Exterior Brownstone Assessment

Arlington Street Church

for

The Foundation for the Preservation of 20 Arlington Street, Inc.
Boston, MA

28 March 2018

Contents

Key Contributors

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Introduction

The Arlington Street Church building was built in 1861 by the congregation of the historic Federal Street Church in a pioneering move from downtown Boston to the new undeveloped Back Bay neighborhood. With the move, the congregation took the name Arlington Street Church. The occupancy history of the building has been consistently of similar use by the same congregation since its construction to date.

The church was originally designed for the congregation by Arthur Gilman, his design being inspired by St. Martin in the Fields in London. The primary exterior material chosen was New Jersey brownstone, including ornately carved stone on the steeple – aesthetically rich, but susceptible to the elements. Exterior materials also include wooden cornice elements, wooden doors and windows, a slate roof with copper details, some membrane roofing, and some ironwork.

The church building is a contributing resource to the Back Bay Historic District, which was designated a National Register District of national significance in 1973. It was also individually listed on the National and State Registers of Historic Places in 1973 and designated a Boston Landmark by the Boston Landmarks Commission in 1978.

The congregation has a history of stewardship and care of the building through the years, including repairs and restoration to brownstone, roofing and interiors. Examples include repointing open joints of the steeple in 1923, waterproofing and repairs to the spire after hurricane damages, replacement of the south pitch of the main roof in 1989, and stone repairs to the steeple and cornices at the main body of the church in 1996/97.

Most recently, the restoration of the church's Tiffany stained glass windows inspired the formation in 2016 of the Foundation for the Preservation of 20 Arlington Street, Inc. The Foundation is focused on the overall restoration of the landmark building and sharing its historic and artistic legacy with the public. With the completion of the stained glass, the Foundation turned its focus to the brownstone and requested this assessment.

The primary focus of the assessment was the brownstone of the church, but it did review the Parish House as well. Also, a review of structural condition, roofing, woodwork and other aspects related to the brownstone were included, taking advantage of the opportunity for access by mechanical lift. The process included the on-site inspection of conditions, the recommendation of a scope of work for repair/restoration, the development of a phasing strategy for incremental implementation and a budget level estimate of the anticipated costs for the work.

The assessment was coordinated by architectural preservation consultant William Barry of Heritage Planning & Design, and the team of specialists included Ivan Myjer of Building and Monuments Conservation, an architectural conservator and specialist in brownstone, leading

the assessment of conditions and the development of treatments for the stone. Preservation masons Phoenix Bay State Construction facilitated the on-site work and make-safe efforts, advised on strategies for phasing and provided the budget level estimating. Additional consultation was provided by structural engineers Structures North, architectural woodwork conservator Richard Muckle with M&A Architectural Preservation, and historic roofing expert Alex Alpert of Gilbert & Becker.

The on-site inspections and make-safe operations took place primarily during the week of December 11 – 15, 2017. Inspections were made primarily from a 135' telescopic boom lift, but also from adjacent roof areas and from the street with binoculars.

The last known major focus of work on the exterior brownstone was approximately 20 years ago. Noticeable advances in deterioration of the stone prompted the Foundation to request this exterior assessment, and initial visual observations of the stone from the sidewalk by the team elevated the urgency of the assessment and indicated that it would have to also include efforts to make safe certain existing conditions.

As detailed later in this report, the condition of the exterior masonry varies considerably. There are some areas in very good condition, but several areas of the steeple and portico show severe weathering of the sandstone as well as cracking and failure of mortar patches that are now at least 20 years old, with some older. Given the proximity of these areas to the entry and the street, the inspection team spent a significant amount of their time removing loose and friable stone and failing patches. Unsafe conditions are not always readily visible, and it was not possible to safely reach and remove all the stone and mortar patches on the steeple that presently constitute a potential safety hazard. Knowing that implementation of even the earliest phases will require time for fundraising, a recommendation for further safety and stabilization was provided separately and in advance of this report to assist the Foundation in the application for emergency funding for further make-safe and stabilization.

Also separate from this assessment, but coincidental to an extended estimating period, assistance was provided to the Foundation in timely pursuit of funding through the recently re-energized federal Save America's Treasures program. To suit the requirements of that grant application, a scope of work was identified that constituted only a portion of the first phase recommended by this assessment. The estimate provided here is flexible in that it can be reassembled into different phases or sub-phases with proper consideration.

