Letter of Report

Albany City Hall Tower Belfry and Roof
Albany, NY

Vertical Access (VA) was retained by Mesick Cohen Wilson Baker Architects, LLP (MCWB) to remove woody plant vegetation and investigate and document the existing conditions at the upper portion of the masonry clock tower of Albany City Hall. VA technicians Mike Gilbert, Tom Zajicek and Evan Kopelson were on-site September 15 to 17, 2006 to perform the vegetation removal and condition survey at the roof and belfry levels of the tower. Larry Wilson and Elizabeth Martin of MCWB were also on site during part of the field survey for discussion of conditions observed by VA technicians. Jeff Hertik of the City of Albany Department of General Services and Elizabeth Martin were on site September 15 to assist with site logistics and preparation for the vegetation removal and masonry investigation.

The scope of work for this survey included investigation of the exterior brownstone portion of the clock tower, comprising the roof and belfry levels, and removal and mitigation of woody plant vegetation from the tower roof. VA used hands-on inspection and hammer-sounding techniques to investigate the existing conditions of the brownstone from the top of the roof to the base of the belfry level. Existing conditions were documented using a combination of annotated elevation drawings and still color photography. To remove and mitigate the woody plants, previously identified by Kent Diebolt as Populus tremuloides, or Quaking Aspen, VA technicians first applied herbicide to the leaves and stalks of the vegetation and after 24 hours cut the plants as far down as possible and applied a concentrated solution of herbicide to the remaining cut stem.

During the investigation of the existing conditions, VA technicians identified multiple conditions that are potentially hazardous. Most of these potentially unsafe conditions occur at previous patching repairs where the brownstone below and around the cementitious patches continues to deteriorate. VA technicians removed some failed patching material to mitigate the worst of these conditions, but numerous smaller and less advanced failed patches remain in place. Vertical Access recommends that a protective bridge be erected over the sidewalks on the west and south sides of the tower.

This Letter of Report with the spreadsheet of extracted survey conditions, supporting photographs and attached annotated AutoCAD drawings constitute VA's condition survey report. The photographs referenced in the Letter of Report are keyed to the drawings using an x-y coordinate name. Digital copies of the Letter of Report, AutoCAD files, photographs and extracted condition quantities are provided on compact disc.

Description of Deliverables

This Letter of Report consists of a brief historical and architectural description of the Albany City Hall tower, a description of the method employed for removal of the woody plant vegetation, general observations of the existing conditions and an outline of the specific conditions identified during the survey. The last section of the Letter of Report includes conclusions and preliminary interpretations of the survey findings.

Three appendices are included with VA's condition survey report. The first appendix contains the cut sheet and material safety data sheet (MSDS) for Roundup herbicide used to mitigate the existing vegetation. Appendix B is a copy of excerpted pages from *Building Stone in New* York by John C. Smock relevant to the East Longmeadow stone used at Albany City Hall. Appendix C is a sketch plan showing the location of displaced stone units at the roof level of the Tower.

Following the Letter of Report is a Spreadsheet of Survey Conditions, containing quantities, notes and photograph references for each condition documented at the belfry and roof. The conditions listed in the spreadsheet are extracted from the AutoCAD drawing of the survey and sorted by condition type.

The Photographs section of the report includes images of representative and notable conditions taken during the survey using digital still cameras. Each of the photographs included in the report is hyperlinked to a condition code within the AutoCAD drawing so that it can be viewed easily as a digital file. The photographs are named with a specific numeric nomenclature (x-y coordinates) that corresponds to the coordinates within the AutoCAD drawing where the conditions are located. The Cartesian grid used to name the photographs is shown on the elevation drawing. For reference, the table below lists the x-coordinates of the four sides of the tower:

x-coordinate	**Tower Facade**
1 to 49	West Facade
50 to 99	South Facade
100 to 149	East Facade
150 to 199	North Facade

Annotated Drawings documenting the condition of the belfry and caryatids comprise the fourth section of VA's condition survey report. For use as base drawings for the condition survey, MCWB provided AutoCAD drawings depicting the upper portion of the tower. During the investigation, existing conditions were recorded directly into an AutoCAD file containing the base drawings using VA's Tablet PC Annotation System (TPAS). TPAS allows direct input of survey information into an AutoCAD drawing so

that there is no loss of information in the transfer of notes from paper to computer. The severity and amount of each condition was recorded in the field using AutoCAD, which streamlines the process of take-offs and the transformation of condition notes to construction documents. A spreadsheet of the survey quantities is included in printed form and as a digital file with this report.

