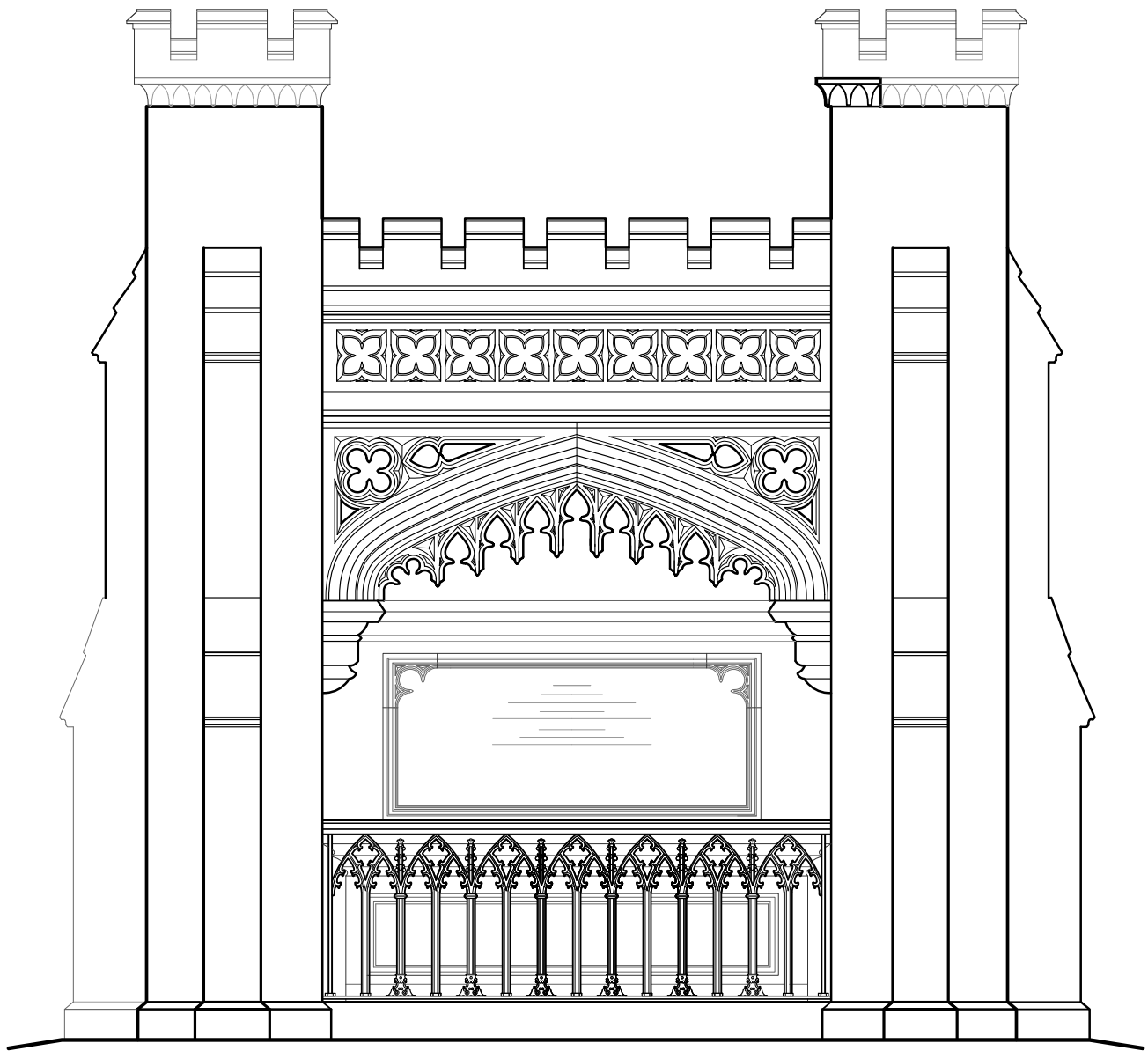


KKBE Coming Street Cemetery • Charleston, SC



*Report by Clemson University/ College of Charleston
Masters in Historic Preservation Program
Advanced Conservation Spring 2015*

Professor Frances H. Ford

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ACKNOWLEDGMENTS

The Clemson University/ College of Charleston Graduate Program in Historic Preservation, Spring Advanced Conservation class would like to thank the Kahal Kadosh Beth Elohim congregation and staff for allowing us the opportunity to work this semester at the Coming Street Cemetery. We would like to thank our professor, Frances H. Ford for guidance throughout the project. We would also like to thank Richard Marks and Craig Bennett for meeting with us and sharing their invaluable advice. Dale Rosengarten and College of Charleston Special Collections staff helped us with our research as well as Barry Steifel of the College of Charleston's Undergraduate Historic Preservation Program.



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INTRODUCTION

This spring, Clemson University and College of Charleston's Graduate Program in Historic Preservation Advanced Conservation Science class focused on the documentation, investigation, mitigation, and rehabilitation plan for the Catherine Lopez Monument in the Lopez family section of the Kahal Kadosh Beth Elohim (KKBE) burial grounds in Charleston, South Carolina.

CURRENT RESEARCH

Founded in 1749, KKBE is one of the oldest Jewish congregations in the United States. Its Coming Street Cemetery is listed on the National Register of Historic Places and is considered one of the oldest surviving Jewish cemeteries in the South. In 1764, Isaac Da Costa conveyed his family burial ground to KKBE for 70£ to begin the congregation's first cemetery.¹ Members of the congregation, such as Reverend Moses Cohen who was the first spiritual leader of KKBE and died in 1762, were buried on the land prior to Da Costa's conveyance.² Cohen's burial is the first known in the cemetery.

Today's KKBE Coming Street Cemetery is located at 189 Coming Street in Charleston, South Carolina. It consists of three historically separate cemeteries. The original KKBE burial grounds (conveyed by Da Costa), is the largest section of the cemetery. In 1841, reform practices, including the installation of an organ, created unrest within KKBE's congregation. Divergences from typical practice led to a division of the synagogue—and resulted in a group of congregants' secession. Those who left KKBE established a new congregation known as Shearit Israel. In 1842, Shearit Israel established

a new cemetery next to KKBE's cemetery. To separate the two burial grounds, Shearit Israel erected a tall brick masonry wall. Shortly after Shearit Israel founded their section, congregant David Lopez was denied burial rights for his wife, Catherine, because she had not converted to Judaism. Lopez reacted by purchasing the plot of land on the northwest border of Shearit Israel's burial ground and established his own family plot. The three sections remained separate until KKBE and Shearit Israel reincorporated in 1866 and demolished the dividing wall in the cemetery.³

David Lopez, Jr., a previous member of KKBE congregation, builder, and leader in the Charleston community, married Catherine Hinton of Edgefield, South Carolina, in 1832 before the congregational division.⁴ When the synagogue split, the Lopez family left and joined Shearit Israel's congregation. Although Catherine married a Jew, she was not Jewish and never officially converted to Judaism. During their marriage, David and Catherine had six children together. Unfortunately, in 1943, four days after delivering her sixth child, Catherine and the infant child died.⁵ According to Charleston death records, her second youngest child, Charles Hinton (b. January 27, 1843), died just about a month later of "consumption," or tuberculosis. Because Catherine

3 KKBE website, <http://www.kkbe.org/index.php?page=history>

4 Randi Serrins, Exploring the enigma of Catherine Lopez and her tomb, *Charleston Mercury*, accessed April 12, 2015, <http://www.charlestonmercury.com/index.php/en/history/91-exploring-the-enigma-of-catherine-lopez-and-her-tomb>.

5 Although this information is conflicting with other sources written about the family and Catherine Lopez Monument, the ancestral records and family genealogy reveal two children, Charles Hinton and an unnamed infant, both died about the same time. Refer to family genealogy, Jewish Historical Society of Charleston, Special Collections, College of Charleston Addlestone Library.

1 Solomon Breibart, "The Jewish Cemeteries of Charleston," *Catalogue* (Summer 1993): 8-9.

2 KKBE website, <http://www.kkbe.org/index.php?page=history>

and her children were not considered Jewish, she and her children were not granted burial rights in Shearit Israel's cemetery (next door to KKBE's). In response, David purchased a small sliver of land off of the cemetery and established a private family plot with its own entrance.

In the Lopez section, thirteen stone monuments line the path leading to an enormous crenellated stone and stucco gothic revival monument dedicated to Catherine, her unnamed infant, and Charles Hinton. It is believed that both children are buried with Catherine. Unfortunately, the designer and builder of the tomb are still unclear. No written documentation has been located relating to the monument. Although Lopez was a builder, it cannot be inferred that he is responsible for the monument's construction. As a builder, he did not design any buildings he is credited for constructing in Charleston.

After many hours of research and numerous phone calls to historic research centers like the Museum of Early American Decorative Arts (MESDA) and the Charleston Museum, designer connections to the monument could not be found. Although several Charleston architects and designers were incorporating similar design features and styles into their work about the time of Catherine's death, no definitive associations with the monument could be made. Because of the controversy connected to the monument's erection, it is no surprise related records are scarce.

ARCHITECTURAL DESCRIPTION AND MINERALOGY

Catherine Lopez's monument can be described as "an elaborately detailed box tomb...with

a stone canopy."⁶ Rising high above the privacy walls encasing the family plot, the center section of the tomb's stone and stucco canopy incorporates a horizontally elongated pointed segmental arch embellished with intricately carved gothic motifs. These embellishments include pointed and rounded quatrefoils, heavy downward facing finials, and decorative coursework carved in stone. A short but extravagant cast iron railing extends across the front of the center section, almost protecting the box tomb and the Carrera marble slab mounted above that bears the names of the entombed. The cast iron railing feature seems to be a later addition to the monument. Many of these design motifs

6 Randi Serrins, Exploring the enigma of Catherine Lopez and her tomb, *Charleston Mercury*, accessed April 12, 2015, <http://www.charlestonmercury.com/index.php/en/history/91-exploring-the-enigma-of-catherine-lopez-and-her-tomb>.

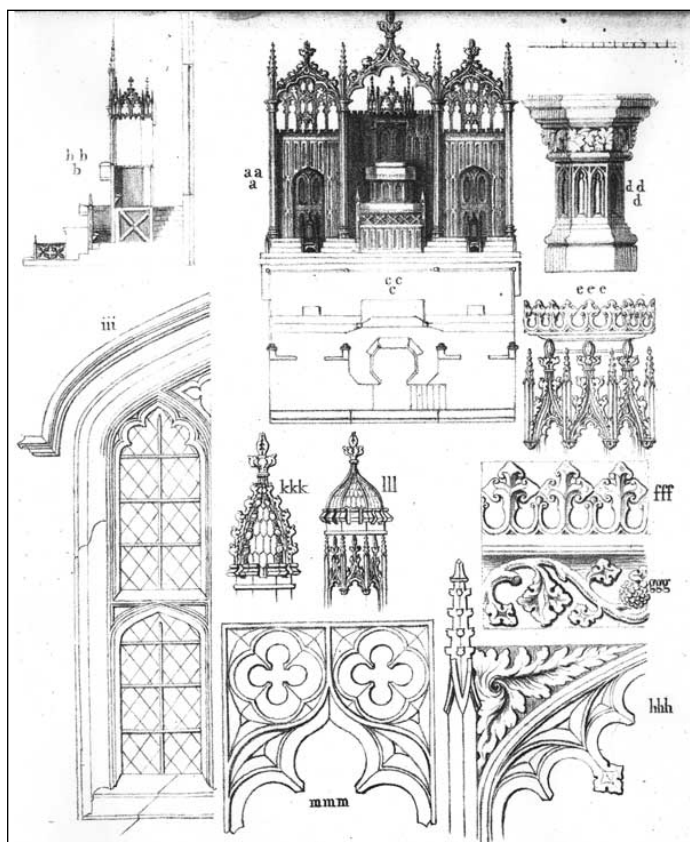


Figure 1. Examples of gothic architecture from "Gothic Architecture, with Various Plans and Drawings for Churches 1836

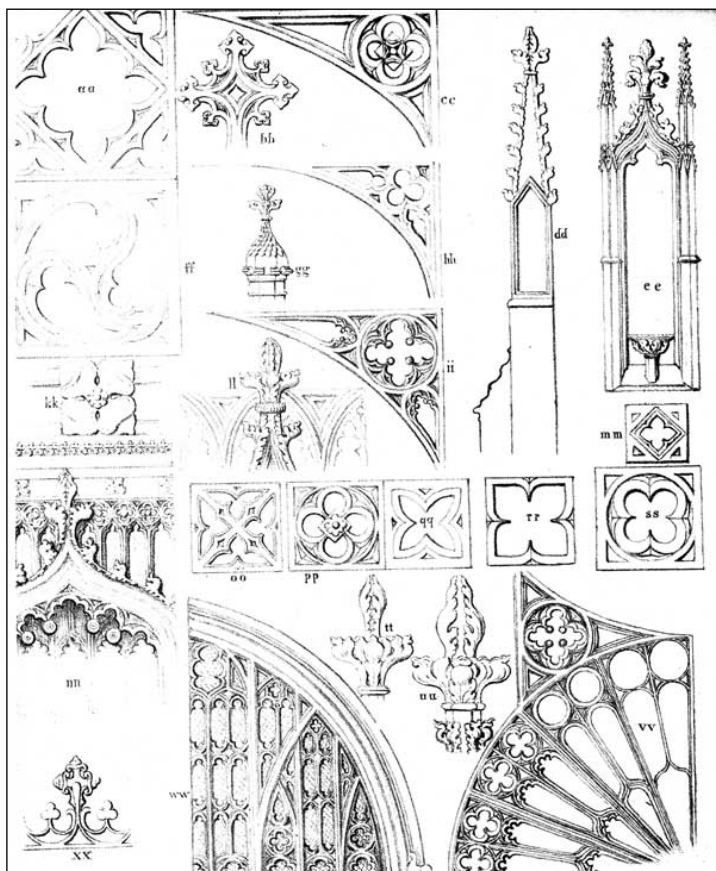


Figure 2. Gothic architecture embellishments from "Gothic Architecture, with Various Plans and Drawings for Churches" 1836.

can be seen in an 1836 illustrated essay on "Gothic Architecture, with Various Plans and Drawings for Churches: Designed Chiefly for the Use of the Clergy" by John Henry Hopkins, Bishop of the Protestant Episcopal Church in the Diocese of Vermont. In his essay, Hopkins includes diagrams and drawings of designs very similar to the details that describe Catherine Lopez's Monument (See examples above).

