

BASIC CONSERVATION WORKSHOP



HISTORIC GRAVESTONE SERVICES

New Salem, MA

www.historicgravestone.com

Basic Conservation

What is the difference between a rock and a stone?

We clear the *rocks* from our fields and stack them along the edges to form *stone* walls, we use a *rock* in the middle of the stream as a stepping *stone* to cross to the other side, or we find a *rock* at the side of the lake which is flat and smooth suddenly it becomes a skipping *stone*..... we change it automatically. As soon as we assign a purpose to *rock*, it becomes *stone* and gravestones serve a very important purpose.

What is a gravestone?

Marker, Monument or Artifact - A gravestone serves to mark the location of a burial, or as a memorial to those whom may or not be buried there and after time become artifacts from another era. They command respect and deserve preservation.

Types of markers – fieldstone, tablet, die and base, obelisk, pedestal with base, box tomb, cairn, table tomb, monument with cribbing, ledger or wolf stone, mausoleum,

Carvers - just a few words about carvers and signatures.....always look for signatures and carver's marks. Record this information on the conservation form

Types of stones Sedimentary, Metamorphic, and Igneous

Sedimentary	accumulation and consolidation of sediment usually in layered deposits like sandstone, limestone and shale
Metamorphic	alterations to the minerals, texture and composition of a rock caused by exposure to heat, pressure and chemical actions. Shale to slate, limestone to marble and sandstone to schist
Igneous	crystallization of magma or lava into rocks like granite, basalt or gabbros

Who does the gravestone belong to?

When a stone is purchased and placed at a sight, it is the property of the family which owns the plot. The grounds are maintained by the company or town which oversees the cemetery, but the stone remains the property of the family and the descendents. Ancient burial grounds, pioneer and family cemeteries, churchyards and abandoned cemeteries can fall under the care of Historical Societies or Commissions. Historical & Friends groups will work to preserve the entire cemetery including the gravestones and structures which are viewed as historical artifacts.

Who should repair gravestones?

An individual should first have the proper training and permission. The stones still belong to the desendants and family members should be notified of any decisions regarding their stones. Cleaning and simple resets of family stones or as part of a conservation project can be performed by physically able and knowledgeable volunteers, however public safety is **priority**. Many repairs require a conservator to be done properly. Be sure to interview all potential conservators and check references!

Why should gravestones be cleaned?

Biological growth and ambient soiling will obscure important details and are detrimental to the stones longevity. Biological growths like algae, moss and lichen can consume the rock and cause a loss of material on the surface as well as conceal other problems; i.e. missing mortar, pests, water damage. Removal of biological growth and a gentle cleaning can be helpful in extending the life of the monument and improve its appearance.

Be aware that stones which have been exposed to the elements for years will likely have soiling and stains which are difficult to remove, if not impossible. Some stones are old and fragile and unable to withstand a more aggressive cleaning. It is okay if they are not fully restored to their former glory, but that they are maintained and appreciated.

Where do I start?

Once a project has been initiated and proper permission has been secured, the first step is to create a project plan. Work should **not** begin until there is a clear plan. Beginning with a stone by stone assessment, document the names, dates, inscriptions, and condition. Documenting forms should contain the location of cemetery, lot numbers, type of stone, monument style, inscription, condition and date of assessment. Document the stones with *before and after* photos. The plan will develop quickly and a priority list will emerge. The project can then easily move forward once there is a plan and a priority list.

What is wrong with this stone?

Assessing the stone properly will determine which treatment is correct. A stone which is *leaning* front to back is at more risk than a stone which is *tilted* side to side and therefore should be prioritized as such. A larger stone which has a 20% lean is at more danger than a small stone which has a 40% lean. A stone which has broken and is on the ground – is at risk of further damage and may be a high priority. A priority list should be generated from the assessments using the following criteria:

Priority List

- | | |
|---------------------|--|
| #1 Public Safety | Can the stone fall on someone or trip them? Is it near a walkway or drive? |
| #2 Stone Safety | Is the stone in danger of falling or suffering further damage? |
| #3 Historical Value | Is the stone for an early settler in the town or important figure in history? Is the stone unusual or hand-carved, maybe from another era? |

