HISTORIC GRAVESTONE CONSERVATION ASSESSMENT PLAN

ANCIENT BURYING GROUND

ASSESSMENT & TREATMENT RECOMMENDATIONS

Submitted To:

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SCOPE OF WORK

The Ancient Burying Ground Association, Inc. contracted Conserve ART LLC to provide assessment of 25 grave markers in critical need of repair and to provide preservation recommendations with associated budgets.

Additionally, the site was reviewed from a conservation perspective, as was historic documentation directly pertaining to past conservation measures. With this additional information, a General Cemetery Condition Assessment, an Objective and Approach to Conservation Treatment, and Recommended Conservation Treatment Procedures are also included.

Count	Section	Map #	Name	Age	Death Year	Epithet	Type
1	VIII	451	Bigelow, Timothy	31	1761	193	Table
2	V	250	Boardman, Benj., Rev	71	1802	95	Table
3	IX	505	Caldwell, Margaret	40	1798	265	Table
4	IV	225	Chevenard, John, Capt.	72	1805	183	Table
5	VIII	424	Dorr, Edward	50	1772	205	Table
6	IX	525	Ellery, John	36	1746	386	Table
7	III	176	Fish, E. Dr.	63	1803	140	Table
8	VIII	422	Haynes, John	44	1713	202	Table
9	VIII	442	Haynes, John, Hon.		1653/4	204	Table
10	I	2	Holcomb, Emily		1923	525	Table
11	VIII	441	Hooker, Thomas	LXI	1647	210	Table
12	XII	654	Ledyard, John Esq.	71	1771	504	Table
13	IX	544	Lord, Daniel		1763	390	Table
14	X	546	Lord, Mary	58	1702	219	Table
15	IV	230	McLean, Susannah	30	23	186	Table
16	VIII	454	Olcott, Samuel, Capt	53	1781	191	Table
17	XIII	813	Seymour, Thomas, Esq.	62	1767	316	Table
18	XII	661	Stanly, Nath. Esq	73	1755	510	Table
19	IV	197	Stanly, William	63	1786	65	Table
20	VIII	440	Stone, Samuel	61	1663	211	Table
21	VIII	413	Talcott, Joseph, Hon		1741	199	Table
22	VIII	414	Wadsworth, Daniel	XLIII	1747	207	Table
23	VIII	382	Wadsworth, Eunice	88	1825	358	Box Tomb
24	VIII	383	Wadsworth, Mehitabel		1817	357	Box Tomb
25	VIII	423	Woodbridge, Timothy	51	1732	203	Table

GENERAL CEMETERY CONDITION ASSESSMENT

The Ancient Burying Ground

The Ancient Burying Ground rests in the heart of downtown Hartford with entry gates on Main Street to the East and Gold Street to the South. With approximately 450 existing markers, the site delineates a fraction of the Burying Ground during its zenith, which once contained thousands of interments.

Predominately containing 17th – early 19th century gravemarkers of Connecticut Valley sandstone, the site also holds historic carvings in marble, schist and slate on conventional tablet headstones and footstones and more

elaborate table and box markers. Posts, walls and bases of the larger structures are primarily fashioned of like sandstone, however, several are constructed of brick, contain interior rubble and have obvious, stone slab foundation materials. Obscured materials inside the structures and below grade have yet to be identified.

The Ancient Burying Ground is a rare and valuable record chronicling over a hundred years of stone restoration and conservation. The following assessment tries to respect historic record, recommending alteration to repairs only if the historic repair materials cause additional harm, or have deteriorated to such a state to prevent current, needed treatment.

Site Location
Thorough documentation of the physical features has been addressed by past and present landscape architects and urban planners. The following observations come from personal experience visiting the site, and how this interaction relates to preservation of the cemetery and individual markers.

Surprisingly, once in the ABG one can readily forget about the surrounding urban environment when wandering between the irregular rows of Colonial Era markers. Evidence of years of industrialization has made its presence known through the acidic decomposition of marble elements and black depositions on siliceous materials, and certainly, as one looks upward or beyond the fenced area, the location of the cemetery within a city is undeniable. However, the grassy areas have few worn paths, and the green space provides a calm contemplative place removed from the heavily trafficked Main Street, filled with autos and busses only yards away.

When assessing the markers, little graffiti or other destructive damage by pedestrians was noted. Past vandalism has most likely taken place, but evidence of it is not obvious. The relatively few people visiting the site has alleviated typical impact associated with higher visitation rates to similar places, such as the Granary Burying Ground in Boston.

One Financial Plaza Building
The most imposing element to the site, outside of Mother Nature herself, is the relatively large One Financial Plaza Building to the North, 755 Main Street, clad with reflective windows. The structure acts like a giant mirror, redirecting sunlight back into the cemetery grounds from the North. As the sun passes from East to West, the reflected light passes across the grave markers from West to East. The increase in sun exposure and all of its detrimental effects of UV radiation and heat exposure is tremendous. Cyclic thermal activity alone is increased in frequency and amplitude. The effects of the increased exposure on the stone are unknown. Slates could undergo additional thermal expansion cycles and subsequent cleavage failure. Sandstones could experience more frequent surface drying periods, increasing the swelling and contraction cycles of constituent clay bodies. And over winter months, there could be a significant increase in freeze-thaw cycles to water and ice, on and inside all stone markers, brick and cementitious repairs, as well as the surrounding soils.

