Gravestone, Monument and Tomb Conservation Plan
for
Old Section, Rural Cemetery
New Bedford, Massachusetts

Completed for:
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for
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Introduction:  

Rural Cemetery, founded in 1837, was conceived under the influence of the burgeoning mid-19th Century "Garden Cemetery" movement which sought to create a parklike setting for burial and remembrance. Rural cemetery’s earliest sections contain all of the hallmarks of this movement. The grave markers are more monumental than they were during, and just after, the colonial period and the family plots incorporate decorative accents such as raised mounds, stone curbing and steps, cast and wrought iron fences and gates as well as elaborately carved monuments.  

The focus of this assessment is primarily on the grave markers, but the conditions of the monuments and tombs located within the selected sections were also assessed. The 29 sections surveyed for this report are located adjacent to the main entry at the intersection of Dartmouth Street and Oak Street. The locations and identification number of each section is indicated on map key contained in the appendix.  

Survey Methodology:  

Each stone in the 29 sections identified for survey in the project RFP were evaluated individually to determine if some form of treatment was required. The conditions of “at risk” markers were recorded on survey sheets that were customized for each type of marker and material. The term ‘at risk’ was defined in the project RFP as, “markers or monuments which are hazardous, unstable, and dangerous to people, itself or to nearby markers, and require immediate treatment.” Each marker was photographed with a blue tag containing the Map ID Number in each image. In addition, each digital photo file was named using the Map ID Number and the last name and first initial of the deceased.  

Safety Hazards  

16 Markers and monuments that consist of large stacked units of stone that are not positively connected to each other with pins, tenons, mortar or adhesive are identified in the attached Excel spreadsheet at potential Safety Hazards. Included in this category are a few markers that consist of a large slab of stone set in the ground or in a stone base that contains a slot to receive the slab. These markers are indicated as potential Safety Hazards if the slabs are leaning or loose in the ground or slot bases.  

Markers that are relatively small and loose or leaning are called out as Priority 1 for treatment but are not identified as Safety Hazards. The term “Safety Hazard” is reserved for markers that we are recommending be addressed immediately.  

Due to seasonal frost heaving as well as other factors such as impact from lawn care or burial equipment, vandalism, grave subsidence and/or the growth of tree roots, markers that are
currently securely fixed in place and upright can become Safety Hazards in the future. Reinspection of the tallest multi-park markers as well as the tall slab markers on a periodic basis is recommended.

Mapping

Each of the markers that requires some level of treatment was located on the photo/maps provided by the City of New Bedford and assigned a unique map identification number. The map identification number is the principal means for identifying the stones that require work. The map identification number for each stone surveyed is recorded in the first column of the Excel spreadsheet attached to this report. The plot maps with the location of the stones that require treatment are located in the appendix this report.

Spreadsheet

The information collected on each survey sheet was entered into an Excel spreadsheet using the unique map identification number for each marker plus the first and last name of the deceased. The conditions of each marker are located in the column titled “Conditions and the recommended treatments are located in the adjacent column titled “Treatment”. A priority of 1 or 2 was assigned to each marker in the final column. Priority one markers are those that require treatment or resetting in the near future, either because they are a broken and/or lying on the ground or tilting precariously. Priority two markers are those that are in need of minor repairs to keep them from deteriorating in the future.

The Excel spreadsheet that accompanies this report is intended as a management tool for the cemetery. It can be used to identify markers that are to be included in a specific bid package and then, after the work has been completed, it can be updated to document the completed treatments and reset the overall priorities.

Examples of Prioritized Conditions

Priority 1

- Potential safety hazards.
- Toppled stones.
- Broken stones where the fragments are lying on the ground.
- Markers at high risk of additional damage due to such conditions as corroding ferrous metal pins or cracking of the slot bases.
- Markers that are leaning more than 15 degrees.

Priority 2

- Intact markers that require treatments to prevent deterioration from advancing.
- Damaged markers at moderate risk of additional damage in the future.
Summary of Findings:

Of the approximately six thousand markers that were surveyed, 798 were identified as requiring treatment. 681 of the 798 markers were identified as priority 1. The balance of 117 markers were identified as priority 2.

Types of Markers Defined

Multi-part Markers

The dominant marker type in the historic sections is the ‘multi-part marker’ pictured on the right. These markers consist of two or more units of stone stacked on top of one another. The older multi-part markers like the one on the right have a granite base and one or two additional units of marble or granite. The younger markers consist of stacked granite units. Many, but not all, of these stacked markers contain brass pins between the units to keep the units from moving around and to resist overturning.

A variant of the multipart stacked marker that is very common in Rural Cemetery is multi-part markers that contain a mortise and tenon connection between the uppermost unit and the middle unit.

The marker on the left is a 3 piece markers consisting of a brownstone base and marble intermediate (2nd) and upper units (3rd). The intermediate unit has a mortise (slot) and the upper unit has a marble tenon. In addition, there is a rusting steel pin in the slot of the 2nd unit. The upper unit is broken into 3 pieces and lying on the ground. To repair this marker, the ferrous pin will have to be drilled out. The 3 fragments will have to be re-adhered and then the repaired upper unit will have to be reset with a new stainless-steel pin.
The markers with a mortise and tenon have problems that the markers where the units are simply stacked do not have. The marble tenons are not very strong and they become progressively weaker as the stone weathers. It does not require much pressure to snap the thin piece of stone that forms the tenon. The mortise/tenon systems works best when the markers are upright and fully vertical. If the ground heaves, or the marker is struck by equipment, the upper slab of stone tilts and the tenon snaps. An additional problem is that water seeps into the mortise slot through the joint. If the water freezes, the force of the expansion cracks or breaks the setting mortar, the tenon, the walls of the mortise, or all three. These types of markers are the most difficult and therefore the most expensive to maintain and repair.

*The marker above contains 3 units all made from marble. The tenon has snapped and part of it remains mortared into the mortise in the 2nd unit. The marker has been repaired in the past with adhesives but it has re-broken along the lines of the old repair. To fix the marker, the old adhesives will have to be removed and new adhesives plus stainless steel pins will have to be inserted into holes drilled for that purpose.*

*The marker on the left consists of 3 pieces. The base is a long piece of granite that also serves as the base of other markers. The 2nd unit is marble and the 3rd which is also marble is broken in 3 pieces. The upper unit has been repaired in the past. To fix this marker, the old adhesive will have to be removed and the 2 fragments on the ground will have to be adhered to the lower section that remains in the slot base.*
Marble Slab Markers

The second largest type of markers in Rural Cemetery are slab markers made of marble. These single slabs of stone can be large or small. They are set in the ground or in granite or brownstone slot bases that are located below grade. A large marble slab set in the ground is can remain stable for a long time but a large slab set into a slot base is the least stable type of marker. The bases placed below ground are not heavy enough to prevent the slabs from leaning when the ground heaves during the winter.

The best preventative conservation treatment for slab markers made of marble is to reset them when they start to tilt more than 15 degrees. Marble loses strength as it weathers and the slabs, which are relatively thin relative to their length, break easily when the markers lean more than 15 degrees. Markers that are tilting more than 15 degrees have been designated Priority 1 in the survey.

The small marble slab marker is a footstone that is lying on the ground. These size markers need to be reset more frequently than the larger slab headstones.
The medium size marble slab marker in the photo above is broken in 3 pieces. To repair this marker, the adhesive from an earlier repair will have to be removed and the two fragments on the ground will have to be adhered to the piece still in the ground and then the seams will have to be grouted.

**Slate and brownstone markers**

There are very few slate or brownstone markers in the cemetery. The few that exist were either relocated from older cemeteries or date from the beginning of the 20th century when the use of slate was revived in order to emulate the look of colonial era stones.