Cemetery

Location

Record Date

Name

Date of Death

Lot #

Material

Marker Type

Base

Orientation

Dimensions

No. Commemorated

Carved Surfaces

Stone Carver

Motif

Border

Carving Condition

Inscription

Previous Work

Stone Condition

Treatment

TOOLS

Cleaning

WATER, WATER, WATER
Buckets
Soft natural or nylon scrub brushes
Craft sticks
Plastic wrap/garbage bags
D-2 or Bio-wash
Elbow Grease

Resetting a Tablet Stone

Shovel
Wheelbarrow
Plastic Garden Trowel
Milk Crate
Tarps
Tape Measure
Level
Sand and Gravel
Pry Bar
Tamper
Wood for support, tamping and bracing
Water for compacting sand & gravel

Resetting Tablet in a Base

Mason Trowels
Pointing tool (flexible blade)
Mixing Bucket
NHL (naturally hydrated lime)
Masonry Sand
Portland cement
Water

Recommendations for cleaning old gravestones in-situ

When preparing to clean a stone ensure that it is stable. Visual observation comes first. Then **GENTLE** hands-on to test and confirm observations. Always stand or kneel to the side of the stone while applying solutions and scrubbing. Do not lean on the stone while cleaning. Should the stone prove to be unstable despite earlier precautions, potential personal injury will be avoided. Safety should be a priority.

- #1 Cover all neighboring gravestones with plastic bags to protect them against splashing while cleaning.
- #2 For all types of stones, dry brush the entire stone with a soft bristle brush to remove loose material such as moss, lichens or grass clippings before wetting.
- #3 Always start to wet the stone with water at the bottom first and work your way up. Wet the stone **thoroughly with water** then begin scrubbing at the bottom of the stone; this will prevent streaks from the dirty water. Rinse with water *frequently* until the water runs clean from the stone.
- #4 For slate, limestone, marble and granite – For biological growths, such as lichens or moss, use an agent like D-2 or Bio-wash designed specifically for biological growths on stone. Follow the manufacturer's directions. Wet the stone with this solution (starting at the bottom), scrub, and rinse with clean water. The solution will produce suds, but it is **NOT SOAP**.
- #5 For slate, limestone, marble and granite – mix one-half cup of household ammonia into one gallon of water. Wet the stone with this solution (starting at the bottom), scrub, and rinse with clean water. Ammonia is non-hazardous to the stone or the environment. **BLEACH SHOULD NEVER BE USED**.
- #6 Some lichen, black in particular, is very resistant to the above procedures. If necessary, the affected area can be treated with a poultice made from powdered clay (kaolin) mixed to a paste using equal parts of water and glycerin. Apply to moist stone and wrap with plastic to keep moist and leave for a day or two. Remove poultice and rinse well with clean water. This should remove most all lichens.

PROCEDURES FOR RESETTING A STONE

Resetting a Tablet Stone

- #1 Remove sod from around the tablet stone carefully and place at side on tarp. Slowly and carefully remove soil from around the stone, using the plastic trowel. Support the gravestone while clearing the soil to expose the bottom of stone. Clear all soil around the gravestone before attempting to remove the stone. Lift the gravestone from the location, using lifting equipment if necessary and gently place horizontal on several pieces of wood for support before cleaning.
- #2 Excavate the area for the stone to more than 1/3 the total height of the stone, removing all large rocks. Sift all soil through a screener and place on tarp. Check the center of site is in line with the row of gravestones. Begin to fill the hole with a few inches of gravel & sand mixed with soil and tamp down.
- #3 Place some loose mix in the bottom of the hole and place in gravestone. Placement should be in line with the row and surrounding stones, facing in proper direction and only 1/3 of the total height of stone should be below grade. Continue to check placement of gravestone in row, depth of stone and that stone is level. Begin to place more loose gravel & sand mixed with soil around stone and tamp with a tamper until area is 4" from grade level. Keep checking the gravestone with the level and alignment of the stone. Pour water around stone to help compact the mix. After the water has drained, fill remaining area with soil and replace sod. Check gravestone again with level.