Surface Biological Growth
Most of the markers are much cleaner than documented in 2010. The markers have minor growths on the surfaces consisting of small algae and bacteria, and larger lichens and mosses. Growths can harbor additional damp and secrete harmful acidic compounds. With the removal of such small organism now possible with contemporary ammonium compounds, such as D/2 and Biowash, little to no scrubbing of the stone surfaces is required. The chemicals eradicate the growth and natural cleansing of rain and wind removes the majority of the unwanted matter without human mechanical cleaning.

Black Deposits or Staining
Blackened surfaces of siliceous stones may be from a combination of factors. It is common for black stains to develop on silicates from pollutants. This can often happen in water patterns along joints and in text, such as on the horizontal, slate, text panels found on table markers. The tops of the exceedingly dark table markers,

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however, may be from past treatment, as noted by Irving Slavid and Fran Gale in their reports. The damage being caused by the discoloration is not obvious and has not been specified. Markers with thick black deposits are not showing signs of further deterioration directly associated with the deposits since the 2010 assessment and many of the markers with blackened tops have text and stone in relatively good condition. It is advised to monitor the stones for damage before removal is authorized.

Unusual honeycomb deterioration patterns have been found in the undersides of some table slabs. Additional research is required to determine if this phenomenon is related to early water proofing/stone strengthening attempts.

Trees and Shrubs

Invasive plant growth has caused possible heaving of Box markers #382 and #383 (significant movement may also be due to settling of burial cavities), and overturning of headstones. Trees can contribute to increased moisture retention in the stones and may also threaten stones with falling limbs. The large maple near markers #382 and #383 has been removed; the stump and roots remain.

Grade and Prolonged Water Exposure

This survey was conducted over a three month period from early winter until spring. It was interesting to witness the accumulation of snow and subsequent thaw, followed by rains. Depressions surrounding markers and valleys below table markers quickly retained water after snow melts and heavy or prolonged rainfalls. Larger regions, now well documented, gathered and retained substantial moisture.

These depressions pose significant threat to the markers by subjecting the porous stones to prolonged water exposure. Prolonged water exposure at the base of sandstone increases the upward wicking of moisture and water soluble compounds. The results are increased levels of dampness that encourage biological growth, increased swelling and shrinkage cycles of clay bodies in the stone near the outer surface where ambient temperatures and humidity levels also fluctuate in cycles, increased threat of harmful salt deposition and increased freeze-thaw damage in cold weather.

Minimally, to correct small depressions, it is advised to remove the top sod layer and to add additional sand, and or gravel, to raise the ground level slightly above grade; in the case of sunken/recessed Box and Table markers, soil removal around the perimeter will allow for improved drainage.

The grade around the central cluster of table markers and box markers in Section VIII should be addressed collectively. A meeting was held with Ty Tryon (ABGA), Christine Jewell (ABGA) and Tom Elmore (Elmore Design Collaborative) to assess the grade. It was decided that the grade could be altered to allow for drainage toward Gold Street, and into a below grade drainage system running through the cemetery to the west. Removal of the tree stump and larger roots would also improve drainage. Altering the grade will also impact the single slab tablet markers within the work area.

The alternative is to raise the table bases for the sunken stones. Given the tight work area and the large stone top and base of marker 454, weighing approximately 2,500 lbs each, a crane could disassemble the marker tops, and relocate the slab and posts to an agreeable work area. This would give access for a smaller gantry to lift and reset the bases to optimal heights. The tops and posts would be reset after treatment. If treated as a group, the costs for crane service would be reduced. Access for a crane to enter and be on the lawn to the front of the cemetery off Main Street would be required. Due to the reach needed to the markers, Summit Crane recommends using a 90 ton crane, which weighs 135,000 lbs. The rate for the crane is approximately $4,000/8 hr day.

Soil Stability

From above grade, visual examination, the majority of the markers are supported on stable ground. Several markers examined, such as #382 and #383 appear to be sinking, possibly due to burial hollows below the markers. Numerous larger structures have either settled or have been slowly submerged by raising ground heights. Introducing richer soils for grasses, the deposition of organic matter from tree leaves, etc, can affect the relative setting heights of the markers over passing years. Some markers recently reset have depressions directly around the upright stones. These depressions appear to be the cause of insufficient tamping of sands/gravel/earth used during the resetting process. The exact compositions and layering sequences of the soils are unknown.

Marker Setting Methods

Table and Box markers of this era generally have stone rubble foundations, and interior rubble fill for stability. The ABG has several structures clearly built on large stone foundations, such as the brick structure of Marker #62 and the twin sandstone structures of markers #382 and #383. Most of the Table and Box markers have finished bases. Small holes dug to measure the base thicknesses of each table marker in this assessment revealed stone rubble below with the addition of shims under many.

