



**Restoration of the  
Barnstable County Superior  
Courthouse  
3195 Main Street  
Barnstable, MA 02630**

**Gale JN 843680  
May 9, 2025**

## **EVALUATION REPORT**



**Prepared For:**

**The County of Barnstable and its  
Commissioners**

**c/o Barnstable County Regional  
Government of Cape Cod and  
ClearPath Advisors  
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- Appendix B – Hazardous Materials
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- Appendix E – Wood Species Identifications Report
- Appendix F – Historic Paint Analysis Report
- Appendix G – Preliminary Cost Estimate

**ACKNOWLEDGEMENTS**

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## **EXECUTIVE SUMMARY**

Barnstable County has contracted with Gale to provide evaluation and schematic design services for the Barnstable County Superior Courthouse (BCSCH). Considered significant for the local historic district, BCSCH was initially constructed 1832/1833 and has been expanded multiple times throughout its history. The building is primarily constructed of brick and granite masonry, with wood and precast cornice trim elements intended to mimic the granite masonry. This report is primarily focused on the exterior walls, fenestration, and basement foundation.

The different exterior envelope elements were observed to be in various states of repair, ranging from poor to fair. The exterior masonry exhibits widespread deteriorated mortar joints, cracked and spalled brick masonry units, and step cracking. The existing wood and steel windows are in poor condition and exhibit deteriorated glazing putty, failed paint coatings, and evidence of potential active leaks. Deteriorated wood elements and widespread failed paint, as well as evidence of water intrusion into the supporting wood framing, were observed at the cornice level wood trim. The basement brick foundation piers were observed to have deteriorated mortar joints with evidence of potential rising damp deterioration; additionally, a number of brick piers had been previously removed for the installation of mechanical equipment and piping or conduits. Gale worked with a hazardous materials consultant who performed testing of various materials throughout the building. Asbestos and lead-containing materials were tested to be present at the existing wood windows and wood trim in elevated levels.

Based on discussions with Barnstable County, Gale has developed a preferred scope of work to address the above mentioned envelope and foundation deficiencies with the intent of maintaining the building's historic nature and appearance while accommodating Barnstable County's desire to modernize the building, reduce long-term maintenance, and improve the overall buildings energy performance and interior comfort, and accommodate courthouse operations. The scope of work was also developed based on feasibility and desire to remove hazardous materials through abatement rather than encapsulation. High levels of lead were detected within the paint and wood itself which would be anticipated to migrate into new paint if the wood was maintained in place. The proposed scope of work includes 100% repointing of the exterior brick and granite masonry, isolated brick unit replacement and granite and precast repairs, 100% replacement of the windows with historic-replica aluminum windows for the oldest portions of the building and high-performance windows for the newer steel window locations, 100% replacement of the wood trim with new synthetic wood components including new weather resistive barriers and supporting wood framing, and isolated rebuilding and repointing of brick foundation piers with new concrete footings and dampproofing.

Gale contracted with a cost estimator to develop the cost based on the proposed scope of work. The total cost of construction, which includes general conditions, 15% design and pricing contingency, and 5% escalation assuming a construction start in Spring 2026, amounts to \$4,898,883. Barnstable County is currently discussing options for accommodating construction activity, whether courthouse operations can continue during construction or if the building can be vacated and potentially streamline and curtail the construction period. This cost assumes an extended 15 month construction period in order to accommodate the courthouse operations during construction through a phased approach. The cost estimate includes an alternate cost for work being performed if the courthouse is vacated in the deduct amount of \$930,827 and shortened construction period of 8 months.

## 1 INTRODUCTION

In accordance with our agreement, Gale Associates Inc. (Gale) has performed an evaluation of the in-place windows, exterior walls, and brick foundation components for the Barnstable County Superior Courthouse (BCSCH). Representatives from Gale visited the project on dates from September 25, 2024 to October 2, 2024 to conduct this evaluation. Access to the roof and building interiors was coordinated and provided by Barnstable County Facilities Department.

The purpose of the evaluation report is to document Gale’s findings and provide Barnstable County with a better understanding of the conditions observed. It is Gale’s understanding that Barnstable County would like to repair the exterior wall components of the building to perform general maintenance as well as restore the appearance of the visible exterior components. The purpose of this report is to provide our opinions as to how to address the repair and restoration of the exterior wall components. It is Gale’s understanding that the roof and cupola are not being considered for repair or restoration at this time. As such, evaluation of these components and their condition are not included in this report except as incidental to the exterior walls and windows.

The building evaluation included walkthroughs of both the exterior and interior of the building to observe the condition of the various exterior wall components and areas of existing moisture infiltration. Gale also observed destructive masonry and wood test cuts in order to observe underlying construction and condition of the components, as well as take samples of existing building materials for laboratory testing for their constitution. Gale contracted with Folan Waterproofing and Construction Company, Inc. (Folan), who provided access to upper elevations of the building, and who performed the masonry and wood test cuts on October 1, 2024 through October 3, 2024. Gale also contracted with PEER Consultants, PC (PEER) who performed sampling of materials to test for the presence of hazardous materials. The results of the test cuts and material sampling are included within this report.

## 2 BACKGROUND INFORMATION

The BCSCH is located at 3195 Main Street in Barnstable, Massachusetts. The building is reported to have been constructed in 1831-32 and was designed in the Greek Revival architectural style. According to previous reports and studies, the building incorporates five (5) expansions dating from 1879 to 1972. It was individually listed on the National Register of Historic Places in the late 1970s and is a contributing structure in the Old King’s Highway Historic District of Barnstable. See the key plan below for a diagram of the additions and their associated construction dates based on provided existing documentation.

The original 1832 building is rectangular in plan, two stories tall with a gable roof. The Greek Doric portico with four (4) fluted columns supporting the triangular pediment faces the street. Rock-faced Quincy granite was used to construct the walls, with honed (smooth-face) Quincy granite used for the corner pilasters. The cornice, entablature, pediment and columns were constructed of wood with a sanded paint system to mimic the texture and appearance of granite. The entablature is composed of a cornice,

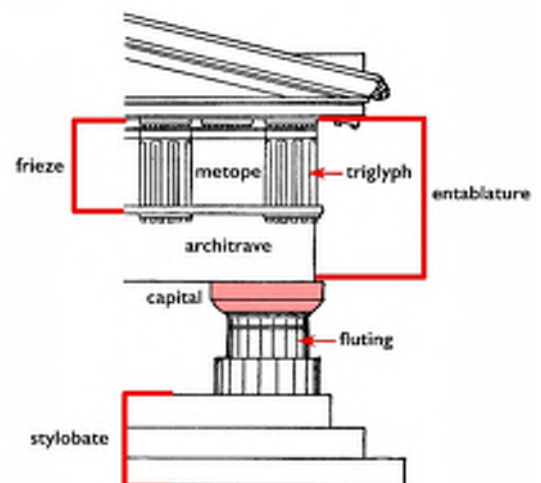


Figure 1: Greek architecture order – image from Alfred D. Hamlin, *College Histories of Art History of Architecture*, 1915)

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frieze and architrave, with classic Doric details. The original fenestration was double-hung wood windows. There is an eight (8) column wood cupola at the peak of the roof, located behind the portico face. It was substantially rebuilt in 1975, and it is unclear how closely it resembles the original.

In 1879, an extension of the original building was added. It was an addition to the original rectangular building that extended it to the south. The wing appears to be the full 40 foot width of the original building and appears to be 24 feet deep. The design is attributed to Samuel D. Kelley, and it used the same granite as the original building.

In 1893 J. Williams Beal designed a one-story east wing, 40 feet wide by 40 feet deep, located adjacent to the 1879 addition's east wall and extending over a portion of the 1832 building. Quincy granite was again used and closely matched to the original building.

In 1906 Boston architect Guy Lowell designed a two story west addition and added a second story to the 1893 east wing. They are both approximately 40x40 feet in plan with a hipped roof. The buildings were constructed using Quincy granite walls and a wood entablature, with all details matching the 1832 building.

In 1925, southeast and southwest additions were designed by J. Williams Beal, Sons Architects and the general contractors are identified as Somers and Drisko of Boston. Quincy granite was again employed for rock faced walls with flat honed blocks used for the corner pilasters for the north, east and west walls. The south elevation was built with yellow brick and cast stone cornice, window headers and sills. The cast stone cornice detailing mimics the appearance of the wood cornice on the earlier portions of the building. The fenestration consists of a combination of steel hopper windows on the first floor and wood double hung windows on the second floor, and the opening sizes on the first floor are larger than the openings on the other parts of the building. The 1925 wings are not symmetrical. The west wing is approximately 8 feet shorter than the east wing, which projects farther east by one window bay.

In 1971, a south-central addition was constructed to fill in between the 1925 east and west wings. The design was by Gaffney Associates, Inc. and provided a new accessible entrance to all parts of the building. This accessible entrance now functions as the main public entrance to the building. The addition is predominantly brown brick with a wood portico entrance and wood cornice.

## 2.1 INFORMATION FROM OTHERS

Barnstable County has provided Gale with previous building drawings sets and evaluation reports. It is Gale's understanding that the drawings for portions of the building constructed prior to the 1925 Additions are not available. The following documents have been utilized by Gale as part of the evaluation and research of the building:

- Portions of the J. Williams Beal, Sons Architects drawing set from 1923 consisting of plans, elevations and heating plans.
- Portions of the Walter M. Gaffney Associates Inc. drawing set from 1971 consisting of plans, elevations, sections, electrical, HVAC, and structural.

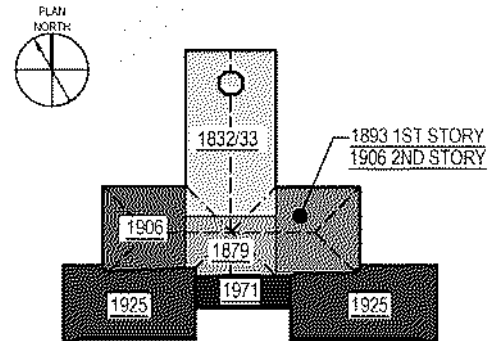


Figure 2 - Building Key Plan with Dates of Additions

- Portions of the Alger & Gunn Architects drawing set from 1991 consisting of plans and elevations for an Exterior Restoration.
- Barnstable Superior Courthouse Building Assessment report dated January 2022, authored by Building Conservation Associates, Inc. This report provided much of the historical and background information for the building and provided an initial scope of work for the restoration.

### **3 ENCLOSURE VISUAL OBSERVATIONS**

The following sections describe the building enclosure components in place at the BCSC. The observations have been divided into sections pertaining to the fenestration, exterior masonry, and exterior wood elements. Each section begins with a description of the observed components, followed by a list of observed defects.

Additionally, observations for each component are further divided by each addition or historic portion of the building as described in the Background Information. As the “T”-shaped building portion built prior to 1925 appears to have similar construction, these portions of the building will be referred to collectively as the “Pre-1920s” portion of the building. The observations in the following sections primarily pertain to those conditions that were readily visible; refer to the Test Observations portion of the report for observations related to concealed conditions and back-up construction uncovered through exploratory test cuts.

#### **3.1 FENESTRATION**

As the building was constructed and modified over time, the building features multiple different window types and configurations throughout the building. The majority of the windows are wood double-hung windows which make up the majority of the Original and Pre-1920s portions of the building. The building also features a number of steel-framed windows installed in the 1925 and 1971 additions.

##### **3.1.1 Pre-1920s Wood Window Frames and Glazing**

The Pre-1920s portions of the building feature primarily wood, double-hung windows with different opening sizes per each floor. The windows utilize putty-glazed, single pane glass within true-dividing muntin grids. The first floor windows feature sashes with 4x2 muntin grids, while the second floor sashes feature 4x3 muntin grids. The 1893 and 1906 additions include basement windows that feature 4x2 muntin grids and are typically built into areaways partially below grade. The windows generally utilize a rope and pulley system for balances. The majority of windows have a rotating brass cam latching mechanism for locking the windows; some of windows incorporate brass handles at the bottom rail of the bottom sash to assist in operation. In general, metal storm windows with vertical sliding sashes have been installed on the exterior of the wood windows throughout the building. The exterior storm windows are fastened into the exterior face of the wood window frame and sill. No documentation is available that indicates when the storm windows were installed.

At one (1) window location within a stairwell to the basement, interior finishes were not installed, and the window frame construction and masonry opening were visible. At this location, the window frame & balance pockets at the jambs could be observed to be installed within a masonry rabbet, whereby the frame is installed behind the exterior granite masonry within a recess of the brick masonry back-up construction. The window frame appears to have a 6-inch depth. On the exterior of the frame, a 1 1/2-inch diameter quarter-round wood trim (brick moulding) is installed at the transition from the window frame to the granite masonry opening at the head and jambs. The windows are installed on 2-inch-thick wood sills, which in turn rest on a granite masonry sill. The window openings are spanned by a solid granite lintel. The first floor windows have a smooth granite reveal around the head and jambs of the windows. Small recesses at the granite jambs appear to indicate that a security screen or shutters were installed over the windows at some point in the past. This detail appears to

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have been copied for the 1893 addition but not the 1906 addition. Refer to the Exterior Masonry observations for information regarding the condition of the masonry opening elements.



Image 1: Overall view of typical window openings at the Original building.

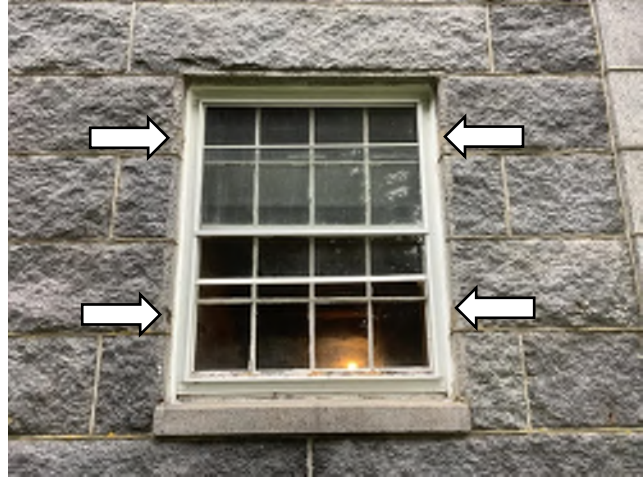


Image 2: Typical First Floor window at the Original building viewed from the exterior. The arrows indicate apparent locations of a previous security screen or shutter attachment.



Image 3: Typical Second Floor window at the Original building viewed from the exterior.



Image 4: Typical Basement window within the 1893 and 1903 wing additions.

According to the previous drawings and report information, the wood windows appear to have had their sashes previously replaced and may not be the original. The original drawings for the 1925 addition call for new wood sashes for the Pre-1920s portions of the building. Based on the visible appearance of the windows, it does appear that the wood window sashes installed on the Pre-1920s portion of the building, and the 1925 Addition are similar. The wood frames and sills would thereby appear to be original or were previously repaired in place. A metal track/weatherstripping has been typically installed within the window frame for the lower sash with a folded groove and is likely not original. The wood sash is fitted with a dado groove that is intended to interlock with the metal track.

The following are the deficiencies observed in the windows within the Pre-1920s portion of the building.

1. In general, the visible components of the wood frame and sashes appeared to be in fair condition. The windows appeared to be largely intact with isolated wood components or window joinery that have

- become displaced, damaged, or decayed. Refer to the Window Schedule for specific windows and wood components that were observed to be deteriorated.
2. The wood sills ranged from fair to poor condition and appear to be experiencing significant moisture accumulation at some locations. Weatherchecking and decay is visible at approximately 20% of the window sills. The majority of window sills exhibited some degree of cracking and peeling paint. Note that the presence of paint and the storm windows inhibited the widespread observation of the wood condition, as paint can conceal further defects in the wood. The exterior storm windows mounted to the face of the sill do not appear to have any weeps to allow bulk water to drain from the horizontal surface of the window sill. Refer to the Window Schedule for window locations with deteriorated wood sills.
  3. At specific window locations, water streaking on the glass, staining on the drapes, and deterioration of paint on the interior wood stool appear to be evidence of active water infiltration through the window opening. Refer to Section 3.1.6 Interior Conditions for further information.
  4. Isolated but numerous instances of cracked panes of glass were observed throughout the building. Refer to the Window Schedule for locations and quantities of cracked glazing.
  5. Glazing putty for sealing the glass to the window frame was generally observed to be in poor condition and has failed. Each window exhibited putty with some degree of cracking and deterioration, with many windows having chunks of putty fallen from the window. The putty debris has collected at the window sill behind the exterior storm windows.
  6. The exterior wood trim appeared to be fair to poor condition. Similar to the condition of the window sills, the trim is exhibiting some degree of paint failure throughout the building. Similarly, the presence of paint makes visual observation of the wood condition difficult and can hide deeper decay within the wood. Wood trim at the basement level windows appear to be in generally poorer condition, with vegetation growing around the windows. In some instances, rust staining from fasteners is visible through the paint on the trim. Refer to the Window Schedule for deteriorated exterior wood trim locations.
  7. Five (5) windows are located on the South Elevation of the Pre-1920s portion of the building. These windows are now located above the roof level of the 1971 addition. One (1) smaller window opening has been replaced with metal vent. Two (2) of these windows have had their lower sashes replaced with metal louvers. Numerous other conduits and piping have been routed to penetrate through the windows. In some cases, the glass has been removed and infilled with a wood panel to accommodate the penetrations. One (1) window has been replaced with a roof access door and exposed wood framing. These windows and associated trim appear to be in heightened state of deterioration compared to the typical wood windows on the building.
  8. In general, a cant sealant joint is installed around the perimeter of the windows between the wood trim and sills and the granite masonry. This sealant was observed to be in poor condition at the majority of window openings.
  9. Gale tested each opening for operability. The majority of windows were generally found to be operational. A few locations the windows and particularly their upper sashes were difficult to access to operate and could not be tested. A number of the upper sashes have been fixed in place with metal brackets. Other windows have had their balance ropes disconnected from the balances, and their sashes do not remain in the open position. Refer to the Window Schedule for window locations. Due to their inaccessibility off the floor, the basement windows often utilize a rope tied to the lower sash to assist in operation.



Image 5: Typical peeling paint and weatherchecking at wood sill.



Image 6: Detail view of typical condition of exterior wood trim and sill. The arrow indicates a rusted fastener that secures the storm window to the wood sill.

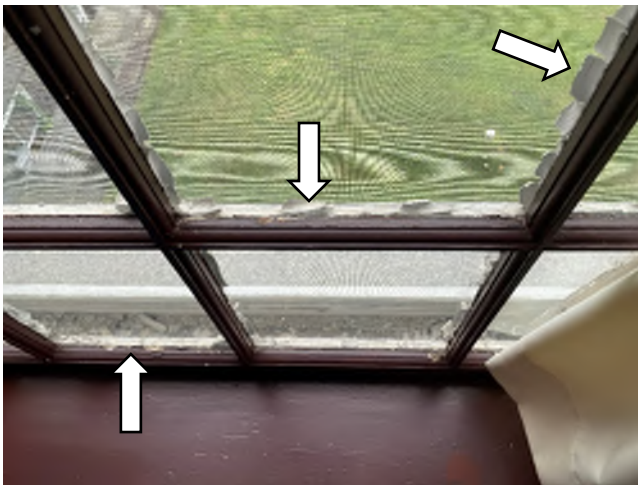


Image 7: The arrows indicate failed glazing putty present at the majority of wood windows.



Image 8: Vegetation growth basement window. At this window location, vegetation growth was observed behind the storm window.



Image 9: Debris from falling glazing putty and paint has typically collected at each window sill.



Image 10: Example of interior deteriorated painted wood surfaces.



Image 11: The arrow indicates an example of a cracked glass pane.



Image 12: At this window location, deterioration was observed where the muntins meet the sash bottom rail (arrows).



Image 13: A severe example of wood deterioration at a sash bottom rail.



Image 14: The arrow indicates an example of gap opened up between the sash bottom rail and stile.



Image 15: The arrow indicates a rope tied to the lower sash in the basement to assist in operation.



Image 16: Basement windows within bathrooms either utilize obscured, textured glass or a translucent film to reduce visibility.



Image 17: View of windows and door located above roof line on the South elevation.



Image 18: View of a window located above the roof line on the South elevation with lower sashed replaced and conduit penetrations.



Image 19: Deteriorated cant sealant between wood trim and granite masonry.



Image 20: View of disconnected upper sash balance.

### 3.1.2 1925 Wood Window Frames and Glazing

The 1925 Addition incorporates double-hung wood windows on the second floor. Based on previous information regarding the windows as described in the previous section, it appears that the wood windows installed on the 1925 Addition have similar construction as the windows in the Pre-1920s portions of the building. Based on their visible appearance and condition, these windows do appear to be similar. Refer to the previous section for their description. One difference between the windows at the 1925 Addition and the Pre-1920s portion, is that a few of the openings feature paired double-hung windows with a wood framed mullion between them. Note that the wall construction varies for the 1925 Addition compared to the Pre-1920s portion of the building. Refer to the exterior masonry portion of the report for observations of the masonry openings.

Deficiencies observed for the wood windows at 1925 Addition are similar to those observed on the Pre-1920s Portion of the building. Refer to the deficiencies noted within that portion of the report as they also apply to the 1925 Addition wood windows.



*Image 21: Overall view of the South Elevation of one of the 1925 Addition wings. Wood windows are typically installed on the second floor of these wings.*



*Image 22: Overall view of the West Elevation of one of the 1925 Addition wings. Wood windows are typically installed on the second floor of these wings.*



*Image 23: Detail view of typical double-hung wood windows at the 1925 Addition.*



*Image 24: A number of the openings at the 1925 Addition feature a wood-framed center mullion.*

### 3.1.3 1925 Steel Window Frames and Glazing

The first floor of the 1925 Addition features steel-framed windows with configurations different from those observed elsewhere on the building. Original design documentation for the 1925 Addition indicate that all of the windows for the addition were to be steel casement style windows, but it appears this design did not come to fruition or have been replaced previously. None of the provided documentation includes information regarding the as-built steel windows in this portion of the building. The as-built steel windows utilize a hopper sash built into a larger fixed frame, depending on the size of the opening. Larger openings incorporate fixed lites above and on either side of the hopper sash, while smaller openings feature only a fixed lite above the hopper. Unlike the wood windows, these windows feature approximately 1/2-inch thick insulating glass units (IGUs) with double glass panes. In some instances, a surface-applied muntin grid has been installed on the interior side of the glass for all or some of the glass panes. The applied muntin grids do not match the style of the steel window frame and appear to consist of aluminum and were seemingly a later addition. The hopper units are operated and latched with a rotating cam handle appearing to consist of brass. The steel frames appear to be built into a

wood rough opening/frame that is visible and painted white on both the interior and exterior to match the steel window paint color.

The following are the deficiencies observed in the steel windows within the 1925 Addition:

1. The steel window frames were observed to be in fair condition. In general, the window frames appeared to be intact. Surface rust was visible on the exterior of isolated window frames, but the presence of paint on the frames may conceal additional frame deficiencies. Paint failure on the steel frames is more common at the portions of the frame where the hopper unit is contact with the fixed frame, visible from the interior.
2. The IGUs are sealed to the steel frame with glazing tape between the glass and window stop. In general, this glazing tape was observed to be powdery and pressed out of the glass stop, indicating deterioration and failure.
3. Gale tested each hopper window for functional operability, and observed that most windows were able to be opened. One (1) window location was observed to have tape applied around the perimeter of the hopper sash and the cam handles were missing. At a few of the narrower window openings, the hopper unit is very tight to the window jambs and, in some cases, the sash rubs against the wood and is causing abrasion of the paint.
4. The painted wood frame components, within which the steel window frames are set, appeared to be in fair condition. Wood at the basement windows close to grade appeared to be worse condition than the first floor windows with wood decay visible. Paint defects are visible on the exterior side of wood at many locations, particularly at the sill. At isolated locations paint defects and staining were visible on the interior side of the window.
5. The majority of IGUs were observed to have staining and condensation within the IGU air space, indicating failure of the IGU seal.
6. Insect screens are installed on the outside of the operable hopper units. The majority of the insect screens were observed to have visible rust on their frames. At isolated locations, the insect screens were observed to be missing.
7. The surface-applied muntin grids were observed to be installed inconsistently throughout the 1925 Addition. In some instances, no muntin grids are present on the window at all, while at other windows the muntin grids are only installed on some glass panes. At isolated locations, individual muntins were observed to missing or have fallen onto the interior window stool trim.
8. The windows typically do not feature a sealant joint around the perimeter of the window between the wood frame and the masonry opening. At isolated locations sealant appears to have been installed. This sealant joint was generally observed to be in poor condition.



Image 25: Overall view of the South Elevation of one of the 1925 Addition wings. Steel windows are typically installed on the first floor of these wings (circle).



Image 26: Overall view of the West Elevation of one of the 1925 Addition wings. Steel windows are typically installed on the first floor of these wings (circle).



Image 27: Typical large steel window opening, with center hopper unit and fixed lites above and on either side of the hopper unit. Note that the muntins are only installed at the fixed lite above the hopper unit at this location. The insect screen is also missing from this window location.



Image 28: The arrow indicates the wood frame within which the steel window frames are set. This wood was generally in fair condition. Also visible is the typical rust visible on the insect screen frames.



Image 29: Isolated windows exhibited heightened paint defects on the steel frame and wood components (arrows). Rust is also visible on the insect screen at the hopper unit. The hopper unit at this location has one (1) muntin installed, but others appear to be missing or not installed.



Image 30: The arrow indicates the glazing tape seal that was generally observed to be in poor condition. Also visible is the fogging and staining of IGUs common throughout the 1925 Addition.



Image 31: The arrow indicates a location where the operable hopper unit sash is rubbing against the wood framing and is eroding the paint layer.



Image 32: The arrow indicates paint defects on the steel window frames common where the hopper sash unit meets the fixed frame.



Image 33: At one (1) window location, the hopper unit was taped around its perimeter and the cam handles were missing.



Image 34: The fixed steel window at basement level appears to be experiencing heightened rusting on the frame. This window appears to be of a different construction compared to the typical steel window at the 1925 Addition. Conduit penetrates through one of the glass panes at this location, typical for basement windows in general.

### 3.1.4 1925 Basement Window Frames and Glazing

The basement level of the 1925 Addition features a number of different window types, some of which are unique to this portion of the building. These windows are located at grade or built within areaways below grade and are installed within the concrete foundation walls. A number of windows appear to have been previously removed to make way for conduit and piping for exterior HVAC equipment located adjacent to the building. These openings have been boarded over with holes cut for the conduit and pipe penetrations. A few of the openings have metal louvers installed into the board infill.

The types of windows located at the 1925 Addition basement and associated deficiencies are as follows:

1. Aluminum horizontal sliding windows are installed at three (3) locations on the South and North Elevations of the East Wing. The window frames generally appeared to be in fair condition. The windows are installed within exposed, painted wood blocking that appears to be in poor condition with paint defects and wood deterioration visible. Due to the height of these windows on the interior, it appears that these are operated with a rope attached to the sashes, as they are difficult to reach for manual operation.
2. A hopper steel window is installed at one (1) location on the return elevation of the west wing. This window appears to be experiencing heightened deterioration compared to other steel windows on the building and appears to be of older construction. Unlike the other typical steel window on the building, this window utilizes single-pane glass and glazing putty to seal the glass to the sash and incorporates true-dividing muntins. Rust is visible throughout the frame and the glazing putty appears cracked and deteriorated. Two (2) conduits penetrate through one of the glass panes which appears to have been purposely broken and then sealed with spray foam on the interior.
3. Two (2) fixed wood windows are installed on the South Elevation of the West Wing. These windows appear to be in worse condition compared to the typical wood windows elsewhere on the building, but it is unclear if these windows were installed at the same time as the other wood windows. Like the typical wood windows, these windows incorporate single pane glass sealed with glazing putty. These

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windows are exhibiting severe deterioration of wood sill and frame components with dark staining and decay visible. One (1) of the windows has a sheet of plexiglass installed over the fixed sash and is currently broken. At this same location, a condensation pipe has been installed through the sash bottom rail at one (1) location.

At five (5) window opening locations, the window has been removed and replaced with an infill panel. Typically, a split system unit or air conditioner is installed adjacent to the opening and its associated electrical conduit and occasionally the condenser lines penetrate through the panel. The panels typically have a metal louver installed within the panel. The panels themselves typically consist of what appears to be painted plywood. At one (1) location the interior side of the window is divided by a partition wall, with a translucent panel installed on the bathroom side of the window and a louver on the other half. In general, the workmanship and condition of these assemblies is inconsistent. At one (1) location the plywood is displaced with a gap opening around the edges of the panel. At the same location, it appears that multiple conduits have been installed through the same penetration opening. At a different location, the penetrations were not sealed and the sealant installed around the panel appears to be failing. Each of these openings features a different style of louver, though, in general, the louvers appear to be in good condition.



Image 35: Exterior view of a typical basement sliding window



Image 36: Interior view of a typical basement sliding window. The arrow indicates a rope attached to the sliding sashes that appears to be means of operating the windows that are too high to operate manually.



Image 37: The arrow indicates exposed wood blocking at the sliding window units that has lost most of its paint and is showing signs of deterioration.



Image 38: Exterior view of the steel basement window. Rust is visible throughout the frame, and the glazing putty is deteriorated. The arrow indicates two (2) conduits installed through a broken pane of glass.



Image 39: Exterior view of one (1) of the wood basement windows.



Image 40: The exterior wood components appear to be experiencing heightened deterioration compared to other wood windows on the building.



Image 41: Exterior view of the infill panel location on the North Elevation of the East Wing. The arrow indicates a gap that has developed around the displaced infill panel.



Image 42: Overall view of the infill panel location at South Elevation of one of the 1925 Addition East wing. This location features a number of abandoned and unsealed conduit penetrations.



*Image 43: At this location on the South Elevation of the East Wing, the opening has been split between a translucent panel on the bathroom side of the partition wall on the left side of the image and a louver on the right side.*



*Image 44: At this location on the West Elevation of the West Wing, a metal grating has been installed over the window opening, which has been infilled plywood and what appears to be an abandoned rectangular penetration.*

### 3.1.5 1971 Steel Window Frames and Glazing

The 1971 Addition features four (4) steel framed windows and appear to be of a different style and construction from the steel windows installed at the 1925 Addition. The first floor windows consist of a double outswing casement with a fixed lite above. The second floor windows consist of a double outswing casement over a hopper unit. These windows utilize true-dividing muntins and single-pane glass; the glass is sealed with a glazing tape installed between the glass pane and the frame. The casement sashes are operated by a crank arm, while the hopper units are operated with a rotating cam lock. Insect screens are installed on the interior side of the casement sashes and on the exterior of the hopper units. The steel frames and sashes are painted white on both the interior and exterior.

The following are the deficiencies observed in the steel windows within the 1971 Addition:

1. In general, the windows appeared to be in fair condition. The frames exhibited minimal paint defects. Some flaking paint was observed where the operable sashes meet the fixed frame. Where the steel frames are visible, they appeared to be in good condition. Note that the presence of the paint may conceal frame defects that are not visible.
2. Gale tested the operability of each of the windows at the 1971 Addition. In general, the operable windows were observed to be functional; one (1) location was unable to be operated.
3. Weatherstripping is not installed between the operable sashes and the fixed frame.
4. The visible components of the steel frame appeared to be in fair condition. One (1) isolated instance of a missing window crank was observed.



Image 45: Exterior view of a typical 1971 Addition steel window.



Image 46: Interior view of a typical 1971 Addition steel window.



Image 47: Interior view of hopper opening at 1971 steel window. Gale noted a lack of weather stripping.



Image 48: Interior view of hopper opening at 1971 steel window. Gale observed peeling paint.



Image 49: Interior view of peeling paint below window.



Image 50: View of broken crank at 1971 steel window.

### 3.1.6 Interior Conditions

Interior finishes and their condition varied widely throughout the building, depending on the addition with which the room was constructed or the use within the space. Gale's observation of the interior conditions relates primarily to those present at window and door openings that could be affected by work at the openings, as well as finishes at the exterior walls that appear to have been damaged by water infiltration into the interior. For brevity, the summaries listed below only describe the most significant interior conditions observed throughout the building. Refer to the window schedule for specific materials and conditions noted at each window location.

The following are a summary of observations of different interior conditions observed in the building:

1. Courtroom (1832) – Within the courtroom at the original portion of the building, the interior wall finishes were observed to be wallpaper over plaster with a dark brown-painted wood wainscoting around the perimeter of the room. The wainscoting returns into the window opening, and a wood stool is installed at the sill of each opening. The interior paint color of the windows and stools match the wainscoting. The windows incorporate a fan-like wood trim within an arched transom above the windows. Cloth drapes are installed at each window opening. A mezzanine level at the north end of the courtroom divides the northernmost windows in half, with the window on east elevation bypassing the mezzanine, while the window on the west side has a blank-off panel installed on the interior side of the upper portion of the window. In general, the finishes appeared to be in good condition, except at specific window locations with staining observed on the drapes and deterioration of paint finishes on the wood stool immediately adjacent to the window. Interior paint finishes on the windows within this space generally appeared to be in worse condition compared to elsewhere on the building.



Image 51: Overall view of the 1832 Courtroom space.



Image 52: . This window in the stairwell adjacent to the courtroom bypasses a mezzanine level within the courtroom space.



Image 53: On the opposite side of the mezzanine, the window has been provided with a dark colored blank-off panel.



Image 54: Interior painted wood finishes within this space appear to be in worse condition compared to elsewhere on the building.



Image 55: The arrow indicates staining on the drapes observed at one (1) window location.



Image 56: View of the typical fan-like arched wood transom and drapes at each window within this space.

2. Second Session Courtroom (1925) – Within the courtroom at the west wing of the 1925 Addition, the interior wall finishes were observed to be mottled beige wallpaper over plaster with a beige-painted wood chair rail around the perimeter of the room installed at window sill height. The window interior paint color matches the chair rail color. Cloth drapes and Venetian blinds are installed at each window opening. A tan-colored marble stool is also installed at each opening. In general, the finishes appeared to be in fair condition, with peeling wallpaper and cracks within the marble stools observed at isolated locations adjacent to windows.

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Image 57: View of the Second Session Courtroom space.



Image 58: Interior view of a typical window within this space.



Image 59: The arrows indicate cracks observed in one (1) of the marble stools.



Image 60: The arrow indicates a location of peeling wallpaper.

3. Meeting Room and adjacent office (1893) – Within the meeting and adjacent office at the first floor of the 1893 Addition, the interior wall finishes were observed to be off-white wallpaper over plaster with a beige-painted wood chair rail and white-painted wainscoting around the perimeter of the room installed at window sill height. The window interior paint color matches the wallpaper color. Accordion-style shades are installed at each window opening. A brown-mottled marble stool is also installed at each opening. A built-in desk/countertop is installed immediately in front of the windows on one (1) side of the room. A strip electrical outlet is installed below the windows above the countertop. In general, the finishes appeared to be in good condition.

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Image 61: View of interior finishes at the windows within the meeting room.



Image 62: View of the built-in desk/countertop installed in front of the windows. The arrow indicates a power strip installed immediately below the windows.

4. First floor offices, east wing (1925) – Within the offices at the first floor of the east wing of the 1925 Addition, the interior wall finishes were observed to be similar to the Second Session Courtroom, with roll shades installed in lieu of drapes and blinds. The spaces utilize a combination of mottled beige wallpaper and off-white colored wallpaper. Some of the openings incorporate an angled jamb to the left or right of the opening. A wood stool is installed over a marble stool within the openings. In general, the finishes appeared to be in fair to poor condition, with peeling wallpaper observed at multiple locations adjacent to windows. Within one (1) of the offices, large filing cabinets block access to the window.



Image 63: View of a typical window opening within this space.



Image 64: The arrow indicates an example of a window with an angled jamb.



Image 65: View of the typical wood stool installed over the marble stool to the right of the image.



Image 66: The arrow indicates peeling wallpaper observed adjacent to a window head.



Image 67: Within one (1) of the offices, large filing cabinets block access to the window.



Image 68: The arrows indicate additional examples of peeling wallpaper adjacent to the windows.

5. First floor offices (1832) – Within the first floor offices at the original 1832 portion of the building, the interior wall finishes were observed to be gray-painted plaster with a white-painted wood stool and apron at each opening. The window interior paint color matches the stool color. Venetian blinds are installed at each window opening. Non-fixed desks and partitions are installed immediately in front of or adjacent to the window at some of the window openings, and mini-split distributor units and condenser lines are installed immediately adjacent to others. In general, the finishes appeared to be in good condition.



Image 69: An example of window opening within the 1832 first floor offices. A mini-split distributor unit and condenser lines are installed immediately above and next to the window opening. Non-fixed desk furniture is installed immediately in front of the opening.



Image 70: An additional example of a window opening within the 1832 first floor offices.

6. First floor offices, west wing (1925) – Within the first floor offices of the west wing of the 1925 Addition, the interior wall finishes were observed to be similar those of the east wing floor offices. In general, the finishes appeared to be in poor condition. Multiple cracks were observed in the marble stools. Deterioration appearing to be related to water infiltration was observed at one (1) window jamb. Previous repairs appear to have been performed at this location. Within the smaller offices, a spline ceiling is installed into the window opening, and staining was observed on the ceiling tiles. Larger slat blinds are installed within the open office area and were observed to be difficult to operate. Abrasion of the paint finishes at the window jambs was common, as the operable hopper units rub against the jambs when opened.



Image 71: One (1) window location exhibited potential previous water infiltration with apparent staining on the ceiling and window jamb, as well as previous wood repairs (arrows).



Image 72: An example of peeling wallpaper at a window head.



Image 73: An example of a cracked marble stool.



Image 74: Staining was observed on the ceiling at one (1) location in this area. The spline ceiling is installed into the window opening at this location.



Image 75: An example of paint abrasion due to the hopper window sash rubbing against the jambs.



Image 76: The windows within this space utilize blinds with larger slats compared to other spaces. These blinds were difficult to operate.

7. Document storage/stacks room, first floor, west wing (1906) – Within the document storage and stacks room of the west wing of the 1906 Addition, the interior wall finishes were observed to be similar those of the 1832 courtroom. No shades are installed at this window location. A raised platform for moveable stacks is installed in front of the window. In general, the finishes appeared to be in good condition.



Image 77: View of the window within the stacks room.



Image 78: View of the window sill within the stacks room.

8. Third Session Courtroom, first floor, west wing (1906) – Within the Third Session Courtroom of the first floor, west wing of the 1906 Addition, the interior wall finishes were observed to be similar those of the 1893 meeting room, with an off-white painted plaster wall finish in lieu of wallpaper and roll shades in lieu of accordion-style shades. In general, the interior finishes appeared to be in good condition.



Image 79: Overall view of the Third Session Courtroom.



Image 80: View of a typical window within the Third Session Courtroom.

9. Lock-up (1906) – Within the lock-up area in the second floor, east wing of the 1906 Addition, the interior wall finishes were observed to be similar those of the Third Session Courtroom. Larger-slat Venetian blinds are installed at window openings within the monitoring office, but otherwise no shades are provided. Other than within the monitoring office, window openings in this area have a metal security screen installed on the interior side of the opening at the outside face of plaster. The wood chair rail returns into the window openings. A build-out for a baseboard radiator assembly is installed immediately below the windows. In general, the interior finishes appeared to be in good condition.



Image 81: View of a typical window within the lock-up area. Interior security screens are installed at the windows within this space.



Image 82: Newer radiation equipment and wall build-out has been installed below the windows in this space.

10. Jury Selection and Deliberation Rooms (1925) – Within the jury selection area and deliberation rooms in the second floor, east wing of the 1925 Addition, the interior wall finishes were observed to be similar those of the Third Session Courtroom. The four (4) south-facing windows incorporate vertical mullions within the opening. Two (2) of these openings are split by an interior partition wall between two (2) bathrooms. The interior wood trim at one (1) of the vertical mullion locations was observed to be warped and displaced.



Image 83: View of the jury selection room.



Image 84: View of one (1) of the deliberation rooms. The windows within these spaces incorporate a vertical mullion.



Image 85: One (1) example of a window opening divided by an interior partition wall.



Image 86: The arrow indicates wood trim at the vertical mullion that is warped and displaced.

11. Judge's Chamber for 1832 Courtroom - Within the Judge's Chamber for the 1832 Courtroom in the second floor, west wing of the 1906 Addition, the interior wall finishes were observed to be similar to those of the Second Session Courtroom. The interior finishes were observed to be in fair to poor condition. Peeling wallpaper was generally noted at the top of the wall around the perimeter of the room. Deterioration of painted surfaces was also noted on the interior trim and stools at multiple windows within the space.



Image 87: View within the Judge's Chamber for the 1832 Courtroom.



Image 88: The windows typically have two (2) sets of drapes.



Image 89: Deterioration of interior painted surfaces was noted at multiple openings within this space.



Image 90: Peeling wallpaper was generally noted at the top of the wall around the perimeter of the room.

12. Basement windows – The basement spaces feature wide variety of interior conditions; however, the majority of the windows are built into window wells and are high above the floor line. The windows sills and heads are often sloped. Many of the windows are blocked by non-fixed equipment and furniture, making them difficult to access. The condition of the interior finishes in the basement ranged from fair to poor condition. Where plaster is installed at the basement openings, paint defects and damaged plaster was noted at multiple locations. Refer to the photos below for additional observations.



Image 91: Example of damaged plaster at the sloped window sill in basement.



Image 92: View of one (1) of the basement bathroom windows with items stored in front of it.



Image 93: View of the storage area in the basement. A split system and multiple shelving units were observed to be installed below one (1) window in this space.



Image 94: Water streaking was evident below isolated window locations in the basement.



Image 95: The arrow indicates cracking was observed in the concrete floor slab at one (1) of the basement window locations.



Image 96: Newer aluminum sliding windows within the facilities office are installed above the suspended ceiling level.

13. Attic windows – The windows at the attic level which was constructed as part of the 1879 extension of the original building are now located above the roof level of the 1971 Addition and now primarily serve as openings for HVAC equipment pass-throughs and louvers. The attic space appears to have had spray foam insulation installed around all interior surfaces, including into the window openings. HVAC and other disused equipment is stored in front of the windows. The wall finishes, if any are present, are obscured by the spray foam insulation and could not be observed.



Image 97: Interior view of one (1) of the attic windows, with spray foam installed into the window opening returns.



Image 98: Equipment and other items are stored in front of the windows.

### 3.1.7 Exterior Doors

The BCSCCH features a wide variety of exterior door assemblies throughout the building, appearing to be combination of doors that have been replaced or repaired at some point in the past. Doors located on the Pre-1920s portion of the building generally consist of wood doors and frames, but it is unclear if these are original materials or configurations. The 1920s Additions feature two (2) egress doors are located at the second floor level that connect to exterior fire escapes. These doors do match what is shown on those original drawings for the addition and may have been more recent installations. Two (2) Doors at the basement level at the facilities office appear to be newer aluminum storefront doors. Gale has indicated the door numbers on the attached building elevations for reference.

The following is a summary of Gale's observations at each of the door locations.

1. Door 1 (East Wing, 1925 Addition, 2<sup>nd</sup> Floor Egress) – This door consists of a wood door with a wood frame that incorporates true-divided, single-pane vision lites, side lite, and transom. The transoms appear to be older, more original construction, utilizing glazing putty to seal the glass to the transom sash. At the door leaf and side lite, the glass is held in with wood window stops on the exterior rather than glazing putty, indicating the door leaf and side lite may have been replaced more recently. The door utilizes panic egress hardware on the interior with no exterior hardware. The exterior portions of door and frame are in poor condition. The exterior painted surfaces of the door, frame, and trim are generally deteriorating, with paint-loss observed throughout the door. The side lite is exhibiting wood decay and peeling wood veneer at the door threshold level. The glazing putty at the transom window is uniformly deteriorated. The interior surfaces of the door appear to be in better condition. The door incorporates a marble stool similar to the windows that are in good condition.



Image 99: Interior view of Door 1.



Image 100: A marble stool is installed on the interior side of the door, similar to the windows.



Image 101: Exterior surfaces of the door are experiencing widespread paint deterioration. The arrow indicates visibly warped and decayed wood at the side lite panel.



Image 102: The transom utilizes glazing putty to seal the glass and is generally poor condition.

2. Door 2 (East Wing, 1893 Addition, 1st Floor Egress) – This door consists of a wood door with a wood frame that incorporates true-divided, single-pane vision lites and an operable, hopper-style transom. The door and frame feature similar to construction Door 1, as the transom appears to be more original construction, utilizing glazing putty to seal the glass to the transom sash. The door appears to be of a different construction and replaced more recently. A concrete landing and stairs are constructed on the exterior side of the door. The door utilizes panic egress hardware on the interior with handle and lever exterior hardware. An insect screen is installed over the exterior of the transom window. The door and frame generally appear to be in fair condition. A gap was observed between the door head and the top of the door leaf when the door was closed. One (1) of the butt hinges was observed to be rusted.



Image 103: Exterior view of Door 2. The arrow indicates a gap observed between the door and frame when the door is in the closed position.



Image 104: Interior view of Door 2 and transom.



Image 105: Interior view of the Door 2 threshold.



Image 106: The arrow indicates a rusted hinge.

3. Door 3 (1832, "Front" Entrance at Portico) – This door appears to be located at would have been the original main entrance to the building, at the north-facing portico. The door features more elaborate exterior wood trim than other doors on the building, with inset wood paneling, scrollwork, dentils, fluted faux pilasters, and cornice above and around the door. The door itself consists of a double wood door and wood frame with single-pane glazed transom above the door. The doors and transom appear to be of newer construction, as vision lites within the doors utilize thin IGUs. The door utilizes brushed stainless steel hardware including panic hardware with retracting vertical rod latching, exterior handle and lever trim, exterior lock cylinder, and automatic door closers. The doors appear to be connected to a local alarm system. A large slate threshold is installed on the exterior side of the door. Bird screening is installed above the cornice ledge above the door. In general, the door appears to be in fair condition. Cracks were observed in the concrete on the interior side of the door threshold, and scuffs were observed in the interior wood trim adjacent to the threshold. The bird screen above the door is rusted and appears to be causing rust staining on the door below. Staining is also observed emanating from the left side exterior door hardware. Weathering of the wood trim was observed where it meets the granite landing.

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Image 107: Exterior view of Door 3. The arrow indicates a gap observed between the door and frame when the door is in the closed position.



Image 108: Exterior view of ornamentation above the door. The arrow indicates rust staining emanating from the bird screen above the door.



Image 109: Interior view of the Door 2 threshold.



Image 110: The arrow staining emanating from the exterior door hardware.



Image 111: Detail view of the door transom.



Image 112: The arrow staining emanating from the exterior door hardware.

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4. Door 4 (West Wing, 1906 Addition, 1st Floor Egress) – This door consists of a wood door with a wood frame that incorporates true-divided, single-pane vision lites. The door and frame are similar to Door 3, but without the transom window. A concrete stair is constructed on the exterior side of the door. The door utilizes push bar panic egress hardware on the interior with handle and lever exterior hardware. The door and frame generally appear to be in fair condition. The door does not incorporate a raised threshold or door sweeps, and the weatherstripping at the jambs and the head is discontinuous. Exterior painted surfaces near the threshold level are weathered and exhibiting paint loss.



Image 113: Exterior view of Door 4.



Image 114: Exterior view of Door 2 and transom.



Image 115: Interior view of the Door 2 threshold. No door sweeps or raised threshold are installed. Painted surfaces near the threshold level were observed to be weathered.



Image 116: Weatherstripping is discontinuous at the head and jamb.

5. Door 5 (East Wing, 1925 Addition, Facilities Department) – This door consists of an aluminum entrance door with a single-pane vision lite and aluminum frame. The aluminum frame is set within a wood-framed rough opening with painted wood trim. The door and frame appear to be newer compared to other doors on the building. The door threshold is located below exterior grade and leads to a sunken concrete landing and stair. The door utilizes panic egress hardware on the interior with handle exterior hardware and exterior lock cylinder. Key fob/card access equipment is installed on the exterior door jamb. The door and frame generally appear to be in good condition.



Image 117: Exterior view of Door 5.



Image 118: Exterior view of Door 5.

6. Door 6 (West Wing, 1925 Addition, Second Session Courtroom Egress) – This door consists of a wood door with a wood frame that incorporates true-divided, single-pane vision lites. The door and frame are similar to Door 1, but without the transom window and side lite. The door is built into an opening that is similar size to the window openings and is raised above the floor level on the interior. The door features similar interior treatments and finishes as the windows within the space. The door utilizes interior push bar panic egress hardware with vertical rod latching and no exterior hardware or trim. The door and frame generally appear to be in fair condition, with some weathering of painted surfaces near the threshold level.



Image 119: Exterior view of Door 5.



Image 120: Interior view of Door 5 (arrow).



Image 121: The door is raised above the interior floor level.



Image 122: Weathered paint was observed on the interior wood surfaces near the threshold level.

7. Door 7 (West Wing, 1925 Addition, Basement) – This door consists of a wood door with a wood frame built within an opening in the concrete foundation wall and is built-into a below-grade concrete landing and stair. The door is not shown on the 1925 Addition original drawings and may be later modification. A louver is located above the door within a separate opening in the concrete and appears to be connected to a duct that is no longer in use. The door utilizes lever hardware on both the interior and exterior of the door. A wood screen door is installed on the interior side of the door. The door and frame appear to be in poor condition. Deterioration and weathering are evident throughout the interior side of the door, and small gaps are visible between the woodwork and between the frame and door leaf when closed. Weatherstripping does not appear to be installed at this location. The butt hinges are exhibiting rust, but the lever hardware appears to be newer and is in good condition. The louver above the door is exhibiting rust and paint-loss.



Image 123: Exterior view of Door 7 with louver above.



Image 124: Interior view of Door 7 and interior screen door. The arrow indicates damage to the screen.



Image 125: The louver above the door appears to be connected to abandoned ductwork.



Image 126: The arrows indicate weathering of the interior painted wood surfaces.



Image 127: The arrow indicates daylight visible between the frame and door when closed.



Image 128: Exterior view of Door 7 and threshold. The door threshold is raised above the interior floor and exterior landing levels.

8. Door 8 (Main Public Entrance, 1971 Addition) – This door consists of an aluminum entrance door within an aluminum frame that incorporates single-pane side lite and transom glazing. The door functions as the main public entrance to the building as constructed with the 1971 Addition. The original drawings for the addition call for a steel-framed door to be installed, indicating that the door and frame may have been replaced more recently. The door incorporates a full-height vision lite that utilizes IGU glazing. The door incorporates wood ornamentation with fluted faux pilasters and cornice similar to the original main entrance door. The door utilizes panic egress hardware on the interior and lever hardware with lock cylinder on the exterior of the door. Key fob equipment is installed on the door frame adjacent to the door, and door position switch and conduit is installed onto the interior side of the frame. The door and frame appear to be in good condition.



Image 129: Exterior view of Door 8 and associated portico.



Image 130: Interior view of Door 8.

9. Door 9 (East Wing, 1925 Addition, 1<sup>st</sup> Floor Offices) – This door consists of an aluminum entrance door within an aluminum frame that incorporates single-pane side lite and transom glazing. The door is not included in the 1925 Addition original drawings and appears to be a newer modification, similar to Door 5 at the Facilities Department. The door and frame appear to be in good condition.



Image 131: Exterior view of Door 9 and associated portico.



Image 132: Interior view of Door 9.

10. Door 10 (Roof Access, 1879 Addition) – This door consists of wood door leaf and is framed with rough wood blocking within a previous window opening. None of the existing documentation indicates when the window was converted to a door, but now it provides access to the roof over the 1971 Addition. The door incorporates a small handle on the exterior but otherwise does not include any latching mechanism. The door is secured by a steel hook and eye bolt. Like the adjacent attic windows, spray foam insulation was installed into the interior head and jambs of the opening. The door appears to be in fair condition, with the visible wood rough opening appearing to be dry and without water staining. However, exposed wood blocking on the exterior appears to be unpainted and is exhibiting severe weathering. Exterior wood trim around the door, seemingly leftover from the previous window trim, is in poor condition. The door does not incorporate a raised threshold, but appears to utilize the previous

window sill, which is also exhibiting weatherchecks and deterioration. Numerous conduits and condenser lines penetrate through the door frame at the threshold level.



Image 133: Exterior view of Door 10 and associated portico. The arrows indicate exposed wood blocking that is exhibiting severe weathering.



Image 134: Interior view of Door 10 and threshold. The arrow indicates the wood sill that is weatherchecked and deteriorated.



Image 135: The arrow indicates where numerous conduits penetrate through the door frame.



Image 136: The arrow indicates the hook and eye which is the only locking mechanism for the door.

## 3.2 EXTERIOR MASONRY

Gale's evaluation of exterior masonry components included a review of Pre-1920s Granite, 1926 Granite, 1926 Brick, 1926 Precast Concrete and 1971 Brick Veneer. Gale's evaluation of these components was performed from grade using binoculars, from fire escapes, via boom lift and un-manned aerial vehicle (UAV) drone.

### 3.2.1 Pre-1920s Granite Masonry

The granite masonry is the primary façade material that provided a structural and decorative element for the building. The building was constructed in stages and was first constructed in 1832/1833, with additions that followed in 1879. Wings were added at the turn of the 19th century in 1906. The granite walls consist of cut, rock-faced blocks that are approximately 18" high and of varying lengths up to approximately 5' and honed (smooth-faced) granite elements at the pilasters. The granite units are set between beds of mortar that are approximately 1/8" to 3/16" wide between the granite. The granite foundation components extend north to south on the west and east sides of the building. The granite protrudes outward approximately 6", forming a ledge that is detailed with mortar.

- The granite units were generally observed to be in good condition, with the exception of occasional spalls or cracks.
- Abandoned holes were observed adjacent to the windows where iron bars had at one time been installed on first floor windows on the west and east elevations on the 1832 building. The holes had been filled-in with mortar at some locations. The locations that were not filled in showed rust from the cut off bars that may have remained embedded in the stone.
- Embedded masonry anchors and abandoned anchor holes were observed in the granite façade.
- Mortar has been deteriorating and detaching from the walls and landing on the ground below. Previous repair attempts have been made at various locations over the existing mortar that appears to have resulted in the detachment of the repair mortar.
- Mortar joints between the rock-faced granite units exhibit scattered small and isolated large areas of deterioration, depending on the elevation.
- Linear deterioration of horizontal mortar joints was observed between the granite units in the field of the wall and the foundation components. Deteriorated mortar was observed within the joints on the foundation.
- The vertical mortar joint between the rock-faced granite in the field of the walls and the honed granite on the pilasters was also observed to be deteriorated.
- Mortar joints within the honed granite components on the pilasters were also observed to be deteriorated. of the building or at columns had various cracking, missing, or deteriorating joints as various locations at both west and east elevations and in poor condition.
- Sealant was observed over previously deteriorated mortar joints between rock-faced granite elements.
- Scattered small, and isolated large, areas of vegetative growth including red algae staining, which is a pigmentation from green algae, were observed on the granite façade.
- One downspout was observed to be missing at the west elevation on the 1906 wing. Water runoff from the missing downspout location appears to be causing rust staining at the skyward facing surface of the granite foundation. The missing downspout appeared to contribute to an opening in the soffit, that appears to have been infiltrated by hornets.
- Copper downspouts in front of the granite pilasters appear to be loose and cracked at the elbows. Isolated ground leaders were observed to be backed-up.
- Wall-mounted fixtures, including lanterns, were observed loose / detached above entry doors.
- Numerous conduits penetrate the granite at an isolated location on the east elevation of the 1906 addition. The penetration appears to be filled with spray foam that appears deteriorated.



Image 137: Overall North Elevation of the 1832/33 Building.



Image 138: Overall West Elevation of the 1832/33 Building.



Image 139: Overall East Elevation of the 1832/33 Building.



Image 140: Spalling of rock-faced granite.

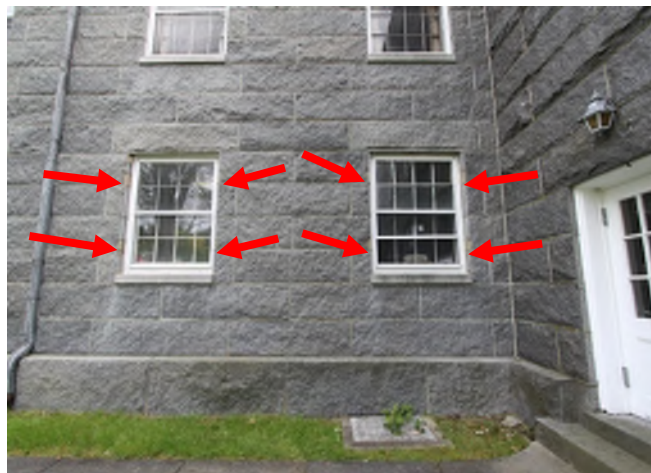


Image 141: Arrows point to locations where mortar patches were applied where iron screens had once been attached.



Image 142: View of deteriorated mortar joints in the granite foundation wall (arrow), cracked copper downspout at the elbow (arrow), and grout-filled ground leader (arrow) at the northeast corner of the 1893 addition.



Image 143: Deteriorated/missing mortar joint.



Image 144: Deteriorated/cracked mortar joint.



Image 145: Previously repaired, deteriorated and missing mortar on the South Elevation



Image 146: South Elevation mortar joint repair and deterioration.



Image 147: Deteriorated and detached vertical mortar joint (arrow) between the rock-faced granite and the honed granite at the pilaster.



Image 148: Cracked granite element in the field of the wall.



Image 149: View shows vegetative growth on the rock-faced and honed granite elements at the building corner.



Image 150: View shows deteriorated horizontal and vertical mortar joints between granite elements (arrows), as well as water back-up in the ground leader (arrow, inset).



Image 151: Arrows point to a mortar-filled hole (front face) and rust stained granite where an apparent section of embedded iron remains on the jamb return.



Image 152: View of sealant application over rock-faced granite mortar joints.



Image 153: View of red algae staining on the rock-faced granite.



Image 154: Loose lantern observed above an entry door.



Image 155: Deteriorated spray foam applied to seal numerous conduits that penetrate the granite wall on the east elevation.

### 3.2.2 1926 Granite Masonry

Similar to the pre-1920s building, the primary building façade consists of rock-faced granite masonry that is accented by honed granite at the pilasters. The granite units are set between beds of mortar that are approximately 1/8" to 3/16" wide between the granite.

The following is a summary of the deficient conditions that were observed on the 1925/26 granite masonry wall areas:

- The granite units were generally observed to be in good condition, with the exception of occasional spalls or cracks.
- Abandoned holes were observed in the honed granite units on the northeast corner pilaster.
- Embedded masonry anchors and abandoned anchor holes were observed in the granite façade.
- Rust and paint staining were observed on the granite in the proximity of the fire escape on the east wing, north elevation of the building. Rust staining was also observed at louvers and at steel lintel locations.

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- Mortar has been deteriorating and detaching from the walls and landing on the ground below. Previous repair attempts have been made at various locations over the existing mortar that appears to have resulted in the detachment of the repair mortar.
- Mortar joints between the rock-faced granite units exhibit scattered small and isolated large areas of deterioration, depending on the elevation.
- Linear deterioration of horizontal mortar joints was observed between the granite units in the field of the wall and the foundation components. This includes the detachment of finish mortar from the joint. Deteriorated mortar was observed within the joints on the foundation.
- The vertical mortar joint between the rock-faced granite in the field of the walls and the honed granite on the pilasters was also observed to be deteriorated. Several open mortar joints were observed.
- Mortar joints within the honed granite components on the pilasters were also observed to be deteriorated. of the building or at columns had various cracking, missing, or deteriorating joints as various locations at both west and east elevations and in poor condition.
- Scattered small, and isolated large, areas of vegetative growth including red algae staining, which is a pigmentation from green algae, were observed on the granite façade.
- Scattered areas of rust staining were observed on the granite façade.



Image 156: North elevation on the east wing of the 1925/26 addition.



Image 157: East elevation of the 1925/26 addition.



Image 158: Deteriorated and detached mortar on top of the granite foundation.



Image 159: Missing/deteriorated mortar joints. Rust staining observed on the granite masonry.



Image 160: Deteriorated and detached mortar, as well as open joints, on top of the granite foundation.



Image 161: Closer view of detached and cracked horizontal mortar between the field of the wall and the foundation.



Image 162: West elevation of the 1925/26 wing.

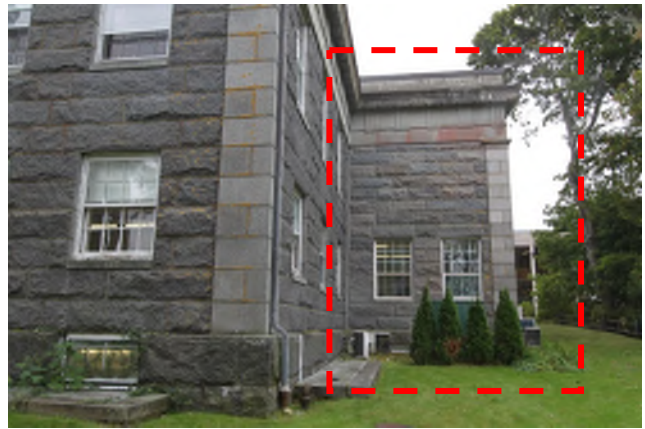


Image 163: North elevation of the 1925/26 west wing (outlined area).

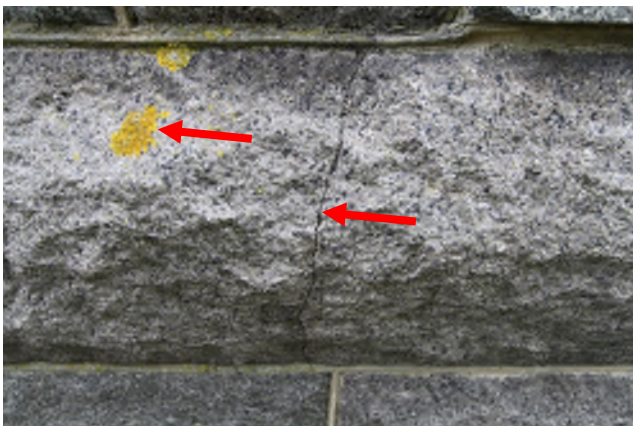


Image 164: Cracked rock-faced granite element. Note the vegetative growth on the wall.



Image 165: Vegetative growth and missing/deteriorated mortar joints.



Image 166: Visible holes where embedded anchors were observed in the honed granite at the northeast corner pilaster.



Image 167: Vegetative growth on the granite foundation wall.



Image 168: Scattered paint and rust staining (arrow) observed below the fire escape on the north elevation of the east wing.



Image 169: Mortar debris had fallen to the ground.

### 3.2.3 1926 Brick Masonry

The use of brick masonry is confined to two additions within the 1925/26 east and west wing additions on the Barnstable Superior Courthouse. Based on our review of existing drawings, the wall construction consisted of yellow brick masonry with a terra cotta backup wall system. A paint coating was visible over the brick masonry at the base of the wall in an apparent attempt to mimic concrete. The brick masonry was found to be in poor condition overall. There were evident areas of previously repaired mortar joints that varied in color, and several areas on the masonry walls where brick masonry replacement had been performed using the same textured brick that are on the 1971 brick masonry elevation. This condition was most prominent on the parapet on the east wing of the south elevation.

The following is a summary of the deficient conditions that were observed on the 1925/26 brick masonry wall areas:

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- Numerous step cracks, scattered efflorescent staining and widespread (100%) deterioration of brick masonry mortar joints were observed on the parapet above the cornice level on the south elevation.
- Numerous cracked and spalled brick and black staining were observed at various locations on the wall.
- Black and rust staining were observed below the fire escape on the west wing of the building.
- The aforementioned mortar joint repointing was observed on approximately 30% of the east and west wings of the building. The repointed mortar was starting to deteriorate.
- The aforementioned, textured replacement brick masonry units also did not match the color of the masonry units in the field of the south elevation, as the replacement brick units were lighter in color, similar to the brick units on the 1971 addition.
- Textured brick masonry units were installed on approximately 33% of the chimney on the east wing of the south elevation.
- Water staining was observed on stone window heads and various cracked stone at window sills.
- The above-referenced paint coating on the base of the brick masonry wall is delaminating from the façade. This condition appears to be occurring on both the east and west wings on the south elevation. This condition was also observed on the walls of the basement access stairwell.
- Mortar joints between brick masonry walls and the honed granite pilasters are cracked and generally in poor condition.



Image 170: View of the west wing of the south elevation on the 1925/26 addition. The arrows identify locations of dissimilar brick masonry units.



Image 171: View of the east wing of the south elevation on the 1925/26 addition.



Image 172: Representative view of the parapet shows deteriorated mortar joints and efflorescence.



Image 173: Arrows point to black staining, replaced brick masonry units, dissimilar repair mortar and delaminated coating at the base of the wall at grade.



Image 174: Closer view of image above shows deteriorated mortar on the parapet wall, as well as dissimilar colors in the mortar and replacement brick masonry units.



Image 175: Closer view of replacement brick masonry units that have a different color and texture than the majority of the wall.



Image 176: Closer view of dissimilar mortar colors on the wall.



Image 177: Abandoned masonry anchors (arrow) were observed in the masonry wall.

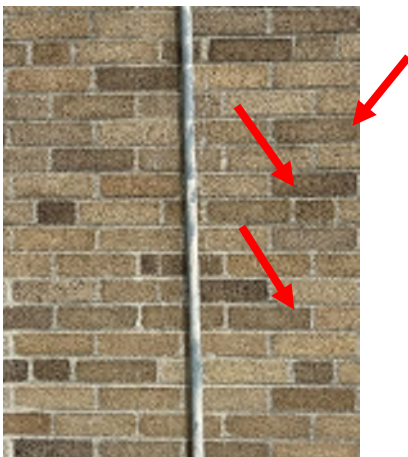


Image 178: View of vertical cracks in the brick masonry wall on both sides of the conduit.

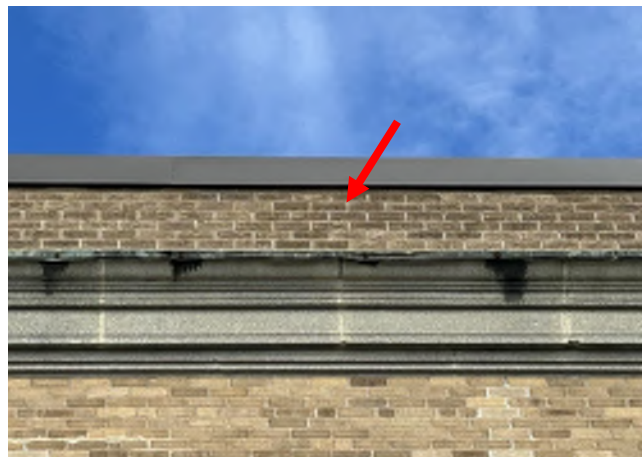


Image 179: Closer view shows textured replacement brick masonry units that had been installed on the east wing parapet. Textured bricks were observed the full length of the parapet on this elevation.

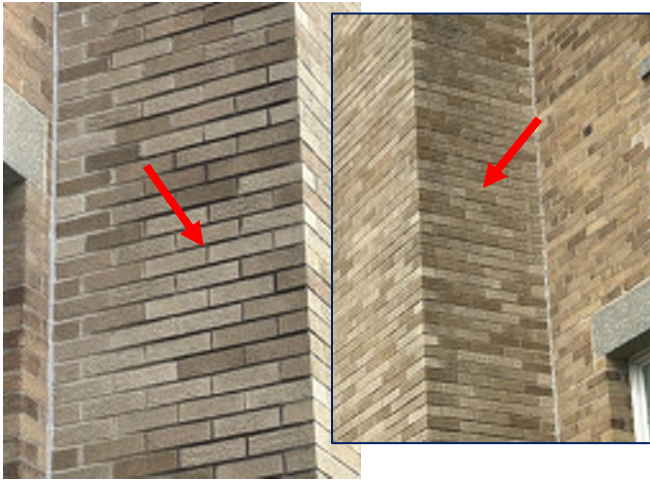


Image 180: Views of textured brick masonry units on the chimney on the south elevation of the building.



Image 181: Closer view of deteriorated mortar on the chimney.

The stairs that lead to the basement level on the south elevation of the building appear to consist of brick masonry on the building foundation wall and concrete on the extended walls that enclose the stairs. These components have a sand-textured coating that is delaminated at several locations.

The following is a summary of additional conditions that were observed on the stairwell:

- Cracks were observed at outside corners in the wall and on the coping.
- Coping joints are filled with mortar that is deteriorating.



Image 182: View looking down the basement stairs shows delaminated coating on the brick masonry and concrete walls.



Image 183: Cracks were observed on the concrete wall and coping.

### 3.2.4 1925/26 Precast Concrete Elements

The use of precast elements was observed on the entablature (cornice, frieze and architrave) components that encompasses each addition, the parapet wall elements above the cornice on the north and west elevations on the west wing, the north and east elevations on the east wing, the pilasters at outside corners and at window heads and sills of the 1925/26 additions on the Barnstable Superior Courthouse. Joints between precast elements are filled with mortar. The precast elements on the parapet walls had been painted to match the paint coating on the wood elements on the older portions of the building. The entire cornice is capped with copper flashing that ties-in to the parapet wall. Flashing joints appear to have been soldered upon installation. The north elevation parapet on the 1926 addition is currently clad with aluminum wall panels indicating potential deterioration of precast parapet elements at this location.

The following is a summary of the deficient conditions that were observed on the precast concrete elements:

- A section of the cornice on the west end of the south elevation appeared to be deflected away from the remainder of the cornice. Iron bars were observed to anchor the deflected portion of the cornice to the remainder of the cornice.
- Open / deteriorated solder joints were observed on the copper cornice flashing. Many of the solder joints had been detailed with sealant. Rusted and missing fasteners were observed in the copper cornice flashing
- The cornice flashing appeared to be dislodged from the parapet at several locations due to deteriorated mortar conditions.
- Spalled, cracked and delaminated sections of precast concrete were observed on parapet and entablature elements. Conditions were also observed on previously repaired precast concrete elements.
- Deteriorated mortar joints were observed on parapet, entablature and pilaster elements.
- Abandoned holes were observed on precast elements at the pilasters.
- Vegetative, black and efflorescent staining was observed on precast elements.



Image 184: Displacement of precast cornice at west end of the south elevation.



Image 185: Iron anchors (arrows) on the cornice at the left side of the image.



Image 186: Deteriorated solder joints (arrows) observed in the copper cornice flashing.



Image 187: Rusted and missing fasteners observed in the copper cornice flashing.



Image 188: Exposed precast cornice section due to loose / displaced copper cornice flashing

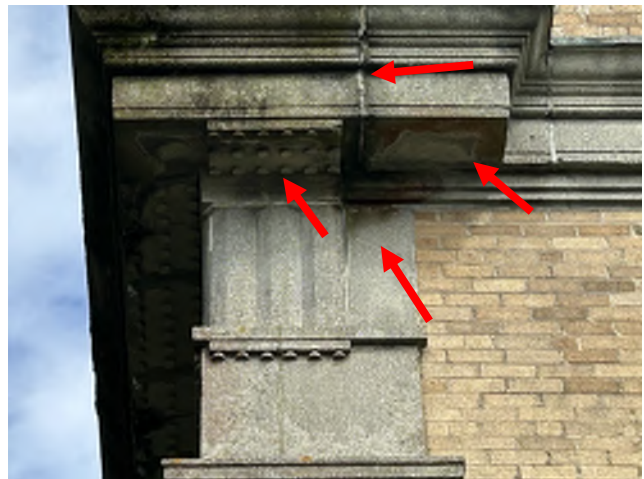


Image 189: Deteriorated mortar in precast joints, cracked and stained precast elements were observed.