TPAS utilizes a library of previously drawn fault code symbols to annotate digital survey drawings in the field. Each fault type is placed on a separate, unique layer in the AutoCAD drawings to allow for easier manipulation and viewing of the survey data by turning layers on and off. The fault code symbols are part of an AutoCAD block library and are composed of a hierarchical grouping of fault attributes:

Material
Condition
Type
Severity
Amount

When all of the information collected in the survey is shown on an elevation drawing, the printed drawing may become unclear due to the density of data. Therefore, TPAS is optimized for digital analysis of survey data. The following processes can be used to better understand and interpret the conditions and material data.

1. Any TPAS symbol can be queried directly in AutoCAD.
2. Because each combination of material and fault condition is on a separate layer in AutoCAD, the survey data can be viewed selectively within AutoCAD by switching layers on and off and by constructing different combined layer "views."
3. The numerical survey data can be extracted or exported from AutoCAD into spreadsheets or databases.
4. Digital photograph files are hyperlinked to "Photo Tag" symbols, so survey photographs can be opened directly from the AutoCAD drawing.

Scope of Work

Industrial rope access techniques were used to allow technicians a hands-on inspection of the brownstone portion of the clock tower and access for removing and mitigating woody plant vegetation. In general terms, technicians are suspended on one rope termed the "working line" with a redundant "fall protection" line used as backup. Hands-off descent control and fall protection devices are integrated into site-specific rigging systems, along with industry-specific climbing and suspension harnesses. Vertical Access technicians are third-party certified for industrial rope access work by SPRAT, the Society of Professional Rope Access Technicians.

As part of VA's investigation of the brownstone at the exterior of the roof and belfry levels of the Albany City Hall tower, the location, severity and quantity of conditions such as displacement, cracks, spalls, previous repairs and soiling were recorded on elevation drawings. The masonry materials were sounded with a one pound acrylic

mallets during the investigation to help in the assessment of their condition. During the survey, VA technicians removed loose brownstone, patching material, mortar and sealant. Although the removals represent the worst of the potentially hazardous conditions identified during the survey, there remain other conditions including failed patches and incipient spalls that are potentially hazardous. Photographs of the material that was removed are included with this report (see photo Removals, Photographs Section page 108). In addition to the vegetation removed from the roof, stone, patching material and sealant that would fill approximately two five-gallon buckets were removed during the investigation.

During the course of the investigation, VA technicians removed and mitigated all existing woody vegetation found on the tower roof and belfry. To treat the vegetation, identified as Populus tremuloides, or Quaking Aspen, a 25% solution of Roundup herbicide was first applied to the leaves and leaf stems of the plants. The treated plants were left in place for 24 hours to allow the plant to absorb the herbicide through the foliage and translocate into its root system. Following the inspection work, the larger plants were cut off as close to the roof as possible and a concentrated solution of the herbicide was applied to the cut stems ranging in diameter from ¼ inch to approximately 1 inch. Smaller plants and their root systems were pulled from the masonry substrate during the inspection.

General Observation

Albany City Hall was designed by Henry Hobson Richardson in 1881 and constructed between 1881 and 1883. Designed in the iconic style that would later become known as Richardson Romanesque, Albany City Hall incorporates many of the elements of H. H. Richardson's other notable structures including rough-faced exterior stone walls, contrasting trim stone colors, arched door and window openings, grouped rectangular windows, roofline broken up by numerous gables, dormers and chimneys and prominent tower incorporated into the building. At Albany City Hall, the three-story structure is constructed of Milford (MA) granite with East Longmeadow (MA) brownstone used for trim and ornament.[1] The clock tower, situated at the southwest corner of the building, rises 210 feet from the street and is predominantly composed of granite masonry with the exception of the belfry and roof levels. The belfry level is 35 feet-2 inches tall from the copper clad cornice deck to the bottom of the roof. The measured distance from the bottom of the roof to the joint at the bottom of the pyramidal block below the finial is 35 feet-3 inches.

The belfry and roof of the Albany City Hall tower are constructed of East Longmeadow brownstone, with brick corbelled back-up used at the interior of the roof. At the belfry level, each façade has a group of three tri-partite arched openings with acanthus leaf ornament used at the capitals of the mullions and corner columns and at the cornice below the roof. At the exterior the pyramidal roof consists of 22 courses of bush-

[1] John C. Smock, *Building Stone in New York*, Bulletin of the New York State Museum 2, no. 10, September 1890 (Albany: University of the State of New York: 1890): 325-326.

hammered brownstone blocks topped by a decorative stone finial. The height of each unit measures approximately 19 inches along the slope of the roof and there is a 3-inch return at the bottom of each unit so that the overall effect is that of a shingled stone roof. Based on several measurements taken at masonry joints with missing mortar, the depth of the stone units is approximately 5 to 6 inches at the top of the unit and 12 to 14 inches at the bottom.