Flanking either side of the center section are two towers, finished with a smaller stone and stucco buttress details on the front elevation and outward facing sides of the towers. Although much of the detailing has been lost or removed for safety, the roofline of the monument was once elaborated with an exaggerated battlement that spanned the entire length. Now, only the center section and a portion of the east tower retain this detail. The west tower faces significant deterioration. The entire

battlement feature has been removed on this tower, and several courses of brick are revealed due to stucco delamination. Examination of the removed battlement portions revealed a line of small piercings across the top. Although no evidence of metal detailing remains, a gothic fret or finial detail could have lined the highest edge of the monument.

Finally, the north elevation and roof prove to be very plain and finished in stucco. The main roof of the canopy consists of a large and thick slab of bluestone. The towers are finished with smaller pieces of bluestone. Much of the roof suffers from a later stucco campaign. Only small portions of the large slab can be seen underneath.

When analyzed, the monument's stone and level of detail seems unique to Charleston. Because the monument's stones differ in color and type in certain areas and due to remnant evidence, there is a possibility it was finished with limewash in a polychromatic schema. Sandstone, marble, and limestone stones comprise the monument.

Sandstone is a sedimentary stone made from disintegrated granite with an iron oxide, calcite, clay, dolomite, or mica mineral binder, depending on the region of origin. The varied mineral composition of sandstone gives it many different colors and textures. Sandstone is soft and relatively easy to carve, however, the quartzite grains it contains dull carving and cutting tools quickly. Sandstone has visible bedding layers and often contains fossils. Types of deterioration relevant to sandstones are pollution crusts, disaggregation, preferential erosion, alveolar erosion, efflorescence, blistering, contour scaling, hollowness, delamination, and cracking.⁷

Marble is a crystalline, metamorphic stone made from limestones that are mostly calcite,

⁷ Colin Muir, "Sandstone," in *Stone Conservation: Principles and Practice*, Alison Henry, ed. (Shaftesbury : Donhead, 2006), 191-204.

dolomite, or a combination of both. Marble comes in a range of colors from pure white to statuary marble to brecciated marbles that have undergone further metamorphosis, which produces colored veins. Marble has been used as both a building stone and a decorative stone since Greek and Roman times, but in the present day is used as an architectural embellishment or stone for fine art because it is too expensive to use as a building material. Types of deterioration relevant to marble are thermally induced micro-cracking, etching, pitting, surface erosion, black crust, staining, sugaring, and warping.⁸

Limestone is the most commonly used historic building stone. It is a sedimentary stone, but has a high range of hardnesses, colors, and textures. Some limestones are dense and polishable, while others are very soft. It can be found in almost every color, including black, brown, orange, green, and pink. Textures range from fine to coarse. Because limestones are so diverse, their methods of deterioration can vary greatly depending on the specific characteristics of the stone. The most common types of limestone deterioration are similar to those of sandstone, such as pollution crusts, efflorescence, blistering, cracking, disaggregation, and preferential erosion.⁹

Many of the deterioration traits discussed above are present on the monument. Unfortunately, much of the monument has also suffered from re-stuccoing and Portland cement repairs. Major structural movement has occurred. A large crack exists in the west tower and arch, as well as on the interior portion of the monument. Because of the arched structure between the two towers, the arch seems to be pushing the towers outward (rather than the towers collapsing inward). Causes include settling, soil characterization, construction in the

area, earthquakes, and hurricanes. Ultimately, all problems are probably related to the outward force.

METHODOLOGY

In order to create this survey, condition assessment, and mitigation report, extensive visual observation ultimately led to the creation measured drawings and further historic research. AutoCAD Historic American Buildings Standards/Historic American Engineering Record (HABS/HAER) drawings were complimented with a full site plan of the Lopez section.

In order to created the site plan, a Leica total station was used on site to collect survey points that were eventually imported into autoCAD. We surveyed the perimeter walls, path, and gravestone locations. Next plans of individual gravestones were drawn in autoCAD and placed into the site plan based on their corresponding survey points.

After the condition assessment was completing, the class used a large-scale photo of the monument and overlaid illustrated symbols that related to a key describing forms of deterioration suffered. This comprehensive diagram allows a graphic example of condition frequency and severity in relation to the rest of the monument. An illustrated condition glossary was also completed and provides a visual descriptions of issues addressed during the assessment. Finally, professional consultations with general contractor Richard Marks, structural engineer Craig Bennett, and (of course) conservator Frances Ford assisted in the compilation of a mitigation report and future recommendations for the site and monument.

⁸ Jonathan Kemp, "Marble," in *Stone Conservation: Principles and Practice*, 217-226.

⁹ Nicholas Durnan, "Limestone," in *Stone Conservation: Principles and Practice*, 161-163.

MAP

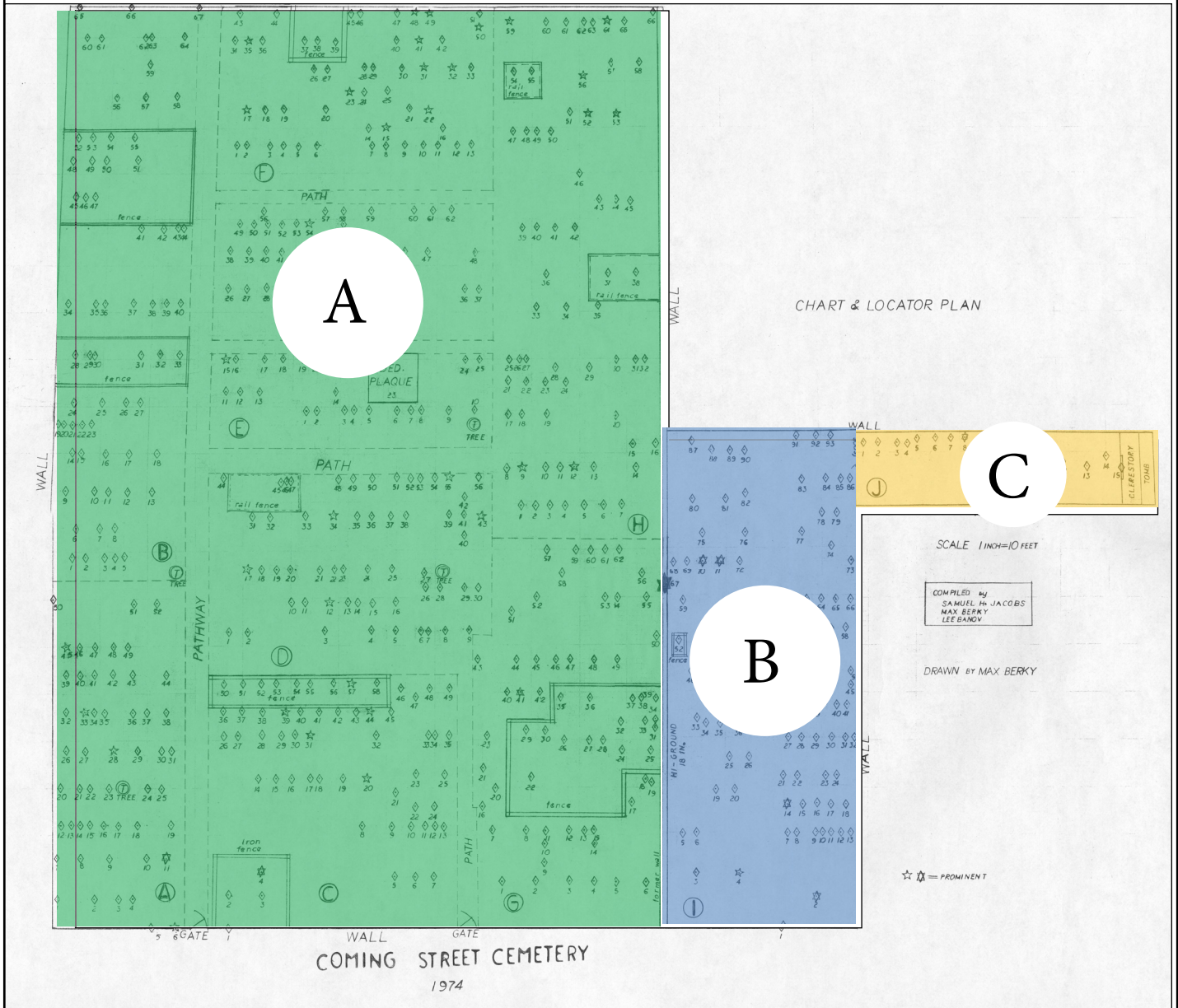


Figure 3.

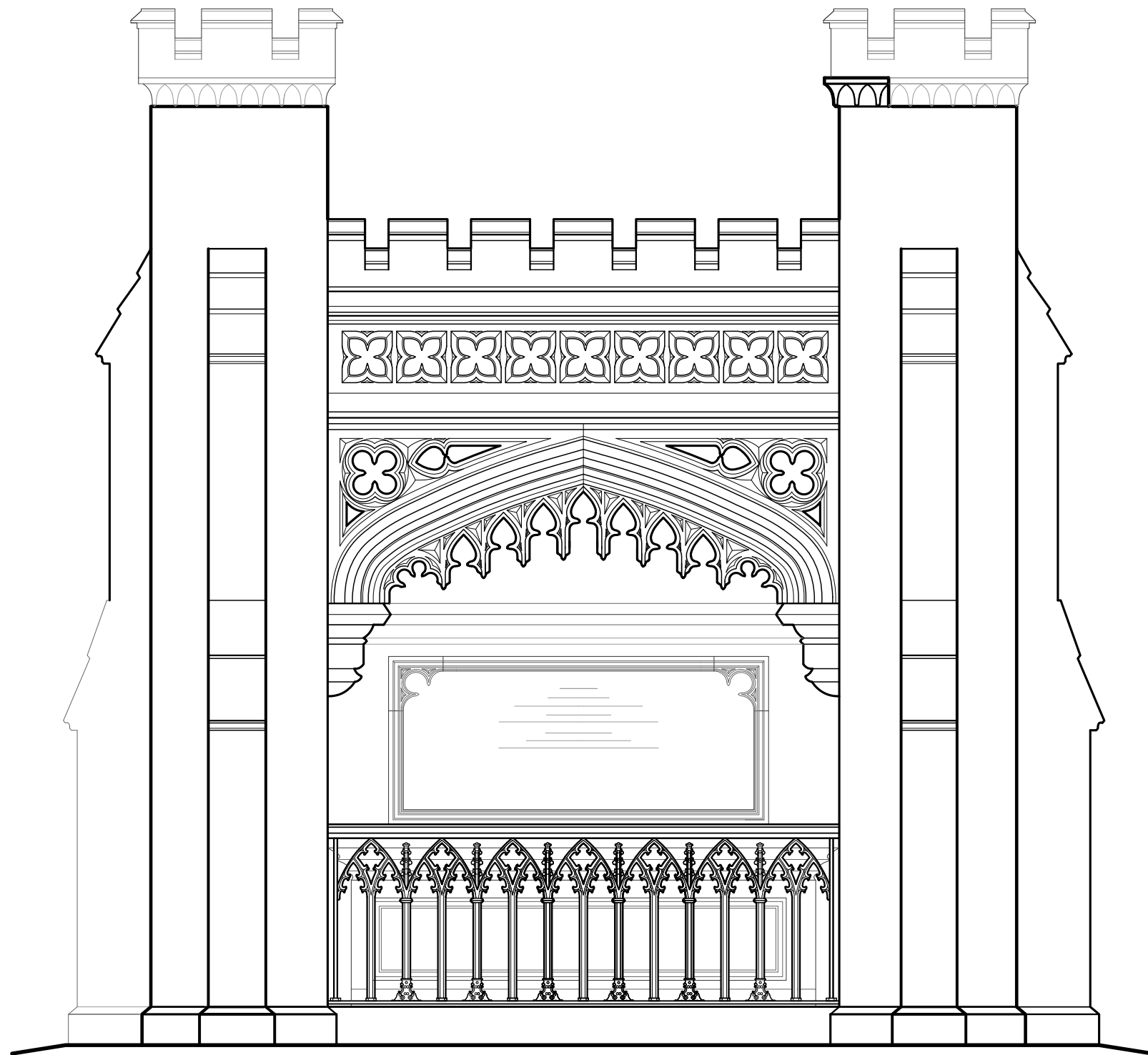
A. This area is the original congregational cemetery and dates from 1764; from 1754; it was the DaCosta family plot.

B. This part was developed by members of Beth Elohim who had seceded in 1841 over the installation of an organ in the synagogue and had formed Orthodox Congregation Shearit Israel. When the two congregations merged after the Civil War, a dividing wall was taken down.