Image 190: Spalled, cracked and delaminated precast components with deteriorated mortar joints on the parapet.



Image 191: Closer view of deteriorated precast repair on the cornice.

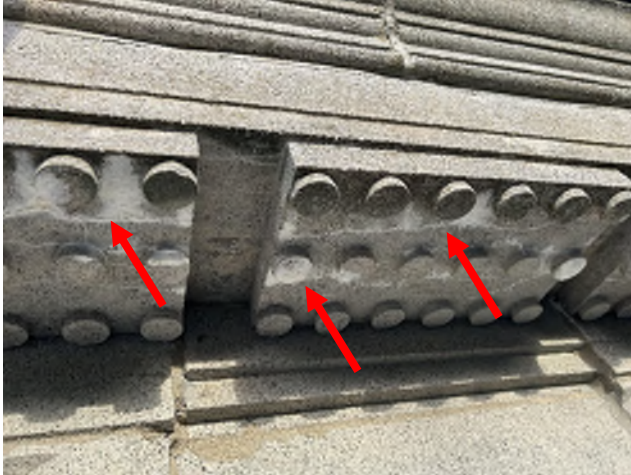


Image 192: View of cracks and efflorescent staining at decorative dentils on the underside of the cornice.



Image 193: Deteriorated mortar observed in cornice elements.



Image 194: Red algae staining and efflorescent staining observed on precast frieze and architrave elements.



Image 195: Black staining observed on precast elements. Note the aluminum wall panels on the parapet above.



Image 196: Arrow points to abandoned hole in precast pilaster.



Image 197: Spalled and stained precast cornice elements (arrows) on the south elevation.

### 3.2.5 1971 Brick Veneer Walls and Concrete Stairs / Ramp

Exterior walls on the 1971 addition consist of textured brick masonry, unlike the original brick masonry that is on the 1925/26 addition. The stairs and ramp appear to consist of cast-in-place (CIP) concrete.

The following is a summary of the deficient conditions that were observed on the 1971 brick masonry wall areas:

- Approximately 30% of the masonry mortar joints are deteriorated. Missing mortar was observed at isolated locations.
- Steel lintels at window heads and above the louvers appear to be rusted.
- Cracks were observed in the concrete landing slab adjacent to the wood plinths next to the entry door.
- An open cold joint was observed between the concrete footings and the slab at the front entry stairs.



Image 198: Overall south elevation of the 1971 addition shows brick masonry and wood elements around the main entrance.

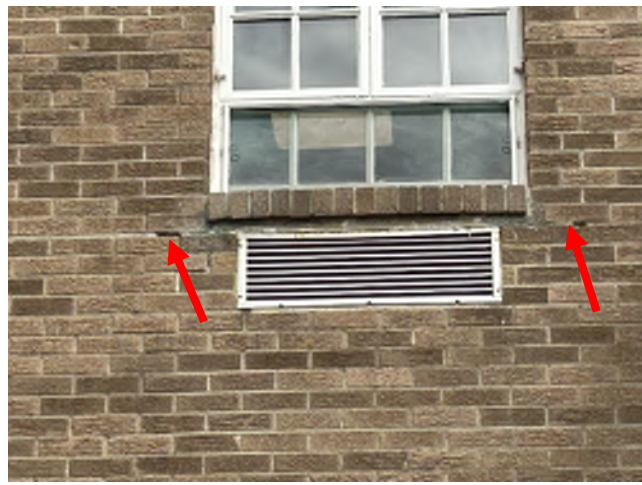


Image 199: Deteriorated mortar and apparent rusted steel lintel observed above the louver.



Image 200: Rusted steel lintels observed above a window and louver on the 1971 south elevation.



Image 201: Cracked concrete and peeled paint.



Image 202: View of open cold joint between the concrete footing and the slab at the main entry stairs.

### 3.3 EXTERIOR WOOD ELEMENTS

Gale's observations of exterior wood elements were performed from grade to view lower-level components, and by using binoculars, portable boom lift and an unmanned aerial vehicle (UAV) to view upper levels of the building, including the entablatures and the pediment on the north elevation of the building. The boom lift provided limited access to the upper levels of the building due to uneven grades around the facility.

#### 3.3.1 Wood Entablature

The wood entablature consists of the cornice, frieze and architrave elements that are located above the granite walls and pilasters. The entablature was constructed circa 1832 – 1833 as part of the original building and circa 1906 on the east and west-wing additions that extend southward from the original building.

- The cornice components include rounded trim below the gutter line, fascia that consists of nominal lumber wood planks, and decorative wood dentils on the soffit portion of the cornice.
- The frieze and architrave portions of the entablature also consist of tongue and groove wood planks. Triglyphs that consist of wood trim boards accent the frieze portion of the entablature

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- The exterior wood elements have a sand-textured paint applied to the surface. The paint is typically cracked and peeled throughout the building.
- A closer view of the entablature from the boom lift and UAV images revealed numerous cracked and deteriorated wood components, including trim components and the tongue and groove planks.
- Wood trim components on the cornice appeared displaced at locations. Decorative dentils exhibited displacement at isolated soffit locations.
- Copper gutters that are located on top of the cornice are typically filled with water and debris. Some gutter sections are deformed / damaged. The gutters are drained by copper downspouts that are generally loose at the connections.



Image 203: Representative view of peeling paint on the cornice, frieze and architrave portions of the entablature.



Image 204: Closer, representative view of cracked wood components on the cornice.



Image 205: Close-up of deteriorated wood trim on the bottom portion of the cornice.



Image 206: View shows a deteriorated (split) decorative wood dentil.



Image 207: Close-up of deteriorated wood frieze components. Note the rusted nails (arrows) that secure the wood.



Image 208: Displaced wood trim was observed below the gutter at an isolated cornice location.



Image 209: View of a displaced wood plank in the architrave and deteriorated wood plank in the frieze portions of the entablature.



Image 210: View of peeled paint, deteriorated wood fascia board and deformed copper gutter at a cornice.



Image 211: Close-up of a missing section of wood trim on top of a pilaster.



Image 212: View of deteriorated and loose soffit board below the cornice.



Image 213: Close-up of a missing section of wood trim on top of a pilaster.



Image 214: View of debris in a copper gutter.

### 3.3.2 Wood Columns and Entrance Porticos

This section includes Gale's review of the wood elements including facades, soffits, columns and plinths at the original front entrance on the north elevation of the original building and the current main entrance on the south elevation of the building. Wood elements on the original building's front entrance have a sand-textured paint application to mimic the appearance of precast concrete. Wood elements on the soffit of the original building and all of the elements on the south elevation portico have a smooth, white painted finish.

The following is a summary of Gale's observations at these locations:

- All sand-textured painted surfaces exhibit peeling, blistering and missing paint, leaving areas of exposed wood.
- Exposed wood trim appears deteriorated, primarily in the form of split wood elements.
- Missing trim components were missing on the columns at the original building's front entrance.
- The white-painted soffit above the original building's front entrance exhibits delamination of paint.
- The white-painted façade above the 1971 addition's main entrance shows signs of blistering, peeling and fading.
- The wood trim on the pilasters at the 1971 addition's main entrance shows signs of deterioration in the form of split wood elements.
- Peeled paint was observed at the base of the columns on the 1971 addition's main entrance.
- Deteriorated wood trim was observed at the base of one of the pilasters adjacent to the 1971 addition's main entrance.

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Image 215: View shows deteriorated sand-textured painted surfaces on the pediment elements at the original building's front entrance.



Image 216: Closer view of the previous image shows apparent deteriorated wood elements (arrow).



Image 217: Close-up of deteriorated wood trim above a column at the original building's front entrance.



Image 218: View shows deteriorated sand-textured paint on the columns on the original building's front entrance.



Image 219: Closer view of the previous image shows exposed and missing wood, which was observed at the column bases.



Image 220: Delaminated white paint observed on the soffit above the original building's front entrance.



Image 221: View of blistered and faded paint (arrows) on the portico façade at the main entrance of the 1971 addition.



Image 222: Peeling paint on the underside of the façade beam.



Image 223: View of blistered and faded paint (arrows) on the portico façade at the main entrance of the 1971 addition.

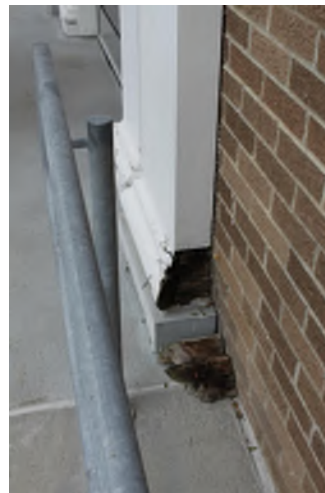


Image 224: Deteriorated and dislodged wood trim observed at the base of a piaster at the main entrance.

### 3.4 STRUCTURAL OBSERVATIONS

Representatives of Gale visited the site on September 26, 2024, to perform a limited visual structural evaluation of the masonry piers and arches at the basement level of the original 1831-1832 courthouse building. While on site, Barnstable County also requested Gale to review the fire escapes. Access to the facility was provided by Barnstable County.

#### 3.4.1 Interior STRUCTURAL OBSERVATIONS

The following is a summary of Gale’s interior observations.

1. Gale observed significant deterioration in the mortar joints at the base of the masonry piers and masonry walls in the basement of the 1831-1832 building. At the time of Gale’s visit moisture was not observed in the section of the basement where the masonry piers are located.



*Image 225: Partial overall view of the masonry piers in the basement of the 1831-1832 building.*



*Image 226: Typical view of the deteriorated mortar joints at the base of the masonry piers in the basement of the 1831-1832 building.*



*Image 227: View of deteriorated mortar joints at the base of two (2) intersecting masonry piers.*



*Image 228: View of deteriorated mortar joints at the base of a masonry wall in the basement.*

2. At various locations in the basement of the 1831-1832 building, Gale observed that brick masonry had been removed from structural components of the masonry arches for the installation of mechanical, electrical and plumbing utilities.



Image 229: View of a large void above a masonry arch where electrical conduits were installed.



Image 230: View of the two (2) voids above the masonry arch where electrical conduits were installed.



Image 231: View of two (2) wythes of brick removed and a hole cored in the third wythe to install an electrical conduit in the basement wall.



Image 232: View of electrical and plumbing conduits installed above the masonry arch and below the granite block. Note: The dashed box indicates the approximate location of masonry void at electrical conduits.

3. The masonry pier that provided support of one side of a masonry arch at the southwest corner of the 1831-1832 building appeared to be removed. It does not appear that additional structural supports were installed prior to the removal of the masonry pier.



Image 233: Overall view of masonry arch where the masonry pier was removed. Refer to Image 10 for a closer view of the masonry pier that was removed. Note: The dashed box indicates the approximate location of masonry pier.



Image 234: Closer view of the missing masonry pier in the southwest corner of the 1831-1832 building that supports the masonry arch. Note: The dashed box indicates the approximate location of masonry pier.

4. At the time of Gale’s evaluation, active water infiltration was observed in the basement below the exterior granite stair. Gale observed various deficiencies in the masonry walls that support the exterior granite stairs. The masonry deficiencies include efflorescence, step cracking in the northwest masonry wall, and several locations of deteriorated mortar joints.



Image 235: Overall view of the north wall below the exterior granite steps.



Image 236: Overall view of the east wall below the exterior granite steps.



Image 237: View of a step crack and deteriorated masonry in the west masonry wall below the exterior granite steps.

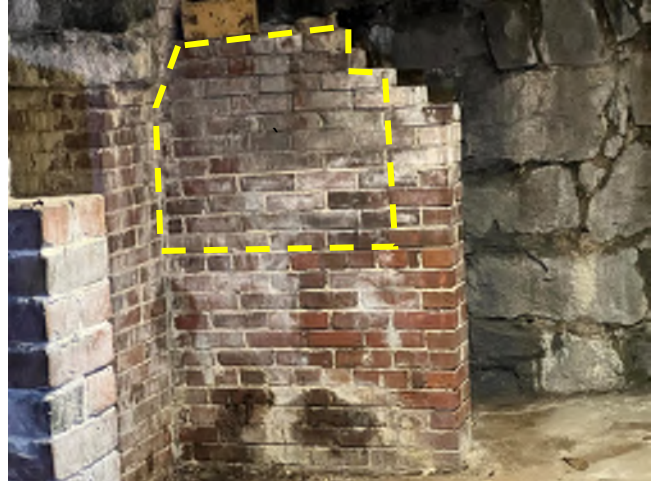


Image 238: View of an isolated location of deteriorated mortar joints in the masonry pier that supports the exterior granite steps. Note: The dashed box indicates the approximate extents of deteriorated mortar joints.

### 3.4.2 Exterior STRUCTURAL OBSERVATIONS

The following is a summary of Gale’s exterior observations.

1. The Barnstable County Superior Court has two (2) fire escapes located on the east elevation of the 1893/1906 addition and the southwest corner of the 1925 addition of the building.



Image 239: Overall view of the fire escape located at the east elevation of the 1893/1906 addition.



Image 240: Overall view of the fire escape located at the southwest corner of the 1925 addition.

## 4 TEST OBSERVATIONS

Testing observations pertaining to this evaluation are provided herein.

### 4.1 TEST CUT OBSERVATIONS

Gale observed test cuts that were performed by Folan Waterproofing & Construction Co., Inc. (Folan) , at seventeen (17) representative locations. The purpose of the test cuts is to verify as-built conditions of representative granite, precast concrete, brick masonry and wood façade areas. Where applicable, Gale obtained samples of precast concrete, mortar and wood materials to be sent out for testing by an independent laboratory. Refer to the Laboratory Testing section of this report for additional information. Refer to the appendices for test cut locations.

The following is a summary of Gale’s test cut observations.

#### 4.1.1 Granite Masonry

Test cuts in the granite masonry were limited to the removal of mortar joints in the pre-1920s granite and the 1926 granite elements of the building. The purpose of the granite masonry test cuts was to verify the profiles of the mortar joints as well as to determine the composition of the mortar that was applied during each phase of construction. Mortar test cut observations are as follows:

- Test Cut No. 1 was performed on the west elevation of the 1926 building. The test cut revealed a clean break between the pointing mortar and the bedding mortar, both of which were intact. A metal shim was observed in the bedding mortar at the back of the mortar joint.



Image 241: View of granite mortar joint test cut no. 1.



Image 242: Angled view of the previous image shows a clean break between the pointing and bedding mortar, and a metal shim in the bedding mortar at the back of the cut.

- Test Cut No. 2 was performed on the north elevation-west wing of the pre-1920s building. The test cut revealed a joint that appeared to be continuously packed with mortar. The mortar was observed to be intact to the back of the cut.



Image 243: View of granite mortar joint test cut no. 2.



Image 244: Angled view of the previous image shows intact mortar at the back of the cut.

- Test Cut No. 3 was performed on the smooth-faced granite pilaster at the north end of the west elevation of the original building. The test cut revealed mortar that appeared to be intact in the joint however, there appeared to be a separation between the bedding mortar and the pointing mortar.



Image 245: View of granite mortar joint test cut no. 3.



Image 246: Angled view of the previous image shows intact mortar at the back of the cut and an apparent separation between the pointing and bedding mortar.

- Test Cut No. 4 was performed on the north elevation of the original building. The test cut revealed a shallow-depth pointing mortar bead - approximately 1-inch deep, separation between the mortar beads, and deteriorated bedding mortar at the back of the cut.



Image 247: View of granite mortar joint test cut no. 4.



Image 248: Closer views of the previous image show a shallow pointing bead, an apparent separation between the pointing and bedding mortar, and deteriorated (crumbled) mortar in the back of the cut.

- Test Cut No. 5 was performed on the east elevation of the original building. The test cut revealed a delaminating pointing mortar bead and bedding mortar that appeared to be intact. Metal, which appeared to be a spacer, was visible in the back of the test cut.



Image 249: View of granite mortar joint test cut no. 5.



Image 250: Closer view of the previous image shows bedding mortar that appeared intact and metal, which appeared to be the spacer.

- Test Cut No. 6 was performed on the smooth-faced granite pilaster on the east elevation of the pre-1920s building. The pointing mortar appeared intact however, once cut out it revealed deteriorated bedding mortar behind.



Image 251: View of granite mortar joint test cut no. 6.



Image 252: Closer view of the previous image shows bedding mortar that appeared to be deteriorated.

#### 4.1.2 Brick Masonry

Test cuts in the brick masonry included the removal of brick masonry and mortar joints from the south elevation of the 1926 building. The purpose of the brick masonry test cuts was to verify the methods of construction and materials that were utilized. The purpose of the mortar sampling was to determine the composition of the mortar that was used on this phase of construction. Brick masonry test cut, and mortar observations are as follows:

- Test Cut No. 1 was a ground-level cut that was performed at the southeast corner on the west wing of the south elevation on the 1926 building. The test cut revealed a solid masonry wall with terra cotta backup.
- Test Cut No. 2 was performed on the parapet wall above the cornice at the west end of the west wing on the south elevation of the 1926 building. The test cut revealed a solid masonry wall with terra cotta backup.



Image 253: View of brick masonry test cut no. 1 shows terra cotta backup.



Image 254: View of brick masonry test cut no. 2.

### 4.1.3 Precast Concrete Elements

Test cuts in the precast concrete included removal of precast concrete via sawcut at two (2) locations, and the removal of a precast concrete core sample at one (1) location. Test cuts were performed on the 1926 precast elements on the building. The purpose of the precast concrete test cuts was to verify the methods of construction and materials that were installed, and to collect samples for testing by an independent laboratory to analyze the composition of the precast concrete elements that are on the building. Precast concrete test cut observations are as follows. Refer to the Laboratory Testing section of this report for additional information related to the test cuts:

- Test Cut No. 1 consisted of an approximate 3" high x 5" wide x 4" deep (3" x 5" x 4") saw-cut in the smooth-faced precast concrete on the east wing – east elevation cornice of the building. The test cut was performed in a precast concrete component that appeared to be intact, and adjacent to one that appeared deteriorated. The test cut revealed precast concrete that appeared solid and intact as there were no internal cracks or fissures observed.
- Test Cut No. 2 consisted of an approximate 3" x 6" x 3" saw-cut in the smooth-faced precast concrete on the east wing – north elevation cornice of the building. The test cut was performed in a precast concrete component that appeared to be intact, and adjacent to one that appeared deteriorated. The test cut revealed precast concrete that appeared solid and intact as there were no internal cracks or fissures observed.



Image 255: View of precast concrete test cut no. 1.



Image 256: Closer view of the previous image shows precast concrete that appeared intact.



Image 257: View of precast concrete test cut no. 2.



Image 258: Closer view of the previous image shows precast concrete that appeared intact.

- Test Cut No. 3 consisted of a 4" diameter x 4" deep core in the precast concrete on the west wing – west elevation parapet of the building. The test cut was performed in a precast concrete component that appeared to be intact. The test cut revealed precast concrete that appeared solid and intact as there were no internal cracks or fissures observed, as well as a hollow steel reinforcing tube in the precast. A bed of mortar was observed against brick masonry backup at the back of the cut.



Image 259: View of precast concrete test cut no. 3

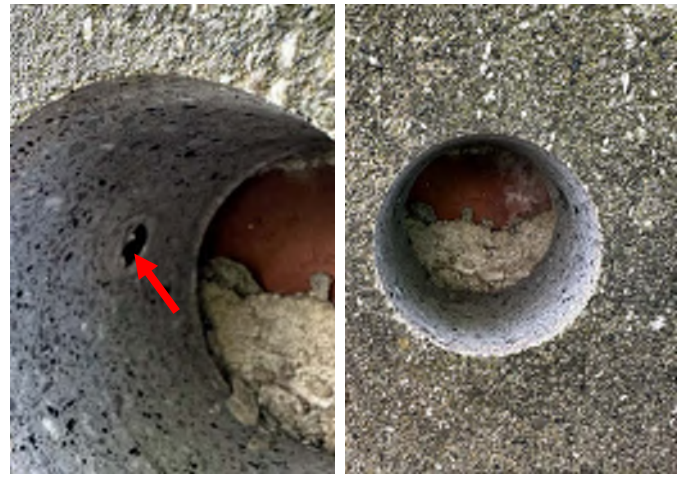


Image 260: Closer views of the previous image show a low steel reinforcing tube and brick masonry backup.

#### 4.1.4 Wood Elements

Test cuts in the wood elements included the removal of wood components at four (4) locations at various locations around the building. The wood test cuts were performed on the architrave, frieze and cornice elements between the granite masonry and the roofline on the pre-1920s and 1926 phases of the building. Wood test cut observations are as follows:

- Test Cut No. 1 consisted of the partial removal of the painted wood fascia of the east wing – east elevation architrave on the pre 1920s portion of the building. The test cut revealed the following:

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- The fascia consists of 1" x 4" (nominal) tongue and groove lumber installed directly over terra cotta backup. A cementitious, adhesive parge appeared to be applied to the terra cotta.



Image 261: View of wood test cut no. 1, which was performed directly above a granite pilaster.



Image 262: Closer view of the previous image shows terra cotta behind painted tongue and groove wood fascia boards.

- Test Cut No. 2 consisted of the partial removal of the painted wood fascia of the east wing – east elevation frieze on the pre 1920s portion of the building. The test cut, which was performed directly above Test Cut No. 2, revealed identical conditions that were observed in Test Cut No. 1.



Image 263: View of wood test cut no. 2 depicted by the arrow.



Image 264: Closer view of wood test cut no. 2 shows terra cotta backup directly behind the painted wood fascia.

- Test Cut No. 3 consisted of the partial removal of the painted wood fascia of east elevation frieze on the pre 1920s (original) portion of the building. The test cut revealed the following:
  - The fascia consists of 1" x 4" (nominal) tongue and groove lumber that is mechanically fastened to wood furring against brick masonry backup. The wood furring appeared deteriorated, and the nails, which appear to be original to the building, are rusted.
  - An approximate 1-3/4" deep cavity behind the wood fascia boards.
  - The brick masonry exhibited efflorescent staining and deterioration of mortar joints.



Image 265: View of wood test cut no. 3 shows painted wood fascia on wood furring against brick masonry.



Image 266: Closer view of the previous image shows efflorescence staining and deteriorated mortar in the masonry wall, deteriorated wood furring and rusted fasteners.

- Test Cut No. 4 consisted of the partial removal of the painted wood fascia of the west wing – north elevation cornice on the pre 1920s portion of the building. The test cut revealed the following:
  - The fascia consists of 1" x 4" (nominal) tongue and groove lumber fastened to wood studs that appeared wet.
  - An 18"-deep, hollow, wood framed cavity over a brick masonry wall that leads to the underside of the roof. Wood framing appeared wet.
  - Brick masonry mortar joints appeared intact, however, chalky.
  - Water staining on wood framing and on the back side of the fascia planks, many of which appear to be split.
  - Daylight between the fascia board planks.



Image 267: Exterior and interior views of wood test cut no. 4. Note water and wet staining on the wood components in the cavity.



Image 268: A brick masonry wall that extends up to the underside of the roof observed in wood test cut no. 4.

## 4.2 LABORATORY TESTING OBSERVATIONS

Gale utilized the services of laboratory testing to assess the material constitution of various building components, including mortar, precast/cast stone, wood, and paint. The following are a summary of the results of those tests. Refer to the Appendices for the full test reports.

### 4.2.1 Brick and Granite Mortar Samples

Gale utilized the services of Highbridge Materials Consulting, Inc. (Highbridge) to perform analysis of the make-up of various mortar samples taken from the BCSC. The samples were taken from each portion of the building associated with each building expansion phase, as well as apparent new mortar installed as part of more recent repointing work. The full findings of their report can be found in Appendix C - Mortar Analysis Report. In summary, the testing results indicated four (4) different types of mortar based on the representative samples provided :

- *Brick masonry mortar, 1830s basement:* Mortar samples taken from the 1830s basement brick piers were tested to be a common lime mix without any hydraulic cement addition and contains clean quartz sand. This mortar was likely soft, friable, and highly water absorptive. This mortar appears to be consistent with historic mortar for interior usage of the mid-nineteenth century.
- *Bedding mortar at 1830s exterior granite:* Bedding mortar samples taken from the 1830s granite masonry were tested to be natural cement mixes that could date to the 1830s, but contain a mid-nineteenth century, high-calcium cement that was less widely used throughout the United States. This type of mortar is moderately soft and permeable, but cohesive, and would have been typical for exterior construction.
- *Bedding mortar at 1906 exterior granite:* A bedding mortar sample taken from the 1906 addition is a pure Portland cement mortar with low sand content, consistent with early twentieth century practice for stone masonry work. It is hard and indurate with low permeability.
- *Newer mortars:* Additional samples taken from the 1830s and 1906 portions of the building appear to be newer cement-lime mortars that date no earlier than the late twentieth century, likely installed as part of repointing work. This mortar is harder and less permeable than the older, natural cement mortars, and could present concern with regard to moisture entrapment within the joint if water penetrates the wall system at 1830s portion of the building.

### 4.2.2 Precast Concrete Samples

Gale utilized the services of Highbridge to perform petrographic analysis of the precast/cast stone cornice at the 1920s portion of the BCSC. Gale submitted two (2) core samples of the precast for analysis. The full findings of their report can be found in Appendix D - Petrographic Examination of Cast Stone Report. In summary, the materials from both samples were found to be similar, being a wet-cast, monolithic architectural cast stone. The cast stone mix contains gray Portland cement and crushed aggregate. No evidence of pigments or air-entrainment was found in either sample. The aggregate consists of a mixture of granitic and metaclastic rock, as well as smelting slag, with outer exposure of the aggregate appearing to mimic the appearance of natural granite. Highbridge indicates that the cast stone is moderately permeable, which along with the lack of air-entrainment, may make the cast stone more susceptible to freeze-thaw distress. However, no such distress was observed in the samples. The type of aggregate has a composition that is known to be susceptible to alkali-silica reaction (ASR), but would be more of a concern if the aggregate were coarser. No ASR was observed in the samples, and the cast stone would appear to be sound and serviceable if the samples can be taken as representative.

#### 4.2.3 Wood Samples

Gale utilized the services of Wood Science Consulting, Inc. (WSC) to perform microscopy analysis of wood samples taken from various locations at the wood entablature, architrave, and columns. The purpose of the analysis was to identify potential wood species utilized for the wood trim at these locations. The full findings of their report can be found in Appendix E - Wood Species Identifications Report. In summary, all samples provided to WSC were identified as eastern white pine.

#### 4.2.4 Paint Samples

Gale utilized the services of John Canning and Company, Ltd. (John Canning) to perform a historic paint analysis on various samples taken from BCSC. Gale removed paint chip samples from multiple locations on the wood entablature and columns and other wood trim locations. The full findings of their report can be found in Appendix F - Historic Paint Analysis. The purpose of the analysis was to reveal a cross-section of the painted finish, in order to color match the historic paint color using the Munsell standard of color notation. In summary, the paint on the wood columns and entablature consists of many layers of paint, aggregate, and binder. The paint included multiple shades of gray and beige mixed with an aggregate to imitate the stone. The gray tones were layered and blended using a wet-on-wet technique, where individual colors are not easily distinguishable. John Canning has provided potential matching colors for each hue, but recommends that on-site mock-ups be performed to best match the blended color technique.

### 4.3 HAZARDOUS MATERIAL TEST

PEER Consultants, PC (PEER) obtained representative samples of various exterior and interior building materials to determine if any hazardous materials were present that would be impacted by the restoration work. Samples were also taken at masonry and wood test cut location to sample materials that may be concealed within the wall construction. Material sampling during the evaluation stage is generally intended to test a wide range of materials to provide a snapshot of suspect materials and should not be considered exhaustive for each type of building component for each portion of the building. As the building was constructed in stages over time and appears to have experienced multiple restoration efforts, different materials and construction methods were applied to different portions of the building. Additional testing may be required once design approaches are confirmed to better understand hazardous material content for a specific aspect or portion of the existing building construction.

The summaries discussed below are intended to be an overview of the information provided by PEER in their report. In general, refer to the Appendix B - Limited Hazardous Building Materials Inspection Report for specific samples and test results, as well as discussion of the regulatory implications.

#### 4.3.1 Asbestos

Tests determined that asbestos is contained in a variety of materials at the building. The representative sampling indicated that asbestos is present within the following materials:

- Window exterior frame caulking at 1832 original building and 1925 Addition
- Window exterior glazing putty at 1971 Addition
- Window exterior paint at 1906 Addition
- Exterior brick masonry repair sealant at 1925 Addition
- Precast cornice joint sealant at 1925 Addition

- Roof parapet – Sealant under capstone at 1925 Addition
- Exterior wood entablature paint at 1906 Addition
- Exterior wood entablature joint sealant at 1906 Addition
- Interior plaster/joint compound at stairwell in 1832 original building

Based on these results, it appears that asbestos containing materials (ACM) may be present in some portions of the building but not others. For example, glazing putty at other windows tested throughout the building did not appear to contain asbestos. Paint at the 1834 window locations do not appear to contain asbestos while the 1906 window locations do. Therefore, additional sampling for more specific materials and locations may be required depending on the potential scope of work, particularly if the selected restoration approach is a combination of repairing certain components in place and replacing others.

In general, per Massachusetts Law, scope of work that affects asbestos-containing materials will need to be carried out by asbestos-certified contractors and will require some form of sealed protection if dust migration into the interior is a possibility, which would primarily occur with work in conjunction with windows and doors. Asbestos abatement work will also require an asbestos project monitor to be on-site test or visually clear portions of the abatement work. The asbestos project monitor is typically hired by the Owner directly and should be factored into asbestos abatement costs.

#### 4.3.2 Lead

Various paint samples were tested qualitatively for the presence of lead. Tests determined that lead is present within painted surfaces at different locations throughout the building. The following items tested positive for lead:

- Exterior paint at the 1971 addition entrance portico
- Exterior and interior paint at the 1832 window locations
- Exterior paint at the 1906 window locations
- Exterior paint on wood frame at 1925 Addition steel windows
- Exterior paint on wood entablature at 1906 Addition
- Exterior paint on wood columns at 1832 original building
- Exterior paint on wood trim at 1832 entrance door

Note that all paint samples collected were tested to contain lead. However, because only one (1) sample was taken of each material and location, similar materials at other portions of the building may or may not contain lead. Similar to the asbestos abatement scope, additional lead sampling may be considered if the selected restoration approach is a combination of repairing certain components in place and replacing others. As many of these materials are deteriorated and have been coming loose from the building as debris, PEER recommends that the site around the building be industrially vacuumed to pick up loose material after the work is performed.

Work associated with lead is regulated by OSHA (29 CFR 1926.62 Subpart D), typically requires a lead-safe renovation contractor. Additionally, for lead-containing materials that are to be disposed as waste, lead is tested for level of hazard determined by the toxicity characteristic leaching procedure (TCLP). If the disposed materials fail TCLP, then the lead materials must be managed as hazardous waste and will require specific disposal facilities, similar to asbestos. Given the elevated amounts of lead within the tested paint samples, the associated painted wood also has the potential to be contaminated with lead due to leaching over time. Therefore, the removal of lead-based paint and painted materials, including wood, should be anticipated to fail TCLP and will

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need to be disposed as hazardous waste. If existing wood is to remain in place as part of the restoration, Barnstable County should be aware that future paint has the potential to test positive for lead due to lead leaching back into the paint from the wood.

## 5 DISCUSSION AND OPINIONS

The following sections describe Gale’s interpretations of the evaluation and propose scopes of work to address the observed deficiencies.

### 5.1 FENESTRATION

As noted in the visual observations, the existing window systems at BCSCB range from fair to poor condition depending on type of window, date it was installed, and location on the building. In general, the windows are intact and functional but are not performing to building enclosure standards and appear to be providing sources of water and air infiltration into the building. The existing windows require either a high-degree of maintenance and restoration or replacement.

#### 5.1.1 Fenestration Options, General

In general, Barnstable can consider two options to the windows that may or may not apply to the different portions of the building, as will be discussed below. One approach is to repair and maintain the existing windows. The second approach is to replace the windows and frames entirely, down to the masonry substrates.

##### *Option 1 - Restoration:*

A full restoration of the windows would entail the repair of the existing frames and sashes. Restoration is more common with wood windows than with steel, as wood windows are generally more receptive to repairs and craftsmen exist who specialize in wood window restoration. Ideally restoration would entail removal of the sashes from the frame and transport to a window carpenter’s wood shop where the windows would be de-glazed, have their glass panes removed, have their wood components repaired, and then re-glazed with new glazing putty and painted. In the meantime, the window frame components left in place would also be stripped of paint, repaired in place, and repainted. Typically, wood repairs would entail either epoxy infill into a decayed portion of the wood or the replacement of an individual wood component or portion thereof, depending on the severity of deterioration. Cracked glass panes would also be replaced with new single-pane glass to match the existing.

The **advantages** of restoration are as follows:

- Historic sensitivity – Given the historic nature of the building, the first option is considered more historically sensitive. It should be noted that even though these windows are installed on the oldest portions of the building, according to the provided documentation and their appearance throughout the building they are not original to the building. The 1925 Addition drawing set indicates that the sashes may have been replaced at that time, and they seem to match those installed on the 1925 Addition. Therefore, the wood windows may not be considered original but could be considered historic depending on the standard of preservation. Nevertheless, they may be considered as a major contributor to the historic nature and appearance of the building and could be valued as such.
- Maintaining the building’s appearance – Unlike with replacement, restoration of the windows will maintain the existing appearance of the windows. Replacement windows, even historic-replica windows, can only approximate the appearance of the windows and unique details can be difficult to replicate with modern manufactured windows.
- Avoidance of newer, stricter code standards – By repairing the windows and maintaining them in like kind, they will not be held to newer building and energy code standards. Newer window products that meet these standards have a very different appearance and larger frames compared to the existing windows. Well-maintained, historic wood windows can have a high thermal insulating performance.

Wood is non-thermal bridging material and, as such, does not naturally conduct heat like steel or aluminum. It is Gale's opinion that the trade-off between the performance of new windows versus well-maintained historic windows is minimal. Performance can also be enhanced with the addition of storm windows.

- Lower carbon footprint – The work associated with repair and maintenance of windows is considered to be less dependent on processes that contribute to greenhouse gas emissions and fossil fuel consumption compared to window replacement.

The **disadvantages** of repair are as follows:

- Unforeseen conditions – Calculating the full quantity and scale of this work can be difficult until the paint is removed from the wood surfaces; Gale would include relatively conservative quantities of these scopes of work within the base bid contract in order to cover unforeseen conditions, but they are largely based on educated guesswork and additional costs can be incurred regardless.
- Time-consuming process – The work is more time-consuming compared to replacement and will require temporary protection such as plywood or plexiglass within the window opening for several weeks. The Contractor can work with the BCSC schedule needs so that only a portion of the windows may be removed at any one time but this will extend out the project schedule and will increase the cost due to the number of trips required.
- High labor cost – The work depends on skilled craftsmen whose services and abilities may be limited geographically and have limited availability. Therefore, the windows may need to be transported long-distance in order to the nearest available workshop. Labor costs are also associated with the time-consuming nature of the work.
- New wood may of a lower quality – Historic wood windows often utilized old-growth wood that had greater strength and durability that is no longer locally available. Therefore, any replacement wood components often consist of costly or tropical wood species such as mahogany that may be associated with irresponsible forestry practices. More common wood species will likely not perform at the same level as the original wood.
- Maintenance required – While any window assembly will require some degree of maintenance, exterior wood products will require more active maintenance compared to steel or aluminum materials. Barnstable should anticipate a regular painting regime every 7-10 years and replacement of the glazing putty every 15-20 years in order to maintain their condition.
- Abatement required – As noted in the attached Hazardous Building Materials Inspection Report, the existing windows and paint contain regulated amounts of asbestos and lead. Therefore, any restoration work will have to be performed in tandem with registered abatement or de-leading professional. The logistics of coordinating the abatement work, particularly for the frame components being repaired in place, can increase costs and prolong the restoration process. Due to the protection required to perform this work on-site, BCSC will need to coordinate carefully with the contractor and may have to give up more interior space adjacent to the windows to allow the abatement contractor to perform the work.

If restoration is pursued, it is Gale's opinion that the existing exterior storm windows be removed. They appear to be contributing to deterioration of the wood window components by trapping moisture against wood components as well as detracting from the exterior appearance of the windows. Exterior storm windows can help protect the wood windows from weather; however, they have lifespan as any other window product and eventually need to be replaced. If low maintenance and durability are important to Barnstable, Barnstable should consider replacing the windows. In instances of historic preservation, it is Gale's opinion that storm windows should be installed on the interior side of the windows, in order to better express the historic windows on the exterior. Storm windows installed on the interior can also help improve performance thermally and

reduce air infiltration. It should be noted that for best performance, the storm windows should be fixed to limit the number of frame joints that act as weak points in the system.

The following photos illustrate the restoration process as experienced by Gale for a similar civic project at a historically listed building in Melrose, MA:



Image 269: Exterior view of a typical double-hung window at the building.



Image 270: Window sashes were removed and transported to a window workshop. The windows were de-glazed and stripped of paint.



Image 271: Once paint was removed, various repairs were performed to the windows. This photo illustrates the replacement of one (1) of the sash rails with mahogany



Image 272: Deterioration at sash joints was common, with joints needing to be reglued and infilled with epoxy.



Image 273: Once repaired, the windows were primed and re-glazed.



Image 274: Eventually the windows received finish paint and were reinstalled.



Image 275: Additionally, the client opted to install fixed aluminum storm windows at all openings.



Image 276: The arrow indicates the storm window frame.

### Option 2 - Replacement:

In lieu of repair of these windows, Barnstable may consider their replacement. Replacement of the windows would preferably entail the replacement of the entire window assembly, including sashes and frame. The existing wood window frame would be removed down the masonry substrates in order to provide sufficient new wood blocking substrates for new window attachment. New replacement windows will need to meet the 780 CMR Massachusetts State Building Code 10<sup>th</sup> Edition based on the 2021 International Building Code (IBC), as well as Massachusetts Stretch Energy Code based on the 2021 International Energy Conservation Code (IECC). Based on initial code analysis, new replacement windows will need to meet wind-borne debris impact standards for a coastal, high wind zone as directed in the Code. As a result, the windows products and substrate attachments need to be engineered and tested to pass a standardized impact test that is over and above a typical window product. In order to meet energy code requirements, insulating glass units (IGUs) with double and triple glass panes are typically necessary.

New window options that could be appropriate for this building would include new wood or aluminum-clad wood and thermally broken aluminum frames. Aluminum windows are typically favored for commercial building as they offer the highest durability and lowest maintenance of the windows. It should be noted that aluminum

frames have limited maintenance options and Wood windows could provide better replication of the appearance of the existing windows, but require maintenance such as continued painting over time. Newer wood window products are not as adaptive as historic wood windows, and generally as the windows begin to deteriorate over time, they will need to be replaced. Aluminum-clad wood offers a similar look to all-wood windows, but with better durability.

**Advantages** of replacement include:

- Faster completion compared to window restoration – As it is assumed that BCSCCH will need to maintain full operations during the work, BCSCCH may consider it beneficial to go with a faster approach to complete the work. With window replacement, the period of time from when the existing window is removed to new window installed can be a matter of days rather than weeks for restoration work, depending on the contractor's means and methods.
- Lower maintenance – Newer aluminum windows will require less maintenance compared to historic wood windows. However, it should be noted that newer windows, like any manufactured product, will have a certain lifespan and eventually will need to be replaced again, as repairs for metal windows are more limited. High performing aluminum windows can be anticipated to have a lifespan of 30+ years.

**Disadvantages** of replacement include:

- Window appearance – Due to the requirements of the energy code, wind-borne debris impact resistance, and frame styles available, newer windows will have limited ability to replicate the existing historic windows' appearance. Newer windows will likely have larger frames and profiles that will change the sight-lines from the existing windows. Given the historic listing of the building, any new windows will need to be approved by the local preservation committee prior to preparing construction documents.
- Invasiveness into interior finishes – The work to remove and install new windows can be invasive with regard to the existing interior finishes. In order to remove all window components and frame, it will also likely require the disturbing and/or replacement of some portion of interior finishes.
- Unforeseen conditions – The removal of the existing windows and frames has the potential to uncover concealed deficient conditions related to the masonry openings that may need to be addressed. The discovery and repair of these conditions could increase the amount of time and invasiveness to install the new windows than would otherwise require.

If the replacement option is pursued, Barnstable will need to consider the configuration of the new windows, pending approval of the local historic committee, if whether they should be double-hung windows to match the existing configuration or match the existing configuration. Generally speaking, windows with fewer moving parts and frame components perform better. Therefore, a single fixed frame or single awning unit would typically provide the highest performance, but may be considered too drastic of change from the existing. A single-hung window offers similar appearance to a double-hung window, but the fixed upper sash reduces the potential for air flow and maintenance due to fewer moving parts. Some window manufacturers offer fixed window that simulates the appearance of a hung, but with some additional performance improvements. Regardless, new replacement windows should be selected to match the existing appearance and profile of the existing windows while meeting hurricane wind-borne debris impact requirements. Impact testing requirements may limit the historic replica windows available for the project. In order to provide a more historic look to the windows, the manufacturer's often provide an outside beveled edge around the glass to mimic a glazing putty look. Three-piece surface applied muntins can be provided to mimic the divided glass without reducing the glazing performance. Custom exterior aluminum brick moulding and sill extensions can also be provided to replica the look of the existing wood brick moulding and sills. Gale has included some imagery of potential window products

below. Note that while the examples below meet impact requirements and provide historic options, they do not meet energy code thermal performance requirements.



Image 277: Exterior image of St. Cloud SCW5000 aluminum hung window (U-0.4) (image taken from St. Cloud Window website).



Image 278: Rendering of Graham HIGT2200 single-hung window (image taken from Graham Window website).



Image 279: Rendering of Architectural Window Manufacturer's (AWM) Series 4750i single-hung window (U-0.39) (image taken from AWM website).



Image 280: Exterior image and rendering of the EFCO 663G single-hung window (U-0.4) (Images taken from EFCO website).

As a variety of window and door system exist on the building, Gale has divided the discussion for each different window system based on each type installed on different portions of the building including the Pre-1920s Wood

Windows, 1925 Wood Windows, 1925 Steel Windows, 1925 Basement Windows, and 1971 Steel Windows. Different approaches could be considered for each window type and each have their benefits and drawbacks.

### 5.1.2 Pre-1920s Wood Windows

Given that these windows are installed within the oldest portions of the building, a more sensitive approach to these windows may be favored. Barnstable will need to balance considerations that these windows are not original to the building with considerations that they may contribute to the overall historic appearance of the building. The local historic committee will need to provide input as to whether replacement of these windows is an option to be considered, and if so, which types of windows would be acceptable for use.

It is Gale's opinion that Barnstable consider both restoration or replacement as acceptable options, with the caveats as noted above. Restoration of the windows would provide the most straightforward path to acceptance of the work by the local historic committee, would better maintain the appearance of the building, and offers salvage and reuse of existing building components. The replacement approach can offer a high performing window with less maintenance required, but with the sacrifice of some of the historic nature and, to a degree, the appearance of the building.

It should be noted that due to the presence of asbestos and lead within the window paint, either approach will require substantial protection on the interior to create a sealed chamber to perform the work. For the restoration work, the abatement work has the possibility of causing further damage to the existing building components, due to the degree to which asbestos-containing materials must be removed from the existing wood surfaces. With the sashes being repaired off-site, some of the hazard associated with work is mitigated; however, frame and trim components would be repaired in place. This abatement work could also extend the time period required at each window to complete the work.

### 5.1.3 1925 Wood Windows

As noted in the visual observations, these windows, even though they were installed on newer addition to the building, appear to be similar to those installed on the older portions of the building. According to the 1925 Addition drawings, the sashes at the older portions of the building were replaced and likely match those installed on the 1925 Addition. However, the drawings also indicate that the 1925 Addition was to receive steel double-casement style windows, similar in appearance to those currently installed on the 1971 Addition. The steel windows that are currently installed on the 1925 Addition first floor also do not match these configurations. Based on the original design documents, it appears that these windows were not originally intended to match the windows on the older portions of the building.

Therefore, Barnstable may want to consider approaching these windows differently, depending on the approach chosen for the wood windows elsewhere on the building. If restoration is being considered for the Pre-1925 windows, it may make sense to apply that same scope of work to these windows. However, if the cost of restoration of all wood windows is found to be prohibitive, then these windows could be considered for replacement, and potentially have a different appearance. By changing the appearance of these windows, it could signify that this portion of the building was built from at a different time from the rest of the building, similar to how the addition's facades utilize different materials than the rest of the building. Additionally, in being more flexible with the appearance of these windows, Barnstable may have the opportunity to provide a high performing window product at these locations.

#### 5.1.4 1925 Steel Windows

The existing steel windows at the 1925 Addition were observed to be in fair to poor condition. While the frames generally appear intact, in general, it is Gale's opinion that these windows have surpassed their service life. Given the thermal inefficiency of the steel frames and the thin IGUs, new window products would be able to provide better performance and functionality.

As mentioned in the visual observations, with the 1925 wood windows, the steel windows currently installed on the building do not match the configuration shown in the original design documents. It is unclear if these windows were installed at the time of the addition's construction or were a later addition. Regardless, these windows do match the original design documents' intent. Therefore, it would be our understanding that the historic considerations would not apply to these windows as compared to elsewhere on the building. Given the difficulty and labor-intensiveness of restoring steel windows, it would be Gale's opinion that these windows be replaced.

If these windows can be considered less historically sensitive, then Barnstable should consider replacing them with high-performing aluminum windows that offer high thermal performance, potentially higher thermally performing than historic replica windows. Given the previous discussion for the 1925 Wood Windows, Barnstable may wish to provide a unified approach for the entire 1925 Addition, and therefore, Barnstable may consider providing the same window products for both the first and second floors.

#### 5.1.5 1971 Steel Windows

Similar to the steel windows at the 1925 Addition,

#### 5.1.6 Exterior Doors

As noted in the visual observations, a variety of exterior door systems are in place throughout the building, with varying degrees of documentation indicating previous repair or replacement. In general, the currently installed aluminum doors and frames (Doors 5, 8, & 9) are in better condition compared to their wood counterparts, but it is uncertain when these were installed. Based on the 1990s restoration drawings, some of the door leaves appear to have been replaced at that time, which would match their newer appearance. These doors (Doors 1, 3 & 6) are in fair condition. A few of the wood doors (Doors 7 & 10) appeared to be in worse condition and should be considered for replacement. Door 7 is located at the rear of the building below grade, and Door 10 is located above the roof line for roof access. Given their lack of visibility and historic nature, Barnstable should consider replacing these doors with more durable, thermally broken aluminum storefront frames and door leaves.

Refer to the Section 7 – Scope of work summary for proposed scope of work items specific to each door location.

## 5.2 GRANITE MASONRY

As noted in the visual observations, the existing granite masonry walls appear in good overall condition. Individual granite units are generally intact with the exception of a few select rock-faced units that exhibit cracking, and random honed units where bore holes were observed. The granite walls exhibit a dark discoloration from their exposure to the elements over the years. Various forms of vegetative growth including algae, which had contributed to many of the red and dark stains on the walls, lichen and moss were observed on

the granite elements. Moss growth was more frequently observed on the foundation portion of the walls. Vegetative, or biological, growth can not only affect the appearance, but also the durability of the stone as this growth is associated with the retention of water in the stone. Mortar joints between the granite units are generally deteriorated, including the vertical joints between the field of the wall and the pilasters. Test cuts at select locations revealed brittle bedding and pointing mortar.

### 5.2.1 Granite Options, Cleaning

Based on Gale's understanding of Barnstable's needs for this building, which is to restore the façade to its original appearance, the granite walls need widespread cleaning to remove the vegetative growth and restore the granite walls to their original color. Several types of compounds, some of which are considered to be toxic, while others are considered to be environmentally safe, are used to remove vegetative growth from exterior masonry substrates. Due to the various types of organisms that are found, and because substrate conditions vary, the number of treatment applications may vary. Cleaning can be performed by one (1) of two (2) following methods.

Option 1 – The use of bleaches and metallic salts, which are known to be toxic, had been used over the years to restore wall surfaces. These substances are generally applied to the surface by brush or spray application and then left in place for several days before removal of the dead organisms can be attempted. The negative aspect of using bleaches is that they could leave residue on, stain, or lighten the color of the stone. Additionally, these compounds may only be capable of performing an initial "kill" of the organisms and not be a long-term inhibitor of vegetative growth.

Option 2 – This method of washing includes the use of non-toxic components that can safely remove vegetative growth and atmospheric staining without risking the potential for causing damage to the building surface or the environment. In addition to the aforementioned cleaning methods, Barnstable may want to consider the application of clear, breathable water-repellant materials due to the moist environment and the building's close proximity to water.

### 5.2.2 Granite Options, Repairs

Due to their deteriorated condition, mortar joints need to be replaced throughout the building. Mortar joints generally have a raised bead profile and as such, would need to be tooled to match the existing profile conditions. Granite cracks and holes can be repaired using epoxy to fill the cracks and holes, followed by the application of an epoxy sealer. Epoxy is the most effective and permanent way to repair granite cracks and holes in granite as it creates a chemical and mechanical bond with the stone that also strengthens the substrate.

### 5.2.3 Granite Options, Miscellaneous

Copper downspouts should be removed to facilitate repairs to granite elements. Due to their age and observed conditions, Barnstable might want to consider installing new downspouts following the completion of granite repairs. Below-grade leaders should be cleaned out to affect proper drainage.

## 5.3 BRICK MASONRY

The brick masonry walls on the 1925/26 and 1971 additions vary greatly in overall appearance, primarily due to the different textures and colors of the bricks and mortar colors that had been installed on both areas of the building. The brick masonry on the 1925/26 addition is in fair to poor condition based on the widespread

deterioration of mortar joints, as well as step and vertical cracks that were observed. Efflorescent staining and discoloration of the façade were also observed that negatively affected the appearance of the facade. On the 1925/26 addition, numerous scattered wall areas have been repaired with the lighter-colored, textured brick that are on the 1971 addition. The mortar joints in these repair areas have deteriorated. Deteriorated mortar joints as well as rusted and deflected steel lintels above the windows were observed on the 1971 addition. The above-referenced conditions are not only aesthetically displeasing, but they also have the potential to allow further deterioration of inner wall components and ultimately, moisture inside the building.

### 5.3.1 Brick Masonry Options, Repairs

In general, brick masonry wall areas require a high-level of maintenance, repairs and / or replacement of various wall elements to improve the waterproofing integrity of the brick masonry facades and to provide a more uniform and aesthetically pleasing appearance in the 1925/26 and 1971 additions. The following is a summary of the potential scope of work to be considered by Barnstable to address the observed conditions of the building.

- Perform 100% repointing of existing mortar joints on the 1925/26 and 1971 additions.
- Repair step and vertical cracks in the masonry walls.
- Remove and replace cracked, spalled and otherwise damaged brick masonry units.
- Remove and replace brick masonry units that have embedded, abandoned anchor ports.
- Remove and replace deteriorated steel lintels.
- Perform masonry cleaning to remove efflorescence, vegetative and atmospheric staining.
- Remove and replace existing cementitious parge over brick masonry foundation walls, including the south-side, basement-access stairwell.
- Repair cracked concrete elements on the stairwell.

### 5.3.2 Brick Masonry Options, Aesthetics

The following repairs should be considered to provide a more uniform and aesthetically pleasing appearance in the 1925/26 and 1971 additions.

- Remove and replace the textured, lighter-colored brick infill areas on the 1925/26 addition with replacement brick masonry units that closely resemble the size, color and texture of the 1925/26 brick units. Please note that since the 1925/26 addition is nearing 100 years in age, the exact size, color and texture of brick masonry may not be available. However, there are old looking bricks available such as the ones that were utilized to patch the test cut areas that were performed on the building.
- Remove and replace the entire brick masonry façade on the 1971 addition to match the color and texture of the brick masonry wall on the 1925/26 addition for an overall uniform appearance.

## 5.4 PRECAST ELEMENTS

This section presents a summary and discussion relating to the condition of precast elements that include parapet and entablature components (cornice, frieze and architrave) and associated components on the building. Based on our observations, the precast elements are in overall fair to poor condition that varies by component, elevation and the age of the building. In general, exposed precast elements have deteriorated mortar joints between elements and a sand-finish coating that is stained with algae, or has blistered and delaminated from the surfaces.

Parapet elements on the 1925 addition appear to be more intact than those observed on the 1926 addition. Hairline cracks were typically observed on the 1925 addition, while parapets on the 1926 exhibit widespread cracking, spalling and delaminating of concrete, including previously repaired precast items. The parapet on the north elevation of the 1926 addition is currently clad with aluminum wall panels indicating that the precast elements on the parapet are in poor condition. This was not verified during the evaluation as the scope of work did not include the removal of metal wall panels

Cornice elements on the entablatures are cracked and spalled with observed areas of delamination of material. Cracks and spalls were accompanied by efflorescent staining. These conditions were observed on the water table, fascia and dentil components within the cornices. The south elevations of the 1925 and 1926 additions include a copper cornice flashing that is generally in poor condition and partially detached and dislodged at locations.

#### **5.4.1 Precast Options, General**

In general, precast elements on the building require a high level of maintenance, repair and / or replacement of components. Maintenance of precast elements would involve the removal of copper cornice flashings and aluminum parapet cladding to accommodate the restoration / removal of precast elements. The following is a summary of the potential scope of work to be considered by Barnstable to address the observed precast conditions on the building.

- Remove 100% of the existing sand-finish coating to fully expose existing precast elements.
- Perform 100% repointing of existing precast mortar joints.
- Repair of precast cracks and shallow spalls.
- Replacement of severely spalled / delaminated elements.
- Application of new textured coating to match adjacent building areas.

#### **5.4.2 Precast Options, Miscellaneous**

Copper downspouts should be removed to facilitate repairs to precast elements. Due to their age and observed conditions, Barnstable might want to consider installing new downspouts following the completion of granite repairs. Refer to Section 6.2.3 for additional information related to this item.

### **5.5 WOOD ELEMENTS**

As noted in our visual observations, the condition of the wood elements on the pre-1971 portions of the building ranges from fair to poor. Wood surfaces are generally coated with a sand-finish coating that has blistered and delaminated throughout the building. Exposed wood elements generally exhibit forms of deterioration that include splitting, bowing and rotting, with missing wood at isolated areas.

Wood surfaces on the 1971 addition have a smooth, white painted finish that are generally in fair condition.

#### **5.5.1 Wood Element Options, General**

Deteriorated wood elements require a high level of repair, replacement or reconstruction. Prior to performing any repairs, replacement, or reconstruction, 100% of the existing sand-finish coating would need to be removed to expose 100% of the wood elements so as to accurately estimate quantities.

## 5.5.2 Wood Element Repairs

### 5.5.2.1 Pre-1971 Wood Elements

- Repair localized holes, splits, etc. in wood elements using epoxy-based filler materials.

### 5.5.2.2 1971 Wood Elements

- Repair localized holes, splits, etc. in wood elements using epoxy-based filler materials.
- Prepare, prime and paint wood surfaces.

## 5.5.3 Wood Element Replacement (Pre-1971 Wood Elements)

Wood elements that cannot be repaired, such as split or bowed items, or where loss of material was observed, should be considered for replacement. There are various options for replacement of deteriorated wood elements. Replacement options include the use of white pine, synthetic wood products such as a poly-ash trim, or poly-vinyl chloride (PVC) products.

### *Option 1 – White Pine*

White pine could potentially provide the best match to the existing lumber. However, the availability of white pine products to match the existing components is uncertain.

### *Option 2 – Synthetic Materials*

Synthetic materials could include poly-ash trim made from fly ash and polymers. Unlike fiber-cement products, this material can be cut and shaped using standard carpentry tools, which can accommodate matching of historic profiles. It is also moisture resistant and does not expand and contract requiring gaps and slip joint in installation and holds paint well.

### *Option 3 – PVC*

PVC is a replacement option as it can be customized to fit most sizes and shapes of wood products.

## 5.5.4 Wood Reconstruction (Pre-1971 Wood Elements)

While the wood appears to be in fair condition, upon close evaluation a majority of the wood is cracked and bowed. Test cuts revealed several areas where water infiltration was occurring from the roof, the gutter, and at deteriorated or split wood components. This water further deteriorated the wood elements, and with a lack of venting, surface moisture was felt on the backside of the wood. While it is possible to salvage the wood there are several factors that Barnstable should consider including:

- The removal of the existing sand-finish coating will expose widespread deterioration of wood components that would require removal and replacement beyond what is currently visible.
- The sub framing system is limited and minimally supported, which may require structural augmentation to support replacement components.
- Independent laboratory testing of numerous coating samples that were obtained during the evaluation revealed an extremely high lead content in the coatings. Due to the high lead content in the coatings, it should be assumed that lead is also present in the wood elements, this lead content may leach back into the new paint coating.

Alternatively, Barnstable could consider removing the existing trim and replacing it with a glass fiber reinforced panels that are created from molds of the existing components or replaced with one of the materials identified under 6.5.3 and installed similar to the current construction but over a newly framing.

## 5.6 BASEMENT STRUCTURAL MASONRY

Overall, the basement of the 1831-1832 building is in fair condition.

The most significant deficiencies observed include the isolated locations of brick masonry removed from masonry piers and arches that support the first-floor granite slab. Replacement of these missing components should be considered as a high priority including rebuilding missing masonry, installing concrete piers/columns where missing, and installation of steel lintels at penetration of masonry arches or masonry openings.

It is Gale's opinion that the significant deterioration of the masonry mortar joints in the masonry piers and walls in the 1831-1832 building is primarily due to the age of the mortar joints. Deterioration may also be attributed to rising damp. Rising damp is when the moisture from the ground that contains salts travels up through the porous brick causing deterioration to the lime binder in the mortar. During the evaluation, Gale observed that the bricks at the base of the masonry piers appeared to be loose due to the advanced deterioration of the mortar. All loose mortar and brick should be removed and the piers rebuilt. Wall areas in good condition may only require pointing.

While the masonry was not observed to be wet at the time of our visit, if rising damp is a concern, Barnstable could consider excavating around each pier to install waterproofing at the granite footings and up the brick masonry piers to a point above the finish floor elevation. This work would occur in conjunction with the concrete slab removal required to install the new concrete piers.

It is Gale's opinion that temporary shoring shall be installed at two (2) locations prior to the repairs due to the condition of the masonry wall. The remaining piers that exhibit significant deterioration of the masonry mortar joints do not need temporary shoring to be installed as long as the repairs are completed this year (2025). If the repairs are not anticipated to be completed until next year (2026), it is Gale's opinion that temporary shoring is installed until the repairs to the masonry piers are completed.

It is Gale's opinion that the fire escapes located on the exterior of the building appear to be in good shape with no deficiencies observed.

## **6 PROJECT AND PHASING CONSIDERATIONS**

### **6.1 PROJECT CONSIDERATIONS**

#### **6.1.1 Noise Disruptions**

The exterior building enclosure renovations will incorporate masonry repairs, carpentry, window and door replacement, hazardous material abatement and painting. It is anticipated that either full staging of the building and/or aerial lifts will be utilized for the exterior renovations. Staging is most likely as the abatement, demolition, masonry and carpentry work will require full access best provided by a continuous work platform. Window installation may occur on staging or by aerial lift depending on the schedule and preferred access method. Staging will require several weeks lead time for installation prior to the start of work. Installation of the staging will be loud and will require machinery to raise pipe staging and planks to each level. Aerial lifts are also loud due to the engine and caution noise when moving.

During the project the contractor will cut mortar joints with circular grinders, saw-cutting of existing metal window frames, jack hammering of the masonry units, saw-cutting of wood elements being removed, onsite cutting of replacement wood trim and framing members, and mechanical fastening of the new window and door frames using power hand tools. These tools (table saws, grinders, screw guns, hammer drills) typically run on electrical generators which can be heard from the work area. The pounding/drilling of the substrates will be audible throughout the building. Cranes, aerial lifts and typical construction equipment will be required to mobilize and access the work areas. The building occupants should be informed that construction noise will likely be heard throughout the building during the renovations.

#### **6.1.2 Fumes/Odor Concerns**

The majority of the products which are anticipated to be specified for this project are considered low Volatile Organic Compound (VOC) compliant. However, odors will be present during the renovations such as bonding adhesives, mastics, and paints. Though they have low VOC's, some of these products have been considered noticeable by building occupants, who often report headaches associated with the odors. Other odors which may be noticeable will include, but not be limited to, diesel and unleaded fuel for construction equipment.

#### **6.1.3 Dust Concerns**

It has been our experience that dust will be present as the existing building components are vibrated from masonry repairs and the installation of new wood components, window and door systems. Natural dust accumulation on the framing, ceiling components, sills and adjacent elements will occur. This dust typically becomes displaced due to vibrations as the work progresses, and can often transfer to the interior spaces. It is recommended that the building occupants relocate as much interior components as possible prior to performing the renovations, and that temporary protection in the form of polyethylene sheeting be considered over non-movable components to reduce dust contamination. Further coordination will be required with the Contractor during construction.

#### **6.1.4 Temporary Weather Protection**

It is recommended that the majority of the work be performed during above freezing weather conditions. The specifications should require that the contractor only perform the window installation during non-precipitation days. Should Barnstable select restoration of the windows, the existing sashes will be removed and restored off-

site. This process may take 1 to 2 months in which time the existing opening will be protected with plywood, during winter conditions these openings will be protected by a combination of plywood and insulation.

Where masonry is removed, it should be flashed in with permanent membrane, or temporary polyethylene sheeting on a daily basis to reduce the potential of wind driven precipitation from infiltrating the wall system. Since the project will likely be staged and may extend from the Fall of 2025 into the Spring of 2026, tenting of the stage and the use of propane heaters to continue masonry work during winter conditions may occur.

### 6.1.5 Relocation of Occupants

As outlined above, both noise and odor concerns will be experienced during the construction activities. These concerns will be subject to the Owner's review and may not require relocation of the occupants in adjacent spaces when performing certain tasks throughout the construction duration. Please note that it is recommended that each office or room is empty while the abatement, demolition, and window work is being performed. Additionally, it is recommended that the Owner relocate building occupants or site patrons and movable equipment directly adjacent to any masonry and window operations.

Overall, due to the large scope of the project, in addition to the interior disruptions noted above, site access during construction operations will have to be monitored and limited. Construction equipment will be traveling around the site, and therefore, pedestrians and field activities will need to be coordinated with the contractor's phasing schedule to separate construction activity and occupant activities. Masonry, carpentry, windows/doors, associated materials, and the contractor's tools and tool boxes will be stored on site, and though they will be the responsibility of the contractor to make secure, could interfere with site parking and some temporary access to the building.

## 6.2 PHASING CONSIDERATIONS

Due to the potential disruption to the occupants and its impact on the project schedule and budget, Barnstable could consider several options such as manage construction and occupant activities throughout the process, or relocating occupants and activities to a different site during construction, manage construction and occupant activities throughout the process, or performing the work during non-business hours. These options are further discussed below:

### 6.2.1 Option #1 – Occupied Building

Under this phase construction labor would occur during regular daily work hours and assumes that the building will remain fully occupied with specific room shut-downs, noise and construction disruptions managed as best as possible. The project would be phased per wing, to limit conflicts but extends the project timeline.

- Budget - \$\$\$ - This is anticipated to be the most costly option
- Time line – Phase 1 – Three to four months  
Phase 2 – Three to four months  
Phase 3a – Two months  
Phase 3b – Two months

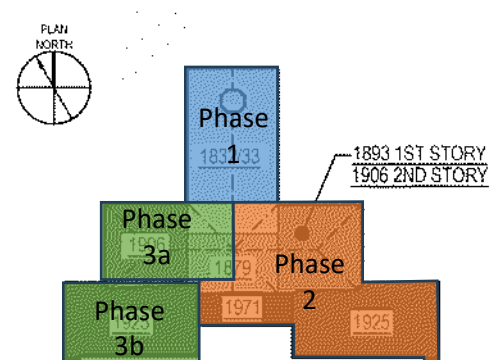


Figure 3: Proposed Phase for Option 1

### 6.2.2 Option #2 – Unoccupied Building

This option assumes that construction would occur within an unoccupied building and that temporary facilities would be identified and utilized by all county and trial court operations. The costs of the temporary facilities are not included in this analysis. This approach may be the most efficient and yield the shortest construction duration, but may not be feasible for Barnstable considering the logistics and challenges of moving county and trial court operations.

- Budget - \$ - This is anticipated to be the least costly option.
- Timeline – Eight months

### 6.2.3 Option #3 – Off Hours Construction

This option would assume that all construction work would occur primarily during off-hours (2:00 PM to 10:00 PM) with the recognition that this would represent a premium labor cost to the project, as well as causing potential noise and light impacts to neighboring property owners.

- Budget - \$\$
- Timeline – Eight to nine months

### 6.2.4 Option #4 – Hybrid Construction

A potential hybrid option could be considered where less invasive construction work occurs during certain days or hours (“quiet work”) and other time/ day blocks during which more invasive work would be allowed. Additional information from Barnstable is required to better understand the limits dictating noisy work from quiet work. It is anticipated that this option would extend out the project timeline and add cost as the contractor will include in their “down hours” where they may be unable to perform work or are less efficient within their bid.

- Budget - \$\$ - \$\$\$
- Timeline – Fifteen months

## 7 SCOPE OF WORK SUMMARY

This section includes an itemized list of proposed scopes of work separated into repair categories: Fenestration, Exterior Masonry, Exterior Wood Elements, Structural, and other additional scopes. The below proposed scope of work items are those that have been included as part of the cost estimate analysis provided in Appendix G – Preliminary Cost Estimate.

### 7.1 FENESTRATION

1. Fenestration Base Bid
  - A. 1830 Wood Window Restoration
    - 1) Restoration of the windows, including the removal of the sashes from the windows to be de-glazed, stripped of paint, repaired, prime, re-glazed and painted.
    - 2) Perform similar restoration to window frame and trim elements in place, including paint stripping, wood repairs, priming, and painting.
    - 3) Perform epoxy infill wood repairs as a Unit Price.
    - 4) Replace deteriorated wood components as noted on the Window Schedule and as a Unit Price.
    - 5) Due to presence of lead and asbestos, install an air-tight chamber at each window location to perform sash removal and paint removal work.
    - 6) Replace broken balances as a Unit Price.
    - 7) Install interior storm windows at each window location.
    - 8) Paint the interior surfaces of the window openings where paint is present. Refer to the Window Schedule for locations.
    - 9) Repair damaged plaster at window openings. Refer to the Window Schedule for locations. Repair additional as a Unit Price allowance.
    - 10) Replace cracked marble stools where indicated on the Window Schedule.
  - B. 1895/1906 Historic Window Replacement:
    - 1) Remove and abate the existing wood window sashes, frames, glazing, and trim down to the masonry substrates.
    - 2) Remove and replace cracked or spalled brick masonry units within the openings as a Unit Price.
    - 3) Rebuild portions of brick masonry openings as a Unit Price.
    - 4) Install concrete parge coat around the masonry opening to provide a smooth substrate for wood blocking.
    - 5) Install two (2) layers of pressure-treated 2x8 wood blocking around the perimeter of the opening.
    - 6) Install self-adhered membrane flashing around the perimeter of the opening.
    - 7) Install new thermally broken, historic replica aluminum single-hung windows. The new windows shall be ASTM E1996 Type D large missile impact rated.
    - 8) Provide two-piece aluminum rectangular snap trim around the interior perimeter of the opening.
    - 9) Provide two-piece aluminum, custom round snap trim at window head and jambs.
    - 10) Provide aluminum sill extension.
    - 11) Provide new interior wood stool where currently present. Refer to the Window Schedule for locations.
    - 12) Paint the interior surfaces of the window openings where paint is present. Refer to the Window Schedule for locations.

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- 13) Repair damaged plaster at window openings. Refer to the Window Schedule for locations. Repair additional as a Unit Price allowance.
  - 14) Repair damaged wallpaper at window openings. Refer to the Window Schedule for locations. Repair additional as a Unit Price allowance.
  - 15) Replace cracked marble stools where indicated on the Window Schedule.
- C. 1925 Wood Windows and 1971 Steel Windows:
- 1) Same scope as B above, except install high performance thermally broken, awning-style, aluminum windows. The new windows shall be ASTM E1996 Type D large missile impact rated.
2. Alternate 1 – Replace 1830 windows with Historic replacement windows, similar scope to Item B above.
  3. Alternate 2 – Instead of replacement restore 1895/1906 wood windows, refer to scope A above.
4. Window openings with equipment (Windows N001, E004, S003, S006, W006, W003, W004, W005, S301, S302, S304) – Perform work as listed for Alternate 1 (Items 1B1 – 1B6), then install 4-inch thick insulated metal panel to infill the opening.
    - A. Provide two-piece aluminum, custom round snap trim at window head and jambs.
    - B. Temporarily disconnect and relocate conduit and condenser lines to new cored holes in the insulated metal panels.
  5. Doors:
    - A. Door 1:
      - 1) Remove and replace with thermal broken, hurricane impact rated, aluminum storefront frame and door leaf.
      - 2) Provide transom and side lites with laminated IGUs and surface-applied muntin grids.
      - 3) Provide new panic egress hardware and auto-closer.
      - 4) Provide new thermally broken aluminum door threshold.
    - B. Doors 2, 4, and 6:
      - 1) Prepare, prime, and paint interior and exterior wood surfaces.
      - 2) Replace weatherstripping and door sweeps.
      - 3) Replace exterior perimeter backer rod and sealant joint.
    - C. Door 3:
      - 1) Prepare, prime, and paint interior and exterior wood surfaces, include wood ornamentation around the door.
      - 2) Replace weatherstripping and door sweeps.
      - 3) Replace exterior perimeter backer rod and sealant joint.
      - 4) Remove metal bird screening above the door and install bird spikes.
    - D. Door 7:
      - 1) Remove and replace with thermal broken, hurricane impact rated, aluminum storefront frame and door leaf.
      - 2) Provide new panic egress hardware and auto-closer.
      - 3) Provide new thermally broken aluminum door threshold.
    - E. Doors 5, 8, and 9:
      - 1) Replace weatherstripping and door sweeps.
      - 2) Replace exterior perimeter backer rod and sealant joint.
    - F. Door 10:
      - 1) Remove and replace with thermal broken, hurricane impact rated, aluminum storefront frame and door leaf.
      - 2) Provide new interior/exterior lever hardware, lockset, and auto-closer.

- 3) Temporarily disconnect/reconnect existing conduit and condenser lines installed through the door frame to relocate to a different location.
- 4) Provide new thermally broken aluminum door threshold.

## 7.2 EXTERIOR MASONRY

### 1. Miscellaneous Exterior Scope

#### A. Downspouts

- 1) Remove and replace downspouts on all elevations. New downspouts shall be Zinc-Coated Copper.
- 2) Clear below-grade downspout leaders to be free flowing.

#### B. Cornice Flashing

- 1) Install zinc-coated copper sheet metal flashing over cornice on 1925/26 at low-slope roof area. (noted 4 on drawings)

### 2. Granite Masonry:

#### A. Repairs – Base Bid

- 1) Cleaning of granite surfaces including the removal of staining and vegetative growth.
- 2) Epoxy repair of granite cracks.
- 3) Epoxy repair of holes in granite surfaces.
- 4) 100% removal and repointing of mortar joints.

### 3. Brick Masonry:

#### A. Repairs – Base Bid

- 1) Perform 100% repointing of existing mortar joints on the 1925/26 and 1971 additions.
- 2) Repair step and vertical cracks in the masonry walls.
- 3) Remove and replace cracked, spalled and otherwise damaged brick masonry units.
- 4) Remove and replace brick masonry units that have embedded, abandoned anchor ports.
- 5) Remove and replace deteriorated steel lintels.
- 6) Perform masonry cleaning to remove efflorescence, vegetative and atmospheric staining.
- 7) Remove and replace existing cementitious parge over brick masonry foundation walls, including the south-side, basement-access stairwell.
- 8) Repair cracked concrete elements on the stairwell.