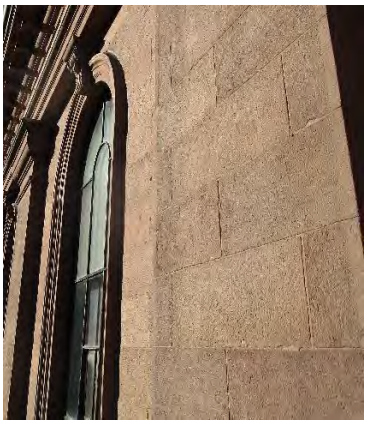
Brownstone Conditions & Recommended Treatment

The lift provided close access to the exterior below the spire. The spire itself could not be accessed at close range. The interior spaces of the sanctuary as well as the interior of the steeple were inspected for signs of water infiltration and other damage. The assessment of conditions included close visual inspection, and where possible, the sounding of stone.

The exterior masonry was examined up to the height of the top of the lantern from a very close range. Units that project from the building line, as well as all existing patches within the reach of the lift were tapped with a mallet to determine if the stone or the patches were loose. In addition to recording the conditions, emphasis was also placed on evaluating potential safety hazards and mitigating those hazards in areas that could be safely reached by the lift. Mitigation consisted of removing sections of cracked and delaminated sandstone as well failing prior repairs.

Several hundred pounds of loose deteriorated stone – enough to fill about ten five-gallon buckets – was removed during the survey. Also removed were two large intact chunks of stone – one located 35 feet directly above the main entrance to the church and another from an engaged column at the lantern level of the steeple 125 feet above Arlington Street and the church entrance.

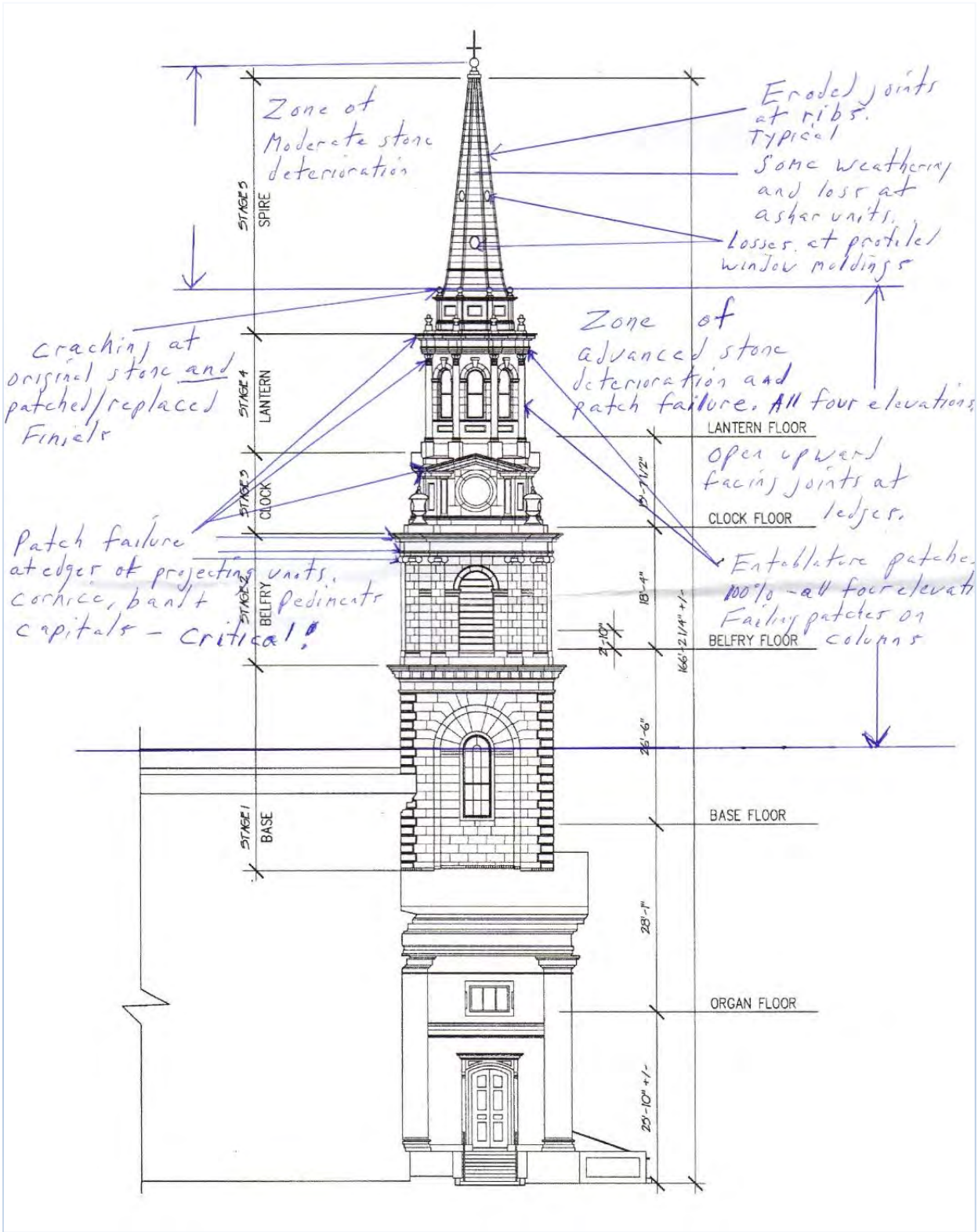
The condition of the exterior masonry varies considerably from location to location. The large expanse of stone along the north and south walls of the nave is in very good condition, including most of the window sills and trim, and does not require a significant amount of work. The base at grade, however, has a variety of issues including open joints, deterioration of original stone, and a large array of unsuccessful patching attempts. It appears that drainage has been installed to address issues of rising damp at the base.



