in color and texture from the surrrounding stone matrix.

GRAPHIC

PHOTOGRAPHS

(a) Raised in relief

(a) Raised in relief

(b) Weathered out

(b) Weathered out

CONDITION

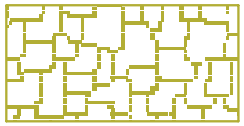
Network cracking

PHOTOGRAPHS

DEFINITION

A patterned network of fine intersecting cracks occurring on the surface of the stone, often in association with mineral inclusion-rich areas.

GRAPHIC



MASONRY CONDITIONS GLOSSARY

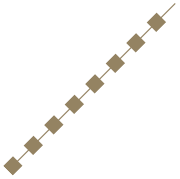
CONDITION

Moderate cracking

DEFINITION

Cracks that are 1/16-1/8 inch (1.6-3.2 mm) wide, of varying orientation and depth. These can be either (a) structural or (b) those that occur along foliation planes.

GRAPHIC



PHOTOGRAPHS

(a) Structural crack

(b) Foliation crack

(a) Structural crack

MASONRY CONDITIONS GLOSSARY

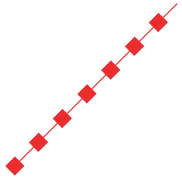
CONDITION

Major cracking

DEFINITION

Cracks greater than ⅛ inch (3.2 mm) wide, of varying orientation and depth. Usually associated with (a) deformation / displacement and/or (b) incipient spalling.

GRAPHIC



PHOTOGRAPHS

(a) deformation or displacement

(b) incipient spall

(b) incipient spall

MASONRY CONDITIONS GLOSSARY

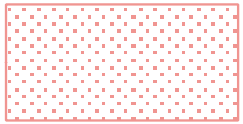
CONDITION

Friability / Flaking

DEFINITION

Surfaces with a) active disaggregation of individual grains and/or b) shallow flakes that dislodge under finger pressure.

GRAPHIC



PHOTOGRAPHS

a)

b)

b)

MASONRY CONDITIONS GLOSSARY

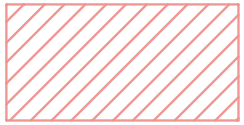
CONDITION

Differential erosion

DEFINITION

Surface weathering defined by (a) large areas of coarse texture, (b) localized loss greater than 1/4 inch in depth along foliation planes and in areas of mineral inclusions, or (c) reduction of surface details (e.g. weathered arrises or edges).

GRAPHIC



PHOTOGRAPHS

(a) Coarse texture

(b) Localized loss

(c) Reduction of surface details

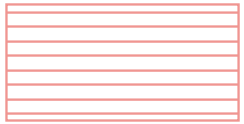
CONDITION

Contour scaling / Exfoliation

DEFINITION

Distinctive localized or overall patterns of stepped irregular surface loss associated with foliation, where the surface loss is greater than ⅛ inch in depth.

GRAPHIC



PHOTOGRAPHS

CONDITION

Incipient spalling

DEFINITION

Surface planar discontinuities that have become partially separated from the parent stone. The detached area can be detected visually and audibly by sounding. The angle of separation will be approximately 0-60° from the surface plane of the surrounding stone and usually in association with foliation.

GRAPHIC

PHOTOGRAPHS

CONDITION

Dimensional loss

DEFINITION

Localized stone loss greater than 2 square inches in area and at least ½ inch in depth as measured in plane with the surrounding stone surface. This may or may not be in association with spalling.

GRAPHIC

PHOTOGRAPHS

MASONRY CONDITIONS GLOSSARY

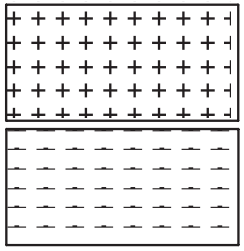
CONDITION

Deformation / Displacement

DEFINITION

Movement and cracking or separation of one or more stones resulting in the shifting of stone surfaces more than 1/2 inch out of plane. Relative planar shifts recorded as (+) or (-) .

GRAPHIC



PHOTOGRAPHS

MASONRY CONDITIONS GLOSSARY

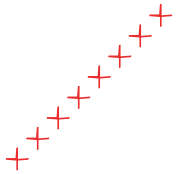
CONDITION

Open joints

DEFINITION

Stone joints where the pointing mortar is lost and the joint open to the weather.