**Conservation Priorities**

Aside from the 16 stones identified in the survey as potential safety hazards, the most pressing conservation issue at Rural Cemetery are the toppled and broken, or just toppled, marble markers. Once a marble marker has fallen, it is vulnerable to additional breakage from pedestrians and/or mowing equipment. Repairing and resetting broken markers and resetting markers that are toppled, but not broken, forms the core of the conservation/preservation work required at Rural Cemetery. The clear majority of the stones identified as Priority 1 fit into this category.
Most multi-part markers at Rural Cemetery were erected with vertical pins between the units. In the cases where the pins were made of bronze, the markers are generally in better condition than the markers where iron or steel pins were used. While some of the markers with brass pins are cracked or spalled at the second or third unit from ice forming in the pin holes, almost all of the markers that were set with ferrous metal pins are broken in multiple locations. The repair of markers with ferrous metal pins requires drilling out and replacing the corroded pins with stainless steel pins. While the number of stones with ferrous pins is relatively small, the removal of the pins is another priority 1 treatment.

**Budgets:**

The cost of repairing the markers at Rural Cemetery is higher than at other cemeteries because the markers at Rural Cemetery are larger and therefore heavier than many cemeteries of the same age. The size of the markers may reflect the comparative wealth of the families of the deceased or it may reflect New Bedford’s role as a major port in the 19th Century as it is less costly to ship heavy stone by sea than over land.

Repairing and resetting the larger toppled and broken markers at Rural Cemetery will require the use of specialized equipment. Small slab headstones and footstones, as well as small multi-part markers, can be lifted by one or two people without equipment. The larger stones however require either a tripod or gantry fitted with a chain fall. There are limits however to the effectiveness of tripods or gantries on uneven ground. Some units may require a fork lift of front loader to pick them up.

We are recommending using an average cost of $700 to $800/ per marker in 2019 dollars for budgeting purposes. This number is based on the actual bid prices for historic cemetery work in Massachusetts in 2017 and 2018 but has been increased to reflect the size of the units in Rural Cemetery. This per marker cost is based on putting at least 200 markers out for bid under the same contract. The overhead and general conditions of a smaller contract would push up the per unit cost.

**Phasing:**

The condition of the markers is about the same throughout the 29 sections surveyed. There are no compelling reasons from a conservation perspective to start in any specific location.

**A Word About Bidding and Contractor Qualifications**

The number of towns that have CPA funding available in Massachusetts has grown significantly in the last couple of years. There are not enough qualified gravestone conservators in the area to meet the growing need. In addition, some of the smaller firms that are qualified to do the work are not able to meet the newer bonding and prevailing wage requirements. The high dollar value of the contracts that have been put out for bid in the last few years has attracted bidders with no real background in historic preservation, stone conservation or even stone repair. What they do...
often have is a background in masonry and the ability to obtain bonding and insurance at the required levels.

While some of the newer firms have been quick learners and are doing good work, others are doing extremely poor work. Work that is in fact so bad that the repairs are failing soon after completion and/or being performed in such an un-craftsmen like manner that the stones have been needlessly disfigured by the firms hired to repair them.

The best defense against unqualified contractors is strong qualification language in the bid package/specifications coupled with a review of completed projects. Often this requires a visit to the cemeteries and burying grounds because the photographs submitted with the bid may not present a fair representation of the work.

The conservation of stone markers and the repair and resetting of landscape features such as perimeter walls and stone curbing require different skills and training, therefore it is generally not a good idea to group these diverse activities into the same contract.

Discussion Regarding the Cleaning of Markers and Monuments:

The amount of biological growths on the markers in the older portions of Rural Cemetery is relatively moderate compared to cemeteries located closer to the ocean or adjacent to ponds.

While some biological growths are detrimental, over a long period of time, to some types of stone, the process of cleaning grave markers can sometimes be more damaging to the stone than the growths. From a conservation standpoint, the most compelling reasons to clean grave markers are to determine the conditions, to facilitate repairs, or read inscriptions during a survey. There is little consensus in the grave stone conservation community regarding the need to clean markers to slow down the rate of stone deterioration caused by biological growths. From a historical and curatorial standpoint, the meaning and context of the cemetery is compromised if the inscriptions are not legible. In New England, however, many people find overly cleaned stones to be out of character with the historic surroundings.

Cleaning of gravestones, while desirable in some cases to allow the visiting public to read the inscriptions, should not be prioritized over and above the repair and resetting of damaged markers if resources are limited.
Section 2: Monuments
Monuments:

All the monuments in the 29 sections included in this contract were inspected and the conditions of the six that require treatment were documented. The monuments in the 29 older sections of the cemetery are primarily obelisks of various heights and stone types. There are no figurative sculptures in this group.

B1-13

Form: Obelisk

Materials: Granite base, brownstone 2nd unit and marble 3rd and 4th units

Conditions: Cracks, fissures and open seam in brownstone and marble.

Treatment: Clean stone to remove biological growths and films. Grout cracks and seams in stone with tinted hydraulic lime based grouts.

B3-43

Form: Obelisk

Materials: Granite
Conditions: Very good condition overall, iron band secured around mid-section is rusting and staining the granite.

Treatment: Remove iron band and clean stone to remove stains.

C1-14

Form: Obelisk

Materials: Granite base and four marble units
Condition: Failing repair at mid-section of upper unit.

Treatment: Remove fill material applied to old repair and replace with lime-based gout.

D2-9

Form: Obelisk

Materials: Granite base and six marble units
Conditions: Upper unit has broken at the thinnest section. Upper section of urn is lying next to the monument. Open cracks and seams in marble.

Treatment: Reattach urn to pedestal with adhesive and stainless-steel pin. Grout cracks and seams in marble.

E4-12

Form: Obelisk

Materials: Granite base and six marble units
Conditions: Cracks, fissures and open seams in marble.

Treatment: Clean stone to remove biological growths and films. Grout cracks and seams in stone with tinted hydraulic lime-based grouts.

E5-3

Form: Obelisk

Materials: Granite base and two sandstone units
Conditions: Cracks, fissures and open seams in sandstone.

Treatment: Clean stone to remove biological growths and films. Grout cracks and seams in stone with tinted hydraulic lime-based grouts.
Section 3: Assessment of Tombs

Cook Family Tomb
Type of Structure: Family tomb

Date of Construction:

Materials: Cast Stone, masonry.

Construction:

- Decorative cast stone units – units possibly made from Natural Cement rather than Portland Cement.
- Cast stone units appear to be veneer set on top of back up masonry. Entry is sealed – condition of interior and back up masonry could not be determined.
- Roof appears to be cast stone units with original parging of cement to cover the joints. Additional application of modern cement patches. Structure of roof not determined.

Condition: Poor

- Open and failing mortar joints.
- Cracked and displaced units.
- Failing parging at roof.
- Non-matching patches of hard and impermeable Portland Cement mortar.
- Entry closed with cement blocks.
Several generations of patching mortars are visible on the roof and walls of the structure. The large patch on the right side of the roof extends to the cornice below. All of the mortar joints are open and some of the units are displaced.

**Recommendations:**

1. Unseal entry so that roof structure, back up masonry and floor can be evaluated.
2. Perform small probes to determine thickness of wall, structure of roof and presence of anchors between units if these are not readily visible when the entry is unsealed.

**Possible Scope:**

1. Repointing of open and fasiling mortar joints.
2. Replacement of severely deteriorated units.
1849 Public Tomb Mound Tomb

Type of Structure: Public Tomb

Date of Construction: 1849

Materials: Granite façade, ledge stone vault

Construction:

- Tomb is constructed on the back side of a brick vault/brownstone façade tomb.
- Relationship of the two structures is not clear. May share a rear wall.
- Large granite block façade – post and beam construction
- Retaining wall extension of façade – granite blocks
- Vault and roof – dry laid ledge stone construction with small shim stones
- Sides and roof covered with soil.

Condition: Very good

- Granite façade is relatively plumb and there does not appear to be a separation between the back of the façade and the stone vault – a common problem with this type of tomb construction.
- Portions of stone slab roof are exposed.
- Shim stones between roof slab units are missing in some locations.
- Granite painted blue/gray – probably because of graffiti.