In contrast to the good condition of the nave walls, the stonework on the steeple located in a zone that extends from just below the belfry floor to a line just above the top of the lantern is in very poor condition. Within this zone the issues are not just severe weathering of the sandstone but also the cracking and failure of mortar patches applied at least 20 years ago.

The failure of previous patches applied to the stone represents as large a potential safety hazard as the weathering of the brownstone units. This is because the patches were applied over the weathered edges of units that project from the wall plane as well as, in many cases, the undersides of the same units. The principal mode of failure in the patches is cracking and debonding of the patch material itself. The deterioration of the patches has been accelerated by the ongoing weathering of the stone substrate below the patch. Most of the patch failure appears to be related to the manner in which it was applied – in a relatively thin layer across broad expanses of the stone, and in some instances applied across existing mortar joints. The deterioration of the brownstone itself on the other hand appears to be closely related to the deferred maintenance of failed and open upward facing mortar joints.

While the conditions in this zone of the steeple were partially mitigated by removing loose and friable stone and failing patches during the inspection of December 2017, it was not possible safely reach and remove all the stone and failing mortar patches on the steeple that presently constitute a potential safety hazard. From a safety perspective, addressing the stone and patch deterioration that was observed on the lower section of the steeple is the highest priority for the exterior of the Arlington Street Church.


Zone of Moderate stone deterioration
Eroded joints at ribs. Typical
Some weathering and loss at ashlar units.
Losses at profiled window moldings
Zone of advanced stone deterioration and patch failure. All four elevations
Cracking at original stone and patched/replaced Finials
Open upward facing joints at ledges.
Patch failure at edges of projecting units. Cornice, band & capitals - Critical!
Entablature patches 100% - all four elevations
Failing patches on columns
STAGE 5 SPIRE
STAGE 4 LANTERN
STAGE 3 CLOCK
STAGE 2 BELFRY & pediments
STAGE 1 BASE
LANTERN FLOOR
CLOCK FLOOR
BELFRY FLOOR
BASE FLOOR
ORGAN FLOOR
15'-7 1/2"
18'-4"
2'-10"
166'-2 1/4" +/-
29'-6"
28'-1"
25'-10" +/-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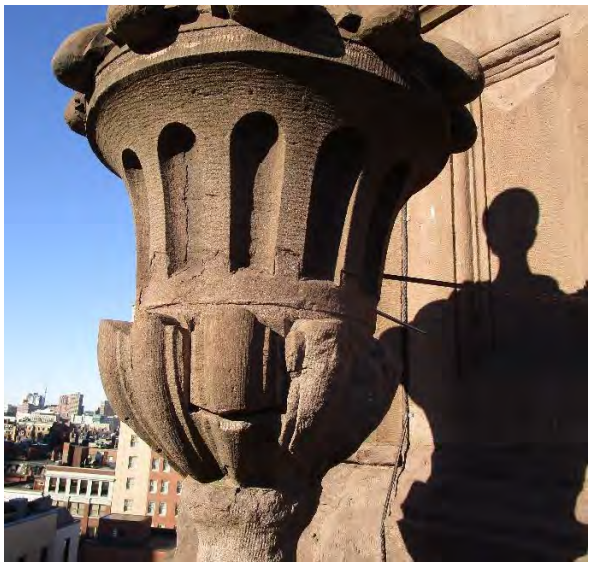