#### B. Alternate 3 – Masonry Replacement 1925/26 building

- 1) Remove and replace the textured, 100 individual lighter-colored brick infill areas on the 1925/26 addition with replacement brick masonry units that closely resemble the size, color and texture of the 1925/26 brick units.

#### C. Alternate 4 – Masonry Replacement 1971 Addition

- 1) Remove and replace the entire brick masonry façade on the 1971 addition to match 1925/26 brick masonry.

4. Precast Masonry:
  - A. Repairs – Base Bid
    - 1) Remove 100% of the existing sand-finish coating to fully expose existing precast elements.
    - 2) Perform 100% repointing of existing precast mortar joints.
    - 3) Repair of precast cracks and shallow spalls.
    - 4) Replacement of severely spalled / delaminated elements.
    - 5) Application of new textured coating to match adjacent building areas.
    - 6) Remove cornice and parapet where indicated on drawings and reinstall,
      - a) Install new EPDM roof membrane 36" onto roof and provide new roof edge flashing. Reinstall roof system substrates as needed to accommodate work.

### 7.3 EXTERIOR WOOD ELEMENTS

1. Pre-1971 Wood Elements (refer to window scope for window surrounds and trim)
  - A. Repairs – Base Bid
    - 1) Remove 100% sand-finish coatings to fully expose existing wood elements on entablatures and columns.
    - 2) Repair localized holes, splits, etc. in wood elements using epoxy-based filler materials.
    - 3) Replace lower 12" of each column and install new synthetic wood column base
    - 4) Sand wood smooth and install new 3 coat paint system with texture finish.
2. 1971 Wood Elements
  - A. Repairs – Base Bid
    - 1) Repair localized holes, splits, etc. in wood elements using epoxy-based filler materials.
    - 2) Prepare, prime and paint 100% of wood elements, 3 coat paint system with smooth finish.
3. Alternate 5 – Replacement of existing wood entablature - Fiberglass
  - 1) 100% removal of wood entablature elements and sub-framing
  - 2) Install new framing to support new glass-fiber-reinforced-polymer panels molded from existing trimwork.
4. Alternate 6 – Replacement of existing wood entablature – Synthetic Wood
  - 1) 100% removal of wood entablature elements and sub-framing
  - 2) Install new framing, plywood, and weather resistant barrier.
  - 3) Install new synthetic wood trim molded to match existing profiles and geometry.

### 7.4 BASEMENT STRUCTURAL MASONRY

1. Basement Masonry Components
  - A. Install temporary shoring support the first level granite slab where deteriorated mortar joints were observed at the base of masonry piers. The temporary shoring shall remain in place until the repairs to the masonry piers are complete.
  - B. Remove deteriorated masonry and mortar, shore masonry pier to remain.
  - C. Cut the concrete slab back and remove loose and deteriorated masonry, form and pour a new concrete pier that is connect to the existing granite footings and extend approximately six inches (6") above the concrete slab on grade. Rebuild the masonry pier down to the new concrete pier

where deteriorated mortar joints were observed. The mortar shall be a similar composition to the original mortar and shall include an integral water repellent admixture. Deteriorated and cracked masonry units shall be replaced if encountered during the rebuilding of the masonry piers.

- D. Option 2 pier rebuild (unpriced)- Cut the concrete slab back and remove loose and deteriorated masonry, form and pour a new concrete pier that is connected to the existing granite footings and extends to sound masonry pier above to remain.
- E. Install a waterproofing membrane at the granite footings and concrete piers located below the concrete slab. The waterproofing membrane shall be terminated above the concrete slab on grade:
- F. At the location of the missing masonry pier, install a new concrete pier connected to the existing granite footing and extends six inches (6") above the concrete slab on grade and rebuild the masonry pier down to the new concrete pier. As outlined above install a new waterproofing membrane at the granite footing and concrete pier below grade.
- G. At the locations where voids were observed in the structural components of the masonry arches, rebuild the voids in the masonry piers around the existing penetrations. The mortar shall be a similar composition to the original mortar of the masonry piers.
- H. Install a new steel lintel above the existing penetrations in the masonry arches. The steel lintel shall bear eight inches (8") on each side of the penetration.

2. Exterior Granite Stair Support Structure

- A. Rebuild masonry at the location exhibiting step cracking. The mortar shall be a similar composition to the original mortar and shall include an integral water repellent admixture. Deteriorated and cracked masonry units shall be replaced if encountered during the rebuilding of the masonry piers.
- B. Repoint areas of deteriorated mortar joints.
- C. Clean masonry at the locations that exhibit efflorescence from moisture infiltration.

3. Exterior Granite Stairs

- A. Clean out granite stair joints. Install mortar bed with  $\frac{3}{4}$ " recess at exterior face.
- B. Install new traffic grade - sealant and backer rod at all stair joints.

## 7.5 ADDITIONAL SCOPES OF WORK FOR CONSIDERATION

1. Base Bid – is anticipated to occur over three phases with limited occupancy in each phase. No additional accommodations are made for noise within the work period.
2. Alternate 7 – Unoccupied Building
  - A. The county and courthouse uses are temporarily relocated to other sites and the building is turned over to the contractor for a single phase construction period.
3. Alternate 8 – Hybrid Construction
  - A. Similar to the Base Bid except the contractor is limited to noise work from 7 AM to 10 AM two days a week and unlimited the other three days.

**8 PREFERRED SCOPE AND PRELIMINARY COST ESTIMATES**

Gale worked with Barnstable County to develop a preferred scope of work based on the base bid and alternate scopes of work listed above. Barnstable County's preferred base bid scope of work includes Alternates 1, 6, and 8. Alternates 3, 4, and 5 will remain as alternates as the design is developed. Alternate 2 is no longer being considered at this time. The feasibility of Alternate 7 is currently being reviewed by Barnstable County and is being included as an option at this time. The cost estimate values listed below are based on this base bid and alternate structure.

The construction budgets presented below shall be considered preliminary. The values are based on current public sector unit pricing of similar construction projects using open shops but have not included all details or design considerations at this time.

The base bid and alternate costs presented below typically take into contractor costs such as:

- Mobilization
- Crane usage
- Dumpsters
- General oversight of the project
- Bonds and insurance
- Building Permits
- Overhead and profit

The cost estimate also includes a 15% design and pricing contingency to cover potential unforeseen cost increases as the design is developed and more refined estimates are provided. Gale's preliminary construction budget, which is conservative at this time, is therefore broken down as follows:

**Base bid..... \$4,898,883.00**

**Alternate Scopes of Work:**

Alternate 3 – Replace non-matching brick masonry .....	\$22,762
Alternate 4 – Replace non-matching brick masonry at 1970s addition .....	\$72,862
Alternate 5 – Fiberglass in lieu of synthetic wood trim.....	\$1,959
Alternate 7 – Unoccupied building during construction .....	-\$930,827

Please be reminded that these budgets are preliminary. Also note that these values do not include soft costs associated with working for Barnstable County and Owner's Project Manager, disruption of facilities operations, and review with the local historic commission. Barnstable County should be aware that due to recent world events, bid pricing has become more volatile and may be higher, or lower, than what has been presented above depending on contractor and material availability. More refined cost estimates can be provided should Barnstable County wish to proceed to the next phase. The cost estimate currently includes an escalation based on a contract award by the end of 2025, with site mobilization to begin Spring 2026. Should the construction schedule be delayed, construction costs may potentially increase.

**APPENDIX A – PRELIMINARY ARCHITECTURAL DRAWINGS**

1

2

3

4

5

6



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# SCHEMATIC

**PROJECT**  
 EXTERIOR RESTORATION  
 BARNSTABLE COUNTY SUPERIOR COURTHOUSE  
 3195 MAIN ST  
 BARNSTABLE, MA 02630

**OWNER**  
 COUNTY OF BARNSTABLE  
 COUNTY OF BARNSTABLE REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
 8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655

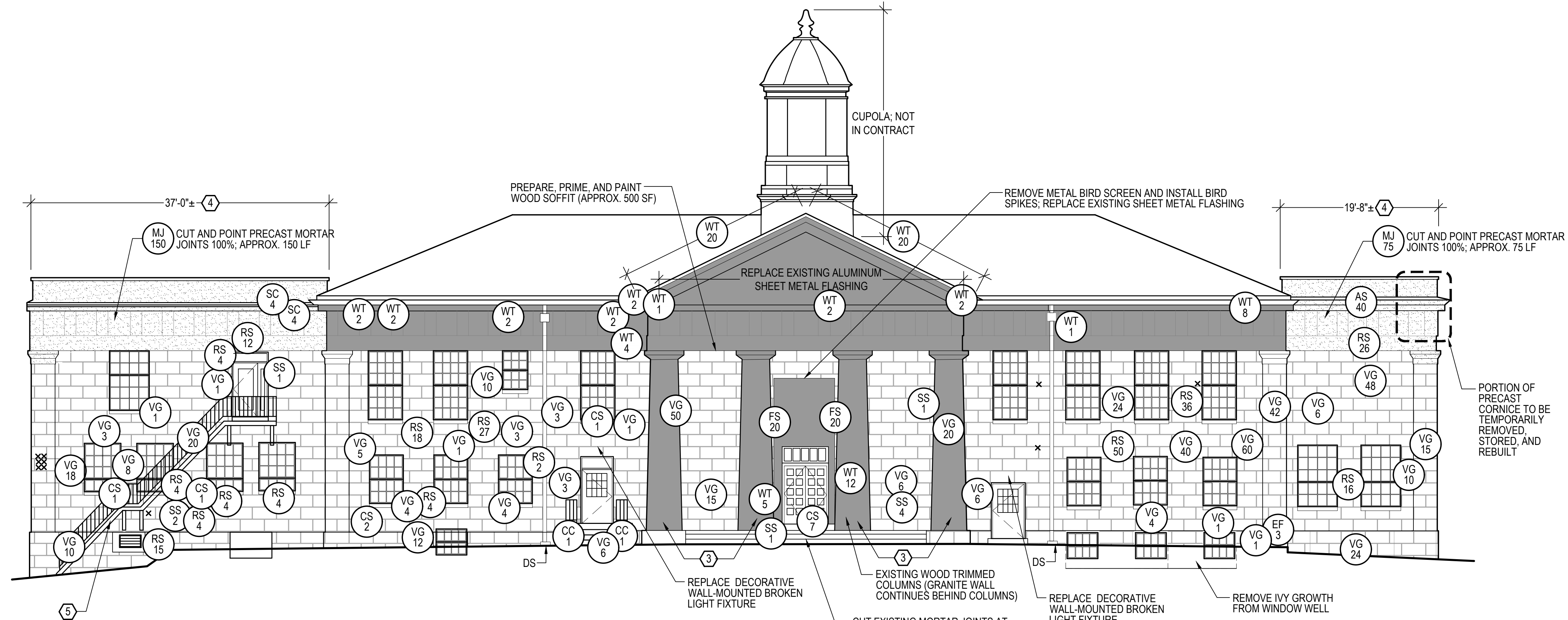
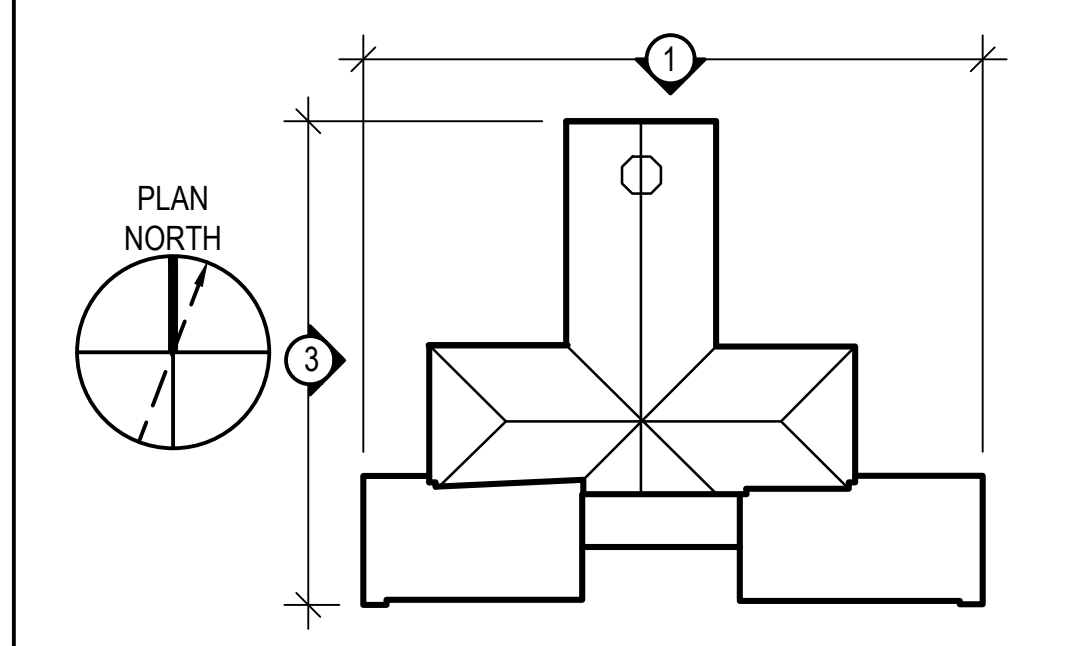
## SHEET NOTES

- DISCONNECT EXISTING CONDUIT AND DUCTS THROUGH WINDOW; REMOVE WOOD WINDOW FRAMES AND SASHES, LOUVERS, AND WOOD TRIM; INSTALL 3" THICK INSULATED METAL PANEL WITH ALUMINUM TRIM; REINSTALL CONDUIT THROUGH NEW CORED HOLES IN PANEL; PROVIDE NEW LOUVER WHERE INDICATED ON THE ELEVATION
- REMOVE EXISTING LEAD-COATED COPPER FLASHING AND INSTALL NEW ZINC-ALLOY COATED COPPER THROUGH-WALL FLASHING AT PRECAST CORNICE; REBUILD FOUR (4) COURSES OF BRICK TO INSTALL FLASHING TO BACK-UP WALL
- REPLACE 12" OF FLUTED WOOD TRIM AT COLUMN BASE; PRIME AND PAINT (APPROX. 14 LF OF BOARD); INSTALL BACKER ROD AND SEALANT JOINT AROUND BASE OF COLUMN (APPROX. 8 LF)
- REMOVE EXISTING LEAD-COATED COPPER FLASHING AND INSTALL NEW ZINC-ALLOY COATED COPPER FLASHING AT PRECAST CORNICE; INSTALL INTO CUT REGLET JOINT.
- PREPARE, PRIME, AND PAINT METAL FIRE ESCAPE STAIR 100%

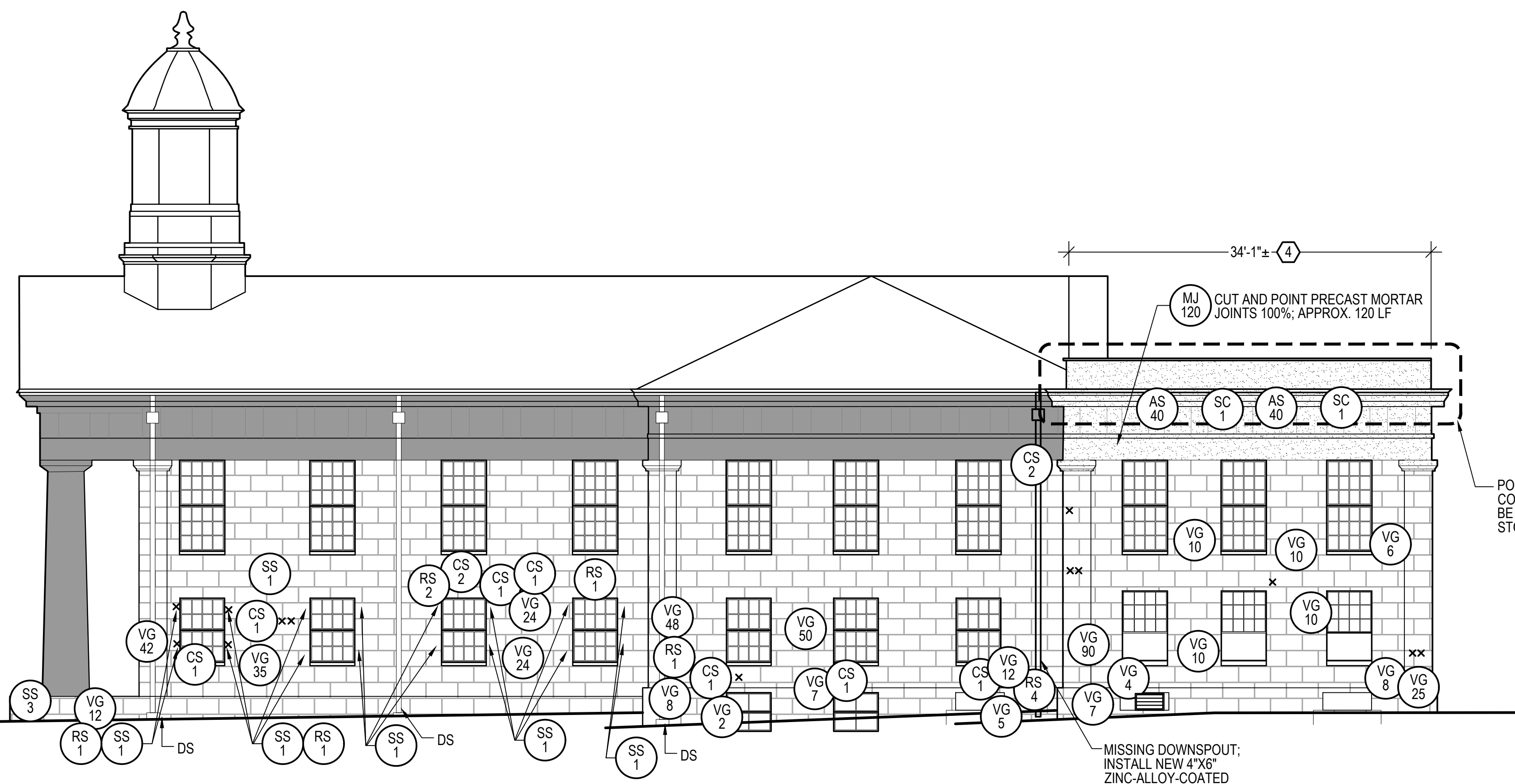
## LEGEND

- AS # ATMOSPHERIC STAINING TO BE CLEANED; # INDICATES SQUARE FEET
- RS # RUST STAINING TO BE CLEANED; # INDICATES SQUARE FEET
- VG # VEGETATIVE GROWTH TO BE CLEANED; # INDICATES SQUARE FEET
- EF # EFFLORESCENCE TO BE CLEANED; # INDICATES SQUARE FEET
- SS # SPALLED STONE; PATCH WITH GRANITE REPAIR MORTAR; # INDICATES SQUARE FEET
- WT # DETERIORATED WOOD TRIM TO BE REPLACED; # INDICATES LINEAR FEET OF ASSUMED 1"x7" BOARD
- SC # SPALLED CONCRETE; PATCH WITH REPAIR MORTAR; # INDICATES SQUARE FEET
- CC # CRACKED CONCRETE; ROUT AND SEAL; # INDICATES LINEAR FEET
- CS # CRACKED STONE; ROUT AND PATCH WITH GRANITE REPAIR MORTAR; # INDICATES LINEAR FEET
- MJ # CUT AND POINT DETERIORATED MORTAR JOINT; # INDICATES LINEAR FEET
- LOUVER: REMOVE AND REPLACE; SIZED APPROXIMATELY AS SHOWN
- ABANDONED ANCHOR TO BE REMOVED; IF LOCATED IN GRANITE, REMOVE AND PATCH WITH REPAIR MORTAR; IF LOCATED IN BRICK MASONRY UNIT; REMOVE AND REPLACE BRICK MASONRY UNIT
- FS # FAILED SEALANT JOINT; REMOVE AND REPLACE WITH BACKER ROD AND SEALANT; # INDICATES LINEAR FEET
- GRANITE MASONRY: CUT AND POINT MORTAR JOINTS 100%; JOINTS LOCATED APPROXIMATELY AS SHOWN
- PRECAST CONCRETE: CUT AND POINT MORTAR JOINTS 100%; REFER TO THE QUANTITIES SHOWN ON THE ELEVATIONS
- WOOD TRIM: PREPARE, PRIME, AND PAINT; PROVIDE SAND TEXTURE
- # SHEET NOTE
- DS DOWNSPOUT; REMOVE EXISTING LEAD-COPPER DOWNSPOUT AND REPLACE WITH 4"x6" ZINC-ALLOY-COATED COPPER DOWNSPOUT

## KEY PLAN



**1**  
 WALL REPAIR SCOPE  
 NORTH ELEVATION  
 A201 SCALE: 1/8"=1'-0"



**2**  
 WALL REPAIR SCOPE  
 WEST ELEVATION  
 A201 SCALE: 1/8"=1'-0"

NO.	DATE	DESCRIPTION	BY
PROJECT NO.			
CADD FILE		843680 A200s	
DESIGNED BY		SWWW/RFM	
DRAWN BY		SWWW/JEN	
CHECKED BY		BHN	
DATE		12/20/24	
DRAWING SCALE		1/8"=1'-0"	

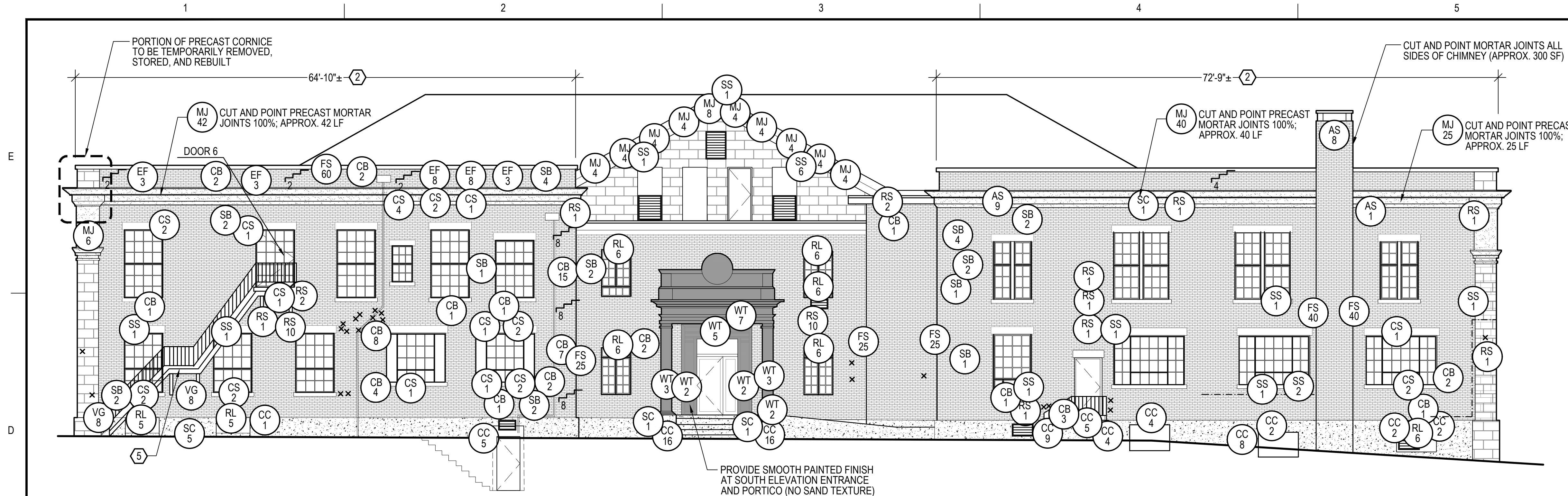
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SHEET TITLE

**WALL REPAIR SCOPE ELEVATIONS**

DRAWING NO.

A201



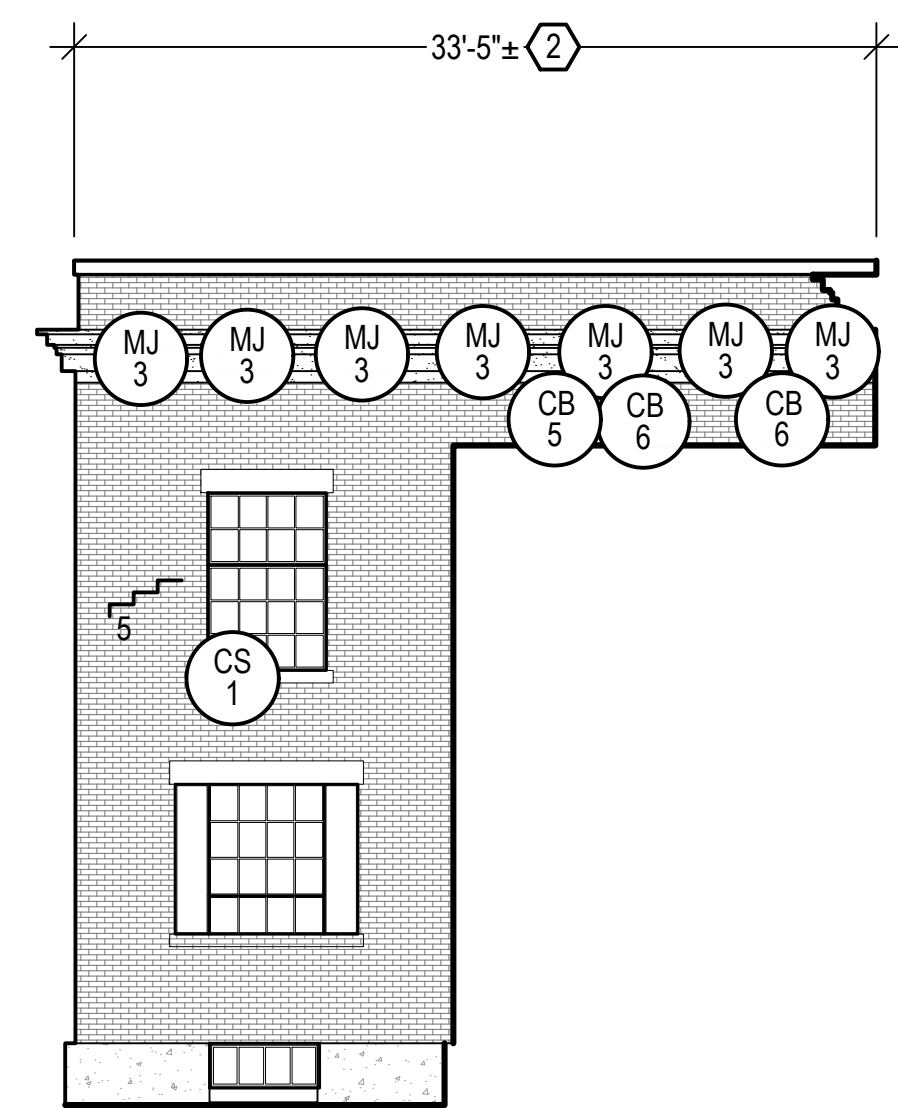
### SHEET NOTES

- NOT USED THIS SHEET.
- REMOVE EXISTING LEAD-COATED COPPER FLASHING AND INSTALL NEW ZINC-ALLOY COATED COPPER THROUGH-WALL FLASHING AT PRECAST CORNICE. REBUILD FOUR (4) COURSES OF BRICK TO INSTALL FLASHING TO BACK-UP WALL.
- NOT USED THIS SHEET.
- REMOVE EXISTING LEAD-COATED COPPER FLASHING AND INSTALL NEW ZINC-ALLOY COATED COPPER FLASHING AT PRECAST CORNICE. INSTALL INTO CUT REGLET JOINT.
- PREPARE, PRIME, AND PAINT METAL FIRE ESCAPE STAIR 100%

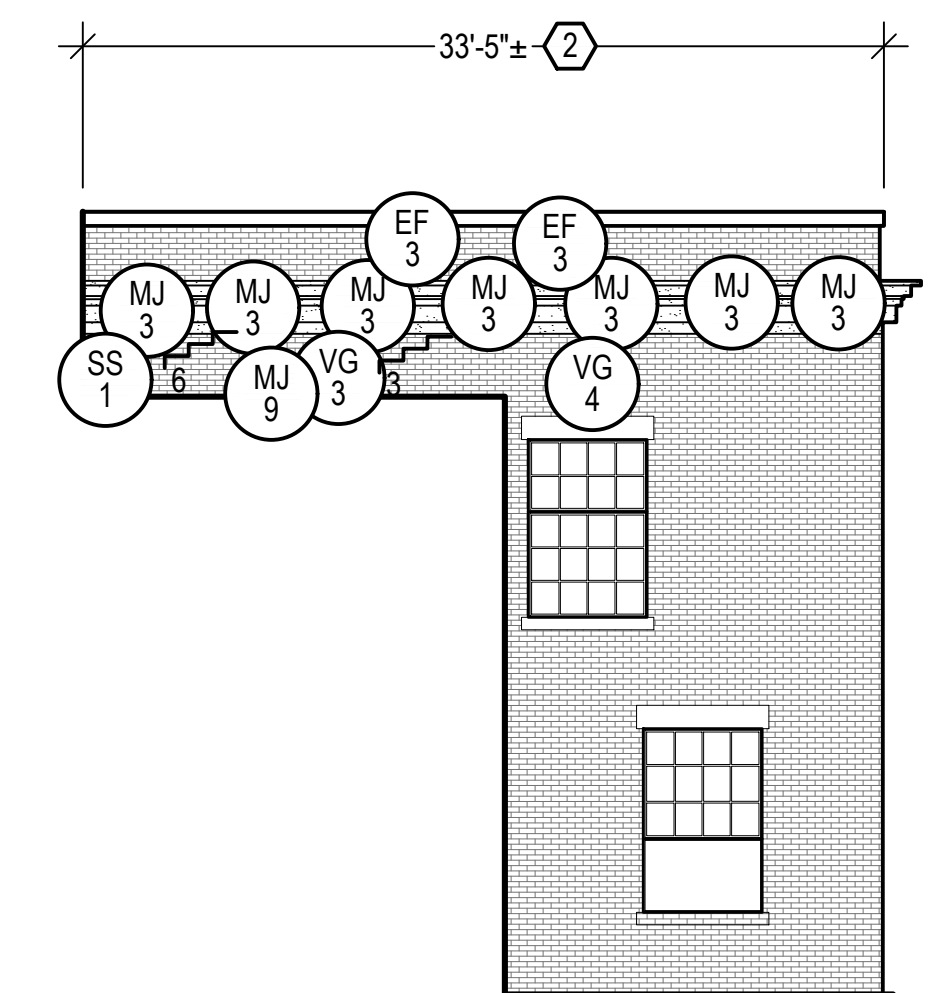
### LEGEND

- AS # ATMOSPHERIC STAINING TO BE CLEANED; # INDICATES SQUARE FEET
- RS # RUST STAINING TO BE CLEANED; # INDICATES SQUARE FEET
- VG # VEGETATIVE GROWTH TO BE CLEANED; # INDICATES SQUARE FEET
- EF # EFFLORESCENCE TO BE CLEANED; # INDICATES SQUARE FEET
- SS # SPALLED STONE; PATCH WITH GRANITE REPAIR MORTAR; # INDICATES SQUARE FEET
- WT # DETERIORATED WOOD TRIM TO BE REPLACED; # INDICATES LINEAR FEET OF ASSUMED 1"x7" BOARD
- SC # SPALLED CONCRETE; PATCH WITH REPAIR MORTAR; # INDICATES SQUARE FEET
- CS # CRACKED STONE; ROUT AND PATCH WITH GRANITE REPAIR MORTAR; # INDICATES LINEAR FEET
- LOUVER; REFER TO WINDOW RESTORATION ELEVATIONS
- ABANDONED ANCHOR TO BE REMOVED; IF LOCATED IN GRANITE, REMOVE AND PATCH WITH REPAIR MORTAR; IF LOCATED IN BRICK MASONRY UNIT; REMOVE AND REPLACE BRICK MASONRY UNIT
- FS # FAILED SEALANT JOINT; REMOVE AND REPLACE WITH BACKER ROD AND SEALANT; # INDICATES LINEAR FEET
- GRANITE MASONRY; CUT AND POINT MORTAR JOINTS 100%; JOINTS LOCATED APPROXIMATELY AS SHOWN
- PRECAST CONCRETE; CUT AND POINT MORTAR JOINTS 100%; REFER TO THE QUANTITIES SHOWN ON THE ELEVATIONS
- WOOD TRIM; PREPARE, PRIME, AND PAINT; PROVIDE SAND TEXTURE
- CONCRETE; REMOVE AND REPLACE ELASTOMERIC COATING 100%
- BRICK MASONRY; CUT AND POINT MORTAR JOINTS 100%
- # SHEET NOTE
- CB # CRACKED BRICK TO BE REPLACED; # INDICATES UNITS
- SB # SPALLED BRICK TO BE REPLACED; # INDICATES UNITS
- RL # RUSTED LINTEL; PREPARE, PRIME, AND PAINT EXPOSED SURFACES. COORDINATE WITH WINDOW SCOPE; # INDICATES LINEAR FEET OF LINTEL
- BRICK MASONRY STEP CRACK; REBUILD BRICK MASONRY; # INDICATES LINEAR FEET
- EXISTING WALL-MOUNTED METAL CONDUIT; TEMPORARILY DISCONNECT, STORE, AND REINSTALL TO PERFORM WORK

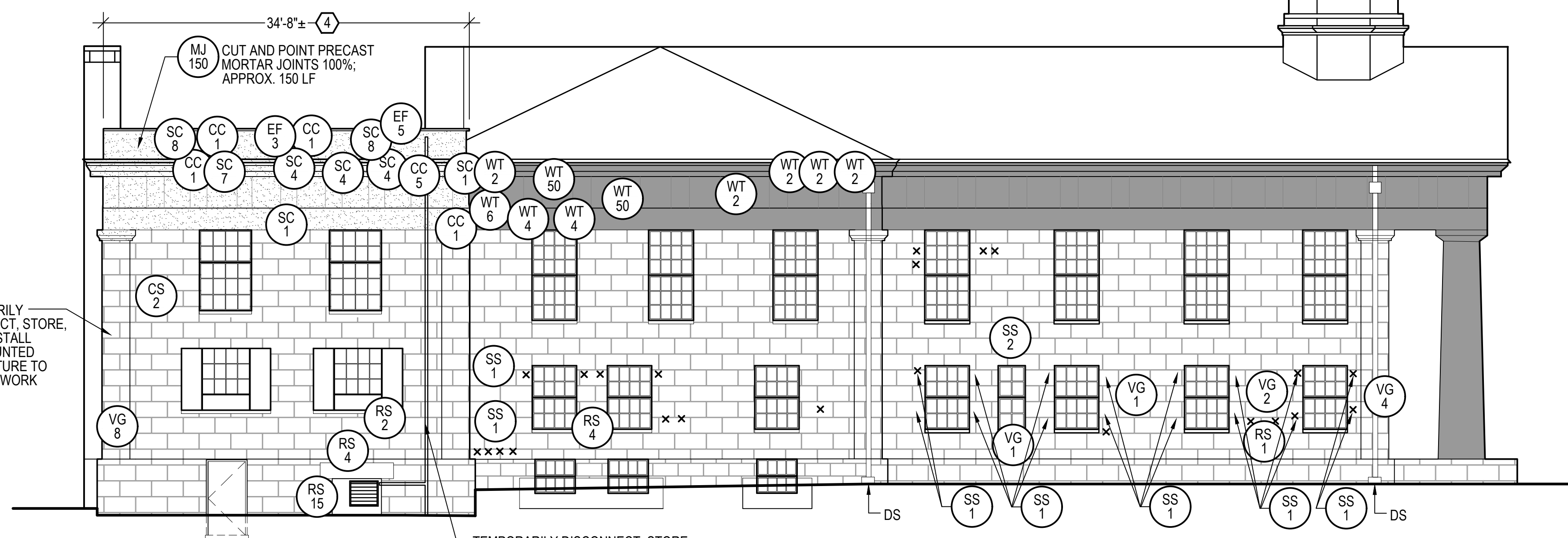
**WALL REPAIR SCOPE SOUTH ELEVATION**  
 3 A201 SCALE: 1/8"=1'-0"



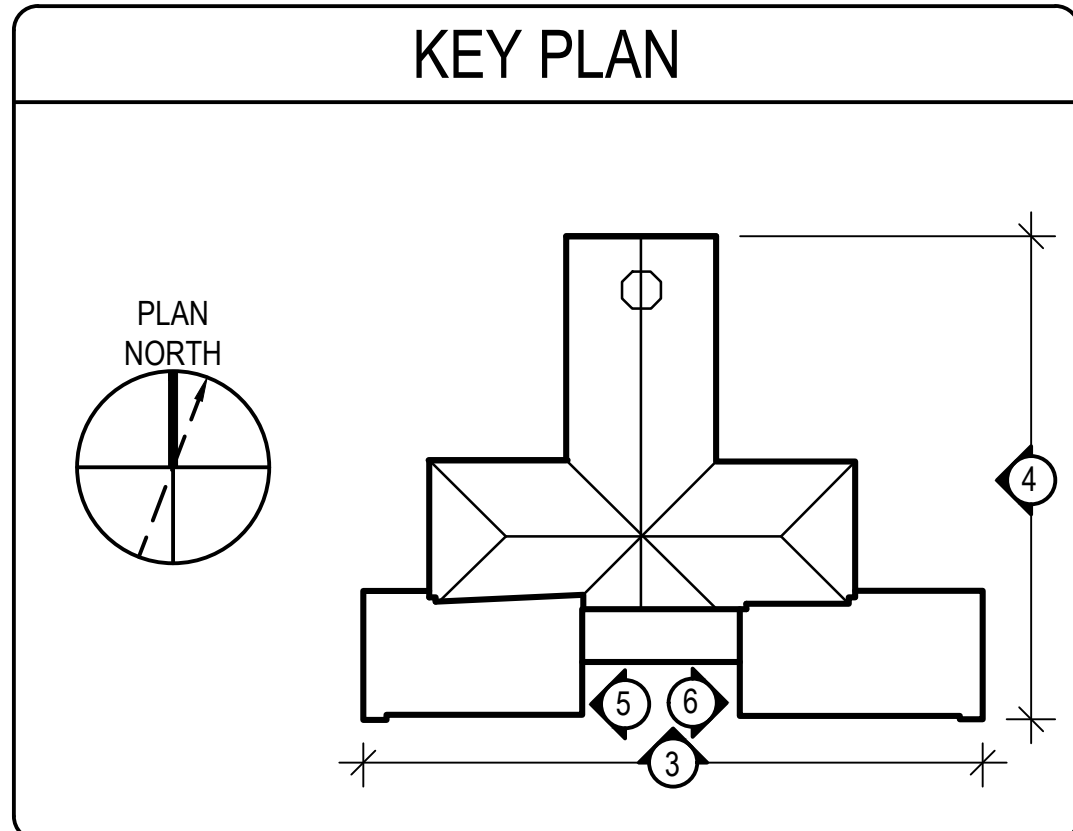
**WALL REPAIR SCOPE HIDDEN WEST ELEVATION**  
 5 A202 SCALE: 1/8"=1'-0"



**WALL REPAIR SCOPE HIDDEN EAST ELEVATION**  
 6 A202 SCALE: 1/8"=1'-0"



**WALL REPAIR SCOPE EAST ELEVATION**  
 4 A202 SCALE: 1/8"=1'-0"



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## SCHEMATIC

PROJECT  
**EXTERIOR RESTORATION**  
**BARNSTABLE COUNTY SUPERIOR COURTHOUSE**  
 3195 MAIN ST  
 BARNSTABLE, MA 02630

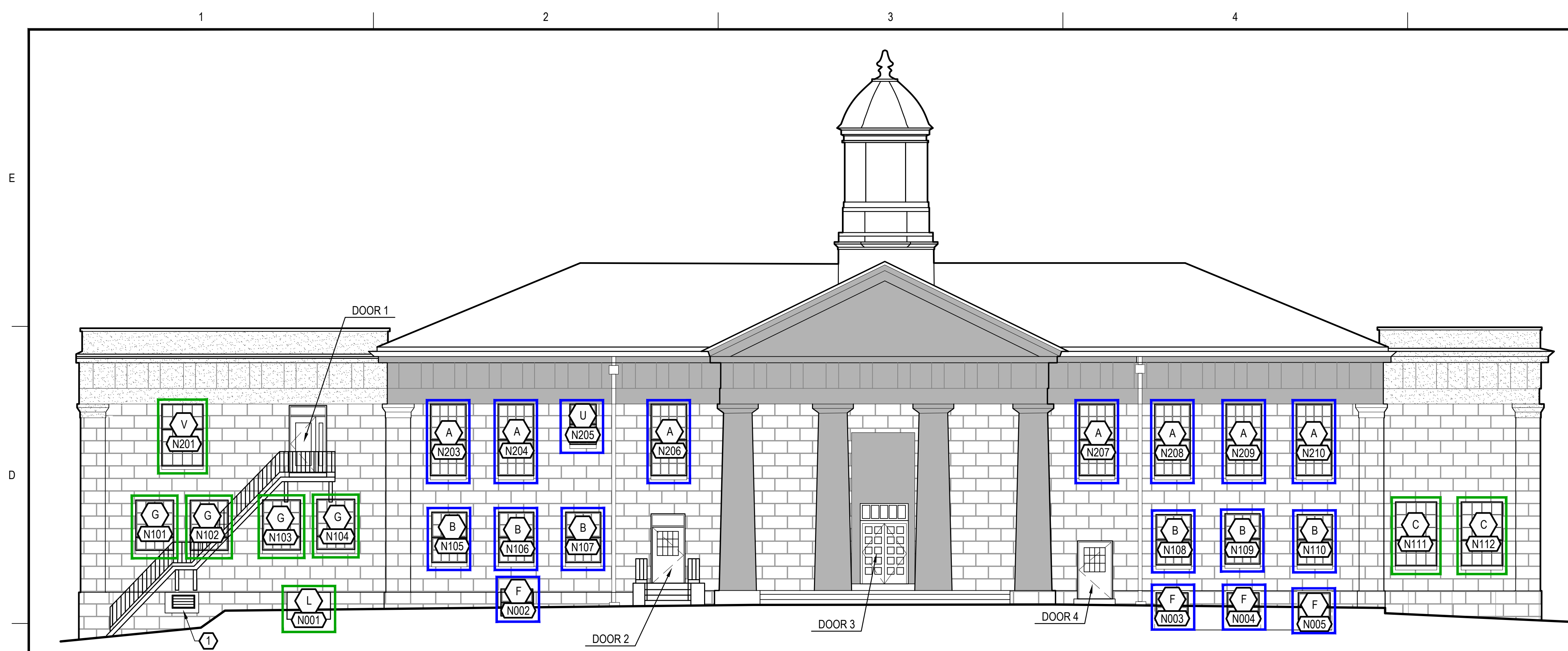
OWNER  
 COUNTY OF BARNSTABLE  
 COUNTY OF BARNSTABLE REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
 8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655

NO.	DATE	DESCRIPTION	BY
PROJECT NO.			
CADD FILE	843680 A200s		
DESIGNED BY	SWWW/RFM		
DRAWN BY	SWWW/JEN		
CHECKED BY	BHN		
DATE	12/20/24		
DRAWING SCALE	1/8"=1'-0"		

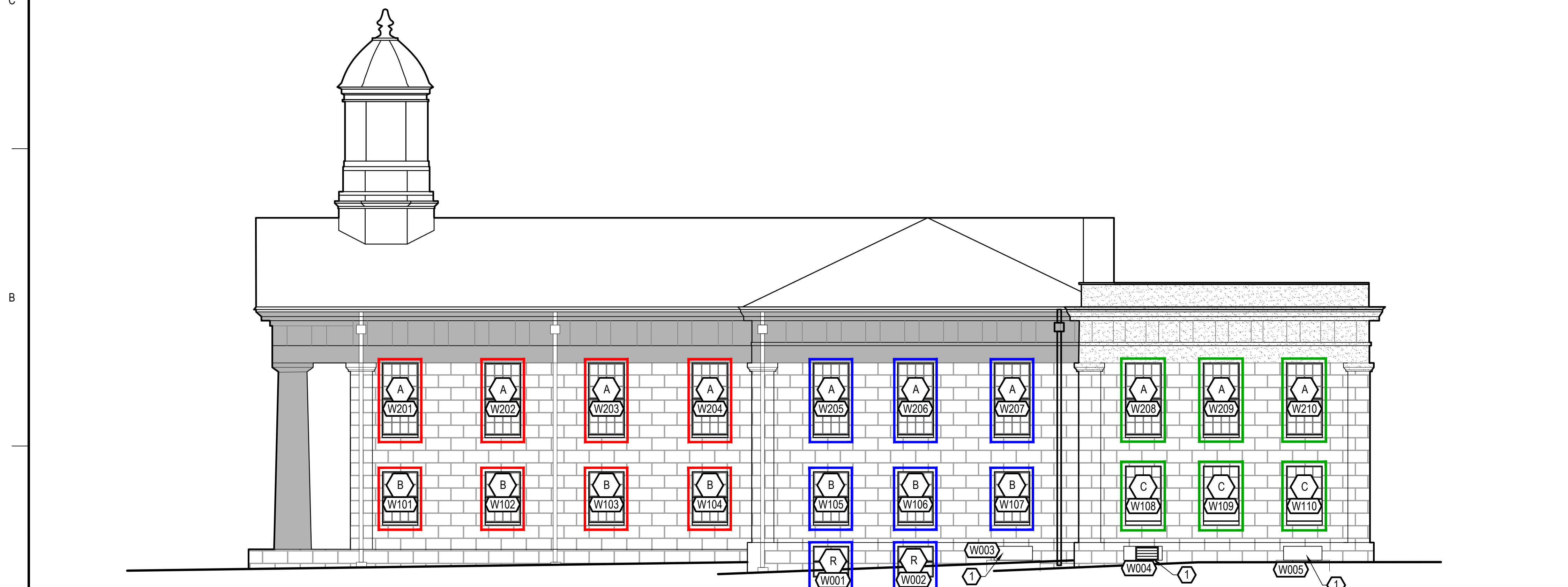
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SHEET TITLE  
**WALL REPAIR SCOPE ELEVATIONS**

DRAWING NO.  
**A202**



2  
A203  
FENESTRATION SCOPE  
NORTH ELEVATION  
SCALE: 1/8"=1'-0"



2  
A203  
FENESTRATION SCOPE  
WEST ELEVATION  
SCALE: 1/8"=1'-0"

SHEET NOTES

- ① DISCONNECT EXISTING CONDUIT AND DUCTS THROUGH WINDOW; REMOVE WOOD WINDOW FRAMES AND SASHES, LOUVERS, AND WOOD TRIM; INSTALL 3" THICK INSULATED METAL PANEL WITH ALUMINUM TRIM; REINSTALL CONDUIT THROUGH NEW CORED HOLES IN PANEL; PROVIDE NEW LOUVER WHERE INDICATED ON THE ELEVATION
- ② NOT USED THIS SHEET.
- ③ NOT USED THIS SHEET.
- ④ NOT USED THIS SHEET.
- ⑤ NOT USED THIS SHEET.



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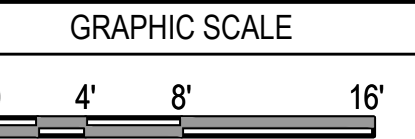
LEGEND

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- GRANITE MASONRY; REFER TO WALL REPAIR SCOPE ELEVATIONS.
- PRECAST CONCRETE; REFER TO WALL REPAIR SCOPE ELEVATIONS.
- WOOD TRIM; REFER TO WALL REPAIR SCOPE ELEVATIONS.
- WINDOW TYPE DESIGNATION; REFER TO WINDOW ELEVATIONS
- WINDOW NUMBER; REFER TO WINDOW SCHEDULE
- SHEET NOTE
- WINDOW SCOPE 1  
BASE BID: RESTORE WOOD WINDOW  
ALTERNATE 1: REPLACE WITH HISTORIC REPLICA ALUMINUM WINDOWS
- WINDOW SCOPE 2  
BASE BID: REPLACE WINDOW WITH HISTORIC REPLICA ALUMINUM WINDOWS  
ALTERNATE 2: RESTORE WOOD WINDOW
- WINDOW SCOPE 3  
BASE BID: REPLACE WINDOW WITH HIGH PERFORMANCE ALUMINUM WINDOW

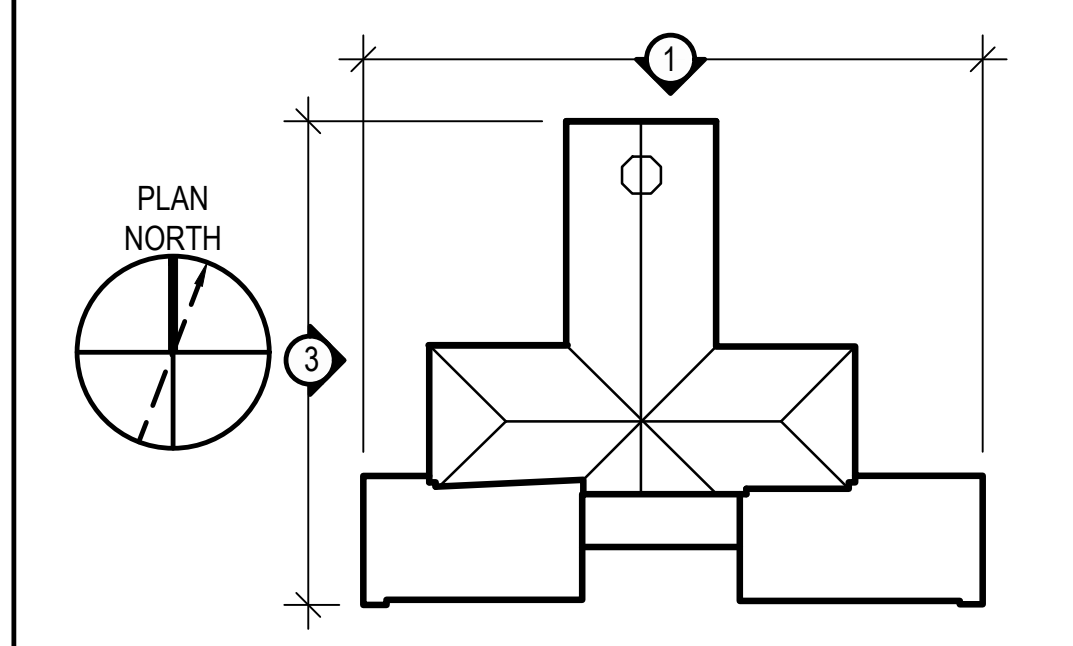
NOTE: REFER TO THE EVALUATION REPORT FOR BREAKDOWN OF EACH SCOPE OF WORK.

PROJECT  
EXTERIOR RESTORATION  
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BARNSTABLE, MA 02630  
OWNER  
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C/O BARNSTABLE COUNTY REGIONAL GOVERNMENT OF CAPE COD AND CLEARFATH ADVISORS  
8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655

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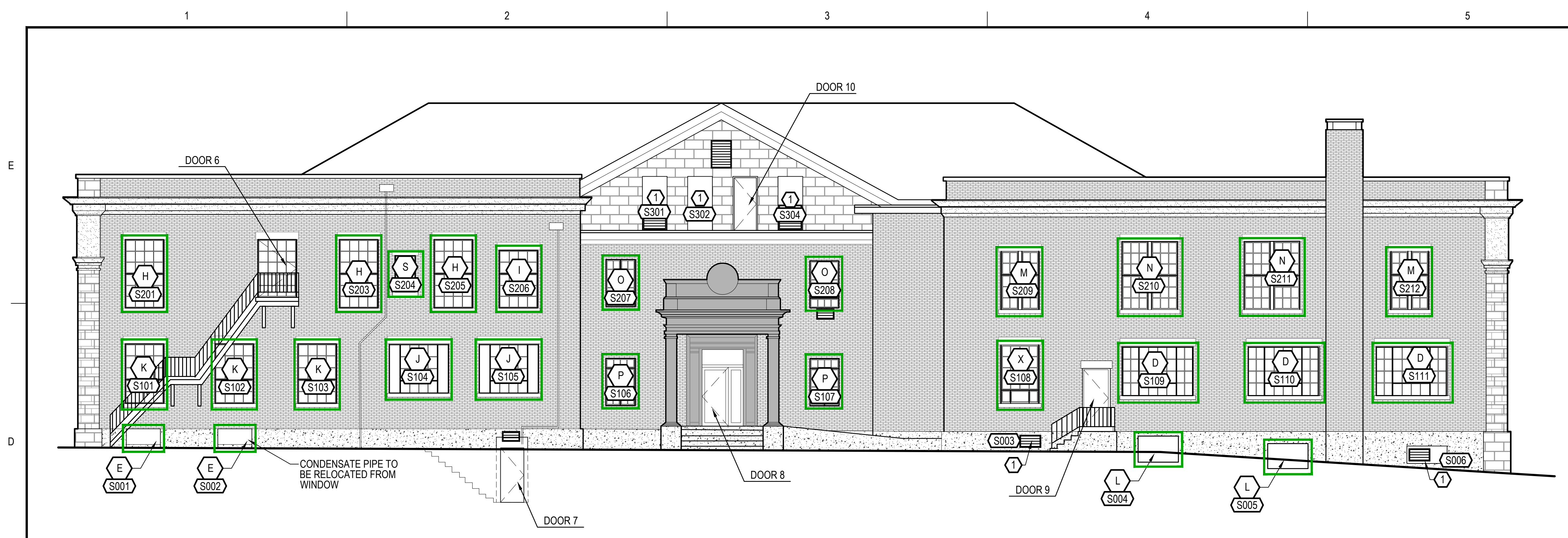


KEY PLAN

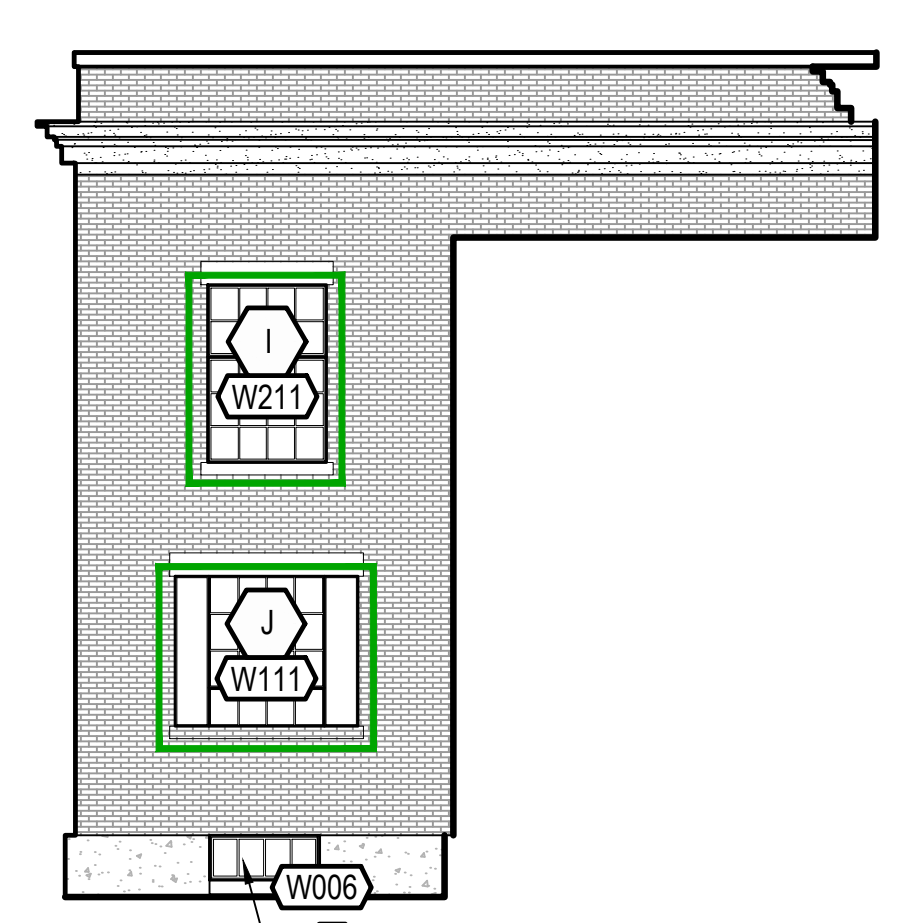


SHEET TITLE  
FENESTRATION  
SCOPE  
ELEVATIONS

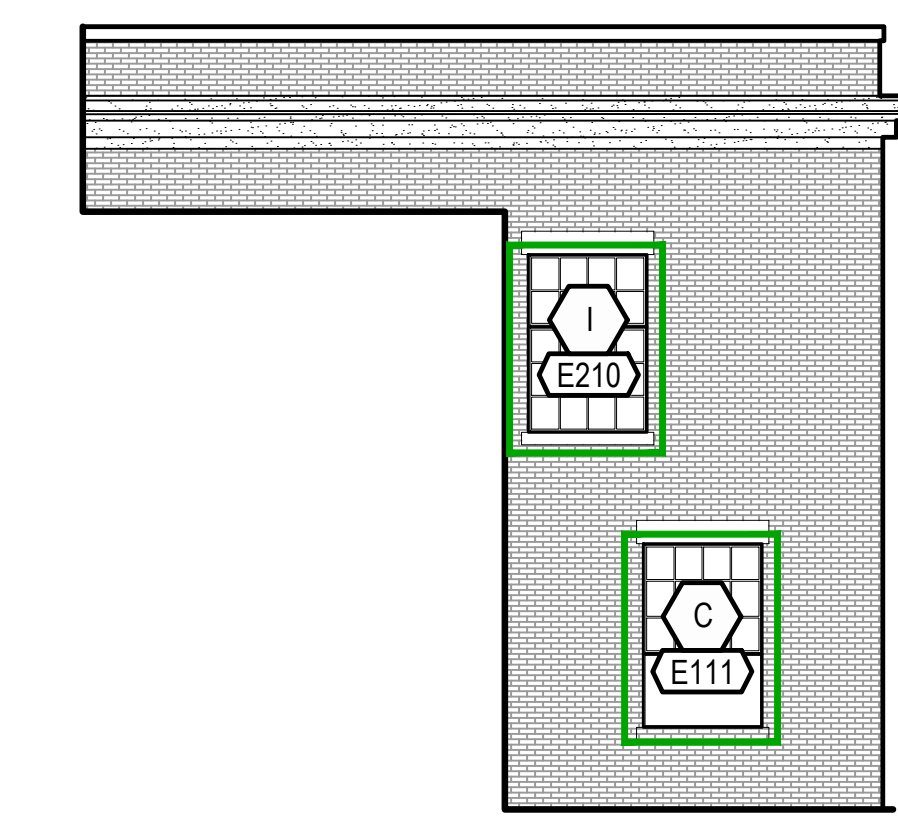
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A203



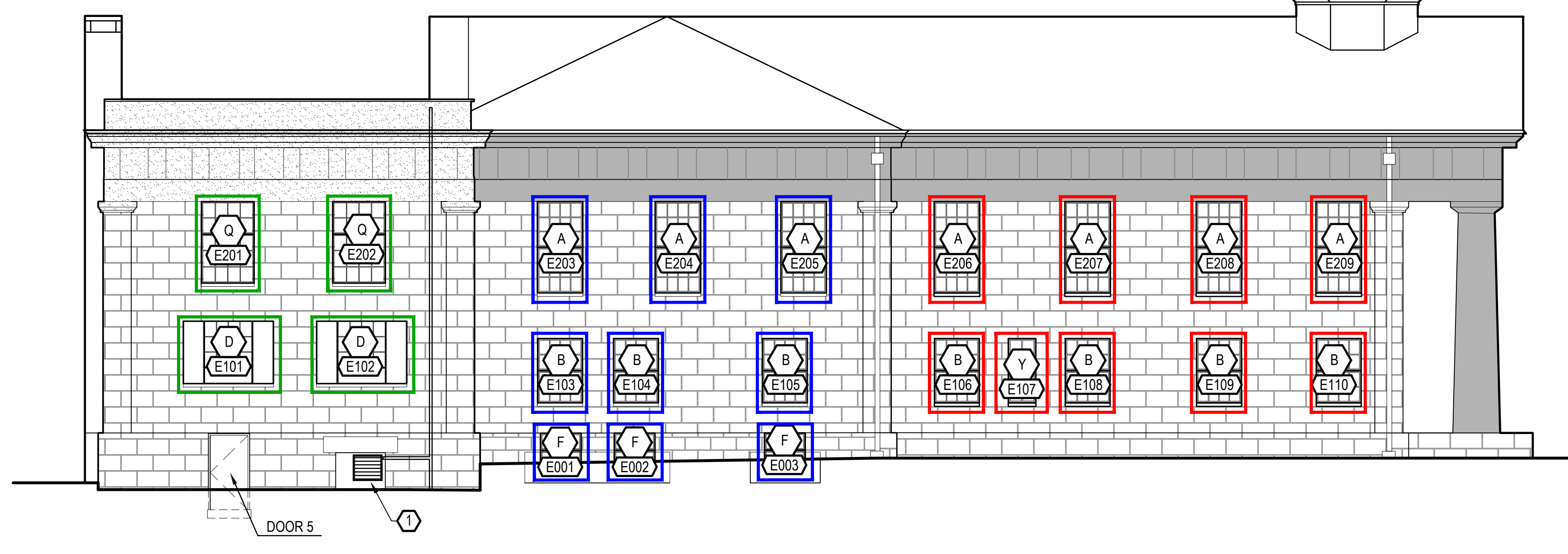
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A204  
SCALE: 1/8"=1'-0"  
**FENESTRATION SCOPE SOUTH ELEVATION**



5  
A204  
SCALE: 1/8"=1'-0"  
**FENESTRATION SCOPE HIDDEN WEST ELEVATION**



6  
A204  
SCALE: 1/8"=1'-0"  
**FENESTRATION SCOPE HIDDEN EAST ELEVATION**



4  
A204  
SCALE: 1/8"=1'-0"  
**FENESTRATION SCOPE EAST ELEVATION**

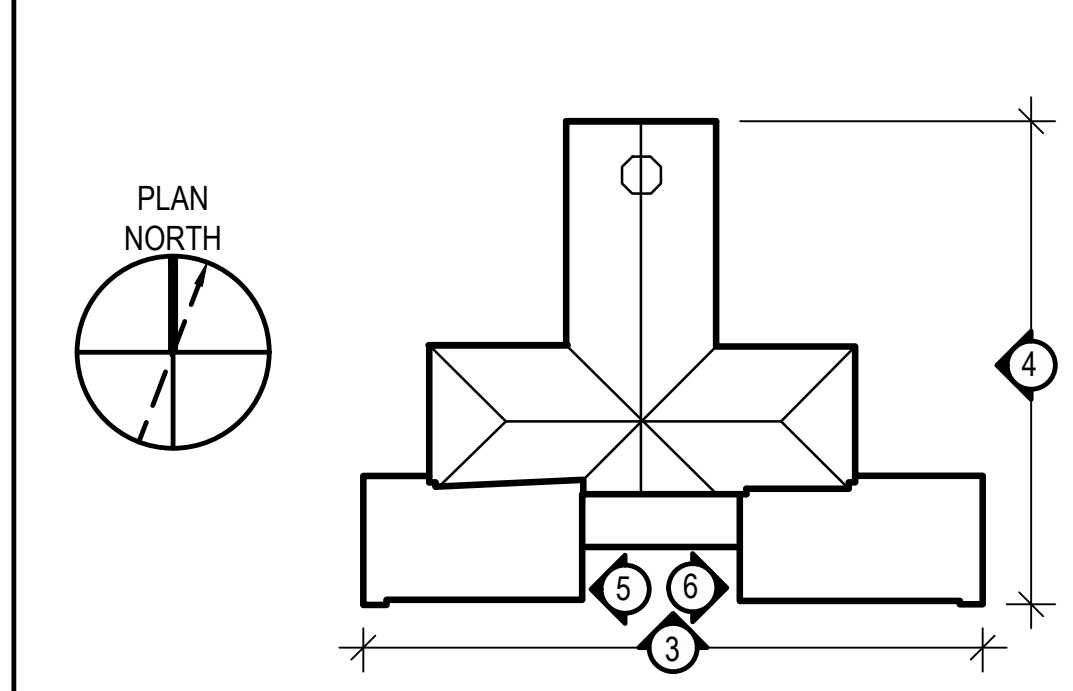
**SHEET NOTES**

- ① DISCONNECT EXISTING CONDUIT AND DUCTS THROUGH WINDOW; REMOVE WOOD WINDOW FRAMES AND SASHES, LOUVERS, AND WOOD TRIM; INSTALL 3" THICK INSULATED METAL PANEL WITH ALUMINUM TRIM; REINSTALL CONDUIT THROUGH NEW CORED HOLES IN PANEL; PROVIDE NEW LOUVER WHERE INDICATED ON THE ELEVATION
- ② NOT USED THIS SHEET.
- ③ NOT USED THIS SHEET.
- ④ NOT USED THIS SHEET.
- ⑤ NOT USED THIS SHEET.

**LEGEND**

- LOUVER; REMOVE AND REPLACE; SIZED APPROXIMATELY AS SHOWN
- GRANITE MASONRY; REFER TO WALL REPAIR SCOPE ELEVATIONS.
- PRECAST CONCRETE; REFER TO WALL REPAIR SCOPE ELEVATIONS.
- WOOD TRIM; REFER TO WALL REPAIR SCOPE ELEVATIONS.
- CONCRETE FOUNDATION; REFER TO WALL REPAIR SCOPE ELEVATIONS
- BRICK MASONRY; REFER TO WALL REPAIR SCOPE ELEVATIONS
- WINDOW TYPE DESIGNATION; REFER TO WINDOW ELEVATIONS
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- SHEET NOTE
- WINDOW SCOPE 1  
BASE BID: RESTORE WOOD WINDOW  
ALTERNATE 1: REPLACE WITH HISTORIC REPLICA ALUMINUM WINDOWS
- WINDOW SCOPE 2  
BASE BID: REPLACE WINDOW WITH HISTORIC REPLICA ALUMINUM WINDOWS  
ALTERNATE 2: RESTORE WOOD WINDOW
- WINDOW SCOPE 3  
BASE BID: REPLACE WINDOW WITH HIGH PERFORMANCE ALUMINUM WINDOW

**KEY PLAN**



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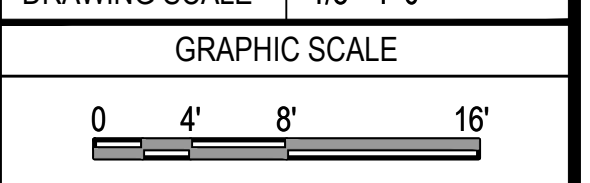
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**EXTERIOR RESTORATION  
BARNSTABLE COUNTY SUPERIOR COURTHOUSE**  
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BARNSTABLE, MA 02630

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COUNTY OF BARNSTABLE REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655

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PROJECT NO.			
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DATE		12/20/24	
DRAWING SCALE		1/8"=1'-0"	



SHEET TITLE

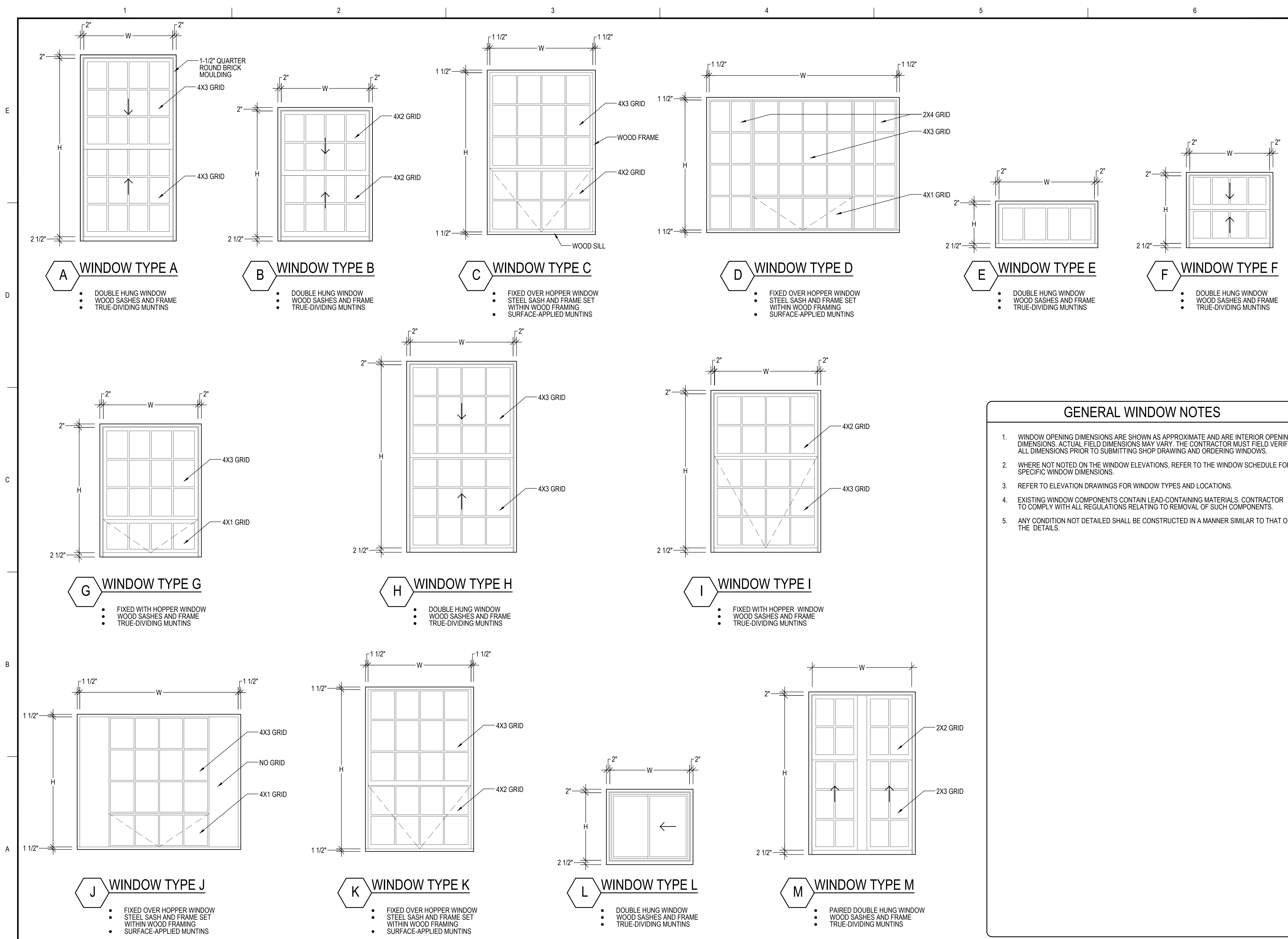
**FENESTRATION SCOPE ELEVATIONS**

DRAWING NO.  
**A203**

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**SCHEMATIC**

PROJECT  
**EXTERIOR RESTORATION**  
**BARNSTABLE COUNTY SUPERIOR COURTHOUSE**  
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 OWNER  
 COUNTY OF BARNSTABLE  
 COUNTY OF BARNSTABLE REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
 8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655



**GENERAL WINDOW NOTES**

- WINDOW OPENING DIMENSIONS ARE SHOWN AS APPROXIMATE AND ARE INTERIOR OPENING DIMENSIONS. ACTUAL FIELD DIMENSIONS MAY VARY. THE CONTRACTOR MUST FIELD VERIFY ALL DIMENSIONS PRIOR TO SUBMITTING SHOP DRAWING AND ORDERING WINDOWS.
- WHERE NOT NOTED ON THE WINDOW ELEVATIONS, REFER TO THE WINDOW SCHEDULE FOR SPECIFIC WINDOW DIMENSIONS.
- REFER TO ELEVATION DRAWINGS FOR WINDOW TYPES AND LOCATIONS.
- EXISTING WINDOW COMPONENTS CONTAIN LEAD-CONTAINING MATERIALS. CONTRACTOR TO COMPLY WITH ALL REGULATIONS RELATING TO REMOVAL OF SUCH COMPONENTS.
- ANY CONDITION NOT DETAILED SHALL BE CONSTRUCTED IN A MANNER SIMILAR TO THAT OF THE DETAILS.