View of granite slab vault construction behind the granite façade. Soil cover is eroded and some shim stones between the slabs have fallen out.

**Recommendations**

1. Remove any soil in joints and hammer flat shim stones into joints between roof slab units.
2. Maintain soil cover over roof.
3. Remove blocks at entry and inspect the interior. Evaluate interior roof and walls as well as possible shared wall with rear of Gothic styled brownstone/brick vault tomb.
4. Monitor possible movement of granite façade away from vault. If a gap develops between the rear of the façade units and the roof of the vault then reset the upper granite slab of the façade.
Type of Structure: Mound Tomb

Date of Construction:

Materials: Brownstone façade and brick barrel vault.

Construction:

- Tomb is constructed on the back side of public tomb with granite façade and ledgestone roof construction.
- Relationship of the two structures is not clear. May share a rear wall.
- Façade is constructed from carved blocks of brownstone – a type of sandstone.
- Vault is constructed from bricks – straight walls and barrel vault roof.
- Small units of granite and cement mortar applied to the top of the barrel vault at the juncture with the back of the brownstone façade units as a way to seal an opening that probably exists between the façade and the barrel vault – a very common problem.
- Cement stucco in several locations on top of exposed portions of brick vault – Probably a repair of frost damaged bricks.
Sides and roof partially covered with soil.

The juncture between the rear of the brownstone façade and the brick barrel vault is covered with granite pieces and cement mortar. The soil cover over the bricks is eroded and the joints between the bricks are deteriorating.

**Condition: Fair to good.**

1. The condition of the brownstone façade is generally good. There are open mortar joints and some small areas of loss in the stone. The stone has been painted brown.
2. The brick barrel vault is exposed due to the erosion of the soil cover. The soil cover serves to protect the bricks and mortar from frost damage.
3. The condition of the interior could not be evaluated because the entry is sealed.

**Recommendations:**

1. Keep soil cover intact and planted with grass. Discourage visitors from walking on vault.
2. Repoint open and failing brick mortar joints with a compatible mortar.
3. Repoint open and failing mortar joints at the brownstone façade.
4. Fill gaps in granite collar at the top of the barrel vault with mortar. Remove failing mortar and replace.

Concrete/stucco Tomb with Granite Façade

Type of Structure: Former mound tomb that was covered or rebuilt with concrete.

Date of Construction:

Materials: Granite slab façade with bluestone wing walls. Vault appears to be a combination of concrete block and brick covered with stucco. Roof is possibly poured concrete.

Construction:

- The granite slab façade with the bluestone wing walls are typical of mid-19th century mound tomb construction however the vault is constructed from a mix of concrete block, brick, stucco and possibly poured concrete.
- The 20th century concrete and block portions of the tomb may have been constructed after the original collapsed or these materials may have been applied on top of the earlier masonry as a repair.
- The concrete portions may have been applied in two phases as phases as the photo on the next page shows a paint coating on top of what appears to be an earlier exposed smooth
This photo shows the juncture of the wall and the roof. There appears to be two layers of repairs – an earlier one with paint over a smooth concrete surface and an outer phase with concrete block, brick and cement stucco.

**Condition:** Poor

1. The granite façade is leaning forward slightly, and a gap has developed between the façade and the vault.
2. The cement-based materials that make up the vault are severely deteriorated. The upper portions of the walls as well as the roof are suffering from severe frost damage as well as possibly deterioration from alkali silica reaction (ASR).
3. The stucco layers are cracked and debonding.

**Recommendations:**

1. Perform probes to determine the construction of the vault walls and roof.
2. Remove closure at door and inspect interior to evaluate the interior walls and roof.
3. Plan for the eventual replacement of the vault structure as it might possibly be beyond repair.
Type of Structure: Above ground tomb

Date of Construction:

Materials: Granite foundation, brick walls and wood and asphalt shingle roof.

Construction:

- Granite foundation at grade, brick walls and wood roof covered in asphalt shingles.

Condition: Good

- Bricks are in good condition, but mortar joints are severely eroded.
- Shingle roof appears relatively new and wood moldings appear to have been painted recently.

Recommendations:

1. Preventative maintenance in the form of repointing with a compatible mortar is needed to prevent conditions of brick masonry from worsening.
The major issue is open and failing mortar joints.
Brick tomb with block at entry painted red

Type of Structure: Above ground tomb

Date of Construction:

Materials: Granite foundation, brick walls and wood and asphalt shingle roof.

Construction:
- Granite foundation at grade, brick walls and wood roof covered in asphalt shingles.

Condition: Fair to good
- Bricks are in good condition, but mortar joints are severely eroded.
- Shingle roof is reaching the end of its service life and the paint is failing at the wood moldings.

Recommendations:
1. Preventative maintenance in the form of repointing with a compatible mortar is needed to prevent conditions of brick masonry from worsening. Woodwork requires painting.
2. Roof repair or possibly complete replacement is needed
The ridge cap of the roof and individual shingles are damaged. The mortar joints are open and failing.
D- 531 Brownstone box tomb with marble top – displaced by tree growth

The brownstone and marble box tomb are constructed from slabs of stone set in mortar. The growth of the tree trunk and roots have pushed against the stone slabs – opening up joints and cracking some unit. Repairs have been attempted with adhesive and mortar but have been ineffective because the tree continues to grow and displace the tomb. It is not feasible to repair the tomb or even stabilize it without either relocating it or removing the tree.
Section Four: Outline Specifications
SAMPLE BID SPECIFICATIONS FOR
GRAVE MARKER CONSERVATION AND Resetting

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all sections within General Requirements, which are hereby made a part of this section of the specifications.

B. Attention is directed toward the pages...of the bid documents for a list of markers included in the base bid of this contract as well as a list of markers for each of the add/alternatives that are part of this bid.

C. Attention is directed to the document entitled "Gravestone/Monument Conditions Assessment by Building and Monument Conservation" for a description of the markers included in this contract. Descriptions of conditions and well as recommended treatments included in the list at the end of the specifications are for the purpose of identifying the markers that will be treated under this contract and for giving a general description of the conditions and recommended treatments. The short description is not intended to define all of the treatments or treatment steps that may be required. It is the responsibility of the bidder to examine each stone on the list prior to submitting a bid.

D. Attention is directed to the documents entitled "– Maps of 29 sections of Rural Cemetery" for the approximate locations of the markers in this contract.
1.02 SUMMARY AND DESCRIPTION OF WORK

A. **Base Bid:** The work of this section consists of the provision of all materials, labor and equipment and the like necessary and/or required for the complete execution of all stone conservation and resetting as required by the specifications and schedules. **Base Bid includes a total of -- markers.**

B. **Outline of Scope of Work:**

1. Excavation, Cleaning, Documentation and Resetting of the markers listed in this document.

2. Conservation treatments inclusive of excavation, cleaning, documentation and resetting of the markers listed in this bid document.

3. Review of existing project reports, conditions assessments and documentation for all the headstones and footstones that are scheduled to receive conservation treatments and/or resetting under this contract.

4. Document the condition of each grave marker or footstone scheduled to receive conservation treatments under this contract with a survey sheet, and digital photographs prior to proceeding with any work. Stones that require resetting and no further treatment can be photographed when they are out of the ground and lying flat. Markers that require resetting only do not require a survey sheet unless, upon removal from the ground, the marker appears to be too short to be reset without adding to the marker and/or creating a custom-made cast concrete base.

5. Some of the markers listed in this RFP are identified in the Conditions Assessment Reports as fragmented. Some of the markers that are scheduled for treatment and/or resetting may turn out to be incomplete when they are removed from the ground. It is the contractor's responsibility to make every attempt to look for and then rejoin separated fragments. Pieces that cannot be matched or are too small to form a grave marker should be marked with the location where they were found and brought to the attention of the client.

6. Submit conservation treatment plan for approval prior to proceeding with any work.

7. Clean all stones to remove biological growths and general soiling. Some species of lichens, particularly on slate markers, may prove resistant to removal using the specified chemicals and methods. If, after applying the specified treatments some lichens remain, no additional cleaning will be required.
8. Stabilize all loose fragments of stone and friable areas of stone prior to proceeding with excavation or cleaning.