A second zone of advanced deterioration is located along the horizontal and raking cornices of the pediment of the portico on the east entry elevation. At the north and south ends of the pediment, the corner blocks that form the intersection of the horizontal and raking cornices are in very poor condition as are many of the modillion blocks located directly below the cornices. The crown of the raking cornice is wood.

On the underside of the northeast corner of the pediment, the original corner modillion blocks are missing, having been removed or possibly detached on their own at some point in the past. Three iron anchors that originally secured the corner modillion blocks to the building are visible where the blocks detached. It is likely that the stone detachment was caused by the corrosion and subsequent expansion of the original iron anchors used to secure the modillion blocks to the wall. The remaining corner modillion blocks were checked during the survey and no current problems were observed; however, corrosion likely exists and replacing the original anchors before they cause the stone to fail is a high priority for the near future.

On the east elevation the advanced stone deterioration is largely confined to the pediment and the steeple. Fortunately, the beautifully carved ionic capitals on top of the round columns that flank the main entrance as well as the composite capitals at the adjacent pilasters are in very good condition. The columns themselves are in good condition structurally but one has a large unsightly patch. The lintels over the north and south bays are cracked, and were flagged for structural review.

There are a significant number of unsightly large but relatively shallow patches on the columns and the east elevation ashlar that have reached the end of their service life. These patches, which are highly visible due to a color shift over time, date from a generation even earlier than the failing patches located at the mid-section of the steeple.

In addition to these zones of concentrated deterioration and conditions in need of treatment, there are localized conditions observed around the building accounted for in the recommended treatments.

In analyzing all of the brownstone conditions observed, there are several things to consider. The sections of the building that are currently in the worst condition are the same sections that have been repaired extensively in the past – an indication that stone weathering is advancing at a faster rate in the mid-section of the steeple than in other locations on the building. The reason for the difference in the rates of weathering around the building is the result of geometry of the structure coupled with the shapes and profiles of the units themselves. The units at the mid-section of the steeple contain more freestanding elements such as finials and urns as well as a greater number of profiles that terminate in attenuated edges. Units of stone that are both thin and exposed to the elements on more than one side deteriorate faster than units that are flush with the wall plane. The presence of many ledges with upward facing mortar joints is also a major factor in the deterioration of the stone as water, snow and ice accumulate on the ledges and infiltrate the upward facing mortar joints.

The options for repairing deteriorated sandstone have not changed all that much in recent decades however the manner in which they are employed has evolved overtime. Twenty years ago a great deal of emphasis was placed on rebuilding areas of loss with tinted patching mortars and treating large expanses of stone with topically applied chemicals that were thought to slow down the rate of stone deterioration either by inhibiting the uptake of water into the stone and/or by strengthening the surface. Current practice, which has profited from the evaluation of earlier treatments, leans more toward, reducing water infiltration through mortar joints by covering upward facing joints and, replacing rather than repairing severely deteriorated units or sections of units.

Summary of Exterior Stone Conditions:

A. Delamination along the natural bedding places.

B. Scaling – generally following the contours of the unit rather than the natural bedding planes.

C. Friable stone – generally at the leading edges of units or at the undersides where water flows over the stone.

D. Cracking – Several types of cracking were noted – related to separation along the bedding planes or the expansion of corroding steel anchors or inserts.

E. Anchor spalls – related to the expansion of ferrous metal anchors between stone units.

F. Cracked and failing stone patches on vertical surfaces.

G. Cracked and failing stone patches on the up surfaces of ledges.

H. Cracked and failing stone patches on projecting edges as well as the undersides of projecting cornices, moldings and belt courses.