Investigation at #813 found rubble foundation extending approximately 30" below the bottom of the base slab. The topsoil extended approximately 12" and then the soil became increasing clay rich and almost entirely clay at the bottom of the test hole. Ceramic fragments were found in the upper levels. Water filled the lower portion of the hole.

Investigation at #382 was challenging due to water quickly filling the hole, springing from the stone foundation approximately 18" below grade. The interior of the box structure is likely filled with rubble. If the rubble continues below grade then the hollows can fill with water and be held by the surrounding clay rich soil. The hole was dug to a depth of approximately 28". The stone, felt by shovel and probe, might continue to approximately 33" below grade. With frost lines being approximately 36", and the general seasonal warming trend, there may be little to be gained from extending foundations.

Discussions with Ty Tryon and Nick Bellantoni, Emeritus State Archeologist, quickly excluded the use of peers or other deeply driven supports for the foundations. The actual burial locations and burial depths are unknown; disturbing the sites as little as possible is a prudent precaution.

Reconstruction of Box and Table Markers

The ABGA will need to decide the extent of restoration to be done on many of the larger structures. Funding may not be available to reconstruct all of the unlevel markers, nor a desire to do so if the structures appear stable at this time. The degree of restoration will also be dependent on individual physical and material conditions of each structure. If reconstruction is undertaken, one of the more problematic components is the evaluation of interior rubble for reuse or to substitute the fill with other materials.

New interior support structures should be designed to reduce entrapment of interior moisture. The use of stainless frames or bracing can provide non-absorptive structural support; however, using drastically foreign materials is questionable if one strictly adheres to the Secretary of the Interior's Standards for the Treatment of Historic Properties.

Markers #382 and #383 will need further assessment after disassembly. The condition of the cut ashlar wall blocks, particularly on the interiors, will need to be assessed for reuse and need for additional support.

Assessment of Past Treatments

The ABGA houses numerous letters, newspaper articles, reports, etc., concerning past history, events, site planning and marker conservation. Files were briefly reviewed with Anne Holcombe as well as past and current

preservation plans. Three major documents provided detailed information from a conservation perspective: *Ancient Burying Ground, Hartford Connecticut, A Pilot Conservation Project* , Fran Gail, Center for Preservation Research, Graduate School of Architecture and Planning, Columbia University, 1986; *By Their Markers Ye Shall Know Them*, William Hosley and Shepherd M. Holcombe Sr., Ancient Burying Ground Association, 1994; *Conservation Treatment, Ancient Burying Ground, Hartford, Connecticut*, Irving Slavid, Monument Conservation Collaborative, 2000.

Individual markers surveyed on site were examined with the effectiveness of past treatments in mind. Specific conditions of repair materials found are noted on the individual survey sheets. Most treatments seen on the markers have weathered very well. Some repairs have not yet aged long enough to discern.

Mortar Testing, Analysis and Additional Investigation

Mortar samples should be retained while disassembling Box markers to both preserve an example of the historic material, and for lab analysis. Mortar analysis will reveal the basic binder compositions and ratios, as well as the original sands used in the mix. Replication of the mortars would provide the most accurate historic restoration. The compressive strengths of the original, or replicas based on the originals, will also be evaluated, and altered if found intrinsically inadequate.

OBJECTIVE AND APPROACH TO CONSERVATION TREATMENT

Governing Philosophies

A committee should meet to discuss the history, current conditions and future of the cemetery. From the discussions, conservation parameters should be developed to guide treatment options, such as level of cleanliness, the evaluation process to retain or discard old repairs, the continuation of past replication practices, etc. With replications of detail and entire markers with composite casts and stone carvings, spanning over 100 years, many of these restorations may now be of historic significance, both intrinsically and as a record of past conservation processes. It is recommended to maintain the historic fabric of the site as much as possible without threatening the safety of the markers. This entails the assessment of past materials and methods used to fabricate, repair and reset the markers.

General Conservation Guidelines

The goals of the conservation treatment should emphasize minimal intervention by using the least aggressive means possible to achieve the most successful conservation results. To achieve such results, it will be necessary to test each recommended procedure to determine which approach is most appropriate for the objects and most acceptable to the client. Therefore, when a procedure is recommended a conservator should only institute it after the proper testing has been done. For this reason, it should be noted, that although a specific treatment may be recommended, the actual treatment should rely on the information generated from the tests. The client should be kept informed on the progress of the treatment and notified if deviations are necessary. The client should make all final decisions in the conservation proposal including the aesthetic choices available during the conservation process.

Recommended Conservator Qualifications

It is recommended to solicit bids from firms experienced with cemetery conservation. This will insure proper care and documentation of performed treatment. The minimum recommended requirements are Professional Associate status or equivalent by the American Institute for the Conservation of Historic and Artistic Works (AIC), a minimum of five years direct experience treating cemeteries of similar scope, client references for work performed in historic cemeteries, and the assurance that the qualifying conservator will be present and actively leading all phases of site treatment. The qualifying conservator must be familiar with all recommended materials and certified accordingly, as with Jahn patching mortars.