9. Complete specified conservation treatments for each marker. Treatments include but are not limited to: Removal and resetting, removal of prior repairs and pins, installing new pins, gluing of pieces separated along cleavage planes, gluing and pining of pieces broken across cleavage planes or bedding planes, grouting of fissures, cracks and seams, application of mortar caps, composite mortar repairs and laying down of flaking areas as well as attaching new pieces of stone to existing markers and/or creating new cast stone bases for markers that are too short to be reset with the carving or lettering above grade.

10. Resetting of grave markers includes supplying all sand, gravel, sod and soil required to reset the designated makers as well as all equipment and materials.

11. Document all treatments with digital photographs and notes on treatment documentation sheets during conservation work.

12. Thoroughly document condition of headstone or footstone after conservation work is complete with digital photographs as well as marked sketches and/or annotated photographs that indicate the locations of individual treatments.

13. Provide the City of New Bedford with a complete project binder at the end of the project containing the following: Copies of all survey sheets with proposed treatments, copies of final treatment reports plus any field reports, and project correspondence. Include material safety data sheets, and manufacturer’s cut sheets for all products. In addition, provide the City with a thumb drive of all of the above plus before, during and after treatment photographs organized by the name(s) of the deceased and the id number assigned to the markers on the 2007 Fannin/Lehner Assessment.

C. Outline of Specific Treatments: The following is an outline of required treatment steps for groups/types of markers but is not intended to address all of the specific treatments that will be required on individual markers. Bidders must review the condition of each marker prior to bidding.

1. Markers that Require Removal from Ground and Resetting in Order to Complete Conservation Treatments.
   a. Document conditions prior to removal using survey sheet and photography per specifications.
b. Secure all loose and friable areas with B-72 or water soluble adhesives and tissue paper or cloth prior to removal from the ground.

c. Number all fragments that are too large to be secured with B-72 using a numbering system based on the existing plot plan and the name and date of the deceased (where legible).

d. Remove markers that require removal and resetting in order to complete conservation treatments from ground as per specifications and transport to work area. If there are detached fragments, place fragments in clearly labeled plastic bags.

e. Remove soil residue from stones with water and stiff brushes and wood scrapers. Clean to remove biological growths such as algae, moss and lichens where required to complete conservation treatments such as reattachment of fragments, grouting, patching and mortar caps.

f. Remove prior adhesive and composite patching repairs. (Remove old pins where applicable)

g. Re-adhere fragments using specified adhesives and methods. (Install new stainless steel pins where required)

h. Laydown flaking areas with specified grouts/adhesives.

i. Fill cracks, seams and fissures with specified grouts.

j. Fill areas of loss with specified composite repair materials.

k. Apply mortar caps on the surface of stones with specified materials if required.

l. Extend stones that are too short to be reset so that the carving and lettering are above grade and/or re-set those stones in custom made cast concrete slot bases that will be below grade.

m. Document the locations of all treatments on survey sheets. Photograph stone during and after treatment with digital photographs.

n. Reset stone per specifications.

2. **Markers That Do Not Require Removal and Resetting to Complete Conservation Treatments.**

a. Document conditions prior to starting treatments using survey sheet and photography as per specifications.
b. Secure all loose and friable areas with B-72 or water soluble adhesives and tissue paper prior to starting other treatments.

c. Remove soil residue and biological growths from stones with water, specified cleaning agents and stiff brushes and wood scrapers.

d. Remove prior adhesive and composite patching repairs where applicable. (Remove existing pins where applicable)

e. Clean areas that are to be adhered using compressed air or low pressure water to remove foreign materials.

f. Clean mating surfaces or areas to be grouted with solvents.

g. Re-adhere fragments using specified adhesives and methods.

h. Laydown flaking areas with specified grouts/adesives.

i. Fill cracks, seams and fissures with specified grouts.

j. Fill areas of loss with specified composite repair materials.

k. Apply mortar caps on top surface of stones.

l. Document locations of all treatments on survey sheet. Photograph stone during and after treatment with digital photographs as per specifications.

3. Treatment for Markers that Require Resetting Only and No Additional Treatments

a. Photograph slab markers when the marker has been removed from the ground prior to resetting and a second time after it has been reset. Multipart markers should be photographed before and after resetting.

b. Some of the markers designated for resetting only are still in the ground but leaning while others are toppled and lying on the ground. Removal of leaning markers from the ground is a required treatment step. Do not attempt to true stones that are leaning without removing them from the ground first.

c. Cleaning of markers designated for resetting only is not required.

d. Upon removal from the ground some markers may turn out to be broken and therefore too short to be reset without having the existing carving
and lettering above grade. These units should be extended by attaching a new piece of matching stone or composite mortar extension, or, by resetting them in a new cast concrete slot base section created specifically for this purpose.

4. **Treatment for Markers that have been set in stone or concrete surrounds**

   a. Document conditions prior to starting treatments using survey sheet and photography as per specifications.

   b. Secure all loose and friable areas with B-72 or water soluble adhesives and tissue paper prior to starting other treatments.

   c. Remove soil residue and biological growths from stones with water, specified cleaning agents and stiff brushes and wood scrapers.

   d. Remove prior adhesive and composite patching repairs where applicable. Remove failing sealants, caulks, joint compound or mortar from interface with marker and surround. (Remove and replace all ferrous pins, clips or mounts that are holding the stone in the frame.)

   e. Clean areas that are to be adhered using compressed air or low pressure water to remove foreign materials.

   f. Clean mating surfaces or areas to be grouted with solvents.

   g. Re-adhere fragments using specified adhesives and methods.

   h. Laydown flaking areas with specified grouts/adhesives.

   i. Fill cracks, seams and fissures with specified grouts.

   j. Fill areas of loss with specified composite repair materials.

   k. Repoint interface between marker and surround with specified mortar.

   l. Document locations of all treatments on survey sheet. Photograph stone during and after treatment with digital photographs as per specifications.

5. **Treatments for Markers that have a cement collar poured around the lower section**

   a. Follow treatment steps a-j described above.

   k. For markers that are lying on the ground and have a cement collar around the lower section, do not reset markers with cement still attached to the stone.
m. Remove cement collar and discard.

n. Reset the stone in the ground if the lower section is intact and of sufficient length to permit the stone to be set with the inscriptions above grade.

o. If the slab marker is too short to be reset, the follow steps outlined below in the specifications for either extending the stone or creating a cast base that will keep will provide below grade support for the stone.

6. Treatments for Markers that have cement applied over a stone slot base.

   a. Follow treatment steps outlined above for stabilization and treatment of the markers but remove cement coating from lower section of marker and stone slot base.
   b. Reset markers in slot base without cement coating

1.03 SUBMITTALS

A. Resumes and Qualifications: Contractor shall submit resumes and qualifications for each of the following individuals with their bids:

   Conservator (s): The names of the proposed Lead Conservator(s), Assistant Conservators and masonry craftspersons shall be identified in the bid. Lead Conservators shall be defined as a professional with training, experience and education in one or more of the following fields: Grave stone conservation, architectural stone conservation and/or museum objects conservation. Lead Conservator shall have extensive experience in the documentation and treatment of historic and culturally significant structures or objects made from stone. Membership in one or more of the following organizations is not a requirement but it will help substantiate a long-term commitment to the profession and knowledge of The Secretary of the Interior’s Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscape. Organizations: American Institute for Conservation, Association for Preservation Technology International. US Icomos, Icrom. Training from product manufacturer's shall be counted as a qualification to use certain products but it will not be counted as an indication of broader training in the conservation of cultural and historically significant objects made from stone.

   Contractor shall submit resume and a list of prior projects for Lead Conservator and any assisting conservators with the bid. Submittal of Lead Conservator’s list of projects shall include at least five examples of projects similar in scope and importance to the work at Old Burial Hill. At least three of those projects must be National Register listed projects. Project references shall include name, location and date of execution of each project as well as the names and telephone numbers of references for each of the five projects. Project references must be from a
knowledgeable preservation professional and/or members of the local or state historical commission(s).

