

THE STANFORD WHITE TRIPLE PORTAL

**ST. BARTHOLOMEW'S
CHURCH**

NEW YORK, NEW YORK

Building Diagnostics and Conditions Survey

Columbia University
Graduate School of Architecture, Planning and Preservation
Historic Preservation Program

2017 - 2019

In Cooperation with St. Bartholomew's Conservancy
With Additional Funding Generously Provided By
French Heritage Society



H·THY·WORD·GRANT·WE·BESEECH·THEE·VNTO·THY·CHVRCH·TO·LOVE·THAT·WO

UPCOMING AT ST. BART'S

TABLE OF CONTENTS

ACKNOWLEDGMENTS	6
INTRODUCTION	7
THE CHURCH AND PORTAL	7
ICONOGRAPHY	9
CHANGES AND CONDITIONS THROUGH TIME	10
CREATION OF BASELINE MEASURED DRAWINGS	18
DOCUMENTATION OF EXISTING CONDITIONS	20
KEY TO CONDITIONS DRAWINGS	20
KEY FOR LABELING OF CONDITIONS	20
ANNOTATED DRAWINGS WITH CONDITIONS INFORMATION	21
REFERENCE PHOTOGRAPHS AND DEFINITIONS	21
ADDITIONAL NON-DESTRUCTIVE EVALUATION	28
TEMPERATURE AND RELATIVE HUMIDITY	28
VIBRATION	30
INFRARED IMAGING	30
DISCUSSION AND AVENUES FOR FUTURE	34
INQUIRY BIBLIOGRAPHY	39
APPENDICES	43
INVESTIGATIVE TECHNIQUES (ADDENDUM)	54

From "The Year in Architecture," The New International Year Book, A Compendium of the World's Progress for the Year 1918: *Probably the most important and interesting building completed during the year is St. Bartholomew's Church in New York, by Bertram G. Goodhue, in a free version of the Romanesque, based primarily on the fine Triple Portal transferred from the old church.*

As Goodhue himself wrote, *the Triple Portal is universally regarded by architects and public alike, as one of the most beautiful things, perhaps the most beautiful thing of its kind in America.*

Frank Moore Colby, (ed.), "Architecture", The New International Year Book, A Compendium of the World's Progress for the Year 1918. New York, Dodd, Mead and Company, 1919, pp. 46, 47.

Bertram G. Goodhue, "The Proposed New St. Bartholomew's Church," January 16, 1915, St. Bartholomew's Archives, 1915.



The team used a lift to get a closer look at the portal's sculpture, one of the many tools employed to assess the condition of the Portal. (Opposite) Associate Rector Matthew Moretz explains the Portal's iconography and rich history to the team on an early site visit.

ACKNOWLEDGMENTS

This project is the result of an ongoing partnership between the St. Bartholomew's Conservancy and the Columbia University Graduate School of Architecture, Planning, and Preservation. Special thanks are due to Constance Evans, Executive Director of the St. Bartholomew's Conservancy, and George Wheeler, Director of Conservation at the Historic Preservation program at Columbia, who both put in considerable effort to get this partnership off the ground. The Conservancy's mission is to raise funds for restoration and preservation of the exteriors and gardens of the St. Bartholomew's site and by so doing, to broaden public understanding of the importance of historic preservation. Paramount to the successful restoration of the Triple Portal is an in-depth investigation required to properly assess the conditions and make appropriate recommendations for its treatment. A grant was generously provided by French Heritage Society to assist in these efforts. This study is the first step in the process.

Percy Preston Jr., Conservancy Board Member and Honorary Warden, was generous with his time, sharing resources that he had identified during his own research on the church as well as facilitating our use of the tremendous photographic archives of the church. The staff of St. Bartholomew's Church also supported this effort. Facilities Manager Corey Durney provided access to the facilities of the church, not only allowing us to use a room for our regular meetings throughout the semester, but also with a lift which enabled us to inspect the conditions of the Portal more closely. A purposely-built ramp was provided by the Conservancy. Finally, Associate Rector Matthew Moretz provided a vivid initial description of the iconography of the Portal, which stuck with us throughout the semester, and helped keep us a little bit warmer as the class conducted its survey in the cold. We understood that the Portal is a significant work of art as part of this National Historic Landmark and an important treasure for the City of New York.

The student participants in the course all played a role in the field documentation of existing conditions as well as the preparation of this report, including the associated drawings. Their names are as follows: Tania Alam, Allison Arlotta, Jessica Betz, Ethan Boote, Justin Clevenger, Allison Fricke, Gilda Gross, Andre Jauregui, Nicholas Kazmierski, Etsegenet Kebede, Siri Olson, Alex Ray, Erik Sandell, Teresa Spears, Katrina Virbitsky, Armon White, and Yaunyi Zhang.



INTRODUCTION

Over the course of the 2017 Spring semester, graduate students from Columbia University's Historic Preservation program studied the Triple Portal of St. Bartholomew's Episcopal Church in New York within the framework of a building diagnostics and conditions survey course led by Will Raynolds and Don Friedman. The Portal study served as an exercise in techniques related to documentation of existing conditions, monitoring, and diagnostics typically implemented in examination of historic structures with ornamental facades.

Despite the storied history of the church and the renowned architect and sculptors involved in the execution of the Portal, it had never been precisely documented in the form of measured line drawings with annotations describing existing material conditions. Using photogrammetry, students in this course generated accurate three-dimensional models of the Portal and then used these models as the basis for producing measured line drawings of the Portal. They then studied the existing conditions of the Portal and the stairs leading to it, and annotated their drawings with this conditions information. They supplemented this documentation work with a summary of the structure's history and previous interventions, as well as preliminary results from non-destructive techniques of evaluation, and recommendations for future interventions.

For the sake of clarity, this report begins with an overview of the history of the church and Portal, identifying some of the most important historical concerns surrounding the material condition of this remarkable work of art and architecture. Then, it continues with a description of the techniques deployed by this class and the results we obtained, followed by a discussion of future avenues of inquiry.

THE CHURCH AND TRIPLE PORTAL

St. Bartholomew's Episcopal Church hosts a thriving congregation at 325 Park Avenue, its third location. The St. Bartholomew's Conservancy supports ongoing restoration of the church exterior, including the conservation of the Romanesque Revival so-called Triple Portal designed by Stanford White. The very thorough essay on the history of the Portal written by Percy Preston Jr. stands as the most comprehensive work of contemporary scholarship on the Portal's history,¹ and what follows is a brief summary of some of the most important aspects of that history.

This Triple Portal was originally installed at the previous location occupied by the congregation, a church designed by James Renwick located on the southwest corner of Madison Avenue and East 44th Street. Intending to commemorate the life of Cornelius Vanderbilt II following his untimely death in 1899, Alice Vanderbilt, the widow of Cornelius, commissioned the new Portal for that church. The couple had maintained unusually close ties to St. Bartholomew's since they had first met there while teaching Sunday School.

Stanford White took his inspiration from the porch of the 12th Century pilgrimage church Saint-Gilles-du-Gard in the Camargue, a site he had visited and sketched as a young man visiting Europe. This provided the inspiration for the overall proportion and rhythm of the Portal, with individual works of sculpture and ornamentation provided by premier sculptors including Daniel Chester French, Andrew O'Connor, Philip Martiny, and Herbert Adams.

1 Percy Preston, Jr. "The Portal of Saint Bartholomew's Church in New York City" *Antiques Magazine*, December 2001, 820–29. See also: "The Late Unpleasantness: St. Bartholomew's Church and the New York City Landmarks Law" *Anglican and Episcopal History*, Vol. 71, No. 1 (March 2002), pp. 85-111; "An Essay in Bronze and Stone: The Portal of St. Bartholomew's Church" (unpublished manuscript, provided by author March, 2017).

The Portal was well received by critics at the time of its initial installation. Royal Cortissoz and other critics often focused in particular on the sculptural achievement.² Montgomery Schuyler, influential architecture critic and a founder of *Architectural Record*, discussed the architecture of the then new Portal in a 1903 issue.³ Russell Sturgis, another influential architecture critic at the time of the Portal's completion, praised it in a 1904 *Architectural Record* article, "A Fine Work of American Architectural Sculpture."

The congregation moved to the present location when a new church, designed by the celebrated architect Bertrand Goodhue, was opened in 1918. Goodhue designed the building to accommodate the beloved Triple Portal, which was dismantled at the Madison Avenue site and reinstalled on Park Avenue. in 1916-17. Goodhue observed that the Triple Portal was "universally regarded by artists and the public alike as one of the most beautiful things, perhaps the most beautiful things of its kind in America". This move produced another flurry of articles touting the Portal's fine features.⁴

St. Bartholomew's was designated a New York City Landmark in 1967, and the Landmarks Preservation Commission designation report specifically mentions the significance of the Portal. The author reported that: "The bronze doors, whose panels depict Old and New Testament themes, are considered by many critics to be the finest of their kind in the City."⁵ The church was also listed on the National Register of Historic Places in 1980 and was recognized as a National Historic Landmark in November 2016.

Over the course of a century, materials comprising both the church and the Portal have naturally deteriorated, and the Portal no longer provides the shining welcome it once did. Nevertheless, it remains beloved. The St. Bartholomew's Conservancy, which has no involvement with the religious mission of the church, currently works to ensure that the site and its legacy will persist, and at the time of our study, restoration was underway on the building's Great Dome.

2 Royal Cortissoz, "The Work of Andrew O'Connor," *Art and Progress*: Vol. 1, No. 12 (Oct., 1910): 343-349

and "Good Work Recently Done in American Architecture" *New York Herald Tribune* (1900-1910); Feb 12, 1916; B3.

3 Schuyler, Montgomery. "Recent Church Building in New York." *Architectural Record* 13 (June 1903): 509-34.

4 For articles pertaining to 1903-04 portal construction, see:

Sturgis, Russell. "A Fine Work of American Architectural Sculpture." *Architectural Record* 15, no. 4 (April 1904): 292-311.

"The New Entrances to St. Bartholomew's Church." *House and Garden* 5, no. 3 (March 1904): 132-38.

"The Facade of St. Bartholomew's Church has been Improved by the..." *New York Herald Tribune* (1900-1910); Jan 18, 1903; B8

"To be Swung on Monday." *New York Herald Tribune* (1900-1910); Aug 22, 1903; 3

"Vanderbilts Add to Gift." *New York Herald Tribune* (1900-1910), Jun 22, 1902; 10

"Great Feat in Casting: Bronze Doors for St. Bartholomew's Turned Out ..." *The New York Times* (1857-1922); Aug 23, 1903; 7

For articles published 1917-20, see:

"Bishop Lays Cornerstone." *The New York Times* (1857-1922). May 2, 1917; 10

"Vanderbilt Doors Still the Feature" *New York Herald Tribune* (1900-1910); Jan 17, 1916

"Model Shows the New St. Bartholomew's" *New York Herald Tribune* (1900-1910); Jan 19, 1916; 5

"St. Bartholomew's Moves Further Uptown" *The New York Times* (1857-1922); Oct 20, 1918; 44

"St. Bartholomew's Open: Bishop Greer Preaches Sermon as Part of Patriotic Exercises." *The New York Times* (1857-1922); Oct 21, 1918; 14

5 New York (NY) Landmarks Preservation Commission, "St. Bartholomew's Church and Community House, 109 East 50th Street, Borough of Manhattan," New York, NY. Landmarks Preservation Commission, Designation list; 1. LP-0275, 1967

ICONOGRAPHY

While this report is primarily concerned with the existing material conditions of the Portal, it is worth briefly considering its iconography. The sculptural embellishment is one of the reasons the Portal has been so celebrated by the congregation, New Yorkers, and visitors from around the world. The sculptural figures have become less legible through time due to the gradual softening of lines and details as the limestone has eroded, coupled with the pervasive dark soiling that tarnishes their surfaces.

Nevertheless, the Portal presents a cohesive iconography that provides a visual reference to the primary figures and scenes of both the Old and New Testaments. The tympanum and lintels present scenes from the Passion of Christ. The frieze between the south and central doors depicts scenes from the Old Testament, while the frieze between the central and north doors depicts scenes from the New Testament. The figures recessed between columns represent prophets.

The diagrams included in Appendix A of this report summarize the locations of these various scenes and figures.

CHANGES AND CONDITIONS THROUGH TIME

In addition to the known and documented alterations that have occurred at the Portal, additional changes have been identified through physical observation of current conditions and comparison with historic photographs. Both the archival research and observation of the current Portal served to create a timeline and understanding of changes through time at the site. The following section uses comparative photographs to illustrate identified changes.