Changes to the Conservation Specifications and Documents
Prior to the bidding process, it is recommended to have a discussion with the client/committee to review the overall governing parameters of the cemetery. Narrowing the treatment options will produce more reliable bid results.

Options for treating stones can be varied. The following guidelines are based on standard practices for conservators. Each conservator may prefer certain methods or materials or may see additional conservation issues and required treatment. Experienced conservators can tailor the recommendations as appropriate to best meet the needs of the objects and governing philosophies of the Cemetery.

Foreseeable changes to the Recommended Treatment Procedures with associated cost adjustments must be clearly written and submitted with future RFP responses.

Replacement Elements
Some of the stone posts are in poor condition with loss of stone grain cohesion, large structural cracks and loss. These posts should be examined in more detail during treatment to determine if replacement is desired by the client. Finding like CT Valley sandstone from old spare blocks or salvaged building materials could prove challenging. Similar sandstone color imported from China is available at O&G Industries, though the quality of the stone exposed to New England weather is unknown.

RECOMMENDED CONSERVATION TREATMENT PROCEDURES
Notes
The following treatment procedures provide examples of specifications for developing a thorough RFP package. Prior to producing such a document, it is advised to review the information with a conservator to ensure the compatibility of treatment with the overall governing philosophies of the site and past experience with other treatments specific to the ABG. The conservation texts cited above contain good and detailed accounts of appropriate materials and procedures for conservation. The current trends in conservation continue to stress minimal intervention, if possible, stressing preservation over restoration. However, given the undeniable restoration emphasis of past treatments at the ABG, the continuation of preservation efforts is logical. The recommendations given in this report encourage a balance of these philosophies.

Some conservation materials are no longer used in outdoor settings, such as nylon pins and polyester resins. Refinement of accepted materials includes Jahn's introduction of M32, an injection grout for soft stone and brick, and the continual improvements in adhesive chemistry. The introduction of new conservation materials is also an ongoing process. Materials developed by Irving Slavid and Norman Weiss include quaternary ammonium cleaning compounds (D/2, Biowash), and the effective consolidation results of ammonium tartrate solutions (HCT), for calcium based stone, have been tested for years in the field and are now safe, accepted conservation materials. Allowing for years of field testing and actual outdoor exposure of materials prior to use on historic objects cannot be over stressed.

Treatment Time Schedule
The treatment of the markers should be given adequate time for effective results, such as site visitations for planning, pre-cleaning stone the season prior to treatment, 9 week consolidation cure times, etc. Allowing for this phasing will maximize the safety of the markers and the effects of the treatments. Given the relatively short work season due to New England's adverse winter climate, compressing overall project durations can compromise successful conservation. It is recommended that a successful treatment campaign be given at least a one year period, after contract award.

Documentation

The number of copies to be submitted is to be specified by the ABGA

All aspects of the conservation treatment should be done in accordance with the American Institute for the Conservation of Historic and Artistic Works (AIC). As part of this documentation, a Conservation Treatment Report should be provided which will include written and photographic documentation. The written report will describe in detail all processes and materials used for conservation, including test analysis, suppliers (name, address, and phone) of sands and stone, and product information with MSDS for all materials used.

The photographic documentation will consist of digital color photographs in an unedited, high resolution JPEG format, of before, during and after conditions. Each image will be numbered and titled with a brief description. Each description will include "Before", "During", or "After" with an explanation of the condition or process being shown. Images are to include overviews of the marker from all elevations, details of each problem type found, and the condition of existing repairs. A photographic example of each treatment process used during the overall campaign must also be included. Before images will be submitted to the client and approved prior to the commencement of treatment. A list of all photographs is also to be generated in text format and to be included in the report. The list will similarly identify "before", "during" or "after" phase and identify the view, and the process being shown.

The final report is to be submitted in a printed and bound copy. The Digital images and a copy of the report are to be submitted on a thumb drive. Also to be included in the report are samples of original mortar found, the original sands cleaned during analysis and a sample and source of the sand used for the replacement pointing mortar.

Mortar Analysis

While re-pointing and disassembling masonry structures, retain samples of mortar that appear to be original. Have the samples analyzed in an analytical lab to determine the basic cement to lime ratio and sand types. Retain both original samples and samples of cleaned original sands for inclusion in the final report.

Cleaning Biological Growths

It is recommended to clean the stones of biological growths using quaternary ammonium based products designed for the eradication of biological organisms, such as D/2 or Biowash. This should be done the season prior to treatment. Pre-wet the stone and apply the solution in the appropriate concentration specified by the manufacturer. Although scrubbing is recommended, it is not advised to scrub the surfaces of fragile or friable stone. Allow the material to dwell for approximately 10 minutes and rinse with potable water. This cleaning should be done the season before treatment if possible, as it will kill growth in the stone and in the small crevices and cracks that require thorough removal of organic matter and loosen debris prior to cleaning for injections and fills. Once the growths are killed, they are typically easier to detach after a period of time and more readily flake from the surfaces with reduced mechanical or chemical effort.