C. The Lopez family plot was established in the 1843 when Shearit Israel refused burial to David Lopez's first wife who had not been converted to Judaism.

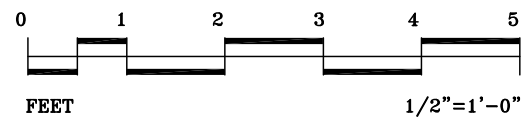
The Cemetery contains over 500 graves; many are not marked. The oldest identifiable grave is that of Moses

D. Cohen, the first religious leader of Beth Elohim, who died in 1762.

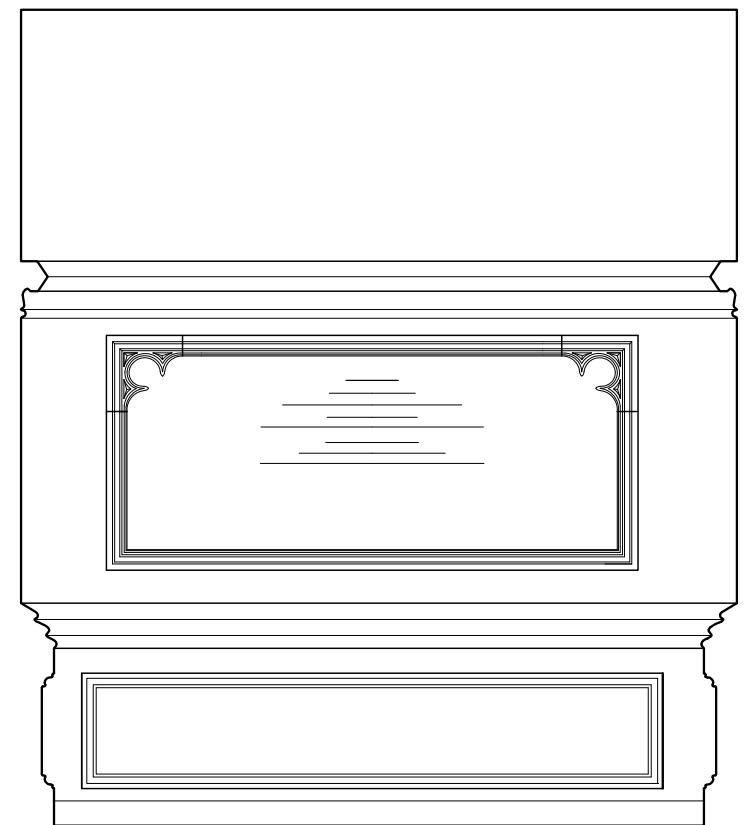


SOUTH ELEVATION

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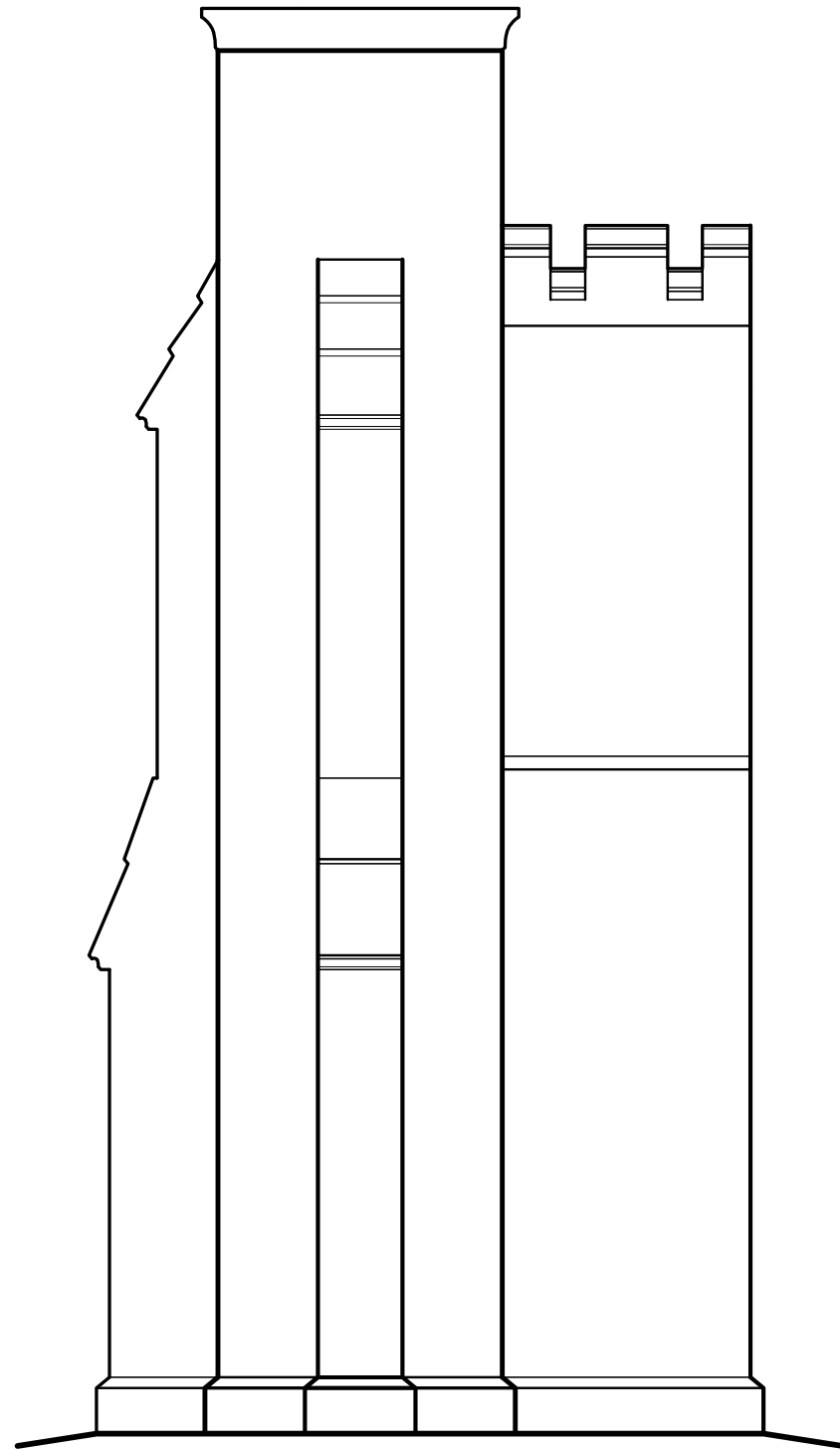
ERECTED
OVER THE REMAINS OF
CATHERINE D. LOPEZ
WIFE OF DAVID LOPEZ
WHO WAS BORN..... JUNE..... AND DIED..... JUNE 1843
AND..... INFANT SON
CHARLES HINTON LOPEZ
WHO WAS BORN..... DIED..... JULY 1843



SOUTH INTERIOR ELEVATION

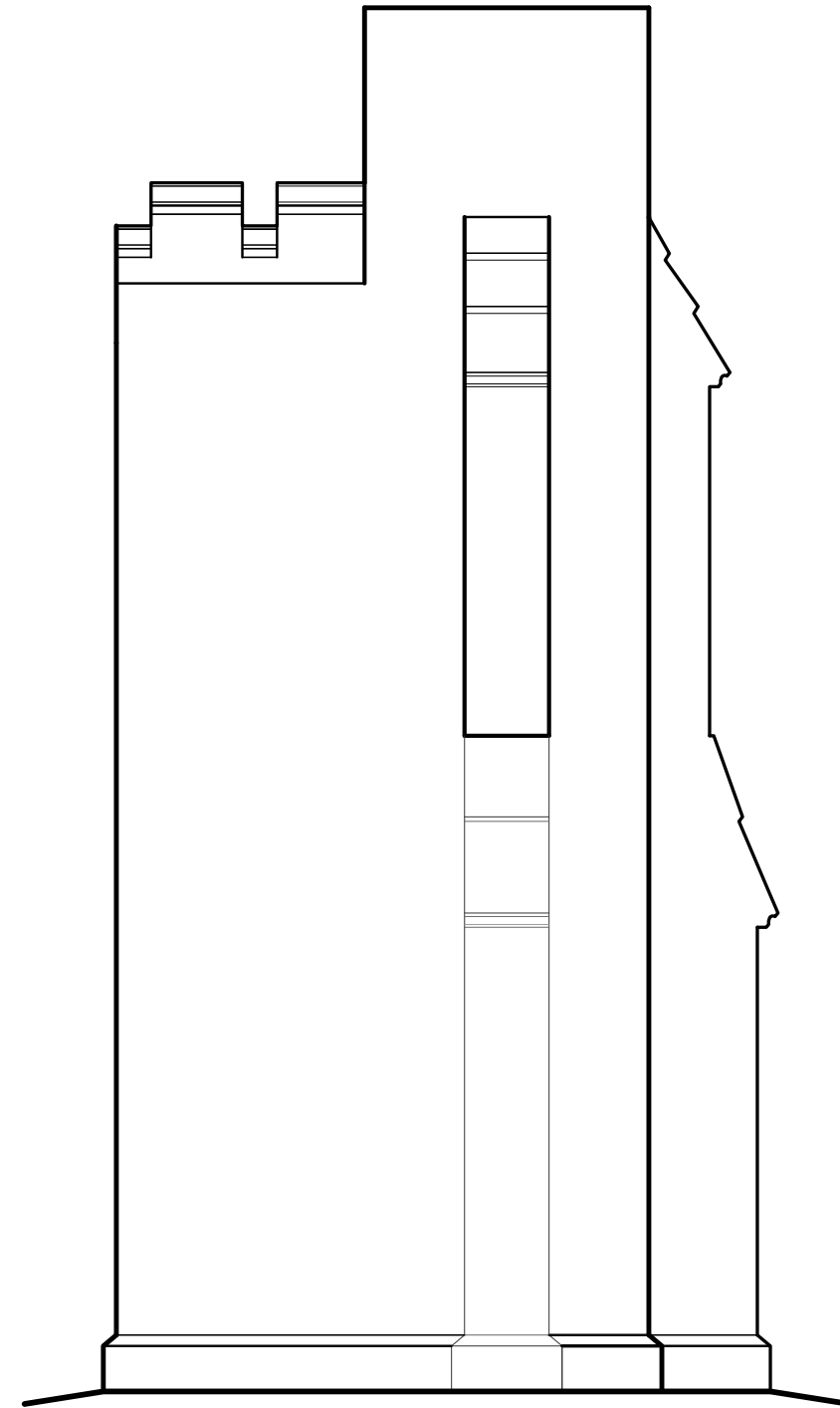
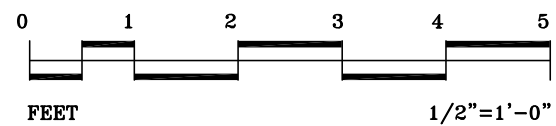
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EAST ELEVATION

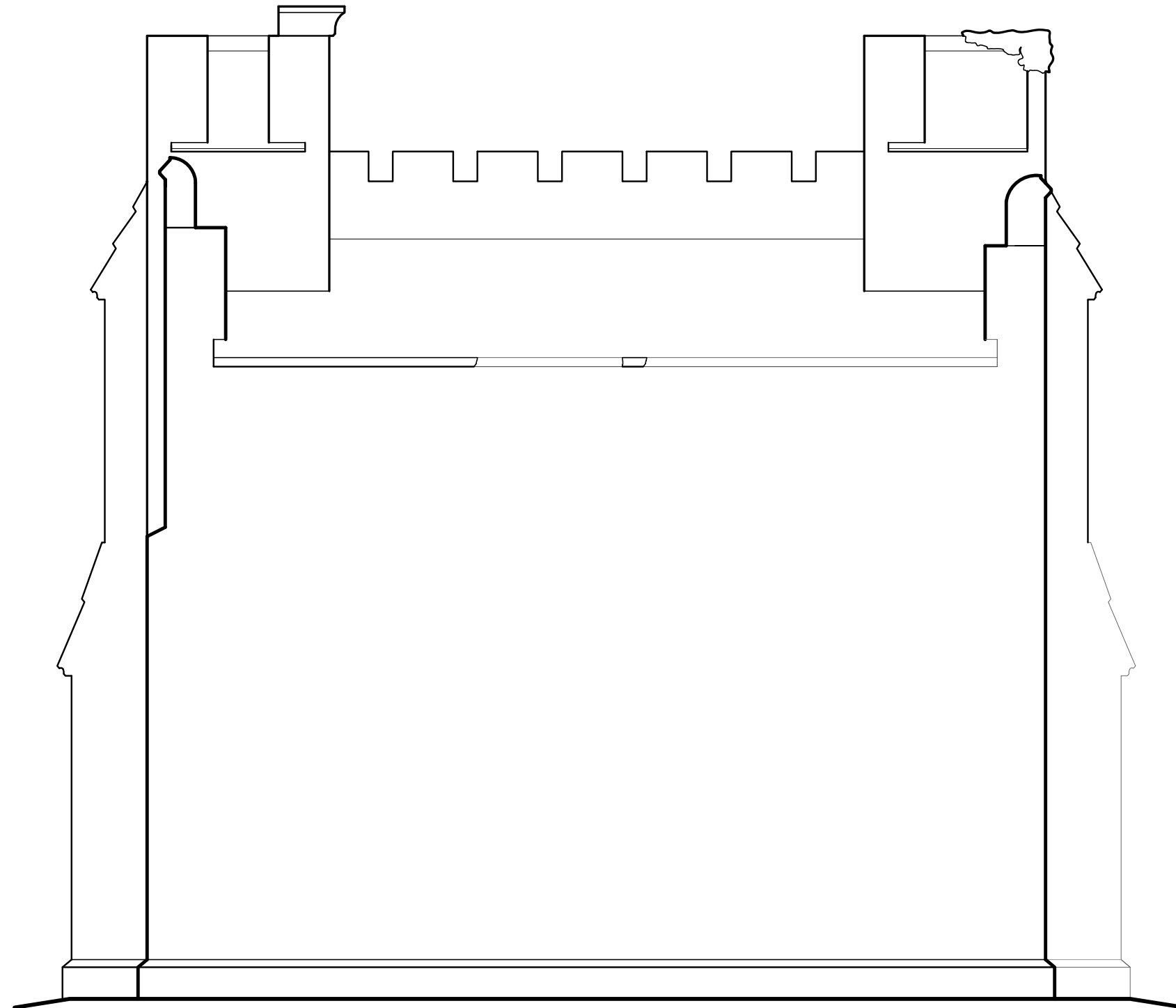
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WEST ELEVATION