The photograph below from 1904 shows the Portal in its original location. Note the differences inherent in its original situation: The light-colored stone on its upper portion; two thin windows above its south door; no flight of stairs raising it above the sidewalk level; and no script at its top.



(Top) Portal at St. Bartholomew's Church II, Madison Avenue and East 44th Street c. 1904. Photo courtesy of St. Bartholomew's Church Archive. (Bottom) St. Bartholomew's Portal, 2017.



(Left) Central door tympanum depicting apotheosis c. 1950. Photo courtesy of St. Bartholomew's Church Archive.
(Right) Central door tympanum, 2017.



(Left) Central door featuring bronze doors and tympanum c. 1950. Photo courtesy of St. Bartholomew's Church Archive. (Right) Central door, 2017. The bronze doors are currently open on the interior until they are restored.



(Left) Frieze between central and south doors c. 1950. Photo courtesy of St. Bartholomew's Church Archive.
(Right) Frieze, 2017.



(Left) Portal, central door, tympanum and friezes c. 1980. Photo courtesy of St. Bartholomew's Church Archive.
(Right) Central door, 2017.



(Left) Central and southern Portal arches with bronze doors and attached sign between columns c. 1950. Photo courtesy of St. Bartholomew's Church Archive. (Right) Central and southern Portal arches with current sign, 2017.



(Left) South door of Portal c. 1927. Photo courtesy of St. Bartholomew's Church Archive. (Right) South door, 2017.



(Left) Portal facade looking south, photograph by Samuel H. Gottscho c. 1940. Photo courtesy of St. Bartholomew's Church Archive. (Right) Portal facade looking south, 2017.



Early construction, July 16, 1917. Photo courtesy of St. Bartholomew's Church Archive.



Portal pieces arriving at St. Bart's construction site, May 17, 1918. Photo by Irving Underhill, courtesy of St. Bartholomew's Church Archive.



(Top) Completed church prior to smokestack demolition, April 1919. Photo courtesy of St. Bartholomew's Church Archive. (Bottom) St. Bart's facing southwest on Park Avenue with Dome restoration underway, 2017.



(Top) Completed church without the dome, April 2, 1919. Photo courtesy of St. Bartholomew's Church Archive. (Bottom) St. Bart's looking northwest from Park Avenue with dome under restoration, 2017.

The following timeline summarizes some of the most significant changes to material aspects of the Triple Portal:

1902-1903

The Portal was installed at its original location, the second St. Bartholomew's Church located at Madison Avenue and 44th Street. Architect Stanford White did the overall design, while the sculptural details and bronze doors are the work of sculptors Daniel Chester French and Andrew O'Conner, Philip Martiny, and Herbert Adams. The four niche statues by Martiny were not completed until 1908.⁶

1909

Materials comprising the Portal had already begun to decay. The Cipollino marble columns were treated by a Caffall paraffin waterproofing process. This involved heating the columns, then filling gaps with melted paraffin wax.⁷

1917-1918

The Portal was transported to its current location and incorporated into the new church designed by Bertram Goodhue. The methods of dismantling and moving the Portal were not well documented. Historic photographs indicate that at least the main facade plane was in place during construction in July 1918.⁸ Positioning within the new location changed the Portal's orientation. The South door is now the North; the North is now the South. Originally facing east, it now faces west.⁹

April 1919

By April 1919, reassembly and installation of the Portal was complete. Around this time, there were also three entryways and railings installed. These appear to be wood stairs mounted over the stone ones, likely to protect the stone.

1930s-40s

Only one flag pole at the center is present, mounted on the roof of the Portal. There had previously been two flag poles, as there are today.

1940

Metal bands around the outermost marble columns were added at the central doorway. In successive decades more metal bands and wire mesh were added around the columns.

Late 1990s

The exterior wood pocket doors, which had always been in place to protect the bronze doors, were fixed in place. The bronze doors had begun to sag on their hinges and were no longer operable.

Physical observation of the Portal indicates that other small interventions have taken place at unknown times, including cementitious patching of the columns and parts of the limestone.

⁶ Preston, Jr., "An Essay in Bronze and Stone" 18.

⁷ Preston, Jr., "An Essay in Bronze and Stone" 11, footnote 40

⁸ "Roofwork Complete, Southern View-07.19.1918" St. Bartholomew's Church Archive, 1918.

⁹ Preston, Jr., "The Portal of Saint Bartholomew's Church in New York City" 1. Though Preston's article in *Antiques Magazine* states the opposite, the present church does currently face west toward Park Ave., not east as is stated in the article.

CREATION OF BASELINE MEASURED DRAWINGS

The most detailed drawings of the Triple Portal previously known to exist are the renderings that Stanford White prepared prior to its original construction in 1902-3. However, these documents were prepared prior to the execution of the sculptural details. While they establish the overall proportions and rhythm of the Portal, it was necessary to supplement these renderings with a more detailed set of measured line drawings reflecting the Portal as it is now.

To create this set of measured line drawings of such an ornate facade, students relied on photogrammetry to streamline their workflow. Students captured a series of photographs on site, used photogrammetry software to produce a scaled 3D model of the Portal, and then used this model and orthorectified photographs to produce a set of line drawings.

For the process of photographic capture, students photographed the Portal at grade from a range of positions to ensure complete coverage. Students divided into teams focusing on the north door, south door, and central door, and collected documentation photographs by specified area. Camera positioning accounted for at least two-thirds overlap between photos and at least two varying distances from the target as is recommended in photogrammetric documentation manuals.¹⁰ To collect the complete data set required to generate an accurate point cloud, students used a lift provided by church staff during one class session to access the upper parapet area. Positioning the lift at several locations across the facade allowed students to photograph the entirety of the elevation. Our final 3D model was thus equally detailed in all areas, from the ground up.

From the approximately 300-600 photos per group collected on site, students used Agisoft PhotoScan photogrammetry software at Columbia University's Conservation Laboratory to prepare a 3D point cloud representing the Portal. The software automatically aligns photographs to create a point cloud that can then be processed, edited, and otherwise manipulated for use in the creation of line drawings based on the 3D information. The inclusion of reference scales in documentation photographs provided accurate scale assigned to the point cloud and subsequent measured line drawings and renderings.

Given the level of sculptural detail present throughout the Portal, and the fact that the point clouds would later serve as the basis for measured drawings, it was important that the point clouds be as accurate as possible. Each group closely monitored the degree of error that PhotoScan calculates for each point cloud. Processing the point clouds involved progressive elimination of less accurate and irrelevant data prior to scaling. In scaling the point clouds, groups aimed for an error of less than one millimeter for the points in the scene. Results of processing and monitoring input data produced highly accurate and streamlined point clouds.

Orthorectified images exported from Agisoft PhotoScan provided a tracing base for the line drawings used in on-site conditions annotation. In producing orthorectified images, the software produces an image without distortion from point of view or lens geometry. Even the most complicated figures in an orthorectified image, such as the architectural elements and sculptural details on the Portal, can be reasonably assumed to have a constant scale. This means that an orthorectified image provides essentially the same view as an architectural elevation drawing, thus allowing its use in measured line drawing generation.

¹⁰ Agisoft LLC., Agisoft PhotoScan User Manual: Professional Edition, Version 1.2, Agisoft 2016. for optimized image collection, see Chapter 2. See also, American Society of Photogrammetry, Manual of Photogrammetry (New York: Pitman Pub. Corp., c 1944). for historic documentation methods.

Photogrammetry is an effective tool for this type of documentation project, because it allows accurate 3D data to be captured using relatively simple photography equipment and techniques. Data collection for this project required only a few days on site. The scale feature in PhotoScan also allows accurate point cloud generation without typically requisite, time-consuming on site hand measurements. Once the point cloud is generated and scaled, architectural elements and sculpture may be measured directly from the point cloud.

Autodesk ReCap software supported file transition between Agisoft Photoscan and an AutoCAD workspace. Autodesk ReCap sets origin point, and orients the X, Y, and Z axes of a LAS file point cloud exported from Agisoft Photoscan so that the point cloud will be completely flat when imported into an AutoCAD workspace. Setting these origins in ReCap can be quite challenging, as control over the program is somewhat limited--the origin and axes must be eyeballed. After a seemingly accurate orientation for the set of data has been established, the file may be saved as a ReCap file, with the extension .rcp.

ReCap files imported into an AutoCAD workspace as point clouds function as an underlay for line tracing similar to the way one would normally trace an image in the program. As is evident in the final conditions report images, each of the four groups drew elevations of the four Portal areas from ReCap point cloud underlay files. These drawings include the overall view of the Portal portico as well as the north, central, and south segments. The overall group was tasked with producing less detailed drawings of the facade, which we have used as a key elevation for locating the more detailed drawings of the individual Portal groups. The more detailed drawings show tracings of the sculptural elements.

The baseline drawings included in Appendix B of this report are clean copies of the sheets produced by the photogrammetric process previously described.


















DOCUMENTATION OF EXISTING CONDITIONS

Following the development of the baseline documentation, students used black and white PDF printouts of the AutoCAD line drawings to annotate conditions found on the Portal with colored markings corresponding to a conditions legend developed by a group of students. Different colors are used to indicate a number of existing conditions, such as material loss, soiling, cracking, previous repairs, and rusting. A darker color indicates a more severe instance of each specific condition. For example, a light purple color indicates light erosion, whereas a heavier purple indicates more extreme erosion, where a sculptural element may be almost completely worn away or unrecognizable.

The following glossary lays out the conditions observed on the Portal over the course of the semester. The conditions are organized into broad categories of “Loss,” “Soiling,” “Cracking,” and “Repairs/Interventions”. Each of the four broad categories includes sub-categories describing more specific conditions and the degree to which the condition is expressed. Additional condition categories include: “Staining,” “Biogrowth,” “Efflorescence,” “Rusting,” and “Patination.”

The following label key outlines the abbreviation standards corresponding to each of the broader categories, subcategories, and degrees. The conditions drawings’ key notes the color used to mark each of the individual conditions. Following the first section, which outlines the whole glossary and provides labeling and coloring keys, the second section provides definitions and reference photographs for each of the individual conditions.

KEY TO CONDITIONS DRAWINGS

LOSS	SOILING
 HEAVY EROSION	 HEAVY GENERAL SOILING
 LIGHT EROSION	 LIGHT GENERAL SOILING
 SPALLING	 BIRD EXCREMENT
 BROKEN/MISSING	
CRACKING	REPAIRS/INTERVENTIONS
 HAIRLINE CRACKING	 CEMENTITIOUS PATCHES
 IN PLANE CRACKING	 STABILIZATION
 OUT OF PLANE CRACKING	
OTHER	
 STAINING	 RUSTING
 BIOGROWTH	 PATINATION
 EFFLORESCENCE	

KEY FOR LABELING OF CONDITIONS

[BIG CATEGORY] - [SUB-CATEGORY] - [MATERIAL] - [SEVERITY] (if applicable)

Example:

Loss - Erosion - Limestone - Heavy

Lo - E - Li - H

ANNOTATED DRAWINGS WITH CONDITIONS INFORMATION

In the elevations contained in Appendix C, the various conditions present at the site and on the three Portal areas are indicated. Conditions are separated into two visuals, with one showing areas of loss, staining, cracks, repairs, and bio-growth, while the other shows areas of soiling, efflorescence, rust, and patination. The key provided notes the color used to designate each of the individual conditions.

REFERENCE PHOTOGRAPHS AND DEFINITIONS

LOSS (LO)

Types of loss:

Erosion (E): Heavy (H); Light (L)

Spalling (Sp)

Broken/Missing (B/M)



Heavy Erosion:

Heavy disintegration of the stone's surface.



Light Erosion:

Light disintegration of the stone's surface.

LOSS (LO) CONTINUED



Spalling:

Chipping off of pieces on the outer surface of the material usually due to internal factors.



Broken/missing:

A unit of material is lost from its original location.

Missing fingers of the central sculpture are indicated at left with the red circle.

SOILING (SO)

Types of soiling:

General soiling (Gs): Heavy (H); Light (L)

Bird droppings (Bd)



Heavy general soiling:

Alteration/change in color due to deposits of materials - heavy layer of deposits.



Light general soiling:

Alteration/change in color due to deposits of materials - light layer of deposits.



Bird excrement:

Deposits of bird excretion.

STAINING (ST)



Staining:

Alteration/change in color in material imparted from another material.