Specific Brownstone Conditions

The East Longmeadow brownstone used at the belfry and roof of the Albany City Hall is a fine-grained stone composed of quartz, feldspar and hornblende. Iron is the principal cementing material for all East Longmeadow sandstones, with lime found in those from Worcester, Massachusetts.[2] There are no clear bedding planes visible in the sandstone at Albany City Hall. In general, the conditions of deterioration observed are related to displacement, erosion, contour scaling leading to exfoliation, previous repairs installed to address these conditions and soiling.

- Horizontal displacement of up to 1-1/2 inches was observed at several sandstone units on all four sides of the roof. The displacement typically occurs at the outer corners of the roof (see Appendix C). At some units, there is also rotation of the corners of the units (see photos 6-64 to 6-64-2, 6-69 to 6-69-2, 7-66, 9-72, 12-48 to 12-48-3, 13-70, 114-66, 119-68 and 160-75).

- There is widespread erosion and exfoliation of the sandstone units at both the roof and belfry portions of the tower. The term erosion is used to refer to loss of material due to failure of adhesion among grains or minerals near the surface of the stone (see photos 3-47, 5-28, 11-37 to 11-37-6, 19-58, 58-60, 63-63, 112-70, 114-20 to 114-20-2 and 164-37). Exfoliation is used at areas where there is loss of material due to shedding of stone layers that are in plane with the cut surface of a stone unit (i.e., not at bedding planes), such as surface or contour scaling (see photos 12-33 to 12-33-4, 63-39 and 166-38. Subflorescence is often associated with areas of exfoliated stone (see photos 106-38 and 171-30 to 171-30-3). At the roof, there does not appear to be a pattern to the surface erosion and deterioration; units exhibiting surface erosion and exfoliation up to one inch deep are adjacent to units that have original tooling sharply intact (see photos 19-58, 112-70). There is also erosion and exfoliation present at the ornament of the belfry; typically at the voussoirs of the arched openings and colonnette mullions.

- There are hundreds of patches present at the roof and belfry of the tower. Many of these are composed of cementitous materials and most of the patches at the roof appear to be from one repair campaign, based on the visual properties of the patching material. The patches are typically installed as a thin layer with

[2] John C. Smock, *Building Stone in New* York, Bulletin of the New York State Museum 2, no. 10, September 1890 (Albany: University of the State of New York: 1890): 362-363.

feathered edges at areas of eroded or exfoliated brownstone (see photos 8-64. 11-24, 12-52 to 12-52-4, 56-58, 68-56, 115-58 and 165-74). Where unsound patches were removed or partially removed, the underlying stone was typically found to be exfoliating, friable and saturated with moisture (see photos 8-47-2, 54-52, 66-56, 116-71 to 116-71-3 and 160-71 to 160-71-2). In some cases, the patching material remains intact but the stone adjacent to the patch has deteriorated due to the incompatibility of the patching material with the brownstone (see photos 55-24, 64-31, 115-47 and 154-52). The mechanism of deterioration is believed to be due to the relatively hard, impermeable composition of the patching material, which leads to differential permeation and entrapment of water behind the patch. Water that cannot evaporate through the patch is directed to the edges of the patch, where it causes further erosion and exfoliation. In addition, if moisture that is trapped in the stone behind the patch undergoes freeze-thaw cycling or contains salts that crystallize, the stone will continue to deteriorate.

- A limited number of patches do not exhibit any cracking, debonding or separation and the surrounding stone does not show signs of continued deterioration. These are considered sound and are indicated as sound patch repairs on the annotated drawings (see photos 9-55, 11-49 and 114-48).

- Compared to the number of patch repairs, there are relatively few spalls that have not been previously treated. Spalls refer to pieces of masonry that have become dislodged from their original location due to localized stress. On the annotated drawings, spalls are either labeled as missing, incipient or bonded. Missing spalls are locations where the spall is no longer in situ (see photos 6-61, 65-77 and 108-67). Incipient spalls are partially formed spalls at locations where a crack in the masonry is likely to lead to the loss of three-dimensional section of stone (see photos 12-76, 61-70). Bonded spalls are those conditions where there the spalled piece of stone is held firmly in place, typically by sealant. Where brownstone material was removed during the survey, a condition code indicating a removed spall is used in the annotated drawing (see photos 8-46 to 8-46-2, 58-64, 60-72 and 158-36).

- There are spalls, both missing and incipient associated with anchors in the masonry. At the inboard side of the belfry deck, many of the corners of the colonnette bases have spalled at the locations of Rawl anchors driven into the sandstone for attaching the grates over the arched openings. The same type of anchor was used for the clips used to attach lightning protection to the exterior of the roof. There is cracking and incipient spalling associated with these anchors at the lightning protection as well (see photos 72-46 and 168-64).