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PROJECT NO.			
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CHECKED BY		BHN	
DATE		12/20/24	
DRAWING SCALE		1/2"=1'-0"	

GRAPHIC SCALE  
 0 1' 2' 4'

SHEET TITLE  
**WINDOW ELEVATIONS**

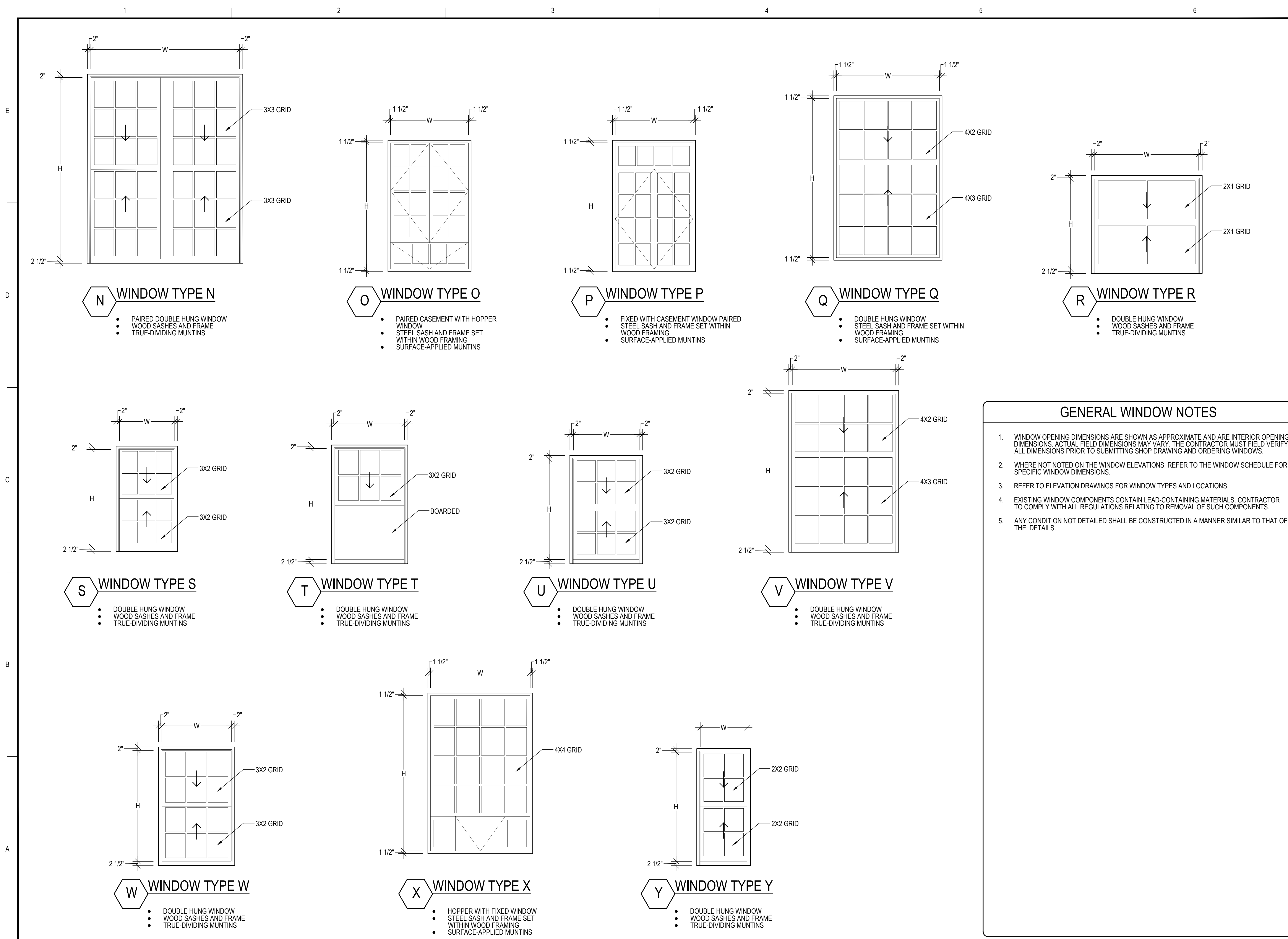
DRAWING NO.  
**A251**

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**SCHEMATIC**

PROJECT  
**EXTERIOR RESTORATION  
 BARNSTABLE COUNTY SUPERIOR COURTHOUSE**  
 3195 MAIN ST  
 BARNSTABLE, MA 02630

OWNER  
 COUNTY OF BARNSTABLE  
 COUNTY OF BARNSTABLE REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
 8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655



**N WINDOW TYPE N**

- PAIRED DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**O WINDOW TYPE O**

- PAIRED CASEMENT WITH HOPPER WINDOW
- STEEL SASH AND FRAME SET WITHIN WOOD FRAMING
- SURFACE-APPLIED MUNTINS

**P WINDOW TYPE P**

- FIXED WITH CASEMENT WINDOW PAIRED
- STEEL SASH AND FRAME SET WITHIN WOOD FRAMING
- SURFACE-APPLIED MUNTINS

**Q WINDOW TYPE Q**

- DOUBLE HUNG WINDOW
- STEEL SASH AND FRAME SET WITHIN WOOD FRAMING
- SURFACE-APPLIED MUNTINS

**R WINDOW TYPE R**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**S WINDOW TYPE S**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**T WINDOW TYPE T**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**U WINDOW TYPE U**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**V WINDOW TYPE V**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**W WINDOW TYPE W**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**X WINDOW TYPE X**

- HOPPER WITH FIXED WINDOW
- STEEL SASH AND FRAME SET WITHIN WOOD FRAMING
- SURFACE-APPLIED MUNTINS

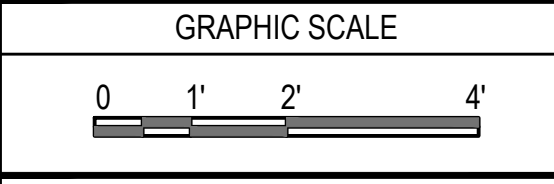
**Y WINDOW TYPE Y**

- DOUBLE HUNG WINDOW
- WOOD SASHES AND FRAME
- TRUE-DIVIDING MUNTINS

**GENERAL WINDOW NOTES**

1. WINDOW OPENING DIMENSIONS ARE SHOWN AS APPROXIMATE AND ARE INTERIOR OPENING DIMENSIONS. ACTUAL FIELD DIMENSIONS MAY VARY. THE CONTRACTOR MUST FIELD VERIFY ALL DIMENSIONS PRIOR TO SUBMITTING SHOP DRAWING AND ORDERING WINDOWS.
2. WHERE NOT NOTED ON THE WINDOW ELEVATIONS, REFER TO THE WINDOW SCHEDULE FOR SPECIFIC WINDOW DIMENSIONS.
3. REFER TO ELEVATION DRAWINGS FOR WINDOW TYPES AND LOCATIONS.
4. EXISTING WINDOW COMPONENTS CONTAIN LEAD-CONTAINING MATERIALS. CONTRACTOR TO COMPLY WITH ALL REGULATIONS RELATING TO REMOVAL OF SUCH COMPONENTS.
5. ANY CONDITION NOT DETAILED SHALL BE CONSTRUCTED IN A MANNER SIMILAR TO THAT OF THE DETAILS.

NO.	DATE	DESCRIPTION	BY
PROJECT NO.			
CADD FILE		843680 A200s	
DESIGNED BY		SWWW/RFM	
DRAWN BY		SWWW/JEN	
CHECKED BY		BHN	
DATE		12/20/24	
DRAWING SCALE		1/2"=1'-0"	



SHEET TITLE

**WINDOW ELEVATIONS**

DRAWING NO.

**A252**

Window Type	Window Designation	Room	Width (in)	Height (in)	Existing Material	Configuration	Square Footage	Interior Finishes				Stool		Wood Replacement Quantities for Restoration Scope Only							Notes		
								Left Jamb	Right Jamb	Head	Sill	Height	Depth	Cracked Glass	Roll Shades?	Replace Deteriorated Sill	Replace Deteriorated Right Jamb Trim	Replace Deteriorated Left Jamb Trim	Replace Deteriorated Jamb Frame	Replace Deteriorated Sash Bottom Rail		Replace Muntin (LF)	
F	E001	1893 Men's Restroom	46	39	Wood	Double Hung	12.46	T	T	P (sloped)	Sc	63	17.5	1									(15), (26)
F	E002	1893 Men's Restroom	46	39	Wood	Double Hung	12.46	T	T	P (sloped)	S	63	17.5										(15)
F	E003	1893 Women's Restroom	46	39	Wood	Double Hung	12.46	T	T	P (sloped)	S	63	17										(15)
D	E101	1925	67	82	Steel	Fixed w/ Hopper	38.15	P	P (angled)	P	M	55	14										
D	E102	1925	67	82	Steel	Fixed w/ Hopper	38.15	P	P	P	M	55	14										(23)
B	E103	1893 Meeting Room	56	67	Wood	Double Hung	26.06	P/ WP	P/ WP	P/ WP	M	38"	12"										(20)
B	E104	1893 Meeting Room	56	67	Wood	Double Hung	26.06	P/ WP	P/ WP	P/ WP	M	38"	12"										(20)
B	E105	1893 Meeting Room	56	67	Wood	Double Hung	26.06	P/ WP	P/ WP	P/ WP	Mc	38"	12"										(3) (20)
B	E106	1834	58	65	Wood	Double Hung	26.18	Gyp/ P	Gyp/ P	Gyp/ P	M	38"	9"										(3) (13)
Y	E107	1834 Small Office	27	63	Wood	Double Hung	11.81	Gyp/ P	Gyp/ P	Gyp/ P	M	35"	11.5"										(3) (14)
B	E108	1834 Offices	58	65	Wood	Double Hung	26.18	Gyp/ P	Gyp/ P	Gyp/ P	M	38"	9"										(3) (13)
B	E109	1834 Offices	58	65	Wood	Double Hung	26.18	Gyp/ P	Gyp/ P	Gyp/ P	M	31"	14"										(3) (23)
B	E110	1834 Stair to Basement	58	65	Wood	Double Hung	26.18	Brick	Brick	Brick	No stool												(28)
C	E111	1925 Offices	53	85	Steel	Fixed w/ Hopper	31.28	P/ WP	P/ WP	P/ WP	Mc	35"	6"										
Q	E201	1925 Jury Room	57	78	Wood	Double Hung	30.88	P (angled)	P (angled)	P	M	30"	10"										
Q	E202	1925 Jury Room	57	78	Wood	Double Hung	30.88	P (angled)	P (angled)	P	M	30"	10"	1									(3)
A	E203	1906 Lock-Up	56	96	Wood	Double Hung	37.33	P	P	P	W	30"	11"	1									(24)
A	E204	1906 Lock-Up	56	96	Wood	Double Hung	37.33	P	P	P	W	30"	11"										
A	E205	1906 Lock-Up Office	57	96	Wood	Double Hung	38.00	P	P	P	W/ P	31"	15"										(3) (25)
A	E206	1834	58	92	Wood	Double Hung	37.06	P/ WP	Arched Wood	P/ WP	Wood	19	10.5	1									(13)
A	E207	1834	55	92	Wood	Double Hung	35.14	P/ WP	Arched Wood	P/ WP	Wood	34	10.5										
A	E208	1834	57	92	Wood	Double Hung	36.42	P/ WP	Arched Wood	P/ WP	Wood	20	10.5										(13)
A	E209	1834	57	92	Wood	Double Hung	36.42	P/ WP	Arched Wood	P/ WP	Wood	75	0										
I	E210	Office Next to Jury	57	78	Wood	Double Hung	30.88	P	P	P	M	28"	5"										(3), (8)
L	N001	1925			Aluminum	Sliding	0.00	C	C	C	C (angled)												
F	N002	1893 Women's Restroom	46	39	Wood	Sliding	12.46	T	T	P (angled)	S	63"	21"										(15)
F	N003	Basement Office	46	39	Wood	Double Hung	12.46	P	P	PI	PI# (sloped)												(27)
F	N004	Basement Office	46	39	Wood	Double Hung	12.46	P	P	P	PI (sloped)												
F	N005	Basement Office	46	39	Wood	Double Hung	12.46	P	P	P	P (sloped)												(27)
G	N101	1925	54	67	Steel	Fixed w/ Hopper	25.13	P (angled)	P	P	M	55"	13"										
G	N102	1925	53	35	Steel	Fixed w/ Hopper	12.88	P	P (angled)	P	Mc	100"	18"										
G	N103	1925	50	67	Steel	Fixed w/ Hopper	23.26	P/ WP	P/ WP	P/ WP	Mc	55"	13"										
G	N104	1925	54	67	Steel	Fixed w/ Hopper	25.13	P/ WP	P/ WP	P/ WP	Mc	55"	13"										(3)
B	N105	1893 Meeting Room	56	67	Wood	Double Hung	26.06	P/ WP	P/ WP	P/ WP	M	38"	12"										
B	N106	1893 Office	56	67	Wood	Double Hung	26.06	P/ WP	P/ WP	P/ WP	M	38"	12"										
B	N107	1893 Office	56	67	Wood	Double Hung	26.06	P/ WP	P/ WP	P/ WP	M	38"	12"										(3), (20)
B	N108	1906 Third Session Courtroom	56	95	Wood	Double Hung	36.94	P	P	P	M	30"	10"										(3)
B	N109	1906 Third Session Courtroom	56	95	Wood	Double Hung	36.94	P	P	P	M	30"	10"										
B	N110	1906 Third Session Courtroom	56	95	Wood	Double Hung	36.94	P	P	P	M	30"	10"										
C	N111	1925 Office	54	85	Steel	Fixed w/ Hopper (33" h)	31.88	P/ WP	P/ WP	P/ WP	M	35"	18"										
C	N112	1925 Office	54	85	Steel	Fixed w/ Hopper (33" h)	31.88	P/ WP	P/ WP	P/ WP	M	35"	18"										
V	N201	1925 Jury Room	57	78	Wood	Double Hung	30.88	P	P	P	M	31"	10"										
	N202	1925 Jury Room	57	78	DOOR OPENING FOR DOOR 1; WINDOW DESIGNATION NOT USED																		
A	N203	1906 Office in Lock Up	57	94	Wood	Double Hung	37.21	P	P	P	W	30"	11"										
A	N204	1906 Lock Up	57	94	Wood	Double Hung	37.21	P	P	P	W	30"	11"										(22)
U	N205	1906 Lock Up	38	58	Wood	Double Hung	15.31	P	P	P	W	66"	11"										(22)
A	N206	1906 Lock Up	57	96	Wood	Double Hung	38.00	P	P	P	W	30"	11"										(3), (22)
A	N207	1906 Judges Entrance	56	96	Wood	Double Hung	37.33	P/ WP	P/ WP	P/ WP	W	30"	11"										
A	N208	1906 Judges Chamber	50	95	Wood	Double Hung	32.99	P/ WP	P/ WP	P/ WP	W	31"	11"	1									
A	N209	1906 Judges Chamber	56	95	Wood	Double Hung	36.94	P/ WP	P/ WP	P/ WP	W	31"	11"	1									(3)
A	N210	1906 Judges Chamber	56	95	Wood	Double Hung	36.94	P/ WP	P/ WP	P/ WP	W	31"	11"	1									


**WINDOW SCHEDULE EAST AND NORTH ELEVATIONS**  
 1  
 A253 SCALE: N/A

**LEGEND**

- P PAINTED PLASTER
- P\* PAINT DEFECT
- PI DAMAGED PAINT
- P# DAMAGED PLASTER; PATCH AND REPAIR
- G GYPSUM
- W WOOD
- S SLATE
- PL PARTICLE LAMINATE BOARD
- WP WALLPAPER
- M MARBLE
- Mc MARBLE; CRACKED; REPLACE MARBLE STOOL
- T TILE
- SPI SPRAY FOAM INSULATION
- C CONCRETE
- Cc CONCRETE; CRACKED; ROUT AND SEAL

**WINDOW SCHEDULE NOTES**

1. NOT USED.
2. FAN UNIT BELOW WINDOW; REMOVE AND REINSTALL TO PERFORM WORK.
3. RADIATOR BELOW WINDOW; PROTECT.
4. REMOVE AND REPLACE TWO (2) COURSES OF SPLINE CEILING TO PERFORM WORK.
5. NOT USED.
6. NOT USED.
7. NOT USED.
8. AIR CONDITIONING UNIT IN WINDOW; COORDINATE WITH OWNER FOR REMOVAL.
9. ONE (1) PREVIOUSLY REPAIRED GLASS PANE; REPLACE AS PART OF RESTORATION SCOPE.
10. NOT USED.
11. MISSING GLASS PANE TO BE REPLACED AS PART OF RESTORATION SCOPE.
12. NOT USED.
13. NOT OPERABLE; MODIFY SASHES FOR SMOOTH OPERABILITY AS PART OF RESTORATION SCOPE.
14. UPPER SASH DISCONNECTED; RECONNECT BALANCES AS PART OF RESTORATION SCOPE.
15. PROVIDE OBSCURED GLAZING.
16. WINDOW SPLIT IN CENTER BY INTERIOR PARTITION WALL.
17. GLASS PANE REMOVED FOR PIPE/CONDUIT; DISCONNECT PIPE/CONDUIT AND RELOCATE.
18. REPLACE SHEET METAL WEATHERSTRIPPING AT SILL AS PART OF RESTORATION WORK.
19. NOT USED.
20. DESK IN FRONT OF WINDOW; OWNER TO TEMPORARILY RELOCATE TO PERFORM WORK.
21. NOT USED.
22. SECURITY SCREEN INSTALLED ON INTERIOR; REMOVE AND REINSTALL TO PERFORM WORK.
23. WINDOW DIFFICULT TO ACCESS; CONSIDER REPLACEMENT WITH FIXED WINDOW.
24. REPLACE BALANCE ROPES AND RECONNECT BALANCES AS PART OF RESTORATION SCOPE.
25. MISSING LATCH; REPLACE BRASS CAM LATCH AS PART OF RESTORATION SCOPE.
26. CONDENSATE LINES THROUGH WINDOW; TEMPORARILY DISCONNECT AND RELOCATE.
27. VENT INSTALLED AT REMOVED GLASS PANE; TEMPORARILY DISCONNECT AND RELOCATE.
28. NO INTERIOR FINISHES.



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**SCHEMATIC**

PROJECT  
**EXTERIOR RESTORATION  
 BARNSTABLE COUNTY SUPERIOR COURTHOUSE**  
 3195 MAIN ST  
 BARNSTABLE, MA 02630  
 OWNER

C/O BARNSTABLE COUNTY REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
 8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655

NO.	DATE	DESCRIPTION	BY
PROJECT NO.			
		CADD FILE	843680 A200s
		DESIGNED BY	SWWW/RFM
		DRAWN BY	SWWW/JEN
		CHECKED BY	BHN
		DATE	12/20/24
		DRAWING SCALE	N/A

GRAPHIC SCALE

SHEET TITLE

**WINDOW SCHEDULE**

DRAWING NO.  
**A253**

Window Type	Window Designation	Room	Width (in)	Height (in)	Existing Material	Configuration	Square Footage	Interior Finishes				Stool		Cracked Glass	Roll Shades?	Wood Replacement Quantities for Restoration Scope Only					Notes		
								Left Jamb	Right Jamb	Head	Sill	Height	Depth			Replace Deteriorated Sill	Replace Deteriorated Right Jamb Trim	Replace Deteriorated Left Jamb Trim	Replace Deteriorated Jamb Frame	Replace Deteriorated Sash Bottom Rail		Replace Muntin (LF)	
E	S001	1925 Storage	54	21	Wood	Fixed	7.88	C	C	Cc	C	85"	9"			Y							
E	S002	1925 Storage	54	21	Wood	Fixed	7.88	C	C	C	C	85"	9"	1									(2), (26)
L	S003	1925 Office	60	52	WINDOW INFILLED WITH PLYWOOD AND LOUVER; REPLACE WITH INSULATED METAL PANEL																		
L	S004	1925 Office	58	34	Aluminum	Sliding	13.69	W	W	W	W	77"	15"		Shades	Y							
L	S005	1925 Office	49	32	Aluminum	Sliding	10.89	W	W	W	W	78"	24"	1	Blinds								
L	S006	1925 N/A	58	34	WINDOW INFILLED HALF WITH LOUVER, HALF WITH TRANSLUCENT PANEL																		
K	S101	1925 Office	54	84	Steel	Fixed w/ Hopper	31.50	P/WP	P/WP	P/WP	M	35"	11"		Blinds								(3)
K	S102	1925 Office	54	84	Steel	Fixed w/ Hopper	31.50	P/WP	P/WP	P/WP	M	35"	11"		Blinds								(3)
K	S103	1925 Office	54	84	Steel	Fixed w/ Hopper	31.50	P/WP	P/WP	P/WP	Mc	35"	11"		Blinds								(3), (4)
J	S104	1925 Office	84	67	Steel	Fixed w/ Hopper	39.08	P/WP	P/WP	P/WP	M	35"	12"		Blinds								(3)
J	S105	1925 Office	84	67	Steel	Fixed w/ Hopper	39.08	P/WP (angled)	P/WP (angled)	P/WP	Mc	35"	12"	1	Blinds								
P	S106	1971 Entrance Lobby	40	64	Steel	Fixed w/ Hopper	17.78	P*	P*	P*	M	36"	8"					Y					
P	S107	1971 Entrance Lobby	40	64	Steel	Fixed w/ Hopper	17.78	P*	P*	P*	M	36"	8"										
X	S108	1925 Office	54	85	Steel	Fixed w/ Hopper	31.88	P/WP	P/WP	P/WP	M	36"	6"	1	Shades								
D	S109	1925	106	67	Steel	Fixed w/ Hopper (50"x16")	49.32	P/WP (angled)	P/WP (angled)	P/WP	M	55"	12"	1				Y					(3)
D	S110	1925	106	67	Steel	Fixed w/ Hopper (50"x16")	49.32	P/WP (angled)	P/WP (angled)	P/WP	M	55"	12"	1	Roller Shades								
D	S111	1925	106	67	Steel	Fixed w/ Hopper (50"x16")	49.32	P/WP (angled)	P/WP (angled)	P/WP	M	55"	12"	1	Roller Shades								(3)
H	S201	1925 Courtroom	57	94	Wood	Double Hung	37.21	P/WP	P/WP	P/WP	M	28"	5"		Blinds + Drapes								
H	S202	1925 Courtroom Emergency Exit Door	CONVERTED TO EGRESS DOOR (DOOR 6)																				
H	S203	1925 Courtroom	57	94	Wood	Double Hung	37.21	P	PI	P	M	28.5"	5"	4	Blinds							1	(8), (9)
S	S204	1925 Bathroom	30	48	Wood	Double Hung	10.00	P/WP	P/WP	P/WP	M	60"	6"	1									
H	S205	1925 Office	57	79	Wood	Double Hung	31.27	P	P	P	Mc	29"	5"	2	Blinds	Y							(11)
I	S206	1925 Office	57	79	Wood	Double Hung	31.27	P	P	P	M	29"	5"		Blinds	Y		Y,B					
O	S207	1971	40	64	Steel	Fixed w/ Hopper	17.78	P/WP	P/WP	P/WP	M	24"	7"										(13)
O	S208	1971	41	64	Steel	Paired Casement w/ Hopper (14" h)	18.22	P/WP	P/WP	P/WP	Mc	24"	7"		Blinds								(3)
M	S209	1925 Bathroom on Office Jury Area	84	93	Wood	Paired Double Hung	54.25	P/T	P/T	P	M	28"	4.5"										(14), (15)
N	S210	1925 Jury Deliberation	84	93	Wood	Paired Double Hung	54.25	P	P	P	M	30"	5"			Y							
N	S211	1925 Jury Deliberation	84	93	Wood	Paired Double Hung	54.25	P	P	P	M	30"	5"			Y		Y,B					(15)
M	S212	1925 Jury Bathrooms (Split)	84	93	Wood	Double Hung	54.25	P/T	P/T	P	M	29"	5"	1	Blinds								(16)
	S301	Attic	40	64	WINDOW TO BE INFILLED WITH INSULATED METAL PANEL																		
	S302	Attic	40	64	WINDOW TO BE INFILLED WITH INSULATED METAL PANEL																		
	S303	Attic	40	64	CONVERTED TO ROOF ACCESS DOOR (DOOR 10)																		
	S304	Attic	40	64	WINDOW TO BE INFILLED WITH INSULATED METAL PANEL																		
R	W001		60	52	Wood	Double Hung	21.67	P	P	P (angled)	P	55"	22"										(23)
R	W002		60	52	Wood	Double Hung	21.67	P	P	P (angled)	P	55"	22"			Y							(23)
	W003		60	52	WINDOW INFILLED WITH PANEL WITH PENETRATIONS AND SMALLER PLEXIGLASS WINDOW; REPLACE WITH INSULATED METAL PANEL																		
	W004		58	34	WINDOW INFILLED WITH PANEL AND LOUVER WITH PENETRATIONS; REPLACE WITH INSULATED METAL PANEL																		
	W005		49	32	WINDOW INFILLED WITH PLYWOOD; REPLACE WITH INSULATED METAL PANEL																		
	W006	Storage	60	20	WINDOW TO BE INFILLED WITH INSULATED METAL PANEL																		
B	W101	1834 Courtroom	57	64	Wood	Double Hung	25.33	P	P	P	W/P	37"	8"										(3), (18)
B	W102	1834 Courtroom	57	66	Wood	Double Hung	26.13	P	P	P	W/P	37"	8"										(3)
B	W103	1834 Courtroom	57	66	Wood	Double Hung	26.13	P	P	P	W/P	37"	8"										(3)
B	W104	1834 Courtroom	57	65	Wood	Double Hung	25.73	P	P	P	W/P	37"	8"					Y,B					(3)
B	W105	1906 Third Session Courtroom	57	65	Wood	Double Hung	25.73	P	P	P	W/P	36"	11"		Roller Shades	Y							(3)
B	W106	1906 Third Session Courtroom	57	65	Wood	Double Hung	25.73	P	P	P	W/P	36"	11"		Roller Shades								(3)
B	W107	1906 Small Stacks	57	64	Wood	Double Hung	25.33	P	P	P	W/P	36"	11"										(3)
C	W108	1925 Office	53	85	Steel	Fixed w/ Hopper	31.28	P/WP	P/WP	P/WP	Mc	34"	13"		Blinds			Y					(3)
C	W109	1925 Office	53	85	Steel	Fixed w/ Hopper	31.28	P/WP	P/WP	P/WP	M	34"	14"		Blinds								(3)
C	W110	1925 Office	53	85	Steel	Fixed w/ Hopper	31.28	P/WP	P/WP	P/WP	M	34"	14"		Blinds								(3)
J	W111	1925 Office	80	67	Steel	Fixed w/ Hopper (50"x15")	37.22	P/WP (angled)	P/WP (angled)	P/WP	M	54"	11"		Blinds								
A	W201	1834 Office	57	87	Wood	Double Hung	34.44	P/WP	P/WP	P/WP	M	31"	15"										(3), (8)
A	W202	1834	55	92	Wood	Double Hung	35.14	P/WP	Arched Wood	P/WP	Wood	34	10.5	1	Drapes								
A	W203	1834	55	92	Wood	Double Hung	35.14	P/WP	Arched Wood	P/WP	Wood	34	10.5	1	Drapes								
A	W204	1834	55	92	Wood	Double Hung	35.14	P/WP	Arched Wood	P/WP	Wood	34	10.5	1	Drapes								
A	W205	1906 Judges Chamber	56	95	Wood	Double Hung	36.94	P	PI	P	M	30"	10"	1	Drapes								(3)
A	W206	1906 Judges Library	56	95	Wood	Double Hung	36.94	P	PI	P	M	30"	10"	1	Drapes								(3)
A	W207	1906 Judges Chamber	56	95	Wood	Double Hung	36.94	P	PI	P	M	30"	10"	1	Drapes			Y					(3)
A	W208	1925 Second Session Courtroom	56	95	Wood	Double Hung	36.94	P/WP	P/WP	P/WP	Mc				Drapes + Blinds								
A	W209	1925 Second Session Courtroom	56	95	Wood	Double Hung	36.94	P/WP	P/WP	P/WP	M				Drapes + Blinds			Y					
A	W210	1925 Second Session Courtroom	56	95	Wood	Double Hung	36.94	P/WP	P/WP	P/WP	M				Drapes + Blinds								
I	W211	1925 Jury Room Office	57	79	Wood	Double Hung	31.27	P	PI	P	M	28"	5"	1	Blinds							Y	(3)

### LEGEND

- P PAINTED PLASTER
- P\* PAINT DEFECT
- PI DAMAGED PAINT
- P# DAMAGED PLASTER; PATCH AND REPAIR
- G GYPSUM
- W WOOD
- S SLATE
- PL PARTICLE LAMINATE BOARD
- WP WALLPAPER
- M MARBLE
- Mc MARBLE; CRACKED; REPLACE MARBLE STOOL
- T TILE
- SPI SPRAY FOAM INSULATION
- C CONCRETE
- Cc CONCRETE; CRACKED; ROUT AND SEAL

### WINDOW SCHEDULE NOTES

1. NOT USED.
2. FAN UNIT BELOW WINDOW; REMOVE AND REINSTALL TO PERFORM WORK.
3. RADIATOR BELOW WINDOW; PROTECT.
4. REMOVE AND REPLACE TWO (2) COURSES OF SPLINE CEILING TO PERFORM WORK.
5. NOT USED.
6. NOT USED.
7. NOT USED.
8. AIR CONDITIONING UNIT IN WINDOW; COORDINATE WITH OWNER FOR REMOVAL.
9. ONE (1) PREVIOUSLY REPAIRED GLASS PANE; REPLACE AS PART OF RESTORATION SCOPE.
10. NOT USED.
11. MISSING GLASS PANE TO BE REPLACED AS PART OF RESTORATION SCOPE.
12. NOT USED.
13. NOT OPERABLE; MODIFY SASHES FOR SMOOTH OPERABILITY AS PART OF RESTORATION SCOPE.
14. UPPER SASH DISCONNECTED; RECONNECT BALANCES AS PART OF RESTORATION SCOPE.
15. PROVIDE OBSCURED GLAZING.
16. WINDOW SPLIT IN CENTER BY INTERIOR PARTITION WALL.
17. GLASS PANE REMOVED FOR PIPE/CONDUIT; DISCONNECT PIPE/CONDUIT AND RELOCATE.
18. REPLACE SHEET METAL WEATHERSTRIPPING AT SILL AS PART OF RESTORATION WORK.
19. NOT USED.
20. DESK IN FRONT OF WINDOW; OWNER TO TEMPORARILY RELOCATE TO PERFORM WORK.
21. NOT USED.
22. SECURITY SCREEN INSTALLED ON INTERIOR; REMOVE AND REINSTALL TO PERFORM WORK.
23. WINDOW DIFFICULT TO ACCESS; CONSIDER REPLACEMENT WITH FIXED WINDOW.
24. REPLACE BALANCE ROPES AND RECONNECT BALANCES AS PART OF RESTORATION SCOPE.
25. MISSING LATCH; REPLACE BRASS CAM LATCH AS PART OF RESTORATION SCOPE.
26. CONDENSATE LINES THROUGH WINDOW; TEMPORARILY DISCONNECT AND RELOCATE.
27. VENT INSTALLED AT REMOVED GLASS PANE; TEMPORARILY DISCONNECT AND RELOCATE.
28. NO INTERIOR FINISHES.



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## SCHEMATIC

PROJECT  
**EXTERIOR RESTORATION**  
**BARNSTABLE COUNTY SUPERIOR COURTHOUSE**  
 3195 MAIN ST  
**BARNSTABLE, MA 02630**  
 OWNER  
 COUNTY OF BARNSTABLE  
 COUNTY OF BARNSTABLE REGIONAL GOVERNMENT OF CAPE COD AND CLEARPATH ADVISORS  
 8 WEST BAY ROAD, SUITE A, OSTERVILLE, MA 02655

NO.	DATE	DESCRIPTION	BY
PROJECT NO.			
		CADD FILE	843680 A200s
		DESIGNED BY	SWWW/RFM
		DRAWN BY	SWWW/JEN
		CHECKED BY	BHN
		DATE	12/20/24
		DRAWING SCALE	N/A

GRAPHIC SCALE

SHEET TITLE

## WINDOW SCHEDULE

DRAWING NO.

A254

2  
A254  
WINDOW SCHEDULE  
SOUTH AND WEST ELEVATIONS  
SCALE: N/A

**APPENDIX B – HAZARDOUS MATERIALS REPORT**

REPORT TO

**GALE ASSOCIATES INC.**

October 21, 2024

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**LIMITED HAZARDOUS BUILDING MATERIALS INSPECTION**  
**BARNSTABLE SUPERIOR COURT BUILDING**  
**3195 MAIN STREET**  
**BARNSTABLE, BARNSTABLE COUNTY, MASSACHUSETTS**



Submitted by:

*dave gorden*

Dave Gorden (AI-900459)  
Certificate # 24-5444-106-251190



PEER CONSULTANTS, P.C.  
25 MALL ROAD, SUITE 206  
BURLINGTON, MA 01803  
781.238.8880

Project Number: 8503

## 1. INTRODUCTION

PEER Consultants, P.C. (PEER) [Asbestos Consulting Service Provider Certificate, AF66] conducted a limited, non-destructive asbestos in building materials inspection; and a limited lead (Pb) in paint/coating inspection (together, the "Scope"), during the Investigation Phase, and related to the proposed Restoration Evaluation and Associated Work (the "Work") at the Barnstable Superior Court building (the "Building"), 3195 Main Street, Barnstable, Barnstable County, Massachusetts (the "Property").

The Scope was conducted on the following date: September 30, 2024 by MA Licensed Asbestos Inspector/Management Planner Dave Gorden [PEER Consultants, 25 Mall Road, Suite 206, Burlington, MA 01803; 781-238-8880] in general accordance with PEER's Proposal to Gale Associates Inc. (the "Client"), dated June 17, 2024.

Where accessible on the dates of the Scope, the interior and exterior building components associated with the Work were inspected, and homogeneous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. The Building was "in use" and occupied during the period of the Scope. Although a reasonable effort was made to inspect accessible suspect ACM associated with the Scope, additional suspect but un-sampled building materials may be located in inaccessible and/or concealed and/or unsafe areas on the interior (or exterior) of the Building, and also may be located in other areas of the interior (or exterior) of the Building not assessed under this limited Scope, and/or not anticipated to be included in the Work. Suspect ACM samples were collected in general accordance with the sampling protocols outlined in United States Environmental Protection Agency (EPA) Regulation 40 Code of Federal Regulations (CFR) Part 763 Subpart E 763.86, known as the Asbestos Hazard Emergency Response Act (AHERA) and 454 CMR 28.00. Suspect ACM samples were delivered to an accredited laboratory for analysis by Polarized Light Microscopy (PLM).

Please note that according to "Final Amendments to 310 CMR 7.15 U Asbestos, dated 7/12/19", the owner/operator of a facility or facility component that contains suspect (asbestos containing material) {ACM} shall, prior to conducting any demolition or renovation, employ or engage an asbestos inspector to thoroughly inspect the facility or facility component, or those parts thereof where the demolition or renovation will occur, to identify the presence, location, amount and condition of any ACM or suspect ACM and to prepare a written asbestos evaluation report. The evaluation shall identify and assess suspect ACM located in all areas that will be breached or otherwise affected by demolition or renovation activities, including, but not limited to wall cavities, areas above ceilings and under/between multiple layers of flooring.

In consideration of this information, PEER recommends that a comparison of sampled and analyzed building materials included in PEER's limited Scope be reviewed against the proposed building materials, which may be impacted by the Work, and if necessary, in coordination with other trades, additional samples of building materials (i.e., a thorough inspection), including irreparable destructive sampling of building materials, be collected, and analyzed for asbestos, prior to any site work.

The Massachusetts Health and Human Services Database (the "Database") for 'Lead Safe Homes' was searched as of September 30, 2024. This Database (Lead Safe Homes 1.0) is no longer updated however it may indicate whether an address has been inspected for lead, has had any lead hazards, or has a letter of compliance (105 CMR 460.00). The address for the Building (3195 Main Street, Barnstable, MA) **was not listed** in this database.

The Massachusetts Childhood Lead Poisoning Prevention Program's Lead Safe Homes 2.0 database was also searched as of September 30, 2024 for lead inspection reports and compliance documents for the Building (3195 Main Street, Barnstable, MA), and the database reported "no documents found".

The Occupational Safety and Health Administration (OSHA) 29 CFR 1926.62 Subpart D, Lead, applies to all construction work where an employee may be occupationally exposed to lead. All construction work excluded from coverage in the general industry standard for lead by 29 CFR 1910.1025(a)(2) is covered by this standard (OSHA 29 CFR 1926.62 Subpart D, Lead). Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. Construction work includes but is not limited to the following: Demolition or salvage of structures where lead or materials containing lead are present; Removal or encapsulation of materials containing lead; New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead; Installation of products containing lead; Lead contamination/emergency cleanup; Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed, and Maintenance operations associated with the construction activities described in this paragraph.

The employer shall include lead in the program established to comply with the Hazard Communication Standard (HCS) (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of lead and safety data sheets, and is trained in accordance with the provisions of HCS. Where lead is present, until the employer performs an employee exposure assessment and documents that the employee performing any of the listed tasks is not exposed above the permissible exposure limit (PEL), the employer shall treat the employee as if the employee were exposed above the PEL.

*Project Objective:*

PEER understands that this limited hazardous building materials inspection was requested by the Facility Owner/Operator of the Barnstable Superior Court Building to gather information on the potential for the presence or absence of hazardous building materials related to the Work at the existing Building on the Property, and in order to satisfy the requirements of the USEPA Regulation 40 CFR Part 61, Subpart M, National Emission Standards for Hazardous Air Pollutants (NESHAP).

The objective of this limited hazardous building material inspection was to inspect readily accessible constructs, finishes, and other building materials that may be affected by the proposed Work at the Building and that may contain asbestos or that may contain metals in paint.

## **2. GENERAL BUILDING INFORMATION**

PEER understands that according to the public notice of designer selection and supporting documents that the following has been documented about the Building.

### **1831-32 Building**

The building is rectangular in plan, two stories tall with a gable roof, designed in the Greek Revival style. The Greek Doric portico with four fluted columns supporting the triangular pediment faces the street. The entablature is composed of a cornice, frieze and architrave, with classic Doric Triglyphs, Metopes, Mutule and Guttae details. Rock faced Quincy granite was used to construct the walls, with honed Quincy granite used for the corner pilasters. The honed granite appears lighter than the rock faced and was a smooth surface to project an illusion of monumental corner stones. The granite was most likely transported by

barge from the quarry near the Neponset River to Barnstable Harbor.

The cornice, entablature, pediment and columns were constructed of wood with a sanded paint system to mimic granite. The use of a faux finish for these elements was also to give the illusion of monumental stones. The original paint layers appear to be the same color as the corner pilasters. The wood elements have been repainted 3-4 times and the color currently visible does not reflect the original intent to have the wood appear as a honed stone surface. The large entrance doors are noted in the National Register of Historic Places as a possible Colonial Revival addition. The wood surround of the opening appears to have a sanded paint underlayer suggesting that at least the wood surround is original to the 1831 construction. The original fenestration was 8/8 double hung wood sash at the first floor, with 12/12 double hung sash at the second floor. The roof was originally slate and was reroofed using asphalt shingles within the last 15 years. There is an eight column wood cupola at the peak of the roof, located behind the portico face. It was substantially rebuilt in 1975, and it is unclear how closely it resembles the original.

A devastating fire destroyed the previous courthouse and most of the town records in 1829. This was a strong incentive to build the new courthouse using fireproof materials to the extent possible. To help meet this goal, the walls were constructed of solid masonry, with flagstone slabs used as the flooring material. While the building design has been commonly attributed to the architect Alexander Parris, recent research suggests that Isaiah Rogers was the architect. The building is more in the style of Parris than Rogers, who was known for hotel design, but a period advertisement clearly identifies Rogers as the architect. At this time in Massachusetts Alexander Parris, Solomon Willard and Gridley Bryant were all known for their large block granite buildings. Rogers worked closely with Solomon Willard, so it is not inconceivable that he took the principles observed in the others' work and applied them to his courthouse design. The building was constructed by "Messrs. I & A Taylor of Plymouth". These brothers also built the Alexander Parris designed Pilgrim Hall in Plymouth in 1824. The cornerstone was laid on Thanksgiving Day in 1831.

### **1893 Addition**

In 1893 J. Williams Beal designed a one-story east wing that overlapped the 1831 building east wall by 40 feet. It is described as 40 square feet in the National Register nomination but appears to be 40 feet wide by 40 feet deep. Quincy granite was again used and closely matched to the original building. It is unknown what kind of roof was on the building until the second floor was added in 1906.

### **1897 Addition**

In 1897 a "south central wing" was added. It was an extension to the original rectangular building and extended it to the south. It is described in the NR form as 24x26 feet in size. It appears that the numbers are not accurate. It is the full 40 foot width of the original building and appears to be 24 feet deep. The design is attributed to Samuel D. Kelley, and it used the same granite as the original building. There is a note in the nomination form that all the lumber was spruce and the trusses were hard pine.

### **1906 Additions**

In 1906 prominent Boston architect Guy Lowell designed a two story west ell addition and added a second story to the 1893 east ell. They are both approximately 40x40 feet in plan with a hipped roof. The buildings were constructed using Quincy granite walls and a wood entablature, with all details matching the 1831 building.

### **1925 Additions**

In 1925 southeast and southwest ell additions were designed by J. Williams Beal, Sons Architects and the

general contractors are identified as Somers and Drisko of Boston. Quincy granite was again employed for rock faced walls with flat honed blocks used for the corner pilasters for the north, east and west walls. The south elevation was built with yellow brick and cast stone cornice, window headers and sills. There were two major differences in the 1925 material choices. Cast stone was employed for the cornice and the design copied the earlier buildings on north, east and west elevations. The second difference was the use of steel sash instead of wood, and the opening sizes on the first floor were larger than the openings on the other parts of the building. The 1925 wings are not symmetrical. The west wing is approximately 8 feet shorter than the east, and the east wing projects farther east by one window bay. When viewed from the front elevation, the asymmetry is apparent. It is unclear why this was done.

### **1972 Addition**

In 1972 the south central addition was constructed to fill in between the 1925 east and west wings. The design was by Gafney Associates, Inc. and provided an accessible entrance to all parts of the building. The addition is predominantly brown brick with a wood portico entrance and wood cornice.

## **3. FIELD ACTIVITIES**

### **3.1 Asbestos Inspection**

The asbestos inspection was completed by Mr. Dave Gorden, Massachusetts Department of Labor Standards (DLS) licensed asbestos inspector (AI 900459). Multiple samples of suspect building materials were collected to meet the requirements of the sampling protocols established in the USEPA Regulation 40 CFR Part 763 Subpart E 763.86, known as the AHERA, 454 CMR 28.00, and the OSHA regulations. A summary of inspection activities is provided below.

#### **3.1.1 Visual Assessment**

Asbestos inspection activities were initiated with limited visual observation of the interior and exterior spaces of the Building associated with the proposed Work to identify homogeneous areas of suspect ACM. A homogeneous area is an area of surfacing material, thermal system insulation material, or miscellaneous material that is uniform in size, color and texture and was applied at approximately the same time. In general, a homogeneous area may consist of building materials that appear similar throughout in terms of size, color, and texture with consideration given to the suspected date of application. The interior and exterior assessment was conducted in visually accessible areas of the interior and exterior portion of the Building proposed for renovation / demolition related to the proposed Work.

#### **3.1.2 Physical Assessment**

A physical assessment of each homogeneous area of suspect ACM was conducted to assess the friability and condition of the materials. A friable asbestos material is defined by the EPA as “any material containing more than 1 percent asbestos as determined using the method specified in Appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure”.

MADEP defines a Friable Asbestos-Containing Material, as a material, “when dry, can be crumbled, shattered, pulverized or reduced to powder by hand pressure or any non-friable ACM that has been subjected to sanding, grinding, cutting, or abrading or has been crumbled, shattered or pulverized by

mechanical means such as, but not limited to, the use of excavators, bulldozers, heavy equipment, or power and/or hand tools”.

Friability was assessed by physically touching suspect materials. If any **friable** building materials were determined by the laboratory to be asbestos containing (i.e., asbestos detected), these materials may have been classified into one of the three following condition categories by the asbestos inspector:

- “Good” condition (G); material with no visible damage or deterioration; or showing only very limited damage or deterioration.
- “Damaged” condition (D); materials with greater than 1% although less than 10% distributed damage or less than 25% localized damage. Damage is determined when deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks fiber cohesion or adhesion qualities. Such damage or deterioration may be illustrated by the separation of ACM into layers; separation of ACM from the substrate; flaking, blistering, or crumbling of the ACM surface; water damage; significant or repeated water stains, scrapes, gouges, mars or other signs of physical injury on the ACM; or damage to jacketing or coatings; and
- “Significantly Damaged” condition (SD); materials where damage impacts at least 10% of a localized subject surface area or if the damage is evenly distributed representing an area of at least 25% of the subject surface area.

### **3.1.3 Asbestos - Sample Collection**

Based on results of the visual observations of suspect building materials, bulk samples of suspect ACM were collected in general accordance with USEPA AHERA (and 454 CMR 28.00) sampling protocols. Samples of suspect building materials were collected from randomly selected locations in each homogeneous area with the access assistance of representatives from the Barnstable Facilities Department, Folan Waterproofing (masonry contractor), and the Client in order to facilitate the sampling of suspect building materials that may be disturbed by the future renovation / demolition activities related to the proposed Work. Bulk samples were collected using wet methods as applicable to reduce the potential for fiber release. Each sample was placed in a sealable plastic container, labeled with a unique sample number using an indelible marker, and appropriate chain-of-custody documentation was completed for all of the samples, prior to delivering and then relinquishing the samples to the analytical laboratory.

*September 30, 2024*

On this date, PEER collected representative building materials and organized those building materials into approximately 105 bulk samples from 41 homogeneous areas of suspect ACM associated with the interior and exterior of the Building on the Property. At the time of sampling, the suspect ACM included: *sealant, frame caulk, cementitious material, coating, brick, mortar, Terracotta, backing material, glazing putty, paint, tar paper, wall paper, mastic, joint compound/plaster, paint/coating.*

The selection of building material locations and frequency of sampling those building materials were based on PEER’s observations and the assumption that similar materials in the same area are homogeneous in content. PEER did not collect samples from suspect ACM associated with any other

portions of the Building or areas on the Property, not specifically identified in the chain of custody (COC) included in Attachment A. However, homogeneous areas of suspected ACM may extend into other portions of the Building beyond those areas in which ACM were sampled, and beyond areas which may have been included in the Scope and the proposed Work at this phase of the project. A summary of suspect ACM samples collected during the inspection is included as Table 1A. An EMSL Analytical, Inc. (EMSL) laboratory Test Report and associated COCs for the suspect ACM is included as Attachment A of this Report.

#### **3.1.4 Asbestos - Sample Analysis**

Bulk samples of suspected ACM were submitted under COC to EMSL of Woburn, Massachusetts for analysis by PLM coupled with dispersion staining techniques per EPA methodology EPA 600/R-93/116 and/or EPA 600/M4-82-020 "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116, July 1993). The percentage of asbestos, where applicable, was determined by microscopic visual estimation or point counting.

OSHA and EPA define ACM as a material which contains greater than 1% asbestos by qualitative or quantitative analysis techniques. MADEP defines ACM as "any material containing 1% or more asbestos as determined by a laboratory using protocols set forth in the Method for the Determination of Asbestos in Bulk Building Materials found in EPA report EPA/600/R-93/116, or another method as directed by the Department". The EPA NESHAP requires quantitative analysis, commonly referred to as a "point count," for all qualitative analysis results when asbestos is detected in concentrations <1% to 10%. However, under common practice, qualitative results greater than or equal to 2% and <10% are often accepted to be ACM.

If the laboratory determined that the building materials contained <1% asbestos, depending on the building material type, the samples may have been re-analyzed via the Asbestos Analysis of Non-Friable Organically Bound Materials by Transmission Electron Microscopy (TEM) via "Method for the Determination of Asbestos in Bulk Building Materials" (EPA/600/R-93/116 Section 2.5.5.1) or Quantitation using the 400 Point Count Procedure.

This reanalysis was not applicable to these ACM sample analyses.

In general, except if and where noted on the "Special Instructions and/or Regulatory Requirements" section of the COC, or the "Positive Stop – Clearly Identify Homogeneous Areas" section of the COC for the specific sampling date, the laboratory was instructed to analyze all samples from each homogeneous area. The analyst described below was overseen by Mr. Steve Grise, Laboratory Manager. EMSL is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP Accreditation No. 101147-0).

At the Building, the building material samples A-1 through A-90 were collected and organized into samples on September 30, 2024. The samples (A-1 through A-90) were kept under custody by PEER until they were delivered to and relinquished to EMSL on October 7, 2024. Mr. Kevin Pine, Analyst, provided the asbestos analytical services for EMSL. The EMSL Test Report, titled "Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy" for samples A-1 through A-90 was received electronically by PEER on October 9, 2024.

### **3.2 Metals in Paint / Coating / Building Materials Inspection**

The limited metals in paint / coating / building materials inspection on interior and exterior building materials was completed by Mr. Dave Gorden, Massachusetts Lead Safe Renovator Supervisor (22-4561-374-251190), and Board Certified Environmental Scientist. PEER collected representative homogeneous paint or coating or building material samples on substrates found on the interior and exterior of the Building on the Property that may be subject to disturbance during the proposed Work. Homogenous paints / coatings may be defined as areas of similar paint or coating history, such as color, consistency, and location. The selection of sample locations and frequency of sampling were based on PEER's observations, the assumption that similar painted materials in the same area on the same surface are homogeneous in content.

#### **3.2.1 Lead in Paint / Coating Inspection – Sample Collection**

On September 30, 2024, PEER collected nine paint chip samples associated with areas of the proposed Work on the interior and/or exterior of the Building on the Property. The suspect lead in paint samples included paint on wood building materials. Each paint chip sample was collected from the substrate, placed in a sealable plastic bag, and labeled with a unique identifier with an indelible marker. PEER completed a COC for the lead in paint samples, and the samples were placed in a cooler until PEER relinquished the samples to Phoenix Environmental Laboratories, Inc. (Phoenix) [MA Lab Registration #M-CT007] of Manchester, CT, on October 2, 2024. Lead in paint chips were analyzed by Inductively Coupled Plasma (ICP) (SW6010D), and PEER received the analytical results from Phoenix on October 8, 2024.

## **4. REGULATORY OVERVIEW**

### **4.1 Asbestos**

USEPA regulation 40 CFR 61, Subpart M, NESHAP regulates asbestos fiber emissions during renovation or demolition activities and asbestos waste disposal practices. It also requires one to thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM.

Under NESHAP, asbestos-containing building materials are classified as Friable or Category I non-friable or Category II non-friable ACM. Friable ACM are those materials containing more than 1% asbestos that, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure. Category I non-friable ACM includes packings, gaskets, resilient floor coverings and asphalt roofing products containing more than 1% asbestos. Category II non-friable ACM are any materials other than Category I materials that contain more than 1% asbestos.

Friable ACM, along with Category I and Category II non-friable ACM which is in poor condition and has become friable or which will be subjected to drilling, sanding, grinding, cutting or abrading and which could be crushed or pulverized during anticipated renovation or demolition activities are considered regulated asbestos containing material (RACM).

In the Commonwealth of Massachusetts, asbestos activities are regulated by the Massachusetts Department of Environmental Protection (DEP) [310 CMR 7.15: Asbestos, dated July 12, 2019], and by the Massachusetts Executive Office of Labor and Workforce Development (EOLWD) under 454 CMR 28.00.

According to 310 CMR 7.15 (2)(a), 310 CMR 7.15 applies to any persons engaged in asbestos abatement activities or associated activities or actions set forth in 310 CMR 7.15(3), and to activities associated with such asbestos abatement activities, including, but not limited to, notifications, inspections, visual inspections, and recordkeeping.

According to 454 CMR 28.01 (2)(a), 454 CMR 28.00 applies to (a) all work, including construction, demolition, alteration or repair, involving any building or structure, including those owned or leased by the commonwealth or any of its political subdivisions or authorities, where such work involves the use or handling of asbestos or material containing asbestos, including the disposal of materials containing asbestos and asbestos contaminated waste. 454 CMR 28.00 also applies to asbestos training, consultation and/or analytical services including, but not limited to:

1. Asbestos inspection and hazard assessment services;
2. The preparation of asbestos project designs, asbestos project oversight and/or monitoring;
3. Asbestos training required by 454 CMR 28.00; and
4. Asbestos analysis performed in connection with any of the above services.

Massachusetts regulations require that any asbestos-related activity conducted in the Commonwealth be performed by personnel licensed by the EOLWD Division of Safety. Asbestos abatement must be performed by Massachusetts-licensed asbestos abatement contractors in accordance with a Project Design prepared by an MA-Licensed Asbestos Designer. Third-party clearance air monitoring must be conducted at the completion of abatement activities. Management Plans developed for the in-place management of asbestos-containing materials must be developed by an EOLWD-licensed Management Planner.

RACM must be removed prior to demolition activities. The owner or operator of a facility must provide DEP (and EPA) with written notification of planned removal activities at least 10 working days prior to the commencement of asbestos abatement activities. In addition, certain cities and towns, including health departments and fire departments, in the Commonwealth of Massachusetts may have additional notification requirements.

The U. S. Occupational Safety and Health Administration (OSHA) Asbestos standard for construction (29 CFR 1926.1101) regulates workplace exposure to asbestos. The OSHA standard requires that employee exposure to airborne asbestos fibers be maintained at or below 0.1 asbestos fibers per cubic centimeter of air (0.1 f/cc) as an 8-hour time weighted average (TWA) and not exceed 1.0 fibers per cubic centimeter of air (1.0 f/cc) over a 30-minute time period known as an excursion limit (EL). The TWA and EL are known as OSHA's permissible exposure limits (PELs). The OSHA standard classifies construction and maintenance activities which could disturb ACM; and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

The DLS Asbestos Program (the "Program") is responsible for the regulation of occupational asbestos exposure in Massachusetts. The Program works with employers, employees, unions, and state and local agencies to create healthier and safer work conditions for Massachusetts workers through site visits, analytical services, and technical information. The Program aids in the coordination of OSHA, EPA, and Multi-State regulatory authorities along with the Consortium of North Eastern U.S. States (CONES) in the common goal of protecting the public from long term damage from excessive asbestos exposure.

## **4.2 Lead in Paint**

### *EPA Renovation, Repair and Painting (RRP) Rule*

EPA's RRP rule was published on April 22, 2008, under the authority of the Toxic Substances Control Act (TSCA). RRP was effective on April 22, 2010 and addresses lead-based paint hazards created in target housing and child-occupied facilities.

Target housing is a home or residential unit built before 1978. There are exceptions for elderly and disable persons and zero-bedroom dwellings. A child-occupied facility is a pre-1978 building that is visited regularly by the same child (under 6 years of age), for at least two different days during the week, and each visit lasts at least 3 hours. The combined weekly visits must be at least 6 hours, and the combined annual visits must be at least 60 hours.

The RRP Final Rule Requires:

- Renovators (individuals) performing work in target housing or child-occupied facilities must be trained and certified.
- Renovation firms must be certified.
- Non-Certified workers must work under and be trained on-the-job by a certified renovator.
- Lead safe work practices must be followed.
- Certified renovators must educate owners/occupants.
- Training providers must be accredited.

The requirements listed above are triggered if renovation, repair, or painting activities will disturb more than 6 square feet of interior paint or 20 square feet of exterior paint in target housing or child-occupied facilities. Please note that the RRP does not replace lead-based paint abatement regulations (40 CFR 745.223) or the OSHA Lead in Construction Standard (29 CFR 1926.62). Federally assisted target housing must address lead hazards under the U.S. Department of Housing and Urban Development (HUD) Guidelines.

Lead is a pollutant regulated by many laws administered by EPA, including the Toxic Substances Control Act (TSCA), Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X), Clean Air Act (CAA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA), and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) among others. Please note that according to EPA, lead-based paint is defined by statute as paint with lead levels equal to or exceeding 1.0 milligrams per square centimeter (mg/cm<sup>2</sup>) or 0.5% by weight (see section 302(c) of the Lead-Poisoning Prevention Act (42 U.S.C. 4822(c)) and Toxic Substances Control Act (TSCA) section 401(9) (15 U.S.C. 2681(9))).

### *OSHA: Lead-Based Paint (LBP) Rules*

29 CFR 1926.62 Subpart D, Lead, applies to all construction work where an employee may be occupationally exposed to lead. All construction work excluded from coverage in the general industry standard for lead by 29 CFR 1910.1025(a)(2) is covered by this standard (OSHA 29 CFR 1926.62 Subpart D, Lead). Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. Construction work includes but is not limited to the following: Demolition or salvage of structures where lead or materials containing lead are present; Removal or encapsulation of materials containing lead; New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead; Installation of products containing lead; Lead contamination/emergency cleanup; Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed, and Maintenance

operations associated with the construction activities described in this paragraph.

The employer shall include lead in the program established to comply with the HCS (§ 1910.1200). The employer shall ensure that each employee has access to labels on containers of lead and safety data sheets, and is trained in accordance with the provisions of HCS. Where lead is present, until the employer performs an employee exposure assessment and documents that the employee performing any of the listed tasks is not exposed above the PEL, the employer shall treat the employee as if the employee were exposed above the PEL.

#### *Commonwealth of Massachusetts LBP Rules*

In the December 1, 2017 update, the Massachusetts lead law (105 CMR 460.000) requires certain actions when lead paint hazards are present in homes built before 1978 where any children under 6 years of age live. Lead paint hazards include loose lead paint, lead on moveable/impact windows, lead on accessible/mouth-able surfaces (windowsills, handrails, railing caps), and lead on friction surfaces (doors edge, door jambs, stair treads). Owners are responsible for complying with the lead law. This includes owners of rental property as well as owners living in their own single-family home.

Under 105 CMR 460.000, Dangerous Levels of Lead means the level of lead in paint, other coating, plaster, or putty which materially endangers the health of children or adults by producing a substantial and serious danger of lead poisoning.

- 1) When present in paint or coatings offered for sale, a dangerous level of lead shall be deemed to be 90 parts per million or greater as measured by atomic absorption spectrophotometry.
- 2) When present in a dried film including, but not limited to, paint, glaze, stain, varnish or other substance on any toy, furniture or other articles, or when present in paint, other coating, plaster or putty on residential surfaces, a dangerous level of lead shall be deemed to be the following:
  - a. a positive reaction with a 6% to 8% sodium sulfide solution, indicative of 0.5% or more lead by dry weight; or
  - b. equal to or more than 1.0 milligram of lead per square centimeter (mg/cm<sup>2</sup>) of surface as measured on site by a mobile X-ray fluorescence analyzer; or
  - c. equal to or more than 5,000 parts per million (ppm) or equal to or more than 0.5% by dry weight, as measured by atomic absorption spectrophotometry.
- 3) When present in a glaze or enamel on a glass, ceramic, porcelain or porcelain-coated cooking, eating or drinking utensil, or a porcelain-coated household appliance or fixture, a dangerous level of lead shall be deemed to be two (2) parts per million or greater as tested by A.S.T.M. Standard Method C 738-94(2000).

If work is to be done in areas that contain lead paint hazards in target housing, it is called deleading. Deleading must be done by people who are trained, certified, and authorized to do the work safely. Renovation is work done to repair or improve a residence if it is built before 1978. Contractors must be RRP certified to do renovations in a residence if it is built before 1978. Work that disturbs lead paint can be dangerous, and can include Painting (removing paint; sanding or scraping painted surfaces; painting outside surfaces); Renovation/Demolition (tearing down walls or plaster; removing windows and woodwork); and Repairing (fixing plumbing or electrical systems; repairing heating or ventilation ducts).

In Massachusetts, the Childhood Lead Poisoning Prevention Program (CLPPP) was established for the prevention, screening, diagnosis, and treatment of lead poisoning, including the elimination of sources of poisoning through research and educational, epidemiologic, and clinical activities as may be necessary. CLPPP provides a range of both primary and secondary prevention services to the children of the

Commonwealth of Massachusetts, their families, and others with an interest in the prevention of lead poisoning. In order to accomplish the fundamental goals of identifying lead poisoned children and ensuring that they receive medical and environmental services as well as preventing further cases of lead poisoning, CLPPP has developed linkages with a wide array of professionals and programs that provide services to children. CLPPP also provides coordinated and comprehensive nursing case management.

#### *Commonwealth of Massachusetts Lead Safe Renovation Information*

Renovation, repair, and painting work conducted for a fee in housing built before to 1978 and child-occupied facilities where more than 6 square feet of painted surface per Room is disturbed on the interior of a building, or more than 20 square feet of painted surface on the exterior of a building, must be carried out by lead-safe renovation (LSR) contractor. Licensed LSR contractors must have a trained and certified LSR supervisor on their staff. Under Massachusetts regulations, an LSR supervisor is always required to be on site while renovation work is in progress. Entities that perform renovation work (as defined in 454 CMR 22.02) must be licensed as an LSR contractor, deleading contractor, or have a contractor licensing waiver.

The presence of lead in paint during renovation and demolition activities may necessitate certain requirements under OSHA for worker protection. In addition, the presence of lead in paint in construction and demolition waste/debris, as it applies to the toxicity characteristic leaching procedure (TCLP), may serve a certain role in the selected location for the final building material disposal location, as it relates to classification as a hazardous waste or non-hazardous waste under RCRA. In addition, Massachusetts has specific transport and disposal requirements related to the characterization of waste, which contains concentrations of lead.

### **4.3 Management of Lead Wastes - Massachusetts**

In Massachusetts, the Massachusetts Policy on the Management of Wastes from Lead Abatement, Remodeling and Renovation Activities Conducted in Households policy provides further clarification of the household hazardous waste exemption cited at 310 CMR 30.104(6) as it relates to the management of lead-based paint (LBP) waste generated from lead abatement, remodeling and renovation activities in residences. LBP waste is composed of coated building components (doors, window frames and painted woodwork), and concentrated residue from chemical and physical paint removal activities (paint chips, dust, and sludges).

This policy adds LBP waste to the household waste exemption, 310 CMR 30.104(2)(g), and is consistent with recent USEPA guidance discussed below. LBP coated building components and concentrated residues generated by residents or by contractors performing activities in residences are classified as household waste, and are therefore exempt from hazardous waste regulations. Accordingly, LBP wastes from residences may be managed as non-hazardous solid waste. However, this policy does not apply to LBP wastes generated from activities conducted in non-residential buildings or from structures (e.g., bridges, tanks); such wastes continue to be subject to the Massachusetts Hazardous Waste Management Regulations, 310 CMR 30.000.

This policy is intended to facilitate lead abatement activities, especially in HUD-funded public housing initiatives, by reducing waste management and disposal costs while ensuring public and environmental protection. The Department's management approach mirrors the federal approach described in a July 31, 2000, memo by Elizabeth Cotsworth, Director of the Office of Solid Waste, USEPA, entitled "Regulatory Status of Waste Generated by Contractors and Residents from Lead-Based Paint Activities Conducted in

Households.” This memo clarifies the federal regulatory status of lead-based paint waste generated as a result of lead abatement, renovation and remodeling activities in homes and other residences.

Specifically, EPA clarifies that the “household waste” exemption, which has been historically limited to residents, is applicable to waste generated by contractors conducting lead abatement, remodeling and renovation activities in residences, thereby allowing both contractors and residents to manage LBP waste as non-hazardous solid waste. The memo further states that LBP waste can be discarded in a municipal solid waste landfill or a municipal solid waste combustor. Finally, the memo expands the definition of “residence” to include not only single-family homes, multifamily homes, apartment buildings, but public and military housing as well. By this policy, the Department adopts the guidance provided in EPA’s July 31, 2000, interpretive memo and strongly recommends that residents and contractors comply with the “Best Management Practices” (BMPs) for removing, packaging and disposing of lead abatement wastes specifically described in the memorandum.

This Policy has been cited for informational purposes; however, the policy is not applicable to the Management of Lead Wastes for the Building on the Property.

#### **4.4 TCLP Lead on Paint and/or Substrates and/or Building Materials**

Since the Building is a Superior Court building within Barnstable County, it’s important to note that the presence of lead in paint in building materials and its associated leachability in the construction and demolition waste/debris waste stream may serve a certain role in the selected location for the final building material disposal location, as it relates to determining whether a “solid waste” exhibits the characteristics of “hazardous waste” or non-hazardous waste under RCRA.

Solid wastes containing lead and other metals (such as RCRA 8 Metals) are subject to RCRA regulation and 310 CMR 30.00. If the amount of lead, for instance, that leaches from a waste using (TCLP exceeds the lead toxicity characteristic (TC) limit of 5 mg/L, the solid waste must be managed as a TC hazardous waste (unless otherwise excluded, as per Paragraph 4.3, above).

A solid waste (except manufactured gas plant waste) exhibits the characteristic of toxicity if, using the TCLP test Method 1311 in “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,” EPA Publication SW-846, as incorporated by reference in § 260.11 of this chapter, the extract from a representative sample of the waste contains any of the contaminants listed in Table 1 of that publication at the concentration equal to or greater than the respective value given in that that table.

## **5. FINDINGS**

### **5.1 Asbestos-Containing Material Classifications**

As discussed in Section 4.1, ACMs, if identified during the Inspection were classified on Table 1B as; RACM (“friable”), Category I non-friable ACM, or Category II non-friable ACM. These categories are shown on Table 1B for each identified building material containing asbestos. The classifications are used because ACMs can vary in the relative hazard these materials present; and based on their characteristics when disturbed by varying renovation or demolition techniques. For this reason, state and federal regulations manage these categories differently when regulating disturbance and abatement activities.

PACM includes building materials that potentially contain asbestos until such a time that the material is tested and found to be non-asbestos containing. The material is "presumed" to contain asbestos unless it is demonstrated, in accordance with 454 CMR 28.00, that PACM does not contain asbestos.

#### **5.1.1 Regulated Asbestos-Containing Material (RACM)**

RACM was identified associated with the proposed Work at the Building (based on the material's expectation to become friable during any disturbance), as per Table 1B. If renovation or demolition will disturb RACM, it must be removed prior to disturbance. All RACM must be removed prior to the demolition of a building. Removal must be performed by Massachusetts licensed Asbestos Contractors using accredited and Massachusetts licensed personnel.

#### **5.1.2 Category I Non-Friable ACM**

At the Building, Category I non-friable asbestos-containing material was not detected associated with the sampled building materials as part of the proposed Work at the Building on the Property.

#### **5.1.3 Category II Non-Friable ACM**

At the Building, Category II non-friable asbestos-containing material (including *plaster or joint compound, sealant, paint, glazing putty, frame caulk*) was detected associated with the sampled building materials as part of the proposed Work at the Building on the Property.

#### **5.1.4 Asbestos Management Recommendations**

Please note that according to 454 CMR 28.00, an asbestos project design is a site-specific written work plan describing the means and methods for asbestos removal, enclosure, encapsulation or repair projects that exceed three linear or three square feet of asbestos containing material in facilities ***(required for facilities subject to AHERA)***.

In addition, according to 454 CMR 28.00, except as mandated by AHERA for Asbestos Response Actions conducted in school facilities, the preparation of an asbestos project design *is recommended*, but not required by 454 CMR 28.00.

Under OSHA and EPA regulations, any employee or contractor working in proximity to asbestos containing materials at the building must be made aware of the asbestos inspection and its limitations, and provided a copy of this Inspection Report prior to commencing renovation/demolition activities. If previously inaccessible suspected ACM is discovered during renovation or demolition activities, disturbance work should immediately stop, until representative bulk samples can be collected by a licensed asbestos inspector and analytical laboratory results are available to render a determination regarding asbestos content within the material discovered.

**PEER notes that the paint on the exterior of certain portions of the Building, and including the paint associated with the white to gray speckled paint coating on wood/brick Lego brick like cornice fascia at elevation contained detectable asbestos. PEER also notes that this Paint (also known to contain lead – See Table 2A below) showed evidence of peeling, flaking, and delamination, and was noted on the grass**

surface under this building fascia feature. PEER noted that the grass for these areas of the exterior of the Building appeared mowed and maintained.

Based on the above paragraph, and as per 310 CMR 7.15, PEER recommends that the Barnstable Facilities Department cease mowing operations, and any other associated activities that may cause asbestos fibers to become airborne and/or may cause the release of visible emissions of fugitive dust to the ambient air. As per 310 CMR 7.15 (3)(g), PEER also recommends that the Barnstable Facilities Department consider conducting an immediate asbestos abatement activity (by MA licensed Asbestos Abatement Contractors) of {at a minimum} all damaged and significantly damaged ACM, which may also involve {at a minimum} the inclusion of a HEPA-vacuum truck for the exterior grass, and similar surfaces, in advance of any other proposed Work at the Building and Property.

Therefore, since this Building (Superior Court) in Barnstable County is not covered by AHERA, an asbestos project design is **RECOMMENDED** prior to any Renovation/Demolition Work at the Barnstable Superior Court Building and Other Associated Work.

#### **5.1.5 Data Gaps - Asbestos**

As part of this Report, PEER understands that there may be areas and building materials within the interior and exterior of the Building, which may become impacted by or become part of the proposed Work, or a future proposed Work, that:

- may have been covered, hidden, or otherwise not visible,
- may not have been safely accessible (as determined by PEER),
- may not have been included in the Facility Owner's / Operator's scope of work
- may not have been included in the Architect's or Engineer's scope of work,
- may not have been included in PEER's limited Scope during this phase of the project,
- may have been modified, removed, or eliminated from PEER's limited Scope by the Architect, Engineer, Owner, or Others after PEER's proposal date(s); and either prior to the date of, or during the date of the hazardous building material sampling investigation event,
- has yet to be evaluated as part of this phase for the project site,
- may have been added to the Building after PEER's September 30, 2024 limited hazardous building materials investigation,
- would have required irreparable, destructive sampling (which may have impacted the historical integrity, structural integrity, or impact the health and safety of the Inspector, occupants, visitors, or workers present or anticipated to be present after the September 30, 2024 building material sampling event, and/or for any other reason (as determined by PEER).

In general, PEER recommends that a comparison of sampled and analyzed building materials (as per Table 1A) be reviewed by the Facility Owner/Operator, Architect/Engineer, General Contractor, Asbestos Contractor, and/or Others (together, the "Parties") against the building materials which may become impacted by the proposed Work, and if determined to be necessary by the Parties, in coordination with other trades, additional samples of building materials, including irreparable destructive sampling of building materials, be collected, and analyzed for asbestos, prior to any site work.