BIOLOGICAL GROWTH (BG)



Biological Growth:

Organic growth visible on the stone's surface, typically algae, lichens, mold, plants, vines.

EFFLORESCENCE (EF)



Efflorescence:

Formation of white coating on the surface due to salt migration from within the stone.

CRACKING (C)

Types of cracking:

Hairline cracking (Hc)

In plane cracking (Ipc)

Out of plane cracking (Opc)



Hairline cracking:

A break in material with less than 1/16th of an inch separation.



In plane cracking:

A break in material with more than 1/16th of an inch separation but with no displacement.



Out of plane cracking:

A break in material with more than 1/16th of an inch separation with displacement.

REPAIRS / INTERVENTIONS (R/I)

Types of repairs/interventions:
Cementitious patching (Cp)
Stabilization (S)



Cementitious patching:

Previous repair of cracking or material loss with a cementitious patching material.



Stabilization:

Use of wire mesh netting to prevent further material loss.

RUSTING (R)



Rusting:

Corrosion of metal resulting in iron oxide deposits.

PATINATION (P)



Patination:

Formation of green patina layer on copper caused by oxidation process.

ADDITIONAL NON-DESTRUCTIVE EVALUATION

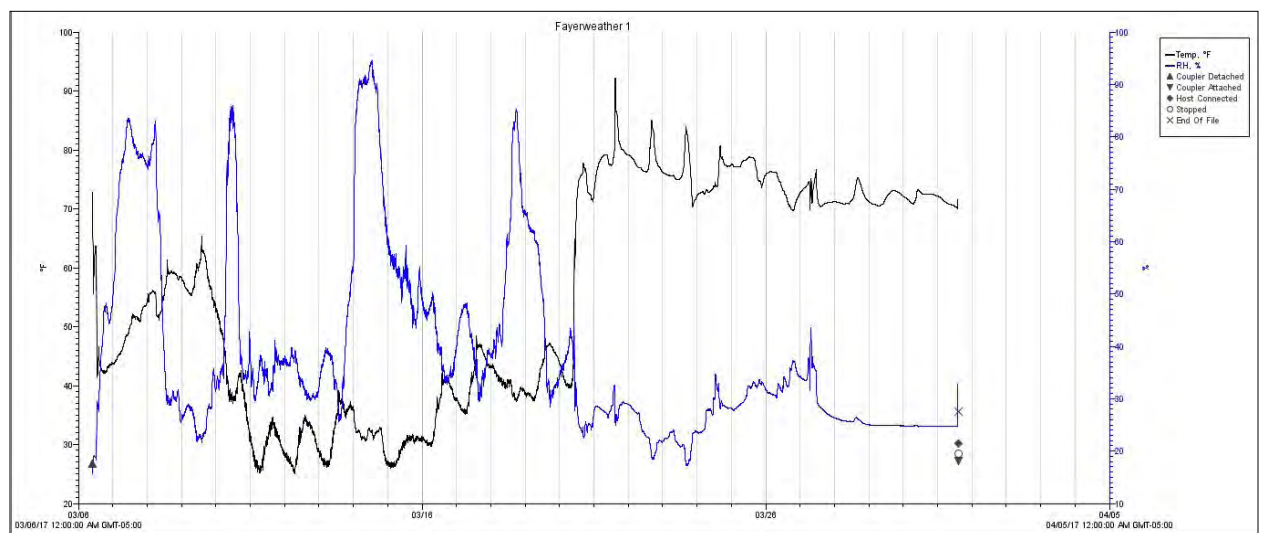
Beyond recording existing conditions, students explored other characteristics of the Portal and its response to the surrounding environment using a series of non-destructive tests. This work included monitoring temperature and relative humidity on the interior and exterior of the Portal, vibration monitoring with rudimentary seismometers in the form of a mobile app, and infrared imaging.

TEMPERATURE AND RELATIVE HUMIDITY

A series of four Hobo data loggers were used to collect measurements concerning temperature and relative humidity over a period of two weeks. The monitors were installed at various interior and exterior locations at the portal, recording average conditions during sunny, rainy, and snowy conditions. The four locations were as follows: 1) outside, adjacent to the St. Bartholomew's sign, 2) outside, northern window grill, 3) inside, behind books in the bookstore, 4) inside, under the bench.

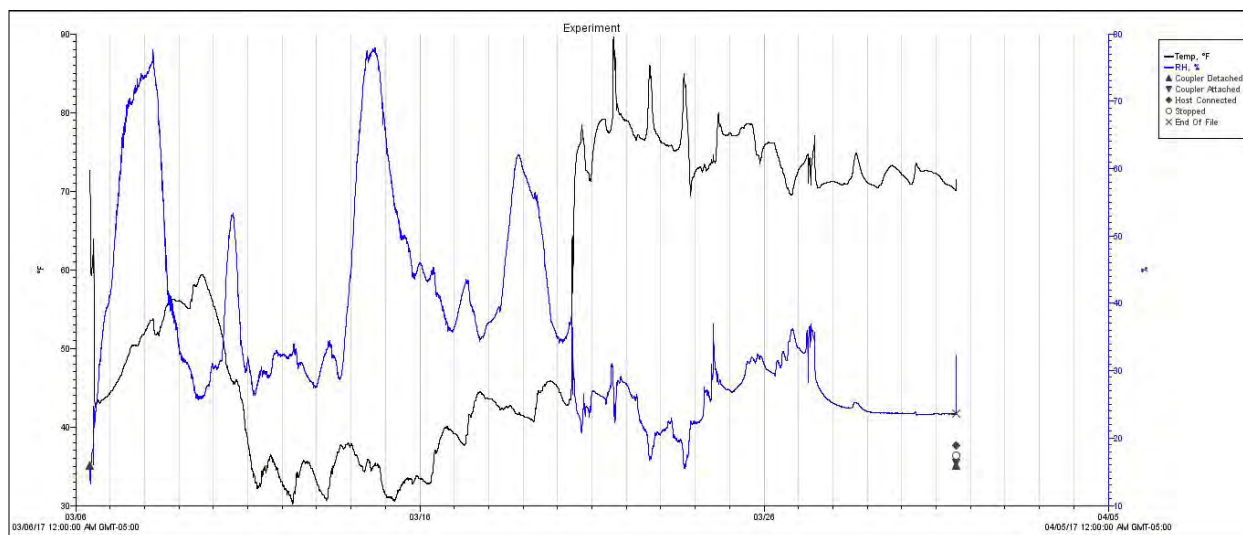
Following two weeks of data collection, the Hobo data loggers were recovered, and the data was parsed on a computer, producing the following visualizations:

Location 1 (outside):



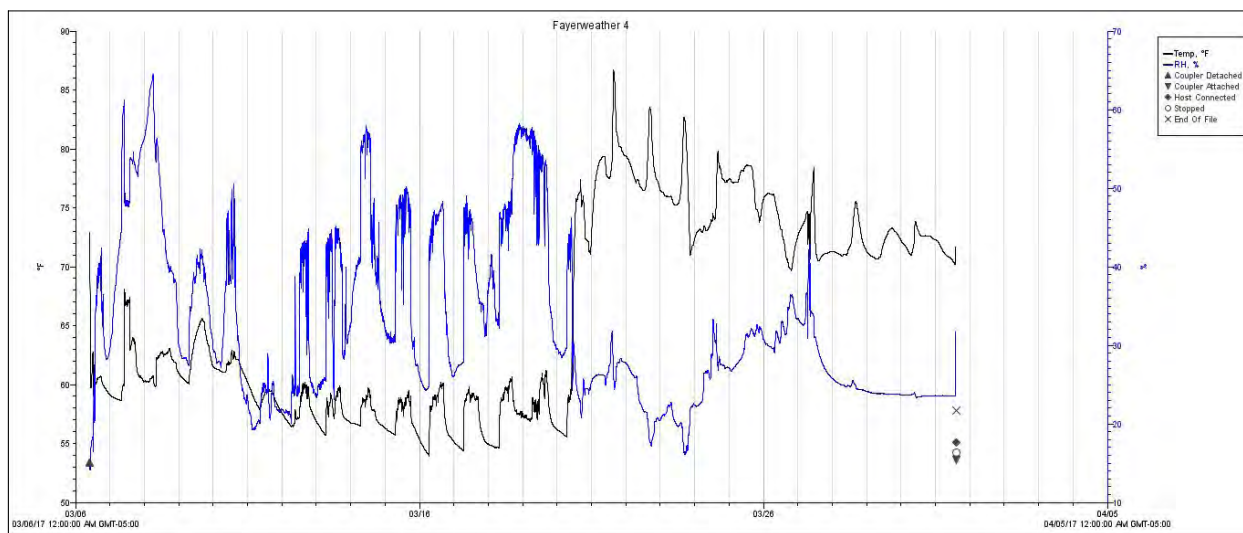
During the data collection period, we saw several spikes in the relative humidity (RH), indicated in this graph by the blue line. The most evident spike on March 12 corresponds with the arrival of the Stella blizzard. Diurnal cycling is also evident in the temperature graph (black line), since it is colder during the night and warmer during the day.

Location 2 (outside):



This data logger was also outside and displays a very similar pattern. It was placed inside of a black bag to make it less assuming, since it was installed within public view. The bag absorbed some heat, which may explain why slightly higher temperatures were recorded by this monitor.

Location 3 (inside):



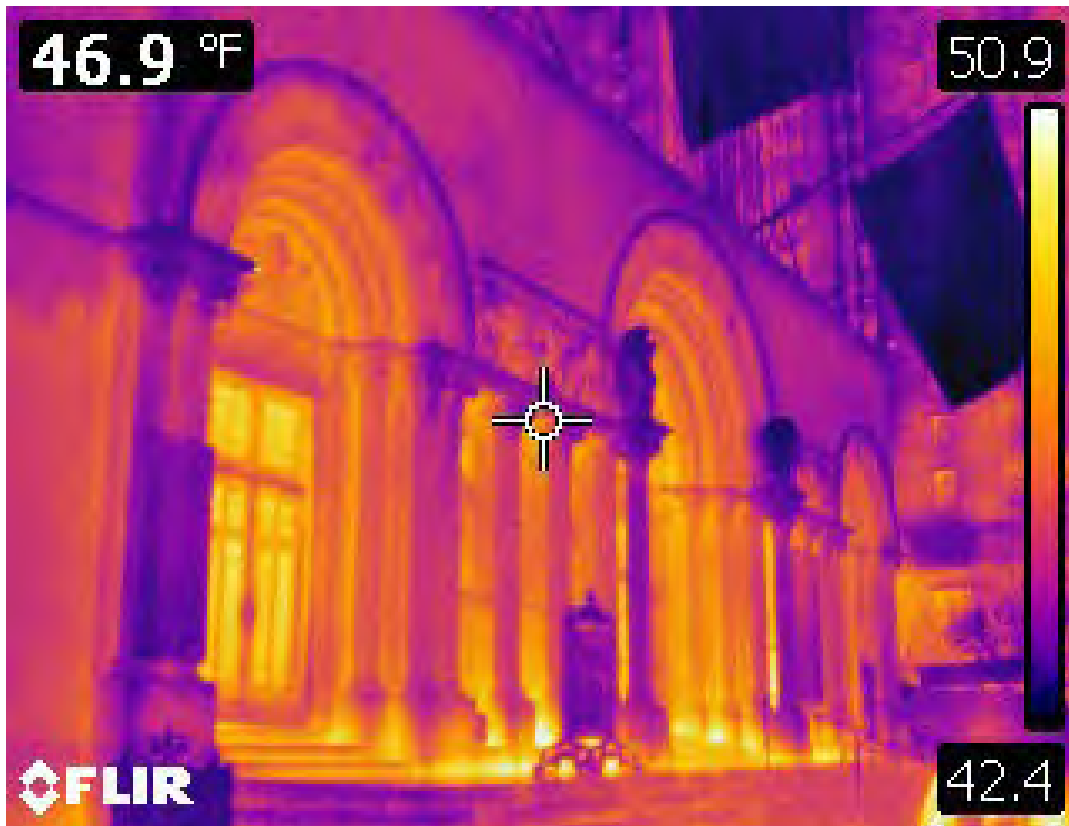
This monitor was located behind books in the church Narthex, the foyer behind the Portal. It stayed consistently warmer on the inside, but not excessively warm overall. The relative humidity also increased in diurnal spikes which likely correlate with the daytime activation of the steam heating system in the Narthex. The fourth monitor, which had been installed under a bench in the Narthex, was dislodged from its location and has not been recovered.