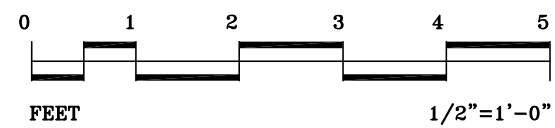
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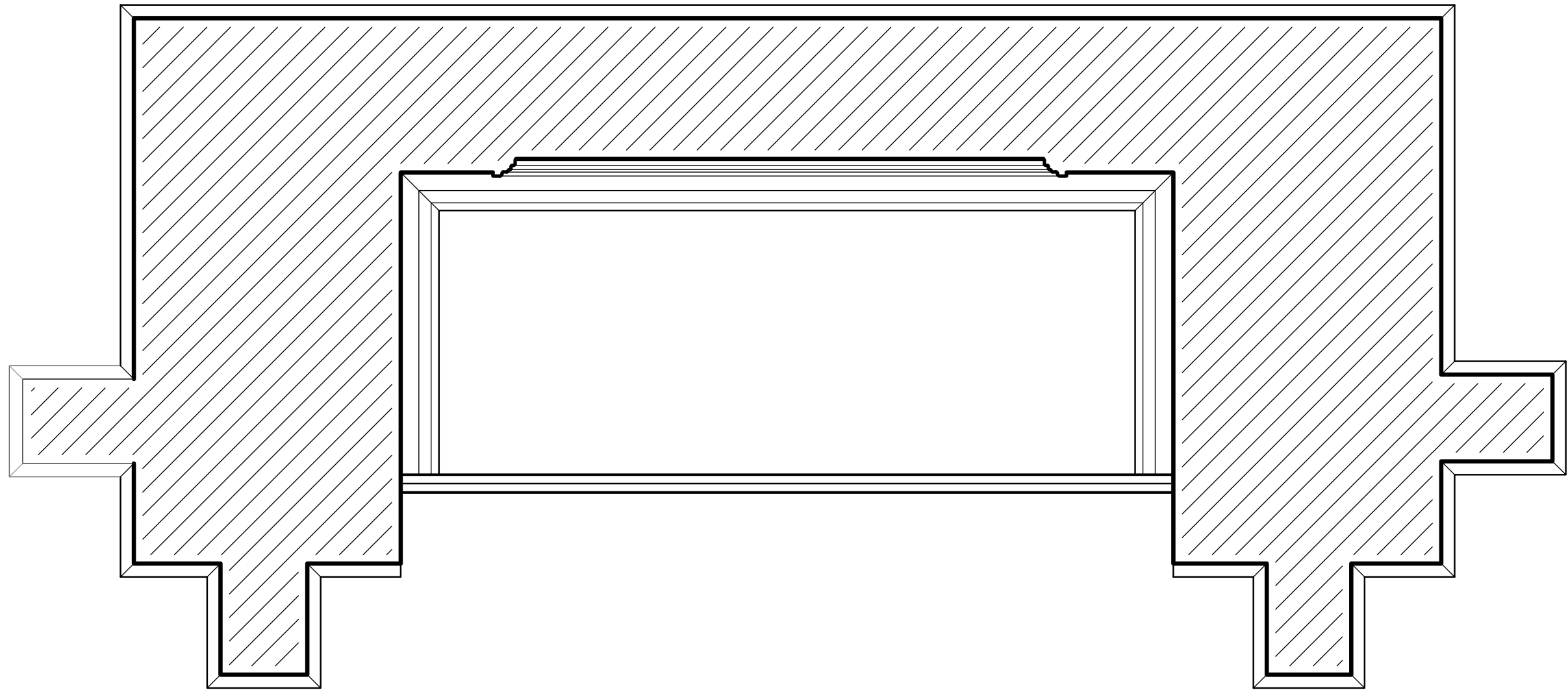


NORTH ELEVATION

1/2"=1'-0" 1:24

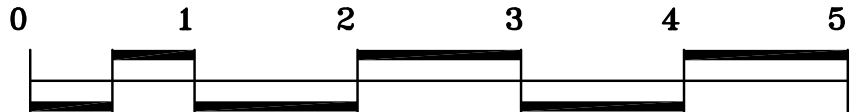


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MONUMENT PLAN

$1/2''=1'-0''$ 1:24



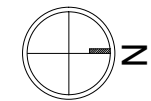
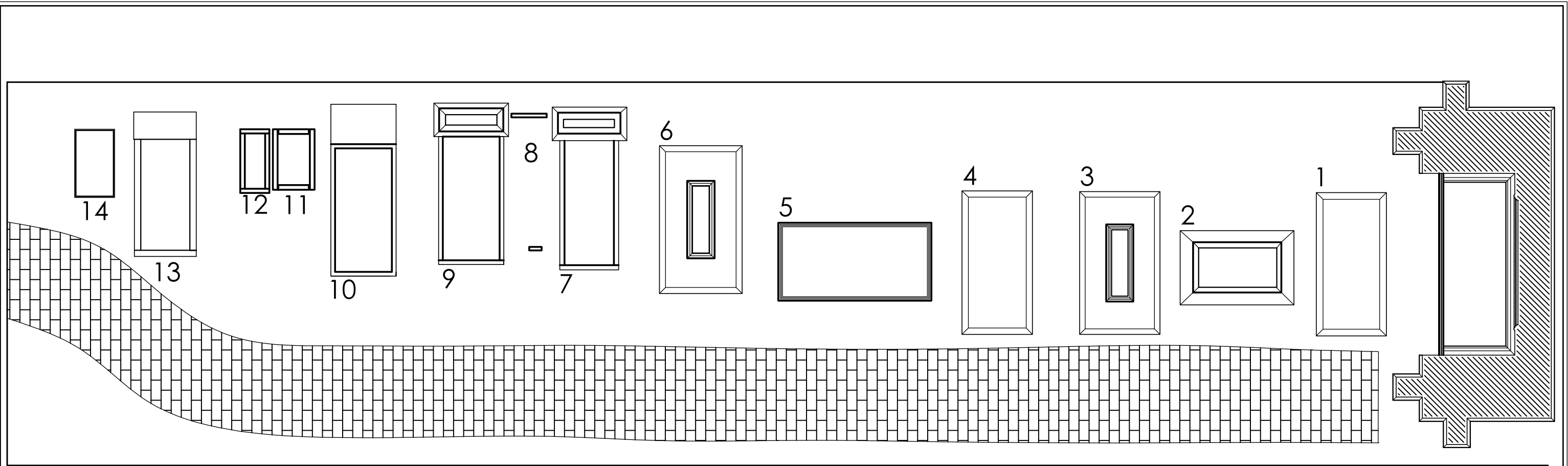
FEET

$1/2''=1'-0''$



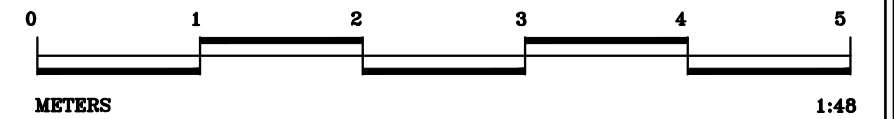
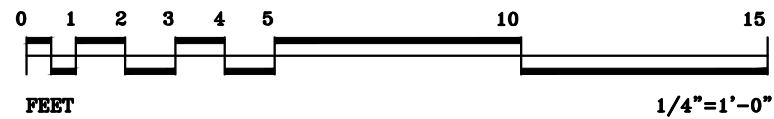
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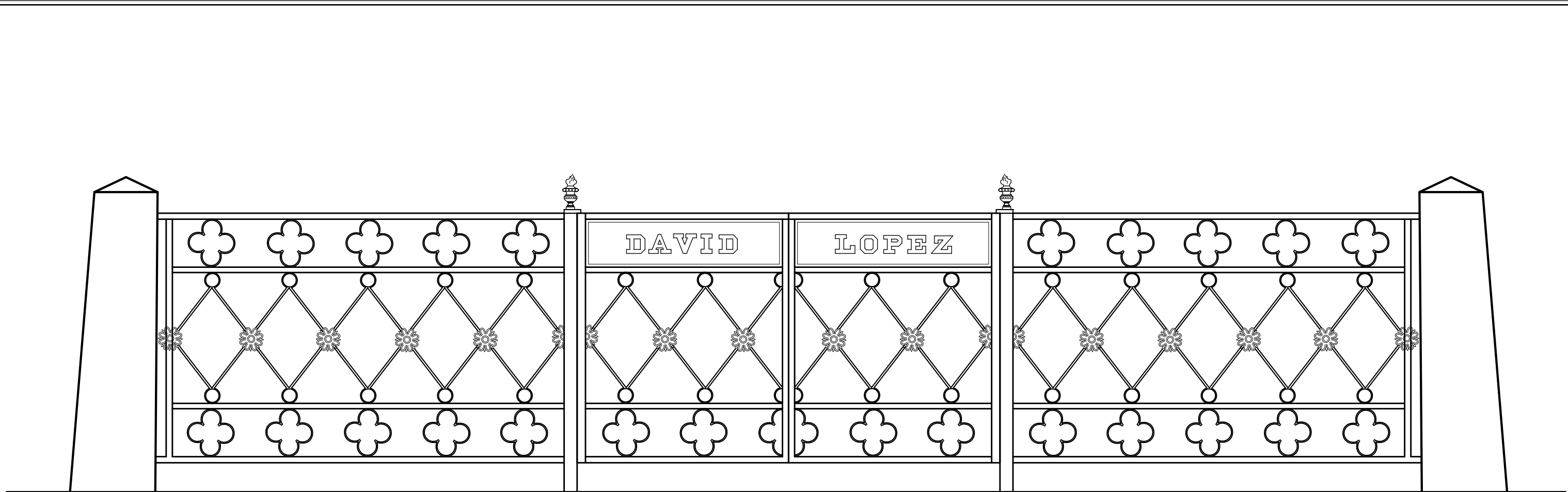
1:24



SITE PLAN

1/4"=1'-0" 1:48

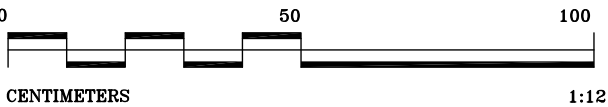


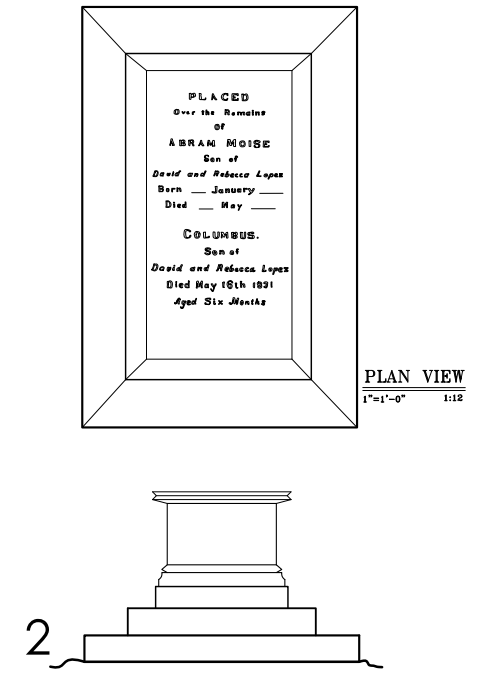
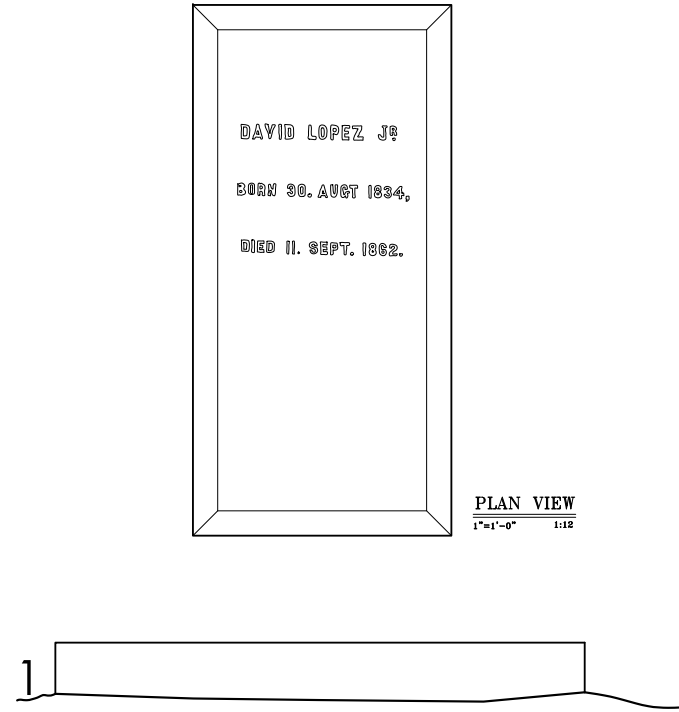
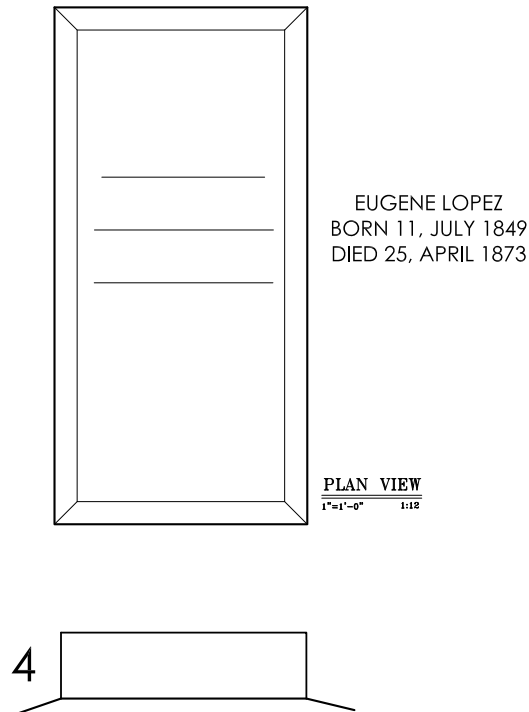