In addition to the resumes and qualifications listed above, contractor shall include a list of prior projects completed by the firm. The list of contractor projects and Lead Conservator projects may overlap if the two firms worked together or if the Lead Conservator was a member of the staff of the Contractor at the time that the projects were completed. Contractor to include a brief paragraph for each of the projects submitted that identifies how the work completed, and the materials that were used conform to the standards set out in The Secretary of the Interior’s Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscape. Contractor project references for each of the five projects shall include name, location and date of execution of each project as well as the names and telephone numbers of references for each of the five projects. Project references must be from a knowledgeable preservation professional and/or members of the local or state historical commission(s).

B. Product Data: After the award of the contract, submit manufacturer’s technical data for each product proposed in the treatment plan including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements. Submit material safety data sheets for each product.

C. Written Description: After the award of the contract, submit written program for each phase of conservation including schedule and phasing. Include items for coordination with the client and indication of how surrounding graves, grave markers, monuments and vital plantings will be protected. Describe materials and equipment to be used on site. Describe safety measures that will be taken to protect visitors while the work is underway and to protect the stones from damage while they are out of the ground.

D. Alternate Methods: If, after the contact is awarded, alternate methods and materials to those indicated in the bid specifications are proposed for any phase of the conservation or resetting work, the contractor shall provide a written description, including evidence of successful use on other comparable projects along with the standard product submittals outlined above. Written approval from the Project Consultant is required prior to substituting any materials or methods. Work completed using substitute materials that does not have the written approval of the Project Consultant shall be rejected as well as any claims for payment until the materials are removed and the work is completed with the approved materials.

1.04  MOCK UPS
A. Sample of workmanship for stone stabilization with B-72 or water soluble adhesives and tissue paper or cloth.

B. The contractor shall submit one sample of removal of prior adhesive repairs and prior composite mortar repairs in locations indicated by project conservator. Samples to be evaluated for methodology and impact on stone.

C. Contractor to submit one sample of new stone to stone adhesive joints for approval prior to proceeding with balance of repairs. Sample to be evaluated for alignment of fragments, width of joint and absence of any epoxy on the visible surfaces of the stone.

D. Contractor to submit one sample of grout injection for approval.

E. Contractor to submit for review one sample of each of the following: tinted mortar fills, composite mortar repairs and mortar caps prior to proceeding with the balance of the work.

F. Contractor to submit one completed treatment cycle of a slab marker that has been removed from the ground, treated and reset.

G. Contractor shall submit a sample of a representative conditions assessment and treatment documentation survey sheet prior to starting work.

H. Contractor to submit sample of mortar fill or patch painted with Kiem mineral paint or approved equal. Sample to be applied to fully cured mortar.

1.05 REFERENCE STANDARDS

A. Aggregates for concrete: ASTM C33

B. Mortar Sand: ASTM C144

C. Bricks: ASTM C216

D. Mortar: ASTM C270

E. Stainless Steel Threaded Rod: ASTM A276

1.06 QUALITY ASSURANCE

A. Statement of Significance: The grave markers and headstones
At New Bedford’s Rural Cemetery represent some of the most significant grave markers in New Bedford. The burial ground is a designated historic burial ground and is listed on the National Register. All work performed must comply with the United States Secretary of the Interior’s Standards for the Treatment of Cultural Landscapes and the AIC Code of Ethics and Guidelines for Practice

B. Stone Conservation Contractor: Work shall be performed by firm(s) employing Grave Stone Conservators and Restoration Masons working under the guidance of a Lead Conservator. Contractor and lead Conservator must have no less than five years of experience with comparable stone conservation projects. The Contractor shall submit references for five successfully completed projects - at least three of which shall be National Register Listed Properties - and identify the scope of work for each project as per Section 1.03.

C. The contractor shall maintain a steady crew for the duration of the project Employ a qualified foreman who is present on the job every day.

D. The following treatments shall not be permitted: 1) Sandblasting, grinding or otherwise abrading the surface of the markers, 2) Covering sections of markers with thin applications of mortar, polymer modified mortars, bulked polymers, resins, bulked resins, thin-set, setting compounds etc. to fill areas of cracks and/or delamination, 3) Grinding the surfaces to remove excess, mortars, resins, polymers, latex. 4) Leaving exposed areas of adhesives/resins etc on markers or bases. 5) Honing of weathered surfaces, 6) Laminating historic markers to new pieces of stone. 7) Bonding the individual pieces of multi-part markers to each other with epoxy or other polymer adhesives. 8) Setting compounds in place of mortar. 9) Replacement stone slot bases manufactured with open ends.

1.07 JOB CONDITIONS

A. Take whatever precautions are necessary to protect all of the grave markers in this contract as well as adjacent markers, graves and monuments from damage resulting from work under this section or other related sections of work. Take all precautions that are necessary to protect the safety of visitors to the burial ground when work is underway, contractor's equipment is on site and markers have been removed from the ground.

B. Prevent mortar and patching compounds, adhesives, resins etc used in conservation and repair work from staining the stones under treatment or any adjacent stones, masonry, bronze etc. Prevent damage from other materials or chemicals used on the project.
C. Work shall not be permitted in freezing weather unless the work area has been enclosed and heated to maintain a constant temperature and humidity.

D. Materials shall be used only at the manufacturer’s recommended and temperature and humidity tolerances. In case of conflict between standards on the project, the more stringent shall apply.

E. Removal of markers from the burying ground to a secure, heated conservation studio is encouraged in order to complete the project within the required time frame. Up to ten (10) markers may be removed at any one time. Return completed markers prior to removing any additional markers. Provide the Town of Plymouth and the project conservator with an inventory of markers to be removed. Specify where the markers will be taken and how they will be transported. The work space must be secure from theft and contain smoke alarms and fire suppression equipment. The space must be available for review prior to transporting the markers and while the work is underway. The inventory shall include a digital photograph of the entire marker inclusive of any fragments as well as the name(s) of the deceased and the map identification number. Update inventory immediately when the markers are returned to the burying ground.

PART 2: PRODUCTS

2.01 MATERIALS GENERAL

A. Comply with referenced standards and other requirements indicated applicable to each type of material required.

B. Reference in the specifications to materials by trade name is to establish a standard of quality. It is not intended to exclude other manufacturers whose materials that, in the judgement of the project conservator are equivalent to those named based on sample panels.

2.02 MORTAR MATERIALS FOR FILLS, REBUILDING AREAS OF LOSS and MORTAR CAPS

A. Composite Repair Mortars

a) Non-Polymer Modified Composite Repair Mortars for filling areas of loss in Slate or Marble: Jahn M-70, Jahn M-120, 160 from Cathedral Stone Products. 8332 Bristol Court, #107, Jessup, Maryland 20794 (800) 684-0901

b) Polymer Modified Composite Repair Mortars for Mortar Caps and Seam fills on Slate Markers: Edison Custom System 45 from Edison Chemical Systems, Inc. 25 Grant Street, Waterbury, CT 06704 (203) 597-8044
c) Hydraulic Lime Based Repair Mortar for Filling Seams and areas of Loss on Marble and Sandstone Markers: Lithomix from St Astier available from LimeWorks.us 215-536-6706 Email LimeWorks.us

2.03 GROUT MATERIALS

A. Acryloid B-72 (Ethyl Methacrylate Copolymer) dissolved in solvent. Concentrations to vary depending on the depth and width of the crack or void to be filled. Large voids to be filled with B-72 bulked with an inert material such as fine silica sand. Exact proportions to be determined by conservator in the field based on the size of the area to be filled and other requirements such as the ability of the mix to flow evenly through the area.

B. Hydraulic Lime Grout for fills and injecting into voids

1 part hydraulic lime. (Available from LimeWorks.us 215-536-6706 Email LimeWorks.us) and 2.5 –3 parts fine sand and/or stone dust and inorganic pigment as required to match color of slate or marble. Not to exceed ASTM ratios of pigment to binder.