VIBRATION

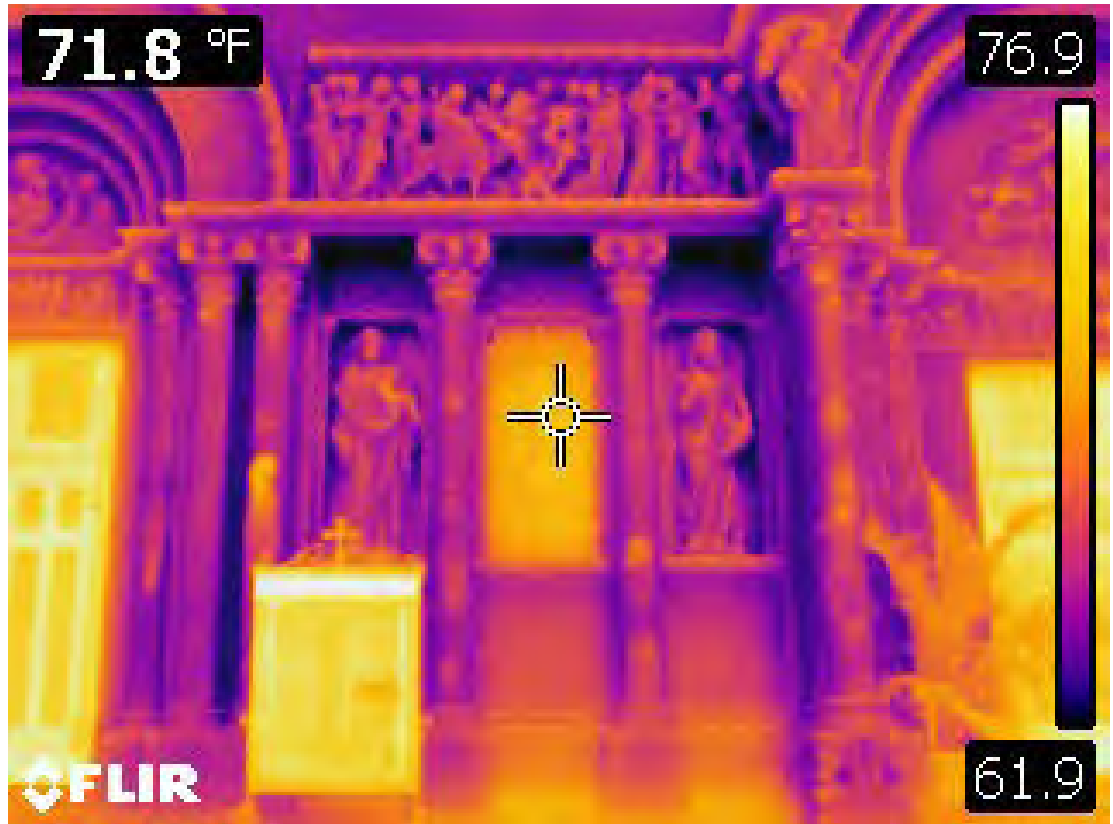
Given the proximity of the Metro North train tracks under Park Avenue, and the vibrations emanating from regularly passing trains -- vibrations that are easily felt on the stairway leading to the church as well as within the Narthex -- we attempted to measure the vibration of the Portal using seismography applications on our mobile phones. Using an app called "Vibration," we attempted to use the accelerometers within our phones to quantify the x,y,z dislocation associated with these movements and then compare the values we recorded with values recorded at other locations like the Metropolitan Museum of Art. This effort was largely inconclusive, and more sensitive instruments would need to be deployed during a regime of further testing. Nevertheless, the fact that the Portal has withstood vibrations from passing trains for nearly a century suggests that the detriment of these vibrations is modest.

INFRARED IMAGING

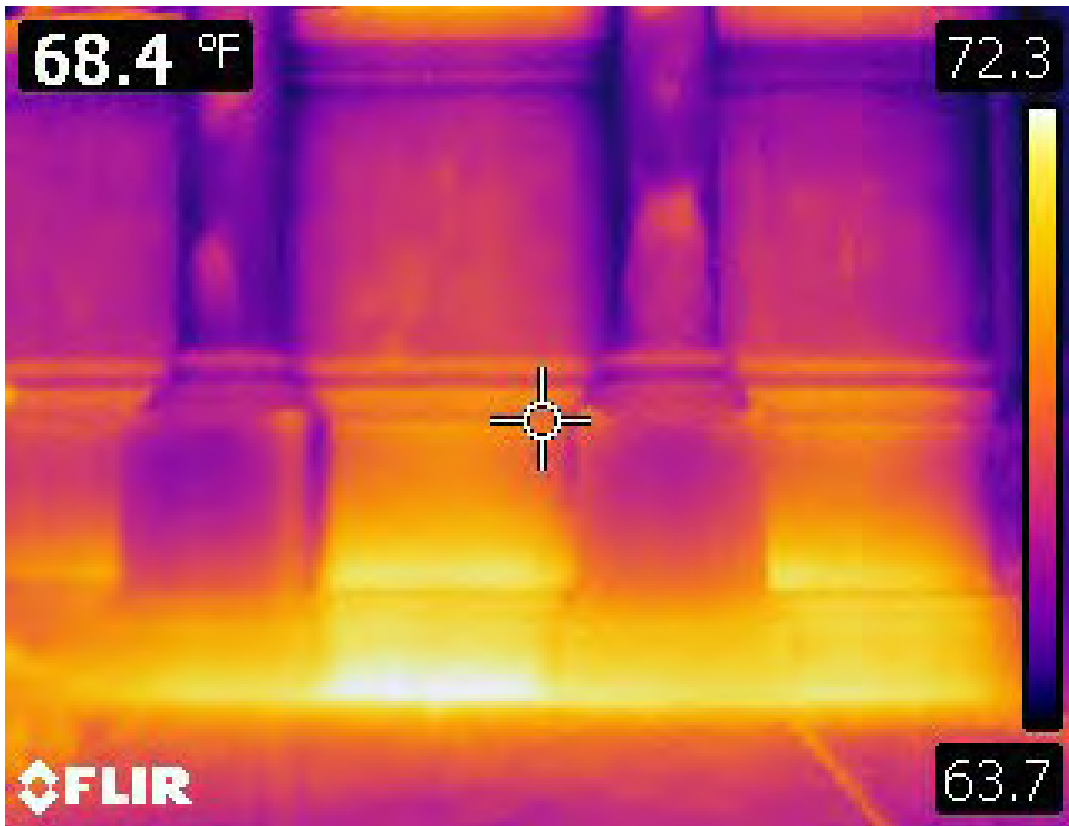
Students deployed an FLIR spot thermal camera to capture a series of images documenting thermal conditions on the interior and exterior of the Portal. This camera captures image pairs, one in the visible spectrum and one that is a false-color image showing differences in the infrared spectrum. A series of these image pairs taken on a rainy day give a sense for the thermal gradient of the Portal. Note that the difference in the false color image between the darkest colors and the lightest colors is less than 10 degrees Fahrenheit.



This first image pair demonstrates that on the whole, surfaces most heavily exposed to the rain (including the prominent statues flanking the central doorway) are distinctly cooler than more recessed portions of the Portal. On a day ten degrees cooler than the day when this image pair was recorded, water on some portions of the Portal would actually freeze. We might therefore expect that some of the most prominent features of the Portal are more frequently exposed to freeze-thaw cycling, whereas those portions that are recessed are buffered from the cold.



This image pair was recorded on a different, warmer day with no precipitation. It shows how much heat is transmitted from the interior of the building through the doors and windows leading to the Narthex. Also note the distinctly lighter (warmer) patch on the third column from the left. This is the cementitious patch applied as a cosmetic fix to the deteriorating Cipollino marble. The different thermal properties of this patch will ultimately contribute to it separating from the column, and it will eventually need a remedy.



This third image pair demonstrates how much heat is being lost through the masonry at the base of the Portal. The steam heating system in the interior of the Narthex is likely the source of this heat, but the heat loss provides the lower portions of the Portal with a buffer against the damaging effects of freeze/thaw cycling.

DISCUSSION AND AVENUES FOR FUTURE INQUIRY

The Portal overall is in good condition, but during our investigation we found three major areas that merit concern about its long-term durability: (i) the deterioration of the Cipollino marble columns, (ii) the displacement of the limestone steps leading up to the Portal, and (iii) the soiling of the sculptural elements.

The erosion of the Portal is noticeably at its worst on the Cipollino marble columns. The columns are not a structural element supporting the Portal, but they have sustained extensive structural damage, which might have begun during the move from Madison Avenue to Park Avenue. In the New York climate, Cipollino marble decays more rapidly than other stones used in the Portal. These columns have been a source of concern for the church since at least 1909, when a wax treatment was applied in an attempt to consolidate them.

In an effort to compare the columns to one another and single out the ones most likely to have performance problems in the future, we attempted to quantify the differences using a pulse velocity device to measure transverse resistivity under the guidance of Gina Crevello. Unfortunately, the device did not have an appropriate transducer head on the day we had it in the field, so our results were inconclusive. However, it may be worth pursuing this line of testing further should the Conservancy wish to better define the differential performance of the Cipollino marble columns.

Short of replacing the columns with a set made of more durable material, entailing a lengthy review process of uncertain outcome, an approach simply replacing the most discolored patches and removing the sign that hangs from the columns could effectively stabilize them in their current condition.

Likewise, the limestone steps leading up to the Portal are cracked due to differential movement of the slabs. The cracks can be patched, but the patches will not hold unless an expansion joint is installed before the repair is made. The Conservancy's plans call for a full restoration of the limestone steps.



One particularly discolored patch that could be replaced.



Sign attached to Cipollino columns that should be removed to prevent the wire attachment from abrading the columns any further.



Substantial crack in northwest corner of stairs leading to the portal.

Finally, the sculptural elements are severely soiled. Since these sculptures have always been one of the most highly regarded aspects of the Portal, and since they are a physical manifestation of the gospels disseminated by the church, they deserve to be made (and kept) more legible.

A necessary first step would be to clean them with water using a low pressure wash for at least twelve hours to remove the heavy accumulation. This would reveal the true conditions of the sculpture, which cannot be readily discerned at present.



Heavy soiling and jarring contrast between light and dark make the sculpture more difficult to read from ground level.



Much of the heaviest soiling may be removed by low pressure washing over a period as short as 12 hours.

When considering the nature of the sculptures' soiling, it is worth reviewing the general ways in which the environment around the Portal has changed since it was first installed. "Clean air" is composed of nitrogen (N_2), oxygen (O_2), CO_2 , water (H_2O) and inert gases, produced by natural pollutant sources. Following the industrial revolution, the atmosphere experienced an increase in the pollutants CO_2 , SO_2 , and NO_x , as well as "secondary pollutants" formed from the primary ones: sulphuric acid (H_2SO_4), (HNO_3) nitric acid and carbonic acid (H_2CO_3).¹ The presence of these pollutants as they are transported and deposited on exposed surfaces, contribute to the deterioration of a building like St. Bartholomew's. Several experiments stress the importance of transport processes, especially as T. Yates pointed out in "Mechanisms of Air Pollution: Damage to Brick, Concrete, and Mortar":

In considering air pollutant attack, we must first consider transport processes, concentrations and chemical type of pollutants. The length of time pollutants remain in the atmosphere, the distance they travel, and the atmospheric concentrations they attain will depend on the meteorological conditions and deposition processes. The processes for transportation from the atmosphere to a surface are usually considered under two main headings — dry and wet deposition.²

The wet and dry deposition of atmospheric particulate material is what we have referred to as "soiling" in this report. Soiling is characterized by a darkening of the stone surface, due to a loss of reflectance of the building material.

The darkening of buildings as a visual manifestation of pollution was noticed as early as ancient Rome, and observations of the phenomenon have continued throughout history. As the historian Peter Brimblecombe has written "such darkening of buildings represents one of the earliest examples of human activities affecting the wider environment."³ The observations of pollution on the built environment continue throughout history, especially during the industrial revolution, and in urban centers powered by coal.