GATE ELEVATION

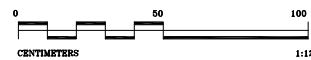
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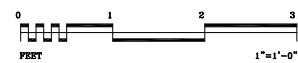
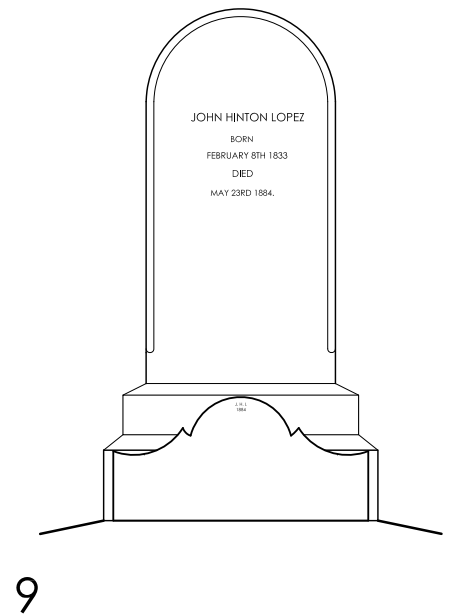
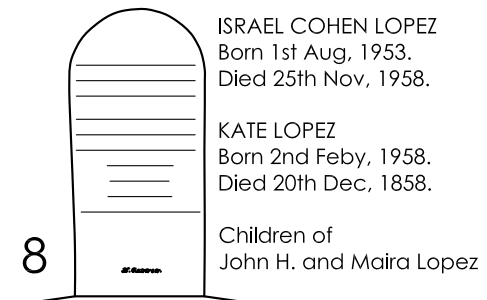
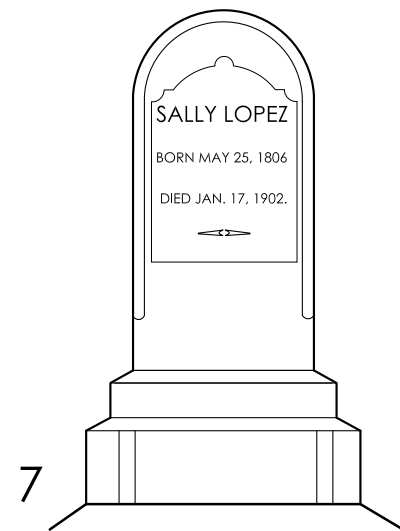
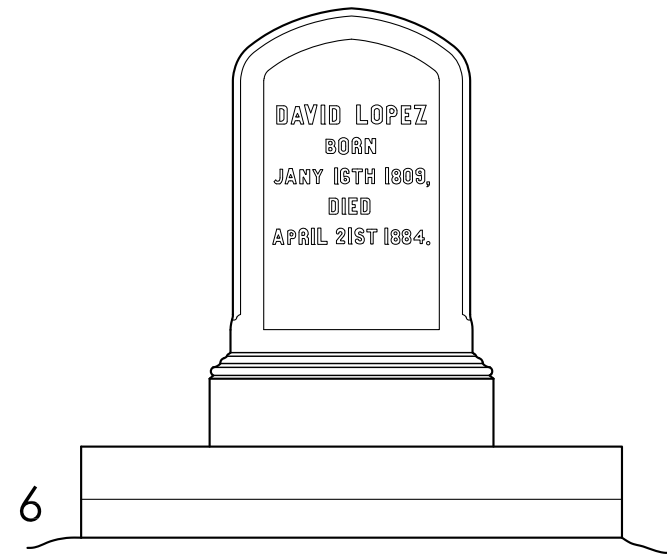
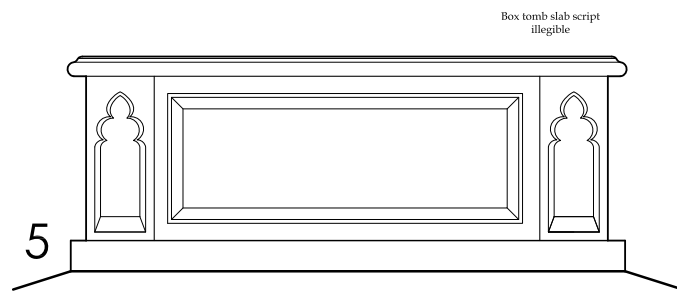
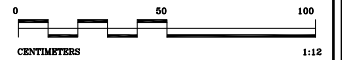




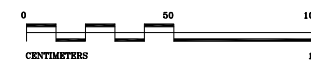
GRAVESTONE ELEVATIONS
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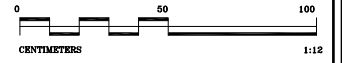
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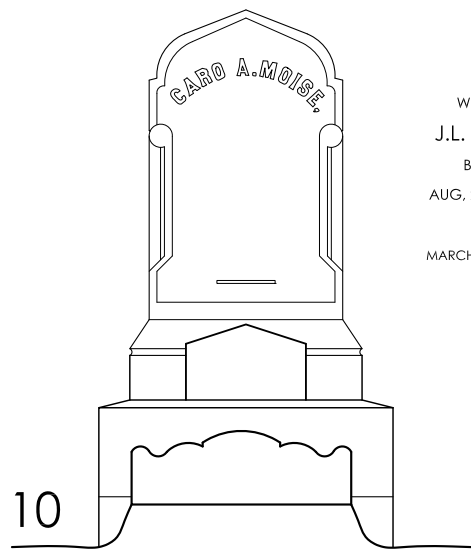


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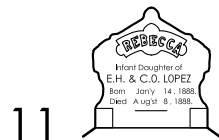


GRAVESTONE ELEVATIONS
1"=1'-0" 1:12





WIFE OF
J.L. LOPEZ,
BORN
AUG. 2ND 1854.
DIED
MARCH 31ST 1885.

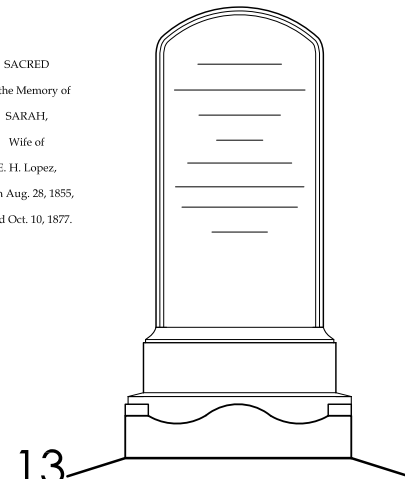


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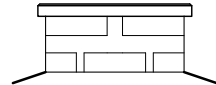


12

ONLY CHILD OF
E.H. & C.O. LOPEZ.
Born Jan'y 14, 1880.
Died Aug 10, 1885.



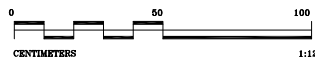
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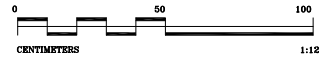
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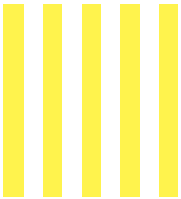
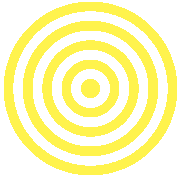
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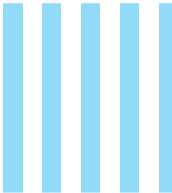


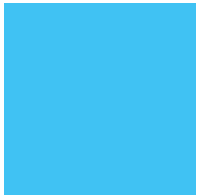
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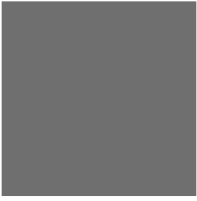
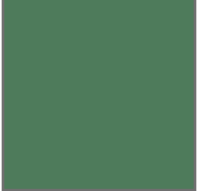


Glossary of Terms

Condition	Illustration	Description	Legend
Bowing		Also known as deformation, bowing occurs when there is a change in shape without losing integrity. It can be caused by settlement, movement, or excess moisture.	
Bulging		Bulging is used to describe when a material begins to move out of plane with the surface material. For instance, stucco may bulge when it becomes delaminated. Masonry walls may also have bulging due to movement or improper brick or stone placement.	
Displacement		Shifting of the stone caused by movement or cracking. Usually more than 1/2 inch out of plane.	
Tooling Marks		Found where the original mason created the shape of the member or a texture on the stone face. Are useful in telling how weathered the stone is.	

Moderate Cracks		Moderate cracks are characterized as those less than 1/8 inch wide.	
Major Cracks		Major cracks are characterized as those more than 1/8 inch wide.	
Open Joint		Open joints are the spaces between stones or bricks that have lost all their mortar.	
Deteriorated Joint		Deteriorated joints are the joints between stone or bricks that have lost some of their mortar.	
Flaking		Flaking occurs when there are areas where there is disaggregation of the individual grains, or flaking, under very minimal amounts of pressure. Also known as scaling or exfoliation.	
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Spalling		When the outer layers of stone have become separated from the original surface, this is called spalling. Spalling can be detected visually or audibly, by tapping on the surface. Usually a hollow sound will be heard.	
Delamination of Stucco		Delamination of stucco occurs when the outer stucco layer separates from its substrate. In this study, it is when the stucco separates from the brick it is covering.	
Sanding		Sanding is a type of disintegration that usually only happens in sandstones and granites. It is characterized by the detachment of single grains or aggregates of grains.	
Sugaring		Sugaring is an indication of surface disintegration. It is usually caused by salts and excess moisture. When touched, the stone comes off in a powder like form. Marble is particularly susceptible to sugaring.	
Staining		Staining is due to the weathering of stone, stucco, or brick that causes discoloration.	
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Filled Cracks		Cracks that have proven inactive (no longer growing in size) are often filled with either a composite repair material or a new mortar (commonly of Portland cement).	
Composite Repairs		Composite is used to repair cracks, spalling, and other material loss. It is made of mortar mixture or an epoxy based resin mixture.	
Black Crust		An encrustation of the stone that can be either white or black, black crust is caused by formation of deposits on the stone. It is most often found in dense population areas with high levels of pollution.	
Biogrowth		Biogrowth usually occurs in areas of moisture intrusion or poor drainage when biological growth of any kind becomes attached to the surface of the material. Common biogrowth includes mosses, lichens, vines, etc.	

CONDITIONS ASSESSMENT: WEST TOWER

The west tower is in very poor condition. The tower is pulling away from the rest of the monuments front façade and is leaning to the left out of plumb. Due to this leaning, the connection between the tower and stone ornament on the top of the middle section has failed. The stucco of the tower is not connected to the stone even after what appears to be a later repair in an effort to reconnect the stone to the stucco. Below the roof, the decorative stone piece is still attached to the west tower.

The foundation on the façade of the monument and on the west side elevation of the



Figure 4. Leaning of the tower to the left with the broken connection between the stucco and brick and the stone.

monument is in good condition with stucco loss only in some areas, exposing the brick beneath. Much of the stucco is still intact. Above the foundation the lower part of the walls stucco is cracked, bulging and delaminating. The connection of the cast iron barrier has been poorly repaired and is starting to delaminate from the stuccoed wall. Bulging of the stucco on the rest of the tower is present with some stucco loss and serious cracks. Vines are still intact in these areas.

The top of the west tower is no longer structurally sound. A tree and other vines are still growing out of the west tower, progressing the other problems such as delamination and are causing water to enter the monument. The root system also causing this water to be retained. This is the area of greatest loss.

There is a major crack opening at the top of the tower that has cracked both brick and mortar. It appears to be getting larger both vertically and horizontally. This crack has caused the displacement



Figure 5. Bulging and delamination of the stucco.

WEST TOWER

of brick causing them to become loose and fall. The displacement can be attributed for the loss of mortar and broken mortar joints. Much of the top of the west tower has significant stucco loss. All of these conditions together are a loss of overall historic and structural integrity.

Historic photographs show the presence of stone work at the top of this tower. Some of the stone work is still apparent on the east tower, however another layer of stone was once on top of the stonework still present. The west tower has lost all of this material.