**Table 1A**

**Suspect ACM Summary Table  
Barnstable Superior Court Building  
3195 Main Street, Barnstable, Barnstable County, Massachusetts**

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**Collection Date (2024): September 30**

<b>Sample Number</b>	<b>Analytical Results (%)</b>	<b>Building Material</b>	<b>Homogeneous Area</b>	<b>Location/ Room</b>	<b>Material Classification</b>	<b>Detailed Description</b>
<b>September 30, 2024</b>						
A-1	NAD	Sealant	1	Exterior Portico	M	Light Brown Sealant on Thick Coat White Paint (Stained) Rear Entry Wood Board
A-2	NAD	Sealant	1	Exterior Portico	M	Light Brown Sealant on Thick Coat White Paint (Stained) Rear Entry Wood Board
A-3	NAD	Sealant	2	Exterior Portico	M	White Flexible Sealant above Metal Cover for Wood at Portico
A-4	NAD	Sealant	2	Exterior Portico	M	White Flexible Sealant above Metal Cover for Wood at Portico
A-5	NAD	Sealant	3	Exterior Portico	M	Light Brown Hard Sealant Mixed with White Paint under Sign at Portico
A-6	NAD	Sealant	3	Exterior Portico	M	Light Brown Hard Sealant Mixed with White Paint under Sign at Portico
A-7	NAD	Sealant	4	Exterior Portico	M	White Sealant Covered in White Paint on Vertical Boards/in between at Portico
A-8	NAD	Sealant	4	Exterior Portico	M	White Sealant Covered in White Paint on Vertical Boards/in between at Portico
A-9	NAD	Sealant	5	Exterior Window	M	Yellow-Brown Firm Flexible Repair Sealant at Window Frame
A-10	NAD	Sealant	5	Exterior Window	M	Yellow-Brown Firm Flexible Repair Sealant at Window Frame
A-11A	NAD	Frame Caulk	6-1	Exterior Window	M	White Weathered Firm Flexible Frame Caulk Repair at Window
A-11B	NAD	Frame Caulk	6-2	Exterior Window	M	White Hard Brittle Original Frame Caulk at Sill

Sample Number	Analytical Results (%)	Building Material	Homogeneous Area	Location/ Room	Material Classification	Detailed Description
A-12A	NAD	Frame Caulk	6-1	Exterior Window	M	White Weathered Firm Flexible Frame Caulk Repair at Window
A-12B	NAD	Frame Caulk	6-2	Exterior Window	M	White Hard Brittle Original Frame Caulk at Sill
A-13	NAD	Sealant	7	Exterior Brick	M	Yellow Orange Flexible Repair Sealant at Brick to Brick Joint Crack
A-14	NAD	Sealant	7	Exterior Brick	M	Yellow Orange Flexible Repair Sealant at Brick to Brick Joint Crack
A-15	2	Sealant	8	Exterior Brick	M	Light Gray Hard Flexible Original Sealant at Brick to Brick Joint Crack
A-16	2	Sealant	8	Exterior Brick	M	Light Gray Hard Flexible Original Sealant at Brick to Brick Joint Crack
A-17	NAD	Frame Caulk	9	Exterior Brick	M	Light Gray Hard Frame Caulk for 10" x 32" Vent in Brick
A-18	NAD	Frame Caulk	9	Exterior Brick	M	Light Gray Hard Frame Caulk for 10" x 32" Vent in Brick
A-19	NAD	Cementitious Material	10	Exterior Brick	M	Light Gray Fine Grained Cementitious Material Filler for 10" x 32" Vent Brick
A-20	NAD	Cementitious Material	10	Exterior Brick	M	Light Gray Fine Grained Cementitious Material Filler for 10" x 32" Vent Brick
A-21	NAD	Parge Coat	11	Exterior Foundation	M	Light Gray Parge Coat with White Fiberglass Particles on Foundation
A-22	NAD	Parge Coat	11	Exterior Foundation	M	Light Gray Parge Coat with White Fiberglass Particles on Foundation
A-23A	NAD	Brick	12-1	Exterior at Masonry Cut 1	M	Orange Standard Brick with Drying Cracks on Exterior Face
A-23B	NAD	Mortar	12-2	Exterior at Masonry Cut 1	M	Light Gray Fine to Medium Grained Cementitious Mortar in between Brick and Inside
A-23C	NAD	Terracotta	12-3	Exterior at Masonry Cut 1	M	Red Fine to Medium Grained Bostonia Rectangular Terracotta with Hollow Interior
A-23D	NAD	Terracotta	12-4	Exterior at Masonry Cut 1	M	Orange Fine to Medium Grained Rectangular Terracotta with Hollow Interior
A-23E	NAD	Mortar	12-5	Exterior at Masonry Cut 1	M	White Fine to Medium Grained Mortar in between Sections of Terracotta

Sample Number	Analytical Results (%)	Building Material	Homogeneous Area	Location/ Room	Material Classification	Detailed Description
A-24A	NAD	Brick	12-1	Exterior at Masonry Cut 1	M	Orange Standard Brick with Drying Cracks on Exterior Face
A-24B	NAD	Mortar	12-2	Exterior at Masonry Cut 1	M	Light Gray Fine to Medium Grained Cementitious Mortar in between Brick and Inside
A-24C	NAD	Terracotta	12-3	Exterior at Masonry Cut 1	M	Red Fine to Medium Grained Bostonia Rectangular Terracotta with Hollow Interior
A-24D	NAD	Terracotta	12-4	Exterior at Masonry Cut 1	M	Orange Fine to Medium Grained Rectangular Terracotta with Hollow Interior
A-24E	NAD	Mortar	12-5	Exterior at Masonry Cut 1	M	White Fine to Medium Grained Mortar in between Sections of Terracotta
A-25A	NAD	Brick	12-1	Exterior Masonry Cut 2	M	Orange Standard Brick with Drying Cracks on Exterior Face
A-25B	NAD	Mortar	12-2	Exterior Masonry Cut 2	M	Light Gray Fine to Medium Grained Cementitious Mortar in between Brick and Inside
A-26	NAD	Mortar	13	Exterior Masonry Cut 2	M	Gray to Light Gray Fine Grained Cornice Mortar
A-27	NAD	Mortar	13	Exterior Masonry Cut 2	M	Gray to Light Gray Fine Grained Cornice Mortar
A-28	NAD	Mortar	14	Exterior Masonry Cut 2	M	Light Gray Fine to Med. Grained Cavity Mortar
A-29	NAD	Mortar	14	Exterior Masonry Cut 2	M	Light Gray Fine to Med. Grained Cavity Mortar
A-30	2	Sealant	15	Exterior Masonry Cut 2	M	White to Light Gray Hard Cornice Joint Sealant
A-31	2	Sealant	15	Exterior Masonry Cut 2	M	White to Light Gray Hard Cornice Joint Sealant
A-32	NAD	Backing Material	16	Exterior Masonry Cut 2	M	Brown Fibrous Backing Material for Cornice Joint
A-33	NAD	Backing Material	16	Exterior Masonry Cut 2	M	Brown Fibrous Backing Material for Cornice Joint
A-34	NAD	Glazing Putty	17	Exterior 1820's Building	M	White Painted Light Gray Glazing Putty with Wood Stain (8 Pane 2 Sash)

Sample Number	Analytical Results (%)	Building Material	Homogeneous Area	Location/ Room	Material Classification	Detailed Description
A-35	NAD	Glazing Putty	17	Exterior 1820's Building	M	White Painted Light Gray Glazing Putty with Wood Stain (8 Pane 2 Sash)
A-36	NAD	Paint	18	Exterior 1820's Building	M	White Thick Coats of Paint in Drip Sill of Window
A-37	NAD	Paint	18	Exterior 1820's Building	M	White Thick Coats of Paint in Drip Sill of Window
A-38	NAD	Tar Paper	19	Exterior 1820's Building	M	Black Tar Paper within Window Drip Sill and Exterior Storm Frame
A-39	NAD	Tar Paper	19	Exterior 1820's Building	M	Black Tar Paper within Window Drip Sill and Exterior Storm Frame
A-40	NAD	Glazing Putty	7	Exterior 1820's Building	M	White Painted Light Gray Glazing Putty with Wood Stain (8 Pane 2 Sash)
A-41	2	Frame Caulk	18	Exterior 1820's Building	M	Black Mildew Stained Light Gray Exterior Frame Caulk for Painted Wood Window
A-42	2	Frame Caulk	18	Exterior 1820's Building	M	Black Mildew Stained Light Gray Exterior Frame Caulk for Painted Wood Window
A-43	2	Sealant	19	Exterior 1820's Building	M	Light Gray to Gray Hard Sealant under Capstone Edge Roof
A-44	2	Sealant	19	Exterior 1820's Building	M	Light Gray to Gray Hard Sealant under Capstone Edge Roof
A-45	NAD	Cementitious Material	20	Interior Men's Room	M	Black Coated Gray Cementitious Sill Interior Men's Room Basement. INFORMATION ONLY. Not Considered a Sample.
A-46A	NAD	Wallpaper	21-1	Interior Room 247	M	Gray Painted Wallpaper Delaminating from Painted Suspect Plaster Wall
A-46B	NAD	Mastic	21-2	Interior Room 247	M	Orange-Yellow Mastic on Back of Wallpaper and on Wall
A-47A	NAD	Wallpaper	21-1	Interior Room 247	M	Gray Painted Wallpaper Delaminating from Painted PL Wall
A-47B	NAD	Mastic	21-2	Interior Room 247	M	Orange-Yellow Mastic on Back of Wallpaper and on Wall
A-48A-Wallpaper	NAD	Wallpaper	22-W	Interior Stairwell Room 225	M	Off-White Wallpaper on/Contaminated by Pink Paint on Suspect Plaster Wall

Sample Number	Analytical Results (%)	Building Material	Homogeneous Area	Location/ Room	Material Classification	Detailed Description
A-48A-Joint Compound	2	Plaster or Joint Compound	22-JC	Interior Stairwell Room 225	S	Suspect Plaster or Joint Compound adhered to Wallpaper
A-49A-Wallpaper	NAD	Wallpaper	22-W	Interior Stairwell Room 225	M	Off-White Wallpaper on/Contaminated by Pink Paint on Suspect Plaster Wall
A-49A-Joint Compound	2	Plaster or Joint Compound	22-JC	Interior Stairwell Room 225	S	Suspect Plaster or Joint Compound adhered to Wallpaper
A-50	2	Glazing Putty	23	1970 Building Exterior	M	Light Gray to Gray Friable Glazing Putty for 8 Pane 2 Operating Sashes with 4 Panes Associated with a Fixed Window
A-51	2	Glazing Putty	23	1970 Building Exterior	M	Light Gray to Gray Friable Glazing Putty for 8 Pane 2 Operating Sashes with 4 Panes Associated with a Fixed Window
A-52	NAD	Caulk	24	1970 Building Exterior	M	White Firm, Flexible Pheno-Seal-like Caulk Fix for Windows
A-53	NAD	Caulk	24	1970 Building Exterior	M	White Firm, Flexible Pheno-Seal-like Caulk Fix for Windows
A-54	2	Frame Caulk	25	1920 Building Exterior	M	Light Brown, Hard Brittle Frame Caulk (Wood on Brick) on Window
A-55	2	Frame Caulk	25	1920 Building Exterior	M	Light Brown, Hard Brittle Frame Caulk (Wood on Brick) on Window
A-56	NAD	Glazing Putty	26	1920 Building Exterior	M	Yellow Brown Hard Brittle Glazing Putty on Metal Window Frame
A-57	NAD	Glazing Putty	26	1920 Building Exterior	M	Yellow Brown Hard Brittle Glazing Putty on Metal Window Frame
A-58	NAD	Glazing Putty	27	1920 Building Exterior	M	Yellow Brown Glazing Putty (Hard) for 4 Pane Basement Window
A-59	NAD	Glazing Putty	27	1920 Building Exterior	M	Yellow Brown Glazing Putty (Hard) for 4 Pane Basement Window
A-60	NAD	Glazing Putty	28	1970 Building Exterior	M	White Glazing Putty for 24 Pane Fire Escape Door at 2 <sup>nd</sup> Floor Elevation
A-61	NAD	Glazing Putty	28	1970 Building Exterior	M	White Glazing Putty for 24 Pane Fire Escape Door at 2 <sup>nd</sup> Floor Elevation

Sample Number	Analytical Results (%)	Building Material	Homogeneous Area	Location/ Room	Material Classification	Detailed Description
A-62	NAD	Frame Caulk	29	1903 Building Exterior	M	Light Gray to Brown, Hard Brittle Frame Caulk for Window
A-63	NAD	Frame Caulk	29	1903 Building Exterior	M	Light Gray to Brown, Hard Brittle Frame Caulk for Window
A-64	NAD	Glazing Putty	30	1903 Building Exterior	M	White to Light Gray Hard Brittle Glazing Putty for 8 Pane 2 Sash Windows
A-65	NAD	Glazing Putty	30	1903 Building Exterior	M	White to Light Gray Hard Brittle Glazing Putty for 8 Pane 2 Sash Windows
A-66	2	Paint	31	1903 Building Exterior	M	White Thick Coat of Paint on Windows for Building
A-67	2	Paint	31	1903 Building Exterior	M	White Thick Coat of Paint on Windows for Building
A-68	NAD	Frame Caulk	32	1820's Building Exterior	M	White Hard Brittle Frame Caulk on 8 Pane 2 Sash Wood Window at Granite
A-69	NAD	Frame Caulk	32	1820's Building Exterior	M	White Hard Brittle Frame Caulk on 8 Pane 2 Sash Wood Window at Granite
A-70	2	Paint	33	1903 Building Exterior	M	White to Gray Speckled Paint Coating on Wood/Brick Lego Cornie Fascia
A-71	2	Paint	33	1903 Building Exterior	M	White to Gray Speckled Paint Coating on Wood/Brick Lego Cornie Fascia
A-72	2	Sealant	34	1903 Building Exterior	M	Gray Suspect Sealant in between Wood Painted Lego Brick-like Fascia
A-73	2	Sealant	34	1903 Building Exterior	M	Gray Suspect Sealant in between Wood Painted Lego Brick-like Fascia
A-74	NAD	Textured Coating	35	1820's Building Exterior	M	Yellow over Gray Fine Grained Textured Coating on 20 Panel Wood Column
A-75	NAD	Textured Coating	35	1820's Building Exterior	M	Yellow over Gray Fine Grained Textured Coating on 20 Panel Wood Column
A-76	NAD	Mortar	36	1820's Building Exterior	M	Gray Smooth Granite Mortar from West Elevation
A-77	NAD	Mortar	36	1820's Building Exterior	M	Gray Smooth Granite Mortar from West Elevation
A-78	NAD	Mortar	36	1820's Building Exterior	M	Gray Smooth Granite Mortar from East Elevation

Sample Number	Analytical Results (%)	Building Material	Homogeneous Area	Location/ Room	Material Classification	Detailed Description
A-79	NAD	Mortar	37	1820's Building Exterior	M	Light Pink Mortar behind Repainted Mortar at East Elevation
A-80	NAD	Mortar	37	1820's Building Exterior	M	Light Pink Mortar behind Repainted Mortar at East Elevation
A-81	NAD	Mortar	36	1820's Building Exterior	M	Gray Smooth Granite Mortar from North Elevation
A-82	NAD	Mortar	37	1820's Building Exterior	M	Light Pink Mortar behind Repainted Mortar at North Elevation
A-83	NAD	Mortar	38	1903 Building Exterior	M	Gray Fine Grained Original Mortar at North Elevation
A-84	NAD	Mortar	38	1903 Building Exterior	M	Gray Fine Grained Original Mortar at North Elevation
A-85	NAD	Mortar	39	1903 Building Exterior	M	Light Gray Fine Grained Smooth Granite Mortar at East Elevation
A-86	NAD	Mortar	39	1903 Building Exterior	M	Light Gray Fine Grained Smooth Granite Mortar at East Elevation
A-87	NAD	Mortar	40	1920's Building Exterior	M	Light Brownish Gray Fine to Coarse Grained Granite Mortar at West Elevation
A-88	NAD	Mortar	40	1920's Building Exterior	M	Light Brownish Gray Fine to Coarse Grained Granite Mortar at West Elevation
A-89	NAD	Textured Paint	41	1820's Building Exterior	M	Textured White Paint over Gray Coating with Cementitious Feel
A-90	NAD	Textured Paint	41	1820's Building Exterior	M	Textured White Paint over Gray Coating with Cementitious Feel

Notes (as may be applicable):

- a. Material Classification = Surfacing (S), Thermal System Insulation (TSI), or Miscellaneous (M)
- b. NAD = No Asbestos Detected.
- c. As per 454 CMR 28.00 – “Homogeneous Area” is an area of surfacing material, thermal system insulation material, or miscellaneous material that is uniform in size, color and texture and was applied at approximately the same time. Homogeneous sub areas, typically materials that could not be separated by hand tools in the field, are represented by a “-” in the above table. Materials listed in these groups are associated with other building materials within that homogeneous area.

**Table 1B**

**Identified ACM Summary Table Details  
Barnstable Superior Court Building  
3195 Main Street, Barnstable, Barnstable County, Massachusetts**

- - -

**Collection Date (2024): September 30**

Sample Number	Analytical Results (%)	Building Material	Homogenous Area	Material Classification	Friable (F) / Non-Friable (NF)	Current Condition	Disturbance Potential	Assessment Category	Estimated Quantity	Detailed Description
A-41; A-42; A-54; A-55	2	Frame Caulk <i>{on Windows and Doors for Building}</i>	18; 25	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ①	See Note ①
A-50; A-51	2	Glazing Putty <i>{on Windows and Doors for Building}</i>	23	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ①	See Note ①
A-66; A-67	3	Paint <i>{on Windows and Doors for Building}</i>	31	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ①	See Note ①
A-15; A-16	2	Sealant <i>{on Brick to Brick Joint Crack}</i>	8	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ②	See Note ②
A-30; A-31	2	Sealant <i>{on Joint of Masonry Cornice}</i>	15	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ②	See Note ②
A-43; A-44	2	Sealant <i>{Under Capstone at Roof Edge}</i>	19	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ②	See Note ②
A-70; A-71	2	Paint <i>{at Elevation on Wood/Brick Lego-Like Cornice Fascia}</i>	33	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ③	See Note ③

Sample Number	Analytical Results (%)	Building Material	Homogenous Area	Material Classification	Friable (F) / Non-Friable (NF)	Current Condition	Disturbance Potential	Assessment Category	Estimated Quantity	Detailed Description
A-72; A-73	2	Sealant {Between Wood of Painted Wood/ Brick Lego Brick-Like Cornice Fascia}	34	M	CAT II NF (RACM)#	Significantly Damaged	High	(4)	See Note ③	See Note ③
A-48A Joint Compound ; A-49A Joint Compound	2	Plaster or Joint Compound {Beneath Wallpaper Interior of Building and Suspected on Walls}	22-JC	S	CAT II NF (RACM)#	Damaged	Moderate	(2)	See Note ④	See Note ④

Notes: Material Classification = Surfacing (S), Thermal System Insulation (TSI), or Miscellaneous (M)  
 Friable = Material containing more than 1% asbestos, that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure  
 Category I Non-Friable: Asbestos containing packings, gaskets, resilient floor covering, and asphalt roofing products containing >1% asbestos...  
 Category II Non-Friable: Any material excluding Category I non-friable...

Assessment Category:

- (1) Damaged or significantly damaged TSI ACM
- (2) Damaged friable surfacing ACM
- (3) Significantly damaged friable surfacing ACM
- (4) Damaged or significantly damaged friable miscellaneous ACM
- (5) ACBM with potential for damage
- (6) ACBM with potential for significant damage
- (7) Any remaining friable ACBM or friable suspected ACBM

Current Condition: Good, Damaged, Significantly Damaged;  
 Disturbance Potential: Contact/Vibration/Air Erosion [High (H), Moderate (M), or Low (L)]  
 # = RACM based on anticipated disturbance during renovation/demolition.

**Notes:** ①, ②, ③, ④

- ✓ Asbestos abatement includes all (100%) of the materials and/or building materials identified in Note ①, ②, ③, and ④ associated with the proposed Restoration Evaluation and Associated Work, under the Base Bid, and as per the Project Drawings, when Project Drawings and the full scope of the Work proposed by the Client at this Building, through the Facility Owner/Operator, is developed.

**PEER notes that this Section has been included as a placeholder and will be developed and discussed further during future project phases and when the understanding of the full scope proposed by the Client at this Building, through the Facility Owner/Operator, is realized.**

All of which occurring at, in, on, and/or associated with the interior and/or façade, and/or exterior of the Barnstable Superior Court building on the Property, and which is comprised of an ACM on a building component associated with the interior, and/or façade, and/or exterior building environment, and any ACM debris, and/or any other asbestos containing or asbestos contaminated materials (including asbestos contaminated building materials), as per the Asbestos Project Design, and as per the Project Drawings (when Project Drawings have been included with the Asbestos Project Design).

**5.2 Metals in Paint, Coatings, and Other Building Materials - Findings**

**5.2.1 Lead in Paint / Coating Inspection**

On September 30, 2024, PEER collected nine paint chip samples associated with areas of the proposed Work on the interior and/or exterior of the Building on the Property. The suspect lead in paint samples included paint on wood building materials.

In the samples analyzed, lead was detected at concentrations which ranged from 137 milligrams/Kilogram (mg/Kg) in Sample L-5 to 359,000 mg/Kg in Sample L-6, as per Table 2A, below.

**Table 2A**  
**Lead in Paint/Substrates**  
**Barnstable Superior Court Building**  
**3195 Main Street, Barnstable, Barnstable County, Massachusetts**  
- - -  
**Collection Date (2024): September 30**

Sample ID	Description	Lead (mg/Kg)	TCLP Pb (mg/L)	Screening (Yes / No)
L - 1	White, hard, flaking paint on the wood fascia for the portico exterior associated with the 1970's portion of the Building	285	--	--
L - 2	White, flexible, peeling latex-like paint "fix" near the roof portion of the portico exterior associated with the 1970's portion of the Building	4,560	--	--
L - 3	White, hard, cracking thick coat of paint in the exterior drip sill of the 8 pane – 2 sash window well associated with the 1820's portion of the Building	242,000	--	--
L - 4	Brown over light gray paint on the interior of the wood sash at the stairwell near Room 225 associated with the 1820's portion of the Building	252,000	--	--
L - 5	White peeling paint on the cracked wood at a first floor window associated with the 1920's portion of the Building	137	--	--
L - 6	White, hard, cracking built-up paint on the wood window associated with the 1903 portion of the Building	359,000	--	--
L - 7	White to gray speckled, textured, thick coat of paint on wood Lego brick-like cornice associated with the 1903 portion of the Building	39,300	--	--
L - 8	Yellow over gray, textured coating on the 20 panel wood column associated with the 1820's portion of the Building	243,000	--	--
L - 9	White textured paint over gray paint on wood for the original entrance to the 1820's portion of the Building	169,000	--	--

**Notes:**

- In general, exterior painted surfaces at the Site were observed to be cracking, peeling, flaking associated with the exterior surfaces, and were observed to be present on the soil and grass ground surface. Interior painted surfaces were observed to be cracked with flaking (where observed).
- EPA Toxicity Characteristic limit for Lead occurs when concentration is  $\geq 5$  mg/L.

- **Yellow** highlighted cells: Based on the 20X Rule, this paint/coating (and potentially the paint on the wood substrate) has the potential to fail TCLP for lead, and be considered a hazardous waste, for disposal purposes.
- **Bolded** = asbestos was detected in the paint.
- “-” = Sample not screened using a Swab or sample not analyzed at an analytical laboratory.

PEER understands that all of the paint and all of the painted wood substrates associated with the samples collected, as per the above table, have the potential to exceed the EPA Toxicity Characteristic limit for Lead of 5 mg/L (based on the 20X Rule) and therefore may be considered a RCRA Hazardous Waste. As part of the Base Bid, separate from any asbestos abatement work on painted building materials by Others, the Contractor performing work associated with the demolition, removal, and disposal of any painted surface shall follow the intent of 454 CMR 22.00, shall have a current OSHA 40 hour HAZWOPER certificate and an 8 hour HAZWOPER Refresher certificate.

### **5.2.2 Metals in Paint, Coatings, and Other Building Materials Recommendations**

Considering the Work Practices which may occur during proposed renovation, repair, and painting activities at the Building on the Property, and considering the current and future use of the Building, including consideration for the occupants and visitors to continue to utilize the interior and exterior of the Building on the Property, **PEER recommends that the work practices associated with 454 CMR 22.00, be considered and then implemented by the Contractor or Contractors for any renovation, repair, and painting which may become associated with the Work at the Property.**

Renovation includes the modification of any existing structure, or portion thereof, that results in the disturbance of painted surfaces. The term renovation includes, but is not limited to, the removal or modification of painted surfaces or painted components (e.g., modification of painted doors, surface preparation activity such as sanding, scraping, or other such activities that may generate paint dust); the removal of portions of structures (e.g., walls, ceiling, large surface replastering, major re-plumbing); and window replacement.

Licensed lead safe renovation (LSR) contractors must have a trained and certified LSR supervisor on their staff. An LSR supervisor is a person who is duly certified under 454 CMR 22.06 to carry out supervisory functions on renovation projects, and with the additional training specified by 454 CMR 22.08(4)(e), to carry out supervisory functions and/or performs the work, in accordance with 454 CMR 22.12(2), on moderate risk deleading projects. An LSR supervisor is always required to be on site while renovation work is in progress. Entities that perform renovation work (as defined in 454 CMR 22.02) must be licensed as an LSR contractor, deleading contractor, or have a contractor licensing waiver.

**In addition, in relation to All Work which may disturb paint or coating, or which may disturb any of the RCRA 8 Metals in paint or coatings, PEER recommends that the policies, rules, and regulations from OSHA (and specifically, OSHA 29 CFR 1926.62 Subpart D, Lead) be reviewed and followed by the Contractor or Contractors performing the Work, for applicability to the Work at the Site on the Property.**

There may be additional considerations, which may be updated during future revisions of this Report, and phases of this project, and dependent on the solution or solutions related to the painted surfaces containing lead, and the painted surfaces containing asbestos and lead.

## 6. Standard of Care / Limitations / Reliance / General Comments

As detailed in the above paragraphs, this limited hazardous building materials inspection report (this "Report") was conducted utilizing limited, non-destructive sampling techniques. Therefore, efforts were made to determine if multiple layers of building materials may be present although limited to the extent of allowable access points with hand tools without affecting historical integrity, structural integrity, the impact to the health and safety of those occupants or workers present, or anticipated to be present, security, fire and life safety, slips, trips and/or fall hazards, and including unacceptable aesthetic or functional damage to building surfaces and materials, as per the judgment of the inspector at the time of the Inspection.

Please note that additional suspect hazardous building materials may be present associated with the Building such as those in concealed spaces, cavities, plenums, behind walls, above ceilings, beneath floors, beneath roofs or roof decks, beneath slabs or underground, in crawl spaces, in confined spaces, behind or associated with any electrical, heating, ventilation, air conditioning, or mechanical system, and in any other area, including non-accessible or unsafe areas (as determined by PEER) associated with the proposed Work for the Building or a future proposed Work for the Building.

This limited hazardous building materials inspection was performed in accordance with generally accepted Practices of this profession, undertaken in similar studies at the same time and in the same geographical area, and in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing.

We have endeavored to meet this standard of care, but may be limited by conditions encountered during its performance, a client-driven scope of work, the inability to review information not received by the report date, and/or any other condition as determined by PEER.

The limited hazardous building materials inspection, such as the one performed at the Building on the Property, is of limited scope, is noninvasive, and cannot eliminate the potential for hazardous building materials to occur elsewhere at the Building on the Property beyond what has been identified through the limited scope of services included in PEER's proposal as part of this limited hazardous building materials inspection.

In conducting the limited scope of services described herein, certain sources of information and other public records were not reviewed. The limitations herein must be considered when Gale Associates Inc. and Barnstable County Facilities formulates opinions as to risks associated with the Building on the Property or otherwise uses this Report for any other purpose. These risks may be further evaluated – but not eliminated – through additional research and/or assessment. We will, upon your written request, advise you of additional research or assessment options that may be available and associated costs.

We have no obligation to provide information obtained or discovered by us after the issuance date of this Report, or to perform any additional scope of services, regardless of whether the information would affect any findings, and/or opinions, and/or conclusions, and/or recommendations in this Report. This disclaimer specifically applies to any information that has not been provided by the Client, and/or by the Facility Owner/Operator, and/or by any other person or entity, as of the date of this Report.

Findings, opinions, and conclusions in this Report are based upon the current use of the Building on the Property, and information visually and/or physically observed during our limited, non-destructive

assessment of the specific building materials sampled (identified earlier in this report from the most recent site visit on September 30, 2024).

Therefore, such information, including findings, opinions, and conclusions are subject to change. Certain indicators of the presence of hazardous building materials may have been latent, inaccessible, not observable, or not present during the most recent site visit and may have subsequently become observable (such as after property renovations, building repairs, building demolition, new development on the property, and/or redevelopment on the Property). Further, our scope of services are not to be construed as legal interpretation or legal advice.

This Report has been prepared for the exclusive use and reliance of Gale Associates Inc. and the Barnstable County Facilities (the "Authorized Parties"). Use or reliance by any other party is prohibited without the written authorization of Gale Associates Inc., Barnstable County Facilities, and PEER Consultants, P.C.

Reliance on this Report by the Authorized Parties will be subject to the terms, conditions and limitations stated in the PEER proposal (or proposals), stated in this Report, and/or stated in PEER's Agreement for Services with the Client. The limitation of liability (i.e., the total cost defined in the PEER's June 17, 2024 proposal to the Client and/or PEER's Agreement for Services) is the aggregate limit of PEER's liability to the Client, and all relying parties.

The information contained in this Report (dated October 21, 2024) is relevant to the date on which the most recent inspection was performed (September 30, 2024) and should not be relied upon to represent building conditions at a later date. This Report represents our scope of services to Gale Associates Inc. and Barnstable County Facilities as of this Report date and constitutes our Final document; its text may not be altered after issuance.

This Report is not a stand-alone bidding document and **MUST NOT** be used by itself for bidding purposes. Contractors or consultants or any other party reviewing this Report must draw their own conclusions regarding further investigation, further assessment, further sampling, and/or remediation/abatement deemed necessary. PEER does not warrant the work of regulatory agencies, laboratories, and any or all other third parties supplying information which may have been used in the preparation of this Report. No warranties, express or implied, are intended or made.

Appendix A

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using PLM

Sample Log and Analytical Data



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10 Mall Road, Suite 301 • Burlington, MA 01803 • (781) 238-8880 • Fax (781) 238-8884

CLIENT: Gale Associates, Inc. PROJECT NAME: Barnstable Superior Court PROJECT #: 8503			Hazardous Building Material Inspection Sample Log / Chain of Custody		
BUILDING NAME: BSC, 3195 Main St., Barnstable, MA YEAR: 2024 ▲ SAMPLING DATE: 9/30			ASBESTOS INSPECTOR: D. Gorden (PEER); MA: AI-900459 PAGE 2 OF 7		
Homogenous Group	Location (Level / Room)	Building Material / Type (S, TSI, M)	Physical Assessment Category, and Damage Type or Disturbance Potential Detailed Description of Sampled Material		Quantity / Other
A-1	1 Exterior portico	sealant M	light brown sealant on thick coat white paint (stained) rear entry wood board		
A-2	1		see A1		
A-3	2		white flexible sealant above metal cover for wood at portico		
A-4	2		see A3		
A-5	3		light brown hard sealant mixed w/white paint under sign at portico		
A-6	3		see A5		
A-7	4		white sealant covered in white paint on vertical boards / in b/w at portico		
A-8	4		see A7		
A-9	5 Ext. window		yellow-brown firm flexible repair sealant at window frame		8 pane vert. 2 sash
A-10	5		see A9		
A-11A	6	F. caulk	white weathered firm flexible frame caulk repair at window		12 P + 8 P 2 sash horiz?
A-11B	6		white hard brittle original frame caulk at sill		
A-12A	6		see A11A		
A-12B	6		see A11B		
A-13	7 Ext. Brick	sealant	yellow orange flexible repair sealant at brick to brick joint crack		
A-14	7		see A13		
A-15	8		light gray hard flexible original sealant at brick to brick joint crack		
A-16	8		see A15		

Physical Assessment: (1) Damaged "D" or significantly damaged "SD" TSI ACBM, (2) D friable surfacing ACBM, (3) SD friable surfacing ACBM, (4) D or SD friable miscellaneous ACBM, (5) ACBM with potential for D, (6) ACBM with potential for SD, (7) Any remaining friable ACBM or friable suspected ACBM.

Damage Type: Contact, Water, Age, Vibration, Air Erosion

Disturbance Potential: Low, Moderate, High

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BUILDING NAME: BSC, 3195 Main St., Barnstable, MA YEAR: 2024 ▲ SAMPLING DATE: 9/30	ASBESTOS INSPECTOR: D. Gorden (PEER); MA: AI-900459 PAGE 3 OF 7

Homogenous Group	Location (Level / Room)	Building Material / Type (S, TSI, M)	Physical Assessment Category, and Damage Type or Disturbance Potential	Quantity / Other
Sample No. ↓			Detailed Description of Sampled Material ↓	
A-17	9 Exterior Brick	F. caulk M	light gray hard frame caulk for 10x32" vent in brick	
A-18	9	↓	see A17	
A-19	10	CM	light gray fine grained cem. material filler for 10x32" vent brick	
A-20	10	↓	see A19	
A-21	11 Ext. Foundat.	coating	light gray parge coat w/ white fg particles on foundation	
A-22	11	↓	see A21	
A-23A	12 Ext. @ mc 1	BRICK	orange standard brick w/ drying cracks on exterior face	7 3/4 x 2 1/2 x 3 9/2
A-23B	12	MORTAR	light gray f-m grained cem. mortar in b/w brick + inside	masonry cut 1
A-23C	12	TERRA	red f-m grained Bostonia rect. terracotta w/ hollow interior	
A-23D	12	TERRA	orange f-m grained rectangular terracotta w/ hollow interior	
A-23E	12	MORTAR	white fine grained mortar in b/w sections of terracotta	
A-24A	12	BRICK	see A23A	
A-24B	12	MORTAR	A 23B	
A-24C	12	TERRA	A 23C	
A-24D	12	TERRA	A 23D	
A-24E	12	MORTAR	A 23E	
A-25A	12 Ext. mc 2	BRICK	see A23A	Masonry cut 2
A-25B	12	MORTAR	See A23B	↓

Physical Assessment: (1) Damaged "D" or significantly damaged "SD" TSI ACBM, (2) D friable surfacing ACBM, (3) SD friable surfacing ACBM, (4) D or SD friable miscellaneous ACBM, (5) ACBM with potential for D, (6) ACBM with potential for SD, (7) Any remaining friable ACBM or friable suspected ACBM.

Damage Type: Contact, Water, Age, Vibration, Air Erosion

Disturbance Potential: Low, Moderate, High

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BUILDING NAME: BSC, 3195 Main St., Barnstable, MA YEAR: 2024 ▲ SAMPLING DATE: 9/30			ASBESTOS INSPECTOR: D. Gorden (PEER); MA: AI-900459 PAGE 4 OF 7		
Homogenous Group	Location (Level / Room)	Building Material / Type (S, TSI, M)	Physical Assessment Category, and Damage Type or Disturbance Potential	Quantity / Other	
Sample No. ↓			Detailed Description of Sampled Material ↓		
A-26	13 Ext. MC 2	mortar M	gray to light gray fine gravel cornice mortar	mason cut 2	
A-27	13	↓	see A27		
A-28	14	↓	light gray fine to med. gravel court mortar		
A-29	14	↓	see A28		
A-30	15	sealant	white to light gray hard cornice joint sealant		
A-31	15	↓	see A30		
A-32	16	Backing mat.	Brown fibrous backing material for cornice joint		
A-33	16	↓	see A32		
A-34	17 Exterior 1020 B	G putty	white painted light gray glazed putty w/wood stain (8P2S)	1st F	
A-35	17	<del>putty</del>	see A34		
A-36	18	PAINT	white thick coats of paint in drip sill of window		
A-37	18	paint	↓		
A-38	19	tar paper	Black tar paper w/in window drip sill + ext storm F.		
A-39	19	↓	↓		
A-40	17	G putty	see A34	6P2S	
A-41	18	F. caulk	Black mildew stained lt. gray ext frame caulk for painted wood w		
A-42	18	↓	see A41		
A-43	19	sealant ↓	light gray to gray hard sealant under capston edge roof		

Physical Assessment: (1) Damaged "D" or significantly damaged "SD" TSI ACBM, (2) D friable surfacing ACBM, (3) SD friable surfacing ACBM, (4) D or SD friable miscellaneous ACBM, (5) ACBM with potential for D, (6) ACBM with potential for SD, (7) Any remaining friable ACBM or friable suspected ACBM.

Damage Type: Contact, Water, Age, Vibration, Air Erosion

Disturbance Potential: Low, Moderate, High

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BUILDING NAME: BSC, 3195 Main St., Barnstable, MA YEAR: 2024 ▲ SAMPLING DATE: 9/30			ASBESTOS INSPECTOR: D. Gorden (PEER); MA: AI-900459 PAGE 5 OF 7		
Homogenous Group	Location (Level / Room)	Building Material / Type (S, TSI, M)	Physical Assessment Category, and Damage Type or Disturbance Potential	Quantity / Other	
Sample No. ↓			Detailed Description of Sampled Material ↓		
A-44	19 Ext. 1920B	sealant M	see A43		
A-45	20 Int. mens	CM	Black coated gray cement silt interior mens rm bsmnt	INFO ONLY	
A-46A	21 Int. RM 247	wall p.	gray painted wallpaper delaminating from painted PL wall		
A-46B	21 ↓	mastic	orange-yellow mastic on back of wallpaper + on wall		
A-47A	21 ↓	wall p.	see A46A		
A-47B	21 ↓	mastic	see A46B		
A-48A	22 Int SW RM 225	wall p	off white wallpaper on / Contam by pink paint on p. wall		
A-49A	22 ↓	wall p	see A48A		
A-50	23 1920B ext	g. putty	light gray to gray friable g. putty for BP 2034P Fixed window		
A-51	23 ↓	↓	see A50		
A-52	24 ↓	F. caulk	white firm, flexible phono-seal like caulk fix for windows at brick		
A-53	24 ↓	↓	see A52		
A-54	25 1920B Ext	↓	light brown, hard brittle frame caulk (wood on brick) on window	12 PGP 23	
A-55	25 ↓	↓	see A54		
A-56	26 ↓	g. putty	yellow brown hard brittle glazing putty on metal w. frame		
A-57	26 ↓	↓	see A56		
A-58	27 ↓	↓	yellow brown glazing putty (hard) for 4 pane basement window	15	
A-59	27 ↓	↓	see A58		

Physical Assessment: (1) Damaged "D" or significantly damaged "SD" TSI ACBM, (2) D friable surfacing ACBM, (3) SD friable surfacing ACBM, (4) D or SD friable miscellaneous ACBM, (5) ACBM with potential for D, (6) ACBM with potential for SD, (7) Any remaining friable ACBM or friable suspected ACBM.

Damage Type: Contact, Water, Age, Vibration, Air Erosion

Disturbance Potential: Low, Moderate, High

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BUILDING NAME: BSC, 3195 Main St., Barnstable, MA YEAR: 2024 ▲ SAMPLING DATE: 9/30			ASBESTOS INSPECTOR: D. Gorden (PEER); MA: AI-900459 PAGE 6 OF 7		
Homogenous Group	Location (Level / Room)	Building Material / Type (S, TSI, M)	Physical Assessment Category, and Damage Type or Disturbance Potential Detailed Description of Sampled Material		Quantity / Other
A-60	28 1970B ext	g putty M	white glazing putty for 24 pane fire escape door at 2nd elev		
A-61	28 ↓	↓	see A60		
A-62	29 1903B ext	F caulk	light gray to brown, hard brittle frame caulk for window		wood/grant
A-63	29 ↓	↓	see A62		
A-64	30 ↓	g putty	white to light gray hard brittle glazing putty for 8P23 windows		
A-65	30 ↓	↓	see A64		
A-66	31 ↓	paint	white thick coat of paint on windows for building		
A-67	31 ↓	paint	see A66		
A-68	32 1820B ext	F. caulk	white hard brittle frame caulk on 8P23 wood window at grant		
A-69	32 ↓	↓	see A68		
A-70	33 1903B ext	paint	white to gray speckled paint coating on wood/brick lego cornice fascia		
A-71	33 ↓	paint	see A70		
A-72	34 ↓	Sealant	gray suspect sealant in b/w wood painted lego brick like - fascia		
A-73	34 ↓	↓	see A72		
A-74	35 1820B ext	coating	yellow over gray fine grained textured coating on 20 wood column		
A-75	35 ↓	↓	see A74		
A-76	36 ↓	mortar	gray smooth granite mortar from west elevation		
A-77	36 ↓	↓	see A76		

Physical Assessment: (1) Damaged "D" or significantly damaged "SD" TSI ACBM, (2) D friable surfacing ACBM, (3) SD friable surfacing ACBM, (4) D or SD friable miscellaneous ACBM, (5) ACBM with potential for D, (6) ACBM with potential for SD, (7) Any remaining friable ACBM or friable suspected ACBM.

Damage Type: Contact, Water, Age, Vibration, Air Erosion

Disturbance Potential: Low, Moderate, High

REC'D Spe 1325  
EMSL-BOSTON OCT 07 2024

# PEER

Consultants, P.C.

ENGINEERS • SCIENTISTS • PLANNERS

10 Mall Road, Suite 301 • Burlington, MA 01803 • (781) 238-8880 • Fax (781) 238-8884

CLIENT: Gale Associates, Inc. PROJECT NAME: Barnstable Superior Court PROJECT #: 8503			Hazardous Building Material Inspection Sample Log / Chain of Custody	
BUILDING NAME: BSC, 3195 Main St., Barnstable, MA YEAR: 2024 ▲ SAMPLING DATE: 9/30			ASBESTOS INSPECTOR: D. Gorden (PEER); MA: AI-900459 PAGE 7 OF 7	
Homogenous Group	Location (Level / Room)	Building Material / Type (S, TSI, M)	Physical Assessment Category, and Damage Type or Disturbance Potential Detailed Description of Sampled Material	Quantity / Other
A-78	1820's B ext	mortar M	see A76 (east elev)	
A-79	↓	↓	light pink mortar behind repaired mortar @ east elev	
A-80	↓	↓	see A79	
A-81	↓	↓	see A76 (north elev)	
A-82	↓	↓	see A79 (north elev)	
A-83	1903 B ext	↓	gray fine grained original mortar @ north-elevation	
A-84	↓	↓	see A83	
A-85	↓	↓	light gray fine grained smooth granite mortar @ east elev	
A-86	↓	↓	see A85	
A-87	1920's B ext	↓	light brownish gray fine to coarse grained granite mortar @ west elev	
A-88	↓	↓	see A87	
A-89	1820's B ext	paint coating	Textured white paint over gray coating w/cementitious feel	(on wood)
A-90	↓	paint coating	see A89	
A-				
A-				
A-				
A-				
A-				

Physical Assessment: (1) Damaged "D" or significantly damaged "SD" TSI ACBM, (2) D friable surfacing ACBM, (3) SD friable surfacing ACBM, (4) D or SD friable miscellaneous ACBM, (5) ACBM with potential for D, (6) ACBM with potential for SD, (7) Any remaining friable ACBM or friable suspected ACBM.

Damage Type: Contact, Water, Age, Vibration, Air Erosion

Disturbance Potential: Low, Moderate, High

REC'D SP1325  
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EMSL Order: 132406152

Customer ID: PEER42

Customer PO: 8503

Project ID:

**Attention:** Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

**Phone:** (781) 238-8880

**Fax:** (781) 238-8884

**Received Date:** 10/07/2024 1:25 PM

**Analysis Date:** 10/08/2024 - 10/09/2024

**Collected Date:** 09/30/2024

**Project:** Barnstable Superior Court / 8503

## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-1 132406152-0001	Exterior Portico - Light Brown Sealant on Thick Coat White Paint (Stained) Rear Entry Woodboard	Gray/White Non-Fibrous Homogeneous	HA: 1	100% Non-fibrous (Other)	None Detected
A-2 132406152-0002	Exterior Portico - Light Brown Sealant on Thick Coat White Paint (Stained) Rear Entry Woodboard	Gray/White Non-Fibrous Homogeneous	HA: 1	100% Non-fibrous (Other)	None Detected
A-3 132406152-0003	Exterior Portico - White Flexible Sealant above Metal Cover for Wood at Portico	White Non-Fibrous Homogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
A-4 132406152-0004	Exterior Portico - White Flexible Sealant above Metal Cover for Wood at Portico	White Non-Fibrous Homogeneous	HA: 2	100% Non-fibrous (Other)	None Detected
A-5 132406152-0005	Exterior Portico - Light Brown Hard Sealant Mixed w. White Paint under Sign at Portico	Gray/White Non-Fibrous Homogeneous	HA: 3	100% Non-fibrous (Other)	None Detected
A-6 132406152-0006	Exterior Portico - Light Brown Hard Sealant Mixed w. White Paint under Sign at Portico	Gray/White Non-Fibrous Homogeneous	HA: 3	100% Non-fibrous (Other)	None Detected
A-7 132406152-0007	Exterior Portico - White Sealant Covered in White Paint on Vertical Boards/in between at Portico	White Non-Fibrous Homogeneous	HA: 4	100% Non-fibrous (Other)	None Detected
A-8 132406152-0008	Exterior Portico - White Sealant Covered in White Paint on Vertical Boards/in between at Portico	White Non-Fibrous Homogeneous	HA: 4	100% Non-fibrous (Other)	None Detected

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**EMSL Order:** 132406152  
**Customer ID:** PEER42  
**Customer PO:** 8503  
**Project ID:**

## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-9  132406152-0009	Ext. Window - Yellow-Brown Firm Flexible Repair Sealant at Window Frame	Tan Non-Fibrous Homogeneous	HA: 5	100% Non-fibrous (Other)	None Detected
A-10  132406152-0010	Ext. Window - Yellow-Brown Firm Flexible Repair Sealant at Window Frame	Tan Non-Fibrous Homogeneous	HA: 5	100% Non-fibrous (Other)	None Detected
A-11A  132406152-0011	Ext. Window - White Weathered Firm Flexible Frame Caulk Repair at Window	White Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
A-11B  132406152-0012	Ext. Window - White Hard Brittle Original Frame Caulk at Sill	White Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
A-12A  132406152-0013	Ext. Window - White Weathered Firm Flexible Frame Caulk Repair at Window	White Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
A-12B  132406152-0014	Ext. Window - White Hard Brittle Original Frame Caulk at Sill	White Non-Fibrous Homogeneous	HA: 6	100% Non-fibrous (Other)	None Detected
A-13  132406152-0015	Ext. Brick - Yellow Orange Flexible Repair Sealant at Brick to Brick Joint Crack	Tan Non-Fibrous Homogeneous	HA: 7	100% Non-fibrous (Other)	None Detected
A-14  132406152-0016	Ext. Brick - Yellow Orange Flexible Repair Sealant at Brick to Brick Joint Crack	Tan Non-Fibrous Homogeneous	HA: 7	100% Non-fibrous (Other)	None Detected
A-15  132406152-0017	Ext. Brick - Light Gray Hard Flexible Original Sealant at Brick to Brick Joint Crack	White Non-Fibrous Homogeneous	HA: 8	98% Non-fibrous (Other)	2% Chrysotile
A-16  132406152-0018	Ext. Brick - Light Gray Hard Flexible Original Sealant at Brick to Brick Joint Crack	White Non-Fibrous Homogeneous	HA: 8	98% Non-fibrous (Other)	2% Chrysotile
A-17  132406152-0019	Exterior Brick - Light Gray Hard Frame Caulk for 10x32" Vent in Brick	Gray Non-Fibrous Homogeneous	HA: 9	100% Non-fibrous (Other)	None Detected

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<b>EMSL Order:</b> 132406152
<b>Customer ID:</b> PEER42
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<b>Project ID:</b>

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E  
Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy**

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-18  132406152-0020	Exterior Brick - Light Gray Hard Frame Caulk for 10x32" Vent in Brick	Gray Non-Fibrous Homogeneous	HA: 9	100% Non-fibrous (Other)	None Detected
A-19  132406152-0021	Exterior Brick - Light Gray Fine Grained Cem. Material Filler for 10x32" Vent Brick	Gray Non-Fibrous Homogeneous	HA: 10	100% Non-fibrous (Other)	None Detected
A-20  132406152-0022	Exterior Brick - Light Gray Fine Grained Cem. Material Filler for 10x32" Vent Brick	Gray Non-Fibrous Homogeneous	HA: 10	100% Non-fibrous (Other)	None Detected
A-21  132406152-0023	Ext. Foundat. - Light Gray Parge Coat w. White FG Particles on Foundation	Gray Non-Fibrous Homogeneous	HA: 11	100% Non-fibrous (Other)	None Detected
A-22  132406152-0024	Ext. Foundat. - Light Gray Parge Coat w. White FG Particles on Foundation	Gray Non-Fibrous Homogeneous	HA: 11	100% Non-fibrous (Other)	None Detected
A-23A  132406152-0025	Ext. at MC 1 - Orange Standard Brick w. Drying Cracks on Exterior Face	Tan Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-23B  132406152-0026	Ext. at MC 1 - Light Gray F-M Grained Cem. Mortar in between Brick & Inside	Gray Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-23C  132406152-0027	Ext. at MC 1 - Red F-M Grained Bostonia Rect. Terracotta w. Hollow Interior	Red Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-23D  132406152-0028	Ext. at MC 1 - Orange F-M Grained Rectangular Terracotta w. Hollow Interior	Red Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-23E  132406152-0029	Ext. at MC 1 - White F-M Grained Mortar in between Sections of Terracotta	Gray Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-24A  132406152-0030	Ext. at MC 1 - Orange Standard Brick w. Drying Cracks on Exterior Face	Tan Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected

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## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-24B <small>132406152-0031</small>	Ext. at MC 1 - Light Gray F-M Grained Cem. Mortar in between Brick & Inside	Gray Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-24C <small>132406152-0032</small>	Ext. at MC 1 - Red F-M Grained Bostonia Rect. Terracotta w. Hollow Interior	Red Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-24D <small>132406152-0033</small>	Ext. at MC 1 - Orange F-M Grained Rectangular Terracotta w. Hollow Interior	Red Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-24E <small>132406152-0034</small>	Ext. at MC 1 - White F-M Grained Mortar in between Sections of Terracotta	Gray Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-25A <small>132406152-0035</small>	Ext. MC 2 - Orange Standard Brick w. Drying Cracks on Exterior Face	Tan Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-25B <small>132406152-0036</small>	Ext. MC 2 - Light Gray F-M Grained Cem. Mortar in between Brick & Inside	Gray Non-Fibrous Homogeneous	HA: 12	100% Non-fibrous (Other)	None Detected
A-26 <small>132406152-0037</small>	Ext. MC 2 - Gray to Light Gray Fine Grained Cornice Mortar	Gray Non-Fibrous Homogeneous	HA: 13	100% Non-fibrous (Other)	None Detected
A-27 <small>132406152-0038</small>	Ext. MC 2 - Gray to Light Gray Fine Grained Cornice Mortar	Gray Non-Fibrous Homogeneous	HA: 13	100% Non-fibrous (Other)	None Detected
A-28 <small>132406152-0039</small>	Ext. MC 2 - Light Gray Fine to Med. Grained Cavity Mortar	Gray Non-Fibrous Homogeneous	HA: 14	100% Non-fibrous (Other)	None Detected
A-29 <small>132406152-0040</small>	Ext. MC 2 - Light Gray Fine to Med. Grained Cavity Mortar	Gray Non-Fibrous Homogeneous	HA: 14	100% Non-fibrous (Other)	None Detected
A-30 <small>132406152-0041</small>	Ext. MC 2 - White to Light Gray Hard Cornice Joint Sealant	Tan Non-Fibrous Homogeneous	HA: 15	98% Non-fibrous (Other)	<b>2% Chrysotile</b>
A-31 <small>132406152-0042</small>	Ext. MC 2 - White to Light Gray Hard Cornice Joint Sealant	Tan Non-Fibrous Homogeneous	HA: 15	98% Non-fibrous (Other)	<b>2% Chrysotile</b>

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**EMSL Order:** 132406152  
**Customer ID:** PEER42  
**Customer PO:** 8503  
**Project ID:**

## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-32 132406152-0043	Ext. MC 2 - Brown Fibrous Backing Material for Cornice Joint	Brown Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
			HA: 16		
A-33 132406152-0044	Ext. MC 2 - Brown Fibrous Backing Material for Cornice Joint	Brown Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
			HA: 16		
A-34 132406152-0045	Exterior 1820B - White Painted Light Gray Glazing Putty w. Wood Stain (8P2S)	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 17		
A-35 132406152-0046	Exterior 1820B - White Painted Light Gray Glazing Putty w. Wood Stain (8P2S)	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 17		
A-36 132406152-0047	Exterior 1820B - White Thick Coats of Paint in Drip Sill of Window	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 18		
A-37 132406152-0048	Exterior 1820B - White Thick Coats of Paint in Drip Sill of Window	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 18		
A-38 132406152-0049	Exterior 1820B - Black Tar Paper within Window Drip Sill & Ext. Storm F	Black Non-Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
			HA: 19		
A-39 132406152-0050	Exterior 1820B - Black Tar Paper within Window Drip Sill & Ext. Storm F	Black Non-Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
			HA: 19		
A-40 132406152-0051	Exterior 1820B - White Painted Light Gray Glazing Putty w. Wood Stain (8P2S)	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 17		
A-41 132406152-0052	Exterior 1820B - Black Mildew Stained Light Gray Ext. Frame Caulk for Painted Wood W	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 18		
A-42 132406152-0053	Exterior 1820B - Black Mildew Stained Light Gray Ext. Frame Caulk for Painted Wood W	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 18		

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**EMSL Order:** 132406152  
**Customer ID:** PEER42  
**Customer PO:** 8503  
**Project ID:**

## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-43  132406152-0054	Exterior 1820B - Light Gray to Gray Hard Sealant under Capston Edge Roof	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 19		
A-44  132406152-0055	Exterior 1820B - Light Gray to Gray Hard Sealant under Capston Edge Roof	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 19		
A-45  132406152-0056	Int. Mens - Black Coated Gray Cement. Sill Interior Men's RM Basement	Gray/Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 20		
A-46A  132406152-0057	Int. RM 247 - Gray Painted Wallpaper Delaminating from Painted PL Wall	White Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
			HA: 21		
A-46B  132406152-0058	Int. RM 247 - Orange-Yellow Mastic on Back of Wallpaper & on Wall	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 21		
A-47A  132406152-0059	Int. RM 247 - Gray Painted Wallpaper Delaminating from Painted PL Wall	White Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
			HA: 21		
A-47B  132406152-0060	Int. RM 247 - Orange-Yellow Mastic on Back of Wallpaper & on Wall	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 21		
A-48A-Wallpaper  132406152-0061	Int. SW RM 225 - Off-White Wallpaper on/Contam. by Pink Paint on P. Wall	White Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
			HA: 22		
A-48A-Joint Compound  132406152-0061A	Int. SW RM 225 - Off-White Wallpaper on/Contam. by Pink Paint on P. Wall	Tan Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 22		
A-49A-Wallpaper  132406152-0062	Int. SW RM 225 - Off-White Wallpaper on/Contam. by Pink Paint on P. Wall	White Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
			HA: 22		
A-49A-Joint Compound  132406152-0062A	Int. SW RM 225 - Off-White Wallpaper on/Contam. by Pink Paint on P. Wall	Tan Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 22		
A-50  132406152-0063	1970 B Ext. - Light Gray to Gray Friable G. Putty for 8P20S4P Fixed Window	Gray Non-Fibrous Homogeneous		98% Non-fibrous (Other)	<b>2% Chrysotile</b>
			HA: 23		

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## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-51 132406152-0064	1970 B Ext. - Light Gray to Gray Friable G. Putty for 8P20S4P Fixed Window	Gray Non-Fibrous Homogeneous	HA: 23	98% Non-fibrous (Other)	2% Chrysotile
A-52 132406152-0065	1970 B Ext. - White Firm, Flexible Pheno-Seal-like Caulk Fix for Windows	White Non-Fibrous Homogeneous	HA: 24	100% Non-fibrous (Other)	None Detected
A-53 132406152-0066	1970 B Ext. - White Firm, Flexible Pheno-Seal-like Caulk Fix for Windows	White Non-Fibrous Homogeneous	HA: 24	100% Non-fibrous (Other)	None Detected
A-54 132406152-0067	1920 B Ext. - Light Brown, Hard Brittle Frame Caulk (Wood on Brick) on Window	Gray Non-Fibrous Homogeneous	HA: 25	98% Non-fibrous (Other)	2% Chrysotile
A-55 132406152-0068	1920 B Ext. - Light Brown, Hard Brittle Frame Caulk (Wood on Brick) on Window	Gray Non-Fibrous Homogeneous	HA: 25	98% Non-fibrous (Other)	2% Chrysotile
A-56 132406152-0069	1920 B Ext. - Yellow Brown Hard Brittle Glazing Putty on Metal W. Frame	White Non-Fibrous Homogeneous	HA: 26	100% Non-fibrous (Other)	None Detected
A-57 132406152-0070	1920 B Ext. - Yellow Brown Hard Brittle Glazing Putty on Metal W. Frame	White Non-Fibrous Homogeneous	HA: 26	100% Non-fibrous (Other)	None Detected
A-58 132406152-0071	1920 B Ext. - Yellow Brown Glazing Putty (Hard) for 4 Pane Basement Window	Tan Non-Fibrous Homogeneous	HA: 27	100% Non-fibrous (Other)	None Detected
A-59 132406152-0072	1920 B Ext. - Yellow Brown Glazing Putty (Hard) for 4 Pane Basement Window	Tan Non-Fibrous Homogeneous	HA: 27	100% Non-fibrous (Other)	None Detected
A-60 132406152-0073	1970 B Ext. - White Glazing Putty for 24 Pane Fire Escape Door at 2nd Elev.	White Non-Fibrous Homogeneous	HA: 28	100% Non-fibrous (Other)	None Detected
A-61 132406152-0074	1970 B Ext. - White Glazing Putty for 24 Pane Fire Escape Door at 2nd Elev.	White Non-Fibrous Homogeneous	HA: 28	100% Non-fibrous (Other)	None Detected
A-62 132406152-0075	1903 B Ext. - Light Gray to Brown, Hard Brittle Frame Caulk for Window	White Non-Fibrous Homogeneous	HA: 29	100% Non-fibrous (Other)	None Detected

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## Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-63 132406152-0076	1903 B Ext. - Light Gray to Brown, Hard Brittle Frame Caulk for Window	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 29		
A-64 132406152-0077	1903 B Ext. - White to Light Gray Hard Brittle Glazing Putty for 8P2S Windows	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 30		
A-65 132406152-0078	1903 B Ext. - White to Light Gray Hard Brittle Glazing Putty for 8P2S Windows	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 30		
A-66 132406152-0079	1903 B Ext. - White Thick Coat of Paint on Windows for Building	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
			HA: 31		
A-67 132406152-0080	1903 B Ext. - White Thick Coat of Paint on Windows for Building	White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
			HA: 31		
A-68 132406152-0081	1820 B Ext. - White Hard Brittle Frame Caulk on 8P2S Wood Window at Granite	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 32		
A-69 132406152-0082	1820 B Ext. - White Hard Brittle Frame Caulk on 8P2S Wood Window at Granite	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 32		
A-70 132406152-0083	1903 B Ext. - White to Gray Speckled Paint Coating on Wood/Brick Lego Cornie Fascia	Gray Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
			HA: 33		
A-71 132406152-0084	1903 B Ext. - White to Gray Speckled Paint Coating on Wood/Brick Lego Cornie Fascia	Gray Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
			HA: 33		
A-72 132406152-0085	1903 B Ext. - Gray Suspect Sealant in between Wood Painted Lego Brick-like Fascia	Gray/White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
			HA: 34		
A-73 132406152-0086	1903 B Ext. - Gray Suspect Sealant in between Wood Painted Lego Brick-like Fascia	Gray/White Non-Fibrous Homogeneous		98% Non-fibrous (Other)	2% Chrysotile
			HA: 34		

Initial report from: 10/09/2024 10:07:34



# EMSL Analytical, Inc.

5 Constitution Way, Unit A Woburn, MA 01801

Tel/Fax: (781) 933-8411 / (781) 933-8412

<http://www.EMSL.com/bostonlab@emsl.com>

<b>EMSL Order:</b> 132406152
<b>Customer ID:</b> PEER42
<b>Customer PO:</b> 8503
<b>Project ID:</b>

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E  
Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy**

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-74  132406152-0087	1820 B Ext. - Yellow over Gray Fine Grained Textured Coating on 20 Wood Column	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 35		
A-75  132406152-0088	1820 B Ext. - Yellow over Gray Fine Grained Textured Coating on 20 Wood Column	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 35		
A-76  132406152-0089	1820 B Ext. - Gray Smooth Granite Mortar from West Elevation	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 36		
A-77  132406152-0090	1820 B Ext. - Gray Smooth Granite Mortar from West Elevation	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 36		
A-78  132406152-0091	1820's B Exterior - Gray Smooth Granite Mortar from East Elevation	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 36		
A-79  132406152-0092	1820's B Exterior - Light Pink Mortar behind Repainted Mortar at East Elev.	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 37		
A-80  132406152-0093	1820's B Exterior - Light Pink Mortar behind Repainted Mortar at East Elev.	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 37		
A-81  132406152-0094	1820's B Exterior - Gray Smooth Granite Mortar from North Elevation	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 36		
A-82  132406152-0095	1820's B Exterior - Light Pink Mortar behind Repainted Mortar at North Elev.	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 37		
A-83  132406152-0096	1903B Ext. - Gray Fine Grained Original Mortar at North Elevation	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 38		
A-84  132406152-0097	1903B Ext. - Gray Fine Grained Original Mortar at North Elevation	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
			HA: 38		

Initial report from: 10/09/2024 10:07:34



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Tel/Fax: (781) 933-8411 / (781) 933-8412

<http://www.EMSL.com> / [bostonlab@emsl.com](mailto:bostonlab@emsl.com)

<b>EMSL Order:</b> 132406152
<b>Customer ID:</b> PEER42
<b>Customer PO:</b> 8503
<b>Project ID:</b>

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E  
Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy**

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
A-85  132406152-0098	1903B Ext. - Light Gray Fine Grained Smooth Granite Mortar at East Elev.	Gray Non-Fibrous Homogeneous	HA: 39	100% Non-fibrous (Other)	None Detected
A-86  132406152-0099	1903B Ext. - Light Gray Fine Grained Smooth Granite Mortar at East Elev.	Gray Non-Fibrous Homogeneous	HA: 39	100% Non-fibrous (Other)	None Detected
A-87  132406152-0100	1920's B Ext. - Light Brownish Gray Fine to Coarse Grained Granite Mortar at West Elev.	Gray Non-Fibrous Homogeneous	HA: 40	100% Non-fibrous (Other)	None Detected
A-88  132406152-0101	1920's B Ext. - Light Brownish Gray Fine to Coarse Grained Granite Mortar at West Elev.	Gray Non-Fibrous Homogeneous	HA: 40	100% Non-fibrous (Other)	None Detected
A-89  132406152-0102	1820's B Ext. - Textured White Paint over Gray Coating w. Cementitious Feel	Gray/White Non-Fibrous Homogeneous	HA: 41	100% Non-fibrous (Other)	None Detected
A-90  132406152-0103	1820's B Ext. - Textured White Paint over Gray Coating w. Cementitious Feel	Gray/White Non-Fibrous Homogeneous	HA: 41	100% Non-fibrous (Other)	None Detected

Analyst(s)  
Kevin Pine (105)

Steve Grise, Laboratory Manager  
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Woburn, MA NVLAP Lab Code 101147-0, CT PH-0315, MA AA000188, RI AAL-139, VT AL998919, ME LB-0039

Initial report from: 10/09/2024 10:07:34

Appendix B

Metals in Paint, Coatings, Substrates, and Building Materials

Sample Log and Analytical Data



Tuesday, October 08, 2024

Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Project ID: BARNSTABLE SC  
SDG ID: GCR76883  
Sample ID#s: CR76883 - CR76891

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

A handwritten signature in black ink that reads "Phyllis Shiller". The signature is written in a cursive style.

Phyllis Shiller

Laboratory Director

NELAC - #NY11301  
CT Lab Registration #PH-0618  
MA Lab Registration #M-CT007  
ME Lab Registration #CT-007  
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003  
NY Lab Registration #11301  
PA Lab Registration #68-03530  
RI Lab Registration #63  
VT Lab Registration #VT11301



Environmental Laboratories, Inc.  
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102 Fax (860) 645-0823

## Sample Id Cross Reference

October 08, 2024

SDG I.D.: GCR76883

Project ID: BARNSTABLE SC

---

Client Id	Lab Id	Matrix
L1	CR76883	BULK
L2	CR76884	BULK
L3	CR76885	BULK
L4	CR76886	BULK
L5	CR76887	BULK
L6	CR76888	BULK
L7	CR76889	BULK
L8	CR76890	BULK
L9	CR76891	BULK



**Environmental Laboratories, Inc.**

587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

8:02  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76883

Project ID: BARNSTABLE SC  
Client ID: L1

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	285	2.3	mg/Kg	1	10/03/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

Results are reported on an ``as received`` basis, and are not corrected for dry weight.

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If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



**Environmental Laboratories, Inc.**

587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

8:51  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76884

Project ID: BARNSTABLE SC  
Client ID: L2

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	4560	1.0	mg/Kg	1	10/03/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



Environmental Laboratories, Inc.  
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
 Tel. (860) 645-1102

# Analysis Report

October 08, 2024

FOR: Attn: Mr Dave Gorden  
 PEER Consultants  
 25 Mall Road, Suite 206  
 Burlington, MA 01803

Sample Information

Matrix: BULK  
 Location Code: PEER-PAINT  
 Rush Request: Standard  
 P.O.#: 8503

Custody Information

Collected by:  
 Received by: SR1  
 Analyzed by: see "By" below

Date

09/30/24  
 10/02/24

Time

9:27  
 14:46

## Laboratory Data

SDG ID: GCR76883  
 Phoenix ID: CR76885

Project ID: BARNSTABLE SC  
 Client ID: L3

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	242000	180	mg/Kg	100	10/05/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



Environmental Laboratories, Inc.  
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
 Tel. (860) 645-1102

# Analysis Report

October 08, 2024

FOR: Attn: Mr Dave Gorden  
 PEER Consultants  
 25 Mall Road, Suite 206  
 Burlington, MA 01803

Sample Information

Matrix: BULK  
 Location Code: PEER-PAINT  
 Rush Request: Standard  
 P.O.#: 8503

Custody Information

Collected by:  
 Received by: SR1  
 Analyzed by: see "By" below

Date

09/30/24  
 10/02/24

Time

10:16  
 14:46

## Laboratory Data

SDG ID: GCR76883  
 Phoenix ID: CR76886

Project ID: BARNSTABLE SC  
 Client ID: L4

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	252000	110	mg/Kg	100	10/05/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



**Environmental Laboratories, Inc.**

587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

11:22  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76887

Project ID: BARNSTABLE SC  
Client ID: L5

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	137	1.8	mg/Kg	1	10/03/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

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**Comments:**

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



**Environmental Laboratories, Inc.**

587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

11:38  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76888

Project ID: BARNSTABLE SC  
Client ID: L6

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	359000	250	mg/Kg	100	10/05/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

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**Comments:**

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



**Environmental Laboratories, Inc.**

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Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

12:03  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76889

Project ID: BARNSTABLE SC  
Client ID: L7

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	39300	17	mg/Kg	10	10/03/24	TH	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



**Environmental Laboratories, Inc.**

587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

12:32  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76890

Project ID: BARNSTABLE SC  
Client ID: L8

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	243000	100	mg/Kg	100	10/05/24	CPP	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

Massachusetts does not offer certification for Soil/Solid matrices.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



**Environmental Laboratories, Inc.**

587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102

**Analysis Report**

October 08, 2024

FOR: Attn: Mr Dave Gorden  
PEER Consultants  
25 Mall Road, Suite 206  
Burlington, MA 01803

Sample Information

Matrix: BULK  
Location Code: PEER-PAINT  
Rush Request: Standard  
P.O.#: 8503

Custody Information

Collected by:  
Received by: SR1  
Analyzed by: see "By" below

Date

09/30/24  
10/02/24

Time

13:18  
14:46

Laboratory Data

SDG ID: GCR76883  
Phoenix ID: CR76891

Project ID: BARNSTABLE SC  
Client ID: L9

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Lead	169000	17	mg/Kg	10	10/03/24	TH	SW6010D
Total Metals Digest	Completed				10/02/24	J/P	SW3050B

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RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

**Comments:**

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**Phyllis Shiller, Laboratory Director**

**October 08, 2024**

**Reviewed and Released by: Greg Lawrence, Assistant Lab Director**



Environmental Laboratories, Inc.  
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
 Tel. (860) 645-1102

# QA/QC Report

October 08, 2024

## QA/QC Data

SDG I.D.: GCR76883

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
-----------	-------	--------	---------------	------------	---------	-------	--------	---------	------	-------	--------	--------------	--------------

QA/QC Batch 751805 (mg/kg), QC Sample No: CR76384 (CR76883, CR76884, CR76885, CR76886, CR76887, CR76888, CR76889, CR76890)

### ICP Metals - Soil

Lead	BRL	0.33	9.6	8.99	6.60	105	111	5.6	102			75 - 125	30
------	-----	------	-----	------	------	-----	-----	-----	-----	--	--	----------	----

Comment:

Additional Criteria: LCS acceptance range is 80-120% for aqueous and for soils the acceptance range is set by vendor limits. MS acceptance range 75-125%.

QA/QC Batch 751832 (mg/kg), QC Sample No: CR76924 (CR76891)

### ICP Metals - Soil

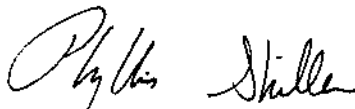
Lead	BRL	0.33	19.4	24.0	21.2	95.3	95.0	0.3	100			75 - 125	30
------	-----	------	------	------	------	------	------	-----	-----	--	--	----------	----

Comment:

Additional Criteria: LCS acceptance range is 80-120% for aqueous and for soils the acceptance range is set by vendor limits. MS acceptance range 75-125%.

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

- RPD - Relative Percent Difference
- LCS - Laboratory Control Sample
- LCSD - Laboratory Control Sample Duplicate
- MS - Matrix Spike
- MS Dup - Matrix Spike Duplicate
- NC - No Criteria
- Intf - Interference
- (ISO) - Isotope Dilution

  
 Phyllis Shiller, Laboratory Director  
 October 08, 2024

Tuesday, October 08, 2024

Criteria: None

State: MA

# Sample Criteria Exceedances Report

## GCR76883 - PEER-PAINT

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL	Analysis Units
--------	-------	-----------------	----------	--------	----	----------	----	----------------

\*\*\* No Data to Display \*\*\*

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedances. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedance information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.



**Environmental Laboratories, Inc.**  
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045  
Tel. (860) 645-1102 Fax (860) 645-0823



## Analysis Comments

October 08, 2024

SDG I.D.: GCR76883

---

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

Coolant:  IPK  ICE  No  No

**CHAIN OF CUSTODY RECORD**

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040  
 Email: info@phoenixlabs.com Fax (860) 645-0823  
 Client Services (860) 645-8726



Customer: PEER CONSULTANTS  
 Address: 25 Mall Rd Suite 206  
Burlington MA 01803  
7812380880

Project: Barnstable SC  
 Report to: D. Gordon  
 Invoice to: D. Gordon  
 QUOTE # PEER PAINT

Project P.O.: 8503

This section **MUST** be completed with Bottle Quantities.