The process can be repeated at the onset of the actual treatment. Both cleaning agents also contain surfactants that aid in cleaning. The stones can be more aggressively scrubbed at this time using fine natural or synthetic bristled brushes. Continual observation and sensitivity to the changing stone conditions is crucial. Stop immediately if damage is observed. Thoroughly rinse with low pressure water.

Thick and tenacious growth may require further chemical cleaning prior to treatment. Tests should be done with ProSoCo Restoration Cleaner, as described below, and with 766 Limestone and Masonry Prewash. This caustic material will dissolve most organic matter. Thoroughly pre wet stone, apply gel diluted with 1 part water to small 6" x 6" test area. Use synthetic brushes. Allow a dwell time of 30 minutes, keeping stone damp at all times with light water misting. Rinse thoroughly. Treat with Limestone and Masonry Afterwash diluted with 1 part water. Rinse thoroughly. Present to ABGA for approval. Proceed to full stone face test for approval. Proceed to full scale cleaning of all soiled surfaces.

Follow manufacturer's requirements and procedures. Thoroughly pre-wet and copiously rinse all surfaces at treatment location and adjoining stone, below treatment area in runoff region, within wind drift, and any other region where chemical may contact masonry surfaces. Test with pH strips after each Afterwash rinse, in each stone condition (rough stone, smooth stone, mortar joint, crack, etc) on each masonry course treated to ensure complete removal. PH strips to be tested on damp surfaces approximately 1-2 minutes following rinse. Rinse copiously with water until pH is the same as the rinse water. All treatment water to be clean, potable supply pressurized to 1000 psi with a 40 degree tip at a working distance of 12".

Cleaning Black Deposits
Markers with thick black deposits are not showing signs of further deterioration directly associated with the deposits. It is advised to monitor the stones for damage before removal is authorized.

If black deposit cleaning is desired by the client, Irving Slavid documents the successful cleaning of the black deposits in his report through the use of ProSoCo Restoration Cleaner diluted 1: 2 and 3 parts water. Test the cleaning process in an inconspicuous location on an area of approximately 6" x 6". Dilute the restoration cleaner 1:3 and apply with natural fiber brush. Allow to dwell for 2-5 minutes and rinse copiously with pressurized water. Determine the effectiveness of the concentration and dwell times and increase as needed. Once an acceptable level is achieved in the small test, apply to an entire side of a stone surface. Evaluate. Clean all deposits on marker after successful testing.
Follow manufacturer's requirements and procedures. Thoroughly pre-wet and copiously rinse all surfaces at treatment location and adjoining stone, below treatment area in runoff region, within wind drift, and any other region where chemical may contact masonry surfaces. Test with pH strips after each rinse, in each stone condition (rough stone, smooth stone, mortar joint, crack, etc) on each masonry course treated to ensure complete removal. PH strips to be tested on damp surfaces approximately 1-2 minutes following rinse. Rinse copiously with water until pH is the same as the rinse water. All treatment water to be clean, potable supply pressurized to 1000 psi with a 40 degree tip at a working distance of 12".

Repeated applications may be required. Monitor with 40x field magnifier to ensure the sand grains are not etched or the surfaces damaged in any manner. Additional tests can be done with ProSoCo EK Restoration Cleaner following the same guidelines.

Ensure personnel safety by using appropriate protective clothing, eyewear and respirators. Protect neighboring stones with plastic to prevent chemical exposure.

Unearthing and Disassembly of Markers
Note the exact location of markers with stakes or pins. The area will be carefully probed prior to digging to locate buried elements. Care will be made not to abrade stone. Heavy stones will be lifted by tripod or portable gantry, or crane systems. All lifting straps will be soft, clean nylon. Foam padding or clean cotton cloths will be used as necessary to protect stone from abrasion and soiling.

For structures, mark each unit for location and direction on joint faces. Dismantle using clean nylon straps and number all stone sections for location. Make drawing of structure with numbering system. Use straps and bracing to prevent collapse during disassembly. Stack stones on wood blocks to prevent spalls and cracks. Save interior rubble and dismantle and number as possible. Evaluate interior rubble for reuse. Gently remove all mortar on sides of blocks with hammer and chisel, chisel inward, toward block center. No damage to the stone will be allowed.

All stones to be placed on soft wood or foam blocks during work. Plastic, barrier sheeting may be required to prevent staining.

Removal of Failing Repair Materials
If specified, failing repair materials will be gently removed with a hammer and chisel, stainless steel scalpels, etc. Adhered material will be removed with Carbide burrs mounted on a rotary Dremel tools. Do not damage parent stone.

Consolidation
Prior to consolidation, clean all stone, rake-out and flush all joints, and thoroughly clean all cracks with pressurized water and air (see related phases below). Allow complete cure period prior to injection, patching and pointing. Follow all manufacturers' application requirements and procedures, including temperature, humidity and other physical concerns. It is vital that the stone surfaces dry for a minimum of two days, stone surface and air temperatures be between 50º-90º with humidity levels above 40% during application, no application occurs during rain, and that surfaces are protected from rain for 2 days following treatment. Protect all markers in range of from overspray and wind drift with plastic sheeting.