GRAPHIC



PHOTOGRAPHS

MASONRY CONDITIONS GLOSSARY

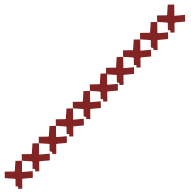
CONDITION

Deteriorated mortar joint

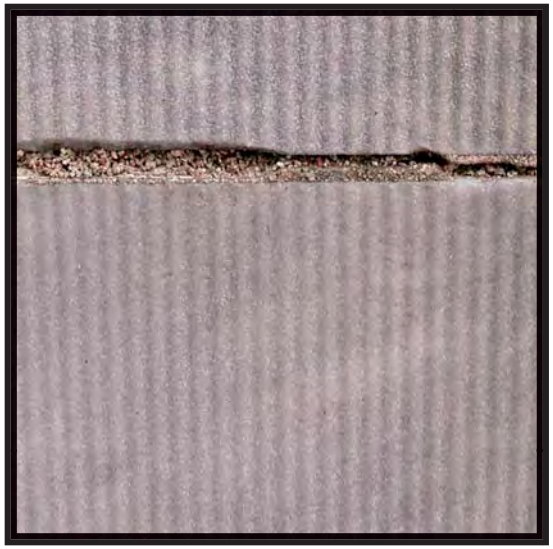
DEFINITION

Stone joints where the mortar is still present but eroded back ½ inch or more in depth, or noticeably cracked, or separated from the stone.

GRAPHIC



PHOTOGRAPHS



MASONRY CONDITIONS GLOSSARY

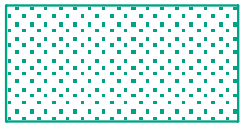
CONDITION

Efflorescence

DEFINITION

White crystalline, water-soluble deposits on the surface or within the pores of the stone indicating the presence of damaging salts.

GRAPHIC



PHOTOGRAPHS

CONDITION

Metallic staining

DEFINITION

Localized discoloration resulting from the weathering of either (a) intrinsic (mineralogical) or (b) extrinsic (copper or iron accessories) sources, usually black/brown (iron) or blue/green (copper) in color.

PHOTOGRAPHS

(a) intrinsic staining

(b) extrinsic staining

GRAPHIC

Intrinsic Metallic Staining

Extrinsic Metallic Staining

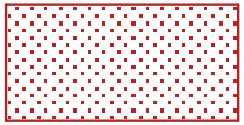
CONDITION

Encrustation

DEFINITION

Formation of gray to black smooth deposits or framboidal crusts in protected areas that are noticeably more concentrated than the prevailing soiling patterns.

GRAPHIC



PHOTOGRAPHS

MASONRY CONDITIONS GLOSSARY

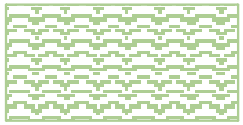
CONDITION

Microflora

DEFINITION

Localized zones of biological growth including algae, fungi, and lichens visible as a black, greenish or brown discoloration. Many of these areas are on the lower sections of the building, under windowsills, and along the cornice area at the tree line.

GRAPHIC



PHOTOGRAPHS

CONDITION

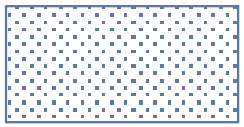
Chemical bird repellent treatments

PHOTOGRAPHS

DEFINITION

Residue of chemical gels and coatings used on horizontal surfaces to deter birds from landing and nesting on the building.

GRAPHIC



CONDITION

Sealant repair

PHOTOGRAPHS

DEFINITION

Presence of elastomeric sealants used as a masonry repair or pointing material.

GRAPHIC

MASONRY CONDITIONS GLOSSARY

CONDITION

Repointing

DEFINITION

All non-original mortars used for repointing joints, usually gray or white in color and often in association with joint recutting.