In the United States, population increases following World War II resulted in increased energy consumption and a drastic increase in the combustion of oil and coal.⁴ Those elevated levels of consumption in turn raised levels of SO_2 , NO , NO_2 , SO_2 , and other pollutants into the earth's atmosphere. Moreover, ambient oxygen, sunlight, temperature, and humidity react with primary pollutants to form secondary ones that exist in the atmosphere as:

gases - SO_3 , HNO_3 , HCl , organic acids, O_3
particles - H_2SO_4 , HN_4 , HSO_4 , $(NH_4)_2SO_4$, or
dissolved in water droplets - CH^+ , NH_4^+ , HSO_3 , SO_4 , NO_2 , NO_3

The many primary and secondary pollutants constitute a complex mixture of reactive compounds, especially in the urban atmosphere, that lead to accelerating deterioration of building materials.⁵ Given the proximity of the second and third locations of St. Bartholomew's Church to the coal-burning IRT power station, such pollutants almost certainly contributed to the deterioration of the Portal's limestone and marble, both of which are prone to acidic attack.

The second half of the Twentieth Century was marked by a reduction in the burning of soft coal, mainly through legislation limiting the burning of fossil fuels. From the early 1980s until

¹ Yates, T., "Mechanisms of Air Pollution damage to brick, concrete, and mortar", Air Pollution Reviews: Effects of Air Pollution on the Built Environment, London, US: ICP, 2003.

² Ibid.

³ Searle, David E., "Particle-induced Soiling on Historic Limestone Buildings: Insights and the effects of Climate Change", Solutions to Climate Change Challenges in the Built Environment, United States: Blackwell Publishing Ltd., 2012.

⁴ Chandra, Satish, "D6:1990 Influence of pollution on mortar and concrete", Swedish Council for Building Research, Solna, Sweden: Byggeforskningsrådet, 1990.

⁵ Ibid.

today particulate matter from vehicular sources has been the dominant source of pollution, particularly in dense urban areas such as the corridor of Park Avenue. In fact, diesel emissions actually rose in the mid-1980s. Diesel exhaust is composed of nitrated polycyclic aromatic hydrocarbons, which react with amides to form carcinogenic nitrosamines compounds.⁶ Diesel particulate consists of spherical particles which collect on the surface of buildings. They have a soiling factor three times greater than the particulates emitted by coal combustion.⁷ The increase in pollution from vehicle emissions supersede the reductions in coal particulates eliminated by compliance with the 1970 Clean Air Act.

Following an initial and prolonged cleaning of the Portal by low pressure washing, any remaining soiling will be unusually hydrophobic or will be incorporated into more solid encrustations, requiring special consideration prior to removal. Then after the first phase of cleaning, samples of any remaining soiling will need to be taken and analyzed before deciding how to proceed further. Following this cleaning, the conditions annotations described in the drawings included in the appendices of this report should be updated and expanded to reflect the state of conservation of the Portal in its clean state.

Prior to a general conservation treatment, the Conservancy should pursue the following paths of inquiry to better determine the nature of the most appropriate intervention: 1) spot cleaning of sculptural elements, and 2) more thorough pulse velocity testing of the Cipollino marble columns.

The spot cleaning should entail tests of low pressure water washing of a modest portion of the sculptural limestone elements, establishing a better approximation for the exposure time necessary to lessen or remove the patches of dark soiling. The spot cleaning should also entail tests of dilute applications of a biocide to lessen or remove the light organic growth on the most prominent sculptural elements.

Further pulse velocity testing will provide a better indication of the current material integrity of the Cipollino marble columns. Previous interventions intended to stabilize these columns, including the application of metal collars and netting, have come with a heavy aesthetic cost. Conducting pulse velocity tests on each column at several proscribed points along its length will enable the Conservancy to make more accurate and less superficial comparisons between the columns in their current state. In the case that one or more columns appear to be deficient, this evidence would justify further conservation treatment or possibly in-kind replacement. If all columns perform in a similar manner during such testing, this evidence could support the removal of the metal columns and netting on the grounds that they are not providing any real protection for the stone. It would also help inform discussions regarding the necessity and nature of any proposed replacement for the cementitious patches that have been applied to these columns in the past.

Such activities could be supplemented through further efforts to more precisely determine the stone types and quarries of origin for all materials used in the Portal. This would entail additional archival research and/or comparisons with existing materials libraries.

All of these activities are well suited to the capacities of the faculty, conservation lab, and students of the Historic Preservation program at Columbia University, and provide potential avenues for ongoing collaboration with the Conservancy and the Church.

⁶ Mansfield, Trudie, et al., "Diesel Particulate Emissions and the Implications for the Soiling of Buildings", *The Environmentalist*, Volume 11 (4), 1991.

⁷ Ibid.

BIBLIOGRAPHY

- Agisoft LLC. Agisoft PhotoScan User Manual: Professional Edition, Version 1.2, Agisoft 2016. Accessed May 2017. < http://www.agisoft.com/pdf/photoscan-pro_1_2_en.pdf>
- American Society of Photogrammetry. Manual of Photogrammetry. New York: Pitman Pub. Corp., c 1944.
- Architectural and Decorative Features of St. Bartholomew's Church in the City of New York. New York: Wickersham Press, 1949.
- "Bishop Lays Cornerstone." The New York Times (1857-1922). May 2, 1917; 10. ProQuest Historical Newspapers. Accessed May 2017.
- Camhi, A.J. "History | 375 Park." RFR Realty. Accessed May 8, 2017. <<http://www.375parkavenue.com/History>>
- Chander, Izora. "The Central Bronze Doors of the Vanderbilt Memorial Portal, St. Bartholomew's Church, New York." American Art in Bronze and Iron 1, no. 5 (January 1907): 18–19.
- Chandra, Satish, "D6:1990 Influence of pollution on mortar and concrete", Swedish Council for Building Research, Solna, Sweden: Byggforskningsrådet, 1990.
- Chorley, E. Clowes. The Centennial History of Saint Bartholomew's Church in the City of New York, 1835-1935. New York, 1935.
- Condit, Carl W. The Port of New York: A History of the Rail and Terminal System from the Grand Central Electrification to the Present. Chicago: University of Chicago Press, 1980-1981.
- Cortissoz, Royal. "The Work of Andrew O'Connor." Art and Progress: Vol. 1, No. 12 (Oct., 1910): 343-349.
- , "Good Work Recently Done in American Architecture." New York Tribune (1900-1910); Feb 12, 1916; B3. ProQuest Historical Newspapers. Accessed May 2017.
- "Civic Development at the Grand Central Passenger Terminal in New York." Railway Review 68, no. 6 (February 5, 1921): 197–204.
- de Vent, I.A.E. "Prototype of a Diagnostic Decision Support Tool for Structural Damage in Masonry." PhD diss.—Delft University of Technology, 2011. Accessed May 2017. <<http://resolver.tudelft.nl/uuid:e9a3a2f9-16b5-4b22-a1f4-6511f3543f6e>>
- St. Bartholomew's Vestry. Architectural and Decorative Features of St. Bartholomew's Church in the City of New York. [New York?] : Wickersham Press, 1949.
- Eschenasy, Dan (ed.). "Facade Conditions: An Illustrated Glossary of Visual Symptoms," New York City Department of Buildings. Accessed May, 2017. < <https://www1.nyc.gov/assets/buildings/images/content/misc/FacadePresentation.pdf>>
- "The Facade of St. Bartholomew's Church has been Improved by the..." New York Tribune (1900-1910); Jan 18, 1903; B8.
- Goodhue, Bertram G. A book of architectural and decorative drawings. New York, The Architectural Book Publishing Co.; P. Wenzel and M. Krakow, 1924.
- Gray, Christopher. "Streetscapes — Park Avenue, the 'Tween Years." The New York Times, August 16, 2012. Accessed May 2017. <<http://www.nytimes.com/2012/08/19/realestate/streetscapes-park-avenue-the-tween-years.html>>

"Great Feat in Casting: Bronze Doors for St. Bartholomew's Turned Out ..." *The New York Times* (1857-1922); Aug 23, 1903; 7.

Historic American Buildings Survey (HABS). "Guide to Field Documentation." National Park Service; 2011. Accessed May 2017. < <https://www.nps.gov/hdp/standards/HABSGuideFieldDoc.pdf>>

Jno Williams, Inc. *American Art in Bronze and Iron*, Vol. 1: Issue 5. New York : Jno. Williams Bronze Foundry, 1970. 18-19

Klein, Christopher. "Iconic Waldorf Astoria Hotel Changes Hands - History in the Headlines." HISTORY.com. Accessed May 8, 2017. <<http://www.history.com/news/iconic-waldorf-astoria-hotel-changes-hands>>

Kopelson, Evan. "Conditions Glossaries as a Tool in the Survey Process: A Review of Several Glossaries." *APT Bulletin* 42, no. 2/3 (2011): 1-6.

Lambert, Bruce. "Neighborhood Report: Upper East Side; Ex-Foe Helps St. Bart's with its Landmark," *The New York Times*, January 22, 1995. Accessed February 2017.

Lamberti, Amy Desmond. "Beyond the Battle: the Architectural and Historical Legacy of St. Bartholomew's Church" Masters Thesis (M.S.)—Columbia University, 1995.

Lowe, David. *Three St. Bartholomew's : An Architectural History of a Church*. New York: Victorian Society in America, Metropolitan Chapter, 1983.

Mansfield, Trudie, et al., "Diesel Particulate Emissions and the Implications for the Soiling of Buildings", *The Environmentalist*, Volume 11 (4), 1991.

McKee, Harley J. (ed.) for Historic American Buildings Survey. *Recording Historic Buildings*. Washington: U.S. National Park Service, 1968.

"Model Shows the New St. Bartholomew's" *New York Tribune* (1900-1910); Jan 19, 1916; 5. ProQuest Historical Newspapers. Accessed May 2017.

"The New Entrances to St. Bartholomew's Church." *House and Garden* 5, no. 3 (March 1904): 132–38. ProQuest Historical Newspapers. Accessed May 2017.

The New York City Chapter of the American Guild of Organists, "St. Bartholomew's Church (Episcopal)" *New York City Organ Project (NYCOP)*. Accessed May 8, 2017 < <http://www.nycago.org/Organs/NYC/html/StBartholomewEpis.html>>

New York (NY) Landmarks Preservation Commission, "St. Bartholomew's Church and Community House, 109 East 50th Street, Borough of Manhattan," New York, NY. Landmarks Preservation Commission, Designation list; 1. LP-0275, 1967.

Plosky, Irving. "Technical Policy and Procedure Notice #10/88." New York, NY. Department of Buildings; Issuance #109, June 6, 1988.

Preston Jr., Percy. *Saint Bartholomew's Church in the City of New York*. New York, NY: St. Bartholomew's Church, 1998.

—, "The Portal of Saint Bartholomew's Church in New York City" *Antiques Magazine*, December 2001, 820–29.

—, "The Late Unpleasantness: St. Bartholomew's Church and the New York City Landmarks Law" *Anglican and Episcopal History*, Vol. 71, No. 1 (March 2002), pp. 85-111.

—, "An Essay in Bronze and Stone: The Portal of St. Bartholomew's Church" (unpublished manuscript, provided by author March, 2017).

Reynolds, Donald M., *Monuments and Masterpieces : Histories and Views of Public Sculpture in New York City*. London: Collier Macmillan, c1988.

Rodrigues-Bavarro, Carlos, and Eduardo Sebastian, "Role of particulate matter from vehicle exhaust on porous building stones (limestone) sulfation", *The Science of the Total Environment* 187 (1996): 79-91.

Schuyler, Montgomery. "Recent Church Building in New York." *Architectural Record* 13 (June 1903): 509–34.

Searle, David E., "Particle-induced Soiling on Historic Limestone Buildings: Insights and the effects of Climate Change", *Solutions to Climate Change Challenges in the Built Environment*, United States: Blackwell Publishing Ltd., 2012.

Sheenhy, John A. "Religious Landmark Preservation Under the First and Fifth Amendments: St. Bartholomew's Church v. City of New York," *St. John's Law Review*: Vol. 65: Iss. 2 (1991): Article 6

Smith, Christine. *St. Bartholomew's Church in the City of New York*. New York: Oxford University Press, 1988.

"St. Bartholomew's Moves Further Uptown" *The New York Times* (1857-1922); Oct 20, 1918; 44. ProQuest Historical Newspapers. Accessed May 2017.

"St. Bartholomew's Open: Bishop Greer Preaches Sermon as Part of Patriotic Exercises." *The New York Times* (1857-1922); Oct 21, 1918; 14. ProQuest Historical Newspapers. Accessed May 2017.

Sturgis, Russell. "A Fine Work of American Architectural Sculpture." *Architectural Record* 15, no. 4 (April 1904): 292–311.