Resetting Tablet in a Base

- #1 Excavate area and remove gravestone as described above. Place gravestone on wood for support and finish excavating site to proper depth. Bases should be just two to three inches below grade unless replacing an exposed base. Prepare area for the base with a foundation of gravel/sand/soil mix tamped down level. Set base with slot opening centered and in line with gravestones close by. Check base is level in all directions before filling around base. Tamp gravel/sand/soil mix around base to secure, leaving a few inches for top soil. Clean the gravestone as described above.
- #2 Dry fit stone in base. Prepare work area with tools, braces, level before mixing mortar. Prepare a mortar mix of 4 parts sand, 2 parts hydrated lime and 1 part Portland cement. Be careful to keep the mortar stiff and not too wet.
- #3 Place some of the mortar mix into the bottom of the base slot and place stone in the base. Check gravestone with a level and support placement with wood wedges. Fill in around the stone with mortar compacting it fully in the joint. Check again with the level and make any adjustments if necessary. Brace with wood to hold in place while setting up. Trowel mortar for final finish and clean excess mortar from surrounding area. Replace dirt and grass around base.

CONSERVATION METHODOLOGY

CLEANING

Cleaning gravestones is generally not recommended unless performing repairs. Biological soiling will degrade stone surfaces over a long time. The affects of this degradation needs to be weighed against the degrading affects of cleaning. Depending on the method of cleaning this can be beneficial or detrimental.

If cleaning is necessary the stone surfaces should be rinsed with a generous amount of water and brushed with a natural bristle brush. Repeat as necessary. If a stone has biological growth, it can be treated with an anti-biological solution. D2 Biological Solution (Cathedral Stone Products) is the recommended product for this application. D2 is a water soluble, non toxic, anti-biological solution which does not react with the stone or leave soluble salts.

Removal of failed repairs

Repairs are considered as having failed if they are no longer functional, are unsightly, or are a hazard. Failed adhesives, mortars and pins require careful removal before proceeding with conservation treatment. Some temporary stabilization may be necessary as poorly attached fragments are disassembled.

Removal of degraded structural resins may be particularly difficult and time-consuming. Mechanical removal is generally done with small hand tools. The cutting of pins and fasteners may require power tools. Ferrous metal pins are most often locked in place by corrosion expansion. Their removal is best done by careful drilling with a properly sized coring bit.

RESETTING

Eighteenth and early nineteenth century New England gravestones are typically stone tablets that were set directly in the ground. By the first half of the 19th century many headstones began to use bases. Stones were either mortared into slots or pinned to the base. In some cases older tablets were cut and reset with a base. Larger monuments are often made of several elements and can be both large and heavy. Specialized hoisting equipment is often required. Competent operation and structural engineering considerations are required when performing this work.

Resetting in ground

Tilted stones set directly in the ground can be made plumb by careful excavation of the soil with hand tools, to permit re-setting in the proper position and drainage. When excavating, all large stones should be removed as ice heaves can cause an underground stone to push on the gravestone. If there is not an adequate length of below grade material to support the marker a new cast concrete below grade base will be required. Once the stone is carefully placed into the vertical position and at the proper depth, the stone is made plumb and level, and aligned with adjacent markers. Backfill with a mixture of coarse sand and pea gravel wetted and compacted. Disturbed areas of the ground are re-graded with topsoil and seeded as required.

Resetting on/in existing base

Unsecured stones in existing bases require re-setting. Generally the base should be reset level and aligned with adjacent stones. Pins should be removed if present. The stone can then be re-set level and plumb in the existing slot.

Re-set stone on a full bed of modified lime (or hydraulic lime) mortar. Historically ratios of 1 part cement, 4 parts lime and 8 parts fine sand have been used with good results. This mix is generally considered to be a soft mortar. Some conservation recommendations have specified ratios as high as 3 parts cement, 2 parts lime and 8 parts sand. The increased cement and reduced lime content has the effect of increasing the strength and adhesion of the mortar. In theory this would tend to make the mortar last longer than the traditional mix. The negative aspect is that the higher cement ratio produces a harder joint which induces a compression stress on the stone as the stone swells with varying weather conditions.