Marble and limestone requiring consolidation will be treated with Conservare HCT (ProSoCo). The consolidant is designed for calcareous material. The application will follow manufacturer's recommended procedures. Sandstone, or severely deteriorated marble pretreated with HCT, requiring consolidation will be treated with *Conservare OH 100* also manufactured by ProSoCo. This consolidant is designed for siliceous materials. The application will follow the manufacturer's recommended application procedures. ***Note: according to George Wheeler (Portland Brownstone Symposium, Portland, Maine, 2007), the consolidant can require up to 9 weeks cure time in CT Valley sandstone.***

Epoxy Mending
Unless there is a minimal bond-line due to erosion or the stone is otherwise unsuitable, broken stone will be mended with epoxy. The stone surfaces will be first washed with Orvus, rinsed with water and allowed to dry for 24 hours. The mating surfaces will be rinsed with acetone using natural fiber brushes, blotted dry with clean cotton towels and air dried for a minimum of 1 hour. The sections will be dry fit to determine the epoxy line and joint thickness. Charcoal pencils will be used to outline the contours of the mating surfaces, preventing over-application in regions with missing sections. The epoxy will be applied with stiff, natural-bristle brushes and clamped for a period of 24 hours. Acetone dampened cotton swabs rolled over the surface will remove excess epoxy along the mend-line before setting. Do not smear the epoxy. Moisture insensitive epoxies such as Akemi Akepox 2030 or equivalent are recommended.

Breaks should be pinned as needed, using the smallest 316 stainless steel pin possible for the application. Holes will be flushed with clean water and dried. Stainless pins will be degreased in acetone and set with epoxy. Flowable versions by the same manufactures can be used to inject cracks that require structural repair.

Cementitious Mending
Large fragments have been successfully reattached in the ABG by floating the fragments onto a bed of mortar. This method allows for full water movement through the stone. Large fragments or sections close to breaking can be reattached using this procedure. The separation of fragments close to breaking should only be separated from the parent stone if the action saves more historic information than if left untreated. Each fragment will need to be carefully assessed and approval given by ABGA prior to action.

Prepare surfaces by removal of loose debris or friable material, consolidate. After curing, prepare mating sections by pre-wetting stones so that the materials have interior moisture, preventing rapid drying. Using the same color-matched Jahn M-70 used for patching spread slurry onto the mating surfaces. Add slightly firmer material to compensate for losses or voids. And press fragment onto parent stone. Secure and keep damp for three days for adequate cure. Fill all edges or provide loss replacement between fragments with patch material Jahn 70 or for tin patches, Edison coatings Systems 45.

Pinning
Pinning will be discussed with the client. It is recommended to utilize all existing pins and pin holes as is safe for the stone. Existing damaging pins, such as iron or other ferrous metals will be extracted with a diamond, water-cooled, core drill (if 3/8" or larger) and replaced with 316 stainless steel. Additional holes will be drilled with a water-cooled, diamond core bit. Holes will be flushed with clean water and dried. 316 stainless steel pins will be degreased in acetone and set with a moisture insensitive epoxy. The pin will be set with epoxy, unless a more reversible system is desired by the ABGA. Use the smallest pin required for the application.

Crack Injection
Flush cracks with pressurized air (100 psi max) to remove loose debris followed by pressurized water (100 psi max.), using appropriate stainless steel needle gauge for crack opening and fragility of stone for each procedure. Allow to dry.

For vertical cracks or others that require damming materials, with careful insertion, fill outer opening with first Teflon tape then backer rod and cap with clay to dam the openings. The Teflon tape and backer rod reduced clay particulate residue in the cracks. Set a series of syringe tip ports in 3" intervals along crack with the stainless needle inserted into the crack.

The cracks will be flushed with a 5% solution of Ethanol and water followed by pigmented Jahn Injection Grout. Injection will begin at the lowest point and progress upwards to the next port. Proceed to third port and allow curing for 24 hours. Continue injections in this 6" lift pattern until crack is filled.

Damming materials will be left in place for approximately 3 days and the stone covered with plastic to prevent rapid drying. The stone will be subsequently cleaned with water and natural fiber brushes to remove clay and injection residues.

Tint grout with Bayferrox Pigments to match stone color, not to exceed 5% pigment by weight. Keep injection 2 ½ x lower than crack opening. Keep stone clean at all times. Remove excess injection material with water and hog hair end brushes. Keep damp for 3 days with periodic misting. Follow all environmental factors specified for pointing and other cementitious procedures.

Use VoidSpan PHLi 600 for hairline cracks, Jahn M32 Injection Grout for cracks less up to 3/16" wide and Jahn M40 injection Grout for cracks up to 3/8".

B-72 Injection for Slate
Slate markers with thin surface flakes can be secured with the thermal setting, methyl acrcylate adhesive, B-72. The adhesive will flex with thermal expansion and is easily reversible with acetone.