—, "St. Bartholomew's Facade." *The International Studio* Vol. 38 (July 1909) pp. XIX-XXI.

Tambour. "The New Entrances of St. Bartholomew's Church." *House and Garden* Vol. XX, No. 3 (March, 1904) pp. 132-138.

"To be Swung on Monday." *New York Tribune* (1900-1910); Aug 22, 1903; 3. ProQuest Historical Newspapers. Accessed May 2017.

Tolles, Thayer. "Daniel Chester French (1850–1931) | Essay | Heilbrunn Timeline of Art History The Metropolitan Museum of Art." *The Met's Heilbrunn Timeline of Art History*. Accessed May 8, 2017. <http://www.metmuseum.org/toah/hd/fren/hd_fren.htm.>

"Vanderbilts Add to Gift." *New York Tribune* (1900-1910), Jun 22, 1902; 10. ProQuest Historical Newspapers. Accessed May 2017.

"Vanderbilt Doors Still the Feature" *New York Tribune* (1900-1910); Jan 17, 1916. ProQuest Historical Newspapers. Accessed May 2017.

Yates, T., "Mechanisms of Air Pollution damage to brick, concrete, and mortar", *Air Pollution Reviews: Effects of Air Pollution on the Built Environment*, London, US: ICP, 2003.

Young, Leonard. *A Short History of St. Bartholomew's Church in the City of New York, 1835-1960*. New York: The Church, 1960.



St. Bartholomew's Church, New York City, with fully restored Dome, 2018. Photo: Kara Flannery.

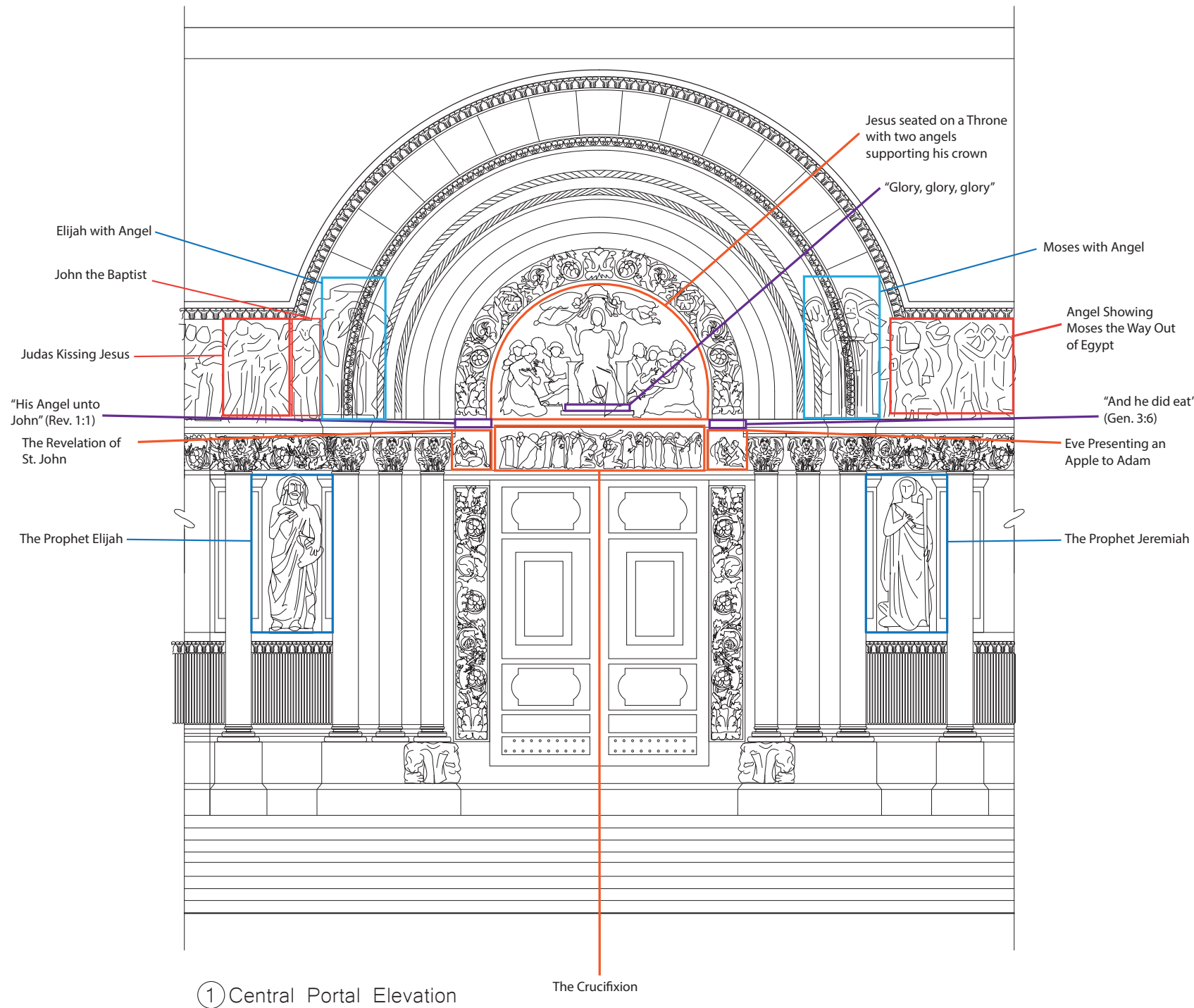
APPENDICES

APPENDIX A - ICONOGRAPHY

APPENDIX B - BASELINE DRAWINGS

APPENDIX C - CONDITIONS DRAWINGS

APPENDIX A - ICONOGRAPHY



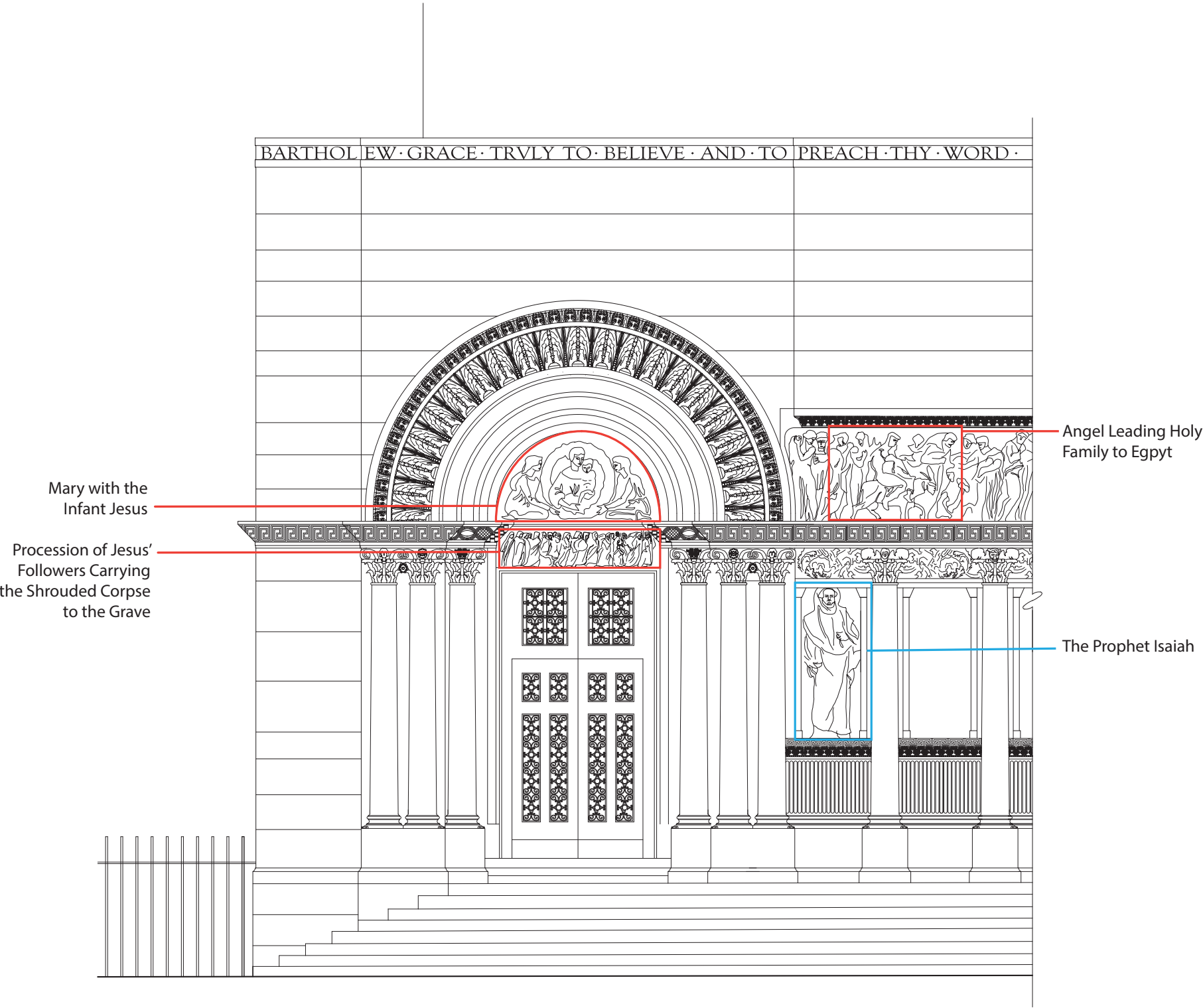
CONDITIONS
ASSESSMENT
ST. BARTHOLOMEW'S
PORTAL
COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

T.....TYMPANUM
F.....FRIEZE
DL.....DOOR LINTEL
WL.....WINDOW LINTEL
PR.....PROPHETS
WI.....WROUGHT IRON
P.....PANEL
C.....COLUMN

COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: SHEET:
1/4":1'-0" 04

APPENDIX A - ICONOGRAPHY



① North Portal Elevation

CONDITIONS ASSESMENT

ST. BARTHOLOMEW'S PORTAL

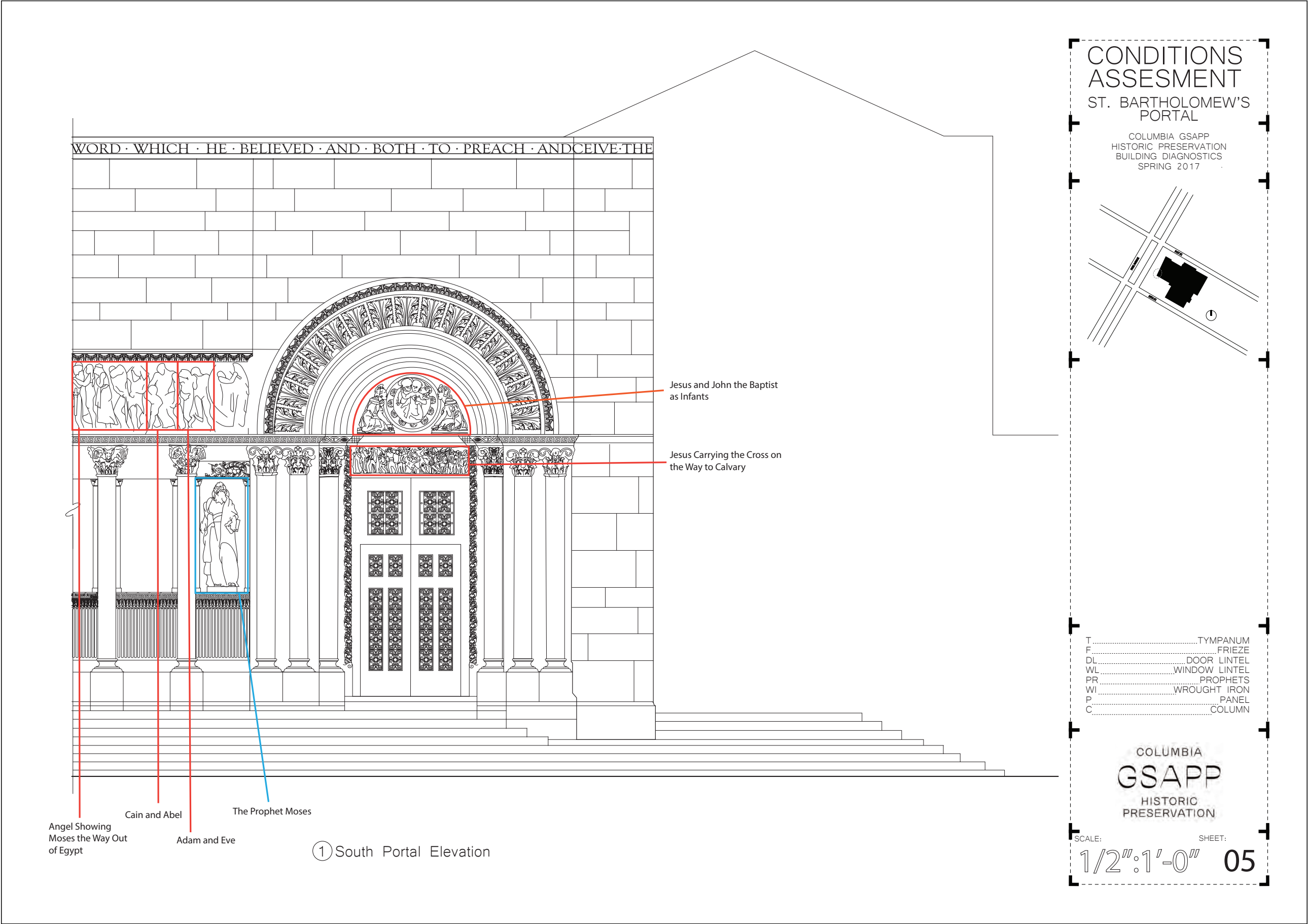
COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