Hydraulic lime Injection Grout and Crack Filler as manufactured by VoidSpan or approved equal. www.voidspan.com

2.04 MATERIALS FOR THE STABILIZATION OF LOOSE FRAGMENTS PRIOR TO REMOVAL OR OTHER TREATMENTS.

A. Acrylic Resin B-72 and Japanese tissue paper applied to the surface of the friable or loose stone. B-72 to be dissolved in solvent such as acetone. Percentage of solids to solvent to be field tested. Approximately 5%. For situations where a water-soluble adhesive is appropriate: Methyl Cellulose or Polyvinyl Alcohol can be used to lay down the tissue paper or cloth.

2.05 STONE ADHESIVES FOR NON-STRUCTURAL REPAIRES AND LAYING DOWN OF STONE FLAKES, AND VERY SHALLOW AREAS OF EXFOLIATION.

A. Paraloid Acrylic Resin B-72 (100%) dissolved in solvent such as acetone. Percentage of solids to solvent to be field tested. Tubes of 10% paraloid B-72 in acetone can be obtained from Talas, 330 Morgan Ave., Brooklyn, NY 11211 212 219-0770 www.talasonline.com or other conservation supply companies.

2.06 STONE ADHESIVE FOR STRUCTURAL REPAIRS AND PINNING

2.07 CLEANING AGENTS FOR REMOVING SOILING PRIOR TO ADHESIVE REPAIRS

A. Water: All water shall be clean potable water. If potable water is not available at jobsite contractor must provide clean potable water.

B. Non-Ionic Detergents: Triton X 100 available from Talas, 568 Broadway, New York, NY 10012 (212) 219-0770

C. Concentrated Soap: Vulpex Soap available from Talas, 568 Broadway, New York, NY 10012 (212) 219-0770

D. Synthetic Anionic Detergent: Orvus WA Paste available from Talas, 568 Broadway, New York, NY 10012 (212) 219-0770

2.08 CLEANING AGENTS FOR REMOVING BIOLOGICAL GROWTHS

A. D2 Biological Cleaner by D/2 Biological Solutions, Inc PO Box 3746 Westport, MA d2bio.com

2.09 TOPICAL COLORING AGENT FOR COLOR MATCHING OF MORTAR PATCHES, SEAMS AND CRACK FILLS ON SLATE MARKERS

A. Kiem Purktistatal silicate paints available from Kiem Mineral Systems, #62 Port Lewes, Lewes, and Delaware 19958 (302) 644-1007 Fax (302) 644-0866

B. Silin Stain from Cathedral Stone Products. 8332 Bristol Court, #107, Jessup, Maryland 20794 (800) 684-0901

2.10 PINS FOR STRUCTURAL REPAIR OF FRAGMENTS

A. Stainless steel Threaded rod grade 304 or better.
2.11 SOLVENTS FOR FLUSHING CRACKS AND FISSURES AND FOR PREPARING MATING SURFACES PRIOR TO GROUTING OR ADHESIVE REPAIRS.

A. Acetone (CH₃) C₀

B. Ethanol-D₆ Anhydrous - May be mixed with water.

2.12 SOIL MATERIALS

A. Structural Fill: Provide gravel, sandy gravel, or gravelly sand free from organic material. Loam, trash, snow, ice, frozen soil and other objectionable materials and well graded within the following limits.

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<thead>
<tr>
<th>Sieve Size Passing Through</th>
<th>Percent Finer by Weight</th>
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<tbody>
<tr>
<td>6 inches</td>
<td>100</td>
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<tr>
<td>No. 4</td>
<td>30-90</td>
</tr>
<tr>
<td>No. 40</td>
<td>10-50</td>
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<tr>
<td>No. 200</td>
<td>0-8</td>
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</tbody>
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B. Crushed Stone: Provide clean, washed crushed stone free of fine materials and graded within the following limits:

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<tr>
<th>Sieve Size Passing Through</th>
<th>Percent Finer by Weight</th>
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<tbody>
<tr>
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<td>¾ inch</td>
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<td>½ inch</td>
<td>20-30</td>
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<td>No. 40</td>
<td>0-5</td>
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<tr>
<td>No. 200</td>
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</tbody>
</table>

2.13 PINS FOR STONE TO STONE PINNING AT MULTIPART MARKERS

A. Replace all existing steel pins with grade 304 or better stainless steel threaded rod matching the existing diameters and cut to the necessary lengths.

B. For two and three piece markers and monuments that were not previously pinned, utilize two 5/8” diameter grade 304 or better stainless steel pins cut to length from threaded rod.

2.14 Bed Mortar for Setting Two and Three Piece Markers and Upright Monuments.

A. Setting Mortar shall be: 1 part Type 1 White Portland Cement or a combination of Type 1/Type II Portland Cement as required to match existing mortar color, 1 Part Type S lime and 6 parts mortar sand.
B. Pointing Mortar for White marble shall be: 1 part Type 1 White Portland Cement or a combination of Type I/Type II Portland Cement as required to match existing mortar color, 1 Part Type S lime and 6 parts mortar sand.

C. Pointing Mortar for Granite to Granite Joints shall be tinted with alkali resistant colors specifically formulated for use with cement.

2.15 Cementitious Grout for Setting Stainless Steel Pins or Setting Upright Markers in Slot Bases

A. Mortar for setting pins and setting stones in slot bases shall be: A soft mortar that is durable but can be reversed in the future containing either Type I/II White or Light Gray Portland Cement and Type S lime and aggregate, or Naturally Hydraulic Lime (NHL 3.5) and aggregate, or Type S Dolomitic lime plus additives to make the mortar hydraulic. Ratio of binder to aggregate shall not be less than 1:2.5 or greater than 1:7

2.16 REPLACEMENT STONE: (For Extending Broken Stones)

A. Marble: Vermont Marble available from Vermont Quarries, 88 Church Street, Rutland, Vermont 05701 (802) 775-1065 or approved equal.

B. Slate: New or Salvaged slate to match color and texture of historic material. Portland Munson Slate available from Sheldon Slate Products, 38 Farm Quarry Road, Monson, ME 04464 207-997-3615, or approved equal.

2.17 GRAVEL

A. Construction grade gravel ranging in size from 1/4" to 1" as required.

2.19 NEW CAST CONCRETE MIX SLOT BASES FOR RESETTING SHORT STONES

A. Cast concrete shall be made from cast stone mix containing Type I/II White or Gray Portland Cement and graded aggregate. Hardened and cured mix shall reach a minimum compressive strength of 5,000 psi after 28 days.

B. Cast concrete bases shall contain a custom-made slot that allows the marker to be inserted into the slot and a weak grout to be placed between the marker and the sides of the slot in the base. Concrete base shall hold the marker in place securely but allow for drainage of water out of the slot.

PART 3: EXECUTION
3.01 TREATMENT PLAN

A. Conservator is to submit for review, a detailed treatment proposal for the grave markers and tombs scheduled for treatment. Conservation plan is to include any changes in scope, materials and/or methodologies from what has been specified. No work may commence on the markers until the treatment plan has been reviewed and approved. Treatment plan to include detailed descriptions of materials and methods to be used in each treatment as well as manufacturer’s data on each product. Material Safety Data Sheets for each product to be submitted separately. Treatment plan to include sequence of treatments.

3.02 DOCUMENTATION

A. Survey Sheet: Each marker that is treated under this contract shall have an individual survey and treatment sheet. The survey sheet shall record the plot number of the marker as indicated on the existing survey, the name of deceased, (where legible) and the year of death. The survey sheet shall contain an outline sketch of the marker and/or a photograph. All conditions and treatment must be noted on the sketch or photograph. The type of material and the rough dimensions of the marker shall also be recorded on the survey sheet. A sample survey sheet shall be submitted at the start of the contract. Four sets of completed survey and treatment sheets shall be placed in archival sleeves and turned over to the City of Quincy in binders with the balance of the project documentation when the project has been completed. The four project binders shall contain all survey and treatment documentation sheets plus hard copies of the manufacturer’s data sheets and MSDS sheets for all products used in the treatments. In addition, all before, during and after digital photographs as well as digital copies of the survey and treatment sheets shall be placed on an external thumb drive and presented to the client. Provide four thumb drives with the complete documentation.