I. Cracked and failing stone patches at carved forms ie capitals, brackets, finials.

J. Open and failing mortar joints.

K. Failing sealants and lead joint covers.

L. Failing asphalt joint covers.

M. Dislodged flashing and related sealant failure.

N. Deteriorated castings used to replace missing or deteriorated stone elements.

O. Corrosion of lightening rod anchors.

P. Misc ferrous metal embedments that are corroding and expanding.

Q. Shallow troughs created by frost damage on the top surfaces of ledges.

General Recommendations for Masonry Restoration

1. 100% repointing of mortar joints.
2. Removal of 100% of existing stone patches and replacement with a combination of new stone patches, stone Dutchmen and possibly unit replacement.
3. Alternate: Removal and replacement of only visibly compromised patches as well as patches that ring hollow when tapped.
4. Removal of existing stone to stone anchors in critical locations and replacement with new stainless steel anchors. ie tops of round columns, corner modillion units.
5. Removal of scaling and delaminating stone followed by honing or tooling.

6. Fill of all losses and delamination at top surfaces of ledges and setbacks with stone repair mortar.
7. Removal of 100% of asphalt shingle joint covers.
8. Removal of 100% lead joint covers.
9. Full unit replacement of severely deteriorated units. Contingent on finding a suitable replacement stone or sufficient salvaged material.
10. Partial unit replacement (Dutchmen) of deteriorated portions of units. Contingent on finding a suitable replacement stone or possibly cannibalizing sound portions of large units that are be replaced.
11. After filling losses and delamination at top surfaces and removal of joint covers, cover all ledges with zinc coated copper flashing.
12. Removal of all ferrous metal embedments and patching of stone.
13. Pinning cracked units.
14. Replacement of carved capitals were existing patches are cracked and failing with cast units – cast stone, GFRC or resin casts.
15. Replacement of carved units that are extensively cracked and scaling with cast replacement units.
16. Removal and reinstallation of bird deterrent systems. Removal required to facilitate repointing and other activities.

Other Related Conditions & Recommended Treatments

Structural

A visual inspection of the building including the steeple observed no indications of significant structural concerns. Over the east entry, each stone lintel at the north and south bay spanning between column and corner pilaster is cracked. The crack in the lintel at the south bay extends into the soffit of the portico. While these conditions warrant the installation of appropriate anchorage and grouting, they do not appear to indicate recent movement. Inclusion of these repairs are recommended for early phases of the work.

Inside the steeple, there are a series of horizontal steel corner braces partially embedded within the brick masonry. Steel embedded within masonry is susceptible to corrosion, and while there are no current signs of significant corrosion at the embedded ends, proactive treatment is recommended.

Woodwork

On the east elevation at the pediment of the portico and at the flanking half-pediments of the main body of the church, the raking brownstone cornice has a wood crown detail. The wood is in need of conservation treatment, repair and special paint to preserve what is believed to be original wood building fabric. Restoration of its sanded paint finish should mimic the appearance of the adjacent stone.

On the west elevation of the church above the Parish House, the raking cornice is detailed entirely of wood – modillions, facia as well as crown. The wood appears to need less overall conservation attention, but localized repairs to preserve what is believed to be largely original wood building fabric, except locations of previous repair/replacement. Restoration of its sanded paint finish should mimic the appearance of the adjacent stone.

All wood windows and louvers of the steeple were inspected, and while the steeple is staged for other work, all of these elements should be addressed. The belfry louvers are deteriorated,

and require conservation including dutchman repairs, slat replacements and reconstruction. All window sash at the lantern and base of the steeple are recommended to be removed to a shop for wood conservation, restoration repairs and re-glazing with the same glass. Other windows throughout are more readily accessible and appear to be in reasonable condition requiring maintenance level attention in place. The portico wood entry doors require repair and restoration that can be done in place.