T. TYMPANUM
F. FRIEZE
DL. DOOR LINTEL
WL. WINDOW LINTEL
PR. PROPHETS
WI. WROUGHT IRON
P. PANEL
C. COLUMN

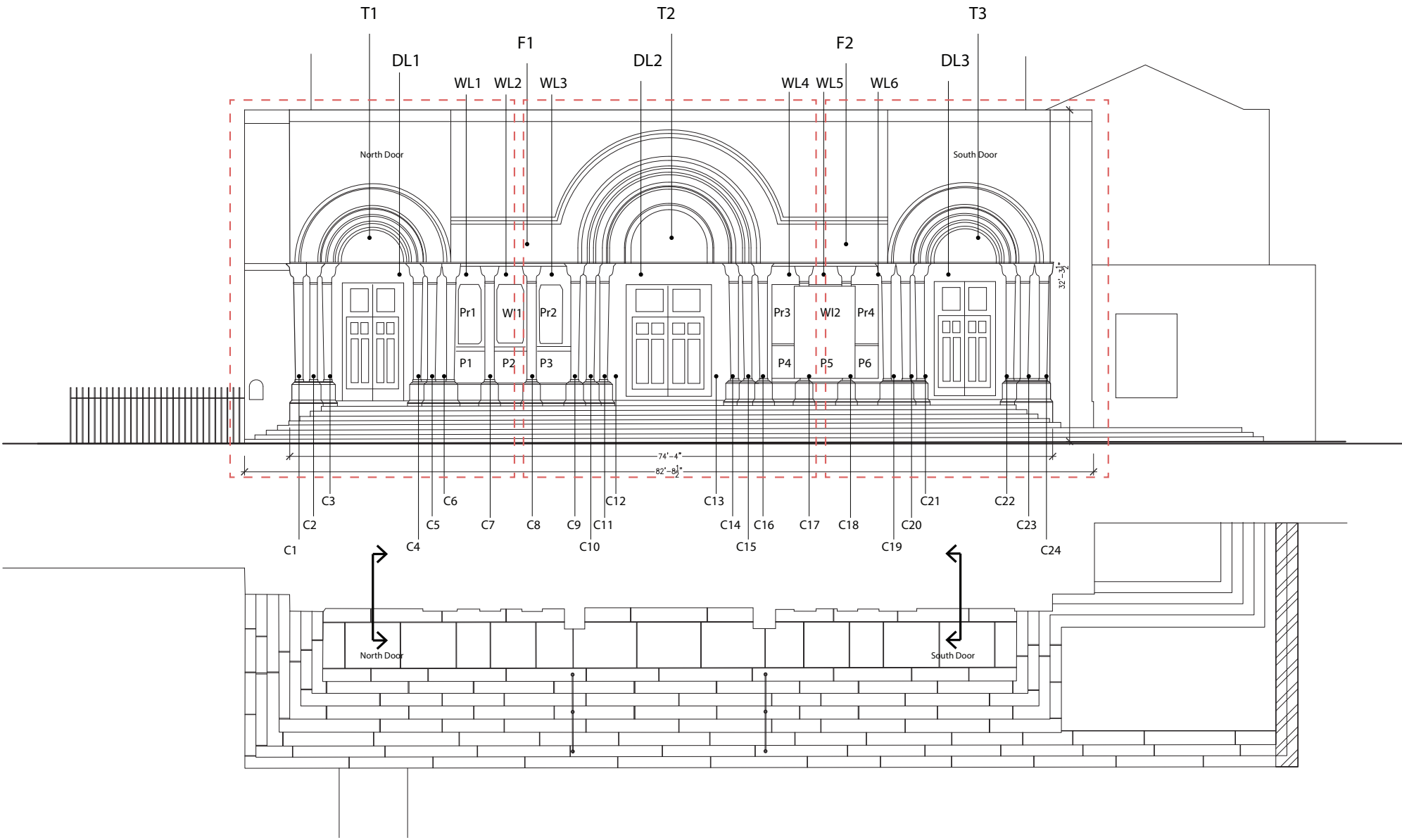
COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: 1/4"=1'-0" SHEET: 02

APPENDIX A - ICONOGRAPHY



APPENDIX B - BASELINE DRAWINGS



CONDITIONS ASSESMENT

ST. BARTHOLOMEW'S PORTAL

COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

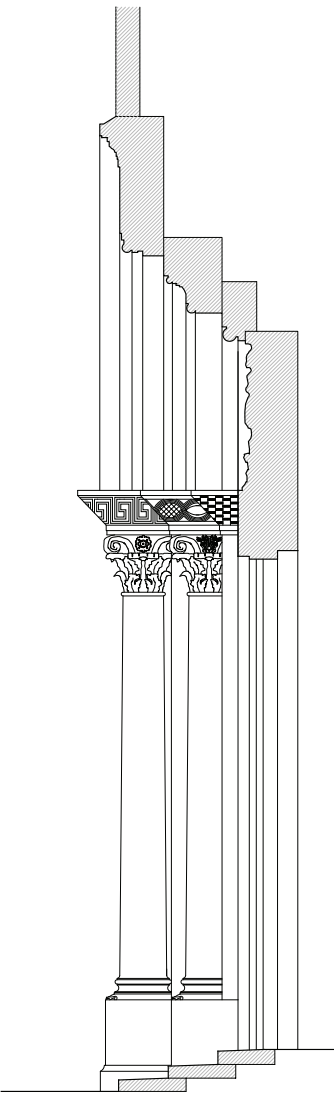
- HEAVY EROSION
- LIGHT EROSION
- SPALLING
- BROKEN/MISSING
- HEAVY GENERAL SOILING
- LIGHT GENERAL SOILING
- BIRD EXCREMENT
- STAINING
- BIOGROWTH
- EFFLORESCENCE
- HAIRLINE CRACKING
- IN PLANE CRACKING
- OUT OF PLANE CRACKING
- CEMENTITIOUS PATCHES
- STABILIZATION
- RUSTING
- PATINATION

T.....TYMPANUM
F.....FRIEZE
DL.....DOOR LINTEL
WL.....WINDOW LINTEL
PR.....PROPHETS
WI.....WROUGHT IRON
P.....PANEL
C.....COLUMN

COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: 3/16":1'-0" SHEET: 01

APPENDIX B - BASELINE DRAWINGS



① North Portal Section
(no conditions annotated)

CONDITIONS
ASSESSMENT

ST. BARTHOLOMEW'S
PORTAL

COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

HEAVY EROSION

LIGHT EROSION

SPALLING

BROKEN/MISSING

HEAVY GENERAL SOILING

LIGHT GENERAL SOILING

BIRD EXCREMENT

STAINING

BIOGROWTH

EFFLORESCENCE

HAIRLINE CRACKING

IN PLANE CRACKING

OUT OF PLANE CRACKING

CEMENTITIOUS PATCHES

STABILIZATION

RUSTING

PATINATION

T.....TYMPANUM

F.....FRIEZE

DL.....DOOR LINTEL

WL.....WINDOW LINTEL

PR.....PROPHETS

WI.....WROUGHT IRON

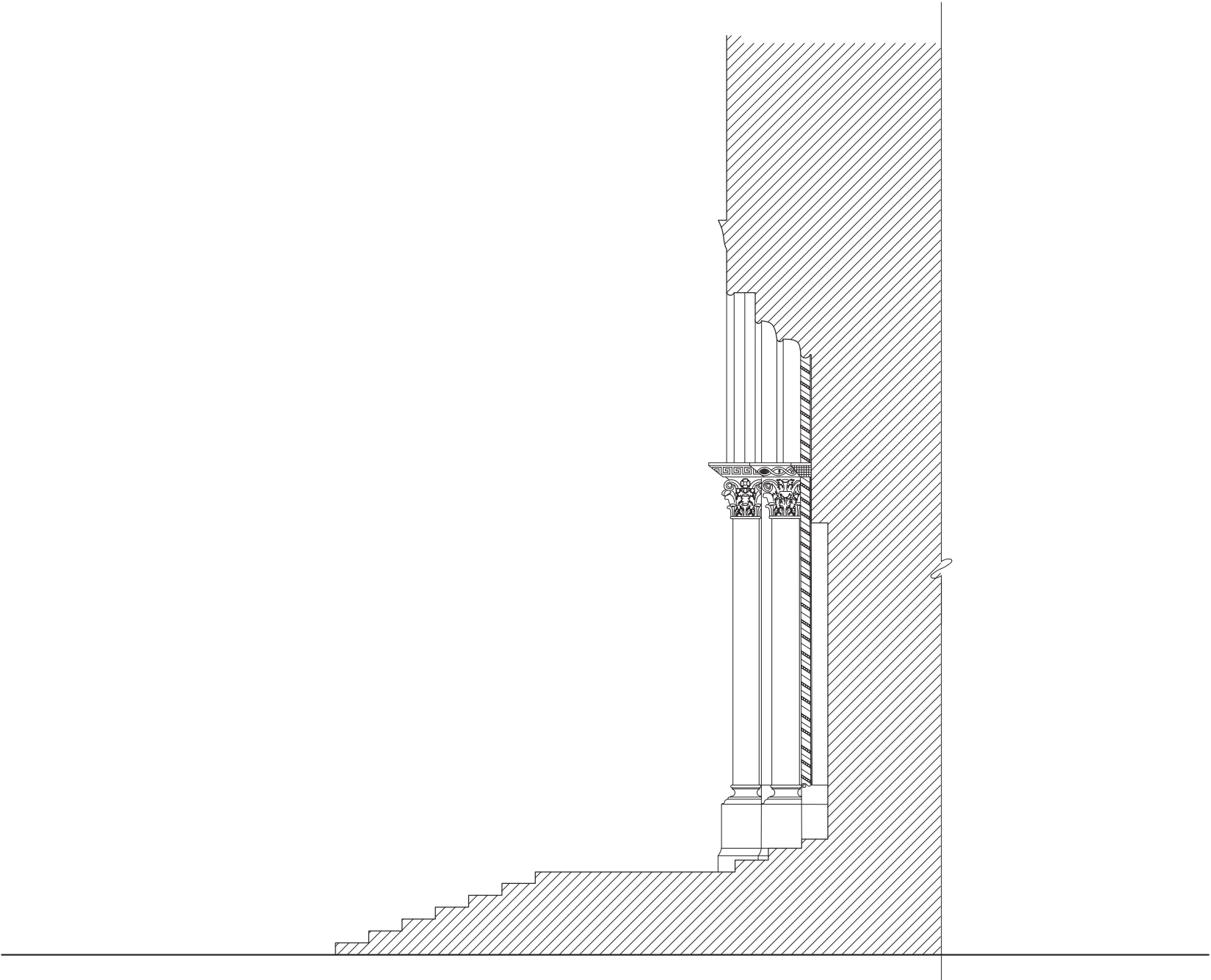
P.....PANEL

C.....COLUMN

COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: 1/2":1'-0" SHEET: 03

APPENDIX B - BASELINE DRAWINGS



① South Portal Section
(no conditions annotated)