B. Photo-documentation: Each marker that is treated under this contract shall have at least 6 views photographed with a digital camera that records images in not less than 6 megapixels. The views shall show the markers from the front and back or top or side depending on the scope of the treatments. There shall be at least two views taken before, during and after treatment. All photographs of the before treatment phase are to be reviewed prior to starting treatments. Dark or unreadable photographs should be redone. All photographs are to be labeled electronically with the map identification number and name of the deceased and submitted with the documentation binders on an external thumb drive as per the above paragraph.

3.03 PRE CONSOLIDATION/STABILIZATION PRIOR TO TREATMENTS
A. The goal of pre consolidation shall be to secure all loose, semi-detached or friable areas against loss during other conservation treatments including pointing and cleaning. Contractor will be held responsible for losses on the stone that take place during conservation treatments therefore the extent of pre-consolidation shall be that which is in the contractor’s judgment sufficient to secure against losses. Submittal shall be for materials and methodology not extent of pre-consolidation.

B. Acrylic Resin B-72 dissolved in a solvent such as acetone approximately 5% solids shall be applied with a brush to areas requiring pre-consolidation. Japanese tissue paper shall be applied to wetted areas. Additional solution of B-72 may be applied over tissue paper. Where conditions permit, water soluble adhesives may be substituted for B-72

3.04 REMOVAL OF PRIOR MORTAR FILLS AND COMPOSITE MORTAR REPAIRS

A. Pre-consolidation as described above shall precede all raking out of joints, removal of mortar caps and prior composite mortar or adhesive repairs. It is the conservator’s responsibility to preconsolidate all loose and friable areas of stone prior to starting other treatments.

B. Surface tension and bond of prior repairs may be broken using power tools such as small diamond cutting wheels, Drummel Tools and small pneumatic chisels. All other removal to be performed by skilled craftsmen using hand tools. Use of hand held grinders or other power tools shall be only after demonstrated proficiency by each craftsman/conservation technician on selected control areas. Cutting wheel shall not be brought in proximity with stone surface or edges. Cutting wheels shall be used only to break the bonds to create entry points for hand tools. Every precaution shall be taken not to damage, nick, scar or abrade the stone.

3.05 MORTAR FILLS AND MORTAR CAPS -GENERAL (Sandstone and Slate Markers)

A. The goal of mortar fills and caps is to create the maximum water shedding fill, joint or seam for each particular configuration of stone.

B. Surface of fill shall be tooled and slicked to conform to the contours of the edge of the stone in order to achieve maximum water shedding.

C. Mix mortar to specified proportions and in conformance with the color and texture of approved samples.

D. Apply mortar to stone that has been properly prepared and is free of dirt, soiling and any loose or friable material or surface accretions that may have a detrimental effect on the bond. Wet stone to avoid excess absorption of moisture from mortar.
E. Apply mortar in consecutive lifts where required to avoid excessive shrinkage.
F. Moist cure mortar for a minimum of seven days or until mortar is properly cured.
G. When mortar has cured, tint surface of mortar with approved product.

3.06 MORTAR APPLICATION FOR FILLS AND MORTAR CAPS

A. First layer to create a uniform depth for later applications and to be thoroughly compacted into cavities: apply mortar to a maximum thickness of 3/8”
B. After voids have been filled to a uniform depth, apply remaining mortar in successive ¼” thick layers: fully compact each layer and allow to dry to thumbprint hardness before applying next layer.
C. When final layer is thumbprint hard, tool to match approved sample.
D. Avoid feather-edging of mortar joint.
E. If existing stonework has rounded edges from wear, recess slightly the mortar from face of stone surface.
F. Immediately after completion, remove excess mortar by light brushing with a natural bristle brush. Do not leave encrusted matter.
G. Keep mortar damp for 48 hours after pointing to permit proper hardening of mortar. Cover masonry temporarily with burlap, which is moistened periodically. Cover wall with plastic sheets temporarily to prevent evaporation. Continue to moisten for up to seven days if required because of high temperatures or high winds. Protect mortar from overnight rain.
H. For proprietary mortars; follow manufacturer’s directions for applying and curing mortars.

3.07 CLEANING AFTER MORTAR FILLS OR PATCHING OR GROUTING

A. The face of all stonework shall be thoroughly cleaned after completion of the pointing and other work liable to soil the stone. The stonework shall be gone over and any mortar splashes or smears shall be carefully removed from the surface with scrapers.
B. The cleaning shall be done with clean water applied vigorously with fiber brushes. After cleaning with brushes the stone shall be thoroughly rinsed with clear water. Proprietary cleaning compounds containing caustic agents, intended
for removing mortar smears shall not be used. The goal is to remove all smears before they set so that caustic agents are not required.

3.08 CLEANING OF MARKERS

A. The goal of the stone cleaning is to produce a surface that is free of organic growths and general soiling prior to adhesion, grouting or application of repair mortars. This includes removal of all surface dirt and encrustations.

B. Pre-Wet surface of stone with potable water. Apply D2 Biological cleaner to stone surface using a natural bristle brush. Allow cleaner to remain on surface for length of time determined in cleaning mock-ups. Rinse surface with water with low pressure from garden hose or equivalent.

C. Repeat water and D2 or proceed to clean with other specified cleaning agents as determined by the results of cleaning mock-up.

3.09 RE-ADHESION OF STONE (NON STRUCTURAL)

A. Prepare mating surfaces of stone that is to be re-adhered by cleaning surfaces until surfaces are free of dirt, sand, old grout, old mortar, ferrous metal stains or deposits and organic materials. After cleaning with specified cleaning agents clean with specified solvents just prior to apply adhesive materials.

B. Loose pieces of stone shall be reattached with Acrylic Resin B-72 dissolved in a solvent such as acetone. Approximately 10%-15% solids. Area of stone to receive reattachment and piece to be reattached shall be thoroughly coated with adhesive. Secure fragment until adhesive is set. Secure with reversible means. Clean surface of stone so that no adhesive residue remains on surface.

3.10 B-72 INJECTIONS FOR AREAS OF SHALLOW EXFOLIATION

A. Using a hypodermic needle, inject solvent into crack or fissures to clean surfaces. After solvent has evaporated inject Acrylic B-72 10-15% by volume in solvent. Wipe surface clean and remove any excess with solvent. Hold acrylic back ½ inch from face of seam with clay. Remove clay and grout seam face with either Edison Custom 45 Tinted to match or bulked and tinted B-72.

3.11 ADHESIVE REPAIRS (STRUCTURAL)

A. Prepare mating surfaces by removing prior adhesives where applicable and cleaning to remove soiling with detergents as specified above. Use solvents to remove any oil or grease from the mating surfaces.
B. Lay fragments to be adhered on clean flat surface if marker has been removed from ground and locate the centerline of holes for pins. The diameter of the pin shall not exceed 20% of the width. Minimum pin embedment on either side of the joint shall be three inches. Holes shall be 1/16” larger than the diameter of the pin.

C. Drill holes to receive pins where applicable. Blow dust out of drill holes. Test fit by placing pins in holes and dry setting. Set pins in edge of one fragment with epoxy and then dryset fragments to ensure that the pins are in the proper locations, mate surfaces. Do not apply epoxy to mating faces or other end of pin at this point. Adjust fit using clamps and jigs to hold stone in place. It is important that proper mating be achieved at this point. When the epoxy in the pin holes has set, separate pieces and apply epoxy to other end of pins and sparingly along mating surfaces. Reclamp stones and keep under pressure until epoxy has set. Set time will vary depending on temperature of air and stone.