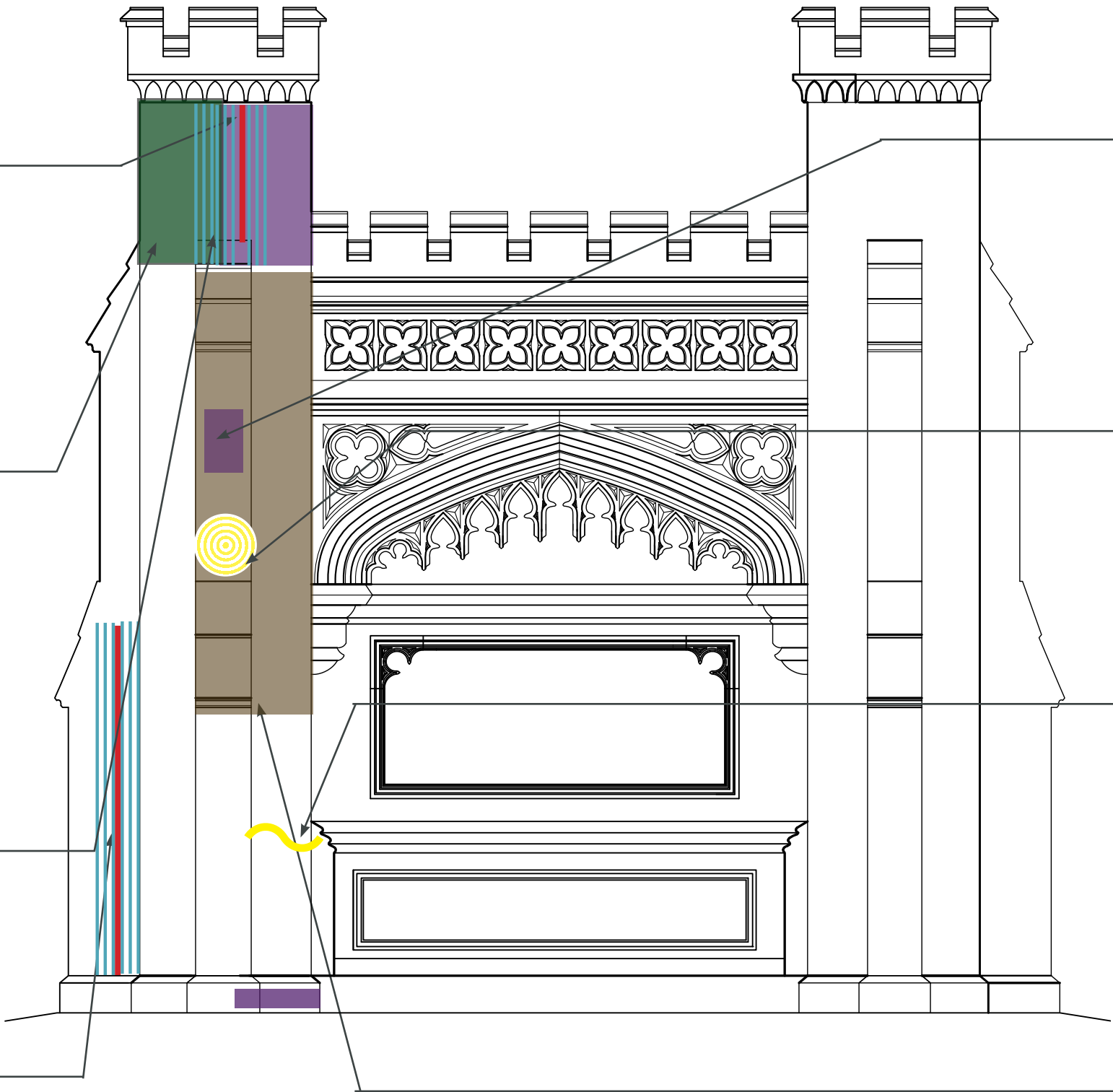


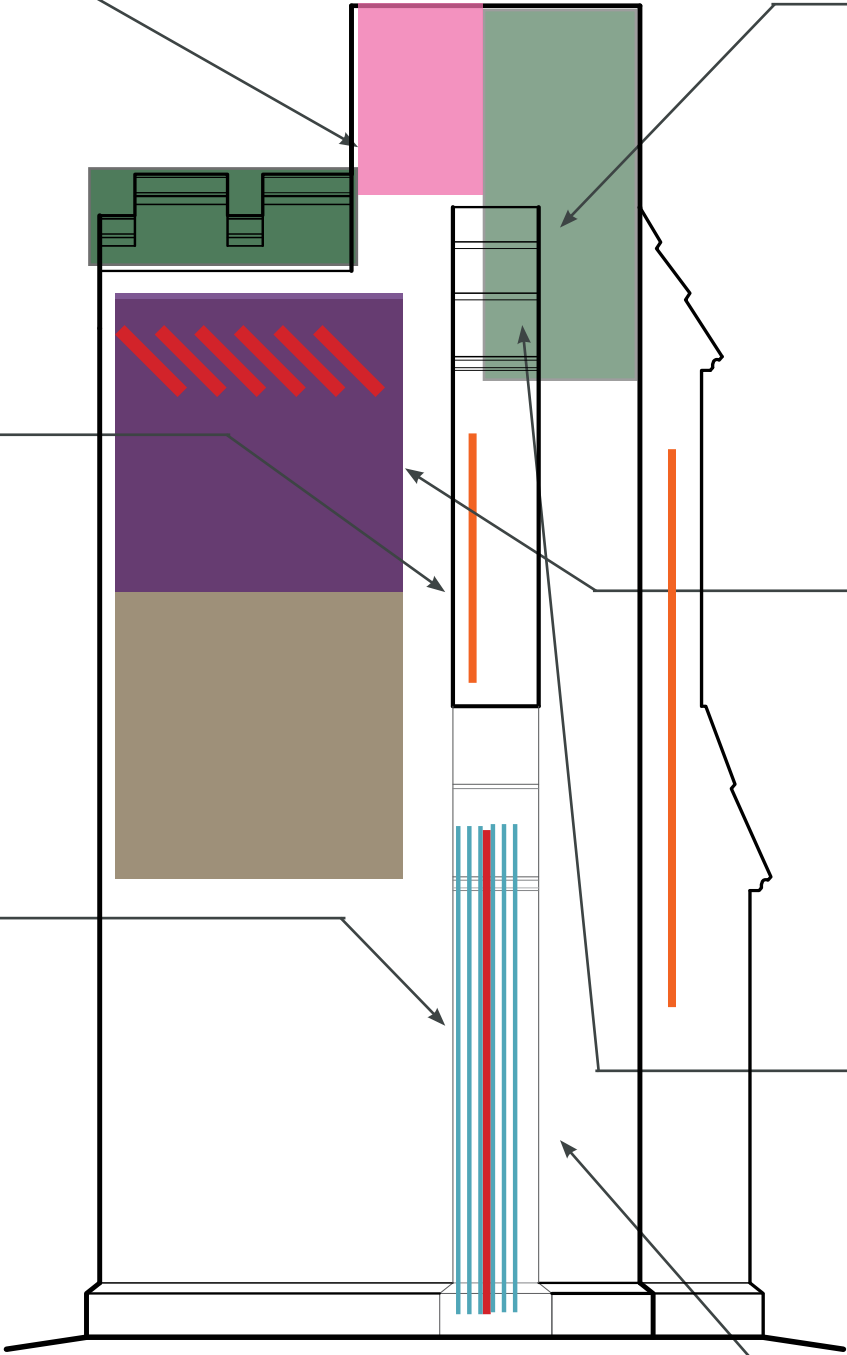
Figure 6. Historic photograph of the west tower.

The buttress to on the west side elevation of the tower is no longer intact. Material loss is extensive as it appears that stone used as a structural as well as decorative feature of the monument has been lost. Brick, mortar and stucco has also failed in this area and there is a significant gap on the west side of the monument. The buttress is still partially connected with the wall surrounding the site and the foundation, however there are vertical cracks, indicating that the wall is leaning away from the buttress.



Figure 7. The crack in the west buttress from the north side of the monument





EAST TOWER

The east tower has settled and is shifting to the east. This has led to some separation between the tower and the rest of the monument, resulting in cracking. This may have caused some of the other deterioration issues such as mortar loss and stucco failure.

Biological growth is prevalent throughout the monument. On the east tower there is residue that has been left behind from vines which have been removed. Mold and mildew have stained certain areas of the tower black. There is lichen growth and a tree or vines growing through the tower, exiting through the top and back.



Figure 8. Staining and biogrowth present on the buttress

In the masonry itself, there are issues with the stucco and the brick. The stucco is delaminating in places and there are cracks, generally along the brick course lines. Portland type mortar has also been placed in areas where the stucco has delaminated. The brick work that is exposed shows missing mortar.

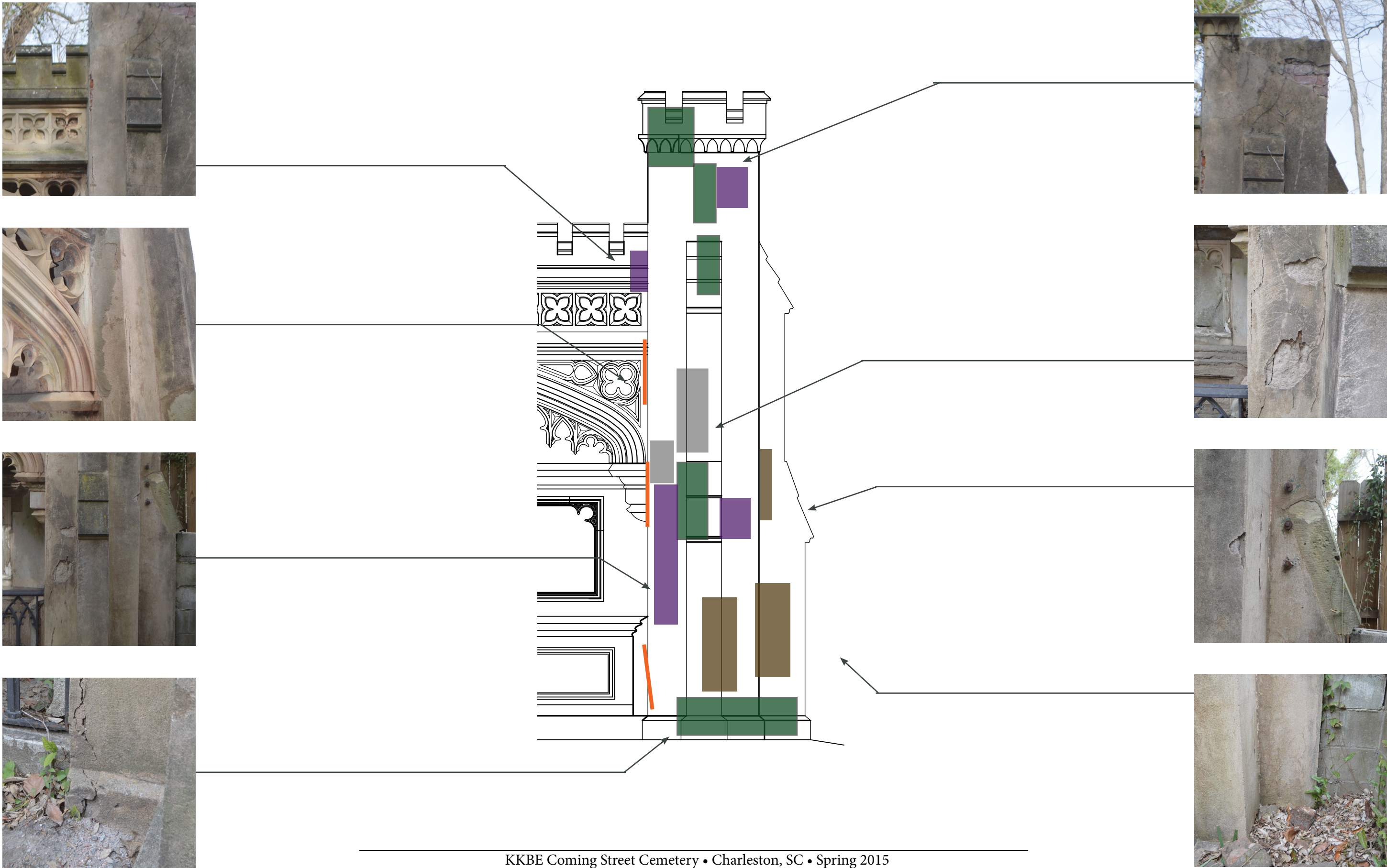
On each tower there is a buttress that helps to support the monument. On the east tower, there are iron bolts that protrude from the center of the buttress. The purpose of these bolts are not known. They are corroding though no cracks have formed around the bolts. The top of the tower is missing architectural features.



Figure 9. Staining and vines present on the east tower, vines have caused delamination, bulging and stucco loss.



Figure 10. Bolts on the east side of the tower of unknown purpose



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CENTER AND INTERIOR

There are several large cracks on the center and interior of the monument. The most noticeable is on the stone archway over the metal railing on the front of tomb. The two pieces of stone that create the arch have separated due to settlement. There is another large crack that starts above the inscribed marble slab. It continues upward onto the ceiling of the interior of the tomb. There are several smaller cracks that are related to stucco or brick failure. Some of the interior stucco appears to be original and the remaining lime wash could possibly be first generation. Some delaminated stucco has been infilled with Portland cement. Bricks have softened and there is mortar loss in areas where the brick is exposed due to stucco loss.

Moss and several small plants are growing on the interior. There is staining on the front of the tomb and on the stone embellishments above the archway.

The most interesting deterioration found on the interior of the tomb is the extensive black crust on the inscribed marble slab. Black crust can actually be

white or black. It more commonly occurs in densely populated cities with high levels of pollution. It is an encrustation of mineral deposits that is more concentrated than other soiling patterns. It has caused the marble to become brittle and flake off when touched even very lightly.