Sampler's Signature: \_\_\_\_\_ Date: 9/30/24

Matrix Code: GW=Ground Water SW=Surface Water WW=Waste Water  
DW=Drinking Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe OIL=Oil  
B=Bulk L=Liquid X=\_\_\_\_\_(Other)

Analysis Request	MS/MSD	GL VOA Vials (methanol) /oz	GL Soil container (oz)	40 ml VOA Vial / 1.5 L	GL Amber 1000ml / 1.5 L	PL H2SO4 / 250ml	PL H2SO4 / 150ml	PL H2SO4 / 250ml	PL H2SO4 / 150ml	PL H2SO4 / 250ml	Bacterial Bottle white
Lead (by ICP)	✓										
	✓										
	✓										
	✓										
	✓										
	✓										
	✓										
	✓										
	✓										

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled
76883	L1	SD	9/30	0802
76884	L2			0851
76885	L3			0927
76886	L4			1016
76887	L5			1122
76888	L6			1138
76889	L7			1203
76890	L8			1232
76891	L9			1318

Reimbursed by: \_\_\_\_\_ Date: 10-2-24  
 Accepted by: \_\_\_\_\_ Date: 9-30-24  
14:46

Comments, Special Requirements or Regulations:  
 Turnaround Time:  
 1 Day\*  
 2 Days\*  
 3 Days\*  
 Standard  
 \*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted. \* SURCHARGE APPLIES

State where samples were collected: MA

CI:  RCP Cert  GW Protection  SW Protection  GA Mobility  GB Mobility  Residential DEC  I/C DEC  Other

MA:  MCP Certification  GW-1  GW-2  GW-3  S-1 GW-1  S-1 GW-2  S-1 GW-3  S-2 GW-1  S-2 GW-2  S-2 GW-3  S-3 GW-1  S-3 GW-2  S-3 GW-3  SW Protection

GI:  (Residential) Direct Exposure  (Comm/Industrial) Direct Exposure  GA Leachability  GB Leachability  GA-GW Objectives  GB-GW Objectives

Data Format:  Excel  PDF  GIS/Key  ECU/S  Other

Data Package:  Tier II Checklist  Full Data Package\*  Phoenix Std Report  Other

\* SURCHARGE APPLIES

**APPENDIX C – MORTAR ANALYSIS**

# Mortar Analysis Report

## Barnstable County Superior Courthouse Restoration

3195 Main Street, Barnstable, MA 02630



**Prepared for**  
Gale Associates, Inc.

**Client ID**  
GALE005

**Report No.**  
SL2011-01

**Report Date**  
01/23/25



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**Cover Image**

Photograph of the Barnstable County Superior Courthouse in Barnstable, MA. Image courtesy of Mr. Marc Loranger of Gale Associates, Inc.

Respectfully submitted,



Heather Hartshorn  
Vice President/ Senior Chemist  
**Highbridge Materials Consulting, Inc.**



John J. Walsh  
President/ Senior Petrographer  
**Highbridge Materials Consulting, Inc.**

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## 1. Executive Summary

Six masonry mortars were examined petrographically and chemically for this report to determine their composition and evaluate their condition. The mortars were reportedly taken from different masonry types and eras of construction at the Barnstable County Superior Courthouse in Barnstable, MA. The estimate mix designs for each sample are presented in Table 1.1 below.

### Original 1831 Mortars

Three of the examined samples are consistent with the original ca. 1831 construction date. The brick mortar (Sample MB4) was reportedly taken from the basement. This mortar is a common lime mix without any hydraulic cement addition. It contains a clean quartz sand. Two of the granite mortars (Samples M4 and M5) are natural cement mixes that could date to the 1830s. The cement microtextures and chemistry are clearly distinct from products manufactured in Rosendale, NY. This appears to represent a mid-nineteenth century, high-calcium cement that was less widely used throughout the United States.

The lime mortar was likely soft, friable, and highly water-absorptive. While the natural cement mixes are still moderately soft and permeable, the mortars are cohesive. The use of a lime mortar in the interior brick masonry and a natural cement mortar in the exterior granite masonry is at least consistent with historical tradition. Natural cement mortars would have been utilized in construction where a more weather-resistant material was desired. Common lime mortars were still effective masonry mixes, but may have been reserved for less exposed areas in larger construction such as this.

### Early Twentieth Century Mortar

The mortar in Sample M2 is a pure portland cement mortar with a low sand content. The cement microtextures are consistent with the reported 1900s construction date for this sample. The mix design is also consistent with early twentieth century practice for stone masonry work. As expected for the composition, this mortar is hard and indurate with a low permeability.

### Later Repointing Mortars

Samples M3 and M6 are cement-lime mortars that date to no earlier than the late twentieth century. Since the client reports that these were respectively taken from the 1831 and 1900s granite masonry, these must represent repointing mixes. This is also suggested by the presence of some earlier mortar residues that are superficially similar to the portland cement mortar in Sample M2 and the natural cement mortar in Samples M4 and M5. The repointing mixes are harder and less permeable than the natural cement mortars, and there may be some concern about moisture entrapment within the joint if there are other avenues for water to infiltrate the 1831 granite masonry. There is less concern about the repointings contributing to any mortar deterioration where these are placed over the hard and impermeable portland cement mortar from the early twentieth century granite masonry.

**Table 1.1: Summary of Estimated Mix Designs**

Client's suspected date	Masonry type	Sample ID	Binder type	Binder to sand ratio
1831	Brick	MB4	Nonhydraulic lime	> 1 : 3.4
1900s	Granite	M2	Portland cement	1 : 1.6
1831	Granite	M3	Type N portland cement-lime (repointing)	1 : 1.5
1831	Granite	M4	Natural cement	~ 1 : 3
1831	Granite	M5	Natural cement	~ 1 : 3
1900s	Granite	M6	Type O portland cement-lime (repointing)	1 : 1.4

**2. Introduction**

On October 23 and November 1, 2024, Highbridge received a total of six (6) masonry mortar samples and three (3) cast stone samples from Mr. Samuel Wesselman of Gale Associates, Inc. According to Mr. Wesselman, the samples were taken from various locations and masonry types at the Barnstable County Superior Courthouse in Barnstable, MA. Mr. Marc Loranger, also of Gale Associates, reports that the building was originally constructed in 1831 and has had several additions throughout its history. The client has identified the samples and described their locations as follows in Table 2.1.

**Table 2.1: Summary of Received Samples**

Material type	Client ID	Location description in client's transmittal
Mortar	MB4	West Basement Brick Mortar
	M2	1900s North Elev. Granite Mortar
	M3	Original Bldg. West Smooth Granite Mortar
	M4	Original Bldg. North Elev. Granite Mortar
	M5	Original Bldg. East Elev. Mortar
	M6	1900s Bldg. East Elevation Smooth Granite Mortar
Cast Stone	PC1	1920s East Elev
	PC2	1920s East Side North Elevation
	PC3	1920s West Elevation

Mr. Loranger has requested a compositional analysis on each of the six mortar samples. The testing includes petrographic examination and chemical analysis to identify constituents, evaluate overall condition, and estimate component proportions. Acid digestions to extract sand samples for description and gradation are also included. The client has also requested a petrographic examination on two cast stone samples. The laboratory has chosen to test Samples PC1 and PC2 since there is a conduit running through the middle of Sample PC3. The petrographic examination includes a qualitative identification of the constituents, an assessment of the original casting method, an investigation of the potential causes of any observed distress.

This report presents the results of the compositional mortar analysis. The results of the cast stone examination are presented under separate cover in Highbridge Report SL2011-02.

### 3. Methods of Examination

The petrographic examination is conducted in accordance with the standard practices contained within ASTM C1324-20a. Data collection is performed or supervised by a degreed geologist who by nature of their education is qualified to operate the analytical equipment employed. Analysis and interpretation is performed or directed by a supervising petrographer who satisfies the qualifications as specified in Section 4 of ASTM C856/C856M-20.

Chemical analysis is performed in general accordance with the procedures outlined in ASTM C1324-20a. Water, carbon dioxide, and aggregate weight percentages are determined gravimetrically. Oxide weight percentages are determined by inductively coupled plasma - optical emission spectroscopy (ICP-OES). While ASTM classifies C1324 as a test method, it is intended to serve as a guideline for qualified practitioners with ample experience in the various materials under consideration. Section 10.2 indicates the need for discretion on the part of the laboratory to ensure that methods are tailored to specific mortar compositions. As such, Highbridge chooses specific digestion methods, supplementary tests, instrumentation protocols, and mathematical models to best characterize each individual mortar under consideration. Many of these are proprietary methods that have been researched internally.

The following personnel contributed to the examination:

Technician:	M. Pattie
Analysts:	G. Shikapwashya
Chemist/ Petrographer:	H. Hartshorn
Supervisor:	J. Walsh

#### **4. Laboratory Findings and Discussion (Lime Mortar - Sample MB4)**

##### **4.1 - Overall Appearance and Quality**

The sample provided for examination consists only of loose granules and powder. The disaggregated condition of the provided material suggests that the mortar was rather soft, permeable, and friable. The mortar debris has a nearly white color overall (Munsell code approximately 2.5Y 8.5/1).

##### **4.2 - Materials**

The aggregate is a clean natural sand consisting primarily of quartz. No clay coatings, friable materials, or organic impurities are observed. The sand is considered hard, non-porous, and durable for use in masonry mortars. A sample of the aggregate was extracted from the mortar through acid digestion. The recovered sand is uniform and semi-translucent with a light gray color (Munsell code approximately 2.5Y 7.25/1). The somewhat sharp-textured sand is medium-grained and broadly graded. Details of the gradation are presented in Section 8. The nominal top size is at the No. 16 sieve, the peak abundance is found between the No. 30 and No. 50 sieves, and the fines content is minor.

Based on the small fragments of binder matrix included in the sample, the binder consists solely of a nonhydraulic lime. No cementitious constituents are identified petrographically, and this is supported by the measured chemistry (Section 9.1). Minor impurities observed petrographically suggest that the lime was manufactured from a marble rock source. This is typical of lime used throughout New England during the nineteenth century. Also typical of New England marble limes is a modest concentration of magnesium in a lime that otherwise consists primarily of calcium (Table 9.1b). These "intermediate limes" would have been slower to slake and would have generated less volume upon slaking as compared to a high-calcium "fat lime". Still, the lime would have been entirely appropriate for use in brick masonry construction.

##### **4.3 - Component Proportions**

The total binder to sand ratio is estimated at 1 : 3.4 by volume. This estimate is based on the chemical analysis presented in Section 9.1. The sand content in the sample may be overestimated compared to that of the original mortar due to the fragmental quality of the provided material. Still, the estimated proportions are considered more or less appropriate and typical of a basic construction mortar.

##### **4.4 - Condition and Service Performance**

The provided sample is fragmental, and it is not possible to assess the quality of the original workmanship. The fact that the mortar could only be collected as debris could suggest that the cured product is soft, friable, and highly water-permeable. If so, then the mortar quality would be at the lower end of a typical range for nonhydraulic lime mortars.

All of the binder paste included in the sample is fully carbonated, but this is a normal and even desirable consequence of long-term curing. As mentioned above, the condition of the mortar cannot be evaluated from the sample. Still, there is no evidence of any secondary mineralizations in the provided material.

## 5. Laboratory Findings and Discussion (Natural Cement Mortars - Samples M4 and M5)

### 5.1 - Overall Appearance and Quality

Samples M4 and M5 are interpreted to be contemporaneous and likely original to the reported ca. 1831 construction date. Both are natural cement mortars with a uniform pale pink color (Munsell code approximately 7.5YR 7/2.25). The cured product is cohesive, though the paste is relatively soft and moderately permeable.

### 5.2 - Materials

The aggregate in both mortars is a clean, natural sand consisting mostly of quartz with minor feldspar and granite particles. No clay coatings, friable materials, or organic impurities are detected, and the sand is considered sound for use in masonry mortars. A sample of the aggregate was extracted from each mortar through chemical digestion. The recovered sand is uniform and semi-translucent with a light gray color (Munsell code approximately 2.5Y 7.5/0.75).

Details of the gradation are presented in Section 8. The sand is medium-grained and somewhat narrowly graded. The nominal top size at the No. 16 sieve, and over 90% of the sand is retained between the No. 16 and No. 50 sieves (i.e., within two standard sieve intervals). If compared to the standard for modern masonry sand gradations (ASTM C144-18), the aggregate in these mortars would not comply with the permissible limits. However, a more narrowly graded sand such as this is commonly found in historical natural cement mixes of the nineteenth century.

The binder consists of a low-fired hydraulic cement that likely represents a historical natural cement. There are some lime-rich particulates observed petrographically, but these could represent part of the natural cement rather than a separate lime addition. The microtextural characteristics of the binder residuals are consistent with cement burned from a clay-rich limestone with some quartz and other siliceous impurities (Tables 10.2 and 10.3). The chemical analysis indicates that the cement was burned from a calcic rather than dolomitic limestone (Table 9.2b). The following commentary may be made with regard to the natural cement:

- Nearly all of the American natural cements produced throughout the nineteenth century were dolomitic products. This includes the cements from both Syracuse and Rosendale, New York that would have been available by the reported ca. 1831 construction date. Both the chemical analysis and petrographically-observed microtextures are inconsistent with the use of either of these products.
- Of the domestic natural cements with analyses reported in the historical literature, there is a high-calcium product that was manufactured in Southington, CT for a few years starting in the late 1820s. The reported composition of this cement similar but not identical to the binder chemistry measured for both samples. The author considers this a possible source, though the analysis does not indicate an unequivocal coincidence with this material.
- The measured chemistry is also near the range expected for imported natural cements from England, though the English cements were typically more iron-rich than the cement in these samples. This may represent another possible source, and there is certainly evidence of this material being imported along the East coast of the United States in the 1830s.

There is also a fine-grained iron-rich component in the mortar, though the purpose of this material is unclear. This consists of a mixed sediment of iron oxide, quartz silt, and mica and could be derived from an ironstone source. Though possible, it cannot be determined whether this represents part of the cement binder. The microtextures of this material are certainly distinct from those of the obvious natural cement residuals. That said, the iron-rich material also does not appear to represent a pigment addition. It is much coarser-grained than a typical pigment addition. However, this material still contributes to the pinkish hue of the mortar.

### 5.3 - Component Proportions

The component proportions are estimated based on the chemical analysis presented in Section 9.2. The binder to sand ratio is estimated near 1 : 3 by volume in both mortars, though it is slightly higher in Sample M4 than Sample M5. The sand contents are higher than often observed in historical natural cement mortars used in construction along the east coast of the United States during the nineteenth century. Typical proportioning for these types of mixtures would have been between 1 : 1 and 1 : 2 by volume.

### 5.4 - Condition and Service Performance

Based on the examined samples, there are no major workmanship issues in either mortar. The ingredients are well-blended, and the mix water is adequately incorporated. Both mortars are compact and well-consolidated. Fine rounded air-voids are somewhat common in each mix, though not excessive. The cured products are cohesive, though the paste is somewhat soft and moderately water-absorptive. These features are within the range expected for the estimated composition.

The binder paste has fully carbonated, which is a normal and desirable result of long-term service. The samples are in sound condition. There is no evidence of any significant cracking, paste alteration, or deleterious mineralizations.

## 6. Laboratory Findings and Discussion (Portland Cement Mortar - Sample M2)

### 6.1 - Overall Appearance and Quality

Sample M2 represents a portland cement mortar from the early twentieth century. The mortar has a uniform appearance with a gray color (Munsell code approximately 5Y 5/0.75). The cured product is hard, indurate, and not noticeably water-absorptive.

### 6.2 - Materials

The aggregate is a clean, siliceous natural sand consisting primarily of quartz and feldspar. The aggregate is considered hard, non-porous, and durable for use in cementitious mixtures. No significant friable materials or organic impurities are present. A sample of the sand was chemically extracted from the mortar. It has a mostly uniform appearance. There is very minor visual variegation due to the presence of a few opaque light gray, pink, and pale greenish-gray grains in the coarser particle sizes. The average color is light gray (Munsell code approximately 2.5Y 7.5/1).

The extracted sand was graded, and these results are presented in Section 8. The aggregate is medium-grained and broadly graded with a nominal top size at the No. 8 sieve and a peak abundance between the No. 30 and No. 50 sieves. The sand is practically compliant with modern masonry sand gradation requirements as specified by ASTM C114-18. The only exception is that there is slightly less material passes the No. 100 mesh than allowed in the modern standard.

The binder consists solely of gray portland cement. No lime gauging, supplementary cementitious materials, or pigment additions are detected. The fact that the cement is a gray variety is determined by the iron-rich mineralogy observed petrographically (Table 10.4), and the low SiO<sub>2</sub>/Fe<sub>2</sub>O<sub>3</sub> contents measured chemically (Table 9.3b). The coarseness of the cement grind and the microtexture of the constituent cement minerals are typical of products manufactured between about 1895 and 1930. This is consistent with the "1900s" construction date provided by the client.

### **6.3 - Component Proportions**

The component proportions are estimated based on the chemical analysis presented in Section 9.3. The cement to sand ratio is estimated at 1 : 1.6 by volume.

By today's standards, The mixture would not be considered appropriate for stone masonry simply because of the absence of hydrated lime as a plasticizer. However, pure cement mixtures for stone work were common practice through the late nineteenth and early twentieth century. Even if lime were present in the mixes, the sample would be considered undersanded with respect to modern standards. Though cement to sand ratios for stone masonry work in the early twentieth century were typically specified at between 1 : 2 and 1 : 3 by volume, pointing mixes such as this often containing even less aggregate. As such, the composition of this mix is considered relatively typical for the time period.

It is outside the scope of the laboratory to recommend repair materials or strategies. However, some commentary is warranted based on the findings of this study. Typically when finding a pure cement mortar in hard stone masonry, it is generally safe to prepare a repair mix as if one were building the structure today. In other words, a mortar that would be appropriate for the stone masonry would almost certainly be compatible with the existing substrate mortar.

### **6.4 - Condition and Service Performance**

Based on the examined sample, the cement and sand were well-blended with no sand streaks or coarse cement lumps. The mix water was adequately incorporated, and the mortar is compact and well-consolidated. The cured product is hard, indurate, and not noticeably permeable. These features are as expected for the estimated composition.

The examined pieces are uncarbonated. Although carbonation is a normal result of long-term curing, it is not unusual to find dense portland cement mortars that remain uncarbonated for prolonged periods of service. The mortar appears to be in sound condition with no evidence of secondary distress. No cracking or paste degradation is observed. Though there is some secondary calcium hydroxide deposited within the air-voids, this mineralization is considered innocuous.

## **7. Laboratory Findings and Discussion (Portland Cement-Lime Mortars - Samples M3 and M6)**

### **7.1 - Overall Appearance and Quality**

Samples M3 and M6 are interpreted to be repointings from no earlier than the second half of the twentieth century. Though the mortars may be contemporaneous with one another, the aggregate addition and proportioning of the ingredients differ between the two samples. Both mortars have a uniform appearance with a gray color (Munsell code approximately 2.5Y 4.75-5/0.5). The tooled face has a convex tooling with relatively high relief, fine sand exposure. In each sample, the cured product is hard, indurate, and slowly water-absorptive.

## 7.2 - Materials

The aggregates are compositionally-similar in both samples, though the gradation differs between the two mortars. Both sands are granitic with lesser metasedimentary clastic rock and trace other rock and mineral grains. The aggregate is clean without any clay coatings, friable materials, or organic impurities. Both sands have a light to medium gray color overall (Munsell code approximately 2.5Y 6/0.5). While the sand in Sample M3 is mostly uniform, the aggregate in Sample M6 has a moderately variegated appearance due to the presence of coarser particles with a range of gray, purplish-brown, and pink colors.

The sands are sharp-textured and broadly-graded, though the aggregate in Sample M6 is coarser-grained than that in Sample M3. Details of the gradations are presented in Section 8. In Sample M3, the sand is medium-grained with a nominal top size at the No. 8 sieve and a peak abundance between the No. 30 and No. 50 sieves. It should be noted that the particle size distribution in this sample complies with the modern masonry sand gradation requirements specified by ASTM C144-18. In Sample M6, the nominal top size is at the No. 4 sieve and the peak abundance is between the No. 16 and No. 30 sieves. The sand in this sample is coarser than one that would be compliant with the modern standard for masonry sands.

In both mortars, the binder is a mixture of portland cement and hydrated lime. The portland cement is identified as a gray variety based on the presence of iron-bearing ferrite and the low  $\text{SiO}_2/\text{Fe}_2\text{O}_3$  ratios measured chemically. The microtextural characteristics of the cement are most consistent with a product manufactured no earlier than the 1950s. The particulate texture of the lime is consistent with that of a packaged dry lime hydrate. The chemistry indicates that the lime is a dolomitic variety. The petrographic observations and chemical data that support these interpretations are presented in Tables 10.5, 10.6, and 9.4b.

## 7.3 - Component Proportions

Based on the chemical analysis presented in Section 9.4, Samples M3 and M6 are estimated to have cement to lime ratios of 1 : 0.71 and 1 : 1.6 by volume, respectively. These binder proportions are consistent with the use of a Type N cement-lime formulation in Sample M3 and a Type O cement-lime formulation in Sample M6.

The total binder to sand ratio is estimated near 1 : 1.5 by volume in each sample. Technically, these mixes would be considered undersanded with respect to the permissible designs specified today in ASTM C270-19a<sup>e1</sup>. However, it is not unusual to find pointing or repointing mortars that contain lower sand contents than the standard requirement and may be chosen to achieve a specific aesthetic.

## 7.4 - Condition and Service Performance

In both mortars, the components were thoroughly mixed based on the samples examined petrographically. The mix water content in each is estimated to have been appropriate to yield a workable mixture that was not too loose. Both mixtures are compact and well-consolidated on the whole. There do not appear to have been any defects in the tooling of the joint face. The cured products are indurate. Sample M3 is hard with a low permeability, and Sample M6 is moderately hard with a relatively low water-absorptivity.

The mortar is fully carbonated in Sample M6 and carbonated up to approximately 0.75 centimeters depth in Sample M3. The comparatively deeper carbonation in Sample M6 is not surprising given the higher lime content in this mortar. No other chemical reactions are noted within the mortar. There is no degradation of the binder, and there are no secondary mineralizations. There is some normal surface weathering in both samples, where sand grains are proud along the surface due to erosion of the adjacent binder. There is also some biological growth within the weathered paste along the tooled surfaces.

## 8. Aggregate Sieve Analysis

Aggregates were extracted from the mortars by digesting each sample in a hydrochloric acid solution. The sand that settled at the bottom of the solution was cleaned, dried, and graded through a standard sieve stack. Fines that remained in suspension were decanted off and treated as follows.

- For Sample MB4, the decanted fines are assumed to represent fine silt and clay from the aggregate. These are cleaned, dried, and combined with the finest fraction of the graded sand to represent the material passing the No. 200 in the gradation analysis below.
- For the other five samples, the decanted fines mostly consist of residuals from the cement binders. As such, these are excluded from the gradation analysis. The exclusion of any fine silt and clay associated with the aggregate is considered to represent only a minor error.

**Table 8.1: Chemical Digestion Data - Weight Retention (g)**

Sieve size	MB4	M4	M5	M2	M3	M6
3/8"	0.00	0.00	0.00	0.00	0.00	0.00
No. 4	0.00	0.00	0.00	0.00	0.00	0.44
No. 8	0.00	0.00	0.00	0.70	0.03	0.84
No. 16	0.27	0.21	0.20	1.29	0.17	2.56
No. 30	3.36	2.46	3.00	3.01	0.65	5.02
No. 50	4.44	1.66	2.21	7.43	1.29	6.44
No. 100	2.34	0.15	0.23	2.34	0.71	3.10
No. 200	0.42	0.03	0.05	0.19	0.15	0.64
Pan	0.13	BDL	BDL	0.02	0.01	0.04

Note:

1. "BDL" indicates that the weight of sand in the fraction is below the 0.01 g detection limit of the balance.

**Table 8.2: Chemical Digestion Data - Cumulative Passing (%)**

Sieve size	MB4	M4	M5	M2	M3	M6
3/8"	100.0	100.0	100.0	100.0	100.0	100.0
No. 4	100.0	100.0	100.0	100.0	100.0	97.7
No. 8	100.0	100.0	100.0	95.3	98.9	93.3
No. 16	97.6	95.3	96.5	86.7	93.2	79.9
No. 30	66.9	40.8	43.7	66.6	71.8	53.6
No. 50	26.3	4.2	4.9	17.0	28.9	19.8
No. 100	4.9	0.8	0.9	1.4	5.3	3.6
No. 200	1.1	0.1	0.1	0.1	0.3	0.2
Pan	0.0	0.0	0.0	0.0	0.0	0.0



**9. Chemical Analysis**

**9.1 - Chemical Analysis (Lime Mortar)**

Sample MB4 consists of a common lime mortar. For this sample, the digestion procedure was modified from that in ASTM C1324 to account for the lime binder. The method includes a room temperature acid digestion alone, and the base digestion is excluded. The insoluble residue was determined directly from the initial digestion rather than through the digestion of a separate aliquot.

**Table 9.1a: Chemical Analysis Results**

Sample ID	MB4
Component (wt. %)	
SiO <sub>2</sub>	0.19
CaO	8.30
MgO	1.92
Al <sub>2</sub> O <sub>3</sub>	0.14
Fe <sub>2</sub> O <sub>3</sub>	0.14
Insoluble residue	77.83
LOI to 110 °C	0.84
LOI 110 °C to 550 °C	3.40
LOI 550 °C to 950 °C	6.53
<b>Measured total</b>	<b>99.29</b>

The binder in the Sample MB4 is interpreted to consist of a nonhydraulic lime with no other additives. As such, the lime chemistry is estimated from the total chemical analysis presented in Table 9.1a. The five major oxides in the binder are normalized to a 99% weight yield. This normalizes the lime to a dry weight basis and is equivalent to the pre-slaked condition. The residual 1% is assumed to represent trace unmeasured constituents. Important chemical indices are calculated as follows:

$$\begin{aligned} \text{Hydraulic index} &= (\text{SiO}_2 + \text{Al}_2\text{O}_3) / \text{CaO} \\ \text{Cementation index} &= (2.8 \cdot \text{SiO}_2 + 1.1 \cdot \text{Al}_2\text{O}_3 + 0.7 \cdot \text{Fe}_2\text{O}_3) / (\text{CaO} + 1.4 \cdot \text{MgO}) \end{aligned}$$

**Table 9.1b: Normalized Lime Chemistry**

Sample ID	MB4
Component (wgt. %)	
SiO <sub>2</sub>	1.8
CaO	77.7
MgO	17.9
Al <sub>2</sub> O <sub>3</sub>	1.3
Fe <sub>2</sub> O <sub>3</sub>	1.3
Other	1.0
CaO/MgO	4.3
<b>Hydraulicity index</b>	<b>0.04</b>
<b>Cementation index</b>	<b>0.07</b>

The following features are worth noting:

- The CaO content is high but less than 90%. The CaO/MgO ratio is calculated at 4.3. The moderate magnesium content of the lime is typical of so-called intermediate limes where the lime is not dolomitic but there is still a notable magnesium content. These were not especially common during the nineteenth century, though they seem to be more common in New England limes manufactured from marble rock.
- Siliceous impurities are noted petrographically in association with the lime. However, the very low hydraulicity and cementation indices indicate that the lime is entirely nonhydraulic. A lime would need to have a cementation index of at least 0.40 to result in even a weak hydraulicity (Eckel, 171).

For Sample MB4, the lime is calculated from the five measured oxides (Table 9.1c) assuming that the CaO and MgO were present as hydrates, and the other phases as pure oxides. The sand is taken directly from the acid-insoluble residue. It should be noted that the sand content is likely overestimated in the proportional estimates since the sample was provided mostly as loose granules and powder. When mortar samples are provided as debris, the finer material (typically binder rather than sand) tends to be lost upon collection and handling.

**Table 9.1c: Calculated Components**

Sample ID	MB4
Component	
Lime expressed as dry hydrate (wgt. %)	15
Sand (wgt. %)	85
Lime : sand ratio (by volume as dry hydrate)	1 : 2.7
Lime : sand ratio (by volume as lime putty)	1 : 3.4

Notes:

1. Volumetric ratios are calculated assuming bulk densities for nonhydraulic lime and damp, loose sand of 40 lbs./ft.<sup>3</sup> and 80 lbs./ft.<sup>3</sup>, respectively. Another calculation is provided assuming the lime in putty form. This assumes a unit of dry lime hydrate will lose approximately 20% of its volume when mixed to the consistency of a stiff paste.

Two separate volume estimates are given in the table above. One is given with the lime in the form of a dry hydrate despite the fact that the lime mortar examined for this report predates the commercial availability of prepackaged hydrated lime. Calculating the lime as a dry hydrate is convenient because it does not have to take into account the mix water used in a lime putty. It also allows for a more direct assessment of possible repair formulations using modern bagged masonry lime. Nonetheless, it is generally assumed that a volume of dry hydrate will lose approximately 20% of its volume when water is added to produce a putty of stiff consistency. This assumption is the basis for the volume estimate reported for lime putty. This ratio is derived from the dry hydrate calculation.

It should also be noted that where volume proportions are given, these are based on estimated original bulk densities of the materials. However, limes are subject to great variation in volume due to factors such as settling or “fluffing” in dry powders and mix water content in putties. The table also presents the weight percentages of the dry ingredients (dry hydrated lime and sand). These are more accurate as they represent direct measurements of material mass and are not based on assumptions of bulk density. Of course, all of these discussions may be academic since it is usually desirable to modify the original design if modern materials will be used to replace their historic counterparts. The findings of a mortar analysis are best used to constrain possible repair designs rather than as a prescription for a specific formulation.

**9.2 - Chemical Analysis (Natural Cement Mortars)**

Samples M4 and M5 consist of a natural cement-based mixture. For these samples, proprietary modifications were made to the chemical digestion procedure described by ASTM C1324 to most effectively decompose the natural cement binder while minimizing any leaching of components from the aggregate. The procedure included a warm digestion in dilute hydrochloric acid solution (20% v/v) followed by a heated digestion in alkaline solution (10 g/L NaOH). The method was also modified to determine the insoluble residue directly from the aliquot used for the soluble oxide analysis rather than through the digestion of a separate subsample.

**Table 9.2a: Chemical Analysis Results**

Sample ID	M4	M5
<b>Component (wgt. %)</b>		
SiO <sub>2</sub>	5.36	5.35
CaO	10.84	12.26
MgO	0.44	0.38
Al <sub>2</sub> O <sub>3</sub>	1.40	1.33
Fe <sub>2</sub> O <sub>3</sub>	0.60	0.54
Insoluble residue	70.52	67.41
LOI to 110 °C	1.16	1.08
LOI 110 °C to 550 °C	1.84	1.52
LOI 550 °C to 950 °C	7.14	8.34
<b>Measured total</b>	<b>99.29</b>	<b>98.21</b>

The binders in both Samples M4 and M5 contain natural cement, potentially imported from Europe. There is not clearly a separate lime addition. However, even if there is a lime addition, it would not be possible to accurately solve the composition of either component from the combined chemistry. Either way, it is worthwhile to review relationships between chemical elements. The table below also includes historical data from a natural cement produced in Southington, CT for a short period ca. 1830 (Wiley, p. 138) and a historical English natural cement from Whitby (Eckel, Table 123). In the table below, the cement chemistry is estimated from the total chemical analysis presented in Table 9.2a. The five major oxides in the binder are normalized to a 92% weight yield, assuming the other 8% consists of trace and insoluble constituents of the natural cement binder. The cementation index is calculated as follows:

$$\text{Cementation index} = (2.8 \cdot \text{SiO}_2 + 1.1 \cdot \text{Al}_2\text{O}_3 + 0.7 \cdot \text{Fe}_2\text{O}_3) / (\text{CaO} + 1.4 \cdot \text{MgO})$$

**Table 9.2b: Normalized Cement Chemistry**

Sample ID	M4	M5	Southington Cement	English Cement
<b>Component (wgt. %)</b>				
SiO <sub>2</sub>	26.4	24.8	28.4	24.4
CaO	53.5	56.8	49.1	52.7
MgO	2.2	1.8	2.5	1.5
Al <sub>2</sub> O <sub>3</sub>	6.9	6.2	9.5	7.4
Fe <sub>2</sub> O <sub>3</sub>	3.0	2.5	2.5	6.0
Other	8.0	8.0	8.0	8.0
CaO/SiO <sub>2</sub>	2.0	2.3	1.7	2.2
CaO/MgO	24.9	31.9	19.6	35.3
SiO <sub>2</sub> /MgO	12.3	13.9	11.3	16.3
<b>Cementation index</b>	<b>1.48</b>	<b>1.31</b>	<b>1.74</b>	<b>1.47</b>

The following features are worth noting:

- The measured binder chemistries are quite similar between the two samples, suggesting that the same cement product was used in both mortars.
- The cement is a high-calcium material. The magnesium content is lower than expected for domestic American natural cements that would have been available by the reported 1831 construction date. Most American natural cement were dolomitic with CaO/MgO ratios near 1.4.
- Of the American products, there was a high-calcium natural cement produced in Southington, CT for several years starting in the late 1820s. The chemistry of that cement is reproduced in the table above. The composition is similar to that measured in the samples, but it is not so exacting as to confirm the use of this product. The binder in Samples M4 and M5 is comparatively lower in SiO<sub>2</sub> and higher in CaO than this single analysis from the historical literature.
- The measured chemistries are also somewhat similar to an English natural cement that could have been imported in the 1830s. However, the historical analyses indicate products that were slightly more iron-rich than measured in the binder for these two samples. Of course, it should be kept in mind that the analyses reported in the historical literature may not be fully representative of the composition of the cement throughout its manufacture.
- There are some lime-rich particles observed petrographically. Though these could represent a separate lime addition, it is also possible that these are residuals from the natural cement. A lime addition is not necessary to explain the measured binder chemistry.

The five measured oxides in Table 9.2a are assumed to represent 92% of the natural cement binder. The insoluble residue is assumed to represent the aggregate. Any reasonable errors in these assumptions have little effect on the calculated binder to sand ratio.

**Table 9.2c: Calculated Components**

Sample ID	M4	M5
<b>Component</b>		
Natural cement (wgt. %)	22	24
Sand (wgt. %)	78	76
Binder : sand ratio (by volume)	1 : 3.3	1 : 2.9

Notes:

1. Volumetric ratios are calculated assuming bulk weights for natural cement and damp, loose sand of 75 lbs./ft.<sup>3</sup> and 80 lbs./ft.<sup>3</sup>, respectively.

The insoluble residue contains both sand and an iron-rich component. Although it is possible that this iron-rich material is part of the natural cement binder, the microtextural characteristics do not support this unequivocally. The iron-rich particles are mostly finer than the aggregate and can be isolated by size and density in the sieve analysis (Section 8). The extracted material that was decanted and treated with NaOH solution is found to consist mostly of iron-rich particles. As such, the weight of this fraction can be directly compared to the total weight of material extracted for the aggregate analysis. The weight of iron-rich material as a percentage of the extracted sand can then be compared to the insoluble residue from the chemical analysis to estimate its content compare to the total mortar and to the binder. Note that this results in a maximum content estimate. This is because the fraction used to quantify the iron-rich material also contains some minor silt from the aggregate and potentially some fines from the natural cement.

**Table 9.2d: Estimate of Iron-rich Component Content**

Sample ID	M4	M5
Extracted decanted fines wgt. (g)	0.34	0.35
Total extracted material wgt. (g)	4.86	6.05
Maximum iron-rich as wgt. % of extracted material	7.00	5.79
Maximum wgt. % of iron-rich in the total mortar	4.94	3.90
Maximum iron-rich material as wgt. % of binder	19.6	15.3

**9.3 - Chemical Analysis (Portland Cement Mortar)**

Sample M2 is interpreted to represent an early twentieth century, portland cement mortar. Chemical analysis was performed in general accordance with methods contained within ASTM C1324. The method was modified to determine the insoluble residue directly from the aliquot used for the soluble oxide analysis rather than through the digestion of a separate subsample.

**Table 9.3a: Chemical Analysis Results**

Sample ID	M2
Component (wt. %)	
SiO <sub>2</sub>	9.06
CaO	23.15
MgO	0.71
Al <sub>2</sub> O <sub>3</sub>	2.57
Fe <sub>2</sub> O <sub>3</sub>	0.95
Insoluble residue	51.18
LOI to 110 °C	4.21
LOI 110 °C to 550 °C	5.51
LOI 550 °C to 950 °C	2.29
<b>Measured total</b>	<b>99.63</b>

Gray portland cement is identified as the sole binder in Sample M2. As such, the original cement chemistry can be estimated from the total chemical analysis presented in Table 9.3a. In Table 9.3b, the five major oxides in the binder are normalized to a 95% weight yield, assuming the other 5% consists of unmeasured components including sulfite, alkalis, and trace elements.

The following features are worth noting:

- The CaO/SiO<sub>2</sub> ratios are less than the approximately 3.0 expected of twentieth century portland cements. Based on the petrographic observations, this may be explained by a silica enrichment. This is a relatively common phenomenon that has been observed by this laboratory in older portland cement mortars that remain uncarbonated. The silica enrichment can result from the reaction of the siliceous sand with the alkaline binder paste over a prolonged period of service.
- At less than 10, the mortar has a SiO<sub>2</sub>/Fe<sub>2</sub>O<sub>3</sub> ratio that is typical of gray portland cement.

**Table 9.3b: Normalized Cement Chemistry**

Sample ID	M2
Component (wgt. %)	
SiO <sub>2</sub>	23.6
CaO	60.4
MgO	1.9
Al <sub>2</sub> O <sub>3</sub>	6.7
Fe <sub>2</sub> O <sub>3</sub>	2.5
Other	5.0
CaO/SiO <sub>2</sub>	2.6
SiO <sub>2</sub> /Fe <sub>2</sub> O <sub>3</sub>	9.5

The following proportions in Table 9.3c are calculated assuming that the five measured oxides presented in Table 9.3a represent 95% of the portland cement by weight. The aggregate is assumed to be fully represented by the insoluble residue. If a correction were made for the silica enrichment, assuming that the cement originally had a CaO/SiO<sub>2</sub> ratio of 3, then the cement to sand ratio would be estimated at 1 : 1.7 by volume.

**Table 9.3c: Calculated Components**

Sample ID	M2
Component	
Portland cement (wgt. %)	43
Sand (wgt. %)	7
Binder : sand ratio (by volume)	1 : 1.6

Notes:

1. Volumetric ratios are calculated assuming bulk weights for portland cement and damp, loose sand of 94 lbs./ft.<sup>3</sup> and 80 lbs./ft.<sup>3</sup>, respectively.

**9.4 - Chemical Analysis (Portland Cement-Lime Mortars)**

Sample M3 and M6 represent cement-lime mortars from no earlier than the late twentieth century. Chemical analysis was performed in general accordance with methods contained within ASTM C1324. The method was modified to determine the insoluble residue directly from the aliquot used for the soluble oxide analysis rather than through the digestion of a separate subsample.

**Table 9.4a: Chemical Analysis Results**

Sample ID	M3	M6
Component (wt. %)		
SiO <sub>2</sub>	5.18	3.73
CaO	19.90	18.12
MgO	1.99	2.48
Al <sub>2</sub> O <sub>3</sub>	1.34	1.08
Fe <sub>2</sub> O <sub>3</sub>	0.99	0.75
Insoluble residue	52.55	55.67
LOI to 110 °C	2.98	2.61
LOI 110 °C to 550 °C	4.10	3.24
LOI 550 °C to 950 °C	9.30	11.91
<b>Measured total</b>	<b>98.31</b>	<b>99.58</b>

The binder in Samples M3 and M6 is interpreted to consist of a mixture of cement and lime. While it is not possible to accurately solve the composition of either component from the combined chemistry, it is worthwhile to review relationships between chemical elements. To remove the diluting effect of the sand, the five major oxides derived from the binder are normalized to a 100% weight yield. This normalizes the binder components to a dry weight basis, and the normalized binder chemistry is presented in Table 9.4b.

**Table 9.4b: Normalized Binder Chemistry**

Sample ID	M3	M6
Component (wgt. %)		
SiO <sub>2</sub>	17.6	14.3
CaO	67.7	69.3
MgO	6.8	9.5
Al <sub>2</sub> O <sub>3</sub>	4.5	4.1
Fe <sub>2</sub> O <sub>3</sub>	3.4	2.9
CaO/SiO <sub>2</sub>	3.8	4.9
SiO <sub>2</sub> /MgO	2.6	1.5
SiO <sub>2</sub> /Fe <sub>2</sub> O <sub>3</sub>	3.9	3.5
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub>	5.2	5.0
Al <sub>2</sub> O <sub>3</sub> /Fe <sub>2</sub> O <sub>3</sub>	1.3	1.4

The following features are worth noting:

- Both samples have higher CaO/SiO<sub>2</sub> ratios than that expected for portland cement alone (typically near 3.0). This shows that there is a notable lime addition in each mortar, and that there is comparatively more lime in Sample M6 than Sample M3.
- Both mortars have SiO<sub>2</sub>/Fe<sub>2</sub>O<sub>3</sub> ratios that are typical of gray portland cement. Gray cements usually have ratios less than 10. Both of these have ratios of approximately 40.
- Both samples have a lower SiO<sub>2</sub>/MgO ratios than expected for gray portland cement along (typically near 7). This indicates that presence of a dolomitic lime.
- SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, and Fe<sub>2</sub>O<sub>3</sub> are considered the refractory oxides. They derive from the portland cement with negligible contribution from the lime. As such, the ratios of these oxides can be compared between samples to evaluate whether cements are from the same source or batch. In this case, the three ratios are similar but not sufficiently so to unequivocally indicate a common source.

For both mortars, the gray portland cement is calculated first assuming a typical chemistry for this product. Remaining calcium and magnesium are calculated as dry lime hydrate. No additional calculations are made to convert the dry hydrate to a putty since it is clear that dry hydrates were used in both mixes. In both mortars, the aggregate is fully represented by the insoluble residue.

It should be noted that where volume proportions are given, these are based on estimated original bulk densities of the materials. However, limes are subject to great variation in volume due to factors such as settling or “fluffing”. The table also presents the weight percentages of the dry ingredients (cement, dry hydrated lime, and sand). These are more accurate as they represent direct measurements of material mass and are not based on assumptions of bulk density. Of course, this discussion is academic since it is usually desirable to modify the original design if modern materials will be used to replace their historic counterparts. The findings of a mortar analysis are best used to constrain possible repair designs rather than as a prescription for a specific formulation.

**Table 9.4c: Calculated Components**

Sample ID	M3	M6
Component		
Portland cement (wgt. %)	29	21
Hydrated lime (wgt.)	8.8	14
Sand (wgt. %)	62	65
Cement : lime ratio (by volume)	1 : 0.71	1 : 1.6
Binder : sand ratio (by volume)	1 : 1.5	1 : 1.4

Notes:

1. Volumetric ratios are calculated assuming bulk weights for portland cement, hydrated lime, and damp, loose sand of 94 lbs./ft.<sup>3</sup>, 40 lbs./ft.<sup>3</sup>, and 80 lbs./ft.<sup>3</sup>, respectively.

## 10. Petrographic Data

**Table 10.1: Petrographic Data - Sample MB4**

Sample ID	MB4
<b>As-received description</b>	
<b>Description</b>	The sample consists entirely of loose granules and powder weighing a total of 47 grams. The material has a nearly white color (Munsell code approximately 2.5Y 8.5/1). No other features can be evaluated given the granular quality of the sample.
<b>Sand</b>	
<b>Lithology</b>	The aggregate consists primarily of quartz. Minor constituents include feldspar and glauconite. Trace heavy accessory minerals are also detected.
<b>Appearance</b>	The extracted sand sample is uniform and semi-translucent. The color is light gray (Munsell color code approximately 2.5Y 7.25/1).
<b>Gradation</b>	The sand is broadly graded and medium grained. The nominal top size in at the No. 16 sieve, and the peak abundance is between the No. 30 and No. 50 sieves. The fines content is minor.
<b>Shape/aspect ratio</b>	The particles are equidimensional and subangular to subrounded in shape.
<b>Clay coatings/friable materials</b>	None observed
<b>Organic impurities</b>	None observed
<b>Binder matrix</b>	
<b>Paste uniformity</b>	The uniformity of the paste cannot be assessed since there are no intact mortar pieces captured in thin section.
<b>Capillary porosity</b>	The fine debris of binder paste appears to have a high capillary porosity.
<b>Microscopic shrinkage cracking</b>	The presence of any cracking cannot be assessed since there are no intact mortar pieces captured in thin section.
<b>Residual calcium hydroxide</b>	Not identified
<b>Evidence for admixtures<sup>1</sup></b>	None detected
<b>Binder residuals</b>	
<b>Binder type</b>	Intermediate hydrated lime
<b>Hydraulic cement</b>	None detected
<b>Lime</b>	Undispersed lime grains up to 1.5 millimeters in diameter are detected. However, the abundance of these cannot be assessed given the granular quality of the provided sample. The fragments of lime paste often include partially to completely sintered residual silicate impurities from the original source rock. These appear to include mostly quartz and mica, and the textures of the fired silicates are consistent with those found in limes burned from marble rock. There are also rare instances of incompletely burned carbonate from the source rock.
<b>Pozzolans/SCMs<sup>2</sup></b>	None detected
<b>Other</b>	None detected

**Table 10.1 (cont'd.): Petrographic Data - Sample MB4**

Sample ID	MB4
<b>Pigment</b>	
Concentration	None detected
Composition	n/a
Particle size	n/a
Color of extracted pigment	n/a
<b>Other materials</b>	
Details	None detected
<b>Placement features</b>	
Details	The placement features of the mortar cannot be assessed since the provided sample includes only debris with no intact mortar pieces.
<b>Secondary effects</b>	
Carbonation	Where visible, the binder paste is fully carbonated.
Paste alteration	None detected
Cracking	Cracking cannot be assessed, as there are no intact mortar pieces included in the sample.
Mineral deposits	None detected
Surface erosion/weathering	No joint faces are evident in thin section.

Notes:

1. Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on paste microstructure can sometimes be discerned.
2. SCMs = supplementary cementitious materials.

**Table 10.2: Petrographic Data - Sample M4**

Sample ID	M4
<b>As-received description</b>	
<b>Description</b>	The sample weighs a total of 178 grams. This includes a mixture of gray pointing (99 grams) and pink bedding mortar (79 grams). The former is visually similar to the mortar analyzed for Samples M3 and M6. The pink bedding is the focus of the analysis for Sample M4. It includes attached and embedded coarse pieces of limestone, presumably from the masonry. There are also residues of a white mortar along the edge of some pieces.
<b>Surfaces</b>	No joint faces are included.
<b>Appearance</b>	Freshly exposed surfaces have a moderately dull luster and pale pink color (Munsell code approximately 7.5YR 7/2.25).
<b>Visible inclusions</b>	None detected
<b>Hardness/friability</b>	The paste is moderately soft, but the mortar is cohesive and nonfriable.
<b>Absorptivity</b>	The mortar matrix is moderately water-absorptive.
<b>Cracking</b>	None detected
<b>Mineralizations</b>	None detected
<b>Sand</b>	
<b>Lithology</b>	The aggregate consists primarily of quartz with minor feldspar and granite particles. No significant other minerals are detected.
<b>Appearance</b>	The extracted sand sample is uniform and semi-translucent with a light gray color (Munsell code approximately 2.5Y 7.5/0.75).
<b>Gradation</b>	The sand is medium-grained and somewhat narrowly graded. The nominal top size is at the No. 16 sieve, and over 90% of the sand is retained between the No. 16 and No. 50 sieves. The fines content is negligible.
<b>Shape/aspect ratio</b>	The particles are equidimensional and subangular to subrounded in shape.
<b>Clay coatings/friable materials</b>	None observed
<b>Organic impurities</b>	None observed
<b>Binder matrix</b>	
<b>Paste uniformity</b>	Mostly homogeneous
<b>Capillary porosity</b>	Moderately high to high
<b>Microscopic shrinkage cracking</b>	None significant
<b>Residual calcium hydroxide</b>	Not identified
<b>Evidence for admixtures<sup>1</sup></b>	None detected
<b>Binder residuals</b>	
<b>Binder type</b>	Natural cement (with or without a separate lime addition)
<b>Hydraulic cement</b>	Residual natural cement particles are identified in low abundance throughout the paste matrix. Larger grains are found to a maximum size of about 0.2 millimeters. The cement grains exhibit complex microtextures consistent with the low-temperature firing of an argillaceous limestone with some minor quartz silt and other siliceous/aluminous impurities. A moderate abundance finer "grit" is also distributed throughout the paste including ferruginous and siliceous residue that did not combine during firing.

**Table 10.2 (cont'd.): Petrographic Data - Sample M4**

Sample ID	M4
<b>Binder residuals (cont'd.)</b>	
<b>Lime</b>	Undispersed lime grains are observed in moderately low concentration. All are carbonated. Most are fine-grained and nondescript with sizes less than about 0.25 millimeters. However, these lime grains do not obviously represent a separate lime addition and may represent residuals from a single natural cement binder.
<b>Pozzolans/SCMs<sup>2</sup></b>	None detected
<b>Other</b>	<ul style="list-style-type: none"> <li>• There is a low abundance of glassy clinker particles with sizes up to 0.25 millimeters. These often contain some recrystallized aluminosilicate. The clinker is interpreted to be associated with binder.</li> <li>• There is a fine-grained, iron-rich component that consists of a mixed sediment of iron oxide, quartz silt, and mica. The material is not as fine as expected for a pigment. However, it likely contributes to the pinkish hue of the mortar. Some of the particles are as coarse as 200 <math>\mu\text{m}</math>, though finer iron oxide particulates are distributed throughout the paste in fairly low density. The microtextures suggest an ironstone source, and there is no clear relation to the aggregate. There is also no evidence of firing or microtextural similarities that would unequivocally demonstrate this material is derived from the natural cement.</li> </ul>
<b>Pigment</b>	
<b>Details</b>	There is an iron-rich component that contributes to the color of the mortar but does not obviously represent a separate pigment addition. See discussion in the "Other" section of the binder description above.
<b>Other materials</b>	
<b>Details</b>	A piece of stone is attached to one of the mortar pieces captured in thin section. This is an argillite and presumably represents the stone masonry.
<b>Placement features</b>	
<b>Constituent distribution</b>	The constituents are well-mixed with no sand lenses observed. There is one coarse binder inclusion that contains cement (and lime?) and is roughly one millimeter in diameter. There are also a few sand grains that are coated with lime-rich paste.
<b>Mix water</b>	The mix water is thoroughly incorporated into the matrix, and there is no evidence for inappropriately late retempering.
<b>Compaction/consolidation</b>	The mortar is compact and well-consolidated.
<b>Estimated air content/structure</b>	The total air content is estimated at 8-10% by volume. Most voids are fine with rounded shapes.
<b>Paste-sand interfaces</b>	Sand grains are well-coated with binder.
<b>Secondary effects</b>	
<b>Carbonation</b>	The binder paste is fully carbonated.
<b>Paste alteration</b>	None significant
<b>Cracking</b>	None significant
<b>Mineral deposits</b>	None detected
<b>Surface erosion/weathering</b>	No joint faces are evident in thin section.

Notes:

1. Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on paste microstructure can sometimes be discerned.
2. SCMs = supplementary cementitious materials.

**Table 10.3: Petrographic Data - Sample M5**

Sample ID	M5
<b>As-received description</b>	
<b>Description</b>	The sample weighs a total of 221 grams. This includes a mixture of gray pointing (136 grams) and pink bedding (85 grams). The former is visually similar to the mortar analyzed for Samples M3 and M6. The pink bedding is the focus of the analysis for Sample M5. It includes attached pieces of granite, presumably from the masonry.
<b>Surfaces</b>	No joint faces are included.
<b>Appearance</b>	Freshly exposed surfaces have a moderately dull luster and pale pink color (Munsell code approximately 7.5YR 7/2.25).
<b>Visible inclusions</b>	None detected
<b>Hardness/friability</b>	The paste is moderately soft, but the mortar is cohesive and nonfriable.
<b>Absorptivity</b>	The mortar matrix is moderately water-absorptive.
<b>Cracking</b>	None detected
<b>Mineralizations</b>	None detected
<b>Sand</b>	
<b>Lithology</b>	The aggregate consists primarily of quartz with minor feldspar and granite particles. Trace constituents include quartzite, sedimentary clastic rock, and glauconite.
<b>Appearance</b>	The extracted sand sample is uniform and semi-translucent with a light gray color (Munsell code approximately 2.5Y 7.5/0.75).
<b>Gradation</b>	The sand is medium-grained and somewhat narrowly graded. The nominal top size is at the No. 16 sieve, and over 90% of the sand is retained between the No. 16 and No. 50 sieves. The fines content is negligible.
<b>Shape/aspect ratio</b>	The particles are equidimensional and subangular to subrounded in shape.
<b>Clay coatings/friable materials</b>	None observed
<b>Organic impurities</b>	None observed
<b>Binder matrix</b>	
<b>Paste uniformity</b>	Mostly homogeneous
<b>Capillary porosity</b>	Moderately high to moderate
<b>Microscopic shrinkage cracking</b>	None significant
<b>Residual calcium hydroxide</b>	Not identified
<b>Evidence for admixtures<sup>1</sup></b>	None detected
<b>Binder residuals</b>	
<b>Binder type</b>	Natural cement (with or without a separate lime addition)
<b>Hydraulic cement</b>	Residual natural cement particles are identified in low abundance throughout the paste matrix. Larger grains are found to a maximum size of about 0.2 millimeters. The cement grains exhibit complex microtextures consistent with the low-temperature firing of an argillaceous limestone with some minor quartz silt and other siliceous/aluminous impurities. A moderate abundance finer "grit" is also distributed throughout the paste including ferruginous and siliceous residue that did not combine during firing.

**Table 10.3 (cont'd.): Petrographic Data - Sample M5**

Sample ID	M5
<b>Binder residuals (cont'd.)</b>	
<b>Lime</b>	Undispersed lime grains are observed in moderately low concentration. All are carbonated. Most are fine-grained and nondescript with sizes less than about 0.15 millimeters. A low abundance of fired quartz is also detected throughout the binder paste. The lime grains described here do not obviously represent a separate lime addition and may represent residuals from a single natural cement binder.
<b>Pozzolans/SCMs<sup>2</sup></b>	None detected
<b>Other</b>	<ul style="list-style-type: none"> <li>• There is a low abundance of glassy clinker particles with sizes up to 0.25 millimeters. These often contain some recrystallized aluminosilicate. The clinker is interpreted to be associated with binder.</li> <li>• There is a fine-grained, iron-rich component that consists of a mixed sediment of iron oxide, quartz silt, and mica. The material is not as fine as expected for a pigment. However, it likely contributes to the pinkish hue of the mortar. Some of the particles are as coarse as 200 <math>\mu\text{m}</math>, though finer iron oxide particulates are distributed throughout the paste in fairly low density. The microtextures suggest an ironstone source, and there is no clear relation to the aggregate. There is also no evidence of firing or microtextural similarities that would unequivocally demonstrate this material is derived from the natural cement.</li> </ul>
<b>Pigment</b>	
<b>Details</b>	There is an iron-rich component that contributes to the color of the mortar but does not obviously represent a separate pigment addition. See discussion in the "Other" section of the binder description above.
<b>Other materials</b>	
<b>Details</b>	Pieces of granite are attached to the mortar pieces captured in thin section. This presumably represents the stone masonry.
<b>Placement features</b>	
<b>Constituent distribution</b>	The constituents are well-mixed with no sand lenses or coarse binder inclusions observed.
<b>Mix water</b>	The mix water is thoroughly incorporated into the matrix, and there is no evidence for inappropriately late retempering.
<b>Compaction/consolidation</b>	The mortar is compact and well-consolidated.
<b>Estimated air content/structure</b>	The total air content is estimated at 9-11% by volume. Most voids are fine with rounded shapes.
<b>Paste-sand interfaces</b>	Sand grains are well-coated with binder.
<b>Secondary effects</b>	
<b>Carbonation</b>	The binder paste is fully carbonated.
<b>Paste alteration</b>	None significant
<b>Cracking</b>	None significant
<b>Mineral deposits</b>	None detected
<b>Surface erosion/weathering</b>	No joint faces are evident in thin section.

Notes:

1. Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on paste microstructure can sometimes be discerned.
2. SCMs = supplementary cementitious materials.

**Table 10.4: Petrographic Data - Sample M2**

Sample ID	M2
<b>As-received description</b>	
<b>Description</b>	The sample consists of seven mortar pieces weighing a total of 136 grams. Two different mortars are included in the sample: one with an intact convex tooling and one where the outer surface has been cut with an angle grinder or similar tool. The mortar with a cut surface was chosen for analysis, and the pieces of this mortar weigh a total of 83 grams. This appears to represent an earlier mortar based on the relationship between these materials in Sample M3.
<b>Surfaces</b>	No original joint face is included.
<b>Hardness/friability</b>	Freshly exposed surfaces have a subvitreous translucent luster and a gray color (Munsell code approximately 5Y 5/0.75).
<b>Appearance</b>	None detected
<b>Visible inclusions</b>	The paste is hard, and the mortar is indurate. The aggregate is transected on the intentionally-fractured surfaces.
<b>Absorptivity</b>	The mortar matrix is not noticeably water-absorptive.
<b>Cracking</b>	None detected
<b>Mineralizations</b>	Air-voids are commonly lined with thin white mineral deposits.
<b>Sand</b>	
<b>Lithology</b>	The aggregate consists primarily of quartz and feldspar. Trace accessory minerals include amphibole, zircon, tourmaline, and glauconite. Trace volcanic rock is also detected.
<b>Appearance</b>	The extracted sand sample is mostly uniform and semi-translucent. The average color is light gray (Munsell color code approximately 2.5Y 7.5/1). There is very minor visual variegation due to the presence of a few coarse, opaque particles that have light gray, pink, and pale greenish-gray.
<b>Gradation</b>	The sand is medium-grained and broadly graded. The nominal top size is at the No. 8 sieve, and the peak abundance is between the No. 30 and No. 50 sieves. The fines content is minor.
<b>Shape/aspect ratio</b>	The particles are equidimensional and subangular in shape on average.
<b>Clay coatings/friable materials</b>	None observed
<b>Organic impurities</b>	None observed
<b>Binder matrix</b>	
<b>Paste uniformity</b>	Homogeneous
<b>Capillary porosity</b>	Low
<b>Microscopic shrinkage cracking</b>	None detected
<b>Residual calcium hydroxide</b>	Calcium hydroxide from the cement hydration is present in moderate abundance within the cement paste as fine-grained crystal masses, sometimes lining aggregate grains.
<b>Evidence for admixtures<sup>1</sup></b>	None detected

**Table 10.4 (cont'd.): Petrographic Data - Sample M2**

Sample ID	M2
<b>Binder residuals</b>	
<b>Binder type</b>	Gray portland cement
<b>Hydraulic cement</b>	Although the cement paste is well hydrated, there is still a high abundance of unhydrated cement residuals detected. These are mostly present as medium-grained agglomerates of belite (and lesser alite) with interstitial iron-bearing ferrite. The constituent crystals are all uniform and fine-grained. The agglomerates have sizes approaching and just retained on the No. 100 sieve.
<b>Lime</b>	None detected
<b>Pozzolans/SCMs<sup>2</sup></b>	None detected
<b>Other</b>	None detected
<b>Pigment</b>	
<b>Concentration</b>	None detected
<b>Composition</b>	n/a
<b>Particle size</b>	n/a
<b>Color of extracted pigment</b>	n/a
<b>Other materials</b>	
<b>Details</b>	One of the pieces of other mortar was included in thin section. This consists of a later cement-lime mix that appears superficially similar to the mortar examined in Sample M3 and M6.
<b>Placement features</b>	
<b>Constituent distribution</b>	The constituents are well-mixed with no sand streaks or coarse cement lumps.
<b>Mix water</b>	There is no evidence for inappropriate retempering.
<b>Compaction/consolidation</b>	The mortar is compact and well consolidated.
<b>Estimated air content/structure</b>	The total air content is estimated at 3-5% by volume. Voids are rounded to deformed in shape and generally less than 1 millimeter in diameter.
<b>Paste-sand interfaces</b>	Sand grains are well-coated with binder.
<b>Secondary effects</b>	
<b>Carbonation</b>	The binder paste remains uncarbonated throughout the examined pieces. There is only a microscopically-thin veneer of carbonated paste along the bed surface of the pieces.
<b>Paste alteration</b>	None detected
<b>Cracking</b>	None significant
<b>Mineral deposits</b>	Air-voids are commonly lined or filled with secondary calcium hydroxide.
<b>Surface erosion/weathering</b>	No joint faces are evident in thin section.

Notes:

- Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on paste microstructure can sometimes be discerned.
- SCMs = supplementary cementitious materials.

**Table 10.5: Petrographic Data - Sample M3**

Sample ID	M3
<b>As-received description</b>	
<b>Description</b>	The sample consists of six mortar pieces weighing a total of 24 grams. The sample contains mostly one mortar mix that has a convex joint face. However, there are residues of a different gray mortar (similar to that examined in Sample M2) directly behind the analyzed mortar. Behind the earlier gray mortar, there are residues of a pink mortar.
<b>Surfaces</b>	The joint face has a convex tooling profile with moderately high relief, fine sand exposure. There is also some biological growth detected on the surface.
<b>Hardness/friability</b>	Freshly exposed surfaces have a moderately subvitreous luster and a gray color (Munsell code approximately 2.5Y 5/0.5).
<b>Appearance</b>	Fine white binder inclusions (much less than one millimeter in diameter) are common and sometimes have tabular shapes. There are also some fine black flecks distributed throughout.
<b>Visible inclusions</b>	The paste is moderately hard to hard, and the mortar is indurate. Some of the sand grains are transected on the intentionally-fractured surface.
<b>Absorptivity</b>	The mortar matrix is slowly water-absorptive.
<b>Cracking</b>	None detected
<b>Mineralizations</b>	None detected
<b>Sand</b>	
<b>Lithology</b>	The aggregate is mostly granitic with constituent quartz and feldspar. Metasedimentary clastic rock particles are a lesser component. Trace metabasite rock particles, ironstone, opaque minerals, and heavy accessory minerals are also detected.
<b>Appearance</b>	The extracted sand sample is mostly uniform, semi-translucent to semi-opaque, and light to medium gray in color (Munsell color code approximately 2.5Y 6/0.5).
<b>Gradation</b>	The sand is medium-grained and broadly graded. The nominal top size is at the No. 8 sieve, the peak abundance is between the No. 30 and No. 50 sieves, and the fines content is relatively low.
<b>Shape/aspect ratio</b>	The particles are equidimensional and subangular in shape on average.
<b>Clay coatings/friable materials</b>	None observed
<b>Organic impurities</b>	None observed
<b>Binder matrix</b>	
<b>Paste uniformity</b>	Homogeneous
<b>Capillary porosity</b>	Low to moderately low
<b>Microscopic shrinkage cracking</b>	None significant
<b>Residual calcium hydroxide</b>	Calcium hydroxide from the cement hydration is present in low abundance within the cement paste as fine-grained crystal masses, sometimes lining aggregate grains.
<b>Evidence for admixtures<sup>1</sup></b>	None detected
<b>Binder residuals</b>	
<b>Binder type</b>	Gray portland cement and dry lime hydrate
<b>Hydraulic cement</b>	The cement hydration is extreme and virtually all calcium silicate has been consumed in hydration reactions. Still, there is a moderate concentration of cement relicts in the form of empty shells (Hadley grains) that are defined only by the residual iron-bearing ferrite. These have the morphology of mostly fine-grained calcium silicate agglomerates with sizes up to and just retained on the No. 200 sieve. There is also a moderately high abundance of ferrite flakes distributed throughout the binder matrix.
<b>Lime</b>	Undispersed lime grains are observed in moderately high concentration as fine-grained, ovoid particulates that are internally nondescript. A low proportion of the lime grains have tabular shapes. All of the lime grains are carbonated.
<b>Pozzolans/SCMs<sup>2</sup></b>	None detected
<b>Other</b>	None detected

**Table 10.5 (cont'd.): Petrographic Data - Sample M3**

Sample ID	M3
<b>Pigment</b>	
<b>Concentration</b>	None detected
<b>Composition</b>	n/a
<b>Particle size</b>	n/a
<b>Color of extracted pigment</b>	n/a
<b>Other materials</b>	
<b>Details</b>	There are residuals of other mortars attached to the rear of the one of the mortar pieces captured in thin section. Directly adjacent to the examined mortar, there is a portland cement-based mix that appears superficially similar to the mortar studied in Sample M2. This is approximately one millimeter thick. Behind this, there is a thin residue of natural cement mortar that appears similar to that studied in Samples M4 and M5.
<b>Placement features</b>	
<b>Constituent distribution</b>	The constituents are well-mixed with no sand streaks or excessive coarse binder lumps. There is only a single, millimeter-scale cement lump observed in thin section.
<b>Mix water</b>	There is no evidence for inappropriate retempering.
<b>Compaction/consolidation</b>	The mortar is compact and well consolidated.
<b>Estimated air content/structure</b>	The total air content is estimated at 4-6% by volume. Voids are deformed in shape and all less than 1 millimeter in diameter.
<b>Paste-sand interfaces</b>	Sand grains are well-coated with binder.
<b>Secondary effects</b>	
<b>Carbonation</b>	The binder paste is carbonated up to a depth of 0.75 centimeters. The remainder of the examined pieces remains uncarbonated.
<b>Paste alteration</b>	None detected
<b>Cracking</b>	None detected
<b>Mineral deposits</b>	There are only traces of secondary calcium hydroxide observed lining air-voids in the uncarbonated areas of the paste. Otherwise, there are no significant secondary mineralizations.
<b>Surface erosion/weathering</b>	Sand grains are proud along the tooled face. There is some degradation of the binder paste up to 0.5 millimeters depth. There is also some biological growth within the weathered paste.

Notes:

1. Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on paste microstructure can sometimes be discerned.
2. SCMs = supplementary cementitious materials.

**Table 10.6: Petrographic Data - Sample M6**

Sample ID	M6
<b>As-received description</b>	
<b>Description</b>	The samples consists of roughly a dozen mortar pieces weighing a total of 97 grams. There are also three small fragments of a lighter gray mortar with a low content of light-colored sand, though this material is too scant to perform an analysis.
<b>Surfaces</b>	The joint face has a convex tooling profile with high relief, fine sand exposure. There is also some biological growth detected on the surface.
<b>Hardness/friability</b>	Freshly exposed surfaces have a moderately subvitreous luster and a gray color (Munsell code approximately 2.5Y 4.75/0.5).
<b>Appearance</b>	Fine white binder inclusions (much less than one millimeter in diameter) are common and sometimes have tabular shapes. There are also some fine black flecks distributed throughout.
<b>Visible inclusions</b>	The paste is moderately hard, and the mortar is indurate. The sand grains are transected on the intentionally-fractured surface.
<b>Absorptivity</b>	The mortar matrix is somewhat slowly water-absorptive.
<b>Cracking</b>	None detected
<b>Mineralizations</b>	None detected
<b>Sand</b>	
<b>Lithology</b>	The aggregate is mostly granitic with constituent quartz and feldspar. Metasedimentary clastic rock particles are a lesser component. Trace metabasite rock particles, ironstone, opaque minerals, and heavy accessory minerals are also detected.
<b>Appearance</b>	The extracted sand sample has a moderately variegated appearance due to a mixture of opaque coarse grains with medium to dark gray, purplish-brown, pink, and lighter gray colors. The rest of the sand is semi-translucent to semi-opaque with a light to medium gray color on average (Munsell color code approximately 2.5Y 6/0.5).
<b>Gradation</b>	The sand is medium to coarse-grained and broadly graded. The nominal top size is at the No. 4 sieve, the peak abundance is between the No. 16 and No. 30 sieves, and the fines content is relatively low.
<b>Shape/aspect ratio</b>	The particles are equidimensional and subangular to angular in shape.
<b>Clay coatings/friable materials</b>	None observed
<b>Organic impurities</b>	None observed
<b>Binder matrix</b>	
<b>Paste uniformity</b>	Homogeneous
<b>Capillary porosity</b>	Moderately low to low
<b>Microscopic shrinkage cracking</b>	None significant
<b>Residual calcium hydroxide</b>	Not identified
<b>Evidence for admixtures<sup>1</sup></b>	None detected
<b>Binder residuals</b>	
<b>Binder type</b>	Gray portland cement and dry lime hydrate
<b>Hydraulic cement</b>	The cement hydration is extreme and virtually all calcium silicate has been consumed in hydration reactions. Still, there is a moderate concentration of cement relicts in the form of empty shells (Hadley grains) that are defined only by the residual iron-bearing ferrite. These have the morphology of mostly fine-grained calcium silicate agglomerates with sizes up to and just retained on the No. 200 sieve. There is also a moderately high abundance of ferrite flakes distributed throughout the binder matrix.
<b>Lime</b>	Undispersed lime grains are observed in high concentration as fine-grained, ovoid particulates that are internally nondescript. A low proportion of the lime grains have tabular shapes. All of the lime grains are carbonated.
<b>Pozzolans/SCMs<sup>2</sup></b>	None detected
<b>Other</b>	None detected

**Table 10.6 (cont'd.): Petrographic Data - Sample M6**

Sample ID		M6
<b>Pigment</b>		
<b>Concentration</b>	None detected	
<b>Composition</b>	n/a	
<b>Particle size</b>	n/a	
<b>Color of extracted pigment</b>	n/a	
<b>Other materials</b>		
<b>Details</b>	None detected	
<b>Placement features</b>		
<b>Constituent distribution</b>	The constituents are well-mixed with no sand streaks or excessive coarse binder lumps.	
<b>Mix water</b>	There is no evidence for inappropriate retempering.	
<b>Compaction/consolidation</b>	The mortar is compact and well consolidated.	
<b>Estimated air content/structure</b>	The total air content is estimated at 6-8% by volume. Voids are deformed in shape and generally less than 1 millimeter in diameter. There are some minor areas where the compaction of the paste is less complete and there is a slightly higher volume of air-voids (up to 10%).	
<b>Paste-sand interfaces</b>	Sand grains are well-coated with binder.	
<b>Secondary effects</b>		
<b>Carbonation</b>	The binder paste is fully carbonated throughout the examined depth.	
<b>Paste alteration</b>	None detected	
<b>Cracking</b>	None detected	
<b>Mineral deposits</b>	None detected	
<b>Surface erosion/weathering</b>	Sand grains are proud along the tooled face. There is some degradation of the binder paste up to 0.5 millimeters depth. There is also some biological growth within the weathered paste.	

Notes:

1. Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on paste microstructure can sometimes be discerned.
2. SCMs = supplementary cementitious materials.

**References**

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## **Appendix I: Photographs and Photomicrographs**

Microscopic examination is performed on an Olympus BX-51 polarized/reflected light microscope and an Olympus SZ40 stereoscopic microscope. The polarized light microscope is fitted with a Tucsen MIchrome 5 Pro 5MP digital camera. The stereoscopic microscope is used for simple magnification. Sample types examined under this microscope include fractured surfaces, fine constituents extracted through chemical or physical means, or honed or polished cross sections. The polarized light microscope (PLM) magnifies but also employs principles of optical crystallography. The most common sample preparation for the PLM is the petrographic thin section. For this preparation, cross-sectioned samples are mounted to glass slides and are milled to a thickness sufficient to allow light to be transmitted through the material. These are usually prepared without water and with minimal heat to avoid altering minerals that are water or temperature-sensitive. In many cases, the samples are impregnated with a low-viscosity, blue-dyed epoxy. When so treated, blue areas represent some type of void space (e.g., air-voids, capillary pores, cracks, etc.). The polarized light photomicrographs are taken using a variety of optical settings chosen to best demonstrate the feature(s) of interest. These are distinguished as follows:

### **Plane polarized light (abbreviated as PPL)**

This method uses the refractive power of different constituents to produce an artificial sense of surface relief. Otherwise, the method is the closest to a simple magnification of the material. The setting is often used to demonstrate granular relationships or microstructure. Pore spaces and cracks are observable with this setting if the blue-dyed epoxy is used.