Flush cracks with 100-psi water using a portable pressurized tank and 100-psi air, using a portable compressor; use 22-gauge needle during the cleaning process. Allow to air dry. Flush cracks with a solution of Acetone and Ethyl Alcohol (1:1). Inject 10% solution B-72 (w: v), mixed in Acetone and Ethyl Alcohol (1:1), followed by 20% solution. Bulk with ceramic Cenospheres 300 as needed. Deliver B-72 to the stone using syringe and needle as well as natural fiber, 0-000 brushes. Loose or springy slate should be compressed gently and clamped, using silicon coated Mylar as a release between clamp materials and the slate. Due to the low vapor permeability of schist and slate, the injected regions require 2-3 days for the solvents to evaporate and the adhesive to set.

Bring B-72 to the edges of the sheeting material. Cap with 20% solution B-72 bulked with like crushed stone dusts. Clean edges with acetone and ethanol

Fills
All damming materials will be removed and the surfaces cleaned with natural fiber brushes. Fill all cracks, injection lines, mend lines and small areas of loss with an appropriate composite patching mortar such as Jahn M70 Limestone Patching Mortar, Jahn 120 Marble Patching Mortar, etc. Fill flush and tool to match surrounding stone contours and textures. The fill material will be tinted with Bayferrox or comparable lime insensitive light fast pigments as needed, not exceeding 5% by dry weight. Color matched Edison Coatings Systems 45 designed for sandstone can be used for thin fill applications.

Larger losses will be filled with the same materials closely following the manufacturers recommended procedures.

All fills will be covered with plastic and periodically dampened with water for a period of at least three days. Longer cure times may be needed during dry, hot and windy conditions.

Small fills on slate should be done with Edison Coatings Systems 45, color matched and filled flush. Cover with plastic and keep damp for a period of 3 days.

Composite Loss Replacement
It is advised to fill areas of loss to allow for water shed, to prevent further damage to stone from deep exfoliation, to provide additional structural support, or to provide additional aesthetic restoration as specified. The ABGA may recommend further loss replacement in keeping with an emphasis on restoration.

Provide test samples of dried Jahn coupons approximately 4" x 4" to match each marker to be treated. Tint Jahn with Bayferrox pigments and the addition of crushed and washed like stone dusts and mica dusts to achieve appropriate color. Remain within manufacturer's recommendations for the amount of pigment and aggregate to be added.

Clean, consolidate and inject all cracks prior to loss replacement. Tool edges in a sensitive manor to the aged stone. Pre wet stone and apply appropriate Jahn patching mortar (M70 for sandstone, M120 for marble, etc.), following all Jahn procedures. Do not smear or feather fills over finished viewing surfaces. If smears occur, clean with fine end brushes and water. Keep damp over three day period to insure adequate cure.

Composite Loss Replacement Under Tops
Many of the losses occurring under the stone tops have whitish efflorescence and unusual loss patterns. To try and draw possible unwanted salts from the stone, it is advised to use a soft lime mortar as sacrificial patching material. Jahn M110 JN is a relatively soft mortar with a compressive strength of 783 psi., as compared to Jahn M70 Sandstone with a compressive strength of 1,800-2,200 psi. Keep damp over three day period to insure adequate cure.

Like Stone Replacement
Damaged table marker posts, missing sections or stone otherwise found structurally unstable should be replaced as specified by the ABGA. After disassembly find best matching sandstone to match damaged or missing unit. Provide sample of sandstone to ABGA for approval. After approval, have element replicated in same dimensions with matching surface finishes. Give original to ABGA. With the Portland brownstone quarry no longer in operation, finding the right size salvaged stone might be difficult. Samples of alternate stone types will be presented to ABGA for approval before being used.

Foundations for Table Markers
For markers that do not require disassembly, lift base stone with a series of compact hydraulic jacks to the needed height and level. Add crushed basalt 2" – ¼" mixed with clean sand. Sizes to be determined by gap size and needed volume. Compact firmly from the sides with flat bar and hammer. Use a power washer to

force materials inward as needed. Avoid power washer contact with sides of stone. Confirm compaction, particularly under post areas. Compact firmly in lifts and wet with water. Keep perimeter free for chinking with like sandstone foundation.

If markers are to be disassembled, lift entire stone with clean nylon straps, compact fill with tamper in lifts and wet to insure sand fill into voids. Build on top of existing perimeter foundation with like sandstone rubble. Set base level. Compact from sides with flat bar as needed and chink perimeter with like foundation stone.

Joint Clean-out

Clean-out two 2' of horizontal joints and vertical risers between for review by ABGA and approval. Clean joints with least aggressive means possible. Use Fein oscillating thin diamond blades for mortar cut out and for cleaning interior joint plane edges of stone of mortar. Do not abrade stone exterior viewing planes or damage stone on interior joint planes. Thin putty knives and thin chisels can be used if the mortar is soft enough to be extracted without excessive hammering and thin enough to fit into the narrow joints without stone/brick contact. Rotary diamond right angle grinders can be used on wide joints. The cuts are to be made in the center of the joints and the remaining mortar along the stone, chiseled inward, away from stone edges. Under no circumstances are the joints to be widened, extended or in any other way damaged.