Roofing

The church roof is primarily of slate, with membrane roofing at certain locations such as the ridge detail, Parish House and some gutters. The portico is a Monson black slate that might be original and is now in need of replacement. It should be replaced only after staging of the steeple is complete. It is understood that the south slope of the main body of the church was re-roofed in 1989. A small amount of repair and slate replacement is warranted there, but at thirty years a quality slate roof should have significant service life remaining. The north slope of the main body of the church appears to be a mix of slate and is in bad condition and in need of replacement. Using a North Country Black slate is recommended as the contemporary equivalent to the Monson, both aesthetically and for durability and service life. The broad ridge detail at the main body of the church, is currently covered in membrane roofing, which could be repaired for a possible 10-15 years of additional service, however, by taking advantage of when the north side of the church is being staged and the north slope is being re-roofed, investing in its replacement with standing seam copper will provide at least 50 years of service.

The spire of the steeple is stone and the steeple does not currently have any existing roofing to consider. Ledges and horizontal stone surfaces at various levels of the steeple can be deep and broad, and open skyward facing joints has been identified as an important factor in stone deterioration. Those joints are extremely difficult to get to for maintenance, and previous attempts at covering them are showing signs of failure. These skyward facing stone surfaces are not visible from the ground. To protect the existing stone from further deterioration and to protect the upcoming new stone repair and restoration work, these ledges and horizontal surfaces should be covered with a cap of zinc coated copper. The same treatment is also recommended at the Portico on the top surface of the horizontal cornice of the pediment.

The Parish House is predominantly a membrane roof in generally acceptable condition with modest general repairs indicated. The roofing on the barrel shaped canopy over the Parish House main entry should be replaced in standing seam copper.

Bird Control

Bird control systems are appropriate for a building with architectural forms and details that provide potential perches and nesting areas. Given its height, the steeple is not considered. There are old systems currently in place, and the scope of work includes their phased replacement with similar but more up to date systems as masonry work is completed.

Lightning Protection

Lightning protection is in place but detached at some locations and the integrity of the paths to ground are not known. The scope of work includes a phased replacement of that system, expanded and updated to contemporary standards.

Wrought Iron

Wrought iron handrails at the main entry steps of the portico are in need of restoration and repair. The scope of work includes them being removed to a specialty shop for restoration, and it anticipates some degree of historically appropriate adjustment and or extension for better performance and compliance.

Exterior Lighting

The key exterior lighting elements directly related to the brownstone work are steeple lighting – if it were to be affixed to the steeple – and the two wall sconces at the main entrance of the east portico. There were light sources affixed to the steeple in the past, but they have since been removed, and lighting of the church has been from neighboring public poles and the surrounding landscape. Confirming the current approach, steeple lighting is not likely to be successful with fixtures affixed to the steeple itself, and maintenance of such fixtures would be very difficult. So, the scope of work does not include any provisions for wiring or attaching lighting fixtures to the steeple during the course of the stone work. It does include an allowance for the rewiring and conservation of metal finish of the two wall sconces at the main entrance.

Phasing Strategy for Implementation

A strategy for a phased implementation of the overall scope was developed, which sought to take into account issues of safety, fundraising the economy of staging and construction logistics.

From a safety perspective, the zones of extreme deterioration at the steeple and at the east entry portico are the highest priority. To avoid the extreme premium of duplicative staging, however, all of the work of the steeple should take place at one time. Also, time will be required for fundraising in advance of implementing even the first phase of the recommended work. To address those safety issues, additional stabilization and make-safe efforts are warranted for both the steeple and portico. A separate recommended scope and explanation has already been provided to the Foundation to help expedite special grant funding.

This phasing is intended as a guide for more detailed planning required to implement the work. It is understood that as planning progresses, there may be some adjustment warranted as to where certain items of scope are included between adjacent phases. So, in the development of bid documents for procurement of the work, the distribution of scope items should be confirmed or adjusted. Adjustments may also be required based on specific fundraising efforts.

Phase 1 – Portico

The first phase takes a first step by focusing on the Portico. This advances one of the high priority zones identified and addresses a high profile and visible aspect of the church to help build awareness, support and momentum for gathering resources necessary for the larger project.

Includes all work on all sides of portico from the ground up to but not including the portico roof, which is deferred to the end of the second phase after the steeple staging has been removed. Early planning efforts into the sourcing of replacement stone will be important.

Phase 2 – Steeple

The second phase advances the additional high priority zone and will enable the removal of any temporary safety rigging that will have been installed. It also tackles the most complex phase of the project, given several factors – the advanced state of deterioration, the ornate nature of the brownstone being repaired/restored and the extensive staging required.