### **Conoscopic polarized light (abbreviated as CPL)**

In this setting, the transmitted light is condensed just before passing through the thin section. The method tends to bring colors or finer particulates into higher contrast at the expense of image sharpness. The setting is often used to image grain boundary failures in dimension stone, pigment particulates in binders, or gel phases in the micropores of cement pastes.

### **Cross polarized light (abbreviated as XPL)**

The setting places the thin section between two pieces of polarizing film oriented at 90° to one another. In isotropic materials (e.g., glasses, simple salts), all light is absorbed and the materials appear black. In anisotropic crystals, two light rays traveling at different speeds are produced within the thin section and these offset waves interfere at the upper polarizing film. The interference produces a color that can be used to calculate properties of the crystal structure and aid in identification of mineral species. In essence, the colors are artificial. It should be noted that color is a function of orientation and color differences do not necessarily indicate material differences.

### **Compensator plates**

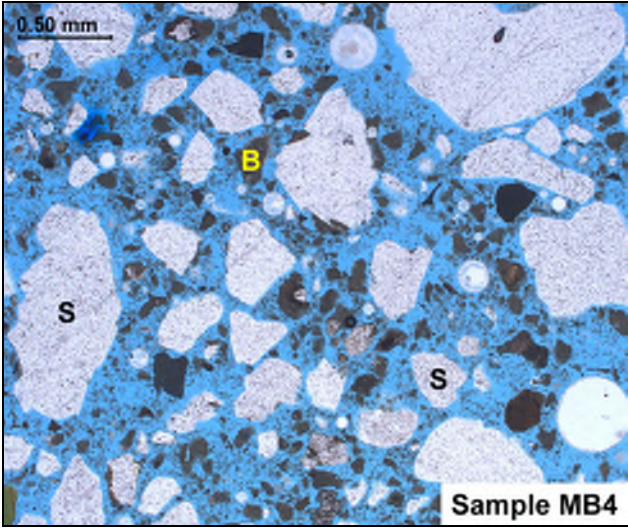
When in XPL mode, full-wave or quarter-wave compensator plates may be inserted into the light path to add or subtract interference. Technically, these methods are used to calculate properties of the crystal structure. However, they can also be used to alter the image appearance to help improve contrast between different constituents. They can also reveal preferred orientations in some materials (e.g., oriented residual crystallinity in fired ceramics).



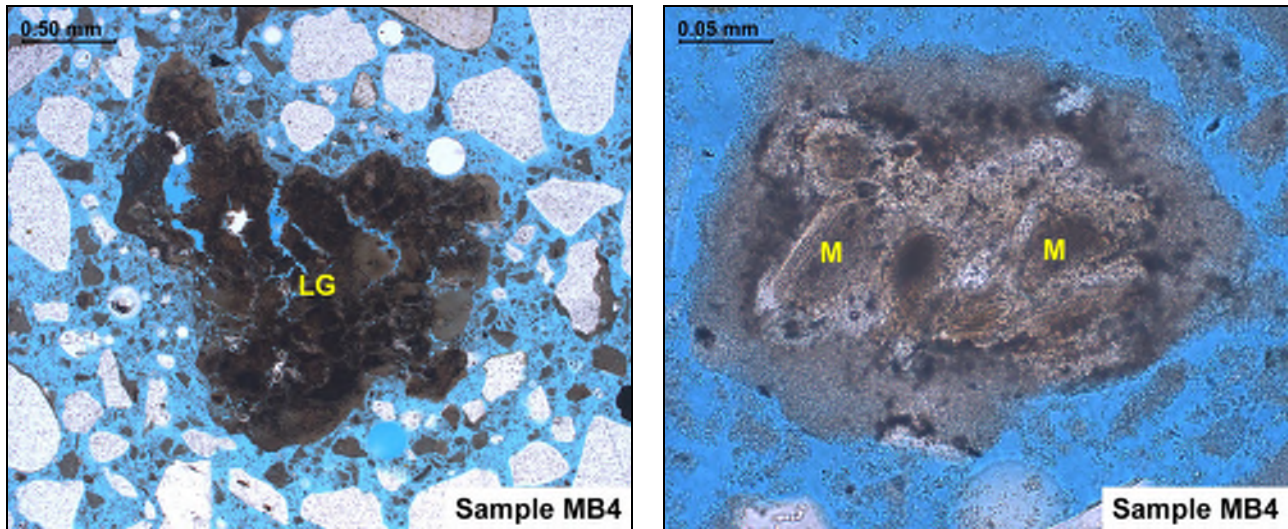
**Figure 1:** Photographs of the lime mortar (Sample MB4) provided to Highbridge for analysis. The sample consists entirely of loose granules and powdered debris. It has a nearly white color overall.



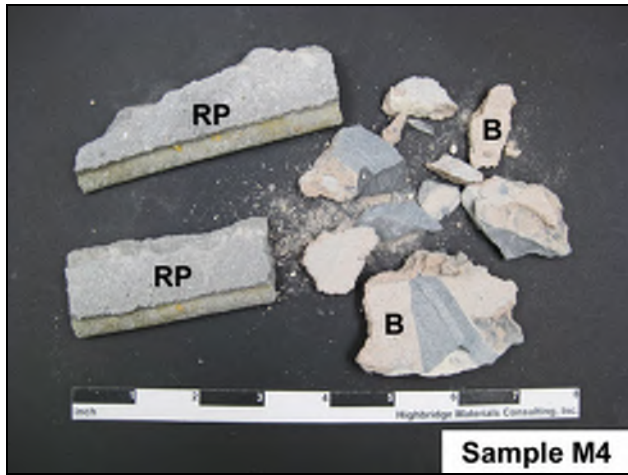
**Figure 2:** Photographs illustrating the sand sample extracted from Sample MB4 through acid digestion. The total extraction is shown at left. The sand is uniform and semi-translucent with a light gray color. At right, the sand is shown after gradation through a standard sieve stack. The gradation is broad and the sand is medium-grained. The vial at right contains minor unwashed silt and clay.



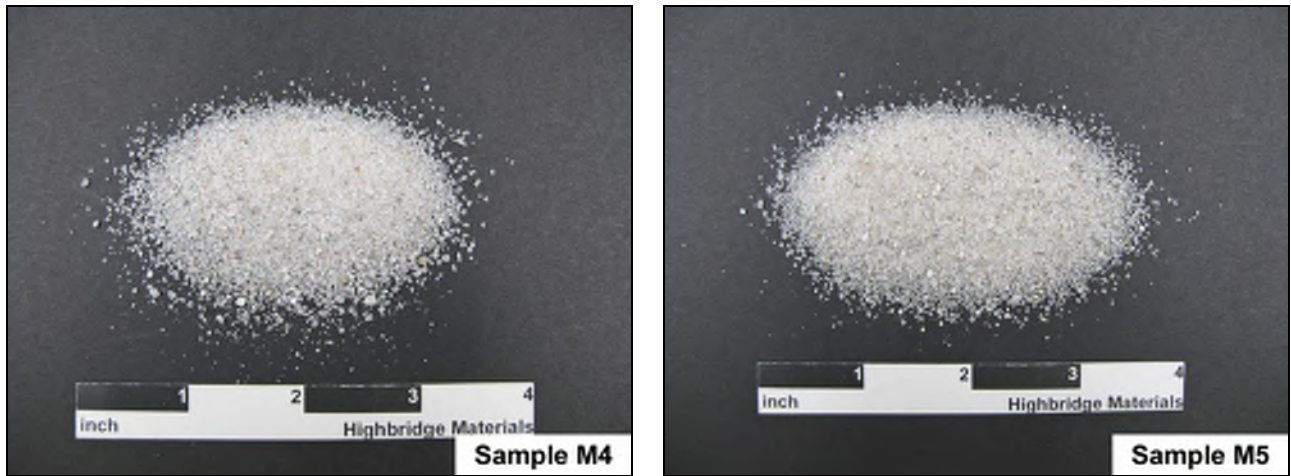
**Figure 3:** PPL photomicrograph illustrating the overall microtexture of the material in Sample MB4. The sample consists of debris with no intact mortar pieces. The sample contains mostly sand particles (S) with fewer fragments of the binder paste (B).



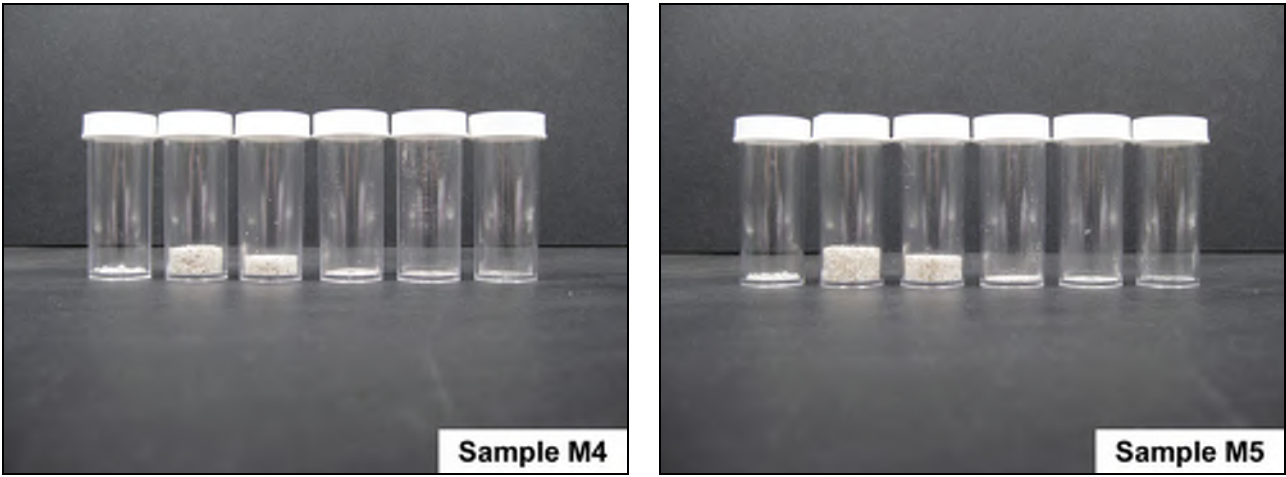
**Figure 4:** PPL photomicrographs illustrating mineralogical and microtextural features of the lime in Sample MB4. (Left image) An undispersed lime grains is shown. (Right image) A cluster of fired mica (M) is shown within a fragment of lime paste. This suggests that the lime was burned from a marble source.



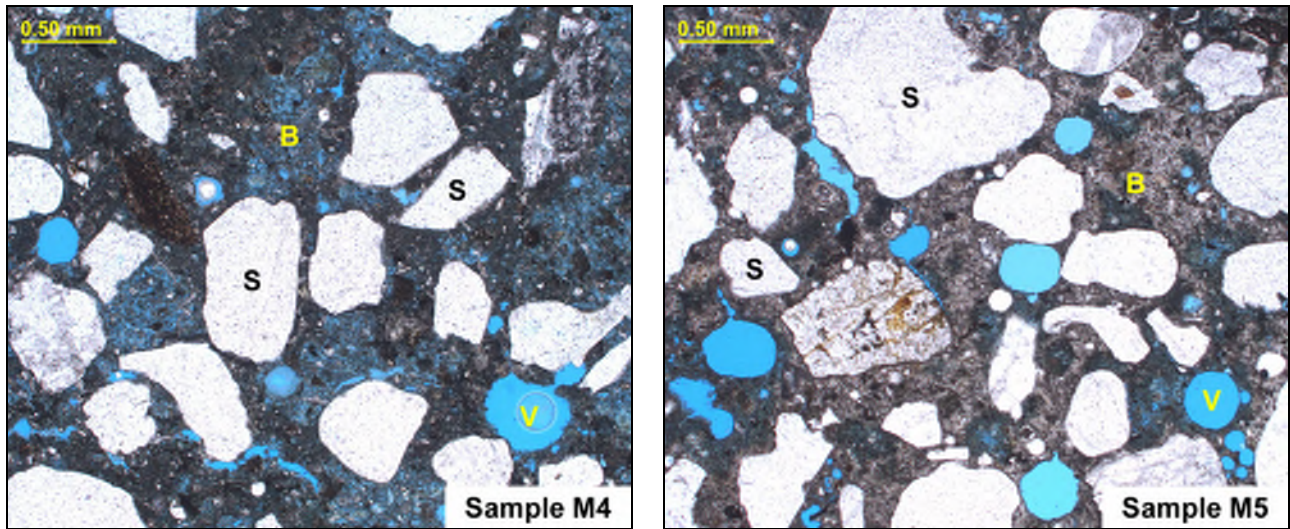
**Figure 5:** Photographs of the natural cement mortars (Samples M4 and M5) provided to Highbridge for analysis. (Left images) Each sample contains some gray repointing mortar (RP) in addition to the pale pink bedding mortar (B) that is the focus of the analysis. (Right images) The examined, pale pink mortars are cohesive yet relatively soft and moderately permeable.



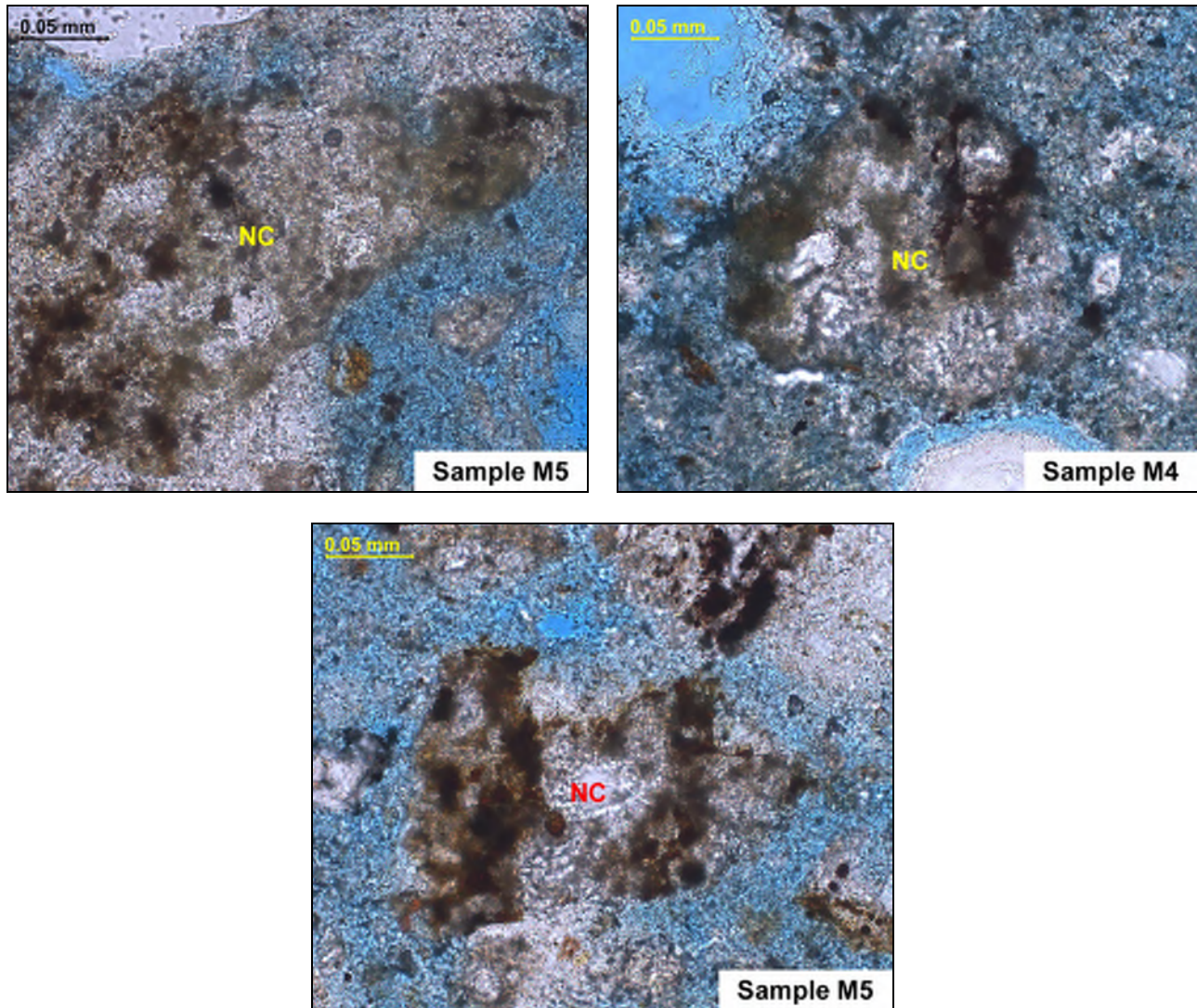
**Figure 6:** Photographs illustrating the sand samples extracted through acid digestion from the natural cement mortars. The total extraction is shown for each. The sands are uniform and semi-translucent with a light gray color.



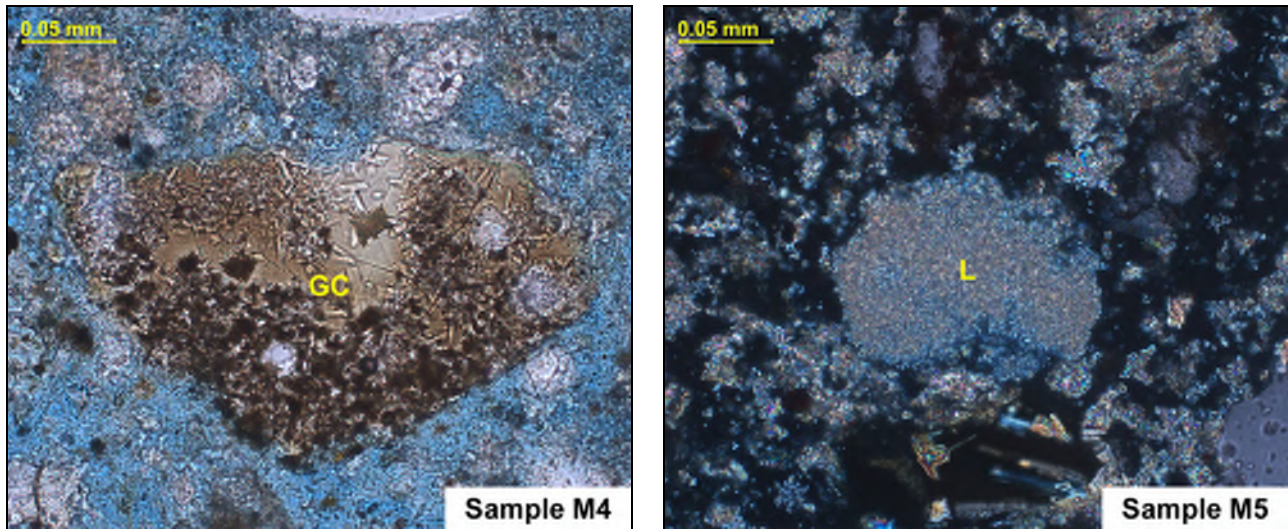
**Figure 7:** Photographs illustrating the sand samples extracted through acid digestion from the natural cement mortars. The sands are shown after gradation through a standard sieve stack. The gradation is medium-grained and somewhat narrow.



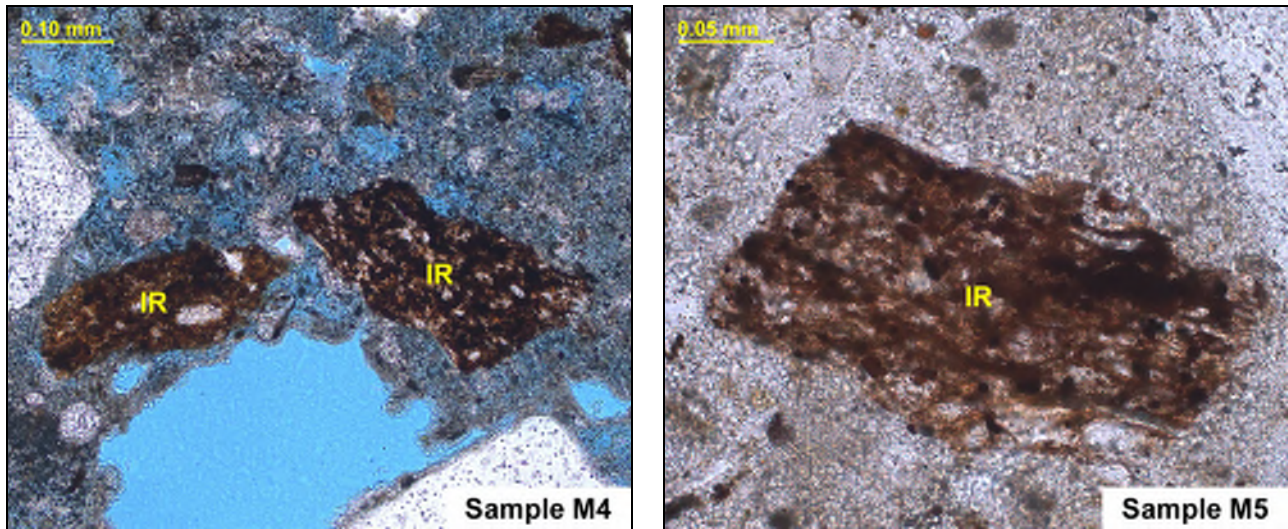
**Figure 8:** PPL photomicrographs illustrating the overall microtexture of the natural cement mortars. The sand (S) is narrowly-graded and somewhat sparsely distributed throughout the matrix. The binder paste (B) strongly absorbs the blue-dyed epoxy used in the sample preparation. This indicates a relatively high capillary porosity. The mortars are compact and well-consolidated, and air-voids are not excessive.



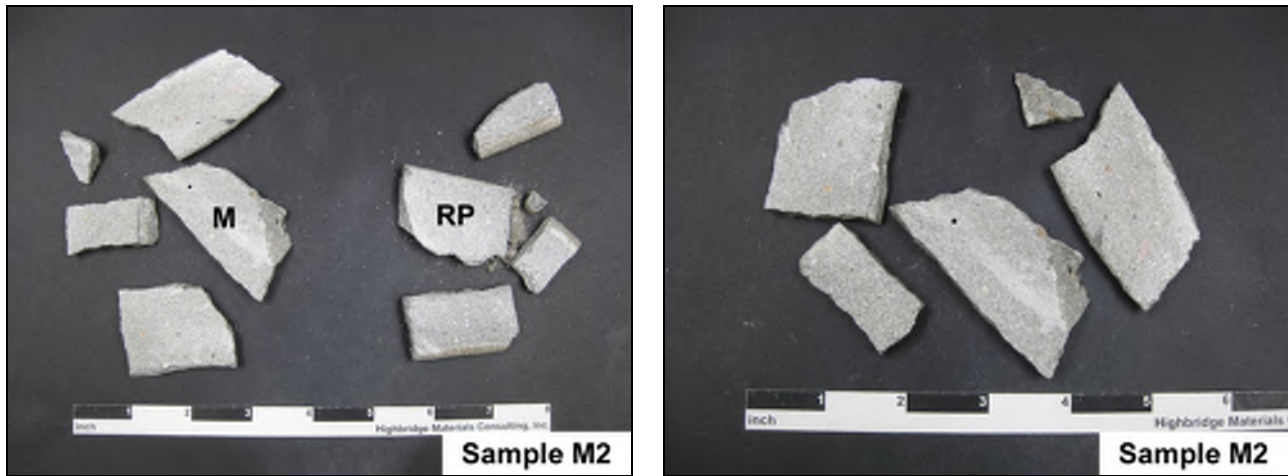
**Figure 9:** PPL photomicrographs illustrating mineralogical and microtextural features of the natural cement in Samples M4 and M5. The natural cement particles (NC) are found to a maximum size of 0.2 millimeters. These exhibit complex microtextures consistent with an argillaceous limestone that has been fired at a low temperature.



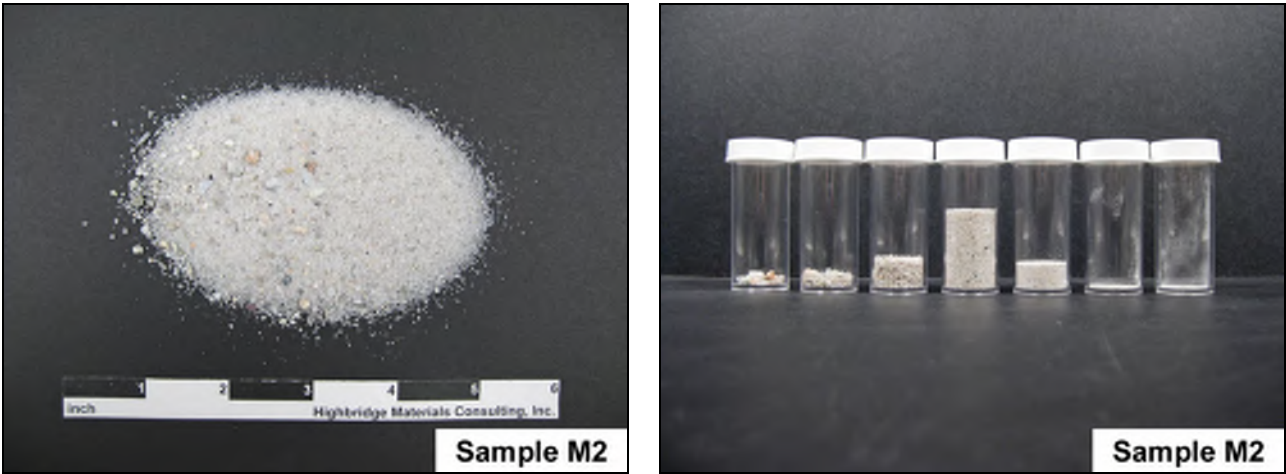
**Figure 10:** Photomicrographs illustrating other particles associated with the natural cement binder in Samples M4 and M5. (Left PPL image) There is a low abundance of glassy clinker particles (GC). (Right XPL image) There are also some lime-rich grains, but these could represent parts of the natural cement rather than signifying the presence of a separate lime addition.



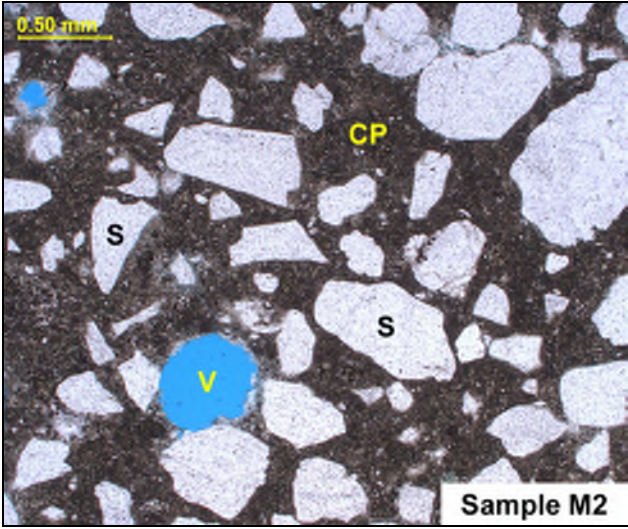
**Figure 11:** PPL photomicrographs of an iron-rich material (IR) that is present in the natural cement mortar in Samples M4 and M5. This is a fine-grained, mixed sediment that is not associated with the aggregate. It is also not clearly associated with the natural cement, nor does it appear to represent a pigment addition.



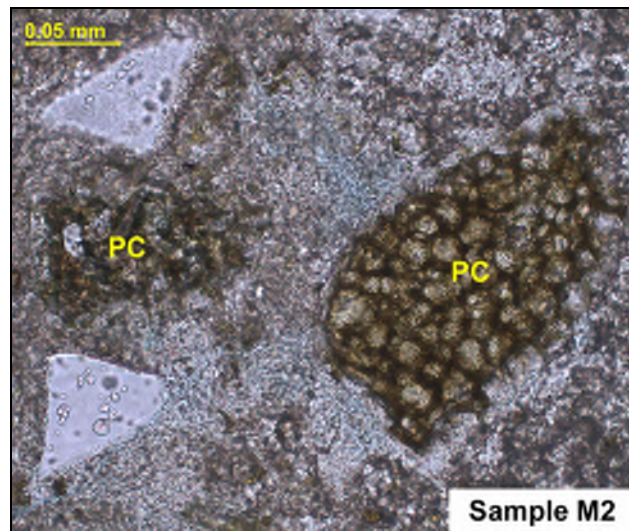
**Figure 12:** Photographs of Sample M2 provided to Highbridge for analysis. (Left image) The sample contains some pieces of repointing (RP) in addition to the mortar of interest (M). (Right image) The examined mortar is a pure portland cement mix that has a gray color. The cured product is hard and indurate with a low permeability.



**Figure 13:** Photographs illustrating the sand sample extracted from Sample M2 through acid digestion. The total extraction is shown at left. The sand is mostly uniform with a light gray color. At right, the sand is shown after gradation through a standard sieve stack. The gradation is broad though the sand is medium-grained on average.



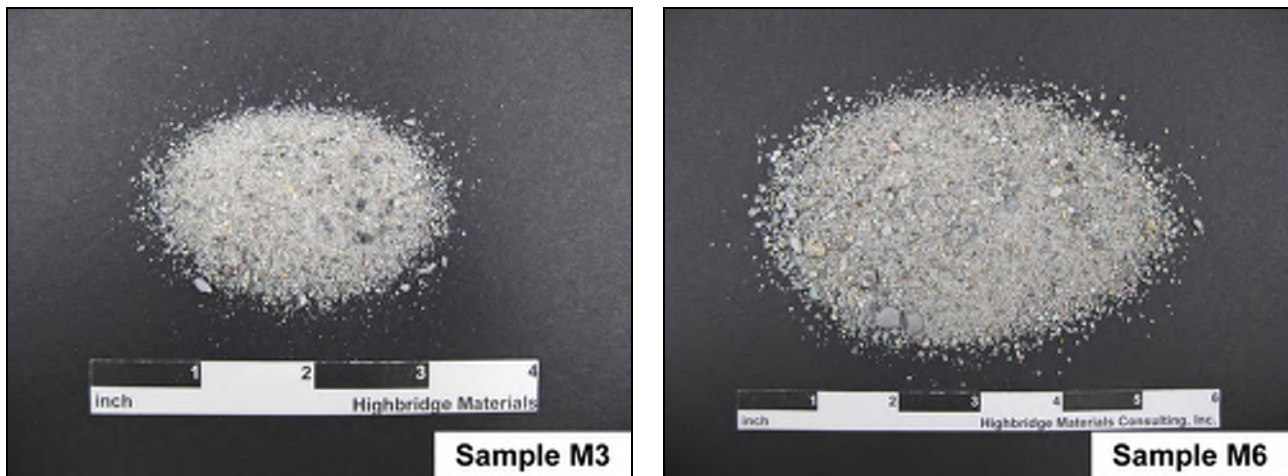
**Figure 14:** PPL photomicrograph illustrating the overall microtexture of the mortar in Sample M2. The sharp-textured sand (S) is somewhat sparsely distributed throughout the matrix. The mixture is compact and voids (V) are not excessive. Note that the binder does not absorb the blue-dyed epoxy used in the sample preparation. This indicates a low capillary porosity typical of pure portland cement mortars.



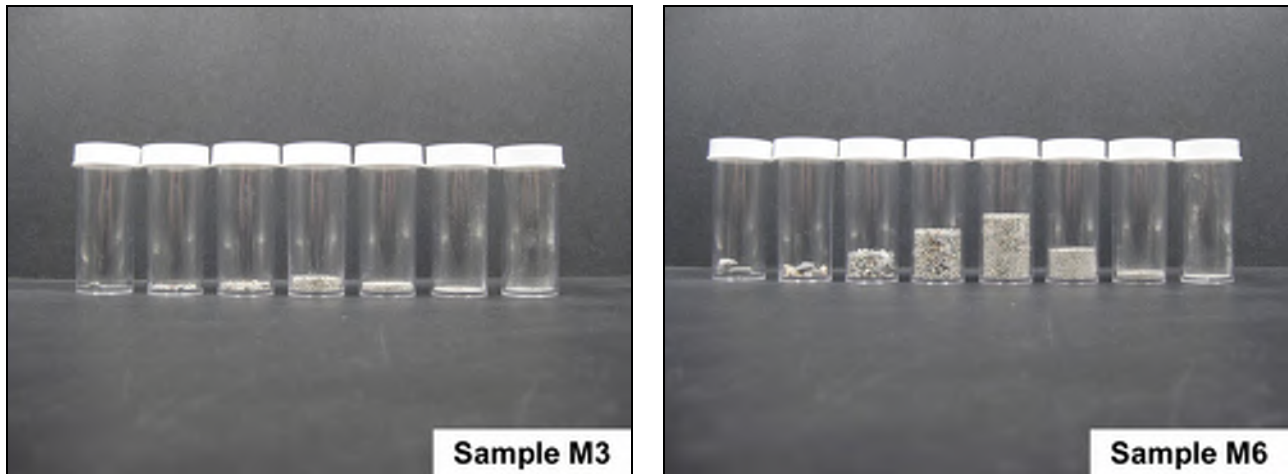
**Figure 15:** PPL photomicrograph illustrating microtextures of the binder in Sample M2. Portland cement residuals (PC) are abundant as medium-grained agglomerates of belite and lesser alite. The interstitial iron-bearing ferrite identifies the cement as a gray rather than white variety.



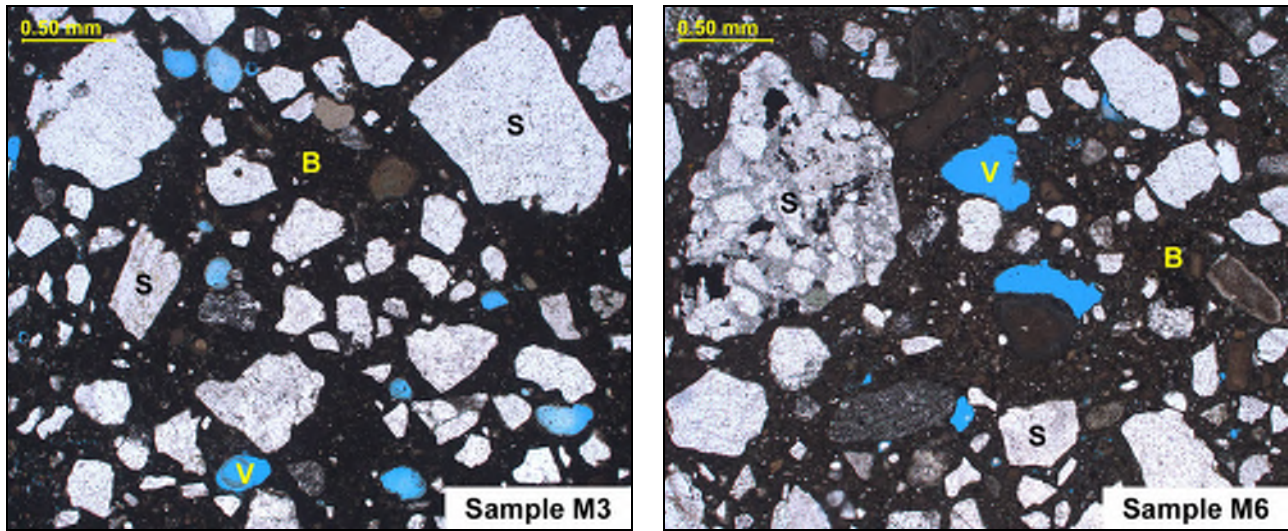
**Figure 16:** Photographs of Samples M3 and M6 provided to Highbridge for analysis. These represent repointing mortars from no earlier than the late twentieth century. The mortar is dense with a light gray color and low permeability.



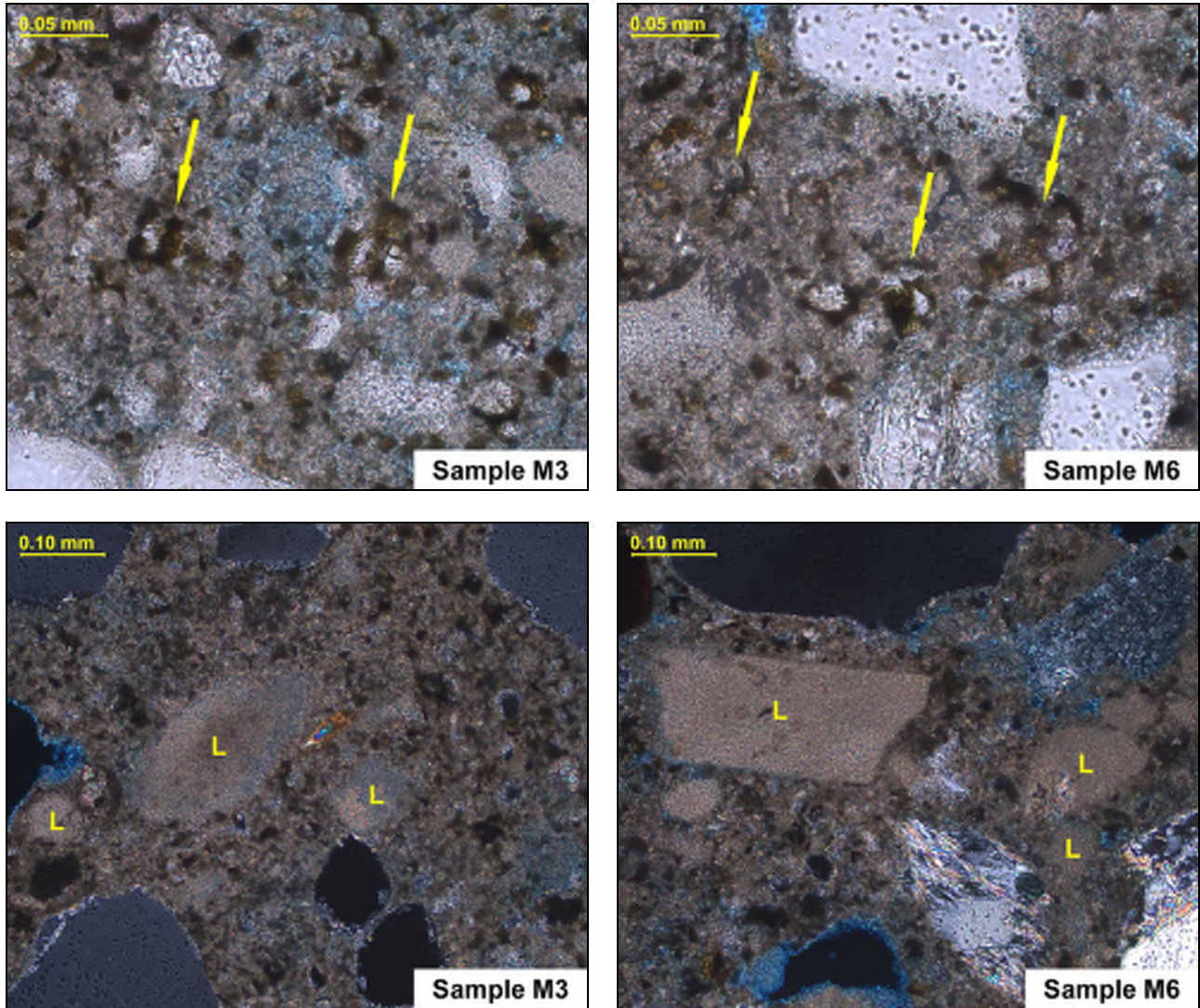
**Figure 17:** Photographs illustrating the sand samples extracted from Samples M3 and M6 through acid digestion. The total extraction is shown. The sands are light to medium gray. The sand in Sample M6 is more variegated due to a mixture of opaque coarse particles in gray, purplish-brown, and pink colors.



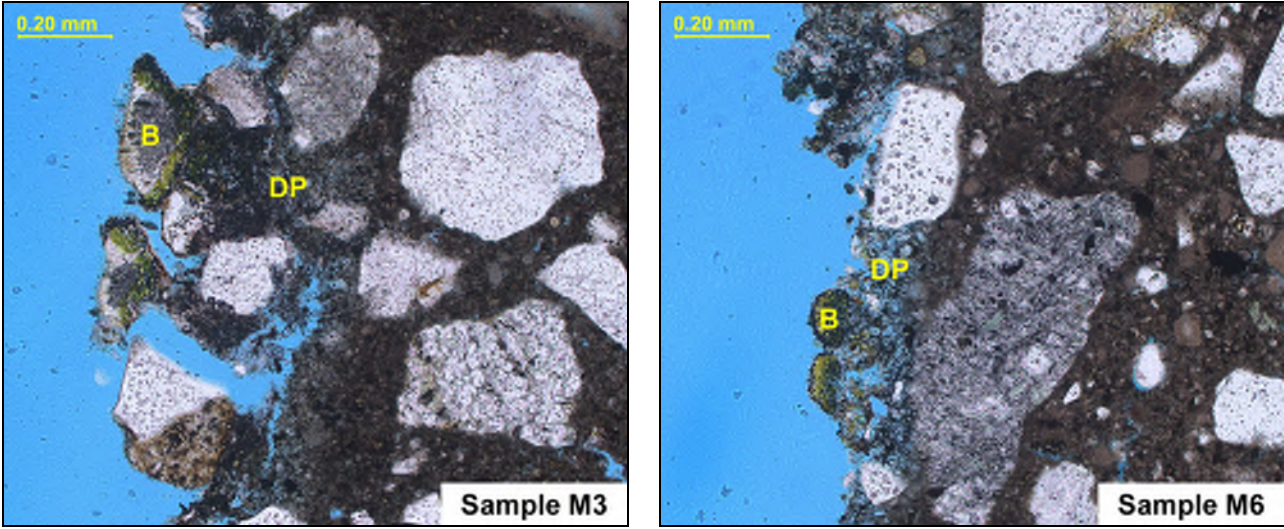
**Figure 18:** Photographs illustrating the sand samples extracted from Samples M3 and M6 through acid digestion. The sand is shown after gradation through a standard sieve stack. The gradation is broad in each mortar. However, the sand is medium-grained in Sample M3 and coarse-grained in Sample M6.



**Figure 19:** PPL photomicrographs illustrating the overall microtexture of the mortars in Samples M3 and M6. The sharp-textured sand (S) is sparsely distributed throughout the matrix. The mixture is compact and voids (V) are not excessive. Note that the binder does not absorb much of the blue-dyed epoxy used in the sample preparation. This indicates a relatively low capillary porosity.



**Figure 20:** Photomicrograph illustrating microtextures of the cement-lime binder in Samples M3 and M6. (Upper PPL images) Gray portland cement residuals (arrows) are abundant as fine Hadley grains that are only defined by the residual iron-bearing ferrite. (Lower XPL images) Undispersed lime grains (L) are present as fine, carbonated particulates. These mostly have ovoid shapes though fewer are tabular in shape.



**Figure 21:** PPL photomicrograph illustrating the weathered joint faces in Samples M3 and M6. Both mortars exhibit some normal surface weathering in which there is a thin veneer of degraded paste (DP) with some biological growth (B).

**APPENDIX D – PETROGRAPHIC ANALYSIS OF CAST STONE**

# Petrographic Examination of Cast Stone

## Barnstable County Superior Courthouse Restoration

3195 Main Street, Barnstable, MA 02630



**Prepared for**  
Gale Associates, Inc.

**Client ID**  
GALE005

**Report No.**  
SL2011-02

**Report Date**  
01/23/25



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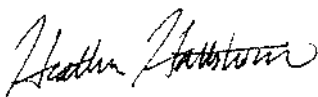
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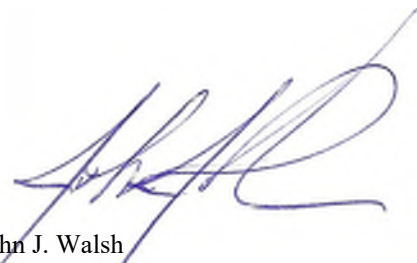
**Cover Image**

Photograph of the Barnstable County Superior Courthouse in Barnstable, MA. Image courtesy of Mr. Marc Loranger of Gale Associates, Inc.

Respectfully submitted,



Heather Hartshorn  
Vice President/ Senior Chemist  
**Highbridge Materials Consulting, Inc.**



John J. Walsh  
President/ Senior Petrographer  
**Highbridge Materials Consulting, Inc.**

## 1. Executive Summary

Two cast stone masonry samples were examined petrographically for this report. The samples were reportedly taken from the 1920s construction at the Barnstable County Superior Courthouse in Barnstable, MA.

The material is similar in both samples. These represent a wet-cast, monolithic architectural cast stone. The mix contains gray portland cement and a crushed aggregate with a nominal top size at the No. 4 sieve (or 3/8" sieve with all passing). There is no evidence of any pigments or air-entrainment in either sample. The aggregate is a mixture of granitic and metaclastic rock as well as smelting slag. The aggregate particles have a mixture of light gray, greenish-gray, purplish-gray, and black colors. Exposure of the aggregate along the outer surface appears to mimic the appearance of natural granite masonry unit.

The material proportioning is estimated to be appropriate for the type of material. The mix water content appears to have been moderately high and sufficient for workability. The cast stone is compact and well-consolidated without any significant void concentrations or heterogeneities. The relatively high w/c ratio has contributed to a moderate permeability in the cementitious matrix. This along with the lack of air-entrainment may make the product more susceptible to freeze-thaw distress. However, there is no evidence of any such distress in the examined samples.

The crushed stone aggregate has a composition that is known to be susceptible to alkali-silica reaction (ASR). However, this would be more of a concern if the material were present as a coarse aggregate addition. There is no significant evidence of ASR in the examined units. Sample PC2 exhibits only a very minor incipient reaction, but there is no pervasive cracking and both units are sound overall. If the examined samples are representative of the cast stone condition on site, then there is no immediate concern about the serviceability of the material.

**2. Introduction**

On October 23 and November 1, 2024, Highbridge received a total of six (6) masonry mortar samples and three (3) cast stone samples from Mr. Samuel Wesselman of Gale Associates, Inc. According to Mr. Wesselman, the samples were taken from various locations and masonry types at the Barnstable County Superior Courthouse in Barnstable, MA. Mr. Marc Loranger, also of Gale Associates, reports that the building was originally constructed in 1831 and has had several additions throughout its history. The client has identified the samples and described their locations as follows in Table 2.1.

**Table 2.1: Summary of Received Samples**

Material type	Client ID	Location description in client's transmittal
Mortar	MB4	West Basement Brick Mortar
	M2	1900s North Elev. Granite Mortar
	M3	Original Bldg. West Smooth Granite Mortar
	M4	Original Bldg. North Elev. Granite Mortar
	M5	Original Bldg. East Elev. Mortar
	M6	1900s Bldg. East Elevation Smooth Granite Mortar
Cast Stone	PC1	1920s East Elev
	PC2	1920s East Side North Elevation
	PC3	1920s West Elevation

Mr. Loranger has requested a compositional analysis on each of the six mortar samples. The testing includes petrographic examination and chemical analysis to identify constituents, evaluate overall condition, and estimate component proportions. Acid digestions to extract sand samples for description and gradation are also included. The client has also requested a petrographic examination on two cast stone samples. The laboratory has chosen to test Samples PC1 and PC2 since there is a conduit running through the middle of Sample PC3. The petrographic examination includes a qualitative identification of the constituents, an assessment of the original casting method, an investigation of the potential causes of any observed distress.

This report presents the results of the cast stone examination. The results of the compositional mortar analysis are presented under separate cover in Highbridge Report SL2011-01.

**3. Methods of Examination**

The petrographic examination was conducted in accordance with the standard practices contained in ASTM C856/C856M-20. Data collection is performed or supervised by a degreed geologist who by nature of their education is qualified to operate the analytical equipment employed. Analysis and interpretation are performed or directed by a supervising petrographer who satisfies the qualifications as specified in Section 4 of ASTM C856.

The following personnel contributed to the examination:

Technician: M. Pattie  
 Petrographer: H. Hartshorn  
 Supervisor: J. Walsh

## 4. Petrographic Findings and Discussion

### 4.1 - General Summary

The two examined samples contain similar materials mixed at essentially the same proportions. These represent an architectural cast stone product designed to emulate natural granite. The material is interpreted to have been wet-cast using a measurable slump mix. The color of the cementitious paste when freshly broken is light gray (approximately N6.5). This weathers to a buff color where carbonated. The surface of the cast stone has some aggregate exposed in low relief. The exposed aggregate adds visual texture with a mixture of black, light gray, greenish-gray, and purplish-gray colors. It is likely that aggregate exposure was part of the original cast stone finish to create a granitic appearance.

### 4.2 - Materials

The cast stone mixture is a normal weight portland cement concrete prepared with a moderately high water to cement ratio (w/c). Though the ratio cannot be quantified, it is estimated to have been in the high 0.5s based on hardened qualities of the cement paste (Tables 5.1 and 5.2). The binder is identified as a gray portland cement with no supplementary cementitious materials and no added pigment. The client has reported that the cast stone dates to the 1920s, and the microtextural qualities of the residual cement are consistent with an early twentieth century product. There is no evidence for intentional air-entrainment, and it is almost certain that the cast stone predates the commercial availability of air-entraining admixtures.

No coarse aggregate was incorporated into the cast stone mixture. The fine aggregate contains a mixture of crushed natural stone and smelting slag. The crushed stone aggregate contains a mixture of granitic and metaclastic rock grains. These materials are consistent with natural deposits in the Boston area, and the individual particles have colors ranging from light gray to greenish-gray and purplish-gray. The smelting slag addition contributes a black color to the aggregate palette.

The aggregate particles are angular and mostly equidimensional in shape, though there are fewer shard-like particles. Despite some preferential orientation of the shard-like grains, there is no major anisotropy in the aggregate that would be considered a defect or be expected to affect the performance of the material. The aggregate has a nominal top size at the No. 4 sieve (or perhaps the 3/8" sieve with all grains passing). Though the distribution of particle sizes is broad, the majority of the aggregate is retained between the No. 8 and No. 30 sieves (i.e., within two standard sieve intervals). There is no excess of rock flour from the crushing operation.

The identified components are considered acceptable for use in portland cement-based cast stone. Although the metaclastic rock in the aggregate tends to be susceptible to alkali-silica reaction, there would be more concern if the mix contained a coarse aggregate with the same composition. With so many fine sand grains competing for alkalis, the aggregate in this particular mixture may exceed the pessimum proportion at which deleterious reaction would have been more likely. There is some exceeding minor cracking in Sample PC2. However, this is not considered a major concern unless more widespread cracking is observed in the cast stone installed on the building.

The mix design was not quantified through chemical analysis for this project. However, the aggregate is estimated to represent approximately half of the hardened concrete volume based on the qualitative petrographic observations. The richness of the mix is typical for architectural cast stone as opposed to cast-in-place concrete. The original mix water content was relatively high and has contributed to a moderately permeable cementitious matrix. Still, the mixture is estimated to have been sufficiently plasticized, and this has resulted in a well-consolidated material.

#### **4.3 - Original Casting and Hydration**

In each sample, an approximately 3" depth of cast stone was provided for examination. Only one mixture is identified throughout the sample, suggesting that the masonry unit is a monolithic casting that did not incorporate a separate facing mixture. That said, the choice of aggregate suggests a specially-prepared mix intended to mimic the appearance of natural stone. The outer surface has exposed aggregate and a lined texture that emulates a tooled granite masonry unit.

The cast stone constituents were thoroughly blended. The moderately high water cement ratio and appearance of spherical voids indicate a measurable-slump wet-cast mixture rather than a dry tamp product. The castings are compact and well-consolidated with no large void structures. There is no evidence of excess bleed water, material segregations, or other heterogeneities. The portland cement is well-hydrated and cured throughout the samples. The hydration is more or less consistent throughout the examined depth, and there is no indication of excessive absorption of mix water by the molds. A slight increase in the presence of unhydrated cement particles near exposed surfaces might indicate a small amount of early evaporation during curing. However, this is negligible.

#### **4.4 - Features Related to Potential for Steel Corrosion**

It is not known whether any steel embedments are present within the cast stone units. In either case, an assessment of the corrosion potential of steel reinforcement is outside the scope of a petrographic examination. Still, some features identified petrographically have a bearing on corrosion potential.

- The carbonation depth is moderate at roughly 1 to 1.5 centimeters depth along the exposed face. Any steel with cover greater than an inch should remain passivated if this carbonation profile is representative of the cast stone units throughout the construction.
- The hardened cement paste has a moderate permeability. The relatively high original mix water content may have contributed to a material that is less resistant to slow the ingress of moisture and any external agents that might promote corrosion of any embedded steel.
- Chloride contents were not measured for these samples. If chloride contents are high, these could cause embedded steel to be vulnerable to electrochemical corrosion.

With all this said, a more thorough evaluation of corrosion potential must be deferred to a corrosion specialist. The statements made here are tentative and offered without any firsthand knowledge of the jobsite conditions or electrical properties of the concrete and any embedments.

#### **4.5 - Condition and Durability**

The two samples provided for petrographic examination represent a fairly high-quality architectural cast stone material. The examined pieces are in relatively sound condition. If the examined samples are representative of the conditions on site, then there should be no concern about the continued serviceability of the material. Still, there are some features worth noting that the client may wish to monitor in the future.

Compositionally, some of the aggregate is expected to be alkali-silica reactive when used in coarse aggregates in portland cement concrete. However, the finer size of the aggregate in this cast stone may help to mitigate any reactivity that might occur between the aggregate and the alkaline cement paste. There is no evidence of any advanced distress in these samples. While Sample PC2 exhibits some exceedingly minor cracking due to incipient ASR, there is even less evidence of incipient reaction in Sample PC1.

The moderate permeability of the cementitious matrix and the lack of air-entrainment make the cast stone more susceptible to freeze-thaw cycling distress. However, there is currently no physical damage that can be attributed to freeze-thaw cycling. Given the decades-long service record of the cast stone, the lack of any cracking could suggest it does not reach a critical degree of saturation during freezing events. An assessment of site conditions is outside the scope of this examination. If the cast stone exhibits cracking that appears to be localized around areas that are more exposed to saturation and also tend to remain saturated for longer time periods, this may be an indication of freeze-thaw distress. Closely-spaced scaling cracks would be one typical form of freeze-thaw cracking.

While the coarse aggregate was likely exposed as part of the original surface finish, there has been some minor degradation of the cementitious matrix and growth of biological matter along this face. Still, this surface weathering is minimal and superficial. There is no incipient scaling and no unusually deep chemical attack on the cement paste related to the weathering.

## 5. Petrographic Data

**Table 5.1: Petrographic Data**

Sample ID	PC1
<b>As-received description</b>	
<b>Dimensions/details</b>	The sample consists of one sawn piece of cast stone. The sample was taken to include a vertical surface of the cast stone, which has an approximately 5" x 2.5" area represented. Up to 3" depth of the cast stone is represented in the sample piece.
<b>Outer surface</b>	The outer surface is planar with a faint vertical lineated texture. Coarse sand grains (mostly in black and greenish colors) are visible in low relief on the surface. There is also some biological growth on the outer surface.
<b>Inner surface</b>	The inner surface of the provided piece is an artificial break from sampling. Most of the aggregate grains are transected on the fractured surface.
<b>Paste qualities</b>	On the broken inner surface, the paste has a moderately subvitreous luster and a light gray color (Munsell code approximately N6.5). The paste is hard and not noticeably water-absorptive.
<b>Embedded items</b>	None included
<b>Visible cracks</b>	There is one hairline, vertical crack that transects the front surface of the piece and is visible to approximately 1.5" depth.
<b>Aggregate</b>	
<b>Type</b>	Crushed natural stone and smelting slag
<b>Estimated volume</b>	Approximately 45% to 50%
<b>Lithology</b>	The crushed stone aggregate contains a mixture of granitic and metaclastic rock particles. The former consists mostly of quartz and feldspar. The latter includes quartz, feldspar, and volcanic lithics with variable amounts of white clay. Rare marble grains are also detected.
<b>Nominal top size</b>	No. 4 (or 3/8" with all passing)
<b>Grading</b>	There is a broad distribution of particles from the No. 4 sieve down to the No. 100 sieve. However, the majority of the aggregate is retained between the No. 8 and No. 30 sieves. Fine dust from the crushing operation is present in moderate concentration.
<b>Roundness</b>	Angular
<b>Aspect</b>	Mostly equant with fewer anisotropic grains. The latter consist mostly of blocky to shard-like grains with aspect ratios typically less than 4 : 1.
<b>Coatings and rims</b>	None significant
<b>Organic impurities</b>	None identified
<b>Cracks</b>	None significant

**Table 5.1 (cont'd.): Petrographic Data**

Sample ID	PCI (cont'd.)
<b>Cement paste</b>	
<b>Hand sample qualities</b>	Intentional fractures are sharp and mostly transect aggregate particles. The freshly exposed paste has a light gray color and a moderately subvitreous translucent luster. The paste is relatively hard and moderately water-absorptive.
<b>Paste microstructure</b>	The cured paste is mostly uniformly developed with a moderate to moderately high capillary porosity.
<b>Calcium hydroxide</b>	Primary calcium hydroxide is present in moderate concentration as fine to medium-grained crystal masses within the cement paste and less commonly as discontinuous deposits along paste-aggregate interfaces.
<b>Evidence for admixtures <sup>1</sup></b>	There is no direct petrographic evidence for any type of performance-modifying admixture or additive.
<b>Degree of cement hydration</b>	The cement hydration is advanced.
<b>Residual unhydrated cement <sup>2</sup></b>	Unhydrated cement grains are found in relatively low concentration and mostly within the outer 1.25" of the cast stone. These are mostly belite agglomerates with lesser alite and interstitial iron-bearing ferrite. The agglomerates are somewhat coarse with sizes up to and retained on the No. 100 sieve.
<b>Hydrated cement textures</b>	Hydrated cement relics are highly abundant as agglomerates of former calcium silicate with a preserved skeleton of interstitial ferrite. These consist of empty shells (Hadley grains) and as molds filled with subsequent cementitious product (Williamson grains). The agglomerates are relatively coarse and some would have been retained on a No. 100 sieve.
<b>SCMs <sup>3</sup></b>	None identified
<b>Pigments</b>	None identified
<b>Other inclusions</b>	None identified
<b>Variations</b>	The paste hydration characteristics are mostly uniform throughout the examined cross section. Unhydrated cement grains are somewhat more common toward the outer surface, particularly in the outer centimeter where the paste is carbonated.
<b>W/cm estimate <sup>4</sup></b>	The water to cement ratio is estimated to have been relatively high. The ratio was probably somewhere in the high 0.5s.
<b>Air-void system</b>	
<b>Entrained air</b>	None identified
<b>Entrapped air</b>	Entrapped voids are estimated at 2-3% by volume. These are generally subspherical in shape and less than 1 millimeter in diameter. The voids are evenly distributed throughout the cast stone matrix. There are no honeycombs or other especially coarse void structures.
<b>Paste-aggregate interfaces</b>	
<b>Description</b>	The aggregate is well coated with cement paste. There are no defects observed along the interfacial zone.

**Table 5.1 (cont'd.): Petrographic Data**

Sample ID	PCI (cont'd.)
<b>Original placement features</b>	
<b>Mixing of dry ingredients</b>	There are no cement lumps or aggregate concentrations. All constituents are estimated to have been well mixed.
<b>Mix water</b>	The mix water was well incorporated into the fresh mixture and there is no evidence for inappropriate retempering.
<b>Consolidation/ compaction</b>	The concrete mixture was adequately consolidated.
<b>Segregations</b>	None observed
<b>Preferential orientations</b>	Some of the more anisotropic aggregate particles tend to be oriented with their lengths parallel to the outer surface. However, this most of the aggregate grains are randomly-oriented and homogeneously distributed overall.
<b>Bleed water features</b>	None observed
<b>Cold joints/ other contacts</b>	None observed
<b>Laitance</b>	None observed
<b>Forming</b>	The cast stone face is well formed, and there are no defects identified.
<b>Curing</b>	The portland cement is thoroughly cured and the cementitious paste is uniformly developed.
<b>Other defects</b>	None
<b>Secondary service effects</b>	
<b>Surface erosion/weathering</b>	Biological growth is present on the outer surface. No significant soot identified. There is no evidence for significant paste attrition, and aggregate grains are just slightly proud along the weathered face. There is no chemical attack within the surface paste, no deposition of sulfates, and no freeze-thaw cracking.
<b>Carbonation</b>	The outer surface is carbonated to a depth of approximately 1 centimeter.
<b>Cracking</b>	No crazing is evident along the outer surface. A single microcrack transects the outer surface of the cast stone sample. There are only trace, discontinuous microscopic cracks captured in thin section. These are mostly oriented parallel to the outer surface.
<b>Chemical alteration in paste</b>	Except for the carbonation reaction, the cement paste does not exhibit any outward sign of leaching, decalcification, bicarbonation, sulfonation, or any other chemical attack.
<b>Mineral deposits</b>	Ettringite is commonly observed lining air-voids. No other secondary mineral deposits are identified petrographically. Note that chloride salts are typically distributed throughout the cement paste capillaries and are usually not detectable petrographically.
<b>Aggregate reactivity</b>	Although the aggregate may be susceptible to alkali-silica reaction, there is no evidence of any ASR. The trace cracking only rarely occurs within aggregate grains, and no reaction gel detected.

Notes:

- Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on concrete microstructure can sometimes be discerned.
- The presence of unhydrated cement grains does not necessarily indicate poor hydration of the binder. A greater abundance of unhydrated cement is typical with reduced w/cm.
- SCMs = supplementary cementitious materials.
- Water to cementitious materials ratio (w/cm) cannot be quantified petrographically. Estimates are made qualitatively based on many characteristics of the hardened cement paste including behavior of the paste when fractured, capillary porosity, concentration of residual unhydrated cement, and microtextural features of the primary calcium hydroxide formed during the cement hydration. The estimates are complicated by the presence of SCMs, organic additives, or through chemical changes that occur with age.

**Table 5.2: Petrographic Data**

Sample ID	PC2
<b>As-received description</b>	
<b>Dimensions/details</b>	The sample consists of one sawn piece of cast stone. The sample was taken to include a vertical surface of the cast stone, which has an approximately 5.5" x 2.5" area represented. Up to 3" depth of the cast stone is represented in the sample piece.
<b>Outer surface</b>	The outer surface is planar with a faint vertical lineated texture. Coarse sand grains (mostly in black and greenish colors) are visible in low relief on the surface. There is also some biological growth on the outer surface.
<b>Inner surface</b>	The inner surface of the provided piece is an artificial break from sampling. Most of the aggregate grains are transected on the fractured surface.
<b>Paste qualities</b>	On the broken inner surface, the paste has a moderately subvitreous luster and a light gray color (Munsell code approximately N6.75). The paste is hard and very slowly water-absorptive.
<b>Embedded items</b>	None included
<b>Visible cracks</b>	None detected
<b>Aggregate</b>	
<b>Type</b>	Crushed natural stone and smelting slag
<b>Estimated volume</b>	Approximately 45% to 50%
<b>Lithology</b>	The crushed stone aggregate contains a mixture of granitic and metaclastic rock particles. The former consists mostly of quartz and feldspar. The latter includes quartz, feldspar, and volcanic lithics with variable amounts of white clay. Rare marble grains are also detected.
<b>Nominal top size</b>	No. 4 (or 3/8" with all passing)
<b>Grading</b>	There is a broad distribution of particles from the No. 4 sieve down to the No. 100 sieve. However, the majority of the aggregate is retained between the No. 8 and No. 30 sieves. Fine dust from the crushing operation is present in moderate concentration.
<b>Roundness</b>	Angular
<b>Aspect</b>	Mostly equant with fewer anisotropic grains. The latter consist mostly of blocky to shard-like grains with aspect ratios typically less than 4 : 1.
<b>Coatings and rims</b>	None significant
<b>Organic impurities</b>	None identified
<b>Cracks</b>	None significant

**Table 5.2 (cont'd.): Petrographic Data**

Sample ID	PC2 (cont'd.)
<b>Cement paste</b>	
<b>Hand sample qualities</b>	Intentional fractures are sharp and mostly transect aggregate particles. The freshly exposed paste has a light gray color and a moderately subvitreous translucent luster. The paste is relatively hard and moderately water-absorptive.
<b>Paste microstructure</b>	The cured paste is mostly uniformly developed with a moderately high to moderate capillary porosity.
<b>Calcium hydroxide</b>	Primary calcium hydroxide is present in moderately high concentration as fine to medium-grained crystal masses within the cement paste and less commonly as discontinuous deposits along paste-aggregate interfaces.
<b>Evidence for admixtures <sup>1</sup></b>	There is no direct petrographic evidence for any type of performance-modifying admixture or additive.
<b>Degree of cement hydration</b>	The cement hydration is advanced.
<b>Residual unhydrated cement <sup>2</sup></b>	Unhydrated cement grains are found in low concentration and mostly within the outer 1" of the cast stone. These are mostly belite agglomerates with lesser alite and interstitial iron-bearing ferrite. The agglomerates are somewhat coarse with sizes up to and retained on the No. 100 sieve.
<b>Hydrated cement textures</b>	Hydrated cement relics are highly abundant as agglomerates of former calcium silicate with a preserved skeleton of interstitial ferrite. These consist of empty shells (Hadley grains) and as molds filled with subsequent cementitious product (Williamson grains). The agglomerates are relatively coarse and some would have been retained on a No. 100 sieve.
<b>SCMs <sup>3</sup></b>	None identified
<b>Pigments</b>	None identified
<b>Other inclusions</b>	None identified
<b>Variations</b>	The paste hydration characteristics are mostly uniform throughout the examined cross section. Unhydrated cement grains are somewhat more common toward the outer surface, particularly in the outer centimeter where the paste is carbonated.
<b>W/cm estimate <sup>4</sup></b>	The water to cement ratio is estimated to have been relatively high. The ratio was probably somewhere in the high 0.5s.
<b>Air-void system</b>	
<b>Entrained air</b>	None identified
<b>Entrapped air</b>	Entrapped voids are estimated at 2-3% by volume. These are generally subspherical in shape and less than 1 millimeter in diameter. The voids are evenly distributed throughout the cast stone matrix. There are no honeycombs or other especially coarse void structures.
<b>Paste-aggregate interfaces</b>	
<b>Description</b>	The aggregate is well coated with cement paste. There are no defects observed along the interfacial zone.

**Table 5.2 (cont'd.): Petrographic Data**

Sample ID	PC2 (cont'd.)
<b>Original placement features</b>	
<b>Mixing of dry ingredients</b>	There are no cement lumps or aggregate concentrations. All constituents are estimated to have been well mixed.
<b>Mix water</b>	The mix water was well incorporated into the fresh mixture and there is no evidence for inappropriate retempering.
<b>Consolidation/ compaction</b>	The concrete mixture was adequately consolidated.
<b>Segregations</b>	None observed
<b>Preferential orientations</b>	Some of the more anisotropic aggregate particles tend to be oriented with their lengths parallel to the outer surface. However, this most of the aggregate grains are randomly-oriented and homogeneously distributed overall.
<b>Bleed water features</b>	None observed
<b>Cold joints/ other contacts</b>	None observed
<b>Laitance</b>	None observed
<b>Forming</b>	The cast stone face is well formed, and there are no defects identified.
<b>Curing</b>	The portland cement is thoroughly cured and the cementitious paste is uniformly developed.
<b>Other defects</b>	None
<b>Secondary service effects</b>	
<b>Surface erosion/weathering</b>	Biological growth is present on the outer surface. No significant soot identified. There is no evidence for significant paste attrition, and aggregate grains are just slightly proud along the weathered face. There is no chemical attack within the surface paste, no deposition of sulfates, and no freeze-thaw cracking.
<b>Carbonation</b>	The outer surface is carbonated to a depth of approximately 1.5 centimeters.
<b>Aggregate reactivity</b>	A very early stage alkali-silica reaction is observed. A very low abundance of the aggregate contains extremely fine microcracks that are sometimes filled with porous reaction gel. These cracks often extend into the adjacent cement paste though the paste cracks are rarely lined with reaction gel.
<b>Cracking</b>	No crazing is evident along the outer surface. Trace, discontinuous microscopic cracks captured in thin section, and these are mostly oriented parallel to the outer surface. See "aggregate reactivity" for a description of the exceedingly minor cracking in the aggregate from incipient ASR.
<b>Chemical alteration in paste</b>	Except for the carbonation reaction, the cement paste does not exhibit any outward sign of leaching, decalcification, bicarbonation, sulfonation, or any other chemical attack.
<b>Mineral deposits</b>	Trace ettringite and calcium hydroxide are observed lining air-voids. No other secondary mineral deposits are identified petrographically. Note that chloride salts are typically distributed throughout the cement paste capillaries and are usually not detectable petrographically.

Notes:

- Organic admixtures or soluble inorganic additives cannot be detected petrographically, though their effects on concrete microstructure can sometimes be discerned.
- The presence of unhydrated cement grains does not necessarily indicate poor hydration of the binder. A greater abundance of unhydrated cement is typical with reduced w/cm.
- SCMs = supplementary cementitious materials.
- Water to cementitious materials ratio (w/cm) cannot be quantified petrographically. Estimates are made qualitatively based on many characteristics of the hardened cement paste including behavior of the paste when fractured, capillary porosity, concentration of residual unhydrated cement, and microtextural features of the primary calcium hydroxide formed during the cement hydration. The estimates are complicated by the presence of SCMs, organic additives, or through chemical changes that occur with age.

## **Appendix I: Photographs and Photomicrographs**

Microscopic examination is performed on an Olympus BX-51 polarized/reflected light microscope and an Olympus SZ40 stereoscopic microscope. The polarized light microscope is fitted with a Tucsen MIchrome 5 Pro 5MP digital camera. The stereoscopic microscope is used for simple magnification. Sample types examined under this microscope include fractured surfaces, fine constituents extracted through chemical or physical means, or honed or polished cross sections. The polarized light microscope (PLM) magnifies but also employs principles of optical crystallography. The most common sample preparation for the PLM is the petrographic thin section. For this preparation, cross-sectioned samples are mounted to glass slides and are milled to a thickness sufficient to allow light to be transmitted through the material. These are usually prepared without water and with minimal heat to avoid altering minerals that are water or temperature-sensitive. In many cases, the samples are impregnated with a low-viscosity, blue-dyed epoxy. When so treated, blue areas represent some type of void space (e.g., air-voids, capillary pores, cracks, etc.). The polarized light photomicrographs are taken using a variety of optical settings chosen to best demonstrate the feature(s) of interest. These are distinguished as follows:

### **Plane polarized light (abbreviated as PPL)**

This method uses the refractive power of different constituents to produce an artificial sense of surface relief. Otherwise, the method is the closest to a simple magnification of the material. The setting is often used to demonstrate granular relationships or microstructure. Pore spaces and cracks are observable with this setting if the blue-dyed epoxy is used.