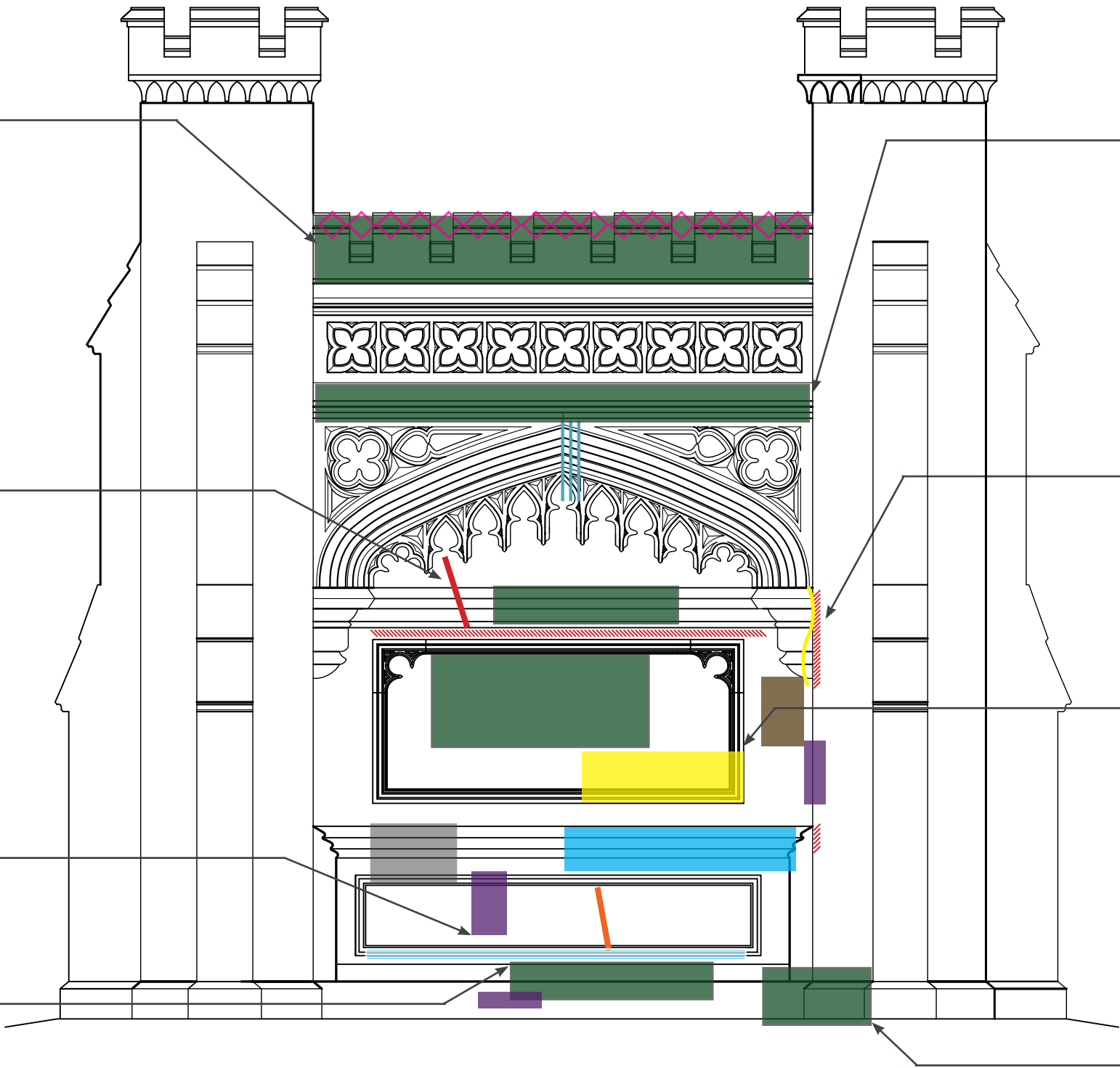
Figure 12. Major crack on the interior of the monument.



Figure 11. The shift in the center stones.



Figure 13. Black Crust on the interior of the monument.



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NORTH ELEVATION

There is a large section in the center of the north elevation of the monument where the stucco has delaminated. Stucco failure is occurring over the entirety of the wall in the form of cracks especially along the top portion and western edge where it covers the roofing material.



Figure 14. Area of Delamination

Vines are growing in a few places across the north elevation. The vines reach from the base of the monument to the top. The vines, mostly lie across the surface but they have started to penetrate the lower mortar joints of the section where the stucco has delaminated and left the bricks and mortar exposed. A vine has also grown underneath the slate roofing material into a separation between the roofing material and the masonry structure.



Figure 15. Moss and vines growing on the north elevation

Biogrowth is on most of the stucco in the form of algae and unidentified black matter. The brick exposed by the delaminated stucco also has biogrowth.



Figure 16. Area of delamination and poor repair.

Portland cement composite repairs have been used to fill in sections along the edge of the slanted roof and on the back of the section near the top of the monument. Portland cement has also been used to fill in the space where the top of

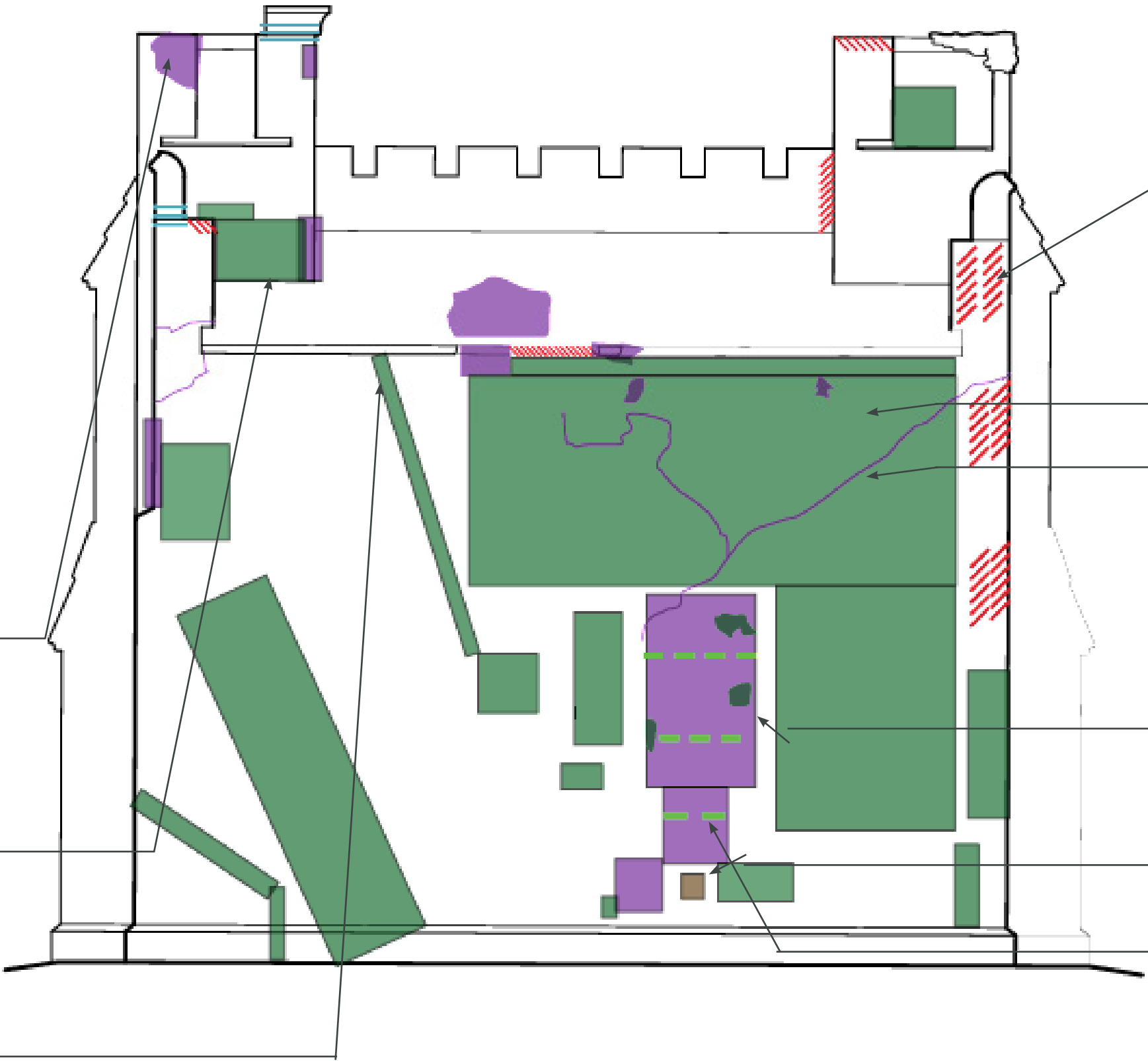
the west tower is leaning away from the monument. The current repair is beginning to crack. Portland has also been used to fill in a small section behind the decorative stonework where stone is missing. A similar section in the same area has not been repaired using this material.

Some mortar joints have begun to deteriorate in areas where the stucco has delaminated and the brick and mortar is exposed. As the joints degrade, they become increasingly dry and sandy. Other mortar joints are intact while others appear to have been pointed with portland cement. No open mortar joints were observed.

The slate roof covering the monument extends past the north elevation on the eastern half of the wall and extends it does not appear to be attached to the masonry structure beneath with mortar or fasteners. The slate roofing material on the western half of the north elevation remains covered with stucco or composite Portland cement repairs. Decorative stone work on the top of the west side of the north elevation is detached from the monument but remains in situ.



Figure 17. Displacement of the monument.



FOUNDATION

It is difficult to determine how much of the original foundation remains. The brick foundation appears to step out around the structure, similar in plan to the structure itself. On the south-west side, the foundation extends 1 foot 6 inches from the structure. But in the center of the south side, the presence of David Lopez slab monument disrupts the space. Here foundation appears to end 1 foot 5 inches from the structure, but it is impossible to determine if this was the original arrangement. On the south-east side of the structure the sidewalk and its footer have prevented probing to determine the extent of the foundation. The depth of the foundation is irregular, presumably from settling. Along the west side the foundation is approximately 7.75 inches below grade. While on the east side it averages 5.5 inches below grade. This supports other evidence that the west column has shifted more than the east column.



Figure 18. Area dug for investigation

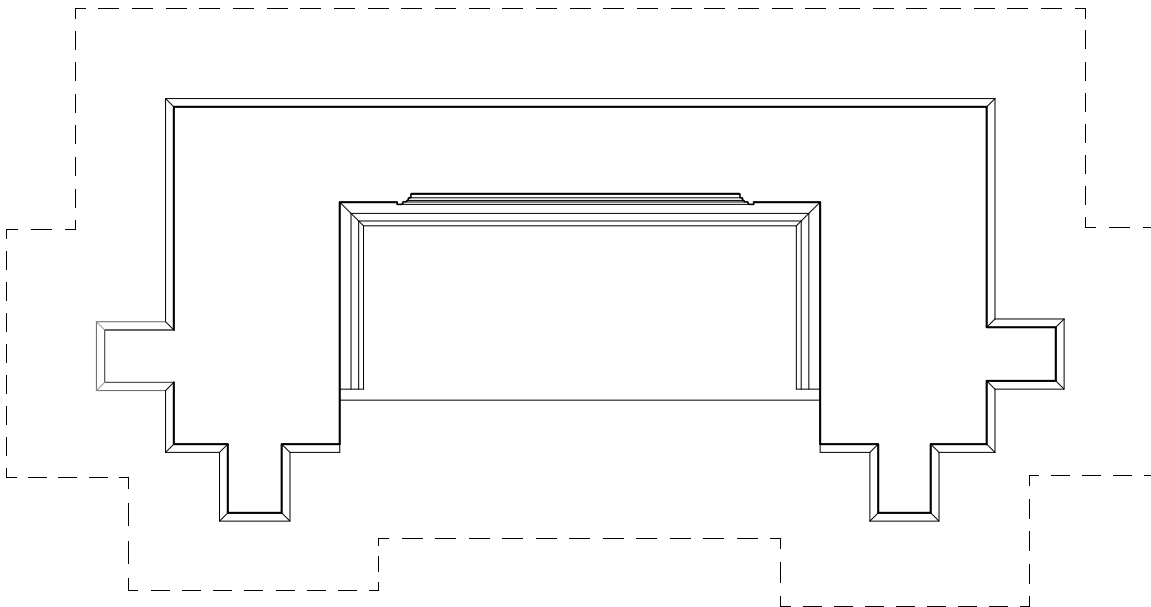


Figure 19. Hypothesized Foundation

EXTERIOR WALLS



Figure 19. Vines and other biogrowth on the east wall.



Figure 20. Staining and biogrowth on the east wall.

Three exterior walls border the Lopez section at KKBE Coming Street Cemetery. The entrance to the Lopez section is a cast iron gate on the south boundary. The gate was restored by Sean Ahern in the summer of 2014 and is in good condition. The east wall is made from concrete masonry units with portland cement mortar. It is in fair condition. The east wall has scattered areas of biogrowth. The majority of the

biogrowth is moss and lichen; there are only a few areas of plant growth. Vines at the bottom of the wall have begun to grow up the wall, but have not displaced any material. The biogrowth has stained the CMU. The east wall is bowed in two locations: The northeast corner and in the middle of the wall span. There are deteriorated joints in these areas as well.