- There are several isolated cracks in the brownstone masonry. At the roof, there are several instances of vertical cracks near the top of the roof units (see photos 7-60, 7-47, 9-71, 110-60 to 110-60-2). There are also horizontal cracks in the roof sandstone, typically at the bottom of the units (see photos 16-59, 17-54, 62-45, 107-48 and 110-53 to 110-53-2). There is also a pattern of cracks at the

horizontal members between the colonettes at the arched openings (see photos 7-31, 62-23 to 62-23-2, 64-30 to 64-30-2). Some of these cracks have been previously treated by installing iron straps across the crack at the bottom of the horizontal mullion (see photo 109-22) or by routing and filling the crack (see photo 57-24).

- As a general note, the mortar joints at all of the sandstone are failing. Elastomeric sealant was previously installed in all of the masonry joints at the tower roof (see photos 19-69 to 19-69-2 and 108-75). This sealant contributes to salt and moisture accumulation in the sandstone by preventing the evaporation of moisture out of the masonry. The existing sealant appears to be quite old and exhibits cohesive and adhesive failure. At a few isolated locations, a black elastomeric sealant has been installed over the older sealant (see photo 23-47). At some areas of the tower roof where the sealant is missing, there is also no mortar in the joints between sandstone units (see photos 60-67, 61-64, 113-77 to 113-77-3 and 160-75). Where the mortar is present, it is typically crumbling and saturated with moisture. At the belfry level, the joints have not been caulked and there are fewer areas of completely missing mortar, but the existing mortar is failing. The mode of failure at the belfry joints is typically separation between the mortar and the adjacent stone unit (see photos 17-39 to 17-39-2 and 107-42 to 107-42-2).

- In addition to the subflorescence associated with exfoliation, there is typically efflorescence on the surface of the masonry at the acanthus leaf cornice below the roof and the voussoirs of the arched openings (see photos 8-39, 9-42, 11-37-4, 12-39, 67-43, 162-38 and 166-42).

- There are deposits on the underside of the acanthus leaf ornament at the roof cornice that appear to be gypsum crusts. These accumulations are black deposits at areas of the façade protected from water run-off (see photo 16-44).

- Guano is found on the skyward-facing surfaces of the acanthus leaf and circular ornament at the top of the belfry level (see photo 16-41).

- Microiological growth is found on some of the patch repairs on the west elevation (14-53 and 15-48)

Vegetation Removal and Mitigation

As part of the scope of work at Albany City Hall, VA removed and mitigated woody plant vegetation at the clock tower roof. Large plants were found on the north, east and south sides of the tower roof (see photos 56-45, 63-61, 113-50, 116-65, and 165-59 to 165-59-2) and smaller samples were identified at the capitals above the corner pilasters at the belfry level and at the acanthus leaf cornice (see photos 12-43, 14-40, 19-16 and 161-52). The vegetation is believed to be Populus tremuloides, or Quaking Aspen, which is a riparian species more commonly found in sandy soils along rivers. It can develop

extensive root systems. The vegetation at the clock tower roof was first treated with a 50% solution of Roundup herbicide and left for 24 hours to allow for absorption into the root system. At the conclusion of the fieldwork, the larger plants were cut off as close to the roof as possible with pruning shears and loppers and a concentrated solution of the herbicide was applied to the cut stumps. Smaller plants and their root systems were pulled from the masonry substrate during the inspection (see photo 12-43-2).

Conclusions and Preliminary Interpretation

Although the East Longmeadow sandstone used at the Albany City Hall tower belfry and roof is a relatively durable stone, there are deteriorated masonry conditions that should be mitigated as soon as possible. One of these conditions is the displacement that was observed on the west, north and south sides of the roof. The type of attachment between the brownstone roof units and the back-up brick masonry is not known at this time. The construction system of the roof should be evaluated to better understand the cause of this displacement.

Another troubling set of conditions is erosion and exfoliation of the sandstone and the extent of failing patch repairs associated with this erosion. Although the worst areas of exfoliated brownstone and failed patch repairs have been mitigated by removal, there are still potentially hazardous conditions that should not be overlooked. The repairs that have previously been installed do not adequately address the exfoliation and erosion of the brownstone, which is exacerbated by the cementitious materials used in the patch repairs and caulking used at the mortar joints. Left in its current state, the patch repairs will continue to fail and the underlying brownstone will continue to deteriorate, likely resulting in the ongoing loss of material.

Vertical Access remains on call to assist with additional investigations or to elaborate on the work already completed.

Respectfully submitted for Vertical Access LLC by:

Evan Kopelson

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