Our recommendation is to use 2 parts cement, 4 parts lime and 8 parts fine sand which, increases the strength somewhat while still retaining some of the softer properties to help reduce stress on the stone.

Resetting into new cast concrete base

There are several situations where a new cast base will be required. Usually tablets which are broken near grade level or have been cut years earlier and set into bases that have failed are typical examples of when a new base is needed. Bases can be set above grade or below depending on the stone, aesthetics or other factors. Bases can be cast on site or pre-cast and set in place on a level bed of gravel and sand.

Traditional cast concrete bases are typically made with a slot that is $\frac{1}{2}$ " wider and thicker than the stone and is recessed 3"-4". Depending on the size of the stone the base is usually 8"-12" deep, 8"-12" greater thickness and 6"-8" wider than the stone. This method is fine when resetting stones with a square bottom although the low moisture permeability of concrete will have a long term affect on the mortar joint. This is due to the slot not being continuous and moisture that collects cannot escape. A slot through the base where moisture can propagate out solves this problem.



Some conservation specifications recommend squaring the bottom of the stone by cutting the stone with a saw. This is not recommended as the use of power tools on old stones can cause damage to the stone. In addition valuable history including inscriptions may be lost. If the bottom of the stone is not square a base with the same

dimensions as above should be made but the slot should go completely through the base. This allows the excess stone to extend under the base level if needed and provides for better support.

To make the slot it is recommended that you use several pieces of Styrofoam insulation. An example would be if you had a stone that was 12" wide by 2" thick you would make a slot opening 13" wide and 3" thick. This would be accomplished by using 3 pieces of 1" insulation stacked together. The center piece should be made in sections which will facilitate the removal of the form after the concrete dries. Rapping the Styrofoam pieces in duct tape will hold all the pieces together while casting the concrete. Use of WD40 on the form also helps in releasing the concrete from the forms.

Restoration mortar repair

Repairs to gravestones, generally involves reassembly of broken pieces and fragments of stone, filling open joints, cracks and delaminating. Depending on the stone and type of break will determine which method of reattachment.

STRUCTURAL REATTACHMENTS

Broken stones to be bonded should be carefully cleaned and dry fitted to insure proper fit. The area around the stone should be probe for any missing pieces which may belong to the stone. Traditional method of two part epoxy (Aboweld 55-22, Abatron) is the common way of bonding stones that require structural integrity. Epoxy is very strong although it also is moisture insensitive. This has the effect of creating a moisture barrier at the repair joint. For marble and slate stones this can cause stone degradation over time due to the inability of the moisture to wick away from the area. Field observations have shown that failures usually occur adjacent to the repair joint which has been attributed to the strength of the epoxy being stronger than the marble. Closer observations have shown that the stone at the new break is usually degraded. Epoxy should be reserved for conditions where high shear forces are acting on the stone. Several factors such as angle of break, thickness of the stone, weight and bonding surface area need to be considered when deciding to use epoxy.

For most bonding applications, a non polymer, cement based restoration mortar (Jahn Restoration Mortars, Cathedral Stone) should be used. The specific bonding method should conform to the manufacturer's specifications for the specific stone and should be performed by a certified Jahn Products Technician. Bonding with restoration mortars is preferable since the mortars are permeable to moisture and allow the stones to breath. Over time the stone integrity is maintained and should last longer than the epoxy. Restoration mortars should be tinted to match the stone color and texture after cleaning. Tinting can be achieved through appropriate pigments (alkali stable oxides) which are available through Cathedral Stone or mason supply.

Reinforcement

The routine use of pins has been the traditional way of reinforcing broken stones. This method is in debate and controversial. The use of pins should be avoided except in some very extreme situations where it is unavoidable. Generally, the use of pins is to provide extra support to keep two pieces together. If the stone begins to lean and the adhesion joint fails between the stones, then the pins are carrying the full weight of the stone. The pin extends the moment arm which can cause a large blow out on the face of the stone next to the pin. Whenever pins are found they should be removed either by cutting the excess pin off or if the stone is not fragile can be core drilled out. Core drilling should be avoided since more damage can be caused to the stone in the process.