### **Conoscopic polarized light (abbreviated as CPL)**

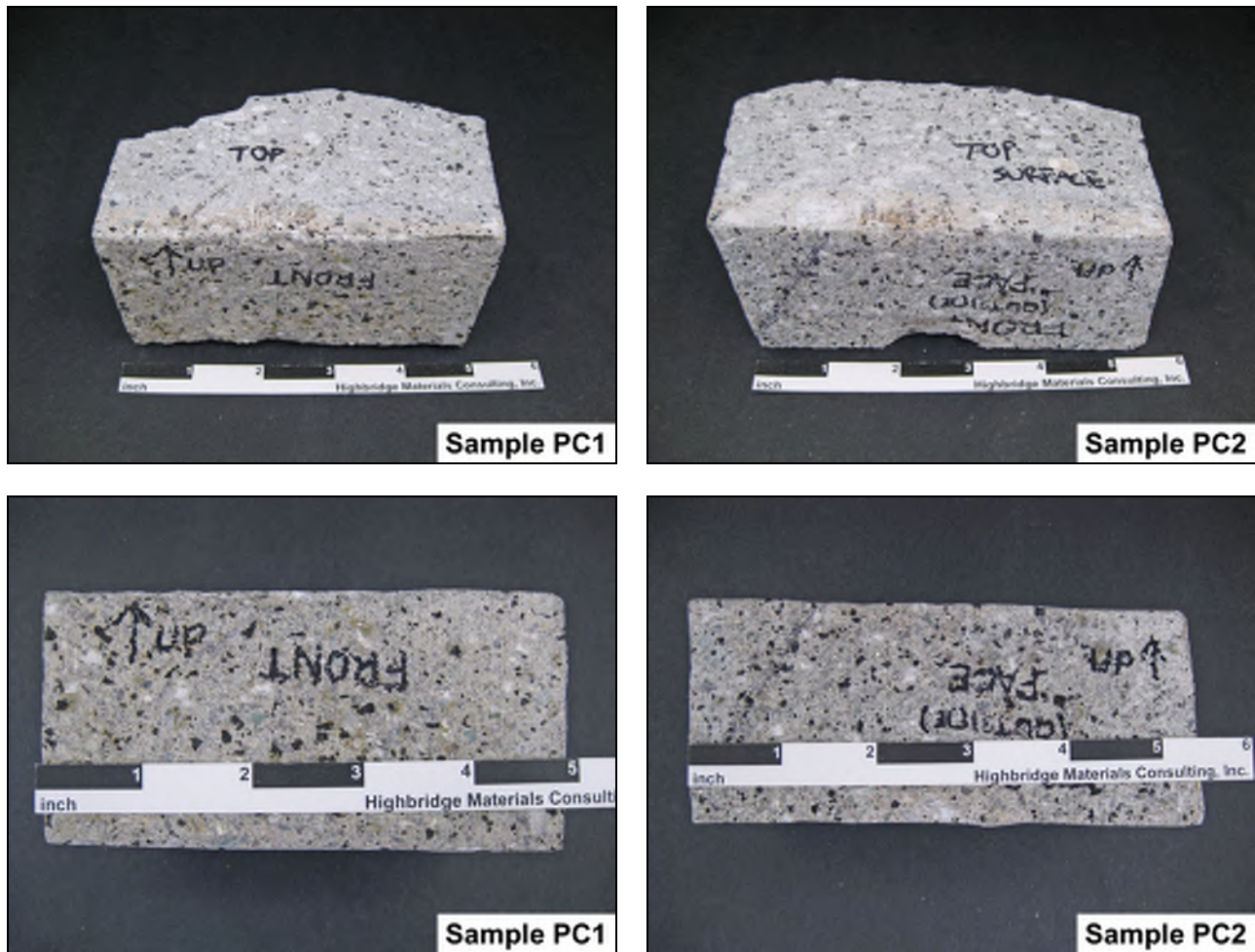
In this setting, the transmitted light is condensed just before passing through the thin section. The method tends to bring colors or finer particulates into higher contrast at the expense of image sharpness. The setting is often used to image grain boundary failures in dimension stone, pigment particulates in binders, or gel phases in the micropores of cement pastes.

### **Cross polarized light (abbreviated as XPL)**

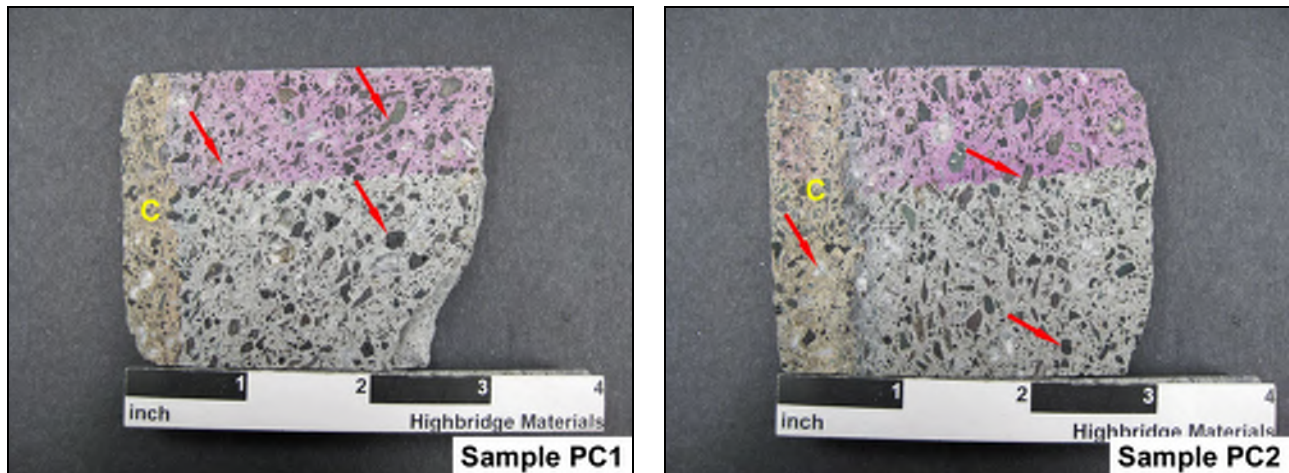
The setting places the thin section between two pieces of polarizing film oriented at 90° to one another. In isotropic materials (e.g., glasses, simple salts), all light is absorbed and the materials appear black. In anisotropic crystals, two light rays traveling at different speeds are produced within the thin section and these offset waves interfere at the upper polarizing film. The interference produces a color that can be used to calculate properties of the crystal structure and aid in identification of mineral species. In essence, the colors are artificial. It should be noted that color is a function of orientation and color differences do not necessarily indicate material differences.

### **Compensator plates**

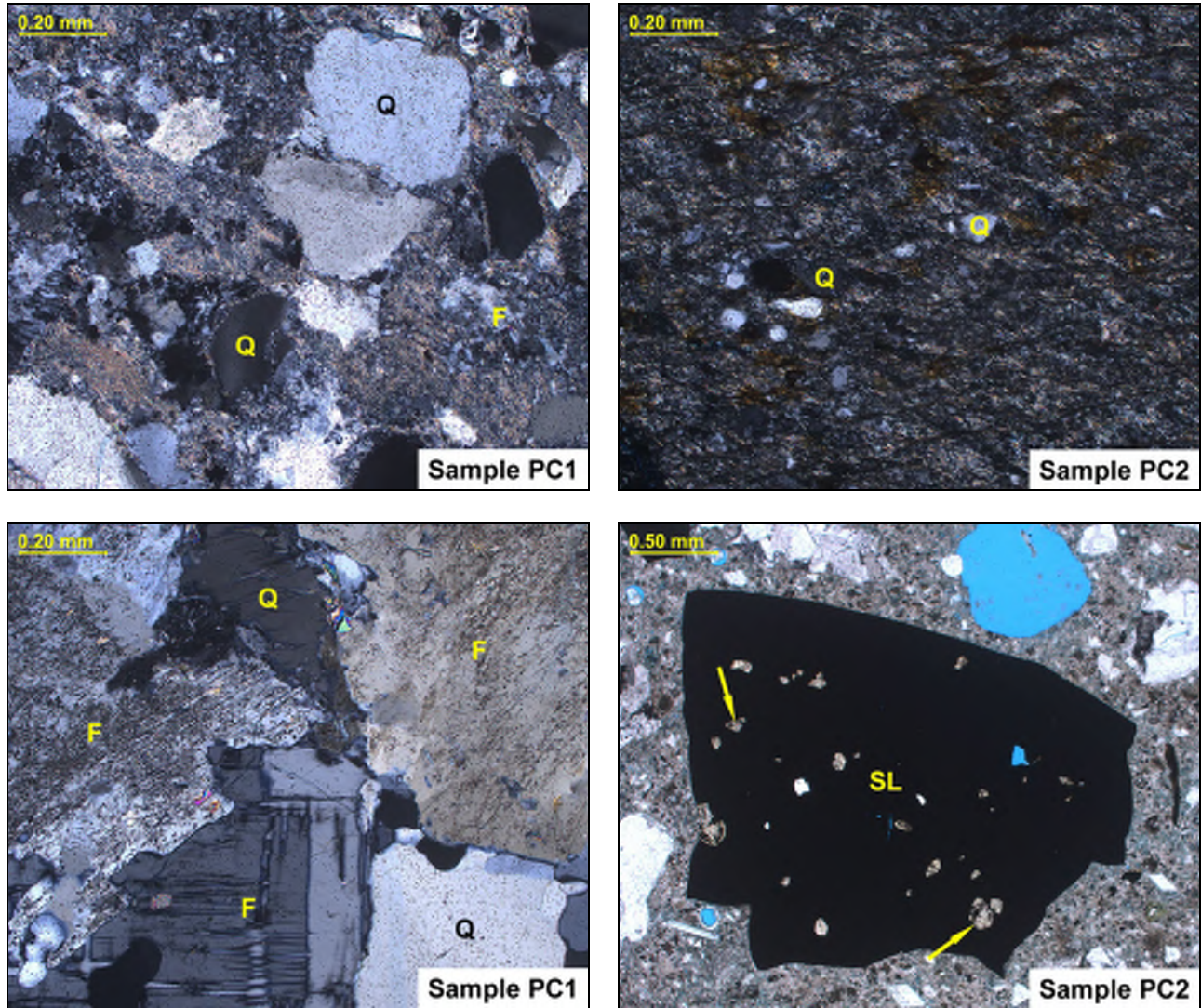
When in XPL mode, full-wave or quarter-wave compensator plates may be inserted into the light path to add or subtract interference. Technically, these methods are used to calculate properties of the crystal structure. However, they can also be used to alter the image appearance to help improve contrast between different constituents. They can also reveal preferred orientations in some materials (e.g., oriented residual crystallinity in fired ceramics).



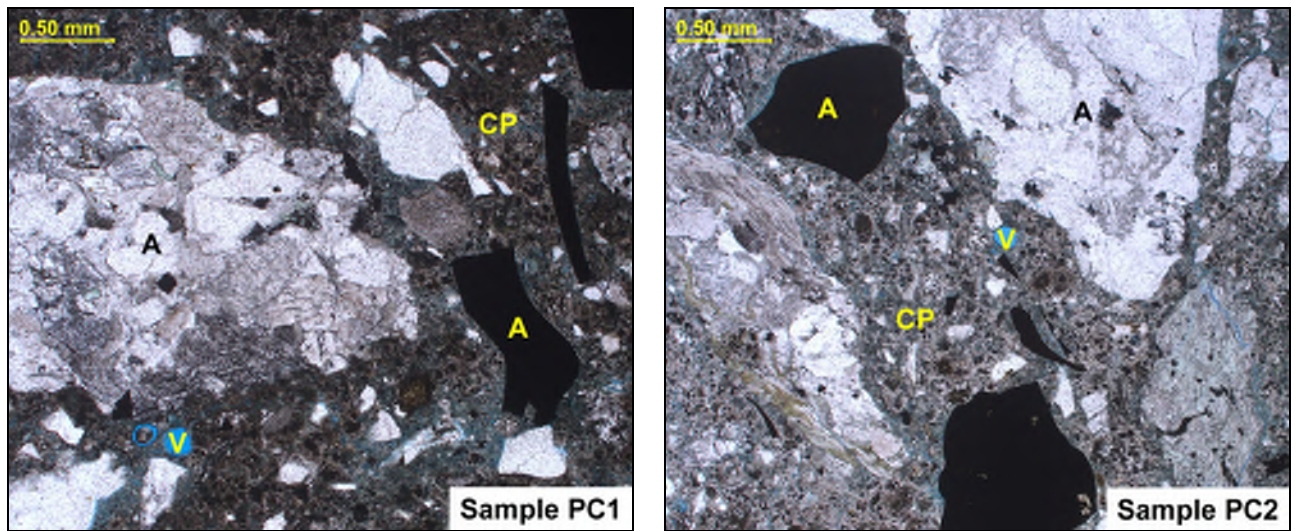
**Figure 1:** Photographs of the cast stone samples examined petrographically. (Upper images) The pieces are shown at an oblique angle with the exposed front surface of the unit toward the front of the image. (Lower images) The outer surface of the cast stone samples is shown. The aggregate exposure creates an appearance that mimics natural granite.



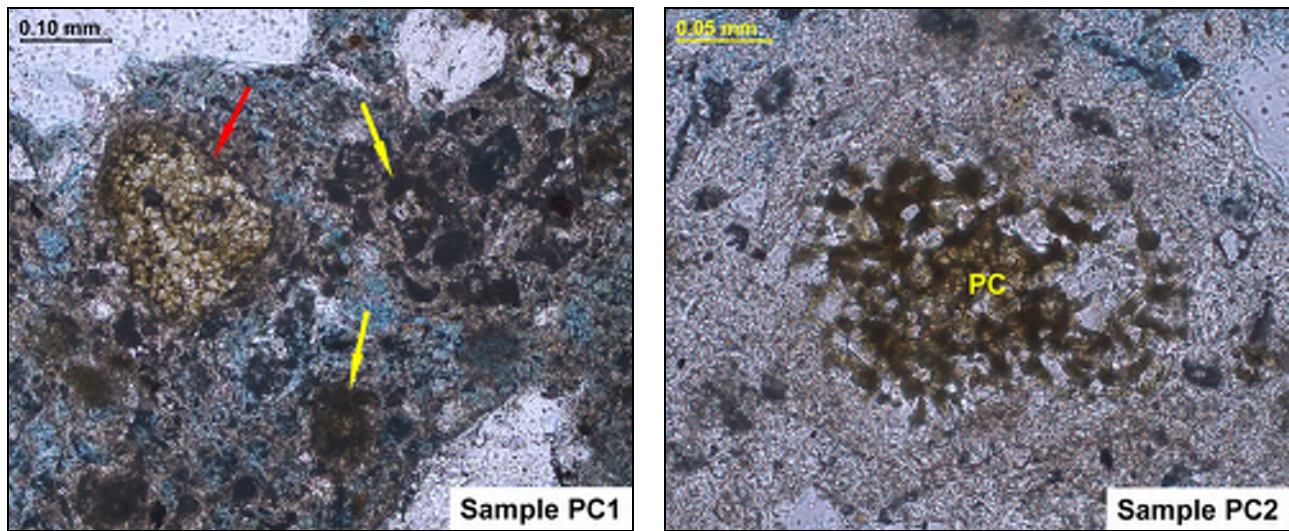
**Figure 2:** Photographs of the honed cross section prepared for each sample. The outer surface is oriented toward the left of the image. It can be seen here that no coarse aggregate is present in the mix. The sharp-textured aggregate (arrows) is rich between the No. 8 and No. 30 sieves. The upper portion was treated with phenolphthalein indicator. The pink color represents normally alkaline cement paste in which any embedded steel should remain passivated. The uncolored region is carbonated. The carbonated paste (C) has a visible buff color along the surface, compared to the light gray color of the cement paste at the interior of the cast stone.



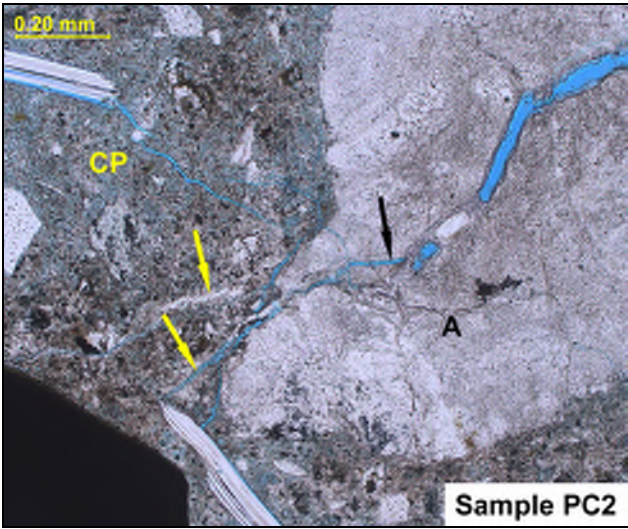
**Figure 3:** Photomicrographs illustrating the composition of the aggregate. (Upper XPL images) Metaclastic rock grains are shown that contain a mixture of quartz (Q), feldspar (F), and some volcanic lithics with variable amounts of white clay. (Lower left XPL image) A granitic particle is shown that contains constituent quartz (Q) and feldspar (F). (Lower right PPL image) A particle of the smelting slag (SL) is shown. This particles contains some olivine crystals (arrows).



**Figure 4:** PPL photomicrographs illustrating the overall microstructure of the cast stone. The cement paste (CP) is mostly uniformly developed. The degree of absorption of blue-dyed epoxy used in the sample preparation indicates a moderate to moderately high capillary porosity. Aggregate (A) are sharp-textured, well-distributed, and thoroughly coated with hardened cement paste. Air-voids are not especially abundant.



**Figure 5:** Photomicrographs illustrating the portland cement residuals in the cast stone. (Left) The red arrow indicates an unhydrated belite agglomerate with interstitial ferrite. The yellow arrows indicate hydrated cement reliefs that have been filled with cementitious product. (Right) A hydrated portland cement agglomerate (PC) is shown in which only the ferrite remains. The mineralogy and microtextures are consistent with gray portland cement manufactured in the early twentieth century.



**Figure 6:** PPL photomicrograph illustrating the very minor occurrence of alkali-aggregate reaction in Sample PC2. The arrows indicate a microcrack through coarse aggregate (CA) that extends into adjacent cement paste (CP). There is some non-porous gel within this particular crack. The occurrence of these features is trace, and there is no pervasive distress in the cast stone.

**APPENDIX E – WOOD SPECIES IDENTIFICATION REPORT**

Wood  Science  
Consulting

PO Box 1381, 20 Ciferri Drive  
Millbrook NY 12545  
o: 845-605-1225 m: 914-489-6727

October 29, 2024

Sam Wesselman  
Gale Associates, Inc.  
300 Ledgewood Place, Suite 300  
Rockland, MA 02370

Re: Wood Species Identifications

Dear Mr. Wesselman:

Five wood samples were forwarded to Wood Science Consulting, Inc. (WSC) for species identification. Wood species identifications are performed at Wood Science Consulting using stereo and light microscopes at magnifications up to 400x. Bulk samples are placed for viewing on the stereo microscope while thin sections are cut from samples and are then placed on microscope slides. The slides are then placed for viewing on the light microscope and then the microscopic characteristics of the sample are analyzed. A dichotomous key is used to determine the wood species based on the specific microscopic characteristics that are observed.

The five samples forwarded to WSC were labeled as follows:

No.	Description
W1	#1 1900s East (lower)
W2	#2 1900 East (upper)
W3	#3 Original Building East
W4	1920s North West End
W5	Column

### **Results**

All five of the samples were positively identified as eastern white pine (*Pinus strobus*). Longitudinal and transverse resin canals were observed in all five samples (Photo 1). The ray parenchyma cross field pitting was classified as large, or fenestriform. There were typically 1 to 2 pits per cross field. The ray tracheids were not dentate and the earlywood to latewood transition in the annual rings was typically gradual. See Table 1, attached, for photomicrographs of each sample.

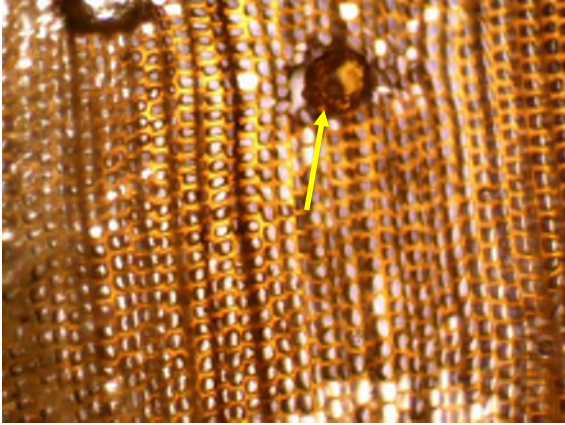


Photo 1 - Longitudinal resin canal observed in sample W2.

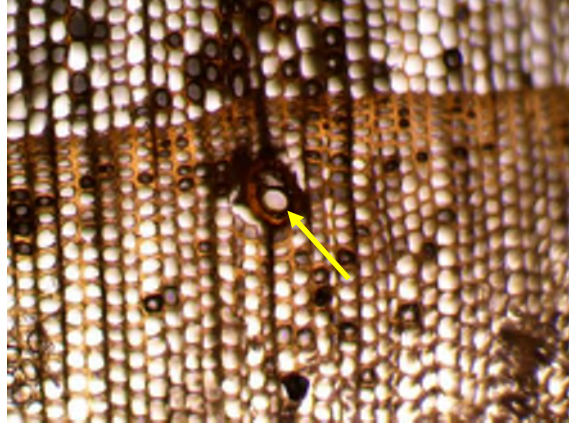


Photo 2 - Longitudinal resin canal observed in sample W3.

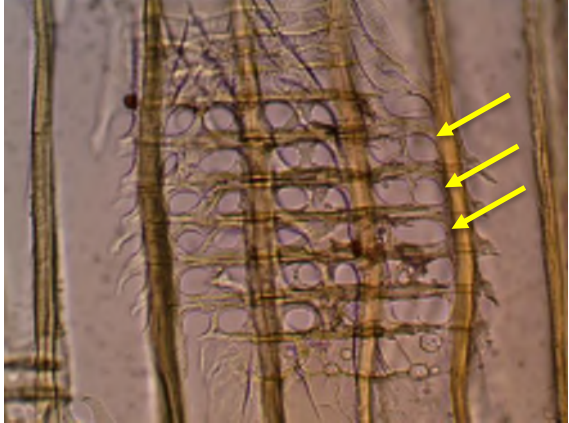
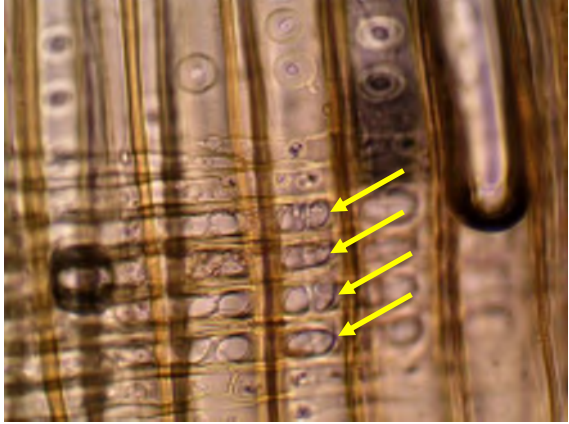
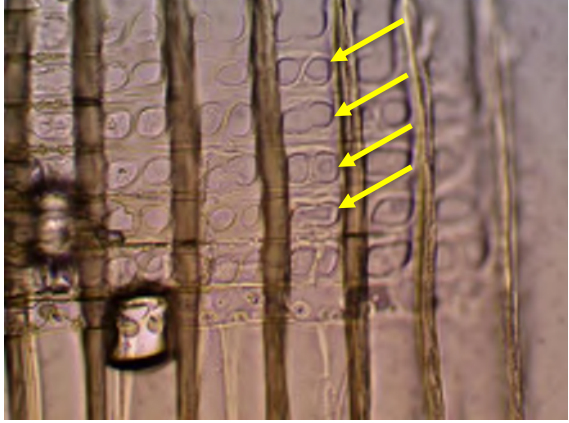
If you have any questions or comments, please do not hesitate to contact me.

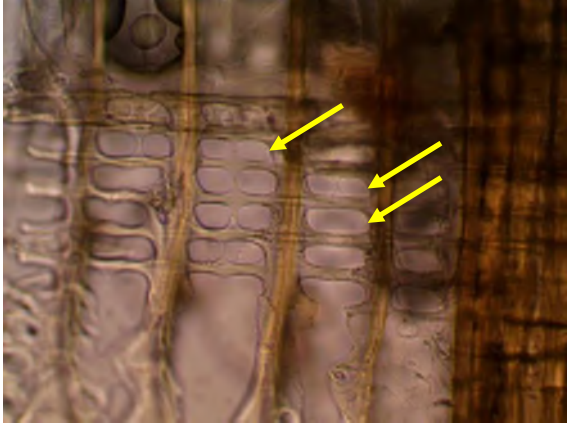
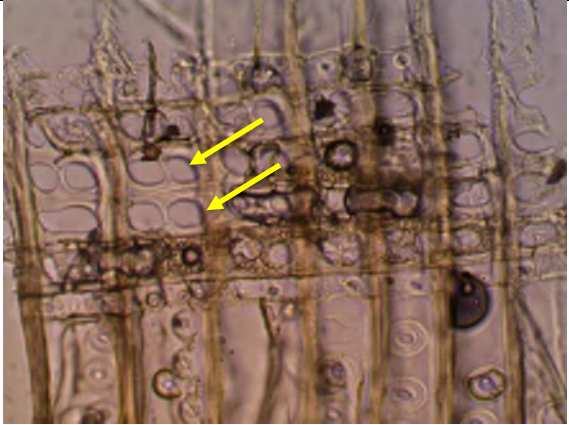
Sincerely,

A handwritten signature in black ink that reads "M.E. Anderson".

Matthew E. Anderson

**Table 1. Photomicrographs of the ray parenchyma cross field pitting observed in all five samples. Cross field pitting observed was fenestriform with 1 to 2 pits per cross field. Ray tracheids are not dentate (i.e. they are smooth, not tooth-like).**

Sample	Species	Photomicrograph
W1	Eastern White Pine	
W2	Eastern White Pine	
W3	Eastern White Pine	

W4	Eastern White Pine	
W5	Eastern White Pine	

**APPENDIX F – HISTORIC PAINT ANALYSIS**

**Barnstable County Courthouse**  
3195 Main Street  
Barnstable, MA 02630



**HISTORIC PAINT ANALYSIS**

December 2024

**Prepared For:**

Marc Loranger  
Gale Associates



150 Commerce Court, Cheshire, CT 06410  
www.JohnCanningCo.com | 203-272-9868

## **1 INTRODUCTION**

John Canning & Co. was contracted to perform a paint analysis to document the original color presentation of several areas of the Barnstable County Courthouse, located at 3195 Main Street in Barnstable, MA. This investigation will serve as an aide for future paint restoration.

A representative of the client collected 15 samples from various locations throughout the historic courthouse. The paint samples were packaged individually, and sent to the Canning Studio lab for analysis.

## **DEFINITIONS**

### **Chroma chronology:**

The arrangement of items in order of intensity or color.

### **Stratigraphy:**

The analysis of the order and position of layers of archaeological remains.

### **Microscopy:**

The use of the microscope.

### **Cross-section:**

A surface or shape that is or would be exposed by making a straight cut through something, especially at right angles to an axis.

## **METHODOLOGY**

Samples were analyzed in Canning's laboratory under supervision of Principal Conservator and Professional Associate of the American Institute for Conservation (AIC), David Riccio.

Samples were set in resin to reveal the cross-section of the painted finishes. The primary purpose of the cross-section analysis is to color match the historic paint using the Munsell standard of color notation. The Munsell Color system identifies colors within a three-dimensional color space by describing the hue, value, and chroma. Once the historic colors have been identified according to the Munsell standard, the Munsell colors will be matched by a commercial paint manufacturer for future paint restoration.

## **MICROSCOPY ANALYSIS**

Microscopy Analysis provides an understanding of the original paint scheme and identifies newer materials and/or additions to a surface, which can tell the history of the space. In order to correctly identify the paint scheme, sampling the structure is necessary. Taking samples in areas with the least exposure to causes of deterioration; such as sunlight, the elements, smoke, and abrasions; yields the most intact and informative samples. Knowledge of the architectural period and style aids the sampling process, instructing where color changes or decorative painting were most likely to be found. The layers of paint can also show periods of neglect, deterioration, and fading or darkening due to UV or smoke, and can also display a change in what type of paint was used.

Refer to Appendix A for a complete list of samples. Samples were set in 100% clear resin, polished with 800 grit to 12,000 grit sandpaper, and finished with polishing papers from 15,000 to 22,000 grit in order to provide a crystal-clear view of the sample cross-section. Samples were mounted and examined using a binocular zoom microscope ranging from 20x to 100x magnification. Illumination was provided by a fiber optic source filtered to approximate daylight conditions.

## **COLOR MATCHING**

The Munsell System of Color is a scientific system in which colors are arranged into a color fan based on three attributes: hue (color), chroma (color intensity), and value (lightness or darkness). Unlike color systems developed by paint manufacturers, the Munsell system provides an unchanging standard of reference, unaffected by the marketplace and changing tastes in color.

There are 100 enumerated hues in the Munsell system, but due to the limitations of digital displays and physical pigments, the Munsell Book of Color used by John Canning Studios contains 40 hues. This scale is broken down into five principal and five intermediate hues, identified by initials indicating the central member of the group: red R, yellow-red YR, yellow Y, yellow-green YG, green G, blue-green BG, blue B, purple-blue PB, purple P, and red-purple R. In the 40-hue system, each group is divided into 4 with intervals of 2.5. For example, the range of hues in the red-R group would be designated as 2.5R (preceded by 10RP), 5R, 7.5R, and 10R (succeeded by 2.5YR).

Chroma indicates the degree of departure of a given hue from its “absolute” or purest form. The lower the chroma, the more washed out or pastel the color will appear. Different hues have different chromatic limits, so there is no universal range for all the hues. Some visible hues have the ability to reach a chroma in the 30s. However, with some exceptions, the Munsell Book of Color has a lower chromatic limit of 2 and higher limit of 16. The purest version of each hue has a chroma close to 8.

Value is the designation of luminosity across the color spectrum. With a chroma of 0, the hue with a value of 10 is pure white, and a value of 0 is pure black, with a range of neutral greys in between.


In our analysis, each Munsell color is expressed as: hue, value/chroma (H, V/C). For example, the color “rust red” might be written as 5R 4/6. This notation means that the color, 5R, is located in the middle of the red hue, the value, 4, is closer to black, and the chroma, 6, is less saturated or intense.

Readily available commercial paint color matches are provided following the Munsell selection. The sample colors were evaluated against Benjamin Moore paint decks. These particular palettes were closest to the historic paint layers as opposed to other commercial colors. The highlighted row in the spreadsheet indicates the historic palette.


## **FINDINGS**

The majority of the samples submitted were from various exterior locations of the Courthouse and are made up of many layers of paint, aggregate, and binder. Through microscopy, we determined that the historic presentation of certain areas involved several shades of grey and beige paint mixed with an aggregate to imitate genuine stone walls. This finish was applied to wood areas, such as the columns at the very front of the building. Under high magnification, we observed that the grey tones were layered and blended to achieve this effect. This suggests that the shades of paint were likely mixed using a wet-on-wet technique, creating a realistic stone-like appearance where individual colors are not easily distinguishable. We have identified these shades as closely as possible, but due to the complexity of the technique, we recommend conducting on-site mockups to best match the existing stone.


**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse	Sample Photo		
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	October 21 2024			
Collected by:	Client Representative			
Analyzed by:	Natalie Murphy			
Sample Location:	<b>Original Building - North Gable</b>			
Substrate:	<b>Wood</b>			
<b>Sample P1</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Primer?	Beige	2.5 Y 7/2 or 4	Benjamin Moore 1046 Sandy Brown	
2 - Paint with small aggregate	Light grey	5 GY 7/1	Benjamin Moore 1482 Sabre Gray	
3 - Paint	Light grey blue	2.5 PB 5/2	Benjamin Moore 1615 Rock Gray	
4 - Paint	Medium grey	10 G 5/1	Benjamin Moore HC-163 Duxbury Gray	
5 - Paint with large aggregate	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs	
6 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
7 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse		Sample Photo
Location:	3195 Main Street		
Date Collected:	Barnstable, MA 02630		
Collected by:	October 21 2024		
Analyzed by:	Client Representative		
Sample Location:	Natalie Murphy		
Substrate:	<b>Original Building - East Elevation</b> <b>Architrave</b> <b>Wood</b>		
<b>Sample P2</b>			
Layer #	Color Name	Munsell	Commercial Paint
0 - Wood			
1 - Paint with small aggregate	Light grey blue	2.5 PB 5/2	Benjamin Moore 1615 Rock Gray
2 - Paint with medium aggregate	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs
3 - Paint with large aggregate	Light grey	10 GY 5/1	Benjamin Moore 1580 Intrigue
4 - Paint with large aggregate	Light grey blue	2.5 PB 6/2	Benjamin Moore 1614 Delray Gray
5 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray
6 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe

**PAINT STRATIGRAPHY FORM**

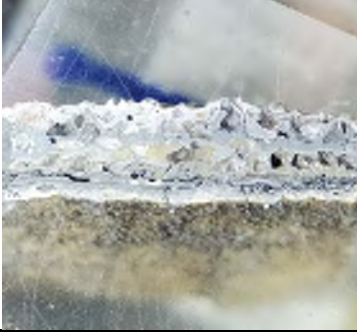
Project:	Barnstable County Courthouse	Sample Photo
Location:	3195 Main Street Barnstable, MA 02630	
Date Collected:	October 21 2024	
Collected by:	Client Representative	
Analyzed by	Natalie Murphy	
Sample Location:	<b>Original Building - West Elevation Architrave</b>	
Substrate:	<b>Wood</b>	

**Sample P3**


Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Primer?	Beige	2.5 Y 7/2 or 4	Benjamin Moore 1046 Sandy Brown	
2 - Paint with small aggregate?	Light grey	5 GY 7/1	Benjamin Moore 1482 Sabre Gray	
3 - Paint with small aggregate*	Light grey blue	2.5 PB 5/2	Benjamin Moore 1615 Rock Gray	
5 - Paint	Light grey	10 G 5/1	Benjamin Moore HC-163 Duxbury Gray	
6 - Sealant/varnish	Translucent yellow			
7 - Paint with large aggregate	Light grey	10 G 5/1	Benjamin Moore HC-163 Duxbury Gray	
8 - Paint with large aggregate	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs	
9 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
10 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

\* Multiple layers


**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse	Sample Photo		
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	October 21 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>Original Building - West Elevation Cornice</b>			
Substrate:	<b>Wood</b>			
<b>Sample P4</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Primer?	Beige	2.5 Y 7/2 or 4	Benjamin Moore 1046 Sandy Brown	
2 - Paint with small aggregate?	Light beige	5 Y 7/2	Benjamin Moore 1517 Mosaic Tile	
3 - Paint with small aggregate	Light grey	5 GY 7/1	Benjamin Moore 1482 Sabre Gray	
4 - Sealant/varnish	Translucent grey			
5 - Paint with large aggregate	Medium grey	5 Y 5/1	Benjamin Moore 1483 Cos Cob Stonewall	
6 - Paint with large aggregate	Deep beige	2.5 Y 5/2	Benjamin Moore 1525 Cleveland Green	
7 - Paint	Medium blue grey	N 4.25	Benjamin Moore 1595 Rocky Coast	
8 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
9 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

**PAINT STRATIGRAPHY FORM**

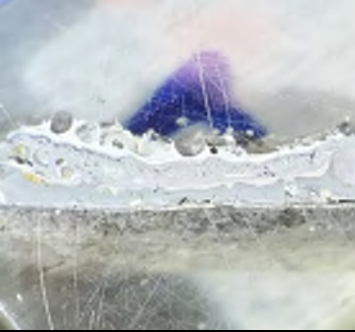
Project:	Barnstable County Courthouse		Sample Photo	
Location:	3195 Main Street			
	Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>1900s Wing East - East Elevation Architrave</b>			
Substrate:	<b>Wood</b>			
<b>Sample P5</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
2 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

**PAINT STRATIGRAPHY FORM**

<b>Project:</b>	Barnstable County Courthouse		<b>Sample Photo</b>	
<b>Location:</b>	3195 Main Street Barnstable, MA 02630			
<b>Date Collected:</b>	February 2024			
<b>Collected by:</b>	Client Representative			
<b>Analyzed by:</b>	Natalie Murphy			
<b>Sample Location:</b>	<b>1900s Wing - North Elevation East Dentil</b>			
<b>Substrate:</b>	<b>Wood</b>		<b>Sample P6</b>	
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint with large aggregate*	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs	
1 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
2 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

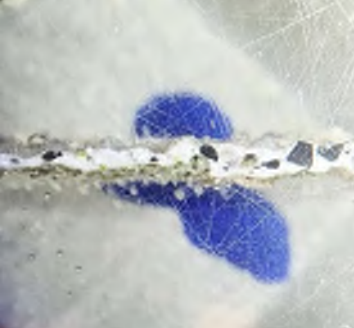
\* Multiple layers

**PAINT STRATIGRAPHY FORM**


Project:	Barnstable County Courthouse		Sample Photo	
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>1900s Wing - North Elevation Cornice</b>			
Substrate:	<b>Wood</b>		<b>Sample P7</b>	
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint with small aggregate*	Medium blue grey	N 4.25	Benjamin Moore 1595 Rocky Coast	
2 - Paint	Medium beige	7.5 Y 6/2	Benjamin Moore 1531 Victorian Garden	
3 - Paint with large aggregate*	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs	
4 - Paint	Light beige	5 Y 7/2	Benjamin Moore 1517 Mosaic Tile	
5 - Paint	Light grey blue	N 6.25	Benjamin Moore 1600 Gray Cardigan	
6 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
7 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

\* Multiple layers


**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse		Sample Photo	
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>Exterior - Coating Basement Stairs</b>			
Substrate:	<b>Concrete</b>		<b>Sample P8</b>	
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Concrete				
1 - Binder with small aggregate	White			Fine fibers and green possibly biological matter throughout

**PAINT STRATIGRAPHY FORM**

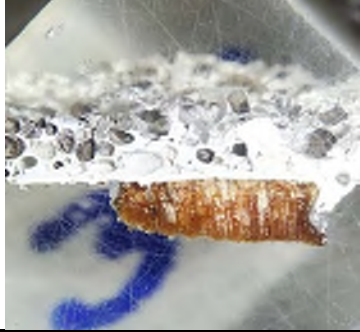
Project:	Barnstable County Courthouse			Sample Photo
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by:	Natalie Murphy			
Sample Location:	<b>White Paint</b>			
Substrate:	<b>Wood</b>			
<b>Sample P9</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint	White	N 9.5	Benjamin Moore 879 Opulence	

**PAINT STRATIGRAPHY FORM**

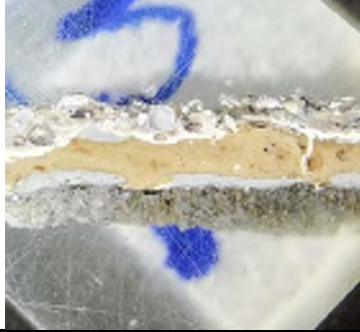
Project:	Barnstable County Courthouse		Sample Photo	
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>Front Column Wood and Coating</b>			
Substrate:	<b>Wood</b>		<b>Sample P10</b>	
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint with small aggregate	Grey & medium beige	10 Y 5/1	Benjamin Moore 1484 Ashwood Moss Benjamin Moore 1531 Victorian Garden	
2 - Paint with large aggregate	Medium grey	5 Y 5/1	Benjamin Moore 1483 Cos Cob Stonewall	
3 - Paint with large aggregate	Medium blue grey	5 PB 4/2	Benjamin Moore 1608 Ashland Slate	
4 - Paint with large aggregate*	Light grey blue	N 6.25	Benjamin Moore 1600 Gray Cardigan	
5 - Paint with medium aggregate	Very light grey	N 7.75	Benjamin Moore 1571 Imperial Gray	
6 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

\* Multiple layers

**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse	Sample Photo		
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>#1 1900s East (lower)</b>			
Substrate:	<b>Wood</b>			
<b>Sample PW1</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint	Off white	No match	Benjamin Moore 1515 Natural Elements	
2 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	


**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse		Sample Photo	
Location:	3195 Main Street			
Date Collected:	Barnstable, MA 02630			
Collected by:	February 2024			
Analyzed by	Client Representative			
Sample Location:	Natalie Murphy			
Substrate:	<b>#1 1900s East (upper)</b>			
	<b>Wood</b>			
<b>Sample PW2</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs	
2 - Paint	Medium grey	5 Y 5/1	Benjamin Moore 1483 Cos Cob Stonewall	
3 - Paint with large aggregate	Deep beige	2.5 Y 5/2	Benjamin Moore 1525 Cleveland Green	
4 - Paint	Off white	2.5 Y 9/2	Benjamin Moore 956 Palace White	
5 - Paint with small aggregate	Grey & light beige	10 Y 5/1	Benjamin Moore 1483 Cos Cob Stonewall Benjamin Moore 1531 Victorian Garden	


**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse		Sample Photo	
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>#3 Original Building East</b>			
Substrate:	<b>Wood</b>		<b>Sample PW3</b>	
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Primer?	Beige	2.5 Y 7/2 or 4	Benjamin Moore 1046 Sandy Brown	
2 - Paint with medium aggregate	Medium grey	5 Y 5/1	Benjamin Moore 1483 Cos Cob Stonewall	
3 - Sealant/varnish	Translucent yellow			
4 - Paint	Medium beige	7.5 Y 6/2	Benjamin Moore 1531 Victorian Garden	
5 - Paint with small aggregate	Light grey blue	2.5 PB 5/2	Benjamin Moore 1615 Rock Gray Benjamin Moore 1614 Delray Gray	
6 - Paint	Light grey blue	2.5 PB 6/2	Benjamin Moore 1614 Delray Gray	
7 - Paint	Light grey blue	2.5 PB 5/2	Benjamin Moore 1615 Rock Gray	
8 - Paint with medium aggregate	Light grey blue	2.5 PB 5/2	Benjamin Moore 1615 Rock Gray Benjamin Moore HC-163 Duxbury Gray	
9 - Paint with large aggregate	Light grey blue	N 6.25	Benjamin Moore 1600 Gray Cardigan	
10 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse			Sample Photo
Location:	3195 Main Street Barnstable, MA 02630			
Date Collected:	February 2024			
Collected by:	Client Representative			
Analyzed by	Natalie Murphy			
Sample Location:	<b>1920s North West End</b>			
Substrate:	<b>Wood</b>			
<b>Sample PW4</b>				
Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Paint	Off white	No match	Benjamin Moore 1515 Natural Elements	
2 - Paint with large aggregate on surface	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe	

**PAINT STRATIGRAPHY FORM**

Project:	Barnstable County Courthouse	Sample Photo
Location:	3195 Main Street Barnstable, MA 02630	
Date Collected:	February 2024	
Collected by:	Client Representative	
Analyzed by	Natalie Murphy	
Sample Location:	<b>Column</b>	
Substrate:	<b>Wood</b>	

**Sample PW5**

Layer #	Color Name	Munsell	Commercial Paint	Note
0 - Wood				
1 - Primer?	Deep yellow beige	2.5 Y 7/4	Benjamin Moore 256 Westwood Tan	
2 - Paint with medium aggregate	Light beige	5 Y 7/2	Benjamin Moore 1517 Mosaic Tile	
3 - Paint	Medium grey	5 Y 5/1	Benjamin Moore 1483 Cos Cob Stonewall	
4 - Sealant/varnish	Translucent yellow			
5 - Paint	Light grey blue	5 B 5/1	Benjamin Moore 1607 Englewood Cliffs	
6 - Paint with large aggregate	Off white	N 8.25	Benjamin Moore 1562 Healing Aloe Benjamin Moore 954 Spring In Aspen	

**APPENDIX G – PRELIMINARY COST ESTIMATE**



## BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION

GALE  
SD ESTIMATE  
4/23/2025

**THE ATTACHED COST ESTIMATE IS BASED ON THE FOLLOWING DOCUMENTS:**

<u>Drawings Dated</u>		<u>Number of Sheets</u>
1/28/2025	Schematic Drawings	8
N/A	Evaluation Report Update	5
N/A	Structural Evaluation Drawing	1
1/10/2025	Evaluation Report	105

**ASSUMPTIONS AND EXCLUSIONS:**

- 1 Estimate assumes a competitive bid process.
- 2 Estimate assumes a spring 2026 procurement schedule. Escalation is included to the point of procurement. Add .5% / month if project is delayed.
- 3 Base estimate assumes the building to remain occupied during construction. See alternates for unoccupied construction.
- 4 Base estimate assumes work will be completed in three phases, consecutively. A multi-year approach is excluded.
- 5 Swing space for tenants in unoccupied alternate is not included.
- 6 Alternates in this study are intended to convey design options and do not reflect a recommended priority ranking of public bid alternates.

*PCM reserve the right to revise and/or amend this estimate accordingly should any new or additional information be made available to us.*

Project estimate prepared by:


Kyla Magnusson, Lead Estimator

Preferred Construction Management Co., Inc.

[kyla@pcmcompany.com](mailto:kyla@pcmcompany.com)

(t) 207.618.7500

(c) 973.945.0323

BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION				SD ESTIMATE	
			PROJ. NO:	29-108	
			REVISION:	R2	
			EST DATE:	4/23/2025	
FAÇADE SF			22860 sf	GROSS SF:	22860
DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST	
DIVISION 2 - DEMOLITION	22,860	SF	\$ 5.46	\$ 124,845.00	
DIVISION 3 - BUILDING CONCRETE	22,860	SF	\$ 2.24	\$ 51,120.00	
DIVISION 4 - MASONRY	22,860	SF	\$ 53.95	\$ 1,233,294.25	
DIVISION 5 - STEEL	22,860	SF	\$ -	\$ -	
DIVISION 6 - CARPENTRY	22,860	SF	\$ 2.91	\$ 66,454.40	
DIVISION 7 - THERMAL MOISTURE PROTECTION	22,860	SF	\$ 4.20	\$ 96,098.83	
DIVISION 8 - OPENINGS	22,860	SF	\$ 26.90	\$ 614,951.33	
DIVISION 9 - FINISHES	22,860	SF	\$ 10.01	\$ 228,897.50	
DIVISION 22 - PLUMBING	22,860	SF	\$ 0.13	\$ 3,000.00	
DIVISION 23 - HVAC	22,860	SF	\$ 1.20	\$ 27,435.00	
DIVISION 26 - ELECTRICAL	22,860	SF	\$ 0.39	\$ 8,913.75	
<b>CONSTRUCTION SUBTOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 107.39</b>	<b>\$ 2,455,010</b>	
<b>GENERAL CONDITIONS / REQ'S - ASSUME 3 PHASES, 3.5 MOS PER PHASE</b>	10.5	MOS	\$ 50,000.00	\$ 525,000	
<b>CONSTRUCTION SUBTOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 130.36</b>	<b>\$ 2,980,010</b>	
<b>DESIGN / ESTIMATE CONTINGENCY</b>	15.00	%		\$ 447,002	
<b>CONSTRUCTION SUBTOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 149.91</b>	<b>\$ 3,427,012</b>	
<b>OVERHEAD AND PROFIT</b>	5.00	%		\$ 171,351	
<b>CONSTRUCTION SUBTOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 157.41</b>	<b>\$ 3,598,362</b>	
<b>BOND AND INSURANCE</b>	2.00	%		\$ 71,967	
<b>CONSTRUCTION SUBTOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 160.56</b>	<b>\$ 3,670,329</b>	
<b>ESCALATION - ASSUME SPRING 2026 START</b>	5.00	%		\$ 183,516	
<b>CONSTRUCTION GRAND TOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 168.58</b>	<b>\$ 3,853,846</b>	

ALT 1 - REPLACE 1830'S WINDOWS W/ HISTORIC REPLICA ALUM WINDOWS ILO RESTORING WOOD WINDOW	17	EA	\$ 3,781.56	\$ 64,286.45
<b>CONSTRUCTION SUBTOTAL</b>	<b>17</b>	<b>EA</b>	<b>\$ 3,781.56</b>	<b>\$ 64,286</b>
<b>ADDONS</b>	56.98%			\$ 36,630
<b>ALT 1 - REPLACE 1830'S WINDOWS W/ HISTORIC REPLICA ALUM WINDOWS ILO RESTORING WOOD WINDOW</b>	<b>17</b>	<b>EA</b>	<b>\$ 5,936.24</b>	<b>\$ 100,916</b>

ALT 2 - RESTORE 1895/1906 WOOD WINDOWS ILO REPLACING WINDOW WITH HISTORIC REPLICA	35	EA	\$ (2,544.96)	\$ (89,073.69)
<b>CONSTRUCTION SUBTOTAL</b>	<b>35</b>	<b>EA</b>	<b>\$ (2,544.96)</b>	<b>\$ (89,074)</b>
<b>ADDONS</b>	56.98%			\$ (50,753)
<b>ALT 2 - RESTORE 1895/1906 WOOD WINDOWS ILO REPLACING WINDOW WITH HISTORIC REPLICA</b>	<b>35</b>	<b>EA</b>	<b>\$ (3,995.05)</b>	<b>\$ (139,827)</b>

ALT 3 - MASONRY REPLACEMENT 1925/26 BUILDING	22,860	SF	\$ 0.63	\$ 14,500.00
<b>CONSTRUCTION SUBTOTAL</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 0.63</b>	<b>\$ 14,500</b>
<b>ADDONS</b>	56.98%			\$ 8,262
<b>ALT 3 - MASONRY REPLACEMENT 1925/26 BUILDING</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 1.00</b>	<b>\$ 22,762</b>

ALT 4 - MASONRY REPLACEMENT 1971 ADDITION	675	SF	\$ 68.76	\$ 46,415.00
<b>CONSTRUCTION SUBTOTAL</b>	<b>675</b>	<b>SF</b>	<b>\$ 68.76</b>	<b>\$ 46,415</b>
<b>ADDONS</b>	56.98%			\$ 26,447
<b>ALT 4 - MASONRY REPLACEMENT 1971 ADDITION</b>	<b>675</b>	<b>SF</b>	<b>\$ 107.94</b>	<b>\$ 72,862</b>

ALT 5 - REPLACE EXISTING WOOD ENTABLATURE W/ FIBERGLASS	3,515	SF	\$ 35.02	\$ 123,107.50
<b>CONSTRUCTION SUBTOTAL</b>	<b>3,515</b>	<b>SF</b>	<b>\$ 35.02</b>	<b>\$ 123,108</b>
<b>ADDONS</b>	56.98%			\$ 70,145
<b>ALT 5 - REPLACE EXISTING WOOD ENTABLATURE W/ FIBERGLASS</b>	<b>3,515</b>	<b>SF</b>	<b>\$ 54.98</b>	<b>\$ 193,253</b>

ALT 6 - REPLACE EXISTING WOOD ENTABLATURE W/ SYNTHETIC WOOD	3,515	SF	\$ 34.67	\$ 121,860.00
<b>CONSTRUCTION SUBTOTAL</b>	<b>3,515</b>	<b>SF</b>	<b>\$ 34.67</b>	<b>\$ 121,860</b>
<b>ADDONS</b>	56.98%			\$ 69,434
<b>ALT 6 - REPLACE EXISTING WOOD ENTABLATURE W/ SYNTHETIC WOOD</b>	<b>3,515</b>	<b>SF</b>	<b>\$ 54.42</b>	<b>\$ 191,294</b>

ALT 7 - UNOCCUPIED BUILDING ILO OF PHASED OCCUPIED BUILDING	22,860	SF		
DEDUCT GC'S / GR'S	(10.50)	MOS	\$ 50,000.00	\$ (525,000)
ADD GC'S / GR'S - ASSUME 1 PHASE	8.00	MOS	\$ 45,000.00	\$ 360,000
<b>ALT 7 - UNOCCUPIED BUILDING ILO OF PHASED OCCUPIED BUILDING</b>	<b>22,860</b>	<b>SF</b>	<b>\$ (7.22)</b>	<b>\$ (165,000)</b>

ALT 8 - HYBRID CONSTRUCTION ILO UNLIMITED NOISE ACCOMODATIONS	22,860	SF		
DEDUCT GC'S / GR'S	(10.50)	MOS	\$ 50,000.00	\$ (525,000)
ADD GC'S / GR'S - ASSUME 2 FULL DAYS, 3 HALF DAYS PER WEEK	15.00	MOS	\$ 50,000.00	\$ 750,000
REDUCTION IN LABOR PRODUCTIVITY	21.50%			\$ 527,827
<b>ALT 8 - HYBRID CONSTRUCTION ILO UNLIMITED NOISE ACCOMODATIONS</b>	<b>22,860</b>	<b>SF</b>	<b>\$ 32.93</b>	<b>\$ 752,827</b>

**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
**SD ESTIMATE**

DETAILED ITEM TAKEOFF

4/23/2025

22860 sf



DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTALS
<b>DIVISION 2 - DEMOLITION</b>				
<b>DEMOLITION</b>				
REMOVE WINDOWS FOR METAL PANEL INFILL	11	EA	330.00	\$ 3,630.00
REMOVE WINDOWS FOR REPLACEMENT	83	EA	330.00	\$ 27,390.00
MISC DEMOLITION	80	MHR	135.00	\$ 10,800.00
<b>ASBESTOS &amp; LEAD PAINT ABATEMENT</b>				
RESTORED WOOD WINDOWS	17	EA	1,320.00	\$ 22,440.00
REPLACED WOOD WINDOWS	83	EA	495.00	\$ 41,085.00
<b>INSTALL TEMPORARY SHORING AT BASEMENT</b>	13	LOC	1,500.00	\$ 19,500.00
<b>DIVISION 2 - DEMOLITION</b>				<b>\$ 124,845.00</b>
<b>DIVISION 3 - BUILDING CONCRETE</b>				
<b>FORM &amp; POUR CONCRETE PIERS AT DETERIORATED PIER LOCATION</b>				
DOWEL & EPOXY INTO EXISTING GRANITE FOUNDATION	12	EA	1,200.00	\$ 14,400.00
ADD WATERPROOFING MEMBRANE AT NEW PIERS & ETR	12	LOC	550.00	\$ 6,600.00
GRANITE FOUNDATIONS				
<b>SAWCUT SOG AT DETERIORATED PIER LOCATIONS</b>	12	LOC	540.00	\$ 6,480.00
<b>PATCH SOG AT PIERS</b>	12	LOC	1,360.00	\$ 16,320.00
<b>DIVISION 3 - BUILDING CONCRETE</b>				<b>\$ 51,120.00</b>
<b>DIVISION 4 - MASONRY</b>				
<b>MASONRY RESTORATION</b>				
REPOINT BRICK VENEER AT CHIMNEY	300	SF	55.00	\$ 16,500.00
REPOINT BRICK VENEER	4900	SF	55.00	\$ 269,500.00
REPOINT GRANITE VENEER	8500	SF	38.00	\$ 323,000.00
MORTAR JOINT TO BE REPOINTED AT GRANITE STAIRS	150	LF	41.25	\$ 6,187.50
<i>3/4" RECESS FOR BACKER ROD &amp; TRAFFIC GRADE SEALANT JOINT</i>				
MORTAR JOINT TO BE REPOINTED - MJ (33 LOC)	703	LF	36.00	\$ 25,308.00
REPAIR / REBUILD STEP CRACK	10	LOC	1,445.00	\$ 14,450.00
REMOVE & REPLACE CRACKED/SPALLED BRICK - CB, SB	94	UNIT	145.00	\$ 13,630.00
PRECAST CORNICE & PARAPET TO BE TEMPORARILY REMOVED, STORED, & REBUILT	34	LF	405.00	\$ 13,770.00
PRECAST CORNICE TO BE TEMPORARILY REMOVED,	2	EA	2,480.00	\$ 4,960.00

**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
**SD ESTIMATE**

DETAILED ITEM TAKEOFF

4/23/2025

22860 sf



DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTALS
STORED, & REBUILT (CORNER LOCATION)				
REBUILD BRICK MASONRY AT WINDOW OPENINGS	9	LOC	1,980.00	\$ 17,820.00
REPLACE DAMAGED BRICK AT WINDOW OPENINGS -	249	UNIT	53.33	\$ 13,280.00
ASSUME 3 EA / OPENING (REPLACED WINDOWS)				
ZINC COPPER FLASHING - INSTALL INTO CUT REGLET JOINT	126	LF	85.00	\$ 10,710.00
ZINC COPPER THROUGH WALL FLASHING REBUILD (4)	204	LF	550.00	\$ 112,200.00
COURSES OF BRICK TO INSTALL TO BACK-UP WALL				
REMOVE ANCHOR STUB AND PATCH - BRICK	19	EA	110.00	\$ 2,090.00
REMOVE ANCHOR STUB AND PATCH - GRANITE	49	EA	110.00	\$ 5,390.00
CC REPAIR CRACKED CONCRETE - CC (19 LOC)	85	LF	55.00	\$ 4,675.00
CS REPAIR CRACKED CAST STONE CONCRETE - CS (30 LOC)	49	LF	55.00	\$ 2,695.00
SC REPAIR SPALLED CONCRETE - SC (55 SF)	16	LOC	660.00	\$ 10,560.00
SS REPAIR SPALLED STONE - SS (67 SF)	54	LOC	825.00	\$ 44,550.00
CLEAN ATMOSPHERIC STAINING	138	SF	15.00	\$ 2,070.00
CLEAN EFFORESCENCE	42	SF	15.00	\$ 630.00
CLEAN IVY / VEGETATIVE GROWTH	997	SF	6.00	\$ 5,982.00
CLEAN RUST STAINING	340	SF	15.00	\$ 5,100.00
PARGE COATING AT WINDOW PERIMETERS	2002	LF	12.50	\$ 25,025.50
WASHDOWN / CLEAN	19346	SF	2.00	\$ 38,692.00
TEMPORARY SHORING AS REQUIRED	1	ALLW	15,000.00	\$ 15,000.00
<b>JOINT SEALANTS &amp; CAULKING</b>				
REPAIR FAILED SEALANTS - FS	255	LF	53.75	\$ 13,706.25
ADD FOR BACKER ROD				
<b>SCAFFOLDING / STAGING / ACCESS</b>	22860	SF	7.00	\$ 160,020.00
<b>UNIT PRICES - 10% ADDITIONAL</b>				
REMOVE & REPLACE CRACKED/SPALLED BRICK - CB, SB	10	UNIT	145.00	\$ 1,450.00
REPAIR CRACKED CONCRETE - CC (19 LOC)	9	LF	55.00	\$ 495.00
REPAIR CRACKED CAST STONE CONCRETE - CS (30 LOC)	5	LF	55.00	\$ 275.00
REPAIR SPALLED CONCRETE - SC (55 SF)	2	LOC	660.00	\$ 1,320.00
REPAIR SPALLED STONE - SS (67 SF)	6	LOC	825.00	\$ 4,950.00
<b>STRUCTURAL MASONRY REPAIRS</b>				
REMOVE DETERIORATED MASONRY & MORTAR AT PIERS	11	LOC	990.00	\$ 10,890.00
REBUILD MASONRY PIERS DOWN TO NEW CONCRETE PIERS	12	LOC	1,950.00	\$ 23,400.00
FILL / REPAIR VOIDS IN MASONRY WALLS	3	LOC	2,280.00	\$ 6,840.00
REPOINT BASE OF WALL	48	LF	36.00	\$ 1,728.00

**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
**SD ESTIMATE**

DETAILED ITEM TAKEOFF

4/23/2025

22860 sf



DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTALS
REPAIR / REBUILD STEP CRACK	1	LOC	1,445.00	\$ 1,445.00
NEW STEEL LINTEL AT ARCHES	1	LOC	3,000.00	\$ 3,000.00
<b>DIVISION 4 - MASONRY</b>				<b>\$ 1,233,294.25</b>
<b>DIVISION 5 - STEEL</b>				
<b>DIVISION 5 - STEEL</b>				<b>\$ -</b>
<b>DIVISION 6 - CARPENTRY</b>				
<b>BLOCKING</b>				
NEW BLOCKING AT REPLACEMENT WINDOWS	2002	LF	10.00	\$ 20,020.40
<b>EXTERIOR FINISH CARPENTRY</b>				
DETERIORATED WOOD TRIM TO BE REPLACED - WT (LOC 32) - ASSUME 1"x7" BOARD	333	LF	58.00	\$ 19,314.00
UNIT PRICE ALLOWANCE - DETERIORATED WOOD TRIM TO BE REPLACED - 15%	50	LF	58.00	\$ 2,900.00
FLUTED WOOD TRIM AT COLUMN BASES - 12"	56	LF	107.50	\$ 6,020.00
<b>INTERIOR FINISH CARPENTRY</b>				
REMOVE & REPLACE CRACKED MARBLE SILLS	21	EA	800.00	\$ 16,800.00
REMOVE & REPLACE DAMAGED WOOD SILLS	8	EA	175.00	\$ 1,400.00
<b>DIVISION 6 - CARPENTRY</b>				<b>\$ 66,454.40</b>
<b>DIVISION 7 - THERMAL MOISTURE PROTECTION</b>				
<b>THERMAL MOISTURE PROTECTION</b>				
NEW SEALANT AT WINDOWS	2002	LF	13.50	\$ 27,027.54
REMOVE & REPLACE ELASTOMERIC COATING AT CONCRETE	550	SF	33.50	\$ 18,425.00
<b>ROOFING</b>				
ADD EPDM AT REBUILT PARAPET	102	SF	22.00	\$ 2,244.00
REMOVE & REPLACE ZINC COPPER DOWNSPOUT - 4"x6"	242	SF	113.57	\$ 27,484.29
REPLACE ALUM SHEET METAL FLASHING	46	LF	73.00	\$ 3,358.00
REMOVE BIRD SCREEN & INSTALL BIRD SPIKES	8	LF	282.50	\$ 2,260.00
<b>METAL PANELS</b>				
INFILL EX WINDOW W/ INSULATED METAL PANEL	170	SF	90.00	\$ 15,300.00
<b>DIVISION 7 - THERMAL MOISTURE PROTECTION</b>				<b>\$ 96,098.83</b>

**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
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22860 sf



DESCRIPTION			QUANTITY	UNIT	UNIT COST	TOTALS
<b>DIVISION 8 - OPENINGS</b>						
<b>RESTORE WOOD WINDOWS</b>						
	WIDTH	HEIGHT	QUANTITY	SF EA	SF TOTAL	
A	4.67	9	8	42.0	336.24	
B	4.58	6.42	8	29.4	235.23	
Y	2.58	5.67	1	14.6	14.63	
			17	EA	\$ 3,300.00	\$ 56,100.00
<b>REPLACE WINDOW WITH HISTORIC REPLICA INCLUDING STAINLESS STEEL FLASHING</b>						
A	4.67	9	13	42.0	546.39	
B	4.58	6.42	12	29.4	352.84	
F	4.17	3.67	7	15.3	107.13	
R	5.33	4.75	2	25.3	50.64	
U	3.5	5.25	1	18.4	18.38	
				\$ 180.00	1,075.37	\$ 193,566.69
<b>REPLACE WINDOW WITH HIGH PERFORMANCE (TRIPLE PANED) INCLUDING STAINLESS STEEL FLASHING</b>						
A	4.67	9	3	42.0	126.09	
C	7.92	5.17	6	40.9	245.68	
D	9.33	6.5	5	60.6	303.23	
E	4.92	2.25	2	11.1	22.14	
G	4.92	6.42	4	31.6	126.35	
H	5.33	9.17	3	48.9	146.63	
I	5.25	7.75	3	40.7	122.06	
J	7.83	6.5	3	50.9	152.69	
K	5.25	7.92	3	41.6	124.74	
L	4.17	3.67	3	15.3	45.91	
M	5.17	7.83	2	40.5	80.96	
N	7.5	9.09	2	68.2	136.35	
O	4	6.33	2	25.3	50.64	
P	4	6.33	2	25.3	50.64	
Q	5.17	7.92	2	40.9	81.89	
S	3	5.09	1	15.3	15.27	
V	5.25	7.83	1	41.1	41.11	
X	5	7.75	1	38.8	38.75	
				\$ 165.00	1,911.12	\$ 315,334.64
<b>REMOVE &amp; REPLACE STORM WINDOWS AT RESTORED</b>						
			17	EA	840.00	\$ 14,280.00

**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
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22860 sf



DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTALS
WINDOWS				
<b>DOOR RESTORATION</b>				
REMOVE & REPLACE ALUM STOREFRONT DOOR & FRAME	3	EA	9,000.00	\$ 27,000.00
<i>HURRICANE IMPACT RATED, INCLUDING HARDWARE &amp; THRESHOLDS</i>				
ADD FOR SIDE LITE AT DOOR 1	16	SF	135.00	\$ 2,160.00
REPLACE WEATHERSTRIPPING & DOOR SWEEPS	7	EA	310.00	\$ 2,170.00
REPLACE EXTERIOR BACKER ROD & SEALANT JOINT	7	EA	620.00	\$ 4,340.00
<b>DIVISION 8 - OPENINGS</b>				<b>\$ 614,951.33</b>
<b>DIVISION 9 - FINISHES</b>				
<b>INFILL INTERIOR FINISHES AT INFILLED WINDOWS</b>	11	LOC	650.00	\$ 7,150.00
<b>MISC CUTTING &amp; PATCHING</b>	120	MHR	180.00	\$ 21,600.00
<b>PLASTER REPAIR AT WINDOWS</b>	100	EA	870.00	\$ 87,000.00
<b>REMOVE &amp; REPLACE (2) COURSES OF SPLINE CEILING</b>	1	LOC	1,960.00	\$ 1,960.00
<b>PAINT</b>				
PAINT PATCH AT INTERIOR SPACES	120	MHR	145.00	\$ 17,400.00
RUST STAINING ON LINTEL TO BE REPAINTED - RL	8	LOC	580.00	\$ 4,640.00
PAINT INTERIOR SURFACES AT REPLACED WINDOW OPENINGS	83	EA	500.00	\$ 41,500.00
PREP, PRIME & PAINT INT & EXT WOOD DOOR SURFACES	4	EA	435.00	\$ 1,740.00
PREP, PRIME & PAINT METAL FIRE ESCAPE STAIRS	2	EA	4,640.00	\$ 9,280.00
PREP, PRIME & PAINT EXTERIOR WOOD SOFFIT	500	SF	8.50	\$ 4,250.00
PREP, PRIME & PAINT EXTERIOR WOOD TRIM/ENTABLATURE	3515	SF	8.50	\$ 29,877.50
PROVIDE SMOOTH PAINT FINISH AT SOUTH ENTRANCE	1	ALLW	2,500.00	\$ 2,500.00
& PORTICO, NO SANDING				
<b>DIVISION 9 - FINISHES</b>				<b>\$ 228,897.50</b>
<b>DIVISION 22 - PLUMBING</b>				
<b>PLUMBING DEMOLITION</b>				
TEMP DISCONNECT, STORE, & REINSTALL WALL MOUNTED	40	LF	75.00	\$ 3,000.00
PIPE				
<b>DIVISION 22 - PLUMBING</b>				<b>\$ 3,000.00</b>
<b>DIVISION 23 - HVAC</b>				



**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
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DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTALS
<b>ALT 1 - REPLACE 1830'S WINDOWS W/ HISTORIC REPLICA ALUM WINDOWS ILO RESTORING WOOD \</b>				<b>\$ 64,286.45</b>
<b>ALT 2 - RESTORE 1895/1906 WOOD WINDOWS ILO REPLACING WINDOW WITH HISTORIC REPLICA</b>				
<b>DEDUCT</b>				
REMOVE WINDOWS FOR REPLACEMENT	-35	EA	330.00	\$ (11,550.00)
ABATE REPLACED WOOD WINDOWS	-35	EA	495.00	\$ (17,325.00)
PARGE COATING AT WINDOW PERIMETERS	-787	LF	12.50	\$ (9,837.50)
NEW BLOCKING AT REPLACEMENT WINDOWS	-787	LF	10.00	\$ (7,870.00)
NEW SEALANT AT WINDOWS	-787	LF	13.50	\$ (10,624.50)
REPLACE WINDOW WITH HISTORIC REPLICA				
A 4.67 9	-13	42.0	-546.39	
B 4.58 6.42	-12	29.4	-352.84	
F 4.17 3.67	-7	15.3	-107.13	
R 5.33 4.75	-2	25.3	-50.64	
U 3.5 5.25	-1	18.4	-18.38	
		\$ 180.00	-1,075.37	\$ (193,566.69)
<b>ADD RESTORE WOOD WINDOWS</b>				
RESTORED WOOD WINDOWS	35	EA	1,320.00	\$ 46,200.00
WIDTH HEIGHT	QUANTITY	SF EA	SF TOTAL	
A 4.67 9	13	42.0	546.39	
B 4.58 6.42	12	29.4	352.84	
F 4.17 3.67	7	15.3	107.13	
R 5.33 4.75	2	25.3	50.64	
U 3.5 5.25	1	18.4	18.38	
	35	EA	\$ 3,300.00	\$ 115,500.00
<b>ALT 2 - RESTORE 1895/1906 WOOD WINDOWS ILO REPLACING WINDOW WITH HISTORIC REPLICA</b>				<b>\$ (89,073.69)</b>
<b>ALT 3 - MASONRY REPLACEMENT 1925/26 BUILDING</b>				
REMOVE & REPLACE THE TEXTURED INDIVIDUAL BRICK	100	UNITS	145.00	\$ 14,500.00
INFILL AREAS w REPLACEMENT BRICK MASONRY UNITS				
<b>ALT 3 - MASONRY REPLACEMENT 1925/26 BUILDING</b>				<b>\$ 14,500.00</b>
<b>ALT 4 - MASONRY REPLACEMENT 1971 ADDITION</b>				
<b>DEDUCT</b>				
REMOVE & REPLACE CRACKED/SPALLED BRICK - CB, SB	-2	UNIT	145.00	\$ (290.00)
REMOVE ANCHOR STUB AND PATCH - BRICK	-2	EA	110.00	\$ (220.00)

**BARNSTABLE COUNTY SUPERIOR COURTHOUSE ENVELOPE RESTORATION**  
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22860 sf



DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTALS
REPAIR FAILED SEALANTS - FS	-50	LF	53.75	\$ (2,687.50)
<b>MASONRY</b>				
REMOVE MASONRY FAÇADE	675	SF	13.50	\$ 9,112.50
NEW BRICK MASONRY TO MATCH 1925/26	675	SF	60.00	\$ 40,500.00
<b>ALT 4 - MASONRY REPLACEMENT 1971 ADDITION</b>				<b>\$ 46,415.00</b>
<b>ALT 5 - REPLACE EXISTING WOOD ENTABLATURE W/ FIBERGLASS</b>				
<b>REMOVE WOOD ENTABLATURE</b>	3515	SF	4.23	\$ 14,880.00
<b>GFRP WOOD ENTABLATURE INCLUDING FRAMING</b>				
MATERIAL	3515	SF	18.50	\$ 65,027.50
LABOR - ASSUME CREW OF 4 FOR 2 WEEKS	320	MHR	135.00	\$ 43,200.00
<b>ALT 5 - REPLACE EXISTING WOOD ENTABLATURE W/ FIBERGLASS</b>				<b>\$ 123,107.50</b>
<b>ALT 6 - REPLACE EXISTING WOOD ENTABLATURE W/ SYNTHETIC WOOD</b>				
<b>REMOVE WOOD ENTABLATURE</b>	3515	SF	4.23	\$ 14,880.00
<b>SYNTHETIC WOOD ENTABLATURE INCLUDING FRAMING</b>				
MATERIAL	3515	SF	12.00	\$ 42,180.00
LABOR - ASSUME CREW OF 4 FOR 3 WEEKS	480	MHR	135.00	\$ 64,800.00
<b>ALT 6 - REPLACE EXISTING WOOD ENTABLATURE W/ SYNTHETIC WOOD</b>				<b>\$ 121,860.00</b>