Includes all work on the steeple, and after staging is removed, the portico roof work.

Phase 3 – Main Body of Church

The third phase focuses on the main body of the church, where portions of the brownstone appear to be in good shape, with the exception of extensive work at grade. By the time this later

phase is implemented, the non-critical but extensive roof work currently called for on the north slope will have advanced in need.

Includes all work of north and south elevations of main church building, the east walls and half-gables that return to meet the portico and steeple, and the main roof.

Phase 4 – Parish House & West Church Elevation

The fourth phase includes the lower priority areas, aspects of which are nonetheless unsightly. While these areas are considered important they are the least urgent.

Includes west brownstone façade of the church, including wooden cornice and the attached Parish House, including allowances for brick masonry at the alley and roof repairs.

Budget Level Estimate of Costs

An estimate of the likely work that will be required was prepared based on the conditions described above, the treatments proposed and the phasing strategy outlined. It assumes a qualified preservation mason will be the prime contractor, acting as the general contractor to coordinate the related work of others. It provides a conceptual overall forecast for the cost of the work.

In addition to estimating the cost of construction work, the summary for each phase includes an allowance for some owner's related soft costs. These might include administrative project costs or fees – costs that are related to the work, but not provided by a contractor.

The summary for each phase is supported by a contingency. While the estimate is based on specific observations onsite, some discoveries and adjustments are inevitable as planning advances, bid documents are prepared and as the work proceeds.

The estimate is based on today's dollars in 2018, yet each phase of work has been assigned an anticipated future start date. An escalation factor has been added separately to the project cost for each phase. If future planning requires a change in the anticipated implementation dates, it is important that the escalation be updated.

The estimate can be reorganized into different phases or sub-phases with proper consideration as future circumstances warrant. This has already taken place in a recent separate effort by this team to support the pursuit of a specific initial grant opportunity for only a portion of the first phase listed here.

Scope of Work

There were several guiding principles in the approach to the development of the scope of work, and it is recommended that the same principles and approach be applied as the scope of work is later refined and bid documents are prepared.

Not all instances of deteriorated stone require full restoration. Existing conditions are considered for both technical and aesthetic performance. Technically, repairs seek to maintain the integrity of the exterior envelope. Aesthetically, the restoration of form and profile is sought where losses are considered detrimental to the integrity of the architectural character of the church. In areas that do not contribute meaningfully to the perception of detail – such as areas at a distance or in strong shadow under cornices – consideration is given to doing less aesthetic restoration, while assuring that conditions are repaired to perform technically.

For durability, longevity and building envelope integrity, the focus is primarily on in-kind stone dutchman repairs and in-kind unit replacement. There are instances where engineered cast stone is appropriate, such as where large unit size might be difficult to source in natural stone,

or where there is a need to replicate repetitive units of ornate design, such as the central steeple, from the belfry to the base of the spire. Patching compounds and systems should be utilized selectively where necessary, such as repairs of shallow depth and mostly at locations that are more accessible.

Finding a strong aesthetic match in a replacement brownstone material is expected to be a challenge. A strong match is more likely to come from salvage sources and to be a limited quantity, so the use of such material should be prioritized for select locations. Generally, the repair and restoration work at or below the belfry will be of higher visibility and will warrant a stronger aesthetic match. The replacement stone for work above that level might be sourced from commercially available supplies with a less strong match or might utilize cast stone replacement.

Separate from this scope of exterior brownstone repair and restoration, is a project focused on building a more permanent access ramp for the front entry of the church. That project is understood to be on hold, however, initial phases of work resulted in the dismantlement of the south side entry landing and steps at the portico. It is expected that those entry steps will be reinstalled as part of that project, however, it is likely that some of the original brownstone elements may not be reincorporated due to the attachment of the ramp. Any unused original stone should be salvaged as stock for dutchman repairs around the building.

Some of the stone deterioration at the base of the main body of the church building was likely exacerbated by conditions of rising damp. The rising damp appears to have been addressed with drainage in past work and is not a part of this project.

Work that is not included in this estimate of costs for exterior repair and restoration:

1. The on-site assessment and make-safe operations already completed.
2. Additional on-site stabilization and make-safe – proposed separately.
3. South ramp and steps project.
4. Perimeter grade drainage understood to be completed.