If pins are required then stainless steel threaded rods ranging from 3/8"-3/4" diameter should be used and should never exceed 1/3 of the thickness of the stone. Stones should be drilled using a wet coring drill and at a slow speed. Pins are then secured using an epoxy structural adhesive.

Repair mortars/ crack fillers

Areas of missing stone can be filled using commercially available restoration mortars (Jahn Restoration Mortars, Cathedral Stone) tinted to match the stone. Tinting can be accomplished by adding masonry pigments to the mortar. Large cracks can also be filled using the same mortars. Mortar repairs should not be performed if there is a risk of freezing temperatures within two weeks after performing work.

Filling of delaminating stones

De-lamination occurs in many stones typically slate and sandstone. Repair of delaminated stones is designed to adhere the separated layers and prevent water penetration. The first step is to thoroughly clean the interior surfaces of the crack to remove debris. Depending on the nature of the crack, hand tools and compressed air can be used to clean out the area. Interior surfaces should then be wetted with water or a solution of water and isopropanol. For cracks larger than a 1/8" commercially available M40 flowable grout (Cathedral Stone) can be used. For smaller cracks M32 can also be used. Grouts should be tinted to match the stone after cleaning. Flowable grouts should be applied using manufacturers recommendations.

Reattachment of small fragments

Small stone fragments or friable areas are typically reattached with a solution of Acryloid B-72 in solution of acetone. This method is mainly for non structural applications where a zero thickness bonding joint is desired. Care should be taken as the B-72 forms moisture impermeable layers at the joint similar to epoxy. Depending on the geometry of the break it is possible to create a moisture trap which can cause deterioration over time.

Consolidation of friable stone

Stones showing signs of sugaring or de-lamination should be consolidated to maintain the granular integrity of the stone. Consolidation should be performed before further treatment is done. Consolidation should be performed using Conservaire OH100 (Prosoco) following manufacturers specifications for proper application. OH100 should be applied a minimum of 6 applications to promote deep penetration. Failure to perform this task can cause a hard skin to form and cause the layer to de-laminate. OH100 binds the grains of the stone without filling the voids between the grains. This allows the stone to continue to breath and expel water from the interior of the stone.

Products/Suppliers

Jahn™ Restoration Mortars - M120, M160 BL, M70

M40 & M32 Flowable Grouts

From: Cathedral Stone Products Inc.

7266 Park Circle Drive

Hanover, MD 21076

800 684-0901 fax 800 684-0904

Aboweld

From: Abatron, Inc.

5501 95th Avenue

Kenosha, WI 66046

262 653-2000 fax 262 653-2019

Conservare OH100

From: Prosoco, Inc.

3741 Greenway Circle

Lawrence, KS 66046

800 255-4255 fax 800 877-2700

D2 Biocide

From: LimeWorks, Inc

PO Box 151

Milford Square, PA

(215)536-6706

Additional information/websites

Association for Gravestone Studies

101 Munson Street

Suite 108

Greenfield, MA 01301

www.gravestonestudies.org

NCPTT

National Center for

Preservation Technology & Training

645 University Parkway

Natchitoches, LA 71457

www.ncptt.nps.gov

THE RECORDING OF A CEMETERY

By Thelma Greene Reagan

Today we walked where others walked
On a lonely, windswept hill;
Today we talked where others cried
For loved ones whose lives are stilled.

Today our hearts were touched
By graves of tiny babies;
Snatched from the arms of loving kin,
In the heartbreak of the ages.

Today we saw where the grandparents lay
In the last sleep of their time;
Lying under the trees and clouds
Their beds kissed by the sun and wind.

Today we wondered about an unmarked spot;
Who lies beneath this hallowed ground?
Was it a babe, child, young or old?
No indication could be found.

Today we saw where Mom and Dad lay.
We had been here once before
On a day we'd all like to forget,
But will remember forever more.

Today we recorded for kith and kin
The graves of ancestors past;
To be preserved for generation hence,
A record we hope will last.

Cherish it, my friend; preserve it, my friend,
For stones sometimes crumble to dust
And generations of folks yet to come
Will be grateful for your trust.