GRAPHIC

PHOTOGRAPHS

CONDITION

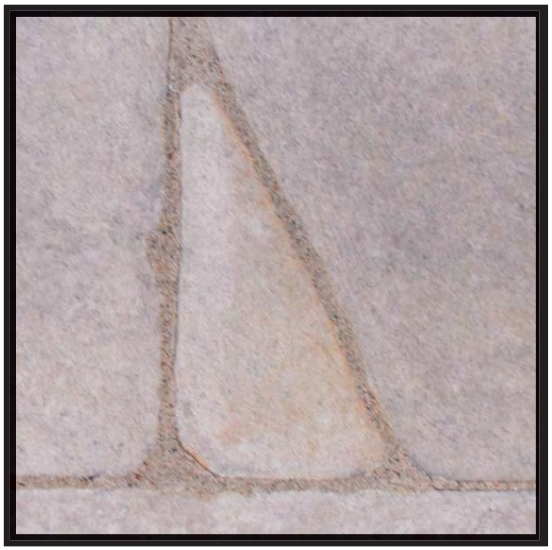
Stone Dutchman

DEFINITION

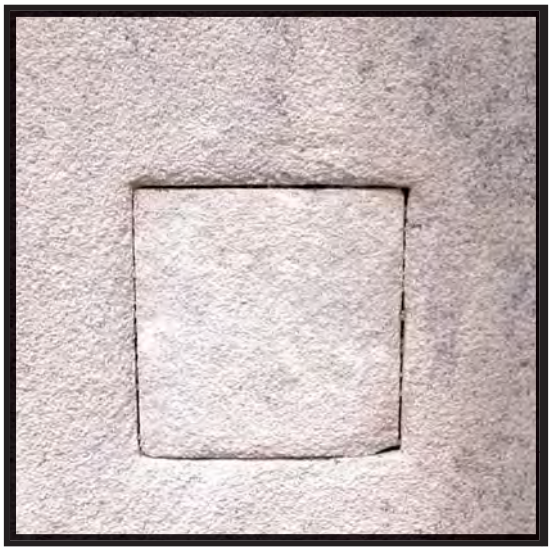
Stone infill repair set into the surrounding masonry (a) with or (b) without mortar.

GRAPHIC

PHOTOGRAPHS



(a) dutchman with mortar



(b) dutchman without mortar

(a) dutchman with mortar

(a) dutchman with mortar

MASONRY CONDITIONS GLOSSARY

CONDITION

Filled cracks

DEFINITION

Repairs to cracks executed at any time (a) less than ¼ inch in width.

Repairs to cracks executed at any time (b) greater than ¼ inch in width.

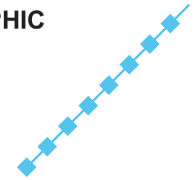
PHOTOGRAPHS

(a) Less than 1/4 inch

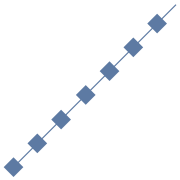
(b) Greater than 1/4 inch

GRAPHIC

(a)



(b)



CONDITION

Tooling marks

DEFINITION

Stones that are relatively protected still display their original surface tooling marks. The tooling marks are a relative indicator of the degree of surface weathering of the stone. The condition was recorded only where the tooling is evident on at least 50% of the stone's surface.

PHOTOGRAPHS

Replacement stone tooling

Original stone tooling

GRAPHIC

CONDITION

Composite Repairs

DEFINITION

A mortar or resin based system, used as a surface repair greater than 3/4 inch in width for spalls and overall losses,including those along joints, but not for cracks.

GRAPHIC

PHOTOGRAPHS

CONDITION

Stone Replacement

DEFINITION

Physical and/or archival evidence that complete stones or sections of the building, terraces, or perimeter walls have been replaced. Include date if known.

PHOTOGRAPHS

1976

1938

GRAPHIC

CONDITION

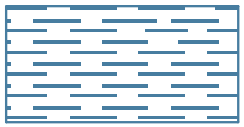
Previous treatment coatings

PHOTOGRAPHS

DEFINITION

The past application of a coating on the stone surface, generally off-white or pale yellow in color.

GRAPHIC



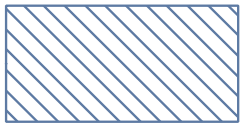
CONDITION

Stone redressing

DEFINITION

Tooling marks that indicate the selective redressing of stone to address advanced surface deterioration.

GRAPHIC



PHOTOGRAPHS

CONDITION

Defective mechanical features

DEFINITION

Building systems and/or anchoring hardware that is contributing to a stone deterioration condition.

GRAPHIC

PHOTOGRAPHS

MASONRY CONDITIONS GLOSSARY

CONDITION

Condition unique

PHOTOGRAPHS

DEFINITION

Any condition or physical alteration to the original surface of the building which does not fit within the existing set of categories. Numbering is sequential but does not reflect a specific order to the conditions.

GRAPHIC

CONDITION

Historic conditions

DEFINITION

Historic photographs that provide a time-based comparison of stone loss, weathering, and soiling patterns.

GRAPHIC

PHOTOGRAPHS

1961

2004

11.4 Appendix D: Overview of 1999 Database of Conditions

Stone Numbering:

Each stone of the north and west elevations were assigned unique stone numbers based on the elevation, architectural element, stone course, and stone number. Courses are numbered from the ground up. Stones are numbered from left to right. All of the stone numbers are shown on the four Stone Numbering Drawings: North Elevation Wall, Pediment, Column and West Elevation.

For example:
North Elevation + **W**all + **4**th Course from the ground + **5**th Stone from the left = NW4.5
North Elevation + **C**olumn **6** + **3**rd Drum from the ground + **S**outh face = NC6.3S

Abbreviations used for stone numbering:

North **W**all = NW
North **P**ediment = NP
North **C**olumns = NC
North **I**nterior **P**ortico (refers to underside and backside of portico) = NP
West **W**all = WW
West **F**oundation = WF
West **C**himneys = WCh

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