Figure 21. View of the east wall with bowed section



Figure 22. Bowing in the northeast corner



Figure 23. View of the stuccoed masonry and CMU sections of the west wall. Biogrowth and staining is visible on the CMU.

The west wall is made of two different materials: the northwest side of the wall is stuccoed brick and a very small portion of the southwest side is CMU with portland cement mortar. The CMU section is in fair condition and has the same biogrowth and staining issues as the east wall. The rest of the west wall is in poor condition. Vines cover the top of the entire wall and other plants grow from cracks on the side of the wall. Moss and lichens grow on the top half of the wall and stain the surrounding areas. There is a small

tree growing out of the top of the west wall at its southern end.

Stucco has delaminated from the brick in many areas. The exposed brick has deteriorated mortar joints and plants that grow in between the bricks. The majority of the cracks in the west wall run horizontally. Some of the vertical cracks have been filled in with portland cement. The entire wall is bowed.

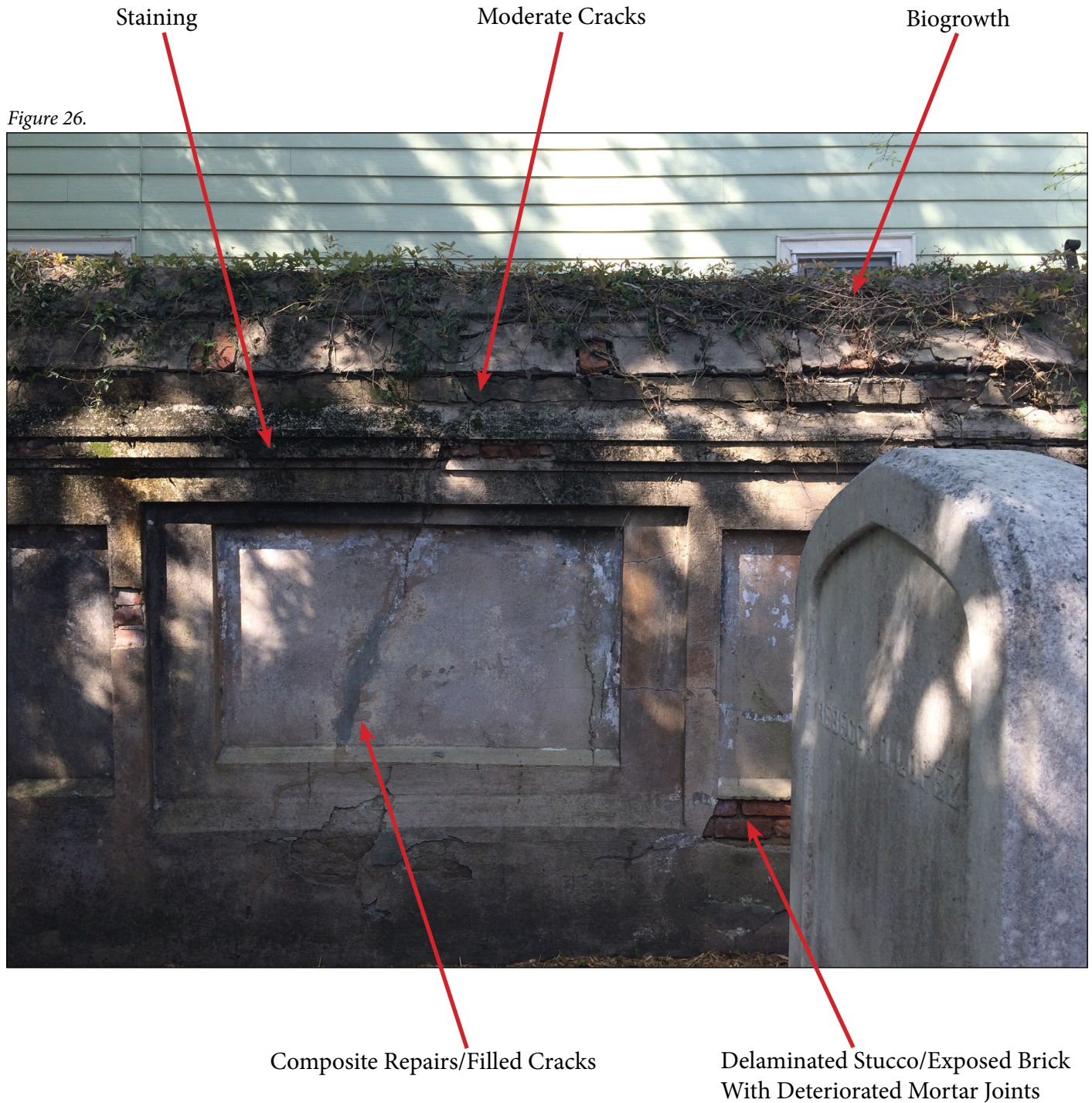


Figure 24. Horizontal cracks, biogrowth, and staining on the west wall. The small tree is growing from the top of the wall.



Figure 25. Detail of biogrowth in the horizontal cracks

Typical Conditions of the West Wall



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Figure 27 and 28. Bowing on the north (top) and south (bottom) sections of the west wall



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PATHOLOGY

While each side of the monument has slightly different deterioration issues, all have the same underlying causes: moisture and biogrowth. The Lopez monument was not designed with a water drainage system, so there is no way to direct water away from the structure. A small portion of the slate roofing system remains on the west side of the north elevation, but the eave is not large enough to shed water away from the foundation. Moisture causes stucco to delaminate from the masonry and encourages biogrowth. Bricks and mortar exposed to excess moisture soften and deteriorate, degrading the structural integrity of the monument. Excess moisture can also cause soil erosion, which leads to differential settlement. The interior of the monument is never exposed to sunlight so moisture accumulates easily. Bulging in the floor of the interior is likely due to excess moisture underneath the cement.

The monument is in a shady area and until recently was covered in vines, which hold in moisture and do not allow sunlight to warm the stone and evaporate any absorbed water. Vines growing up the monument can work their way into cracks and crevices. When they expand, the vines can push the stucco away from the masonry, causing it to delaminate. Vines may also be responsible for the displacement of the decorative stone pieces on the top of the towers. Trees growing around the monument may cause the structure to move. Their root systems can grow under the foundation and displace soil, causing settlement. A small tree growing out of the west tower had displaced most of the bricks and mortar around the top, causing the stucco to delaminate and the top half of the tower to become structurally unstable. Other forms of biogrowth such as mosses and lichens hold moisture on the monument's surface and stain

the stucco. The interior of the tomb gets very little sunlight and is often damp. This creates the perfect environment for biogrowth and other forms of decay such as black crust.

Moderate cracks in the monument are caused by moisture intrusion and stucco delamination, and major cracks are caused by differential settlement. When one portion of the structure settles at a different rate than the rest, other parts of the structure move to fill in the open spaces. Too much uneven movement puts stress on the monument, causing cracks to form. Repairs to the stucco made with an incompatible material, such as portland cement, cause cracks because the original stucco is much softer than the modern-day portland cement. The two materials expand, contract, and move at different rates.

The walls around the Lopez section have many of the same types of deterioration as the Lopez monument. The bowing of both the east and west walls is caused by the trees that grow on the exterior of the wall. Their root systems pushed the wall out of plumb. Vines, moss, and delaminating stucco are also present and have the same causes as those on the monument.

RECOMMENDATIONS

The recommendations for the Catherine Lopez Monument were created to ensure the continued preservation of this unique and special historic monument. The recommendations include suggestions for preventative maintenance of the monument and the David Lopez plot site. It is also important to consider that long-term conservation requires long-term maintenance and retreatment and thus cost must be considered. It is with these factors in mind that the following measures were chosen for the conservation plan and recommendations for the Catherine Lopez Monument. The recommendations are made for immediate action and maintenance on an annual basis.

Immediate Action for Catherine Lopez Monument

The west tower of the monument needs immediate attention. The tower must be stabilized, as it is currently unsafe for visitors to the site since loose stone pieces and bricks pose safety hazards. Craig Bennett, a local engineer and preservationist, was consulted to determine what course of action might be best for stabilizing the west tower. Six options were discussed during the consultation and are presented below:

1. Reconstruct: Stabilize the west tower by rebuilding it completely in the likeness of the original design.

There are three materials, each of which would affect the aesthetic quality of the structure, that have been suggested with which the west tower could be rebuilt.

- a. Unreinforced masonry with added sand coated fiberglass rods for winds and seismic reinforcement
- b. Concrete or CMU for the structure, brick veneer facade, and stucco applied on top to create an appearance of original monument materials being used.
- c. Concrete or CMU with no coating applied

2. Stabilization: Another option is to provide support behind the arch with a tie rod. It is recommended that the tie rod be black and thin, perhaps an inch thick, to prevent noticeability. The tie rod should be galvanized or stainless steel. Galvanized steel is easier to finish. The tie rod should then be secured in place with earthquake washers. The tie rod may also be secured by means of a split or round plate adhered to the outside of the buttresses or a small cut can be made and the rod slid in place. A second tie rod may be needed near the back of the interior section of the monument for full stabilization. In order to determine the best place for the rod to support the structure a finite element analysis can be undertaken by an experienced structural engineer. This test analyzes where the rod can best resist the thrust of the settling monument. However, it is an expensive procedure.

Moisture is a major mechanism of decay causing deterioration issues within the monument and a system for guiding water off of the structure should be installed. Restoration general contractor Richard Marks was consulted to determine an effective procedure for achieving this conservation repair.

- A floating roof system should be installed over the structure to handle movement. A membrane applied over the stone will help dry it out. The floating roof could be made inexpensively from simple buttons, plywood and bithathane and lasts 3-4 years. Bithathane is the synthetic membrane material used for the roofing. The

membrane will have to flash into masonry so that water runs off the structure instead of being directed on to it and causing moisture damage.

Annual Catherine Lopez Monument Maintenance

An annual maintenance plan for the Catherine Lopez Monument will assist in preventing further deterioration. The conservation procedures listed should be undertaken by a trained professional.

- Soiling and Biogrowth (Algae, Bacteria)

Water cleaning methods were chosen for removing soiling and biogrowth. The reasons are that water cleaning can be performed as many times as needed. Water cleaning must be done from top to bottom to avoid dirty water running over already clean areas. A garden hose can be used and should not be pressurized. Natural bristle brushes can be used in combination with the water to assist in removing soiling. A gentle non-ionic detergent may also be used for tougher to remove staining. A small amount of the detergent should be mixed in a bucket and applied using the natural bristle brush. Brushing the surface of the monument must be done lightly to prevent further delamination of stucco. The washing should be able to remove dirt and small biogrowth such as algae. If water is not sufficient for removing biogrowth, then a biocide such as D2 might be tested in a small area by a trained conservator.

- Biogrowth (Woody)

The vines taking over joints in the monuments should be cut using root cutters and gently removed. They should not be pulled out forcefully as this may affect any unstable elements in the structure. Pulling the vines may result in loss of original material or structural stability. A structural assessment is needed for the west tower before the tree is removed due to the risk of collapse. If the tree is removed, the west

tower may need to be rebuilt.

- Cracking

Crack monitors should be used to determine if large cracks are active. If cracks are active and not historic then structural repair of the west tower must be considered. A lime-based mortar could be applied immediately as a temporary fix to the cracks. If the cracks are stable then a lime mortar can be mixed and injected into the cracks using grout filler or applied with small masonry trowels to prevent moisture or biogrowth from causing deterioration within the structure.

- Black Crust

The simplest way to remove the black crust is to use water from a garden hose. Water is particularly useful for removing sulphate crusts from limestone since in cold water gypsum is 150 times more soluble than limestone (calcium carbonate). For additional conservation, a clay or fiber poultice can be used to draw any remaining crust to the outer surface of the poultice by a trained conservator. The area that is to be poulticed should be wetted first and edged with cotton or the poultice. A thick layer of poultice should be applied and covered with a plastic sheet to slow evaporation.

- Broken stone

The top stones on the monument are located around the cemetery and can be reattached. A professional should be used to reattach the displaced stone since experience with a drill and cutting fiberglass is required. It is recommended that fiberglass rods be used to pin the stone back in place. Two drill holes should be marked on the broken piece and the monument that match. The two marks can then be drilled to a depth where the fiberglass rods are inserted substantially in each area. The rods are then placed in the stone, the broken piece slid into place,

Annual Site Maintenance

- Displaced bricks and stones should be regularly collected and removed from around the base of the monument and site area and placed into a collection area for future repairs.
- Weeds should be dug from the ground to keep aesthetic appeal and from maintaining water in the soil. Vines should be clipped with garden cutters and removed before they insert themselves into joints.
- For the maintenance of the site, mulch can be added to prevent growth of unwanted weeds and to provide aesthetic appeal to the area.
- Stones should be cleaned with water either from a hose or a pressure washer. Non-ionic detergent can be mixed in a bucket and applied with natural bristle brushes. The gravestone can be scrubbed and rinsed again with water.
- For the maintenance of the site, mulch can be added to prevent growth of unwanted weeds and to provide aesthetic appeal to the area.
- Poultices should be applied to highly soiled gravestones to make the designs visible. A trained conservator must apply the poultice.
- Stones should be cleaned with water from a hose. Non-ionic detergent can be mixed in a bucket and applied with natural bristle brushes. The gravestone can be scrubbed and rinsed again with water. A trained professional should oversee the work.

Conclusion

The course of action prescribed in the recommendations was chosen so the least amount of intervention necessary is used. The methods were also chosen with cost in mind since some techniques require a large fee for technology and professional expertise. The conservation plan also kept in mind that the ability to retreat is needed and that annual maintenance is required for continued preservation.

APPENDIX