D. For fragments that will not be pinned, follow steps above for cleaning and dry setting to ensure proper fit. Use clamps and jigs as required to secure pieces.

E. For Fragments to be adhered while marker is still in the ground follow steps above for cleaning. Use jigs and flat surfaces clamped to the stone in order to achieve best possible mating of surfaces.

F. Mix and apply adhesives as per manufacturer’s recommendations.

G. Hold glue line away from face of stone in order to grout seam with tinted grout. Immediately remove any adhesive residue that has flowed over the face of stone using acetone or other solvent.

H. Apply a tinted grout to the seam after the structural epoxy has set. Grout in seam should be flush with edges of stone on either side of the repair.

3.12 REMOVAL OF MARKERS FROM THE GROUND

A. Carefully dig on both sides of the marker without damaging or scraping the marker.

B. If lifting equipment is required to lift the marker out of the hole, carefully place straps around marker so that the straps will not abrade or scratch the stone. For soft or friable stones such as deteriorated marble, place moving blankets around marker prior to securing straps and lifting marker.

C. Store markers or component pieces of markers in a safe location. Cover markers when necessary to prevent damage or soiling.
3.13 REMOVAL OF OLD SETTING MORTARS FROM STONES OR SLOT BASES

A. Carefully remove existing setting mortars with hand held chisels being careful not to damage the edges or faces of the stones.

B. Completely remove old setting mortar in order to ensure a good bond for the new setting mortar.

3.14 REMOVAL OF EXISTING FERROUS PINS AND/OR EPOXY ADHESIVES FROM EXISTING PIN CONNECTIONS

A. Carefully remove existing pins by either drilling into the grout, mortar or epoxy around the pin until the pin is free or by core drilling around existing pins.

B. After core drilling carefully remove any remaining cement in the setting holes by chipping out the cement with small chisels.

3.15 RESETTLEMENT OF TWO AND THREE PART MARKERS

A. Relevel lowest unit of multi-part markers using gravel and/or shim stones prior to setting additional units on top. Depending on the existing conditions, provide six inches of gravel beneath the lowest unit if the existing is sitting on soil

B. Use stainless steel pins set in existing holes between units or drill new holes if none are existing. Holes should be 1/8” to ¼” larger in diameter than the pin and ½” deeper than the length of the pin.

C. Set pins in specified grouts. Do not set pins in epoxy or other types of adhesives without prior approval. (Connections should remain reversible in the future) Do not adhere the individual units of two and three piece markers to each other with epoxy.

D. Set units of two and three piece markers and monuments on full mortar beds. Use wood wedges placed in the joints to control thickness of setting beds. Do not use shims that will remain as part of the setting bed. Maintain existing joint thicknesses. Do not set historic markers in joint compound.

E. Compress setting mortar to a depth 2.5 times the joint height in order to prepare for the final pointing.

F. Point joints using specified mortars. Use white mortar for white marble and tinted mortars for colored stones such as granite or sandstone. Tint mortar to match the base color of the stone.
3.16  RESETTING SINGLE PIECE UPRIGHT MARKERS (SLAB MARKERS)

A. Carefully remove and retain sod with topsoil retained in the root systems. Following sod removal, remove topsoil down to a depth where it becomes sandy and retain for reuse. Remove balance of earth to required depth without damaging marker. If marker is broken below grade search soil for fragments and reattach fragments. If no fragments are located proceed to extend the stone or manufacture a custom slot base so that it can be set with the letting and carving above grade.

B. Shoring and Bracing: Slope excavations and provide shoring and bracing as needed to prevent collapse of the soil.

C. Mark site of excavation with caution tape and orange cones and protect area by covering hole with plywood to prevent anyone from stepping into hole.

D. Dewatering and Drainage: Remove water from hole using appropriate methods and protect excavations from surface runoff.

E. When resetting single piece upright markers, place backfill in lifts of not more than 6” and compact material around gravemarker prior to starting next lift. Brace the grave markers as required while surrounding them with compacted structural fill. Replace top soil and sod to existing depths.

F. Disposal: Dispose of excess materials off site in a legal manner.

G. Cold Weather: Do not reset grave markers when temperatures are below freezing or the fill could freeze prior to compaction.

H. Stockpile soil, sod and inorganic soil removed from grave on site in separate piles for reuse.

I. Protect all grave markers from damage during excavation and backfill operations.

3.17  RESETTING MARKERS IN EXISTING OR NEW SLOT BASES

A. Reset slot base on six inches of compacted gravel and sand. Do not widen holes so that fill is visible around the edges of the base. Set slot base to its original depth so that top of base is at or just above grade for historic markers with existing slot bases. Set new slot bases created for broken markers below grade so that concrete base is not visible.

B. After slot base has been cleaned of old mortar and re-set, set upright portion of marker in slot using specified grout/mortar. Compress setting grout/mortar and
add another lift of mortar to create a bevel that will shed water away from the slot. Brace markers in place until setting mortar has cured and slab will not shift.

C. Do not cut the bottom edge of broken markers to make a level edge if the break occurs in an area of carved lettering or decorative carving.

3.18 CASTING OF NEW SLOT BASES

A. Cast new concrete bases using wood forms and a removable insert to create the slot. Slot in base should be wide enough on all sides to allow for a soft mortar to be installed between the stone and the concrete. Slot should contain drainage holes to keep water from accumulating in the slots.

3.19 EXTENTIONS TO SLAB MARKERS THAT ARE TOO SHORT TO BE RESET

A. Stone extensions: Markers that are too short to be reset in the ground without covering the existing lettering and carvings can be extended with natural stone in the same manner that fragments of broken markers are reattached. See paragraph 3.11 Adhesive Repairs (Structural). The new piece of stone must be of the same with and thickness as the original and from the same geological class of stone. i.e. marble with marble and slate with slate. The new piece of stone must be coped out to mate with existing piece of stone without removing any of the historic material that contains carving or lettering.

3.20 TREATMENT OF MARKERS THAT ARE SET IN GRANITE SURROUNDS

A. Remove failing sealants, caulks, mortar etc from gap between marker and surround. Check adhesion of marker to stone surround. If marker is loose enough to remove, then remove marker and store in safe place temporarily and notify Project Conservator prior to proceeding with any additional steps or re-adhering the marker to the surround. Repoint gap between marker and surround with approved mortars. Use sealants only with the approval of the Project Conservator.

B. Markers that are going to be reset in the granite surround should be reset with reversible methods and materials. Acceptable methods include but are not limited to using lead wool or lead shims to set the marker, recaulking the perimeter seams with sealant but not the back of the monument, installing reversible hidden connections manufactured from non-ferrous metal and/or other non-corrosive materials.

3.21 TREATMENT TO MARBLE MARKERS WITH SLOT BASES IN SITUATIONS WHERE THE ORIGINAL MARBLE TENON THAT WAS INSERTED IN THE SLOT BASE IS BROKEN OR MISSING

A. A number of markers were constructed with marble tenons that fit into slots in
marble, granite or sandstone bases. Many of these tenons are either broken with portions remaining in the slot bases or are missing altogether.

B. For markers where the tenon is broken but remains in the slot base repair marker using epoxy and stainless steel pins.

C. For markers where the tenon is missing, fill the slot with mortar and insert stainless steel pins between the slab and the slot base.

3.22 REMOVAL OF EXISTING CEMENTITIOUS COATINGS

A. A few markers have been treated with a cementious coating applied over the edges of delaminating stone. Carefully remove coatings using hand chisels. Apply mortar caps as outlined above to delaminating slate or sandstone.

3.23 BROKEN SLOT BASES

A. Repair broken granite or sandstone slot bases in the same manner as a broken marker using epoxy and where appropriate, stainless steel pins.

Silence of Specifications

The apparent silence of these specifications as to any detail or omission from it, or a detailed description concerning any point, shall be regarded as meaning that only the best commercial practices are to prevail, and that only materials of first quality and correct type, size and design are to be used. All interpretations of these specifications shall be made on the basis of this statement.