Joints to be cleaned to a depth of 2 ½ x the width of the joint, with squared backs and all mortar removed from masonry edges. Blow joints with oil free compressed air and flush with water and allow to dry prior to review. Rinse lower monument to remove cleanout residue.

The approved tests will be used as the quality standard for the remaining clean-out and are not to be pointed until approval is given for clean-out of all joints on the project. Clean all joints in the same manner after approval. Rinse all joints with low pressure water and rinse all masonry to remove cementitious residue. Rinse all adjoining stones of dusts or splash. Cover neighboring stones with protective plastic sheeting to prevent soiling during this process.

Mortar Analysis and New Mortar

Inspect the marker during the joint clean-out for original pointing mortar and analyze samples in professional lab to determine the content (lime based vs. cement based mortar), and the color and shape of the aggregate used. Present lab results and cleaned original aggregate to the client.

Design a new mortar based on historic mortar using same proportions and sand type that matches the original color, shape and sizes. If original mortar cannot be found, or original mortar otherwise determined inappropriate, then samples of mortar should be designed with materials sympathetic to the aged stone. Present samples cured for 2 weeks in metal forms or channeled granite approximating the width of the existing joints and 2 1/2x the depth, to the client for approval. Tests will include washed and dried local sand types, including red, free of salts, organic matter, soils or other foreign matter.

Retain lab analysis, samples of historic and new mortars and historic and new sands for inclusion in Treatment Report

Mortar mixes for the following situations are acceptable. The sizes of the aggregate will vary to be compatible with the joint widths.

Marble:	1 part white Portland: 1.5 parts hydrated lime: 7 parts aggregate.
Sandstone:	1 part Saint Astier Naturally Hydraulic Lime: 2.25 parts aggregate.

Pointing

Follow temperature guidelines of 40-95 degrees and protect surfaces from excessive wind or sun. Pre wet masonry several hours prior to pointing. Wet again before mortar application until surfaces remain damp, but

not covered with surface water. Do not apply mortar if air temperatures are to drop below 40º for a period of 14 days.

Apply mortar tests in two 2' of horizontal joints and vertical risers between for review and approval. Mix mortar to match test specifications. Compressive strengths must be softer than brick or stone. Aggregate to be washed, dried and well graded. Apply in lifts for deep joints until lower layer is thumb nail hard. Finish flush. Do not apply thin fills or feathered edges to losses in stone or brick. Do not smear mortar on stone or brick.

Clean smears with blunt wood scrappers to remove thick mortar and small, natural fiber end brushes and water for thin films. Keep joints damp for a period of 3 days with periodic misting and the use of wetted burlap as needed.

Reassembly of Table Markers
After completion of new foundation, set historic foundation stones to be integrated and level base stone. If the base stone or lower stone elements suffered from excessive damage due to continued water exposure, such as the lower walls of box markers, use 1/16" lead sheeting between the foundation and the base stone to prevent or reduce rising damp. Layout upper stone for design. Dry set table markers on lead shims to achieve and maintain joint widths. Firmly point joints with mortar described above in appropriate lifts.

Box Markers #382 and #383
Disassemble and number units.

Assess walls and rubble system for reuse. Design new support system/bracing based on findings. Consult with an engineer as appropriate. Present new design to client for review and approval. All metal bracing or pins to be 316 grade stainless steel.

Remove tree roots. Fill found hollows with clean sands and peastone, use tamper and flat bars and water to insure fill. Use crushed basalt and sands, in unison with rubble to form firm compact foundation.

Incorporate large 6" x 6" x 48" – 72" granite blocks into below grade foundation as needed to bridge areas that are in threat of collapse. Build foundation level with like historic rubble at top course.

After completion of new foundation, set historic foundation stones. If the base stone or lower stone elements suffered from excessive damage due to continued water exposure, such as the lower walls of box markers, use 1/16" lead sheeting between the foundation and the base stone to prevent or reduce rising damp.

Install new support system/bracing as approved.

Set stones in same numbered pattern as documented in drawings and photographs, using the numbers on the stones as a guide. Keep joints to appropriate thicknesses using lead shims. Integrate interior rubble, support rods, armatures, etc, as designed for each individual box marker.

After lower structure cures, dry set top slab on lead shims to level and to maintain appropriate joint width. Lift stone and apply mortar with enough material to adequately compress until stone meets shims.
Point and clean joints flush. Clean all brick of smears with water and dilute acetic acid.

Site Safety
Work areas will be fenced from the public using stakes and plastic snow fencing. Additionally, open holes will be marked with smaller stakes and caution tape. All areas accessible by the public will be kept clean and orderly. Clean areas after daily work. Store materials in areas designated by ABGA.

Site Care and Artifacts

Treat site with due respect. Expect unmarked areas to contain burials. Keep work areas clean, orderly and presentable at all times. Retain all sod in earthen sheets for reuse onsite. Retain all soil. Excess soil will be disposed of as directed by the ABGA. Minimize all impact from treatment to the site with the use of appropriate plastic sheeting, tarps, plywood, etc.

All artifacts will be immediately placed in clean containers, marked with location and the client notified of their existence. Upon finding significant artifacts or burial remains, halt project and notify the ABGA.

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