CONDITIONS
ASSESSMENT

ST. BARTHOLOMEW'S
PORTAL

COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

HEAVY EROSION

LIGHT EROSION

SPALLING

BROKEN/MISSING

HEAVY GENERAL SOILING

LIGHT GENERAL SOILING

BIRD EXCREMENT

STAINING

BIOGROWTH

EFFLORESCENCE

HAIRLINE CRACKING

IN PLANE CRACKING

OUT OF PLANE CRACKING

CEMENTITIOUS PATCHES

STABILIZATION

RUSTING

PATINATION

T.....TYMPANUM

F.....FRIEZE

DL.....DOOR LINTEL

WL.....WINDOW LINTEL

PR.....PROPHETS

WI.....WROUGHT IRON

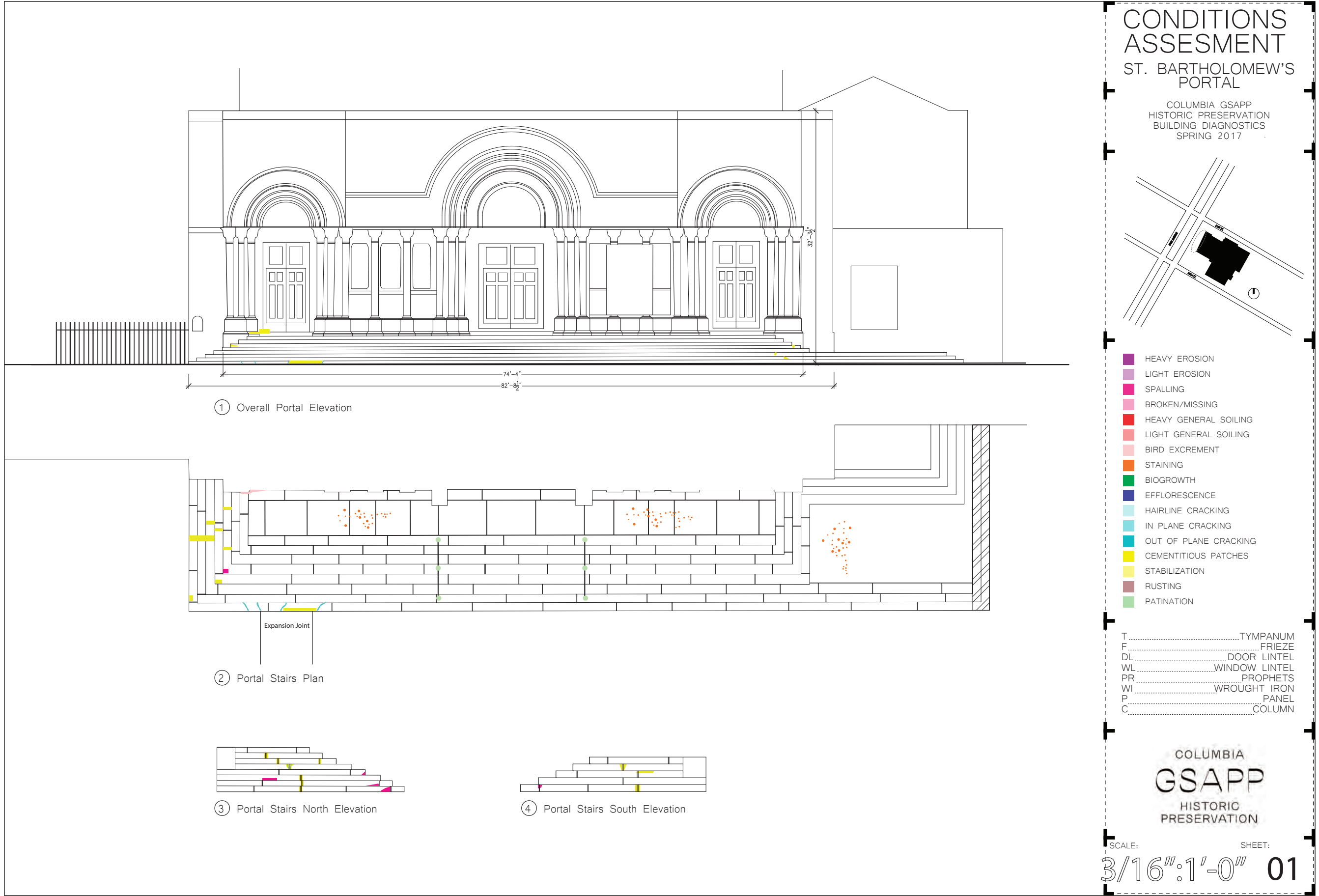
P.....PANEL

C.....COLUMN

COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: 1/2":1'-0" SHEET: 06

APPENDIX C - CONDITIONS DRAWINGS



APPENDIX C - CONDITIONS DRAWINGS



① North Portal Elevation

CONDITIONS
ASSESSMENT

ST. BARTHOLOMEW'S
PORTAL

COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

HEAVY EROSION

LIGHT EROSION

SPALLING

BROKEN/MISSING

HEAVY GENERAL SOILING

LIGHT GENERAL SOILING

BIRD EXCREMENT

STAINING

BIOGROWTH

EFFLORESCENCE

HAIRLINE CRACKING

IN PLANE CRACKING

OUT OF PLANE CRACKING

CEMENTITIOUS PATCHES

STABILIZATION

RUSTING

PATINATION

T.....TYMPANUM

F.....FRIEZE

DL.....DOOR LINTEL

WL.....WINDOW LINTEL

PR.....PROPHETS

WI.....WROUGHT IRON

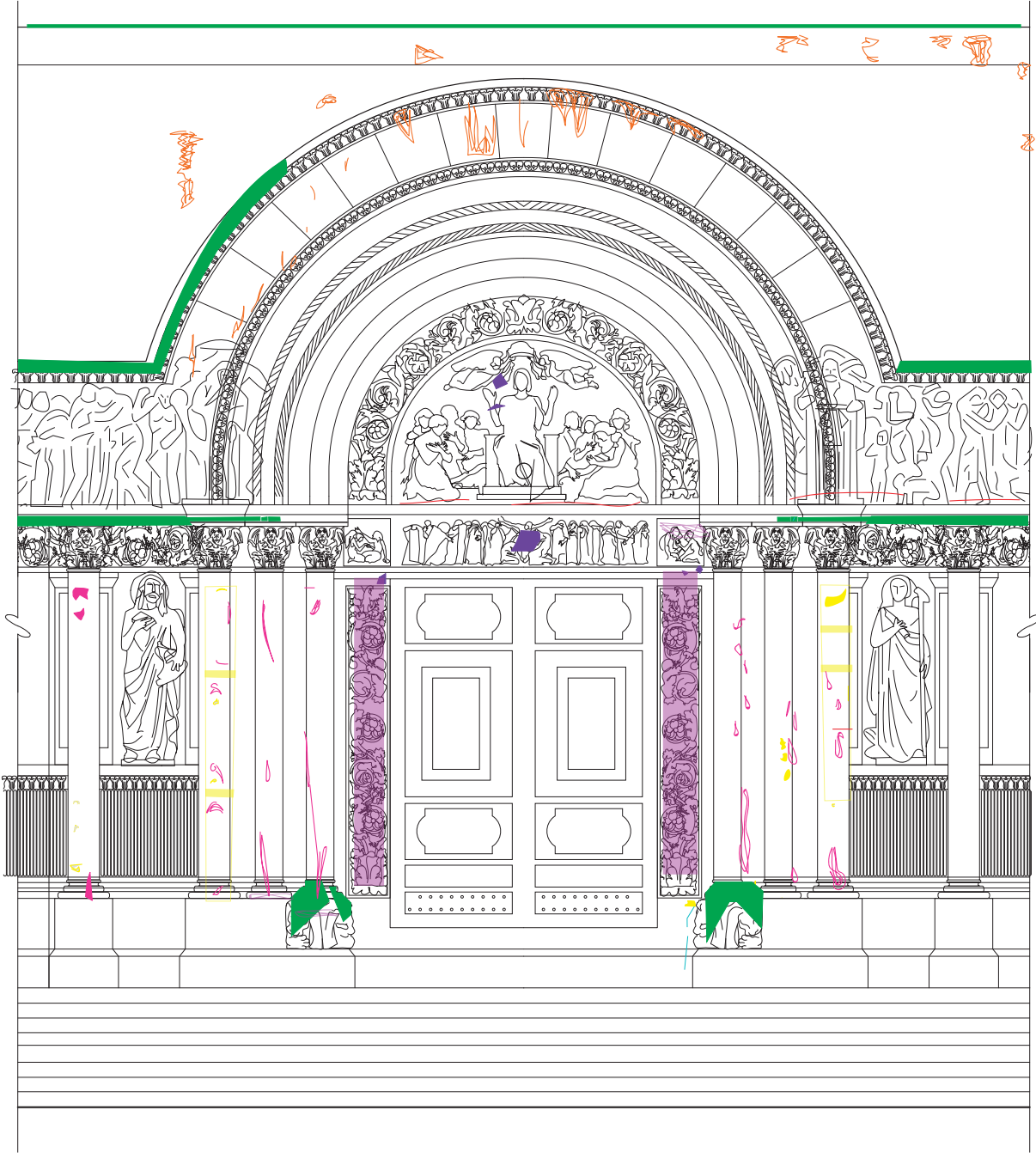
P.....PANEL

C.....COLUMN

COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: 1/4":1'-0" SHEET: 02

APPENDIX C - CONDITIONS DRAWINGS



① Central Portal Elevation

CONDITIONS ASSESMENT

ST. BARTHOLOMEW'S PORTAL

COLUMBIA GSAPP
HISTORIC PRESERVATION
BUILDING DIAGNOSTICS
SPRING 2017

- HEAVY EROSION
- LIGHT EROSION
- SPALLING
- BROKEN/MISSING
- HEAVY GENERAL SOILING
- LIGHT GENERAL SOILING
- BIRD EXCREMENT
- STAINING
- BIOGROWTH
- EFFLORESCENCE
- HAIRLINE CRACKING
- IN PLANE CRACKING
- OUT OF PLANE CRACKING
- CEMENTITIOUS PATCHES
- STABILIZATION
- RUSTING
- PATINATION

T.....TYMPANUM
F.....FRIEZE
DL.....DOOR LINTEL
WL.....WINDOW LINTEL
PR.....PROPHETS
WI.....WROUGHT IRON
P.....PANEL
C.....COLUMN

COLUMBIA
GSAPP
HISTORIC
PRESERVATION

SCALE: 1/4":1'-0" SHEET: 04

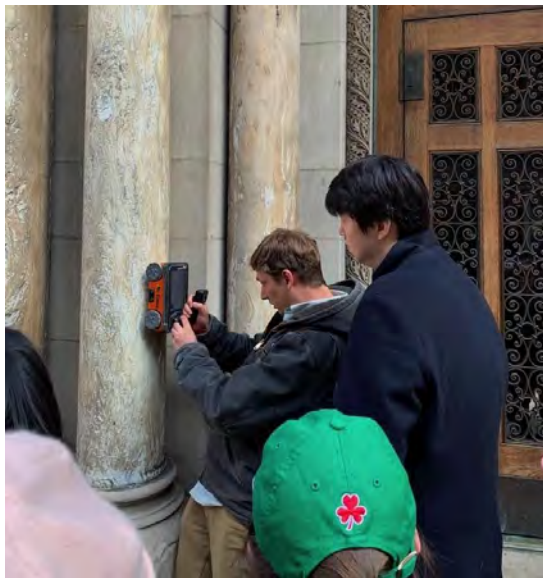
APPENDIX C - CONDITIONS DRAWINGS



INVESTIGATIVE TECHNIQUES (Addendum)

Columbia University GSAPP's Investigative Techniques class made two site visits to St. Bartholomew's Church during the spring semester of 2019. One was focused on the non-destructive evaluation (NDE) techniques of ground penetrating radar (GPR) and ultrasound pulse velocity. These techniques were recommended by the prior GSAPP class that recorded surface conditions of the front portico marble, to determine if NDE could provide information on its subsurface conditions. GPR was able to detect possible repair pins within the columns and ultrasound could discern differences between damaged and undamaged areas. These techniques need to be employed more methodically on all columns to document the subsurface anomalies and help determine a conservation approach.

The second site visit was cleaning testing the limestone at the front portico. Particular attention was given to the green biological growth on the limestone plinths, atmospheric soiling on the statues, and the gypsum crust on the column capitals. Further testing is required, but promising results on the gypsum crust were attained from this limited study.



GPR in use on the marble columns.



Ultrasound Pulse Velocity in use on the columns.



Before testing on the top of the acanthus leaf.



After testing on the top of the acanthus leaf.